New Semester Course in Railway Terminal Design & Operations

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The new Railway Terminal Design & Operations course (CEE 598 RTD) at the University of Illinois at Urbana-Champaign (UIUC) introduces students to the role of terminals in the freight railway transportation system, the functions required at different types of terminals, and best practices for design of terminal infrastructure to support these roles and functions.

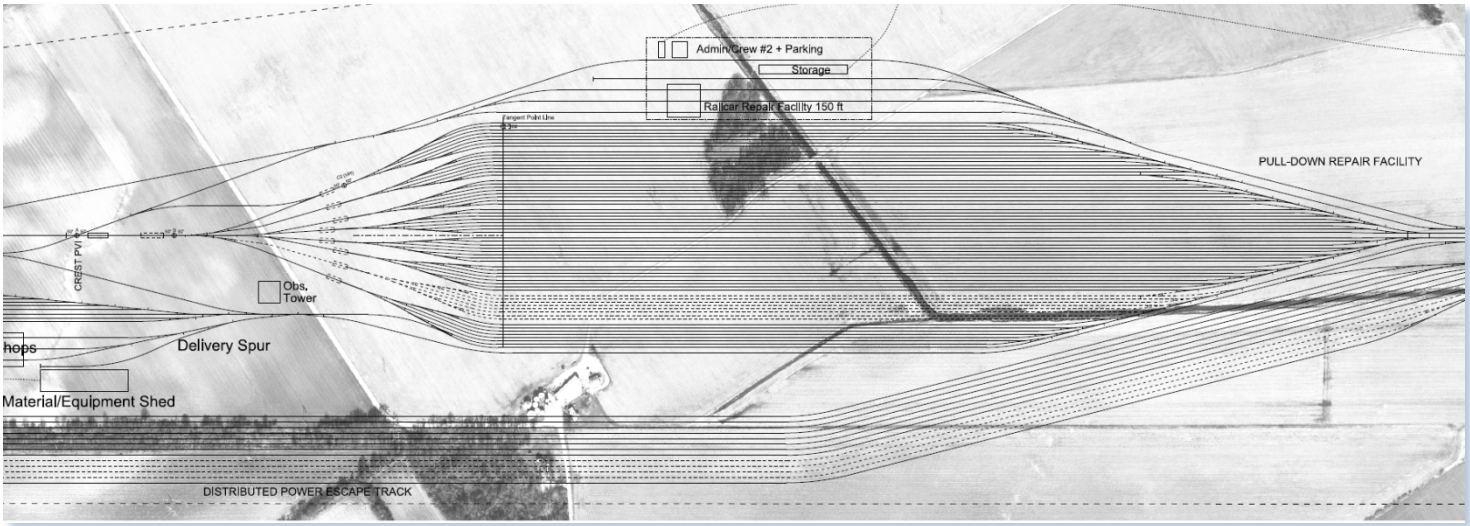
Course Rationale

The primary focus of railway engineering courses at UIUC is on infrastructure, geometry, and economic justification of mainline projects to benefit passenger and line-haul freight rail operations. However, the typical railcar spends the majority of its time off the mainline, either in intermediate classification yards or specialized terminal facilities where freight is transloaded to and from rail customers or connecting modes of transportation. These facilities represent significant capital investments for the railways and, given the amount of time that railcars and trains spend in them, poor design of terminal facilities can lead to inefficiencies that quickly degrade the provided level of freight transportation service.

In the new Railway Terminal Design & Operations course (CEE 598 RTD) developed as a NURail education project, students learn details of the design, operations planning, management, and optimization of the terminal facilities required for the railway network to function as an efficient freight transportation system. The focus is on design of classification yards, intermodal facilities and bulk terminals, and how these facilities are organized into a network to provide different types of freight transportation service by rail.

Lecture Topics

The lecture material developed for the course centers around three major topic areas. The first topic area is the railway as a freight transportation system. Lectures in this portion of the course cover network operations, terminal functions, the train origination process, train planning, connections and transit time, and classification and blocking. These topics provide students with an understanding of how railcars are moved across the freight railway network, and the terminal activities that are required to support these movements. This knowledge is essential for students to understand the fundamental terminal engineering and design considerations introduced in subsequent



sections of the course. As part of this background, students are also introduced to railway operation concepts such as empty railcar distribution and locomotive and crew assignment.

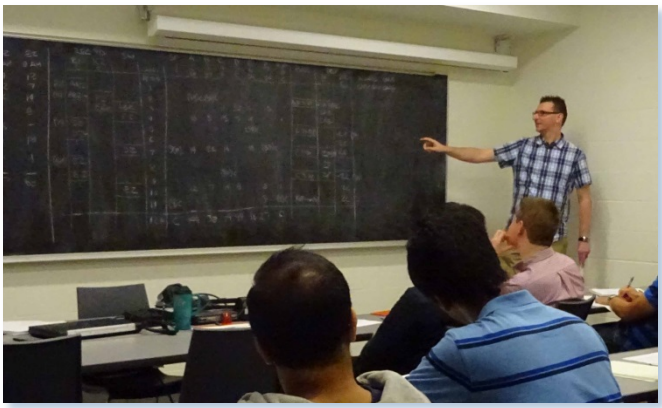
The second topic area focuses on the design of classification yards. Lectures introduce basic yard geometry, ladder tracks, flat yards and hump yards. Several lectures are dedicated to the physics and detailed design of the hump crest and retarder speed control system, a topic that several students likened to "the railroad version of fluid mechanics."

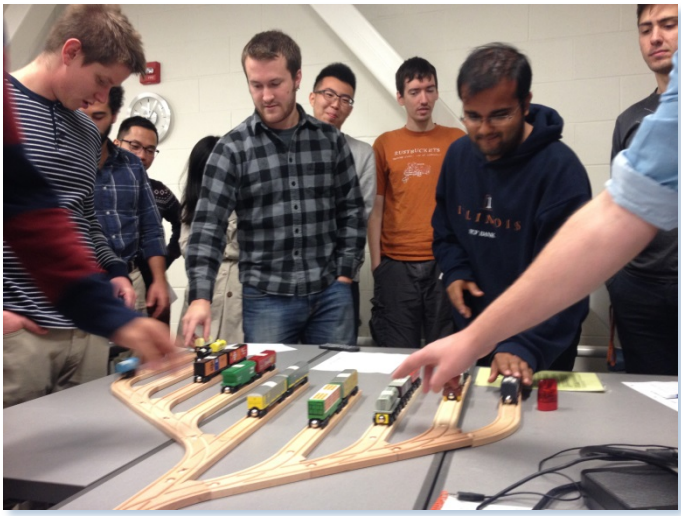
The third topic area examines specialized terminal facilities, including intermodal facilities and bulk freight terminals. In addition to facility layout, lectures cover intermodal lift equipment and bulk loading and unloading mechanisms.

Class sessions are designed to be interactive with blackboard lecturing supplemented by video clips and hands-on activities. As an example, students are taught classification, blocking and sorting schemes by constructing a yard with wooden railway track and sorting railcars as a team.

Assignments and Design Studio

The course includes ten individual assignments to help students understand the application of course concepts. These tasks are supplemented by two larger "design studio" assignments completed using MicroStation CAD software. The MicroStation assignments allow students to develop their understanding of track geometry and how various turnouts, curves and tangents are arranged into a yard design that will operate efficiently. The two design studio assignments, a 12-track classification yard and a unit train loop unloading facility, are based on real-world projects and design criteria.





Semester Class Design Project

During the course of the semester, the CEE 598 RTD students work as a class to complete a major terminal planning study. The main components of the planning study include a track layout, control system design, and operating plan for each of several project alternatives.

Through the class project, students are exposed to the matrix style of project team organization employed by design consultants. Each student is assigned a specific component of the study for a certain alternative. Successful completion of the project requires the student to collaborate with their peers working on the same alternative and with those working on the same task for the other alternatives.

The class design project also involves a design charrette and two project review meetings where the instructor functions as the project owner and students assume the role of consultants presenting their designs for review.

Inaugural Course Offering

CEE 598 RTD was offered for the first time in Fall 2014 with 23 students enrolled on the UIUC campus. The initial design project, developed in conjunction with CSX Transportation, investigated four alternative layouts for a new hump classification yard near Terre Haute, IN and a new intermodal facility near Indianapolis, IN. The student design submittals exceeded expectations. Overall the course was ranked as "excellent" by the students enrolled, marking it as another NURail success.

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