School of Planning Faculty of Environment  
University of Waterloo  

PLAN 484 / CIVE 484  
Physical Infrastructure Planning  
Spring Term 2019  

Instructor:  
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Teaching Assistants:  
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COURSE OUTLINE  

Calendar Description:  
This course deals with the planning, financing and impacts of investment in public infrastructure, such as water, wastewater, and transportation systems.  

Prerequisite:  
None. Students should have an understanding of economics.  

Introduction:  
This course is intended to provide students with an understanding of how public infrastructure, utilities, transportation facilities, etc. are planned, designed, evaluated, financed and managed. The course covers 1) the historical motivation for providing infrastructure 2) the legal steps required in planning infrastructure, including environmental analyses; 3) technical design standards for infrastructure systems, primarily transportation facilities; 4) evaluation methodologies, including short- and long-term economic, equity, and land-use impacts; 5) methods of financing, including public, private, public-private partnerships and innovative methods; 6) infrastructure management techniques; and 7) a case study of a major infrastructure investment.  

Course Objectives:  
- Students will understand the philosophical differences between Canadian and international environmental assessment processes for major infrastructure provision;  
- Students will gain a deeper understanding of how the provision of infrastructure has shaped metropolitan regions physically, environmentally and socially;  
- Students will learn to systematically (holistically) evaluate planning projects – to understand cost structures (marginal, fixed, operating, etc.) as well as externalities or socially-borne costs;  
- Students will be encouraged to consider the role of the private sector in the provision of major infrastructure projects;  
- Quantitative skills will be enhanced including a review of probability and statistics and their application to infrastructure (asset management);
Learning Modes:
The course will be conducted in primarily a lecture mode with student presentations. Guest lecturers, including professionals and other academics, will also be invited. The lectures are intended to provide background information to students, as well as some exposure to “real-world” challenges in infrastructure planning. The student presentations are designed to improve the students’ critical thinking, ability to research and evaluate projects, and presentation skills.

The course materials include both classic works in the field of infrastructure planning as well as newly published research. Students are expected to have read and prepared the readings prior to each class period. A prepared student will have critically evaluated the readings and assessed the validity of the authors’ perspectives, and applied the authors’ thought process to examples in the readings and developed in the lectures. Required readings may be referenced on examinations even if not directly discussed in class. When applicable, quantitative examples and case studies will be presented.

At various points in the course, students will be asked to present orally concepts or ideas related to course materials or current events. Satisfactory presentations will increase class participation marks. Inability to participate will result in lower participation marks.

SCHEDULE
Class Meetings
The course meets in EV3-1408 on Thursday evenings, from 6:30pm to 9:20 pm.

There are tutorials in RCH 110 on Monday afternoons from 4:30pm to 5:20pm. Tutorials will not meet each week; the schedules will be announced in class.

Professor’s and teaching assistants’ office hours will be announced in class.

SEQUENCE OF COURSE TOPICS
There may be minor adjustments from time to time in sequence and date. Students are responsible for all of the topics listed below. Readings for each week are listed in the course reading pack.

<table>
<thead>
<tr>
<th>Course Week</th>
<th>Date</th>
<th>Topics</th>
<th>Assignment</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>May 9</td>
<td>Course logistics and requirements. Introduction: What is physical infrastructure? Historical perspectives; Why is it publicly provided? What is the current state of infrastructure in North America?</td>
<td>Assignment 1</td>
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<td>Planning and Design of Infrastructure; Governance structures in Canada and the US; Legal and Environmental Processes in North America; Federal Requirements</td>
<td>Term paper topic proposal due</td>
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<tr>
<td>2</td>
<td>May 16</td>
<td>Planning and Design (continued): predicting facility utilization, generating design requirements (transportation examples);</td>
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<tr>
<td>3</td>
<td>May 23</td>
<td>Assignment 1</td>
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<td>Course Week</td>
<td>Date</td>
<td>Topics</td>
<td>Assignment</td>
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<td>4</td>
<td>May 30</td>
<td>Planning and Design completion; Impacts of Infrastructure Provision: Land use patterns (decentralization), environmental and equity issues</td>
<td>Assignment 2</td>
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<td>Term paper outline</td>
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<td>5</td>
<td>June 6</td>
<td>Impacts of Infrastructure Provision (continued). Economic development: short- and long-term analysis</td>
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<td>6</td>
<td>June 13</td>
<td>Midterm exam</td>
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<td></td>
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<td>Introduction to Economics</td>
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<td>7</td>
<td>June 20</td>
<td>Economics of Infrastructure: Cost definitions: fixed, variable and marginal costs, life-cycle costs and externalities</td>
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<td>8</td>
<td>June 27</td>
<td>Economics of Infrastructure: Pricing. Considerations of Equity, economic efficiency, public objectives.</td>
<td>Assignment 3</td>
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<td>Term paper annotated outline</td>
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<td>9</td>
<td>July 4</td>
<td>Infrastructure Financing: public / private financing; user charges, measuring public benefits; efficiency, innovative funding techniques (development fees, special–purpose governments, etc.)</td>
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<td>10</td>
<td>July 11</td>
<td>Infrastructure management systems: Objectives and goals; research trends; optimal investment strategies, quantitative tools</td>
<td>Assignment 4</td>
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<td>11</td>
<td>July 18</td>
<td>Infrastructure management (continued): probability models, Markov decision models, discount methods, multicriteria decision making.</td>
<td>Term paper</td>
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<td>12</td>
<td>July 25</td>
<td>Introduction to AHP; Case study – TBD</td>
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**STUDENT EVALUATION**
Marks for the course will be assigned as follows:

<table>
<thead>
<tr>
<th>Course Component</th>
<th>Value</th>
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<tbody>
<tr>
<td>Midterm examination</td>
<td>25%</td>
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<tr>
<td>Final examination</td>
<td>40%</td>
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<tr>
<td>Paper submission OR quantitative assignments</td>
<td>20%</td>
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<tr>
<td>Class presentation OR written communication assignment</td>
<td>10%</td>
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<td>Class participation</td>
<td>5%</td>
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Midterm Examination:
Students will be allowed to bring to the examination one 8.5 by 11 inch sheet (both sides) of personal notes; no course readings may be directly copied or transcribed onto the examination sheet. Sheets will be collected and returned to students with the graded exam.

Final Examination:
There is a compulsory final examination in this course. Students are required to be present to write the examination. The date, time and location of the examination are scheduled by the registrar and are within the University’s normal examination period. Students should not make travel arrangements until they have consulted the examination time table. The University examination schedule is published by the Registrar.

Term Paper or Quantitative Assignments:
Students may prepare a term research paper on a suitable course topic of their choosing. The goal of the term paper is to apply the knowledge, methods or principles presented in the class to a project (or policy) that is occurring locally, in Canada or globally. Successful papers will contribute independent thought and analysis to the topic chosen. Critical dates for the paper are listed in the table of course topics. The paper shall be between 8 and 20 pages in length, excluding references. The paper shall be formatted as follows:

- 1” margins on all sides;
- 12 point font;
- full justified text;
- All pages shall be numbered, with page 1 being the first page of text (excluding the cover sheet);
- All tables and figures shall be numbered sequentially, and included in the body of the text as near as possible to the point at which they are introduced in the text;
- References shall be presented in accordance with APA Reference Style. Examples can be found here: http://www.apastyle.org/.
- All paper submissions shall include the academic integrity form, found here: https://uwaterloo.ca/academic-integrity/sites/ca.academic-integrity/files/uploads/files/AIAcknowledgementForm.pdf

In lieu of preparing a written research paper, students may complete four homework assignments for the course. The assignments will often be quantitative in nature and be due one week from the time that they are assigned. Students must select by week 2 whether they will complete the term paper or the weekly assignments. Once a student has chosen one course of action, he or she may not change.

Course Presentation or Written Communication Assignment
Because communication is such an important component of Planning and Engineering, the course offers students an opportunity to improve their skills in this area. Students have a choice in how they satisfy this requirement. The two options are group presentation to the class or an individual written assignment. The expectations for each are explained here.

Group Presentation
Each week (beginning in the 2nd week) a group of students will make a presentation of approximately 30 minutes on the weekly topic. The purpose of this presentation is not to simply summarize the readings, but rather to research further and expand the topic’s scope. One week following the presentation, the presenting students will submit a written “executive summary” of their presentation that shall include the seminal points of their presentation as well as any additional material that is introduced in subsequent discussions. Students will be graded based on their presentation (communication) skills, primarily how well the presentation engages the audience, as well as the written summary of their presentation (approximately 2-4 pages). Students not
presenting will be expected to engage the presenters with feedback and appropriate questions and potential debate on the topic.

**Written Communication Assignment**

Currently, there are a number of very important infrastructure projects ongoing locally, across Canada and globally. The goal of the written assignment is to critically assess the planning, design, and construction methods being used in the delivery of an ongoing infrastructure project. Of particular concerns is how the project’s management is either consistent with, or contrary to the “best practices” described in class. A sample outline includes:

1. An introduction – what is the project, where is being built, who are the agencies responsible for it, and what are the goals? A statement of the current status – in which phase is the project (planning, design, construction, operation).
2. The identification of one (or possibly two) components of the project for further evaluation. This could include the planning process by which it was approved; the physical design; the method of financing / construction; its environmental impacts; etc.
3. A critical assessment of the components identified. Is the approach taken for the study project representative of best practices? If not, how could the approach be improved? What recommendations can be made?
4. A conclusion.

The written assignment shall be between 1500 and 2000 words and follow the same formatting rules as presented for the term paper.

**Requirements, Grade Penalties and Special Considerations:**

- Attendance: in order for class discussion to be meaningful, attendance must be mandatory. Students will be allowed two unexcused absences; each additional unexcused absence during the semester will result in a 5% overall reduction of your final mark.
- Lateness penalty: all assignments are due on the date set by the professor. Teaching assistants are NOT allowed to change the due dates. The first day an assignment is late brings about a 5% penalty. An additional 5% penalty is assessed for each additional late day. A student's assignment more than four business days late will not be accepted and a grade of zero will be recorded for that assignment.
- Examinations and tests: students are expected to be present at the time examinations and tests are scheduled. There is a required final examination in the normal examination period as scheduled by the Office of the University Registrar. Students should consult the final examination timetable before making any August travel plans. No “make up” examinations are provided.
- Requests for exemptions or compassionate considerations are to be discussed with the professor in advance or as soon as possible.
- The professor determines the content and establishes the grading rules for all assignments, midterm and final examinations, and any essays or projects. The professor is also the sole evaluator of class participation. The teaching assistants may grade parts of exams and assigned coursework. To obtain a passing grade in the course, students are expected to achieve a pass in each graded course component. When determining a student's final grade in the course, the professor will examine the record of each individual student's achievement; the final grade may be adjusted to take into account the component passing requirement, extenuating and compassionate circumstances and the student's general pattern of achievement in the course.
TEXTS

Required Reference Texts
Readings are in electronic format through the University’s on-line course management system.

Recommended Reference Texts
York, NY
University Press Canada
York

AVOIDANCE OF ACADEMIC OFFENSES
Students are expected to know what constitutes academic integrity, to avoid committing academic offenses,
and to take responsibilities for their actions. Students who are unsure whether an action constitutes an
offense, or who need help in learning how to avoid offenses (e.g. plagiarism, cheating) or about “rules” for
group work / collaboration should seek guidance from the course professor, TA, academic advisor or the
Undergraduate Associate Dean. For information on categories of offenses and types of penalties, students
should refer to policy number 71, Student Academic Discipline, http://www.adm.uwaterloo.ca/infosec/policy/policy71.html Students who believe they have been
wrongfully or unjustly penalized have the right to grieve; refer to policy number 70, student Grievance
http://www.adm.uwaterloo.ca/infosec/policy/policy70.html

Collective completion of quantitative assignments is acceptable when:
- learning occurs such that each member of the group's level of understanding is improved;
- each group member's submission reflects his or her level of understanding at the time of
  submission;

If a student submits an assignment that demonstrates greater capacity that he or she possesses at the time
of submission then that is unacceptable. The way to evaluate the student's capacity is to verify that the
collective work can be completed independently by each student.

For written assignments (papers, executive summaries, etc.) completed as a group must ensure:
- that each member of the group has read the full content of the submission and is comfortable that
  the content is free of violations of academic integrity;
- that each student has identified his or her individual contribution to the work submitted such that if
  violations of academic integrity are identified, then the student primarily responsible for the
  violations may be identified. Note that in this case the remainder of the team will also be subject
to disciplinary action, but the penalties for the extended team members may be less severe.

All notes, assignments, and other course materials not directly attributed to others are to be considered
owned by the instructor. Posting of these materials to file sharing sites is a violation of copyright and of
academic integrity.
University Policies

Intellectual Property:

Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:
- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student’s educational experience. However, sharing this intellectual property without the intellectual property owner’s permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

Mental Health:
The University of Waterloo, the Faculty of Environment and our Departments/Schools consider students' well-being to be extremely important. We recognize that throughout the term students may face health challenges - physical and/or emotional. Please note that help is available. Mental health is a serious issue for everyone and can affect your ability to do your best work. Counselling Services http://www.uwaterloo.ca/counselling-services is an inclusive, non-judgmental, and confidential space for anyone to seek support. They offer confidential counselling for a variety of areas including anxiety, stress management, depression, grief, substance use, sexuality, relationship issues, and much more.

Religious Observances:
Students need to inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

Unclaimed assignments:
Unclaimed assignments will be retained until one month after term grades become official in quest. After that time, they will be destroyed in compliance with UW’s confidential shredding procedures.

 Communications with Instructor and Teaching Assistants:
All communication with students must be through either the student’s University of Waterloo email account or via Learn. If a student emails the instructor or TA from a personal account they will be requested to resend the email using their personal University of Waterloo email account.