Spring 2022

CE 350-104: Transportation Engineering

Dejan Besenski

JOHN A. REIF, JR. DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING

NJIT New Jersey Institute of Technology

CE 350 Transportation Engineering **Spring 2022**
Section 102

Brief Course Description

This course will discuss the principles and practices of transportation engineering and urban transportation planning. The major topics of this course cover 1) highway geometric design, 2) capacity analysis of highways and intersections, and 3) travel demand forecasting. The course will have a group project investigating real world example problems related to traffic impact analysis studies for transportation facilities.

Prerequisites: CE 200, CE 200A. A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

Course Objectives

1. Understand the principles and practices of transportation engineering and urban transportation planning.
2. Understand the interactions between transportation planning and land use planning, economics, social planning and master plans.
3. Gain the facility of utilizing the state of the art techniques and models in the field.
4. Have the capability to identify and solve transportation problems within the context of data availability and limitations of analysis tools

Instructor Info & Office Hours

Dejan Besenski
Office: 276 Tiernan Hall | E-mail: besenski@njit.edu | Office Phone: 973-596-5315
Office Hours: Tuesday, 1:00-4:00PM or by appointment

- The office hours are conducted both in person and virtually via WebEx in the instructor's personal WebEx meeting room: https://njit.webex.com/meet/db44
- Canvas Chat and Discussion Forum can be used to post questions and discuss the course materials and assignments with the instructor and fellow students. Students can also send e-mails to the instructor through Canvas, or call the instructor's office phone number.

Lecture Hours and Location

Wednesday, 6:00 PM to 8:50 PM
Tiernan Hall 105

- The lectures will be conducted during the regular class hours in the classroom. Important notice: The first two classes with be fully synchronous online – there will be no meeting in the classroom.
- The lecture notes and other materials will be posted in Canvas.

Textbook

F.L. Mannering and S.S. Washburn. Principles of Highway Engineering and Traffic Analysis, **7th Edition**, John Wiley & Sons, Inc., ISBN 978-1-119-49396-9

Grading

Homework: 10%
Mid-term Exam: 30%
Final Exam: 30%
Group Project: 30%

Code of Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is the instructors' professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

Exam/Homework Policies

Exams: Students will be given exam problems at the beginning of the examination period and will have a specified amount of time (e.g., 1.5 hours for the midterm exam and 3 hours for the final exam).

Homework: Problems will be assigned to reinforce course learning objectives. The assignments will be targeted to provide practice for methods that may be included in course exams. There will be approximately eight-nine homework assignments during the semester. Homework should be turned in at the start of the class period identified by the instructor. No late homework will be accepted. Homework assignments will be posted in Canvas, and students will be expected to submit the solutions through Canvas by the indicated due time.

Collaborating, sharing, and/or copying of exam/homework is **NOT** allowed. Credit will not be given to individuals who either initiated, allowed, or participated in such behaviors. The NJIT honor code will be upheld and any violation will be brought to the immediate attention of the Dean of Students.

Group Project

The class will be divided into multiple groups, each consisting of 4 students. Each group will be assigned an intersection in the vicinity of NJIT campus to conduct a Level of Service analysis, determine deficiencies in intersection operations, identify and evaluate potential solutions. The proposed solutions will be evaluated using Highway Capacity Software (HCS) and a microscopic traffic simulation software VISSIM. The software will be provided by the instructor. Each group must submit the list of group members by the end of the 4th week of the semester, and the presentation of the group project will be held in the 14th week of the semester. The format of the presentation is free, but the presentation must include the following sections:

a. Goal and objectives of the project;
b. Spatial and temporal scopes of the project;
c. Project site description (e.g., intersection geometry, traffic condition, signal phase sequence, etc.);
d. Summary of the traffic flow data – current conditions (e.g., approach volume, green time, yellow time, saturation flow rate, etc.);
e. Description of the identified problems and proposed solutions (improvements);
f. Summary of the Level of Service analysis using HCS (current conditions vs. improvements);
g. summary of the traffic simulation analysis using VISSIM (current conditions vs. improvement);
h. Conclusions and Recommendations (if any).

Due to the circumstances caused by the COVID-19 pandemic, the students may not be able to collect the traffic flow data at the intersection assigned to their team. In such cases the team will work with the instructor to obtain the current conditions data, including the traffic flow data and the signal timing data. Each group will then use the data (collected or obtained in collaboration with the instructor) to develop a model of the intersection in HCS and VISSIM, optimize the signal timing, and evaluate the intersection performance.

Each group will present their project virtually in a WebEx meeting during the regular class hours on May 3. One member of the group will be designated to operate the PowerPoint slides and other presentation materials, but all team members must participate in the presentation.

Hardware and Software Requirements

As noted earlier, each student is expected to have a personal computer with a web-camera. The personal computer will be required to complete the exams, participate in the laboratory exercises using HCS and VISSIM software, and conduct the software analysis as part of the class project. The web-camera is required for the exams.

Class Polices

Cell Phones and mobile devices (e.g., Laptop, iPad/Tablet PC, iPod, etc.): Cell phones should be turned off prior to coming to class. Texting and the use of mobile devices during the class shall not be allowed. Each student will be excused to miss up to two classes with prior permission/**VALID** reason. Each subsequent class absence will be reported to the Dean of Students and may affect student's standing and grade. Five (5) or more missed classes may result in an F grade.

Course Schedule

Week	Topic	Reading	Assignment
1	Course Overview & Introduction to Transportation Engineering Road Vehicle Performance: Principles of Braking, Braking Forces	*Ch.1 (pp. 1-10)* *Ch.2 (pp. 11-43)*	
2	Road Vehicle Performance: Stopping Sight Distance Geometric Design of Highway: Vertical Alignment	*Ch.2 (pp. 11-43)* *Ch.3 (pp. 57-87)*	Homework #1
3	Geometric Design of Highway: Vertical Alignment; Horizontal Alignment	*Ch.3 (pp. 57-96)*	
4	Geometric Design of Highway: Horizontal Alignment; Combined Vertical and Horizontal Alignment	*Ch.3 (pp. 88-109)*	Homework #2
5	Geometric Design of Highway: Combined Vertical and Horizontal Alignment Fundamentals of Traffic Flow	*Ch. 5 (pp. 165-200)*	Homework #3
6	Fundamentals of Traffic Flow Queuing Theory and Models		
7	**Midterm Exam** Queuing Theory and Models		Homework #4
Spring Recess	No class		
8	Highway Capacity and Level of Service Analysis: Basic Freeway Segment/Multi-Lane Highway		
9	Highway Capacity and Level of Service Analysis: Basic Freeway Segment, Multi-Lane Highway/Two-Lane Highway	*Ch. 6 (pp. 211-240)*	Homework #5
10	Traffic Control and Analysis at Signalized Intersections	*Ch. 6 (pp. 231-258)*	Homework #6
11	Lab: Highway Capacity Software	*Ch.7 (pp. 269-325)*	Homework #7
12	Lab: VISSIM Microscopic Traffic Simulation Model		Homework #8
13	Travel Demand and Traffic Forecasting	*Ch. 8 (pp. 341-378)*	Homework #9
14	Group Project Presentations		
15	Final Exam		

Outcomes Course Matrix – CE 350 Transportation Engineering

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Demonstrate the principles and practices of transportation engineering and urban transportation planning.			
Discuss public transportation facilities.	2, 7	1, 2	Discussions and homework.
Use analytical tools to design transportation facilities.	2, 7	1	Homework, hands-on laboratory exercises, group project, exams.
Implement design of transportation facilities.	2	1, 2	Graded group project.
Student Learning Outcome 2: Recognize the interactions between transportation planning and land use planning, economics, social planning and master plans.			
Link transportation to land use, economics, social planning, and master plans.	2, 4	2, 3	Homework and exams.
Develop interactions between each of the above factors.	2, 4	2, 3	Homework and exams.
Give examples of growth due to improvement in transportation.	2	2, 3	Discussions, exams, and homework.
Student Learning Outcome 3: Employ state of the art techniques and models in the field.			
Introduce need for forecasting models.	1, 2, 7	1, 2	Homework and exams.
Discuss application of models.	1, 2, 7	1, 2	Homework and exams.
Assign large scale problems.	1, 2, 7	1, 2	Graded group project.
Student Learning Outcome 4: Identify and solve transportation problems within the context of data availability and limitations of analysis tools.			
Discuss how to obtain data necessary for transportation studies.	7	1, 2	Homework, graded group project
Match up analysis tools, data sets and problems to solve.	2, 7	1, 2	Homework, laboratory exercises, group project.
Introduce problems to be solved using analysis tools.	2, 7	1, 2	Homework, group project, exams.

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Revised: 12/19/19