RailTEC Complementary Courses

These elective courses complement the core railway courses offered by RailTEC faculty and help support research activities. While these courses may not contain specific railroad material, they are particularly useful in research and broader understanding of railway engineering and transportation issues. The partial list of complementary courses below includes courses within civil engineering, other engineering departments and other academic units on campus.

Infrastructure

CEE 401: Concrete Materials
CEE 468: Prestressed Concrete
CEE 471: Structural Mechanics
CEE 472: Structural Dynamics I
CEE 570: Finite Element Methods
CEE 588: Geotechnical Earthquake Engineering

Safety and Risk

CEE 491: Decision and Risk Analysis
CPSC 541: Regression Analysis
NPRE 461: Probabilistic Risk Assessment
NPRE 561: Adv. Risk Analysis for Technological Systems
STAT 420: Methods of Applied Statistics

Systems

ACE 563: Math Program App Econ I
CEE 416: Traffic Capacity Analysis
CEE 417: Urban Transportation Planning
CEE 498 ML: Machine Learning in CEE
CEE 498 TE: Transportation Economics
CEE 512: Logistics Systems Analysis
CEE 598 UTM: Urban Transportation Models
IE 413: Simulation

RailTEC Education Program

- Most extensive rail transportation engineering academic curriculum in North America.
- B.S., M.S. and Ph.D. degree programs in civil engineering with a railway transportation focus.
- Distance education program offers working professionals the opportunity to earn an MS degree or Railroad Certificate via online rail-focused courses. RailTEC also provides continuing education opportunities for the rail community.
- Railway Engineering Short Course for industry professionals held virtually each summer.
- W.W. Hay Railroad Engineering Seminar Series, hosted on campus bi-weekly and broadcast online.
- Organizer and host of the annual Railroad Environmental Conference and the bi-annual Crosstie & Fastening System Symposium.

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RAILTEC

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

RAILROAD ENGINEERING COURSE OFFERINGS

The University of Illinois at Urbana-Champaign (Illinois) has the strongest academic program in railroad engineering of any university in North America. The core courses cover the fundamental topics of railway transportation and economics, track engineering, rail project design, and railway signaling and traffic control. RailTEC also has a unique partnership with KTH Swedish Royal Institute of Technology to offer joint courses on railway mechanical and electrical engineering.

Illinois offers B.S., M.S. and Ph.D. programs in civil engineering with a railway transportation focus, and a professional M.Eng. in Railway Engineering degree program. RailTEC also offers online classes through the Illinois CEE Online program consisting of individual courses, Railroad Certificate, and M.S. program.

RailTEC Core Railway Courses

CEE 408: Railroad Transportation Engineering*

Rail transportation requires infrastructure, vehicles, motive power and energy to move goods and people. Each of these affects efficiency, service quality, economics and environmental impact of railroad transport. This course includes an introduction to track design, railroad rolling stock design, and train speed, power, acceleration and braking.

CEE 409: Railroad Track Engineering*

This course provides in-depth understanding of railroad track engineering concepts including track component and system design, construction, evaluation, maintenance, load distribution, wheel/rail interaction and track layout and geometry.

CEE 410: Railway Signaling and Control*

The course introduces concepts of train separation to ensure safe and efficient use of equipment and infrastructure. Principal topics include train movement authority, track circuits, and train control systems, such as radio-based, wayside signals, cab signaling, positive train control (PTC), interlocking design, operation, and control.

CEE 411: Railroad Project Design and Construction*

This course provides a comprehensive understanding of planning and designing a railroad engineering project from concept through to operation. Focus is on five elements of a railroad project: Economic Analysis, Planning, Design, Construction, and Operation.

CEE 412: High-Speed Rail Engineering*

This course covers the unique engineering design requirements of high-speed rail (HSR) passenger transportation technology including the subgrade, track system, motive power, rolling stock, traffic control, power distribution system, traffic control and station design.

Special Topics Courses and Seminars

RailTEC frequently organizes full-semester special topics and seminar courses to explore important challenges and emerging issues in railway transportation and engineering. Based on student demand and faculty interests, past subjects of these courses include:

- **Advances in Railway Technology**
- **High-Efficiency Freight Rail Transport**
- **Shared Rail Corridors**
- **Transportation Safety and Risk**
- **Precision Scheduled Railroading**

Other Courses with Rail Content

RailTEC affiliated courses are taught by other transportation and civil engineering faculty actively engaged in railroad research projects.

CEE 310: Transportation Engineering

Design, planning, operation, management, and maintenance of transportation systems including highways, airports, and railroads.

CEE 418: Public Transportation Systems

In-depth overview of the fundamental principles of efficient operations, management, and planning of public transportation systems.

CEE 509: Transportation Soils

Covers occurrence and properties of surficial soils, soil classification systems, soil variability, and soil trafficability and subgrade stability for transportation facility engineering.

Joint Courses with KTH Royal Institute of Technology, Sweden

Railway transportation demand for both freight and passengers is increasing throughout the world. A special characteristic of the railway system is that the vehicle and infrastructure are extremely dependent on each other. An understanding of the dynamic interaction between vehicle and track is crucial for an engineer working in this sector.

To provide students with a deeper background in mechanical and electrical concepts related to railway design, RailTEC has partnered with the rail research group at KTH Royal Institute of Technology in Sweden to offer joint courses. A limited number of Illinois students may enroll as online students in the following rail courses taught by KTH faculty.

CEE 498 RVT: Rail Vehicle Technology

This course describes the components of rail vehicles as well as their design to meet various demands, including railcar suspension and carbody tilting systems.

CEE 598 RVD: Rail Vehicle Dynamics

This course provides an understanding of the dynamic interaction between vehicle and track by describing superelevation and curve negotiation, vibration and ride comfort, hunting and conicity, wheel-rail contact, wheel and rail wear, and derailment safety.

CEE 598 ET: Electric Traction

An introduction to electric railway traction including traction mechanics, rail systems, electrical drives, and power supplies.

***Available Online:**
cee.illinois.edu/ceeonline