

**CARLETON UNIVERSITY**  
**Department of Civil and Environmental Engineering**

**Highway Engineering CIVE4209A/B**

**Winter 2022**

**Course Objectives**

The main objective of this course is to introduce Civil Engineering students to the basic concepts and techniques of Highway and Transportation Engineering. Emphasis is placed on the components of the highway system, i.e., road user, vehicle, and the road itself in addition to the interaction among these components as related to the design, construction, operation and maintenance of the highway system.

Learning Outcomes: By the end of this course, students are expected to have been introduced to the main highway engineering concepts. The specific learning goals of the course are to:

- Learn the basic concept of highway networks and classification.
- Understand the main components of the highway system and their characteristics
- Learn techniques and procedures for collecting dynamic traffic data
- Learn the main criteria and procedures for evaluating quality of traffic operation
- Learn procedures for designing main road components based on design guidelines
- Learn basic concepts of pavement condition evaluation and pavement maintenance

**Course Outline:**

<b>Week</b>	<b>Topic</b>	<b>Chapter</b>
1	<b>Introduction:</b> Importance of Transportation, Road Classification, Road Classification in Canada	1
1,2	<b>Driver, Vehicle, and Road Characteristics:</b> The Human Response Process, Older Drivers, Pedestrians and Bicyclists, Resistance to Movement, Braking Distance, Minimum Curvature of a Horizontal Curve, Sight Distance	3
3	<b>Traffic Engineering Studies:</b> Spot Speed, Volume, Travel Time and Delay, Parking	4
4	<b>Highway Safety:</b> Issues Involved in Transportation Safety, Strategic Highway Safety Plans, Effectiveness of Safety Design Features	5
5,6	<b>Intersection Design and Control:</b> Types of Intersections, Design Principles for At-Grade Intersections, Sight Distance at Intersections, Conflict Points at Intersections, Signal Timing	7-8
7,8	<b>Highway Capacity and Level of Service:</b> Traffic Flow Elements, Fundamental Diagram of Flow, Two-Lane Highways, Multilane Highways, Basic Freeway Sections	6,9
9	<b>Geometric Design:</b> Highway Location, Cross-Section Elements, Vertical Alignment, Horizontal Alignment, Design Consistency	14-15
10	<b>Highway Materials:</b> Soil Characteristics, Frost Action, Bituminous Materials, Superpave Asphalt Binder Grading, Asphalt Concrete, Asphalt Concrete Mix Design	17-18
11,12	<b>Structural Design:</b> Flexible Pavement, AASHTO Design Method, Rigid Pavement, PCA Design Method, Mechanistic-Empirical Pavement Design	19-20
12	<b>Pavement Maintenance and Rehabilitation:</b> Pavement Evaluation, Maintenance and Rehabilitation Techniques	21

**Marking Scheme:**

Assignments	20%
Quizzes/Tests/Project	30%
Final Examination	50%
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Total	100%

**Course Instructor:**

Dr. Y. Hassan  
Room 3434 ME  
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**Text:**

- Garber, N.J. and Hoel, L.A. *Traffic & Highway Engineering*. Enhanced Fifth Edition, Cengage Learning, 2019.
- Students can purchase an e-book directly from the publisher through the link: <https://www.cengage.ca/c/traffic-and-highway-engineering-44-enhanced-edition-44-5e-garber-hoel/9781337631020/>
- The library has a 3-user e-book of this title. A short video has been created on e-book etiquette. Please review the video and use the title properly without blocking access to other students [https://mediaspace.carleton.ca/media/ebook+etiquette/1\\_pubms14p](https://mediaspace.carleton.ca/media/ebook+etiquette/1_pubms14p)

**Notes:**

- The instructor may alter the course outline and/or the marking scheme depending on the class performance.
- All materials posted on Brightspace are for the exclusive educational purpose by registered students in this course in the designated term and cannot be used for any other purpose.
- Working in this course requires access to specific tables and charts from different sources including the text. The notes do not include a full set of the tables/charts in the textbook.
- **Assignments:**
  - Considerable percentage of the mark will be deducted for messy assignments, tests, or exams.
  - Assignments are to be uploaded to Brightspace as a typed file using a word processor or a clean and legible scan. Only one file is allowed for each assignment, and the preferred file type is PDF to avoid potential changes in the file formatting.
  - Assignments that are submitted after (but within 24 hrs of) the due date will have the grade discounted by 20%. No assignments will be accepted after 24 hrs of the due date. Students who miss an assignment for a legitimate reason must report their reasons as soon as possible.
- **Tests and Exams:**
  - Use of e-Proctoring system: Please note that quizzes, tests, and examinations in this course may use a remote proctoring service provided by Scheduling and Examination Services. You can find more information at <https://carleton.ca/ses/e-proctoring/>.
  - Sequential examination is a format that is different from what students in engineering are used to. However, the literature has much evidence on the viability of this format in the online examination setting. While the decision on the examination format will be made during the term, students are to be aware that quizzes, tests, and/or examination in this course may follow a sequential examination format.
- A minimum of 30% (15 out of 50) in the final is required to pass the course.
- **Graduate Attributes (GA):** This course is used to assess GA 1: Discipline-specific concepts, Transportation Engineering. For information on GAs and continual curriculum improvement, visit the Accreditation section of Engineers Canada website: <https://engineerscanada.ca/>.

- **Mental Health:**
  - University is a difficult time - for everyone! Some of us weather the ups and downs better than others. Some of us may need a little extra support sometimes. I assure you that this is ok. There is absolutely nothing wrong with asking for help. The Carleton Wellness page (<https://carleton.ca/wellness/>) is an excellent place to find resources for support. Depending on when you fall along the ‘wellness continuum’, sometimes the ‘extra help’ might be using an app to track your mood. Sometimes it might mean having a talk with a trained counsellor or psychologist to help get your thoughts under control. Sometimes it can feel so overwhelming, you are not sure what you need. If you are not sure - reach out. While I admit that I am not a trained counsellor or psychologist, I am always available to point you in the right direction.
  - If you have a reason to be concerned for the wellbeing of a classmate, or any student at Carleton University, you may consider submitting a care report at (<https://carleton.ca/studentaffairs/care-report/>). The team in the Office of Student Affairs is monitoring Care Report submissions daily and continue to follow up virtually or over the phone.
- **Special Accommodation:** You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:
  - **Pregnancy obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Department of Equity and Inclusive Communities (EIC) website: <http://www.carleton.ca/equity/>
  - **Religious obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Department of Equity and Inclusive Communities (EIC) website: <http://www.carleton.ca/equity/>
  - **Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam.
  - You can visit the Department of Equity and Inclusive Communities (EIC) website to view the policies and to obtain more detailed information on academic accommodation at <http://www.carleton.ca/equity/>