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Spring 2020

## CE 350-104: Transportation Engineering (Revised for Remote Learning)

Branislav Dimitrijevic

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



**CE 350 Transportation Engineering  
Section 104**

**Spring 2020**

REVISED (16 April 2020)

**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**

Branislav Dimitrijevic

Office: 286 Tiernan Hall | E-mail: [dimitrijevic@njit.edu](mailto:dimitrijevic@njit.edu) | Office Phone: 973-596-6463

Office Hours: Tuesday, 1:00-3:00PM, and Thursday 4:00-5:00PM

The office hours are conducted virtually via WebEx in the instructor's personal WebEx meeting room:

<https://njit.webex.com/meet/bxd1947>

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, and call the instructor's office phone number.

**Lecture Hours and Location**

Thursday, 6:00 PM to 8:50 PM

Central King Building (CKB) 207

The lectures will be conducted during the regular class hours using WebEx. Some lectures may require the students to review pre-recorded videos of lecture presentations, and then participate in a WebEx discussion during the portion of regular class hours. The recorded lectures will be posted in Canvas. The lecture notes and other materials will be posted in Canvas, as they have been from the start of the semester.

## Textbook

F.L. Mannering and S.S. Washburn. Principles of Highway Engineering and Traffic Analysis, **6th Edition**, John Wiley & Sons, Inc., ISBN 978-1-1193-8558-5

## 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](mailto:dos@njit.edu).

## Exam/Homework Policies

**Exam:** All exams will be in-class closed book. Students are allowed to bring their own one-page formulation sheet which must be submitted to the instructor along with the question and answer sheet at the end of each exam.

The final exam will be conducted through Canvas. Students will be given exam problems at the beginning of the examination period and will have a specified amount of time (e.g. 3 hours) to submit the solutions in Canvas.

**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 seven 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 to conduct virtual traffic impact analysis (TIA) studies dealing with level of service analysis for transportation facilities such as freeway, interchange, intersection, and parking lot. Each group will perform the modeling of such facilities by using a microscopic traffic simulator, VISSIM, and Highway Capacity Software (HCS). Each group must submit the list of group members by the end of the 4<sup>th</sup> week of the semester, and the presentation of the group project will be held in the 14<sup>th</sup> week of the semester. The format of the presentation final report is free, but the following sections must be included in the report presentation:

- 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. Data collection summary (e.g., approach volume, green time, yellow time, saturation flow rate, etc.);
- e. Level of service analysis summary (current conditions vs. improvements);
- f. Conclusions and Recommendations (if any).

Due to the circumstances caused by the COVID-19 pandemic and inability to collect the data on the site, the instructor will assign an intersection to each group and provide input data for the analysis. Each group will then use the data 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 April 30. 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.

### **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	<b>Midterm Exam</b> Queuing Theory and Models		Homework #4
8	Highway Capacity and Level of Service Analysis: Basic Freeway Segment/Multi-Lane Highway CLASS CANCELED	Ch. 6 (pp. 211-240)	Homework #5
Spring Recess	No class		
9 (26 March)	Queuing Theory and Models		
10 (2 April)	Highway Capacity and Level of Service Analysis: Basic Freeway Segment, Multi-Lane Highway/Two-Lane Highway		
11 (9 April)	Traffic Control and Analysis at Signalized Intersections	Ch. 6 (pp. 231-258)	Homework #6
12 (16 April)	Lab: Highway Capacity Software	Ch.7 (pp. 269-325)	Homework #7
13 (23 April)	Lab: VISSIM Microscopic Traffic Simulation Model		Homework #8
13	Travel Demand and Traffic Forecasting	Ch. 8 (pp. 341-378)	Homework #9
14 (30 April)	Group Project Presentations		
15 (14 May)	Final Exam		

**Outcomes Course Matrix – CE 350 Transportation Engineering**

<b>Strategies, Actions and Assignments</b>	<b>ABET Student Outcomes (1-7)</b>	<b>Program Educational Objectives</b>	<b>Assessment Measures</b>
<b>Student Learning Outcome 1: Demonstrate the principles and practices of transportation engineering and urban transportation planning.</b>			
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.
<b>Student Learning Outcome 2: Recognize the interactions between transportation planning and land use planning, economics, social planning and master plans.</b>			
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.
<b>Student Learning Outcome 3: Employ state of the art techniques and models in the field.</b>			
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.
<b>Student Learning Outcome 4: Identify and solve transportation problems within the context of data availability and limitations of analysis tools.</b>			
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