

**New Program Proposal  
 Master of Science in Civil Engineering  
 The Citadel**

**Summary**

The Citadel requests approval to offer a program leading to the Master of Science in Civil Engineering to be implemented in August 2016. The proposed program is to be offered through traditional instruction. The following chart outlines the stages of approval for the proposal. The Committee on Academic Affairs and Licensing (CAAL) voted to recommend approval of the proposal. The full program proposal is attached.

<b>Stages of Consideration</b>	<b>Date</b>	<b>Comments</b>
Program Proposal Received	8/1/15	Not Applicable
Comments and suggestions from CHE staff sent to the institution	8/21/15	Staff requested the proposal be revised to: <ul style="list-style-type: none"> <li>• Identify the companies requesting the program</li> <li>• Revise the Curriculum by Category chart to show the core requirements, electives, and other requirements in addition to the focus area requirements.</li> <li>• Revise the language in the proposal to make it clear that the focus area is a collection of electives, but not an official concentration, option or track.</li> <li>• Explain that if the student is interested in earning a graduate certificate in one of the focus areas, the student will need to complete additional coursework to meet all of the requirements of the certificate program.</li> <li>• Provide a brief explanation and timeline for developing and implementing these new courses.</li> <li>• Provide the total FTE needed to support the program.</li> <li>• Provide an estimated hire date for the new faculty member.</li> <li>• Clarify the amount of funds spent on library resources for engineering.</li> <li>• Explain The Citadel's relationship with the Clemson Restoration Institute.</li> <li>• Provide the implementation date for the new BSME program in the Physical Resources section.</li> <li>• Describe the Taskstream software and provide more detail as programmatic assessment.</li> </ul>

Stages of Consideration	Date	Comments
		<ul style="list-style-type: none"> <li>Identify the specific courses in which the particular Student Learning Outcome will be assessed.</li> </ul>
ACAP Consideration	9/10/15	<p>ACAP members discussed the need for the proposed program. Representatives from Academic Affairs, Clemson, Coastal Carolina University, USC Aiken, and Winthrop, requested the following explanations:</p> <ul style="list-style-type: none"> <li>Source of faculty personnel (full-time or part-time via recruitment, re-assignment, or otherwise) needed to teach the new course load</li> <li>Total number of new courses and projected budget for new course implementation</li> <li>Details about collaboration with Clemson</li> <li>Capability to provide student support</li> <li>A description of the five proposed program certificates</li> </ul>
Revised Program Proposal Received	9/16/15	<p>The revised proposal and appendix satisfactorily addressed the requested revisions.</p>
CAAL Consideration	10/16/2015	<p>The Committee agreed to consider all three Master of Engineering proposals (Civil, Electrical, and Mechanical) as a group. Commissioners asked why The Citadel chose not to submit one degree program with three concentrations.</p> <p>The representative from The Citadel explained that the three specific degrees were developed to meet employers' expectations.</p> <p>Commissioners then asked about the following topics:</p> <ul style="list-style-type: none"> <li>How the proposed programs will affect Clemson and USC</li> <li>Course transferability</li> <li>The revenue model</li> <li>Enrollment projections, including the substantial projected increase in year 4</li> <li>The number of new courses required</li> <li>The financial loss in the third year.</li> </ul> <p>Representatives from The Citadel provided the following responses:</p> <ul style="list-style-type: none"> <li>The proposed programs are not expected to affect the enrollments at Clemson or USC and that The Citadel has an MOU with Clemson to share up to 50% of the courses.</li> <li>Regarding transferability, the courses will transfer to each institution.</li> </ul>

Stages of Consideration	Date	Comments
		<ul style="list-style-type: none"> <li>• Regarding the revenue model, tuition will go to the institution that teaches the course.</li> <li>• Enrollment projections are estimates based on conversations with local companies (the representative provided a brief explanation of how the projections were made.)</li> <li>• Additionally, most of the students will be employed full-time and enrolled part-time because the programs are designed to enable employees in the Lowcountry to improve their skill set.</li> <li>• Regarding the year 4 enrollment projection increase, representatives stated that students are in the pipeline already because of the certificate programs offered by The Citadel, and furthermore, emphasized that the enrollment will be limited by the number of courses offered, not student demand.</li> <li>• The Citadel has the capacity for the number of new courses with a plan for new courses to be developed and implemented gradually.</li> <li>• The Citadel's representative stated that if each program grows within the first two years as estimated, there will be a need to hire an additional faculty member in year three which would explain the loss. However, she noted that each program will be profitable over the course of the first five years.</li> </ul> <p>Two Committee members mentioned that they submitted questions to the institution which were answered satisfactorily prior to the meeting. The questions addressed the types of engineering fields needed in the Lowcountry; the long-term goal to offer engineering PhD's in the Lowcountry; projected enrollment; the costs and benefits of offering the programs; accreditation; faculty; and instruction sites. The questions and the institution's responses are included in the attached proposal packet.</p> <p>Commissioners praised the programmatic assessment described in the proposal.</p>

**Recommendation**

The Committee on Academic Affairs and Licensing recommends that the Commission approve the program leading to the Master of Science in Civil Engineering to be implemented in August 2016.

***Institutional Responses to Commissioner Questions  
about Program Proposals considered at the October 16, 2015 CAAL meeting***

**The Citadel, M.S., Civil Engineering**

**General comments for all The Citadel programs**

- 1. *These programs increase the number of masters students in engineering disciplines by more than 100.***

**A. *What is the effect on Clemson, USC?***

Response: Based on our surveys (verbal – not able to do anything official until program approved) of local companies, the anticipated growth of these companies in the out years and the number of employees currently not taking courses at Clemson or USC (desire face-to-face or online is not available in their desired sub-discipline) show a trend of not affecting the enrollments at Clemson or USC. Additionally, we have signed an MOU with Clemson to share up to 50% of our graduate courses to better assist students taking courses at both universities and completing the degree at the desired university based on desiring a thesis or no thesis at the MS degree level. These new engineering MS degrees will provide opportunities to students not currently taking courses at Clemson or USC due to being available locally.

- B. *Are the estimates of program size reasonable, roughly 40 a piece for 5 programs? Where will these students come from? All internal to The Citadel from other programs like the program management MS? Or will they come from other state institutions?***

Response: The program sizes are estimates based on verbal conversations with local companies. We tried to project lower bound amounts. As a point of reference on making these estimates, we projected 210 enrollments in our new ME undergraduate degree in 5 years. We have 170 students in only 2 years. Again, the 210 was only an estimate. For the graduate degrees, we will work to establish cohorts to ensure courses meet as well as more accurate timeliness of the courses to allow for consistent progression through the degree. As stated in the program request form, we expect most, if not all, of the students will be full-time enrolled in the Lowcountry and will be part-time students. These degrees and associated inherent graduate certificates are to allow employees in the Lowcountry to improve their skill set.

- C. *Each program requires roughly 25 new courses. Does The Citadel have the capacity to create these in the needed time?***

Response: Each course to be completed has an outline developed by a current faculty member as part of developing the course descriptions presented in the proposal. The roll-out of courses presented in the appendix was an estimate based on establishing cohorts in each of the sub-disciplinary areas simultaneously to display how we would meet the demand; however, we believe this will be unlikely. We have met with each faculty member to get their input on the roll-out provided if cohorts can be established within each sub-disciplinary area as a worse case for them developing courses, but a best case for The Citadel.

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- D. Programs show a financial loss in the third year, with five programs this adds to a significant amount. Has the board of trustees agreed with this financial plan? It is noted that the board did not sign for agreement to the individual programs, shouldn't they have?***

Response: If each program grows within the first two years as estimated, there will be a need for the hiring of an additional faculty member to cover the demand or some sub-disciplinary cohorts might need to be delayed a year to stagger new faculty hiring. However, if viewed over the five years of the table, it is anticipated that each program will be profitable. Student demand for courses will better inform the actual growth required in each of the degree programs.

**Master of Science in Civil Engineering, Master of Science in Electrical Engineering and Master of Science in Mechanical Engineering:**

- 1. Page 5 – The Charleston Regional Competitiveness Center forecasts are sourced as projecting a 16.4% growth in the engineering field in the area by 2018. Is that study specific to the various types of engineers which will be needed?***

Response: This data source is for many types of engineering fields needed in the Lowcountry, but the major ones are CE, EE, and ME. Another of the high interest areas is aeronautical, which we are addressing as a portion of our ME program (4 courses can be taken in aeronautical for a certificate as well as 4 courses as part of the MS degree) for overall efficiency. We believe that the curricular addition of the certificates and masters degrees creates a strong value proposition for high caliber engineering firms to further locate in the Lowcountry.

- 2. Page 7 – “To support the long-term goal to offer engineering PhD’s in the Lowcountry....” At what point in time would that be and what additional resources would be necessary?***

Response: Clemson and USC will offer the PhDs. We have signed an MOU with Clemson to allow up to 50% of each other’s courses to be accepted by the other school. We have used very similar course descriptions for our MS level courses so that it eases the acceptance of the courses by Clemson and USC. The MOU also supports our faculty teaching courses for Clemson that are at the PhD level. Clemson plans (CHE approved) to offer PhD programs through the restoration center, but they do not see it possible to be able to have the requisite faculty on hand to offer the number of MS and PhD courses needed in the Lowcountry. That is where our MS programs come in and assist in the stated needs by our legislature to have more PhD programs available in the Lowcountry (i.e., University of Charleston). The University of Charleston is not poised to be able to offer engineering, The Citadel will be with these MS degrees and will work with Clemson and USC to offer PhD programs (we will teach required courses and our faculty can be a part of the dissertation research committees). The actual administration of the PhD programs and associated research is a mission for Clemson and USC, not us. The need for a Ph.D. in the Lowcountry is likely far on the horizon. We want to be a part of the solution by providing what we can – MS programs (which we know has demand in the area), faculty teaching some of the doctoral courses for Clemson, and our faculty conducting research with Clemson and USC, as well as, sitting on dissertation research committees.

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- 3. *Page 14 – CIVL 504: Designing for Natural and Manmade Hazards looks like an excellent course. Is this specifically designed for the needs of the Lowcountry and state of South Carolina?***

Response: Yes and no. It will cover a number of natural hazards such as earthquakes, hurricanes, tornados, blasts, etc. Many of those are inherent in the natural and manmade hazards we experience in SC. This is a course we hope to eventually go online with so, we need to ensure it has a broader base of hazards than only those in SC.

- 4. *Projected Enrollments in all three programs are the same?***

Response: The projected enrollments are the lowest numbers we think will be in each program. We expect higher numbers, but since we cannot actively survey each company in the area nor advertise the MS degrees with other programs around the country until we have approval for the program through CHE, we decided to use the lowest reasonable numbers that show we are still profitable over a 5 year period of time. We had fairly conservative numbers in the ME undergraduate program (210 students in the program by the 5 year mark) and we have almost reached that number in only 2 years (186 students in the ME program). We would rather be on the low end for our estimate rather showing numbers that might be difficult to obtain. So the numbers are conservative and were used for planning to show the program will be profitable.

- 5. *Page 24 – Cost/benefit analysis – The long-term net gain is minimal and identical for all three programs. Please discuss.***

Response: This information is tied directly to the estimated enrollments (low end estimates for each program – need five students for a course to make and therefore for us to offer the first course). We purposely tied this to the worst case numbers to show we are still profitable. We expect even greater numbers, but no way to know for sure until we begin to advertise and recruit heavily which we cannot do until we have CHE approval.

**General questions affecting the School of Engineering at The Citadel:**

- 1. *Would these programs have any impact on The Citadel's national ranking of #22 in the nation for its school?***

Response: The new masters degrees should help (but certainly would not hurt) the ranking since the #22 ranking is for programs with no more than MS programs. Clemson and USC are ranked with programs having PhD programs. Notice that there are no rankings for programs with only a BS, they are lumped in with the programs where the highest degree offered is an MS. The reason is schools with MS and undergraduate degrees are more focused on students directly entering the workforce, where the programs with PhD programs are also heavily focused at both the MS and PhD level on research results. This ensures an appropriate comparison for rankings.

- 2. *Would these programs impact the recent SACS reaccreditation with zero recommendations?***

Response: No. When we are reassessed in four years, the assessment data for these new programs will be lumped in with the results for all of our programs. We will be using the same standards we used in

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gaining ABET accreditation for our BS programs to assess our MS programs. The assessment will be focused on SACS accreditation criteria.

***3. Will these programs be offered at the Lowcountry Graduate Center or on The Citadel campus or a mixture of both?***

Response: Right now we are planning on offering on campus since the ability to walk into the lab to show theory in action is so powerful. Some courses and faculty might opt to teach at the LGC if they do not see a need to use the available lab equipment. Those students opting to take project management courses for one of the four courses that do not have to be an engineering course will take the course at the Lowcountry Graduate Center.

***4. For the joint programs offered through The Citadel/Clemson, who would oversee the students?***

Response: We do not have any joint programs. What we do have is an articulation agreement that allows students to more easily take courses at the other institution and transfer them to The Citadel. They will not need to apply to the other school; their admittance at the home school will allow them to enroll in a course at the other school. The students who desire a thesis as part of the MS degree will need to have Clemson as the home school. Those only desiring to take 10 courses for the MS degree can have either school as a home school. Our faculty will be adjunct for Clemson if they are teaching a PhD level course to assist Clemson in offering a PhD program at the restoration center. So no joint programs, but an MOU to assist in students in easy transfer of courses.

***5. Can you really get by with hiring only one faculty member?***

Response: Yes, if the enrollment numbers stay low and the students only opt to take 6 technical courses and all desire to take 4 non-technical (project management, business, leadership, etc.) courses to complete the degree. Again, we can only go by word of mouth at this time and will request additional faculty as the demand grows. Initially, the CE, EE, and ME graduate courses will be offered in the summer when faculty are looking for additional pay capitalizing on the business, leadership, and program management courses already being offered during the academic year to assist students to be able to take at least one course each term. As demand grows and we have cohorts desiring a certain slate of courses, we will need to have the courses offered in the fall and spring and we will accordingly request more faculty positions during the budget building process.

***Proposal Master of Science in Civil Engineering Science with Certificates (CIP Code 14.1801) and Proposal Master of Science in Electrical Engineering Science with Certificates (CIP Code 14.1001)***

***1. Page 9, shows a strange sequence of projected enrollment, spring of the fourth and fifth year are much larger than the fall. Please explain. Also the same chart is used for electrical engineering. Do you expect the same enrollment across the two programs?***

Response: We expect to be able to roll out more graduate courses each spring based on the current CE undergraduate load balance and the availability of the current pool of adjunct faculty for fall and spring semesters. We do estimate generally the same student demand for CE and EE based on informal surveys of the local companies.

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***2. Page 28... Why no subject specific, engineering, accreditation? (Same for all 5 programs)***

Response: No requirement exist to apply for specific ABET accreditation for the graduate programs. The key is ABET accreditation for the undergraduate programs. The CE and EE programs have just recently been approved for a 6 year reaccreditation for the undergraduate programs and the ME program is collecting data as part of its record year to request its initial accreditation visit next fall.

## NEW PROGRAM PROPOSAL

Name of Institution  
The Citadel

Name of Program (include concentrations, options, and tracks)  
Master of Science in Civil Engineering (MSCE)

### Program Designation

- Associate's Degree                       Master's Degree  
 Bachelor's Degree: 4 Year               Specialist  
 Bachelor's Degree: 5 Year               Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA)  
 Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.)

Does the program qualify for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes  
 No

Proposed Date of Implementation  
Aug 2016

CIP Code  
14.0801

### Delivery Site(s)

Courses offered on-site or at the Low Country Graduate Center

### Delivery Mode

- Traditional/face-to-face\*  
\*select if less than 50% online
- Distance Education  
 100% online  
 Blended (more than 50% online)  
 Other distance education

Program Contact Information (name, title, telephone number, and email address)

Dr. Ronald Welch  
Dean of Engineering  
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### Institutional Approvals and Dates of Approval

Graduate Curriculum Committee: 17 Feb 2015  
Academic Board: 24 Feb 2015  
President: 10 April 2015

## NEW PROGRAM PROPOSAL

### Background Information

State the nature and purpose of the proposed program, including target audience and centrality to institutional mission. (1500 characters)

The MSCE is intended to meet the expressed needs of South Carolina industries, especially Charleston based companies. Nationally, Civil Engineering is broken out as a separate category by the Department of Labor which shows that Civil Engineers are the most hired group of engineers followed by electrical and mechanical engineers.

The engineering related job market in the Charleston area has exploded in recent years, especially as the Lowcountry has become a manufacturing hub. Employers include architectural-engineering firms, firms with specialties in multiple areas of civil engineering or even single area of civil engineering (construction management, environmental, geotechnical, water resources, structural, surveying, transportation), aviation, defense applications, power and energy firms, manufacturing, and many others. The growth in manufacturing leads to civil engineers designing/constructing facilities, maintaining facilities, and even designing/building airplanes as a number of structural engineers work at Boeing. The MSCE supports The Citadel's LEAD 2018 Objective 2 (academic programs of distinction), Objective 4 (expand enrollment in The Citadel Graduate College), and Objective 8 (provide outreach to the region and serve as a resource in its economic development) and is being developed at the request of a number of Charleston based companies such as STV Group, URS, Stantec, Tarracon, SM&E, and Soil Consultants. The desire to hire local talent and educate an existing workforce drives the need for a local graduate CE program to complement an existing undergraduate engineering program. Our ability to offer graduate courses within The Citadel MSCE is complementary to any other graduate courses being offered in the Lowcountry in providing graduate engineering education. Engineering problem solving is in increased demand and civil engineers are a necessary and diverse core engineering skill set that are primarily focused on designing and maintaining the built and natural environment.

List the program objectives. (2000 characters)

Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Graduates of the Master of Science degree program in Civil Engineering will, by the time of graduation:

- Outcome 1: Demonstrate breadth of knowledge in complimentary areas of civil engineering that promotes an awareness of and skill in interdisciplinary problem solving.
- Outcome 2: Demonstrate a depth of knowledge in a chosen focus area of civil engineering that allows the student to apply innovative techniques to solve problems.
- Outcome 3: Demonstrate knowledge in methods of advanced analysis appropriate for professional use when solving problems.
- Outcome 4: Demonstrate knowledge of contemporary issues in their chosen focus area.
- Outcome 5: Demonstrate the skills relevant to graduate level work to include the ability to formulate problems, synthesize and integrate information, work collaboratively, and to communicate effectively.
- Outcome 6: Demonstrate preparation for successful careers in industry or continued graduate work and an ethic for lifelong learning.

## NEW PROGRAM PROPOSAL

### Assessment of Need

Provide an assessment of the need for the program for the institution, the state, the region, and beyond, if applicable. (1500 characters)

The number of students taking engineering courses at The Citadel has increased dramatically over the last few years. For example, the number of undergraduate engineering students within the Corps of Cadets has grown from 318 in 2012 to 379 students in 2014. The number of evening students has grown from 65 to 85 students. All of this growth is prior to the inclusion of the mechanical engineering undergraduate cadet and evening students who began to attend in fall 2014 (90 new students). The number of enrollments in our MS in Project Management has grown from 95 in 2011 to over 350 in 2013-2014. Many of the evening students in Project Management have asked when will we begin to offer more technical masters level courses and degrees. The arrival of Boeing and their survey of employee educational needs estimate nearly 1000 employees needing undergraduate degree completion, many in engineering. However, recent discussions with key leaders and news releases at Boeing and other companies in the Lowcountry have noted a desire for their current workforce to complete certificates that will show immediate skill attainment as well as master's level technical degrees.

The Charleston Regional Competitiveness Center forecasts there will be a 16.4% growth (7200 new jobs) in the engineering field in the area by 2018. This information follows closely to the Department of Labor statistics that show a 12 month growth rate for construction in South Carolina as 7.2% while in Charleston it was 16.2%, growth rate for manufacturing in South Carolina as 2.0% while in Charleston it was 25.4%, and the growth rate for trade, transportation, and utilities in South Carolina as 2.5% while in Charleston it was 3.1%. Many other areas were growing at a faster rate in Charleston than the state as a whole.

### Employment Opportunities

Is specific employment/workforce data available to support the proposed program?

Yes

No

If yes, complete the table and the component that follows the table on page 4. If no, complete the single narrative response component on page 5 beginning with "Provide supporting evidence."

**NEW PROGRAM PROPOSAL**

<b>Employment Opportunities</b>			
<b>Occupation</b>	<b>Expected Number of Jobs</b>	<b>Employment Projection</b>	<b>Data Source</b>
Based on industry input noted above, a majority of students will be fully employed and part-time students. In-depth discussion in next section.			

Provide additional information regarding anticipated employment opportunities for graduates.  
(1000 characters)

## NEW PROGRAM PROPOSAL

Provide supporting evidence of anticipated employment opportunities for graduates, including a statement that clearly articulates what the program prepares graduates to do, any documented citations that suggests a correlation between this program and future employment, and other relevant information. Please cite specific resources, as appropriate. (3000 characters)

**Note: Only complete this if the Employment Opportunities table and the section that follows the table on page 4 have not previously been completed.**

There is not specific employment data beyond the fact that there is documented growth of current and new companies providing engineering support and/or products for the rapidly expanding manufacturing hub here in the Lowcountry. One example; Boeing has expanded its workforce to 7500 employees within the last year (many desiring additional skills through graduate certificates and MS degrees) and is currently bringing in a design center, a research center, and expanding the plant footprint. The lead engineer and the engineering lead of the liaison team at Boeing are both civil engineering undergraduates who are now part of building the newest Boeing airplane, the 787. This only scratches the surface of the numerous newspaper articles noting companies moving production of required aeronautical parts to decrease the shipping costs from Washington State. Each of these companies requires an engineering team to support design and production, but also of the facilities and the infrastructure supporting the company. The future deepening of the harbor heightens the desire for more companies to locate their production efforts here in the Lowcountry such as Continental Tire and the expansion of the Daimler Truck manufacturing center. Most of the students that will be taking the courses within the MSCE and its associated certificates will be existing mid-level employees with Lowcountry companies working to improve their current skill set. Our industry contacts as well as our robust departmental industry advisory board (list attached in the Appendix) have been asking for a number of years for engineering level master degrees in the Lowcountry to support not only improved technical competence and company advancement, but also promotion opportunities for the current workforce. As noted in many locations to include Forbes Magazine, the master's degree helps distinguish a candidate for promotion and advancement within the company and industry.

The argument within the State House for many years is the need for a comprehensive university in the Lowcountry to be able to offer those already here the ability to obtain PhD level degrees. To support the long-term goal to offer engineering PhD's in the Lowcountry, The Citadel is positioned with its all PhD faculty team to offer an MSCE degree. The new civil engineering graduate program will closely resemble course offerings at Clemson University and USC to ensure ease of transfer for students desiring to transfer for a MS Thesis option or PhD. An MSCE degree at The Citadel will support the needs of local students who want face-to-face instruction but are unable to fully attend Clemson or USC for an MS degree, courses needed by PhD students conducting research in the Lowcountry, employees of local companies, and the current students already taking a BSCE at The Citadel whether as a cadet or an evening student.

Will the proposed program impact any existing degree programs and services at the institution (e.g., course offerings or enrollment)?

Yes

No

If yes, explain. (500 characters)

**NEW PROGRAM PROPOSAL**

**List of Similar Programs in South Carolina**

<b>Program Name</b>	<b>Institution</b>	<b>Similarities</b>	<b>Differences</b>
MSCE	Clemson University	Offering of courses in construction management, environmental, geotechnical, water resources, structural, surveying, transportation	The Citadel MSCE will only be a no thesis MS degree, only requires 6 CE courses and the other 4 courses can be Technical (ME, CE, EE, other) or non-technical (accounting, business, leadership, project management, etc.)
MSCE	The University of South Carolina	Offering of courses in construction management, environmental, geotechnical, water resources, structural, surveying, transportation	The Citadel MSCE will only be a no thesis MS degree, only requires 6 CE courses and the other 4 courses can be Technical (ME, CE, EE, other) or non-technical (accounting, business, leadership, project management, etc.)

**Note:**

There are no Masters of Science in Civil Engineering programs in the Lowcountry of South Carolina. There are MSCE programs at Clemson University and The University of South Carolina, but limited opportunity for local students in the heavily populated area of Charleston to attend face-to-face a Civil Engineering program without leaving the area as well as limited opportunity for local employees to further their education face-to-face in Civil Engineering. The Citadel has Bachelor of Science in Civil Engineering. Trident Technical College has an Associate in Science, Civil Engineering Transfer. Many students in the Associate in Science, Civil Engineering Transfer program at Trident Technical College matriculate into The Citadel’s evening undergraduate Civil Engineering program. Many of these students desire to continue living in the Lowcountry and eventually obtain a MSCE degree face-to-face.

## NEW PROGRAM PROPOSAL

### Description of the Program

Projected Enrollment						
Year	Fall		Spring		Summer	
	Headcount	Credit Hours	Headcount	Credit Hours	Headcount	Credit Hours
2016-17	5	45	5	45	3	9
2017-18	10	90	12	90	6	18
2018-19	15	135	19	135	10	30
2019-20	17	153	29	153	13	39
2020-21	25	225	39	225	18	54

Besides the general institutional admission requirements, are there any separate or additional admission requirements for the proposed program?

Yes

No

If yes, explain. (1000 characters)

Are there any special articulation agreements for the proposed program?

Yes

No

If yes, identify. (1000 characters)

## NEW PROGRAM PROPOSAL

### Curriculum

Select one of the following charts to complete: Curriculum by Year **or** Curriculum by Category

The categories listed in the following table represent courses in the focus areas of the proposed MSME program. Focus areas are a collection of courses that are interrelated. Focus areas will not be recorded on a student's transcript, but they allow the student depth in a particular area of civil engineering and to build on previous knowledge. Specific requirements for the courses are listed in a subsequent table in this section.

The Citadel MSCE will require 30 credit hours where 18 credit hours will be technical while 12 credit hours can be non-technical (finance, accounting, leadership, program management, etc.). Of the 18 credit hours of technical courses, 12 must be from one of the three categories listed in the following table. The other 6 technical hours can be from the same or a different category.

Requirements - Citadel MS in Civil Engineering:

- 30 credit hours, non-thesis
- Require at least 6 courses (18 hours) in technical classes; 4 courses (12 hours) in one focus area / category;

4 courses (12 hours) in technical or non-technical classes (Mechanical, Electrical, Civil, Program Management, Business)

<b>Curriculum by Category*</b>				
<b>Geotechnical Focus Area</b>			<b>Structural Focus Area</b>	
CIVL 730 Geotechnical Earthquake Engineering	3		CIVL 504 Designing for Natural and Manmade Hazards	3
CIVL 731 Geo-environmental Engineering	3		CIVL 608 Structural Loads and Systems	3
CIVL 732 Advanced Soil Mechanics	3		CIVL 610 Wood Design	3
CIVL 733 Advanced Foundations Design	3		CIVL 655 Masonry Structural Design	3
CIVL 734 Soil Behavior	3		CIVL 657 Indeterminate and Matrix Structural Analysis	3
			CIVL 711 Design of Masonry, Wood and Cold Formed Steel Structures	3
<b>Transportation Focus Area</b>			CIVL 712 Design of Coastal Structures and Bridges	3
CIVL 506 Geographic Information Systems	3		CIVL 713 Design of Civil Engineering Systems for Natural and Manmade Hazards	3
CIVL 575 Traffic Engineering Operations	3		CIVL 714 Advanced Steel Design	3
CIVL 576 Roadway Geometric Design	3		CIVL 715 Advanced Reinforced Concrete Design	3
CIVL 612 Urban Transportation Planning	3		CIVL 716 Analysis and Design of Prestressed Concrete Members	3
CIVL 640 Urban Mobility Infrastructure Policy and Planning	3		CIVL 718 Matrix and Finite Element Analysis	3

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CIVL 642 Public Health, Physical Activity, and Design of the Built Environment	3		CIVL 719 Elastic Stability of Structures	3
CIVL 740 Transportation Safety Engineering	3		CIVL 720 Dynamic Analysis of Structures	3
CIVL 741 Travel Demand Forecasting	3		CIVL 721 Earthquake Engineering for Structural Engineers	3

\* Add category titles to the table (e.g., major, core, general education, concentration, electives, etc.)

Total Credit Hours Required      30

## NEW PROGRAM PROPOSAL

### Curriculum Notes:

The new civil engineering graduate program will closely resemble course offerings at Clemson University and USC to ensure ease of transfer for students desiring to transfer for a MS Thesis option or PhD. A comparison of the degree with those at Clemson University and the University of South Carolina is provided below in Table 1. The Citadel MSCE will require 30 credit hours where 18 credit hours will be technical while 12 credit hours can be non-technical (finance, accounting, leadership, program management, etc.). As shown in Table 1, there will be the opportunity to complete individual graduate certificates in four main focus areas to meet the needs of the local industry in South Carolina: Geotechnical, Structures, Transportation, and Built Environment, Planning and Design for Public Health. If the student is interested in earning a graduate certificate in one of the focus areas, the student will need to complete the necessary coursework to meet all of the requirements of the certificate program.

Table 1: MS Civil Engineering Comparison to Other Institutions

	<b>Citadel</b>	<b>Clemson</b>		<b>USC</b>	
	MS Non Thesis	MS Thesis	MS Non Thesis	MS Thesis	ME Non Thesis
Total Hrs	30	30	30	30	30
Core / Focus Area Possibilities	Geotechnical Structural Transportation Built Environment, Planning and Design for Public Health	Applied Fluid Mechanics Construction Materials Geotechnical Construction Eng and Management Structural Engineering Transportation systems		Environmental Geotechnical Structural Transportation Water Resources	
Other Tech	N/A	Advisor	Advisor	9 max	12 max
Other	12	Advisor	Advisor	Advisor	Advisor

### Citadel MS in Civil Engineering:

- 30 credit hours, non-thesis
- Require at least 6 courses (18 hours) in technical classes
- 4 courses (12 hours) in technical or non-technical classes (Mechanical, Electrical, Civil, Program Management, Business, Leadership)

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### Example Course Plan:

If a student, for example, has a focus in Structures, he/she must take 4 Structures courses. The remaining technical courses must be a minimum combination of 2 from the Other Technical Courses (from available focus areas such as geotechnical, structures, or transportation – chose two more structures courses). The Other 4 courses can be from non-technical (Business, Leadership, Program Management) or from technical programs (Mechanical, Electrical, or Civil). See example in Table 2, below.

Table 2: Sample Course Plan for Structures Focus in MSCE Program

	Course # and Title	Credit Hours
MS CE Tech Courses	CIVL 657: Indeterminate and Matrix Structural Analysis	3
	CIVL 718: Matrix and Finite Element Analysis	3
	CIVL 712: Design of Coastal Structures and Bridges	3
	CIVL 711: Design of Masonry, Wood and Cold Formed steel Structures	3
	CIVL 714: Advanced Steel Design	3
	CIVL 715: Advanced Reinforced Concrete Design	3
Other Courses	PMGT 650 Overview of Technical Project Management	3
	PMGT 651 Tech Project Planning and Scheduling	3
	PMGT 671: Project Manager Leadership Development	3
	BADM 604 Foundation of Management and Organization	3
		30 Total

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### Course Descriptions for New Courses

New courses will be developed beginning just after CHE approval. Most 600-699 courses will be developed first followed by the 700-799 courses. Priority will be to courses and focus areas requested by enrolling students and in demand by employers through an employer survey.

Course Name	Description
CIVL 730: Geotechnical Earthquake Engineering	Fundamentals of soil dynamics, plate tectonics and earthquakes; application of the concepts to seismic ground response, design ground motions, soil liquefaction, site response analysis, seismic slope stability, dynamic lateral earth pressure, and soil improvement. Prerequisites: CIVL 402, 409, and 410.
CIVL 731: Geo-environmental Engineering	Geo-environmental engineering is a multi-disciplinary area of study that involves various aspects of geotechnical engineering, environmental engineering, hydraulics/hydrology, and groundwater engineering. The course focuses on the following two specific technical issues: (1) characterization and remediation of contaminated soil and groundwater; (2) design of waste containment barriers (e.g., liners, covers, vertical barriers) used for waste remediation. Prerequisites: CIVL 322, 402, and 409.
CIVL 732: Advanced Soil Mechanics	Study of stresses in soils, stress-strain and shear strength properties of soil, plastic equilibrium of soil masses, failure conditions, earth pressures, with applications to geotechnical engineering design. Prerequisites: CIVL 402 and 409.
CIVL 733: Advanced Foundations Design	The engineering design process is demonstrated through use of practical problem-solving methods for public infrastructure and built environment projects. Analysis and design of deep foundations, earth slopes, retaining walls, sheet-pile walls, and braced excavations, anchored bulkheads, reinforced earth, and underpinning. Prerequisites: CIVL 410.
CIVL 734: Soil Behavior	Detailed study of physiochemical aspects of soil behavior, stabilization of soils, and engineering properties of soils. Prerequisites: CIVL 402, 409, and 410.
CIVL 504: Designing for Natural and Manmade Hazards	Engineering and science applications and socio-economic impacts of natural hazards on historic structures. Course provides thorough overview of design, rehabilitation, and other socio-economic decisions related to natural hazards and historical structures. Prerequisites: Admission to partner graduate degree programs; BS in math, science or engineering; or permission from professor
CIVL 608: Structural Loads and Systems	Structural engineering applications of analysis methodologies used to determine loads in accordance with ASCE 7. In-depth discussion of minimum design loads and load combinations. Includes overview of various steel and concrete systems. Discusses practical selection and design issues and design of proprietary building materials and components such as steel joists, diaphragms, engineered wood products, etc. Prerequisites: CIVL 309.
CIVL 610: Wood Design	Design of wood framed structures in accordance with the NDS Specification. Course provides thorough overview of practical member and connection design and real world applications. Introduction to wood design and engineering; properties of wood and wood-based materials; design of beams, columns, walls, roofs, panel systems, and connections. Prerequisites: CIVL 309.

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CIVL 655: Masonry Structural Design	Introduction to design of structural elements for masonry buildings. Lintels, walls, shear walls, columns, pilasters, and retaining walls are included. Reinforced and unreinforced elements of concrete or clay masonry are designed by allowable stress and strength design methods. Introduction to construction techniques, materials, and terminology used in masonry. Prerequisites: CIVL 309.
CIVL 657: Indeterminate and Matrix Structural Analysis	Analysis of indeterminate structures using moment distribution, energy methods such as virtual work and Castigliano's Theorem. Matrix displacement method derived and simplified to a form suitable for structural engineering applications. Truss and frame applications with modifications for symmetry, internal releases, and support settlements. SAP2000 and other structural engineering software is used to compare with analytical solutions. Prerequisites: CIVL 309.
CIVL 711: Design of Masonry, Wood and Cold Formed Steel Structures	Design of masonry structures in accordance with ACI specifications, wood framed structures in accordance with NDS specifications, and Cold Formed Steel Structures in accordance with AISI specifications. Course provides thorough overview of practical member and connection design and real world applications. Prerequisites: CIVL 309.
CIVL 712: Design of Coastal Structures and Bridges	AASHTO based design of bridge structures and foundation elements. Design of piers and seawalls for coastal applications. Prerequisites: CIVL 309.
CIVL 713: Design of Civil Engineering Systems for Natural and Manmade Hazards	Design of infrastructure for hurricanes, earthquakes, floods, tornadoes, and man-made or accidental explosions. Focus on design philosophy and practical examples. Structural design, site layout, and economics discussed in detail. Prerequisites: CIVL 309.
CIVL 714: Advanced Steel Design	Advanced design of structural steel buildings emphasizing the relationship between design and response of the structural system; theoretical basis of building code provisions; limit state and plastic design; beam-columns; plate girders and composite sections and connections. All design provisions in accordance with AISC 360. Prerequisites: CIVL 406
CIVL 715: Advanced Reinforced Concrete Design	Second course in design of reinforced concrete structures; advanced concepts in analysis and design of beams, columns, and slabs; introduction to prestressed concrete. All design provisions in accordance with ACI 318. Prerequisites: CIVL 404.
CIVL 716: Analysis and Design of Prestressed Concrete Members	This course covers the analysis and design of prestressed concrete flexure loads; axial loaded; and diagonal tension using both the allowable stress procedure and the ultimate strength methodology. Construction techniques are discussed. Evaluation of serviceability requirements such as deflection and cracking are also discussed. Prerequisites: CIVL 309.
CIVL 718: Matrix and Finite Element Analysis	Finite element method derived and simplified using matrix approach to truss, beam, plate, and shell structures. Solid elements also discussed. Mesh layout and refinement, convergence characteristics, and solution accuracy proven. SAP2000 and other structural engineering software is used to compare to analytical solutions. Prerequisites: CIVL657: Indeterminate and Matrix Structural Analysis.
CIVL 719: Elastic Stability of Structures	Stability of elastic structural components under conservative loads. Precise definitions of stability; energy approaches; Rayleigh-Ritz and Galerkin methods utilized with primary applications to frame structures. SAP2000 and other structural engineering software is used to compare to analytical solutions. Prerequisites: CIVL 309.
CIVL 720: Dynamic Analysis of Structures	Analysis and design of structures subjected to dynamic loading; response of lumped and distributed parameter systems of one or many degrees of freedom; approximate design methods; introduction to earthquake analysis and design. Prerequisites: CIVL 309.

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CIVL 721: Earthquake Engineering for Structural Engineers	Effects of earthquake-induced forces on buildings, bridges, and other structures; development of design codes and their application to the design of structures to resist seismic forces; fundamental structural dynamics and analysis techniques used to compute the response of structures or obtain design forces. Prerequisites: CIVL 309.
CIVL 506: Geographic Information Systems	Instruction in Geographic Information Systems (GIS) focusing on data analysis and spatial application methods, for engineers, planners, scientists and related professions. Fundamental topics include spatial analysis, geostatistical analysis, 3-D analysis/display, and vector/raster data. The focus of the course is on gaining an essential knowledge of spatial data structures in GIS, geo-spatial data acquisition, geoprocessing, geostatistical methods; visualization, exploration of spatial data; network analysis, terrain mapping, and spatial analysis. The course will include specific emphasis on land use evaluation methods and transportation network analysis. Prerequisites: BS in mathematics, science, or engineering, or permission from instructor.
CIVL 575: Traffic Engineering Operations	Basic characteristics of motor-vehicle traffic, highway capacity, applications of traffic control devices, traffic design of parking facilities, engineering studies, traffic safety, traffic laws and ordinances, basic statistical analysis, components of traffic systems, measurement of traffic data, characterizing traffic system performance, analysis of existing traffic facilities, and design of traffic facilities for achieving desired system performance. Prerequisites: CIVL 305, Transportation Engineering, or permission from professor
CIVL 576: Roadway Geometric Design	Geometric design of roadways, at-grade intersections, and interchanges, using software programs, in accordance with conditions imposed by driver ability, vehicle performance, safety sustainability, and economic constraints. Prerequisites: CIVL 305, Transportation Engineering, or permission from professor
CIVL 612: Urban Transportation Planning	A systems approach to the transportation planning process focusing on policy issues and the decision making process. Topics include: 1.) Trip generation modeling –variables influencing trip generation, regression analysis and category analysis; 2.) Trip distribution – modeling factors governing trip distribution, growth-factor methods and gravity models, calibration of gravity models; 3.) Mode split modeling – factors influencing mode choice, discrete choice models; 4.) Route selection – traffic assignment; and 5.) Transportation surveys; transport related land use models, urban structure, urban goods transport. Use of popular transportation planning software will also be covered. Prerequisites: CIVL 302, Highway Engineering, or permission from professor
CIVL 640: Urban Mobility Infrastructure Policy and Planning	Foundation for understanding transportation systems' relationship to cities and people and managing urban transportation systems, including: 1.) multi-faceted understanding of the historical, spatial, economic, social, and environmental factors affecting transportation issues, 2.) transportation and land use relationships, 3.) transportation as a tool of economic development and growth, 4.) transportation political influences and finance, and 5.) regional, state and federal governmental structure of committees, agencies and oversight. Prerequisites: Admission to partner graduate degree programs; BS in math, science or engineering; or permission from professor
CIVL 642: Public Health, Physical Activity, and Design of the Built Environment	Multidisciplinary evaluation of cities, suburban communities and neighborhoods to identify positive and adverse effects of the built environment on levels of physical activity and measures of public health, with an emphasis on adoption of approaches for improving desirable outcomes. The course focuses on establishing basis of need and potential benefits from implementation of optimal solutions to the challenging dilemma of built environment, urban mobility, transportation infrastructure networks, economics, sustainability, livability, and community wellness. Interconnections between the fields of public health, public policy and engineering

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	design are identified. Students are equipped with proficiencies needed to create more healthy communities through an emphasis on physical activity. Prerequisites: Admission to partner graduate degree programs; BS in math, science or engineering; or permission from professor
CIVL 740: Transportation Safety Engineering	Methodology for conducting transportation accident studies, accident characteristics as related to operator, facility, and mode, statistical applications to accident data, current trends and problems in transportation safety. Prerequisites: CIVL 305, Transportation Engineering, or permission from professor
CIVL 741: Travel Demand Forecasting	In-depth coverage of travel-demand forecasting theory and the four-step process, site traffic impact analysis, and disaggregate travel demand models. Theory and method of forecasting travelers' choices of route, mode, destination, departure time, trip frequency and origin location in congested transportation networks. Prerequisites: CIVL 305, Transportation Engineering, or permission from professor

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**Faculty**

<b>Faculty and Administrative Personnel</b>				
<b>Rank</b>	<b>Full- or Part-time</b>	<b>Courses Taught or To be Taught, Including Term, Course Number &amp; Title, Credit Hours</b>	<b>Academic Degrees and Coursework Relevant to Courses Taught, Including Institution and Major</b>	<b>Other Qualifications and Comments (i.e., explain role and/or changes in assignment)</b>
Professor	Full-time	<ul style="list-style-type: none"> <li>• CIVL 506 Geographic Information Systems, 3 Credit Hours</li> <li>• CIVL 575 Traffic Engineering Operations, 3 Credit Hours</li> <li>• CIVL 576 Roadway Geometric Design, 3 Credit Hours</li> <li>• CIVL 612 Urban Transportation Planning, 3 Credit Hours</li> <li>• CIVL 640 Urban Mobility Infrastructure Policy and Planning, 3 Credit Hours</li> <li>• CIVL 642 Public Health, Physical Activity, and Design of the Built Environment, 3 Credit Hours</li> <li>• CIVL 740 Transportation Safety Engineering, 3 Credit Hours</li> <li>• CIVL 741 Travel Demand Forecasting, 3 Credit Hours</li> </ul>	PhD from Georgia Tech and MS from Auburn University both with a Transportation Engineering focus	<p>Registered Professional Engineer in Alabama 2003-2008, founding member of a community partnership with Berkeley Charleston Dorchester Council of Governments, to obtain and administer “Active Living by Design” grant from the Robert Wood Johnson Foundation, for improved land policies, programs and facilities to support healthy life styles.</p> <p>Fellow, ENO Center for Transportation Leadership Development, Washington, DC, 1996</p>
Professor	Full-time	<ul style="list-style-type: none"> <li>• CIVL 504 Designing for Natural and Manmade Hazards, 3 Credit Hours</li> <li>• CIVL 608 Structural Loads and Systems, 3 Credit Hours</li> <li>• CIVL 610 Wood Design, 3 Credit Hours</li> <li>• CIVL 655 Masonry Structural Design, 3 Credit Hours</li> <li>• CIVL 657 Indeterminate and Matrix Structural Analysis, 3 Credit Hours</li> </ul>	PhD and MS both with a Structural Engineering focus from North Carolina State University	Registered Professional Engineer in South Carolina

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		<ul style="list-style-type: none"> <li>• CIVL 711 Design of Masonry, Wood and Cold Formed Steel Structures, 3 Credit Hours</li> <li>• CIVL 713 Design of Civil Engineering Systems for Natural and Manmade Hazards, 3 Credit Hours</li> <li>• CIVIL 714 Advanced Steel Design, 3 Credit Hours</li> <li>• CIVL 715 Advanced Reinforced Concrete Design, 3 Credit Hours</li> <li>• CIVL 716 Analysis and Design of Prestressed Concrete Members, 3 Credit Hours</li> <li>• CIVL 718 Matrix and Finite Element Analysis, 3 Credit Hours</li> <li>• CIVL 719 Elastic Stability of Structures, 3 Credit Hours</li> <li>• CIVL 720 Dynamic Analysis of Structures, 3 Credit Hours</li> <li>• CIVL 721 Earthquake Engineering for Structural Engineers, 3 Credit Hours</li> </ul>		
Associate Professor	Full-time	<ul style="list-style-type: none"> <li>• CIVL 504 Designing for Natural and Manmade Hazards, 3 Credit Hours</li> <li>• CIVL 608 Structural Loads and Systems, 3 Credit Hours</li> <li>• CIVL 610 Wood Design, 3 Credit Hours</li> <li>• CIVL 655 Masonry Structural Design, 3 Credit Hours</li> <li>• CIVL 657 Indeterminate and Matrix Structural Analysis, 3 Credit Hours</li> <li>• CIVL 711 Design of Masonry, Wood and Cold Formed Steel Structures, 3 Credit Hours</li> <li>• CIVL 712 Design of Coastal Structures and Bridges, 3 Credit Hours</li> <li>• CIVL 713 Design of Civil Engineering Systems for Natural and Manmade Hazards, 3 Credit Hours</li> </ul>	<p>PhD with a Structural Engineering focus from Virginia Polytechnic Institute and State University</p> <p>Master's thesis in coastal engineering.</p> <p>Ph.D. dissertation focused on finite element modeling and earthquake engineering.</p> <p>Practical experience includes 15 years of structural design including the design of award winning buildings and marine structures.</p>	Registered Professional Engineer in South Carolina

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		<ul style="list-style-type: none"> <li>• CIVIL 714 Advanced Steel Design, 3 Credit Hours</li> <li>• CIVIL 715 Advanced Reinforced Concrete Design, 3 Credit Hours</li> <li>• CIVIL 716 Analysis and Design of Prestressed Concrete Members, 3 Credit Hours</li> <li>• CIVIL 718 Matrix and Finite Element Analysis, 3 Credit Hours</li> <li>• CIVIL 719 Elastic Stability of Structures, 3 Credit Hours</li> <li>• CIVIL 720 Dynamic Analysis of Structures, 3 Credit Hours</li> <li>• CIVIL 721 Earthquake Engineering for Structural Engineers, 3 Credit Hours</li> </ul>		
Associate Professor	Full-time	<ul style="list-style-type: none"> <li>• CIVIL 504 Designing for Natural and Manmade Hazards, 3 Credit Hours</li> <li>• CIVIL 608 Structural Loads and Systems, 3 Credit Hours</li> <li>• CIVIL 610 Wood Design, 3 Credit Hours</li> <li>• CIVIL 655 Masonry Structural Design, 3 Credit Hours</li> <li>• CIVIL 657 Indeterminate and Matrix Structural Analysis, 3 Credit Hours</li> <li>• CIVIL 713 Design of Civil Engineering Systems for Natural and Manmade Hazards, 3 Credit Hours</li> <li>• CIVIL 714 Advanced Steel Design, 3 Credit Hours</li> <li>• CIVIL 716 Analysis and Design of Prestressed Concrete Members, 3 Credit Hours</li> <li>• CIVIL 718 Matrix and Finite Element Analysis, 3 Credit Hours</li> <li>• CIVIL 720 Dynamic Analysis of Structures, 3 Credit Hours</li> </ul>	PhD and MS both with a Structural Engineering focus from Clemson University	

Note: Individuals should be listed with program supervisor positions listed first. Identify any new faculty with an asterisk next to their rank.

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Assistant Professor	Full-time	<ul style="list-style-type: none"> <li>• CIVL 506 Geographic Information Systems, 3 Credit Hours</li> <li>• CIVL 575 Traffic Engineering Operations, 3 Credit Hours</li> <li>• CIVL 576 Roadway Geometric Design, 3 Credit Hours</li> <li>• CIVL 612 Urban Transportation Planning, 3 Credit Hours</li> <li>• CIVL 640 Urban Mobility Infrastructure Policy and Planning, 3 Credit Hours</li> <li>• CIVL 740 Transportation Safety Engineering, 3 Credit Hours</li> <li>• CIVL 741 Travel Demand Forecasting, 3 Credit Hours</li> </ul>	PhD and MS both with a Transportation Engineering focus from University of Florida	
Assistant Professor	Full-time	<ul style="list-style-type: none"> <li>• CIVL 730: Geotechnical Earthquake Engineering, 3 Credit Hours</li> <li>• CIVL 731: Geo-environmental Engineering, 3 Credit Hours</li> <li>• CIVL 732: Advanced Soil Mechanics, 3 Credit Hours</li> <li>• CIVL 733: Advanced Foundations Design, 3 Credit Hours</li> <li>• CIVL 734: Soil Behavior, 3 Credit Hours</li> </ul>	PhD and MS both with a Geotechnical Engineering focus from Arizona State University	4 years of Geotechnical Engineering Design Experience

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Total FTE needed to support the proposed program (i.e., the total FTE devoted just to the new program for all faculty, staff, and program administrators):

Faculty	1	Staff	0	Administration	0
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Expect to hire the new FTE in 2016-2017. Request position within 2016-2017 budget build.

### Faculty /Administrative Personnel Changes

Provide a brief explanation of any additional institutional changes in faculty and/or administrative assignment that may result from implementing the proposed program. (1000 characters)

Faculty are required to teach a full load – 12 credit hours each semester. Each faculty member may consult one day per week and can gain teaching release time for successful research proposals. Additionally, The Citadel has a foundation grant that provides funding (\$2500 each area/year) in the following three areas: research seed funding, result presentations at conferences, and/or participate in faculty development opportunities. The new MSCE program will start with current faculty teaching courses as an add pay in the summer while leveraging the ability for students to take up to 4 non-technical courses already being offered throughout the year. As the demand increases beyond the ability for faculty to cover courses with add pay, faculty positions will be requested or reallocated. Current estimates would allow the program to cover 8 graduate courses per semester with one additional FTE faculty member (2017). **The staff and administration positions supporting the BSCE will also support the MSCE program.**

### Library and Learning Resources

Identify current library/learning collections, resources, and services necessary to support the proposed program and any additional library resources needed. (1000 characters)

The 2011 Standards for College Libraries does not address Civil Engineering specifically beyond recommending that a comparison of our holdings should occur with a group of peer institutions. The Citadel's holdings were compared with those of Clemson and USC (PASCAL members), VMI, UT-Chattanooga, Western Carolina, and University of North Florida. The Citadel library catalog holdings are small for civil engineering; however, the current ebook package, Academic Complete from ebrary, yields 3,521 hits from the same phrase search. These ebooks are available from on and off campus to currently-enrolled students.

The top 5 U.S. journals in civil engineering are: *Journal of Composites for Construction* (access through Business Source Complete); *Journal of Structural Engineering* (access through Academic Search Complete); *ACI Materials Journal* (access through interlibrary loan); *Mechanical Systems and Signal Processing* (access through ScienceDirect); and *ACI Structural Journal* (access through interlibrary loan).

The new BSME program has purchased a print version of the entire ASTM package. We expect many fully employed students will be using company resources to complete assignments. The Citadel currently spends approximately \$40,000 on library resources per year on engineering.

## **NEW PROGRAM PROPOSAL**

### **Student Support Services**

Identify academic support services needed for the proposed program and any additional estimated costs associated with these services. (500 characters)

The Citadel currently has strong student support services for existing undergraduate programs, graduate programs and veterans. These same services would provide support for the evening students who would be taking courses within the MSCE degree or associated certificates. It is expected that a majority of the students will be either full time employed or completing research degrees through Clemson's Restoration Institute. The Citadel and Clemson support credit (up to five courses) for each other's masters programs and The Citadel courses and faculty could support the research and associated courses at Clemson's Restoration Institute.

### **Physical Resources**

Identify any new instructional equipment needed for the proposed program. (500 characters)

The equipment being purchased as part of the new BSME program (first graduates 2016) as well as the equipment used within the BSCE and BSEE programs will support any physical demonstrations needed within MSCE level courses. Since the MSCE degree requires only 10 courses and no thesis, the lab equipment needs will be limited to support for showing theoretical concepts within a given course. The four focus areas: geotechnical, structures, and transportation, and built environment, planning and design for public health follow the five focus areas within the BSCE (geotechnical, structures, transportation, water resources, environmental) and associated equipment being purchased.

Will any extraordinary physical facilities be needed to support the proposed program?

Yes

No

Identify the physical facilities needed to support the program and the institution's plan for meeting the requirements, including new facilities or modifications to existing facilities. (1000 characters)

**NEW PROGRAM PROPOSAL**

**Financial Support**

<b>Estimated New Costs by Year</b>						
<b>Category</b>	<b>1<sup>st</sup></b>	<b>2<sup>nd</sup></b>	<b>3<sup>rd</sup></b>	<b>4<sup>th</sup></b>	<b>5<sup>th</sup></b>	<b>Total</b>
Program Administration	0	0	0	0	0	0
Faculty and Staff Salaries	6,000	12,000	105,000	105,000	117,000	345,000
Graduate Assistants	0	0	0	0	0	0
Equipment	0	0	0	0	0	0
Facilities	0	0	0	0	0	0
Supplies and materials	500	500	500	500	500	2500
Library Resources	0	0	0	0	0	0
Other*	0	0	0	0	0	0
<b>Total</b>	<b>6,500</b>	<b>12,500</b>	<b>105,500</b>	<b>105,500</b>	<b>117,500</b>	<b>347,500</b>
<b>Sources of Financing</b>						
<b>Category</b>	<b>1<sup>st</sup></b>	<b>2<sup>nd</sup></b>	<b>3<sup>rd</sup></b>	<b>4<sup>th</sup></b>	<b>5<sup>th</sup></b>	<b>Total</b>
Tuition Funding	19,500	45,000	72,000	109,500	147,000	393,000
Program-Specific Fees	0	0	0	0	0	0
State Funding (i.e., Special State Appropriation)*	0	0	0	0	0	0
Reallocation of Existing Funds*	0	0	0	0	0	0
Federal Funding*	0	0	0	0	0	0
Other Funding*	0	0	0	0	0	0
<b>Total</b>	<b>19,500</b>	<b>45,000</b>	<b>72,000</b>	<b>109,500</b>	<b>147,000</b>	<b>393,000</b>
<b>Net Total</b> (i.e., Estimated New Costs Minus Sources of Financing)	<b>13,000</b>	<b>32,500</b>	<b>(33,500)</b>	<b>4,000</b>	<b>29,500</b>	<b>45,500</b>

\*Provide an explanation for these costs and sources of financing in the budget justification.

## NEW PROGRAM PROPOSAL

### Budget Justification

Provide a brief explanation for the other new costs and any special sources of financing (state funding, reallocation of existing funds, federal funding, or other funding) identified in the Financial Support table. (1000 characters)

**Note: Institutions need to complete this budget justification *only* if any other new costs, state funding, reallocation of existing funds, federal funding, or other funding are included in the Financial Support table.**

n/a

## NEW PROGRAM PROPOSAL

### Evaluation and Assessment

**Programmatic Assessment:** Provide an outline of how the proposed program will be evaluated, including any plans to track employment. Identify assessment tools or software used in the evaluation. Explain how assessment data will be used. (3000 characters)

The Citadel is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools. The undergraduate engineering programs are accredited by ABET (CE just completed their reaccreditation visit in Nov 2014 and expects official reaccreditation in July 2015). The MS in Project Management has requested accreditation through the Project Management Institute Global Accreditation Center. The MSCE program will track accomplishment of Program Outcomes through the Taskstream software. Taskstream's platforms provide a centralized information and communication hub for assessment, accreditation, and planning activities across an institution. These include academic and non-academic outcomes assessment, planning, and program review. Taskstream offers specialized tools that enable users to document learning outcomes, align outcomes to institutional goals and standards, develop assessment plans, create curriculum maps, manage faculty credentials, and improve education based on findings. Taskstream's suite of tools facilitates the collection of student work, student reflections on the learning process, and faculty or peer rubric-based assessment. Rubrics, which are used to clarify expectations and scoring criteria, may also be aligned with established learning outcomes, standards, and competencies. The software provides reporting capabilities to support the aggregation and analysis of student performance data for the review of program and institutional effectiveness, as well as for reporting to accrediting agencies and other external stakeholders.

All programs within the School of Engineering track employment or employment changes after completion of each degree. The MSCE will track employment data in a similar way, but will also track from where students are initiating their MSCE (full-time employment, research, full-time schooling by continuing their education after a BSCE, etc.). Surveys from employers and continuing education institutions will be part of the post-graduation assessment data. Additionally, Professional Registration (PE) success rates will be used to assess the program.

## NEW PROGRAM PROPOSAL

### Student Learning Assessment

Expected Student Learning Outcomes	Methods of/Criteria for Assessment
Demonstrate breadth of knowledge in complimentary areas of civil engineering that promotes an awareness of and skill in interdisciplinary problem solving	Exams, design projects Courses: CIVL 504, CIVL 506, CIVL 640, CIVL 642, CIVL 657, CIVL 712, CIVL 713, CIVL 718, CIVL 730, CIVIL 731
Demonstrate a depth of knowledge in a chosen focus area of civil engineering that allows the student to apply innovative techniques to solve problems	Exams, design projects Courses: CIVL 575, CIVL 576, CIVL 608, CIVL 610, CIVL 655, CIVL 711 CIVL 714, CIVL 715, CIVL 716, CIVL 719, CIVL 720, CIVL 721, CIVL 732, CIVL 733, CIVL 734, CIVL 740, CIVL 741
Demonstrate knowledge in methods of advanced analysis appropriate for professional use when solving problems	Exams, design projects, homework Courses: CIVL 575, CIVL 576, CIVL 608, CIVL 610, CIVL 655, CIVL 711 CIVL 714, CIVL 715, CIVL 716, CIVL 719, CIVL 720, CIVL 721, CIVL 732, CIVL 733, CIVL 734, CIVL 740, CIVL 741
Demonstrate knowledge of contemporary issues in their chosen focus area	Papers, presentations Courses: CIVL 504, CIVL 713, CIVL 506, CIVL 612, CIVL 640, CIVL 642
Demonstrate the skills relevant to graduate level work to include the ability to formulate problems, synthesize and integrate information, work collaboratively, and to communicate effectively	Exams, design projects, homework, presentations Courses: CIVL 575, CIVL 576, CIVL 608, CIVL 610, CIVL 655, CIVL 711 CIVL 714, CIVL 715, CIVL 716, CIVL 719, CIVL 720, CIVL 721, CIVL 732, CIVL 733, CIVL 734, CIVL 740, CIVL 741
Demonstrate preparation for successful careers in industry or continued graduate work and an ethic for lifelong learning	Surveys, work placement tracking Courses: CIVL 504, CIVL 506, CIVL 640, CIVL 642, CIVL 657, CIVL 712, CIVL 713, CIVL 718, CIVL 730, CIVIL 731

## NEW PROGRAM PROPOSAL

Will the proposed program seek program-specific accreditation?

Yes

No

If yes, provide the institution's plans to seek accreditation, including the expected timeline for accreditation. (500 characters)

Will the proposed program lead to licensure or certification?

Yes

No

If yes, explain how the program will prepare students for licensure or certification. (500 characters)

### Teacher or School Professional Preparation Programs

Is the proposed program a teacher or school professional preparation program?

Yes

No

If yes, complete the following components.

Area of Certification

Please attach a document addressing the South Carolina Department of Education Requirements and SPA or Other National Specialized and/or Professional Association Standards.

Civil Engineering  
Appendix – Additional Questions from CHE

**1. How are we going to fund the new degree when we have asked for no money and placed none in the table?**

The new civil engineering (CE) degree will start slowly allowing the administration to gauge interest and demand, and at the same time, not strain any existing resources. We anticipate the majority of the initial students to be part-time since they will be full-time employed within the Low Country. The new degree requires no new infrastructure, laboratory facilities, or services since the new master's degree is an evening program and a majority of our undergraduate courses and laboratories are completed by 5 PM each day; therefore, we have the infrastructure to support the new MS degree which begins after 5 PM.

Initially, full time PhDs at The Citadel will teach the MS CE courses and will be compensated with add pay. In subsequent years, adjuncts will be used to fill teaching opportunities within the undergraduate degree to allow PhD credentialed faculty to teach within the graduate degree as the demand increases. Currently the program only utilizes 1-2 adjuncts per year teaching one course to support the undergraduate program. A full time faculty member will be hired when the demand for full time graduate courses grows to justify a full time position. The administration of the program will initially be handled by the Department Head with the addition of a program director (course reduction for an existing faculty member) once the work load and revenue generation allow for that increase.

**2. How we plan to roll-out the new programs.**

Summary: Initially, the civil engineering (CE) program will select one focus area (Geotechnical, Structural, or Transportation) to offer to the first cohort of students. The CE courses will be developed and taught based on interest from prospective students. Surveys of interested students will be used to gather this data. In the first cohort (2-3 years), we expect the current faculty to be able to develop and teach two courses over the summer term. Students will be able to take non-technical graduate level courses in Program Management, Business, Leadership or technical graduate level courses in other engineering departments such as mechanical and electrical. In addition and based on availability, students will be able to take technical classes offered at Clemson. Students must complete at least six technical courses. The remaining four courses can be technical or non-technical.

Example: Based from surveys of potential students, the Structural focus area is selected as the first to be developed. Students would earn a MSCE selecting the following sequence of courses:

Table 1: Example MSCE Sequence

<b>Term</b>	<b>Technical Courses</b>	<b>Non-Technical Courses</b>
<b>Academic Year 1</b>		
Summer	CIVL 608: Structural Loads and Sys.	
	CIVL 657: Indeterminate and Matrix Structural Analysis	
Fall	Potential for Clemson Transfer Class	PMGT <i>or</i> BADM 600/700 level
		Note: PMGT and BADM courses are currently offered fall, spring, and summer and can support additional enrollment.
Spring	Potential for Clemson Transfer Class	PMGT <i>or</i> BADM 600/700 level
<b>Academic Year 2</b>		
Summer	CIVL 610: Wood Design	
	CIVL 712: Design of Coastal Structures	
Fall	Potential for Clemson Transfer Class	PMGT <i>or</i> BADM 600/700 level
Spring	Potential for Clemson Transfer Class	PMGT <i>or</i> BADM 600/700 level
<b>Academic Year 3</b>		
Summer	CIVL 718: Matrix and Finite Element Analysis	
	CIVL 720: Dynamic Analysis of Struc.	

Priority: The following table lists the initial priority of focus areas with the course development sequence within each.

Table 2: MSCE Course Priority for Development

<b>Focus Area</b>	<b>Course</b>	<b>Estimated Development / First Year Offering</b>
<b>Geotechnical</b>	CIVL 730: Geotechnical Earthquake Engineering	Year 2
	CIVL 731: Geo-environmental Engineering	2
	CIVL 732: Advanced Soil Mechanics	3
	CIVL 733: Advanced Foundations Design	3
	CIVL 734: Soil Behavior	4
<b>Structural</b>	CIVL 608: Structural Loads and Systems	Year 1
	CIVL 657: Indeterminate and Matrix Structural Analysis	1
	CIVL 610: Woods Design	2
	CIVL 712: Design of Coastal Structures and Bridges	2
	CIVL 718: Matrix and Finite Element Analysis	3
	CIVL 720: Dynamic Analysis of Structures	3
<b>Transportation</b>	CIVL 575: Traffic Engineering Operations	Year 3
	CIVL 576: Roadway Geometric Design	3
	CIVL 612: Urban Transportation Planning	4
	CIVL 740: Transportation Safety Engineering	4
	CIVL 741: Travel Demand Forecasting	5

**3. How our relationship with Clemson at the restoration center will influence funding and/or roll-out of the new programs.**

An articulation agreement (ref TIGE, The Institute for Graduate Education) between The Citadel and Clemson is in effect for the new MS programs. The Citadel and Clemson support credit (up to five courses) for each other's masters programs. This is above the typical limit of 9-12 transfer hours or 3-4 courses from another institution. Under the agreement, The Citadel's courses and faculty could support the research and associated courses (graduate level) at Clemson's Restoration Institute. This relationship will help to provide additional students and course offering that neither institution would have individually. The Citadel currently has one faculty member and two students working with Clemson's Restoration Institute.

**4. Complete list of current faculty, adjunct, and staff supporting the program. We are in the process of adding additional adjuncts once the MS program is approved.**

Faculty Name	Highest Degree Earned-Field and Year	Rank <sup>1</sup>	Type of Academic Appointment <sup>2</sup> T, TT, NTT	FT or PT	Years of Experience			Professional Registration/ Certification – Current Employer if not Citadel
					Govt./Ind. Practice	Teaching	This Institution	
Kevin C. Bower	Ph.D., Environmental, 2003	ASC	T	FT	5	11	12	SC
William J. Davis	Ph.D., Transportation, 1997	P	T	FT	15	17	18	AL, GA
Dennis J. Fallon	Ph.D., Structural, 1980	P	T	FT	8	31	27	SC
Simon Ghanat	Ph.D., Geotechnical, 2011	AST	TT	FT	0	2	2	EIT
James Michael Grayson	Ph.D., Structural, 2013	AST	TT	FT	0	1	1	EIT
John Greenan	M.S., Structural, 2010	A	NTT	PT	5	2	2	SC – Applied Building Science
Timothy W. Mays	Ph.D., Structural, 2000	ASC	T	FT	3	12	13	SC
Dimitra Michalaka	Ph.D., Transportation, 2012	AST	TT	FT	0	1	2	EIT
John A. Murden	Ph.D., Structural, 1987	ASC	T	FT	5	25	26	EIT
Timothy Parker	M.S., Structural/ Project Mngt., 2012	A	NTT	PT	33	5	5	SC, NC, GA – Parker Rigging

Faculty Name	Highest Degree Earned-Field and Year	Rank <sup>1</sup>	Type of Academic Appointment <sup>2</sup> T, TT, NTT	FT or PT	Years of Experience			Professional Registration/ Certification – Current Employer if not Citadel
					Govt./Ind. Practice	Teaching	This Institution	
M. Kevin Turner	M.S., Structural, 2003	A	NTT	PT	11	2	2	SC - SCDOT
Mary Katherine Watson	Ph.D., Environmental, 2013	AST	TT	FT	0	1	2	EIT
Ronald W. Welch	Ph.D., Structural, 1999	P	T	FT	14	18	4	VA
Michael H. Woo	Ph.D., Water Resources, 1985	ASC	T	FT	0	29	30	SC

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other 2. Code: TT = Tenure Track T = Tenured NTT = Non Tenure Track

**5. As can be seen below, we have a robust and very active in the lowcountry set of industry advisors for our program. They have been voicing a need for face-to-face MS degrees for years to ensure the continuous improved technical competence, company advancement, and promotion opportunities.**

CIVIL AND ENVIRONMENTAL ENGINEERING ADVISORY BOARD ROSTER  
The Citadel, 171 Moultrie Street, Charleston, SC 29409

Academic Year 2015-2016

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