National University Rail Center - NURail
US DOT OST-R Tier 1 University Transportation Center

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Railway Project Design and Construction (CEE 411)
Course Updates

By

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20-01-2017

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DISCLAIMER

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National University Rail Center - NURail
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TECHNICAL SUMMARY

Title

Railway Project Design and Construction (CEE 411) Course Updates

Introduction

Course CEE 411 "Railway Project Design and Construction" is a cornerstone of the railway engineering education program developed by the Rail Transportation and Engineering Center (RailTEC) at the University of Illinois at Urbana-Champaign (UIUC). Prior to this project, many elements of the course dated to its initial offering in 2008. This project developed new and revised course materials to expand coverage of key concepts that influence the design and construction of railway projects. A specific focus of the effort was to incorporate rail-specific CAD design software (MicroStation and Bentley RailTrack) into the course lectures and assignments for the first time.

Description of Activities

CEE 411 is a full-semester course that is open to graduate students and upper-level undergraduate students at UIUC. Although most students enrolled in the course are in the civil/transportation engineering program at UIUC, students from other departments and campus units with an interest in railway transportation or construction management frequently enroll in the course. The course is also offered online to non-degree students and students enrolled in the UIUC online M.S. program in civil engineering.

When previously taught, CEE 411 covered the following major topic areas, reflecting the experience and expertise of the instructor, J. Riley Edwards:

- Track charts
- Operating cost and revenues
- Alternative analysis
- Subgrade design and permitting
- Surveying
- MicroStation (by guest lecture)
- Construction contracts and bid documents
- Construction management field procedures

When the course was conceptualized, it was assumed that all students enrolled in CEE 411 (offered during the spring semester) would have completed CEE 409 Railway Track Engineering the previous

fall and be familiar with basic track geometry concepts. However, over time, more students began to enroll in the course without taking any previous courses on railway topics. Thus there was a need to introduce additional basic track design content into the course.

With the arrival a new co-instructor, C. Tyler Dick, P.E. with multiple years of railroad project design experience, the opportunity arose to restructure the course with new and revised materials and additional assignments.

This project completely redeveloped the first half of the course with a new emphasis on track design and use of specific design software. The course is now organized into the following major topic areas:

- Railway geometry and design
- Railway project planning, evaluation and alternative analysis
- Surveying, construction management and construction procedures

New lectures and assignments were added to the course for Spring 2013. Further changes to the structure of the assignments and semester design project were made for Spring 2015. Finally, for Spring 2017, the order of lectures during the first two-thirds of the course was altered to better fit the new pattern of lecture topics, classroom activities, assignments and semester design project.

Outcomes

The revised Spring 2013 and Spring 2017 course syllabus and schedule for CEE 411 developed through this project are attached to the end of the report.

The course consists of 26 lectures and nearly all of them were modified, expanded or otherwise improved through this project. A total of nine lectures of entirely new content were developed on the following topics:

- Railway capacity analysis (new for 2017)
- Railway geometry: horizontal
- Railway geometry: vertical
- Railway geometry: fundamentals of railroad location
- Railway design: MicroStation track layout
- Railway design: project phasing and constructability
- Railway design: Bentley RailTrack design
- Alternative analysis: capital cost estimation in-class exercise
- Utilities and clearances

This project also redeveloped five assignments for the course with three of them being brand new:

- Geometric layout (new assignment)
- Semester design project alignment and earthwork calculations
- Capacity and siding location (new assignment)
- Railway Geometric Design with MicroStation and Rail Track (new assignment)
- Semester design project route selection

The midterm test and final exam were also modified to fit the new course structure.

The redeveloped version of CEE 411 was first taught in Spring 2013 and again during subsequent spring semesters. Enrollment in the course for each of these five years is as follows:

- Spring 2013: 45 students (including 4 online)
- Spring 2014: 42 students (including 4 online)
- Spring 2015: 26 students (including 4 online)
- Spring 2016: 32 students (including 3 online)
- Spring 2017: 30 students (including 3 online) – as of 1/20/2017

Conclusions/Recommendations

From the instructor perspective, introducing new CEE 411 lecture content was a complete success. Given the small class size, and that no students were enrolled in both the "new" and "old" versions of the course, it is difficult to definitively quantify if student performance changed following the changes to the course. However, anecdotal evidence from course reviews indicates that students place a high value on the additional design content, particularly the exposure to MicroStation and RailTrack. This design software experience is one factor that can distinguish students enrolled in the course from their peers when applying for internships and permanent positions in the rail and general transportation design industry.

A key lesson learned from this project is that examining an established course from a fresh perspective can improve and reenergize the conduct of the course. New lecture material can reignite instructor enthusiasm for lecture topics that have grown routine, stale or out-of-date. Careful ordering of lecture materials can aid instructor delivery and student comprehension of important course concepts.

Publications/Examples

Not applicable.

Primary Contact

Principal Investigator
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Other Faculty and Students Involved

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University of Illinois at Urbana-Champaign
1243 Newmark Civil Engineering Lab, MC-250
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Samantha Chadwick
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CEE 411 Teaching Assistant (Spring 2013)
Rail Transportation and Engineering Center - RailTEC
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CEE 411 - Spring 2013
Railroad Project Design and Construction
Tuesdays and Thursdays • 2:00 - 3:20 PM • NCEL 1311

Course Syllabus

Instructor Information

J. Riley Edwards
Senior Lecturer - RailTEC
Department of Civil and Environmental Engineering
University of Illinois at Urbana-Champaign
Office: 1245A Newmark Civil Engineering Laboratory, MC-250
205 N. Matthews Ave., MC-250, Urbana, IL 61801
Telephone: 217-244-4717 (office); Fax: 217-333-1924
E-mail: jedward2@illinois.edu
Office hours: Feel free to email me and set up an appointment.

C. Tyler Dick, P.E.
Senior Railway Research Engineer - RailTEC
Department of Civil and Environmental Engineering
University of Illinois at Urbana-Champaign
Office: 1241 Newmark Civil Engineering Lab, MC-250
205 N. Mathews Avenue, Urbana, IL 61801
Telephone: 217-300-2166 (office); Fax: 217-333-9464
Email: ctdick@illinois.edu
Office hours: Feel free to email me and set up an appointment.

Teaching Assistant (TA)

Samantha Chadwick
Graduate Research Assistant - RailTEC
Email: schadwi2@illinois.edu
Telephone: 217-244-6063 (office)

Samantha will be holding office hours at the following times and locations:

- Tuesdays from 3:30 to 4:30 PM (NCEL 2218)
- Thursdays from 1:00 to 2:00 PM (NCEL 2218)
- Other times by appointment (make appointment via email)

Course Web Site (Compass 2G): <https://compass2g.illinois.edu>
Set your Web browser to accept pop-up windows from compass2g.illinois.edu. PDFs of all PPT handouts will be posted on Compass 2G after the class period in which they were given. All reading assignments and course PPTs (PDF format) will be posted on Compass 2G.

Classes: Tuesdays and Thursdays, from 2:00–3:20 PM, Newmark Civil Engineering Laboratory, Room 1311. Occasional make-up classes will be scheduled at times mutually agreed upon by the instructor and students, and occasional class exercises may involve extended classes.

Credit: 3 or 4 undergraduate or graduate hours. Graduate students enrolled for 4 credit hours will be required to undertake additional work, as described below.

Prerequisite: CEE 310. Students that have not taken CEE 408 and CEE 409 may wish to complete additional background reading in order to perform well on the exams, pull your weight in the team design project, and to be in a position to participate fully in class discussions. Additional details to be provided in class.

Course Description

This course provides an in-depth understanding of the critical aspects encountered in a railroad civil engineering capital project, how these aspects relate to one another, and how to effectively manage these aspects. This course covers the economic analysis, planning, site civil design, MicroStation design, surveying, construction management, and construction procedures for typical railroad projects. The course design project will be based around a case study of a typical railroad civil engineering project, which will enhance the techniques needed to effectively analyze, plan, and manage a railroad construction project.

Course Vision

To prepare students for the challenges facing civil engineers engaged in design and construction activities centering around railway infrastructure projects, and to improve each student's ability to consider the "big picture" objectives and challenges on a railroad engineering capital project.

Course Instructor's Mission

Encourage students to develop and/or refine their ability to critically evaluate multiple engineering capital projects (alternatives), encourage growth in communication skills and the ability to converse about alternates, form lasting friendships amongst the class, and leave the class a stronger leader and communicator than when you entered. Encourage students to consider careers in railway engineering through increased exposure to railway capital projects and the possible job opportunities associated with these projects.

Course Objectives

This course will prepare you to undertake railroad engineering capital projects by providing a broad understanding of the responsibilities of each party. The class will focus on the following four elements of a railroad project; economic analysis, planning, design, and construction. The economics and planning portions of the course will address route selection, location, equipment, financial

and other capacity decisions associated with the construction of additional railroad infrastructure. The design and construction portion will cover the environmental permitting, civil site design, civil track design, cost estimation, scheduling, and phasing issues. The class will place substantial responsibility on students to identify, gather and analyze the needed information, with interim milestones requiring progress reports and status updates. Practicing engineers from the railroad industry will also be involved as a source of expertise and as an information resource. The ultimate objective of this course is to equip students with the necessary tools to enter into a railroad engineering capital project (as either a railroad employee or a consultant) understanding the planning, design, and construction processes and the role of each party in the safe and timely completion of the project.

Required and Suggested Reading:

- Armstrong, The Railroad; What it is, what it does (5th Edition)
- Hay, W. W., Railroad Engineering, Wiley and Sons (1982)
- Wellington, The Location of Railways (1910)
- AREMA Manual on Railway Engineering (2006)
- AREMA Practical Guide to Railway Engineering (2009)
- Trains Magazine (selected articles)
- Engineering News Magazine (selected articles)
- Proceedings of the AREA (Various Years)
- Other selected textbooks, magazines, and manuals

You are not required to purchase any of the above textbooks or reference materials. All relevant chapters will be provided on Compass 2G.

Class Sessions

Class sessions will include lectures, discussions of the readings, guest speakers, small group activities, and group presentations. There will also be two field trips for this class, one locally to the Monticello Railway Museum in Monticello, IL and another to railroad capital projects in Chicago, IL. The class field trips will be scheduled by taking into consideration the availability of the class. Field trips are not required, but if you are unable to attend one of these field trips, please notify the instructor immediately. Finally, please bring calculators to all class meetings, as there may be problems that we will be working through individually or as a group.

Assignments

Course assignments will help you achieve the objectives of the course that were described earlier. Detailed instructions will be provided when each assignment is given. Unless otherwise specified, all written assignments must be submitted on paper in hard-copy form **AND** via Compass 2G. The filename for your assignments should be as follows:

"CEE_411_LastName_HomeworkNumber". Compass 2G submissions should be submitted prior to the class period in which they are due.

Assigned Reading and Discussion

To prepare for the classroom discussions and enhance your understanding of the subject, you will be required to complete the reading assignments prior to the beginning of each class period for which the reading is listed. Reading assignments are listed in the course schedule and PDFs of all reading assignments can be found on Compass 2G in the "Reading Assignments" folder.

Quizzes

Quizzes will be given periodically to reinforce the topics that are covered in class lectures, guest lectures, and in the reading assignments. They are not intended to monitor attendance, but the dates for the quizzes will not be announced in advance. There will be approximately 3-4 quizzes over the course of the semester.

Examinations

There will be two closed book exams in this course:

- The first exam (mid term) will be held Thursday 7 March during class
- The final exam is scheduled for Friday 10 May from 1:30-4:30 PM

Semester Design Project

The group design project will incorporate a major portion of the effort you expend on this class. Teams will be made up of four or five persons, and will be selected by the instructor, with the goal of evenly matching the teams based on class standing, experience in railroad engineering, and prior knowledge of the subject matter. *You will have the opportunity to evaluate the performance of your team members, which will constitute a portion of the total design project grade.* The suggested length of the final team design submission is 20 pages total, or whatever length is required to sufficiently describe your design. Sample calculations should be added as an appendix.

Design Project Dates:

Project Assigned and Preliminary Discussion in Class: **January 31**
Class Presentation on Route Selection (Assignment 4): **March 14**
Class Presentation on Complete Design: **TBD**
(Draft Report Due): **April 23**
Complete Design (Final): **April 30**

Course Grading (3 Credit Hours)

Mid Term Exam	20%
Final Exam	20%
Homework	15%
Quizzes	10%
Design Project	30%
Class Participation*	5%

Note: Plusses and minuses will be given.
*Modified for online students

Course Grading (4 Credit Hours)

In addition to what is listed above, students signed up for 4 credit hours will have an additional 33% added to their grade that is based on acceptance and successful completion and evaluation of one of the following items:

1) Act as team project manager for the semester design project
2) Write a comprehensive technical paper on a topic that is agreed upon between the student and instructor
3) Take a specific element of the course design project to a deeper technical level, and present your findings to the class. The specific topic should be agreed upon between the student and instructor

Specific topic suggestions for Items 2 and 3 above are due to the instructors via email by January 31, 2013. Technical reports will be due April 25, 2013.

COURSE POLICIES

This course will follow all policies in the *Student Code* (http://www.admin.uiuc.edu/policy/code/index.html). In addition to University Policies, I expect you all to show respect to your instructor, your classmates and to our guest lecturers at all times, both in the classroom and on our field trips. During field trips, you will be required to **strictly** follow individual railway safety procedures that will be discussed in greater depth prior to field trips. If you are unable or unwilling to abide by these procedures, you will not be allowed to attend the field trips. No exceptions.

Class Discussion and Participation

You are encouraged to actively participate in class, and class participation constitutes 5% of your course grade. If you have questions about this policy, or would like interim feedback on your participation in class, please feel free to contact the instructor throughout the semester.

Attendance

Attendance in class is critical to you success in class, and an attendance sheet will be passed around at the beginning of each class. Attendance will account for a portion of your class participation grade.

Accommodations

If you require special accommodations, you should notify the instructor as soon as possible. In particular, you should contact the instructor if a disability might interfere with the successful completion of a course requirement. All accommodations will follow the procedures as stated in Article 1-110 of the *Student Code* (http://www.admin.uiuc.edu/policy/code/article_1/a1_1-110.html).

Academic Integrity

This course will follow Articles 1-401 through 1-406 of the *Student Code* (beginning at http://www.admin.uiuc.edu/policy/code/article_1/a1_1-401.html). This rule defines infractions of academic integrity, which include but are not limited to cheating, fabrication, and plagiarism. You are responsible for following these guidelines. If you have any questions about whether something would be an infraction, please consult with the instructor before proceeding.

Late Submission Policy

You are expected to submit assignments at or before 2:00 PM on the due dates. If you are unable to submit an assignment by this time, please contact the instructor and an agreement will be reached that is fair to all parties involved.

CEE 411 – Spring 2013
Railroad Project Design and Construction
Tuesday and Thursday 2:00 - 3:20 PM • NCEL 1311

Pre-Spring Break Course Schedule

Instructors

J. Riley Edwards	**C. Tyler Dick, P.E.**
Telephone: 217-244-7417 (office), Fax: 217-333-1924 e-mail: jedward2@illinois.edu Office: 1245A NCEL Office hours: Feel free to set up an appointment via email.	Telephone: 217-300-2166 (office), Fax: 217-333-1924 e-mail: ctdick@illinois.edu Office: 1241 NCEL Office hours: Feel free to set up an appointment via email.

First Half of Semester – Economics, Route Selection, Planning, and Design

Class #	Class Date	Lecture Topic	Handout	Reading Assignment	Homework
	Tuesday 15 January	No Class – TRB Annual Meeting, Washington, DC			
1	Thursday 17 January	Overview of course content and learning objectives Introduction to typical railroad capital projects and the current state of the railroad industry	*Course Syllabus* *Course Schedule* *Course Survey* *1 Intro.ppt*	Trains: *How Much Does it Cost?* (10 pages) Trains: *Creating a Sunset* (12 pages) Trains: *Eastern Corridors* (8 pages)	Read all 3 Trains Magazine Articles **All subsequent reading assignments should be completed prior to the class they are listed for**
2	Tuesday 22 January	Wellington's Principles of Alternative Project Selection and Railroad Civil Construction	*2 Wellington Principles.ppt*	Wellington: Ch. I, Sec 1-15 (8 pages) *3 Lackawanna Cutoff Articles* (19 pages)	Assignment #1 Team Project: Wellington Review of Lackawanna Cutoff (Due Jan 29)
3	Thursday 24 January	Introduction to Track Chart and Railroad Engineering Plan Reading	*3 Eng Plans Intro.ppt* track charts, and question sheet		Assignment #2 Siding Location (Due Feb 5)
4	Tuesday 29 January	Introduction to Track Chart and Railroad Engineering Plan Reading (Cont.)	11x17 eng. prints,		Completion of Plan Reading Questions (Due Feb 5)

Class #	Class Date	Lecture Topic	Handout	Reading Assignment	Homework
5	Thursday 31 January	Introduction to semester design project Introduction to alternative generation Fundamentals of Railroad Location	*4 Design project intro.ppt* Course Design Project (Word Document) Site Plan (11x17 print) *T1 Intro to Railroad Location.ppt*	Hay: Ch. 4 (10 pages)	Assignment #3 Rough alignment and earthwork calculations (Due Feb 19)
6	Tuesday 5 February	Alternative generation and geometric considerations	*T2 geometric Design.ppt*		Assignment #4 Geometric Layout (Due Feb 12)
7	Thursday 7 February	Basics of MicroStation	*T3 Microstation Basics.ppt*		Completion of MicroStation Tutorial Before Class
8	Tuesday 12 February	Alternative generation with MicroStation	*T4 Microstation track design.ppt*		Assignment #5 Geometric Layout with MicroStation (Due Feb 19)
9	Thursday 14 February	Alternative analysis procedure: Revenue estimation	*5 Intro and Revenues.ppt*		
10	Tuesday 19 February	Alternative analysis procedure: Operating cost estimation	*6 Operating Costs.ppt* AREA Operating Costs Sheet 2006 Operating Costs Spreadsheet	Hay: Ch. 5, 9, and 12 (40 pages total) Hay: Ch. 14 (21 pages)	Assignment #4 Calculation of revenues and operating costs
11	Thursday 21 February	Operating cost estimation (Cont.)			
12	Tuesday 26 February	Alternative analysis procedure: Capital cost estimation	*6 Capital Costs.ppt* Railroad cost estimation spreadsheet		Assignment #4 (continued) Construction cost estimation

Class #	Class Date	Lecture Topic	Handout	Reading Assignment	Homework
13	Thursday 28 February	Alternative analysis procedure: Matrix analysis approach		Alignment Analysis and Comparison in the 21st Century *C. Tyler Dick*	
14	Tuesday 5 March	Project Phasing and Constructability	*T5 Project phasing.ppt*		
15	Thursday 7 March	Examination #1 (Mid-Term)			
	Friday - Sat. 9-10 March	Engineering Open House 2012	Check out the railroad exhibits in Newmark!		
16	Tuesday 12 March	Subgrade Subgrade Design	*8 RD Subgrade Design.ppt*	Hay: Ch. 17 and 18 (40 pages) Hay: Ch. 19 (33 pages)	
17	Thursday 14 March	Group Presentations on Route Alternatives			
	Tuesday 19 March	**NO CLASS SPRING BREAK**			
	Thursday 21 March	**NO CLASS SPRING BREAK**			

CEE 411 – Spring 2013
Railroad Project Design and Construction
Tuesday and Thursday 2:00 - 3:20 PM • NCEL 1311

Post-Spring Break Course Schedule

Instructors

J. Riley Edwards	**C. Tyler Dick, P.E.**
Telephone: 217-244-7417 (office), Fax: 217-333-1924 e-mail: jedward2@illinois.edu Office: 1245A NCEL Office hours: Feel free to set up an appointment via email.	Telephone: 217-300-2166 (office), Fax: 217-333-1924 e-mail: ctdick@illinois.edu Office: 1241 NCEL Office hours: Feel free to set up an appointment via email.

Second Half of Semester – Surveying, Environmental, Railroad Contracts, and Construction Management

Class #	Date	Lecture Topic	Handout	Reading	Homework
18	Tuesday 26 March	Route Alternatives Group Presentations			
19	Thursday 28 March	Surveying Part 1 – Introduction and Leveling (Vertical Control)	*9A Railroad Surveying Applications 1.ppt*	Hay: Ch. 26 (28 pages)	
20	Tuesday 2 April	Surveying Part 1 (Cont.) – Introduction and Leveling (Vertical Control)			
21	Thursday 4 April	Surveying Part 2 – Horizontal Control, GPS and Other Surveying Techniques	*9B Railroad Surveying Applications 2.ppt*		
22	Tuesday 9 April	Surveying Vertical Control Field Assignment (*Pending Good Weather*)			Assignment #7 Surveying Group Field Assignment
23	Thursday 11 April	Railroad Construction Contract and Bid Document Preparation Typical railroad contracts	*10 Railroad Contracts.ppt*		Assignment #8 Project Scheduling

Class #	Date	Lecture Topic	Handout	Reading	Homework
24	Tuesday 16 April	Railroad Project Environmental Planning and Permitting *Jennifer Sunley - Hanson Prof. Services*		Environmental Regulations and Permitting (PGRE Ch. 11)	
25	Thursday 18 April	Utilities and Clearances	*T6 Utilities.ppt*		
	Saturday 20 April	Semester Field Visit to Chicago – Railway Capital Projects			**Obtain Steel Toe Boots and Sign Waivers**
26	Tuesday 23 April	Railroad Construction Management Office Duties and Accounting	*11 Railroad Construction Management.ppt*		
27	Thursday 25 April	Railroad Construction Management Field Duties and Reporting			**Technical Reports Due (4 Credit Hour Students)**
28	Tuesday 30 April	Railroad Bridge Construction Management (*Last Class*)	*12 Railroad Bridge CM.ppt*		**Final Submission of Cumulative Design Project**
Final Exam	Friday 10 May **1:30-4:30 PM**	Final Examination			

CEE 411 - Spring 2017
Railroad Project Design and Construction
Tuesdays and Thursdays • 2:00 - 3:20 PM • NCEL 1311

Course Syllabus

Instructor Information

J. Riley Edwards, P.E.
Research Scientist and Senior Lecturer - RailTEC
Department of Civil and Environmental Engineering
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E-mail: jedward2@illinois.edu
Office hours: Feel free to email me and set up an appointment.

C. Tyler Dick, P.E.
Senior Railway Research Engineer - RailTEC
Department of Civil and Environmental Engineering
University of Illinois at Urbana-Champaign
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Telephone: 217-300-2166 (office); Fax: 217-333-9464
Email: ctdick@illinois.edu
Office hours: Feel free to email me and set up an appointment.

Grader

TBD
Email: TBD@illinois.edu

XXX will be holding office hours at the following times and locations:

- TBD
- TBD
- Other times by appointment (make appointment via email)

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Classes: Tuesdays and Thursdays, from 2:00–3:20 PM, Newmark Civil Engineering Laboratory, Room 1311.

Credit: 3 or 4 undergraduate or graduate hours.

Prerequisite: CEE 310. Students that have not taken CEE 408 and CEE 409 may wish to complete additional background reading in order to perform well on the exams, pull your weight in the team design project, and to be in a position to participate fully in class discussions. Additional details to be provided in class.

Course Description

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Course Instructor's Mission

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each party in the safe and timely completion of the project.

Required and Suggested Reading:

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- Hay, W. W., Railroad Engineering, Wiley and Sons (1982)
- Wellington, The Location of Railways (1910)
- AREMA Manual on Railway Engineering (2015)
- AREMA Practical Guide to Railway Engineering (2009)
- Trains Magazine (selected articles)
- Engineering News Magazine (selected articles)
- Proceedings of the AREA (Various Years)
- Other selected textbooks, magazines, and manuals

You are not required to purchase any of the above textbooks or reference materials. All relevant chapters will be provided on Compass 2G.

Class Sessions

Class sessions will include lectures, discussions of the readings, guest speakers, small group activities, and group presentations. This class will also include a field trip to view railroad capital projects in or around Chicago, IL. The class field trip will be scheduled by taking into consideration the availability of the class. The field trip is not required, but if you are unable to attend, please notify the instructors and TA/grader immediately. Finally, please bring calculators to all class meetings, as there may be problems that we will be working through individually or as a group.

Assignments

Course assignments will help you achieve the objectives of the course that were described earlier. Detailed instructions will be provided when each assignment is given. Unless otherwise specified, all written assignments must be submitted on paper in hard-copy form **AND** via Compass 2G.
The filename for your assignments should be as follows:
"CEE_411_LastName_HomeworkNumber".
Compass 2G submissions should be submitted prior to the class period in which they are due.

Assigned Reading and Discussion

To prepare for the classroom discussions and enhance your understanding of the subject, you will be required to complete the reading assignments prior to the beginning of each class period for which the reading is listed. Reading assignments are listed in the course schedule and PDFs of all reading assignments can be found on Compass 2G in the "Reading Assignments" folder.

Course Email Etiquette

When sending emails about this course, ensure they are sent to Tyler Dick, Riley Edwards, **and** [TA]. This will allow us to better serve you and improve our response time.

Examinations

There will be two closed book exams in this course:

- The first exam (mid term) will be held Tuesday 14 March during class
- The final exam is scheduled for Wednesday 10 May from 7:00-10:00 PM

Course Grading (3 Credit Hours)

Mid Term Exam	30%
Final Exam	30%
Homework	35%
Class Participation*	5%

*Modified for online students

Course Grading (4 Credit Hours)

Mid Term Exam	22%
Final Exam	22%
Homework	25%
Design Project	25%
Class Participation*	6%

*Modified for online students

Number to Letter Grade Conversion

96-100	A+
91-95	A
88-90	A-
85-87	B+
81-84	B
78-80	B-
75-77	C+
71-74	C
68-70	C-
65-67	D+
62-64	D
60-62	D-
59 and below	F

Semester Design Project (4 Credit Hour Students)

The group design project will incorporate a major portion of the effort you expend on this class. Teams will be made up of four or five persons, and will be selected by the instructors, with the goal of evenly matching the teams based on class standing, experience in railroad engineering, and prior knowledge of the subject matter. *You will have the opportunity to evaluate the performance of your team members, which will constitute a portion of the total design project grade.* The suggested length of the final team design submission is 20 pages total, or whatever length is required to sufficiently describe your design. Sample calculations should be added as an appendix.

Design Project Dates:

Project Assigned and Preliminary Discussion in Class: **January 31**
In-Class Presentation on Preliminary Design and Route Selection: **April 4**
Complete Design and Final Report: **May 2**

COURSE POLICIES

This course will follow all policies in the *Student Code* (http://www.admin.uiuc.edu/policy/code/index.html). In addition to University Policies, we expect you all to show respect to your instructor, your classmates and to our guest lecturers at all times, both in the classroom and on our field trip. During field trips, you will be required to **strictly** follow individual railway safety procedures that will be discussed in greater depth prior to field trips. If you are unable or unwilling to abide by these procedures, you will not be allowed to attend the field trips. No exceptions.

Class Discussion and Participation

You are encouraged to actively participate in class, and class participation constitutes 5-6% of your course grade. If you have questions about this policy, or would like interim feedback on your participation in class, please feel free to contact the instructors throughout the semester.

Attendance

In class attendance is critical to your success in class, and an attendance sheet will be passed around at the beginning of each class. Attendance will account for a portion of your class participation grade.

Accommodations

If you require special accommodations, you should notify the instructor as soon as possible. In particular, you should contact the instructor if a disability might interfere with the successful completion of a course requirement. All accommodations will follow the procedures as stated in Article 1-110 of the *Student Code* (http://www.admin.uiuc.edu/policy/code/article_1/a1_1-110.html).

Academic Integrity

This course will follow Articles 1-401 through 1-406 of the *Student Code* (http://studentcode.illinois.edu/PocketCode_web2016-17.pdf). These rules define infractions of academic integrity, which include but are not limited to cheating, fabrication, and plagiarism. You are responsible for following these guidelines. If you have any questions about whether something would be an infraction, please consult with the instructor before proceeding.

Late Submission Policy

You are expected to submit assignments at or before 2:00 PM Central Time on the due dates. If you are unable to submit an assignment by this time, please contact the instructor and an agreement will be reached that is fair to all parties involved.

Safety and Security in the Classroom

Please see the attached handout from the University of Illinois Division of Public Safety and Public Affairs.

Run > Hide > Fight

Emergencies can happen anywhere and at any time. It is important that we take a minute to prepare for a situation in which our safety or even our lives could depend on our ability to react quickly. When we're faced with any kind of emergency – like fire, severe weather or if someone is trying to hurt you – we have three options: Run, hide or fight.

Run

Leaving the area quickly is the best option if it is safe to do so.

- Take time now to learn the different ways to leave your building.
- Leave personal items behind.
- Assist those who need help, but consider whether doing so puts yourself at risk.
- Alert authorities of the emergency when it is safe to do so.

Hide

When you can't or don't want to run, take shelter indoors.

- Take time now to learn different ways to seek shelter in your building.
- If severe weather is imminent, go to the nearest indoor storm refuge area.
- If someone is trying to hurt you and you can't evacuate, get to a place where you can't be seen, lock or barricade your area, silence your phone, don't make any noise and don't come out until you receive an Illini-Alert indicating it is safe to do so.

Fight

As a last resort, you may need to fight to increase your chances of survival.

- Think about what kind of common items are in your area which you can use to defend yourself.
- Team up with others to fight if the situation allows.
- Mentally prepare yourself – you may be in a fight for your life.

Please be aware of persons with disabilities who may need additional assistance in emergency situations.

Other resources

- **police.illinois.edu/safe** for more information on how to prepare for emergencies, including how to run, hide or fight and building floor plans that can show you safe areas.
- **emergency.illinois.edu** to sign up for Illini-Alert text messages.
- **Follow the University of Illinois Police Department** on Twitter and Facebook to get regular updates about campus safety.

CEE 411 – Spring 2017
Railroad Project Design and Construction
Tuesday and Thursday 2:00 - 3:20 PM • NCEL 1311

Course Schedule

Instructors

J. Riley Edwards, P.E.	C. Tyler Dick, P.E.
Telephone: 217-244-7417 (office), Fax: 217-333-1924 e-mail: jedward2@illinois.edu Office: 1243 NCEL Office hours: Feel free to set up an appointment via email.	Telephone: 217-300-2166 (office), Fax: 217-333-1924 e-mail: ctdick@illinois.edu Office: 1241 NCEL Office hours: Feel free to set up an appointment via email.

Class	Class Date	Lecture Topic	Lecture Material & Handouts	Reading Assignment	Assignment
1	Tuesday 17 January	Overview of course content and learning objectives Introduction to typical railroad capital projects and the current state of the railroad industry	*Course Syllabus* *Course Schedule* *Course Survey* *1 Intro.ppt*	Trains: *How Much Does it Cost?* Trains: *Creating a Sunset* Trains: *Eastern Corridors*	Read all 3 Trains Magazine Articles **All subsequent reading assignments should be completed prior to the class they are listed for**
2	Thursday 19 January	Railway Capacity Analysis	*2 railway capacity.ppt*		
3	Tuesday 24 January	Railway Geometry: Horizontal	*3 horizontal geometric design.ppt*		**Assignment #1** Geometric Layout (Due Feb 2)
4	Thursday 26 January	Railway Geometry: Vertical	*4 vertical geometric design.ppt*		
5	Tuesday 31 January	Railway Geometry: Fundamentals of Railroad Location **Introduction to 4-credit semester design project**	*5 Intro to Railroad Location.ppt* Design Project Description 11x17 Site Plan	Hay: Ch. 4 (10 pages)	**Assignment #2** Alignment and earthwork calculations (Due Feb 16)
6	Thursday 2 February	Railway Geometry: Introduction to Track Charts and In-Class Exercise	*6 Track Chart Intro.ppt* track charts, and question sheet		**Assignment #3A** Plan Reading (*In-Class Exercise*) **Assignment #4** Capacity & Siding Location (Due Feb 9)

7	Tuesday 7 February	Railway Design: MicroStation Track Layout	*7 Microstation Basics.ppt*		
8	Thursday 9 February	Railway Design: Project Phasing and Constructability	*8 Project phasing.ppt*		
9	Tuesday 14 February	Railway Design: Introduction to Railroad Engineering Plan Reading	*9 Eng Plans Intro.ppt* 11x17 eng. prints,		**Assignment #3B** Plan Reading (*In-Class Exercise*)
10	Thursday 16 February	Railway Design: Bentley RailTrack Design	*10 Microstation track design.ppt*		**Assignment #5** Geometric Layout with MicroStation (Due Mar 2)
11	Tuesday 21 February	Alternative Analysis: Wellington's Principles of Alternative Project Selection and Railroad Civil Construction	*11 Wellington Principles.ppt*	Wellington: Ch. I, Sec 1-15 (8 pages) *3 Lackawanna Cutoff Articles* (19 pages)	**Assignment #6** Team Project: Wellington Review of Lackawanna Cutoff (Due Mar 7)
12	Thursday 23 February	Alternative Analysis: Revenue Estimation	*12 Intro and Revenues.ppt*		
13	Tuesday 28 February	Alternative Analysis: Operating Cost Estimation	*13 Operating Costs.ppt* AREA Operating Costs Sheet 2006 Operating Costs Spreadsheet	Hay: Ch. 5, 9, and 12 (40 pages total) Hay: Ch. 14 (21 pages)	
14	Thursday 2 March	Alternative Analysis: Capital Cost Estimation	*14 Capital Costs.ppt*		**Assignment #7** Route Selection (Due Mar 30)
15	Tuesday 7 March	Alternative Analysis: Capital Cost Estimation (Cont.) Passing Siding In-Class Exercise	Railroad cost estimation spreadsheet		
16	Thursday 9 March	Alternative Analysis: Matrix Approach to Alternative Comparison	*15 Matrix Approach.ppt*	Alignment Analysis and Comparison in the 21st Century *C. Tyler Dick*	

--	*Friday - Sat. 10-11 March*	*Engineering Open House 2017*		*Check out the railroad exhibits in Newmark!*
17	Tuesday 14 March	**EXAMINATION #1 (Lectures 1-16)**		
18	Thursday 16 March	Utilities and Clearances	*16 Utilities.ppt*	
--	Tuesday 21 March	***NO CLASS*** ***SPRING BREAK***		
--	Thursday 23 March	***NO CLASS*** ***SPRING BREAK***		
19	Tuesday 28 March	Subgrade Design	*17 Subgrade Design.ppt*	Hay: Ch. 17 and 18 (40 pages) Hay: Ch. 19 (33 pages)
20	Thursday 30 March	Subgrade Design (Cont.)		
21	Tuesday 4 April	**Group Design Project Progress Presentations (4-credit students)**		
22	Thursday 6 April	Railroad Project Environmental Planning and Permitting	*Doug Dorsey - Hanson Prof. Services*	Environmental Regulations and Permitting (PGRE Ch. 11)
23	Tuesday 11 April	Surveying Part 1 – Introduction and Leveling (Vertical Control)	*18 Railroad Surveying Applications 1.ppt*	Hay: Ch. 26 (28 pages)
24	Thursday 13 April	Surveying Part 1 (Cont.) – Introduction and Leveling (Vertical Control)		
25	Tuesday 18 April	Surveying Part 2 – Horizontal Control, GPS and Other Surveying Techniques	*19 Railroad Surveying Applications 2.ppt*	

26	Thursday 20 April	Railroad Construction Contract and Bid Document Preparation	*20 Railroad Contracts.ppt*		**Assignment #8** Project Scheduling (Due May 2)
27	Tuesday 25 April	Surveying Vertical Control Field Assignment (*Pending Good Weather*)			**Assignment #9** Surveying Group Field Assignment (In-Class)
	Saturday in March/April	Field Visit to Chicago – Railway Capital Projects		**Sign Waivers**	**Obtain Steel Toe Boots**
28	Thursday 28 April	Railroad Construction Management	*21 Railroad Construction Management.ppt*		
29	Tuesday 2 May	Railroad Bridge Construction Management	*22 Railroad Bridge CM.ppt*		**Submit Final Group Design Project Report (4-hr students)**
--	**Wednesday 10 May 7:00-10:00 PM**	**FINAL EXAMINATION (Lectures 17-29)**			