

### PROGRAM MODIFICATION PROPOSAL FORM

Name of Institution: University of South Carolina Columbia

Briefly state the nature of the proposed modification (e.g., adding a new concentration, extending the program to a new site, curriculum change, etc.):

Adding an optional Railway Engineering concentration to the current Ph.D. in Civil Engineering degree.

Current Name of Program (include degree designation and all concentrations, options, and tracks):

Doctor of Philosophy in Civil Engineering with optional concentrations in Environmental Engineering, Geotechnical Engineering, Structural Engineering, Transportation Engineering, and Water Resources Engineering.

Proposed Name of Program (include degree designation and all concentrations, options, and tracks):

Doctor of Philosophy in Civil Engineering with optional concentrations in Environmental Engineering, Geotechnical Engineering, Structural Engineering, **Railway Engineering**, Transportation Engineering, and Water Resources Engineering.

Program Designation:

- |   |  |
|---|--|
| <input type="checkbox"/> Associate's Degree   | <input type="checkbox"/> Master's Degree   |
| <input type="checkbox"/> Bachelor's Degree: 4 Year  | <input type="checkbox"/> Specialist  |
| <input type="checkbox"/> Bachelor's Degree: 5 Year<br>DMA)  | <input checked="" type="checkbox"/> Doctoral Degree: Research/Scholarship (e.g., Ph.D. and |
| <input type="checkbox"/> Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.) |  |

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

- ☐ Yes  
☒ No

If No, should the program be considered for supplemental Palmetto Fellows and LIFE Scholarship awards?

- ☐ Yes  
☒ No

Proposed Date of Implementation: Fall 2023

CIP Code: 140801

Current delivery site(s) and modes: 51102 USC Columbia, Main Campus

Proposed delivery site(s) and modes: 51102 USC Columbia, Main Campus

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

Dr. Fabio Matta, Associate Professor and Graduate Director, Department of Civil and Environmental Engineering, 803-777-1917, [fmatta@sc.edu](mailto:fmatta@sc.edu)

#### Institutional Approvals and Dates of Approval:

Department of Civil and Environmental Engineering (Chair): 10/17/2022

Dean of the College of Engineering and Computing: 10/17/2022

Graduate Council Committee on Science, Math, and Related Professional Programs: 10/21/2022

Graduate Council: 10/24/2022

Provost: 12/5/2022

President: 12/6/2022

Board of Trustees Academic Excellence and Student Experience Committee: 12/13/2022

Board of Trustees: 12/13/2022

### **Background Information**

Provide a detailed description of the proposed modification, including target audience, centrality to institutional mission, and relation to strategic plan.

The proposed modification adds a concentration area to the Ph.D. program in the Department of Civil and Environmental Engineering (CEE). The proposed modification builds on existing competencies in the CEE department. In 2011 as part of the strategic planning of the CEE department to cater to the needs of targeted industries a team of faculty and associates with interest in railway engineering established the Advanced Railway Technology Group (ART Group). The ART Group is a focus group that promotes research, education, technology transfer and workforce development in Railroad Engineering. Members of the group have been involved in rail related research sponsored by federal agencies and private industry. In 2016, the Post-Baccalaureate Certificate in Railway Engineering program was approved as a 12-credit hour program. The Post-Baccalaureate Certificate program in railway engineering along with the other research, education, technology transfer and state and national service activities of the group have generated a strong interest at the local, state, and national and international levels. As a result, the department has seen an increase in the number of applicants to the graduate program with interest in railroad engineering. The proposed concentration area targets the following groups: (i) undergraduate students at USC and other institutions; (ii) junior engineers already in the industry; (iii) any level engineers interested in joining the industry; (iv) any level engineers seeking professional development through continuing education.

### **Assessment of Need**

Provide an assessment of the need for the program modification for the institution, the state, the region, and beyond, if applicable.

The rail industry growth and modernization along with aging rail employee demographics is creating a strong demand for graduates with rail expertise, *particularly in engineering and related technical fields*. Rail industry and government organizations recognize the importance of academic partners in educating and supplying the next generation workforce. However, unlike Asia and Europe, there exist a very small number of organized academic rail programs in the USA and these are inadequate to meet the workforce demand for experts and educators in Railway Engineering. The railroad industry currently hires new employees with engineering background from a general pool of applicants. Because of the shortage of graduates with railway engineering skills, applicants with a basic knowledge of the railway industry are preferred hires by the railroad industry. Even fewer individuals enter the academia or research institutions to lead the development of the next generation of leaders in research and education. There are four US institutions with concentration areas in railroad engineering: (i) the University of Illinois at Urbana Champaign, offers a 12-credit hour graduate certificate, as well as M.S.

and Ph.D. degrees in Civil Engineering with emphasis in railroad engineering. (ii) Michigan Tech offers a 16-credit hour minor in railroad engineering as part of the civil engineering curriculum and targets the institution's own students, (iii) Penn State – Altoona offers the only B.S. degree in Rail Transportation Engineering in the US and (iv) University of Delaware offers a 9-credit hour graduate certificate in rail engineering in the civil engineering program. Beyond these limited offerings, only a handful of other programs in the academic community are at various stages of developing and implementing rail-related activities that range from integration of rail related modules in existing transportation courses to development of core courses in rail engineering.

The proposed concentration area of the Ph.D. program, when designed around the research and workforce development needs of the industry will fill the educator and research gap, accelerate the production of highly qualified graduates with research background for the industry and strengthen the relationship between industry and academia. Furthermore, Ph.D. students with focus on railway engineering will give the ART Group faculty teams a competitive edge and the human resources to compete for new funding sources for sponsored research. A graduate degree (M.E., M.S. or Ph.D.) adds significant value to the graduate certificate at this point.

This presents a unique opportunity for the department of Civil and Environmental Engineering at USC to capitalize on its current strengths in railway engineering research and education and set itself among the leading programs in research, education and workforce development related to railroads.

#### **Transfer and Articulation**

Identify any special articulation agreements for the modified proposed program. Provide the articulation agreement or Memorandum of Agreement/Understanding.

None

#### **Description of the Program**

<b>Projected Enrollment</b>						
<b>Year</b>	Fall Headcount		Spring Headcount		Summer Headcount	
	New	Total	New	Total	New	Total
1	1	1	0	1	0	1
2	2	3	0	3	0	3
3	2	5	0	5	0	5
4	1	6	0	6	0	6

#### **Explain how the enrollment projections were calculated.**

The anticipated enrollment in the proposed program is estimated based on: (i) The enrollment of the CEE students in the railroad related courses currently offered; (ii) Inquiries by past and current and perspective applicants to the graduate program about railway engineering; (iii) Enrollment estimates provided by colleagues at other institutions with similar programs; and (iv) Anecdotal feedback from industry contacts

## Curriculum

Courses required for the program are listed in Attachment A

### Curriculum Changes

Courses Eliminated from Program	Courses Added to Program	Core Courses Modified
None	None	None

### New Courses

List and provide course descriptions for new courses.

There are no new courses

### Similar Programs in South Carolina offered by Public and Independent Institutions

Identify the similar programs offered and describe the similarities and differences for each program.

As of October 2022, there are no existing programs that offer graduate degrees or courses in railway engineering in South Carolina.

## Faculty

State whether new faculty, staff or administrative personnel are needed to implement the program modification; if so, discuss the plan and timeline for hiring the personnel. Provide a brief explanation of any personnel reassignment as a result of the proposed program modification.

No new faculty are requested or needed, and existing courses are already being taught by current faculty. Given the existing faculty and other resources, this program requires no additional costs for the College of Engineering and Computing

## Resources

Identify new library, instructional equipment and facilities needed to support the modified program.

**Library Resources:** No additional library resources are needed to support the new concentration.

**Equipment:** No additional equipment is needed to support the new concentration.

**Facilities:** No additional facilities are needed to support the new concentration.

### Impact on Existing Programs

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

☐ Yes

☒ No

### Financial Support

Estimated Sources of Financing for the New Costs						
Category	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	Total
Tuition Funding	\$0	\$0	\$0	\$0	\$0	\$0
Program-Specific Fees	0	0	0	0	0	0
Special State Appropriation	0	0	0	0	0	0
Reallocation of Existing Funds	0	0	0	0	0	0
Federal, Grant, or Other Funding	0	0	0	0	0	0
<b>Total</b>	\$0	\$0	\$0	\$0	\$0	\$0
Estimated New Costs by Year						
Category	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	Total
Program Administration and Faculty and Staff Salaries	0	0	0	0	0	0
Facilities, Equipment, Supplies, and Materials	0	0	0	0	0	0
Library Resources	0	0	0	0	0	0
Other (specify)	0	0	0	0	0	0
<b>Total</b>	0	0	0	0	0	0
<b>Net Total</b> (i.e., Sources of Financing Minus Estimated New Costs)	\$0	\$0	\$0	\$0	\$0	\$0

**Budget Justification**

Provide a brief explanation for all new costs and sources of financing identified in the Financial Support table.

The proposed modification does not require any new costs and is not expected to generate any revenue as students are already taking the rail courses as part of their program of study. Adding the concentration formally recognizes their expertise and thereby enhances the reputation of the university.

**Evaluation and Assessment**

<b>Program Objectives</b>	<b>Student Learning Outcomes Aligned to Program Objectives</b>	<b>Methods of Assessment</b>
To educate students at the most advanced level in civil and environmental engineering (CEE), giving them both depth and breadth of knowledge in CEE subjects. For methods, the faculty will be responsible for making decisions and recommendations based on data.	Graduates will be able to demonstrate expertise in a core subject area of civil and environmental engineering.	Evaluation of class projects, term papers and or design problems in major exams. Written and oral qualifying examinations.
	Graduates will be able to demonstrate a working knowledge of various areas of CEE and related fields.	PhD Comprehensive Exam
	Students will be able to describe and discuss sound research approaches and knowledge of advances in Civil and Environmental Engineering.	PhD Comprehensive Exam
	Students will be able to demonstrate the ability to apply knowledge of mathematics, science and engineering.	Written and oral PhD Qualifying Exam
To prepare students to be effective researchers in civil and environmental engineering.	Graduates will be able to identify pertinent research problems, and formulate and execute a research plan.	PhD Comprehensive Exam and PhD Dissertation Defense
	Graduates will be able to describe and discuss advances of knowledge in civil and environmental engineering	PhD Comprehensive Exam and PhD Dissertation Defense
	Graduates will be able to generate and analyze original research results, and to communicate these results through oral presentations and written publications submitted to refereed archival journals.	PhD Comprehensive Exam and PhD Dissertation Defense
To prepare students for life-long learning and professional development.	Graduates will demonstrate the basic skills needed for life-long	PhD Dissertation Defense

	learning and professional development.	
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Will any the proposed modification impact the way the program is evaluated and assessed? If yes, explain.

☐ Yes

☒ No

Will the proposed modification affect or result in program-specific accreditation? If yes, explain; and, if the modification will result in the program seeking program-specific accreditation, provide the institution's plans to seek accreditation, including the expected timeline.

☐ Yes

☒ No

Will the proposed modification affect or lead to licensure or certification? If yes, identify the licensure or certification.

☐ Yes

☒ No

Explain how the program will prepare students for this licensure or certification.

If the program is an Educator Preparation Program, does the proposed certification area require national recognition from a Specialized Professional Association (SPA)? If yes, describe the institution's plans to seek national recognition, including the expected timeline.

☐ Yes

☒ No

**Attachment A**  
**Courses Required for the Program**

Course	Title	Credits
<b>Select 2 from the following Fundamental Courses</b>		<b>6</b>
ECIV 580	Railway Engineering I	
ECIV 582	Operation and Logistics of Railway Systems	
ECIV 588	Design of Railroad Bridges and other Structures	
ECIV 590*	Intermediate Special Topics	
ECIV 7xx**	One of 7xx of the <u>Advanced Courses</u> list	
ECIV 7xx**	One of 7xx of the <u>Advanced or Cross-Discipline Courses</u> list	
<b>Select 1 from the following Advanced Courses</b>		<b>3</b>
ECIV784 or ECIV724 or ECIV734	Railway/Structural/Soil Dynamics	
ECIV 789	Design Project in Railway Engineering	
ECIV 707	Management of Engineering Projects	
ECIV 790*	Selected Topics in Civil Engineering	
<b>Select 1 from the following Cross-Discipline Courses</b>		<b>3</b>
ECIV 72X	Any structural engineering core course	
ECIV 73X	Any geotechnical engineering core course	
ECIV 74X	Any transportation engineering core course	
ECIV 75X	Any environmental engineering core course	
ECIV 76X	Any water resources engineering core course	
<b>Total Credit Hours</b>		<b>12</b>

\*\* Applies to Ph.D. students with an M.S./M.E. degree only and requires Faculty Advisor and Graduate Director approval. Can be taken either for *Fundamental Courses* credit or *Advanced/Cross-Discipline Course* credit, not both