

## Graduate Certificate in Railroad Engineering

### I. Description

The Graduate Certificate in Railroad Engineering will be offered by the University of Delaware's Department of Civil and Environmental Engineering and will be administered through the Engineering Outreach Program. Satisfactory completion of the certificate will require the taking of three graduate courses (as detailed below) earning passing grades (C or better). Students eligible to pursue this graduate certificate will be those who hold an undergraduate degree showing satisfactory completion of STEM courses prerequisite to success in graduate engineering courses and thus admitted as EGOR-ND/graduate/non-degree or matriculated in a graduate engineering degree program. The certificate completion will be noted on the student's graduate transcript, and a certificate will be awarded as well, signed by the Director of UD's Railroad Engineering & Safety Program, the Chair of the Department of Civil & Environmental Engineering, and the Assistant Dean/Director of the Engineering Outreach Program.

*Objective:* To prepare students to meet railroad industry employers' expectations with respect to their knowledge of railroad and rail transit. Additionally, it is anticipated that it will serve as a recruiting tool for the graduate program in civil engineering, with a railroad engineering focus.

### II. Rationale and Demand

#### A. Institutional Factors

1. UD Mission Compatibility – Among the “milestones” mapped out in UD's *Path to Prominence* were excellence in professional education and a global initiative that extends UD's geographic reach. Through use of UDCapture and Sakai (and whatever other platforms the University chooses to support in the future), this certificate will be accessible to students well beyond the Delaware region. To date, we have had students taking the core courses remotely from India, Israel and Brazil, as well as U.S. locations more than an hour from campus (making it difficult for them to attend on-campus classes). These engineering professionals speak highly of the courses and are spreading the word among their colleagues.
2. Planning Process – Because the College of Engineering/Department of Civil & Environmental Engineering recognized the gap (railroad engineering) in their graduate offerings, Dr. Allan M. Zaremski was hired to start the Railroad Engineering & Safety Program, the national need for which has been affirmed by a marketing study done for us by the Educational Advisory and On-line Education Forum. (See Student Demand, below) Through input from the Railroad Engineering Advisory Board (with industry representation from Amtrak, Norfolk Southern, CSX, and others), as well as from the Department of Civil and Environmental Engineering transportation faculty, the appropriate courses were designated (with additional courses planned as options for the certificate program). In addition, the Education Advisory Board, Continuing and Online Education Forum, conducted a market research study at the request of the University of Delaware, *Market Demand for Graduate Railroad Engineering Programs: An analysis of Employer Demand and Existing Programs*. One of the key observations was that “Completion of several courses in railroad engineering adequately prepares students to compete for employment in the rail transportation industry.”
3. Impact on other UD Programs – Program course requirements are all CIEG courses. The Department of Mechanical Engineering has confirmed that a graduate student in mechanical engineering could use the certificate program courses to fulfill their three electives.

4. Utilization of Existing Resources – No additional resources are required at this point, as all courses are existing or planned and UDCapture capability is existing on-campus.

B. Student Demand

This certificate is designed for engineering professionals working in the area of railroad engineering or for those desiring to expand their knowledge of railroad engineering and related engineering disciplines, to thereby become viable candidates for employment in the railroad industry. Our railroad engineering advisory board suggests that, with the courses in distance format and the availability of Certificate recognition, our enrollment of engineering professionals in the courses will increase from its current levels (generally 2-5/semester). We conservatively anticipate an ongoing enrollment of engineering professionals pursuing the certificate program courses to reach ten/semester.

C. Transferability – The certificate program courses are all transferable into a graduate program in civil engineering or mechanical engineering. Because the University policy is that at most 9 credits taken in non-degree status can be transferred into a graduate degree program, completion of this graduate certificate is in conformity with that policy, should the student decide to apply/is accepted into a graduate degree program.

D. Graduate and Professional Program Access – Those wishing to pursue this graduate certificate will be guided by Engineering Outreach staff through the admissions process used for all engineering graduate/non-degree students, including review of undergraduate transcripts and completion of the UD graduate application to Engineering Outreach/Non-degree status.

E. Demand & Employment Factors - As the market research study points out, there are no institutions offering graduate degrees in railroad engineering, although there are a few institutions offering certificate programs (Michigan Tech, University of Illinois at Urbana-Champaign, University of Kentucky, and more recently Penn State). For the most part, these programs are face-to-face. Employers typically hire civil or mechanical engineering graduates and subsequently have to find training for them in railroad engineering. Moreover, because of the transient railroad engineering workforce, with railroad engineers often relocating for jobs but seeking graduate programs while concurrently employed, online graduate programs are needed.

F. Regional, State and National Factors - Railroad activity in the US is flourishing, with expansion across the industry – in freight, passenger (inter-urban and commuter), transit, and emerging high-speed rail. With increased activity comes the need for highly trained professionals to ensure operating safety, efficiency, and cost-effective use of resources. Yet many of the most experienced engineers and supervisors are retiring, leaving a gap in knowledge, experience and capability. This certificate program can help fill that need.

G. Other Strengths – anticipated collaborations – We already have interest from the major rail agencies through the Railroad Engineering Advisory Board, whose railroad industry members recognize the benefits to their industry:

- By requiring three graduate level courses in railroad engineering, the graduate certificate will meet employers' expectations for the educational background of prospective railroad engineering hires.
- Because of the "professionally convenient" nature of the graduate level railroad engineering courses (generally late-day scheduling and/or available on-line, thanks to UDCapture technology), new railroad engineering hires who have not had specific railroad engineering coursework in their undergraduate civil/structural or mechanical engineering degree programs will be able to pursue this graduate certificate while working full-time. Similarly with engineers who would like to advance their careers in the railroad industry.
- Faculty can get to know students taking the railroad engineering certificate program courses

and can then more legitimately make recommendations to prospective railroad industry employers of interns and full-time employees.

### **III. Enrollments, Admissions and Student Finances**

Admissions and enrollment in railroad engineering certificate program courses by those who are not already matriculated in a graduate engineering degree program will be managed through the Engineering Outreach Program. The prospective student is required to submit a copy of his/her undergraduate transcript for review and, upon approval by the Assistant Dean/Director of Engineering Outreach, the student will be guided through the graduate admissions process to obtain Engineering Outreach/Non-degree matriculation status. This results in courses taken to reside on the graduate transcript (making them applicable to a degree program if/when the student elects to apply/is accepted into a graduate engineering degree program). Part-time students are self- or industry-funded.

### **IV. Curriculum Specifics**

Program Description: The graduate certificate courses can be taken for credit with standard grading (A, B, etc.) or on a Pass/Fair basis. Courses in which the student earns a grade of B or better would be transferable as electives into a graduate civil or mechanical engineering degree program. (At most institutions, including the University of Delaware, a maximum of three courses – 9 credits – taken in non-degree status can be transferred into a graduate degree program.) If the certificate program participant already holds a graduate degree and does not intend to use the courses toward any future degree program, then the participant may elect to take the courses Pass/Fail, still earning graduate credits toward the certificate; however, those credits would not be considered transferable into a graduate degree program.

Professor Allan M. Zarembski, Director of the Railroad Engineering & Safety Program, will also serve as Director of the Graduate Certificate Program in Railroad Engineering. This certificate program will be offered by the University of Delaware's Department of Civil and Environmental Engineering and will be administered through the Engineering Outreach Program. Satisfactory completion of the certificate will require the taking of three graduate courses (as detailed below) earning passing grades (C or better). (This can be done by students classified EGOR-ND/graduate/non-degree or matriculated in a graduate engineering degree program.) The certificate completion will be noted on the student's graduate transcript, and a certificate will be awarded as well, signed by the Director of UD's Railroad Engineering & Safety Program, the Chair of the Department of Civil & Environmental Engineering, and the Assistant Dean/Director of the Engineering Outreach Program.

#### Course Requirements:

#### **Required Core Courses:**

Two courses, selected from the following (this list will be added to over time):

CIEG617, Introduction to Railroad Engineering  
CIEG618, Railroad Derailment and Safety  
CIEG667<sup>1</sup>: Railroad Geotechnical Engineering

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<sup>1</sup> Permanent status is being requested in parallel for this experimental course that will be offered for the first time in Spring 2015.

***Note that any of the courses currently listed, or later added to the list of core course options, that are not used to fulfill the required core may be used as an elective course.***

**Elective Options:**

One course from the following CIEG courses. (Also see the note above.)

CIEG608, Introduction to Bridge Design

CIEG626, Soil Behavior

CIEG628, Ground Improvement Methods

(Additional course options may be added as approved by the CEE graduate committee.)

**V. Resources Available**

There are no special learning resources required to support this certificate program, other than the availability of UDCapture and a learning management platform, both of which currently exist.

**VI. Resources Required**

Current resources (learning resources as well as faculty resources) are currently sufficient to support this graduate certificate program.

**VII. Implementation and Evaluation**

In collaboration with the Engineering Outreach Program and the Railroad Engineering Advisory Board, this graduate certificate will be marketed broadly, both nationally and internationally. Because of the anticipated part-time status of its clientele, the program will be administered by the Engineering Outreach Program, including admission and advisement (in collaboration with the Director of the Railroad Engineering and Safety Program, currently Dr. Allan M. Zarembski). Upon completion of three certificate program courses with grades of C or better (or Satisfactory, in the case of those taking the courses pass/fail), Engineering Outreach will notify the Graduate Office to have the notation added to the graduate transcript, "Completion of the Graduate Certificate in Railroad Engineering."

University course evaluations of the certificate program courses (which are part of the graduate curriculum in civil engineering) will be reviewed by the Department of Civil & Environmental Engineering. In addition, a follow-up survey will be conducted by the Engineering Outreach Program of those who complete the certificate program in an effort to assess the usefulness of the information provided for those in the railroad industry. That feedback will be provided to the Director of the Railroad Engineering & Safety Program, enabling continual improvement.