

**SONNY ASTANI DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
UNIVERSITY OF SOUTHERN CALIFORNIA**

**CE 588: INTRODUCTION TO RAILROAD ENGINEERING
3 Units, Spring 2018**

COURSE DESCRIPTION

Instructor: Genaro Mejia, M.S.; P.E	Office: KAP-200A, Hours: 2:00 – 3:00 PM
Time: Wednesday 3:30 – 6:10 PM	Phone: (310) 578-4462
Place: KAP-134	Email: gmejia@usc.edu

Recommended Preparation

CE 471: Principles of Transportation Engineering; Highway Design or equivalent

Purpose and Objectives

The purpose of this course is foster a curiosity and passion for railroad engineering. Rail transportation has been around since the 1800's however, the United States is experiencing a renaissance in this mode of transportation due to the need to provide more transportation choices in rapidly growing urban center. In addition, current government policies supporting the development of rail networks through the use of local tax increases makes this course a strategic opportunity for transportation students. This course has been designed to offer a fundamental understanding of railroad infrastructure including passenger and freight operations, track alignment (horizontal and vertical) design, basic components and terminology used in rail design. The course will include several guest lecturers, field visits and videos of track construction.

Course Material

No textbook is required. Copyright cleared course readings are provided by and the instructor and selected from a variety of books, journals, articles, case studies and manuals. However, there are text books and a manual that are recommended for a more in-depth understanding of the subject:

- TCRP Report 155: Track Design Handbook for Light Rail Transit, (Second Edition)
- Railroad Engineering (Second Edition), William W. Hay, 1982, ISBN 0-471-36400-2
- Practical Guide for Railroad Engineering by AREMA
- The Railroad, What It is, What It Does, The Introduction to Railroading, (Fourth Edition), John H. Armstrong, 1998, ISBN: 0-911382-04-6
- Railway Management and Engineering (Third Edition), V.A. Profillidis, 2009, ISBN: 0-7546-4854-0

Grading

This course grade will be calculated as follows:

Class Participation and Field Trips	15%
Assignments	25%
Midterm Exam	25%
Final Exam (Final Project)	35%
TOTAL:	100%

Class Participation

Participation in class is a key requirement of this course. During each class session students are required to present and discuss a “rail” related article from the past weeks news. Students will be asked to summarize the article and briefly explain how it will affect the rail industry. Locally generated articles are preferred but national and global articles will be accepted.

Assignments

Will be assigned on a weekly basis as needed. For each assignment include assignment number, student number and name. Electronic submissions via email prior to next class date preferred.

Field Trips

Field trips are mandatory, there will be 3 planned throughout the semester a field report of key observations with photos shall be submitted the following week after the field trip.

Guidelines for Final Project

The final project will be assigned by the Professor. The purpose of the term project is to bring all the concepts taught in class into one final major assignment. It is highly encouraged to start the research of the assigned topics as soon as possible. There will be three parts for the Term Project: A draft report, the final report and the presentation.

Grading for Final Project

Draft Report	10%
Final Report	15%
Presentation	10%
TOTAL:	35%

Course Grading Scheme

Letter Grade	Percentage	Grade Points/ Credit	Rating
A	93% - 100%	4.00	Superior
A-	90% - 92%	3.70	
B+	87% - 89%	3.30	
B	83% - 86%	3.00	Excellent
B-	80% - 82%	2.70	
C+	77% - 79%	2.30	
C	73% - 76%	2.00	Good - Average
C-	70% - 72%	1.70	
D+	67% - 69%	1.30	
D	63% - 66%	1.00	Passing
D-	60% - 62%	0.70	
F	0% - 59%	0.00	Failing

Lectures Plan

DAY	TOPIC	QUIZ / EXAMS/ PROJECTS DUE	GRADE %
January 10, 2018	<p>History of the Railroad</p> <ul style="list-style-type: none"> • What is the Railroad • What does it do • Types of Rail Projects <ul style="list-style-type: none"> ○ Freight ○ Passenger <ul style="list-style-type: none"> ▪ Commuter ▪ Light Rail ▪ Heavy Rail ▪ High Speed Rail ▪ Maglev • Sample Rail Projects in Los Angeles area • Video - High Speed in California and Hyperloop <p>Readings/Viewing: The History Channel, Modern Marvels – <i>The Transcontinental Railroad</i></p>	Assignment 1	2%
January 17, 2018	<p>Rail, Cross Section, Track Elements</p> <ul style="list-style-type: none"> • Track Terms • Track Components and Cross Section, Gauge <ul style="list-style-type: none"> ○ Rail, CWR, Rail Weights <ul style="list-style-type: none"> ▪ Making of the Rail ▪ Types of Rail 	Assignment 2	1%

DAY	TOPIC	QUIZ / EXAMS/ PROJECTS DUE	GRADE %
	<p style="text-align: center;">Welding</p> <ul style="list-style-type: none"> ○ Ties, timber, concrete, steel, composite ○ Fasteners ○ Ballast ○ Subballast ● Video - Rail fabrication <p>Reading: <i>TCRP 155: Chapter 5; The Dictionary of Railway Track Terms</i> by Christopher F. Schulte</p>		
January 24, 2018	<p>Track Types</p> <ul style="list-style-type: none"> ● Ballasted ● Embedded <p>Direct Fixation</p> <ul style="list-style-type: none"> ● Slab Track ● Pocket Track ● Shoofly Track ● Ladder Tracks ● Special Trackwork <ul style="list-style-type: none"> ○ Components of a Turnout ○ Geometry of a Turnout ○ Crossovers, Single, Double, Universal ○ Crossing Diamonds ● Video – Track Construction <p>Reading: <i>TCRP 155: Chapter 4; The Dictionary of Railway Track Terms</i> by Christopher F. Schulte</p>	Assignment 3	2%
January 31, 2018	<p>Track Alignment – Horizontal</p> <ul style="list-style-type: none"> ● Simple Horizontal Curve ● Compound Curve ● Spiral Curve ● Superelevation <p>Track Alignment – Vertical</p> <ul style="list-style-type: none"> ● Maximum/Minimum Gradients ● Vertical Curves <p>Design Criteria/Standards Railroad Clearances</p>	Assignment 4	

DAY	TOPIC	QUIZ / EXAMS/ PROJECTS DUE	GRADE %
	Helpful Reading: <i>TCRP 155: Chapter 3; Railroad Engineering</i> by William Hay, Chapter 26, Track Geometry		
February 7, 2018	Introduction to Rail Design preferred software - Microstation/Inroads/Inrail Railroad Project to be assigned today Construction Estimates for Rail Work Reading: <i>Railroad Engineering</i> by William Hay, Chapter 26, Track Geometry	Final Project Assigned Today Assignment 5	4%
February 14, 2018	Stations <ul style="list-style-type: none"> • Station type • Platforms • Access Elements of Railroad Signals and Train Control <ul style="list-style-type: none"> • Wayside Signal • Warning Devices for At-grade Crossings • Positive Train Control (PTC) Reading: <i>AREMA Manual</i> , Volume IV ; and <i>Elements of Railway Signaling</i> by General Railway Signal	Assignment 6	2%
February 21, 2018	Field Visit to Union Station	Paper on Field Trip Observations	4%
February 28, 2018	Yards <ul style="list-style-type: none"> • Classification Yards • Light Rail Transit Yards Readings: <i>Railroad Engineering</i> by William Hay, Chapter 27, Turnouts/Crossings		
March 7, 2018	Midterm (Approximately 1 hour)	Midterm Exam	25%
March 14, 2018	Spring Recess – No Class		

DAY	TOPIC	QUIZ / EXAMS/ PROJECTS DUE	GRADE %
March 21, 2018	Field Visit to Maintenance Yard Yards continued Elements of Railroad Signals and Train Control <ul style="list-style-type: none"> • Wayside Signal • Warning Devices for At-grade Crossings • Positive Train Control (PTC) Reading: <i>AREMA Manual</i> , Volume IV ; and <i>Elements of Railway Signaling</i> by General Railway Signal	Paper on Field Trip Observations	6%
March 28, 2018	Civil Design of Rail Projects <ul style="list-style-type: none"> • Grading • Drainage Reading: <i>Railroad Engineering</i> by William Hay, Chapters 17 and 20		
April 4, 2018	Field Visit to Light Rail Construction Site	Paper on Field Trip Observations	4%
April 11, 2018	At-Grade Crossing Design <ul style="list-style-type: none"> • Horizontal and vertical alignment • Signing and Striping • CPUC Grade Separations <ul style="list-style-type: none"> • Underpasses • Overpasses Railroad Structures <ul style="list-style-type: none"> • Bridges • Culverts • Retaining Walls Reading: <i>California Public Utilities Commission, General Orders</i>	Draft Projects Due	10%
April 18, 2018	Rail Planning - Permits and Environmental Readings: Army Corps of Engineers Design Manual.		
April 25, 2018	High Speed Rail / Maglev <ul style="list-style-type: none"> • Subgrade for High Speed • Track Design • Rolling Stock • Traffic Control 	Final Projects Due	15%

DAY	TOPIC	QUIZ / EXAMS/ PROJECTS DUE	GRADE %
	<ul style="list-style-type: none"> • Station Design • High Speed Corridors in the United States Video – Maglev Readings: Railway Management and Engineering (Third Edition), V.A. Profillidis, 2009		
Friday, May 4, 2018	Final Exam - 2:00 to 4:00 PM	Final Project Presentation	10%