

Purdue University School of Civil Engineering

CE 361 – TRANSPORTATION ENGINEERING

The purpose of this course is to provide students with a solid introduction to the principles of transportation engineering with a focus on highway engineering and traffic analysis. The material learned will provide the basic skill set that will allow students to solve transportation problems that are likely to appear in professional practice and on the Fundamentals of Engineering exam (FE) and the Principles and Practice of Engineering exam (PE). The material also serves as foundation for future coursework in transportation should students wish to pursue further coursework in the field.

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Class hours: Tuesday and Thursday, 12:00 p.m.-1:15 p.m., HAMP 1144.

Course Requirements:

1. Seven problem-oriented assignments. The objective of these assignments is to assist in the learning of course material, so discussion of assignments among students is encouraged.
2. Eight in-class design problems will be given during the semester. These problems are to be completed in groups in one class period.
3. Each student will be required to complete a design project. The project can deal with any transportation-oriented problem and can be completed individually or in groups of two to five students. The project report should be on the order of 10 to 15 pages.

Key Dates:

March 24: Submit description of proposed design project.
May 8: Design project reports due.

4. Two mid-terms and a final exam will be given. All exams will be problem-oriented open book and open notes exams.

The following grade distribution will be used for the course:

In-class design and problem assignments	10%
Mid-term exams	20% (each)
Project report	20%
Final exam	30%

Course website: [https://engineering.purdue.edu/~flm/CE361\(15\).htm](https://engineering.purdue.edu/~flm/CE361(15).htm). In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. These changes will be reported as soon as possible on the course website.

Text:

The required text is "Principles of Highway and Traffic Engineering" **5th Edition**, by Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, John Wiley & Sons, 2013. Available at amazon.com, bn.com, bookstores and other sources. **Do not get the 4th Edition.**

Subject Areas and Learning Objectives

Introduction

- Transportation and society
- Role of civil engineering in the planning, design, construction, operation and maintenance of highways and associated transportation facilities and services.

Learning Objective: This portion of the class provides some general background information on transportation. This information is intended to give the student a basic knowledge of some of the fundamental issues in transportation. The primary objective is to get students to start thinking critically about transportation-related issues.

Road Vehicle Performance:

- Resistance
- Acceleration
- Deceleration
- Braking theory
- Fuel consumption

Learning Objective: The objective of this portion of the course is to give students a basic understanding of the factors influencing road vehicle performance. This includes familiarity with terms such as power, torque, and gearing as they apply to actual road vehicles and the elements of braking including brake-force proportioning and braking efficiency. After completing this section, the student is not expected to be able to design a vehicle but is expected to have a basic understanding of the performance characteristics and design compromises that are associated with modern road vehicles.

Geometric Design of Highways

- Sight requirements
- Superelevations
- Horizontal and vertical alignments

Learning Objective: The geometric design of highways is the key element in safety and critical in accident litigation. The objective of this chapter is to familiarize students with the elements involved in geometric design and the safety concerns that motivate vertical curve length and horizontal curve design. After completing this section, the student is expected to have a basic understanding of curve design and stationing and have all of the tools to begin a basic design of a highway, and the background necessary to readily begin learning a variety of computer software packages that assist in the details of highway geometric design.

Pavement Design

- Design of flexible pavements
- Design of rigid pavements

Learning Objective: Pavement design integrates many of the student's previous knowledge relating to strength of materials and soils. From this section, the student is expected to have a basic understanding of the factors that are considered in pavement design including equivalent single-axle loads, the concept of reliability, material properties, soil properties, and serviceability measures. The student should also have the ability to undertake a basic pavement design and the background to readily learn computer software packages used for pavement design.

Subject Areas and Learning Objectives (continued)

Fundamentals of Traffic Flow and Queuing Theory

- Queuing theory
- Applied queuing models ($D/D/1$, $M/D/1$, $M/M/1$, $M/M/N$)
- Traffic delay computations

Learning Objective: Queuing theory has broad impacts in transportation engineering and it builds upon student's basic math and probability knowledge. The objective of this section is to give the student a very basic understanding of queuing theory and familiarity with the deterministic and probabilistic assumptions made for arrivals and departures. After completing this section, the student is expected to have the tools to understand basic queuing principles and have the underlying basis for understanding complex queuing systems.

Highway Capacity and Level of Service Analysis

- Basic Freeway segments
- Multilane Highways
- Rural two-lane highways

Learning Objective: Basic level of service analysis serves as a basis for determining highway construction needs and other transportation resource allocations. This section provides students with the knowledge needed to conduct level of service analysis, familiarity with the terminology used in such analysis, and the background needed to use Highway Capacity Manual (HCM) level of service software.

Traffic Control and Analysis at Signalized Intersections

- $D/D/1$ queuing
- Probabilistic arrivals
- Traffic signal timing

Learning Objective: The objective of this section is to give students a familiarity with the elements of signal timing, terminology, and signal timing theory. This material is designed to serve as a background for a more detailed study of traffic signal theory and the use of signal-timing software.

Travel Demand and Traffic Forecasting

- Traveler Decisions
- Trip Generation
- Mode and Destination Choice
- Highway Route Choice

Learning Objective: Determining and forecasting travel demand is a complicated process because it involves predictions of human behavior. This section presents various mathematical and statistical models that have been developed to predict individuals' travel behavior. Many of the methods originated in social science fields but are now used widely by engineers for behavioral predictions. The objective is to give students a basic understanding of the various modeling approaches and to have them become familiar with the terminology and potential applications.