Department of Civil & Environmental Engineering
Carleton University
CIVE 4209: Highway Engineering

Course Information, Policies and Outline

1. Course Instructor

Dr. Kamal Hossain, PhD, PEng
Associate Professor, Civil Engineering
Office: ME-3370
Email: kamal.hossain@carleton.ca

2. Teaching Assistants

Note: Since we have many lab groups, assignments, tutorials, and labs in this course, things can be confusing, so for lab related questions (if any confusing item), email your question to TA TBD. The TA TBD will serve as a one stop solution. If you still have any questions, then please email to Dr. Hossain.

Lab Group	Group TA	TA Contact Info
G1, 2	TBD	
G3,4	TBD	
G5,6	TBD	

3. Lab Technologist

Mr. Jason Arnott, Room: Minto 2082, Email: jason.arnott@carleton.ca Phone: 520-2600x7472

4. Office Hours

Please visit course website for details.

5. Course Website and Communication

Carleton D2L will be used for posting some of the course materials and discussions. You are required to **frequently** check the website for updates. You are also required to check your Carleton email account/D2L for e-mails sent to you related to this course.

6. Course Description, Schedule, Outcomes, Graduate Attributes and Accreditation Unit

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

Graduate Attributes: The Canadian Engineering Accreditation Board (CEAB) requires graduates of undergraduate engineering programs to possess 12 attributes. Courses in all four years of our programs evaluate students' progress towards acquiring these attributes. Aggregate data (typically, the data collected

in all sections of a course during an academic year) is used for accreditation purposes and to guide improvements to our programs. Some of the assessments used to measure GAs may also contribute to final grades; however, the GA measurements for individual students are not used to determine the student's year-to-year progression through the program or eligibility to graduate. This following list provides the GAs that will be measured in this course, along with the Learning Outcomes that are intended to develop abilities related to these attributes.
GA 1.5.C Discipline-specific concept CEE-5 Transportation Engineering. This GA will be assessed using students' grades in a dedicated quiz of a weight of 5% using multiple choice questions.

Accreditation Units

Math	Natural Science	Complementary Studies	Engineering Science	Engineering Design
	-	-	30%	70%

Course Meeting Location and Schedule
Lectures: For class time and location, please visit university website.
Labs: For lab meeting time and location, please visit D2L announcement page.

7. Course Materials
Main Text Book (Required): Traffic and Highway Engineering. Nicholas Garber and Lester Hoel. 4th or 5th Edition. SI. Nelson. Estimated cost for the e-book is $75 and the Hardcopy is $350
Other References:
- Lecture slides/notes

8. Major Topics
- **Introduction to Highway Engineering (W1)**
  - Importance of Transportation
  - Road Classification
  - Road Classification in Canada
- **Highway Materials: Asphalts, Aggregates, Mixtures: Designs, Tests (W2, W3)**
  - Asphaltic Materials; Sources, Types and Usages
  - Fundamental and Engineering Properties of Asphalt
  - Cutback and Emulsified Asphalts
  - Review of Classical Tests of Asphalt
  - An Overview of Advanced Tests (Superpave™) for Asphalt
  - Review of Classical Tests of Aggregate Physical Properties
  - Asphalt Mixtures; Review of Marshal Mix Design Method, Asphalt Mixture Volumetrics;
  - Various Seal Coating
  - An Overview of Superpave System
- **Designs of Flexible and Rigid Pavements (W3, W4)**
  - Structural Components of Flexible Pavement
  - Factors Affecting Pavement Design; Pavement Performance, Traffic, Roadbed Soils, Materials, Environment, Design, Reliability
  - Design of Flexible Pavement using AASHTO Design Method; An Overview of Mechanistic-Empirical Deign Method
  - Rigid Pavement Design using AASTHO Method – overview
- **Characteristics & Interaction of Driver, Vehicle, & Road & Effects on Highway Design (W5)**
  - Driver Characteristics Affecting Highway Design, Concept of Driver's Perception-Reaction Process
  - Vehicle Characteristics Affecting the Highway Design (Static, Kinematic, Dynamic)
  - Vehicle Classifications
  - Sight Distance

- **Geometric Design of Highways (W6, W7)**
  - Principles of Highway Location, Steps or Process in Highway Location
  - Factors Affecting Highway Design
  - Design Hourly Volume, Design Speed, Design Vehicle
  - Cross-Section Elements of Highway, Design of Vertical and Horizonal Alignments
- **Traffic Engineering Studies (W7)**
  - Spot Speed, Volume, Travel Time and Delay, Parking
- **Highway Safety (W8)**
  - Importance of Highway Safety, Crashes or Accidents, Factors Causes Highway Crashes, Processes of Highway Safety Management
  - Review of Crash Type Related to Highway Design and Associated Contributing Factors
  - Review of Safety Effectiveness of Commonly Used Highway Design Features
  - Safety Effects of Traffic Calming Strategies
- **Highway Capacity and Level of Service (W8, 9)**
  - Traffic Flow Elements, Fundamental Diagram of Flow
  - Basic Freeway Segments
  - Multilane Highways
  - Two-Lane Highways
- **Intersection Design and Control (W10, 11)**
  - Types of Intersections
  - Design Principles for At-Grade Intersections
  - Sight Distance at Intersections
  - Conflict Points at Intersections
  - Signal Timing
- **Pavement Asset Management (W12)**
  - Overview of Asset Management: Highway Maintenance and Rehabilitation, Approaches to Highway and Pavement Management, Levels of Management;
  - Importance of Highway and Pavement Performance Data, Methods of Collecting Pavement Condition Data (Pavement Roughness, Pavement Distress, PCI, Pavement Structural Condition, Skid Resistance, ITS in Pavement Condition Monitoring;
  - Models for Pavement Condition Prediction; Deterministic - Family Based and Multiple Regression
  - Different Rehabilitation Techniques and Strategies

❖ The topics above maybe adjusted/supplemented with other topics from the textbook or additional information. All topics that are covered will be part of the examination.

❖ No lecture on government or university holidays. Any change will be discussed in class before implementation

Lab Tests, Data Collection, Analysis of Data, Test Reports:

- Marshall Stability and Flow Tests for Load Capacity, Optimum Binder Content Determination; Indirect Tensile Strength
- For lab test manual/standard/report format, if they are not available on course website, please contact your TA TBD.

9. Course Assessment Plan

Assessment Scheme	Weight	Tentative Dates
Lab	*10%*	
Assignments	*15%*	
Mid-term exam	*20%*	*March 5*
Quiz	*5%*	*March 26*
Final exam	*50%*	

Mid-term exam

Midterm exam will be administered during the semester. If you miss mid-term exam because of unavoidable circumstances, a reasonable accommodation may be arranged based on university practice. However, there has to be a documented, genuine and reasonable cause for missing an exam, without which accommodations will not be made. As per the university regulations, you can document illness by submitting a self-declaration form, which must be submitted to the instructor within three (3) calendar days (or as per current university policy) following the midterm examination. Any request for re-evaluation or grade change must be made within one week from the day the graded test is returned, and after that no such requests will be accepted. Midterm exam may cover both the qualitative and quantitative questions covered in class/labs/fields.

Final examination

Final examination is for evaluation purposes and will not be returned to the students. A minimum of 30% in the final is required to pass the course.

10. Guest Lecture

During the delivery of the course, professional(s)/researcher(s) from the subject/field of study maybe invited to the class. Students are required to attend those classes as well, since exams may include questions from those lectures.

11. Classroom Etiquette

Behaviour that limits another student's ability to learn or that disrupts the instructor's ability to deliver material will not be permitted. You must be polite, professional, and attentive in class, and must not exhibit any disruptive behavior in or out of class. In the event of disruptions caused by students, the instructor/TA reserves the right to discontinue lectures and/or prohibit the disruptive students from attending classes. Examples of disruptions are loud conversation, whispering during lectures, replying to instructor's questions or comments with the intention to gain undue attention or to disrupt class proceedings, disrespectful or threatening behavior, physical or verbal abuse, and showing disdainful or intolerant attitude. Use of electronic devices including cell phones, mobile devices, gaming devices, pagers, transmitters, computers, etc., is prohibited inside the classroom and during examinations. You may use a laptop computer or tablet for writing notes from the class provided the activity does not disturb your neighbors.

Important Notes on Class Attendance: You are strongly recommended to attend all classes and instruction sessions. Certain information given in class, e.g., information about the format of examination questions or about the important examination topics, will not be given outside class or posted on course website. Therefore, you may miss certain important information if you do not attend classes. You must arrive in time -- if you arrive late, the instructor and teaching assistants may ask you to leave. If you consistently arrive late, then you may be barred from attending all the remaining sessions.

Notes on Absences: This course follows the topics required by the curriculum at a very fast pace. Every lecture presents a new topic, and each new topic is based on the previous; missing a single class may have a serious impact on your academic performance. If you are absent from class, due to illness or a personal or family emergency, it is recommended that you review the material missed as soon as possible; consult

with your fellow students, your TA/Instructor, and try to "catch-up" on the topic(s) missed. Anticipated and/or documented absences due to health reasons or important commitments should be brought to the attention of the instructor. Undocumented absences will result in a mark of zero assigned to the course component missed. For duly justified and documented absences please consult the instructor for adjustment of marks.

Documenting your absence using current university policy or practice. In case of illness, in general, you need to consult a doctor within 24 hours of the onset of the conditions leading to your absence. A medical note or self-declaration form (https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf) must be submitted within three (3) calendar days of the missed activity.

If your absence is due to a personal emergency please document it in detail, as much as possible, including tickets, visas or passport entries, if travel is involved. You may also wish to include affidavits from coaches, witnesses, religious officials, police reports, etc, as appropriate. If you know in advance of your absence, please contact the instructor early with information on dates and nature of your absence.

12. Grading Policy and Other Important Notes

- If you miss an assessment activity (e.g., midterm/lab works) because of unavoidable circumstances, a reasonable accommodation may be made based on university practices. You have to **inform the instructor and provide supporting documents within three (3) calendar days** of missing the activity.
- Students are required to complete the course work on an individual basis unless specifically stated otherwise. However, discussion and consultation between students is encouraged.
- **LAB ATTENDANCE IS MANDATORY, AND SIGNATURE OF STUDENTS MAYBE RANDOMLY COLLECTED DURING THE LABS. If you miss any lab/field activity for any unavoidable reason, you have to arrange with teaching assistant/lab technician/instructor to do the lab/field activity and submit evidence(s). You will get zero mark for the missing activity(s).**
- You should properly understand the lab/field works. Final exam may include question(s) from the lab/field activities.
- The instructor determines the content and establishes the grading rules for all assignments, midterms, quizzes, final exam, labs/projects/poster/presentation/class activity, etc. The teaching assistant may grade parts of exams involved in the course. When determining a student's final grade in the course, the instructor will examine the record of each individual student's achievement; the final grade may be adjusted to take into account the compassionate circumstances and the student's general pattern of achievement in the course.
- Students are required to collect the marked lab reports, exam papers or assignments on the day when they are delivered to class. If you miss any class; check with your classmate(s) and make arrangement with your classmate or with a teaching team member to get the marked paper on the same day but by latest within the following week. After that, the teaching team is not responsible for any missed marked paper.
- 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.
- 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.

13. Co-op Interviews

I am aware that co-op interviews often take place at times that conflict with this course meeting. It is expected that a student should not schedule an interview that conflicts with a quiz.

14. Lab Safety

Students are expected to demonstrate awareness of, and personal accountability for, safe laboratory conduct. Appropriate personal protective equipment (PPE) must be worn (e.g., lab coat, gloves, steel-toed shoes, safety glasses, etc.) and safe work practices must be followed as indicated for individual laboratories, materials and equipment. Students will immediately report any concerns regarding safety to the teaching assistant, staff technologist, and professor. Mandatory Safety Equipment required for this course:

- Lab Coats, Gloves, Steel-toed Shoes/Boots, Safety Glass are mandatory

15. Academic Integrity and Professional Conduct

Students are expected to attend all lectures and tutorials; participate in class; and to observe standards of behavior expected in a university environment and in the profession of engineering. Unless otherwise indicated by the instructor, all work submitted for evaluation must be the result of the students' individual efforts without advice or answers obtained from other sources. Cheating of any kind is a serious instructional offense subject to sanctions that may include: failure in the course, suspension from your degree program, and in some cases expulsion from the university. Please consult the university undergraduate calendar for definitions and penalties in https://carleton.ca/registrar/academic-integrity/

16. Accommodation and Mental Health

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 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). Requests made within two weeks will be reviewed on a case-by-case basis. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally scheduled exam (if applicable)"

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/

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Mental Health: University is a difficult time - for everyone! Some of us weather the ups and downs better than others. Some or may be many of us 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.