University of Alberta

Department of Civil and Environmental Engineering

CIV E 719 – Sustainable and Resilient Transportation

Winter 2025

Course Instructor: Professor Stephen D. Wong, Ph.D.

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Dr. Wong's Office Hours: Tuesday 11:00 AM – 1:00 PM, or by appointment.

Lecture: Tuesday & Thursday 9:30 AM – 10:50 AM, NRE 2-122

Course Objectives

Upon completion of the course, students will be able to:

- Define, describe, and provide examples of sustainable, resilient, and equitable transportation systems, infrastructure, and plans.
- Understand the effects of transportation systems on climate change and the environment.
- Understand the effects of hazards on transportation systems.
- Describe and apply different transportation modes and strategies to reduce greenhouse gas emissions and environmental impact.
- Describe and apply different transportation concepts and strategies to increase infrastructure, operational, and community resilience to chronic disruptions and acute shocks.
- Communicate sustainability, resilience, and equity ideas in written and oral forms.
- Guide transportation planning and operations toward more sustainable and resilient outcomes in their work.

Course Description

The course will provide an introduction and overview of transportation sustainability, resilience, and equity, including their connections to advanced engineering design, policy, and land use. The sustainability section of the class will survey a variety of current and emerging strategies used to reduce the impact of transportation on climate change, pollution, and environmental degradation. Topics will include: public transit, shared mobility, walking, cycling, intelligent transportation systems, freight/logistics, and pricing. The resilience section of the class will focus on strategies to safely protect infrastructure and populations from hazards (both natural and man-made). Topics will include: resilient infrastructure, street design,

community design, evacuations, transportation responses in disasters, and recovery mechanisms. The course will focus on written and oral communication, prepare transportation engineers for a diverse range of professions, and encourage the adoption of emerging and innovative engineering strategies and ideas.

Land Acknowledgement

The University of Alberta respectfully acknowledges that we are located on Treaty 6 territory, a traditional gathering place for diverse Indigenous peoples including the Cree, Blackfoot, Métis, Nakota Sioux, Iroquois, Dene, Ojibway/Saulteaux/Anishinaabe, Inuit, and many others whose histories, languages, and cultures continue to influence our vibrant community.

Contingency Planning for Disruptions and Other Challenges

Should the instructor be indisposed or otherwise unable to attend in-person lectures, a set of pre & post-recorded lectures will be made available via Canvas. Please be sure to stay on top of announcements made via email, in class, and in Canvas.

Course References

Course references are lecture-specific. If a copy is not available via the UofA Library, I will provide the reading in Canvas.

Class website (Canvas)

Canvas will play a very central role in the delivery of this class this term. Please familiarize yourself with the CIV E 719 Canvas page, and its contents and functions. All class materials (lecture materials/recordings, assignments, supplemental references, etc.) will be posted here.

Course Deliverables and Grading

Assignments	45%	Reading Responses	10%
Interim Report	10%	Participation	5%
Final Project	30%		

Lectures

All lectures will be delivered in-person (NRE 2-122), unless otherwise noted. Lecture content/materials are copyrighted; hence students must not attempt to record or redistribute.

Assignments

There are 3 assignments in total. Assignments will be posted on Canvas and must be submitted electronically on the date and time indicated in each assignment handout. Always remember to include your name and ID. Students must work independently for assignment 1. *You will be working in groups for assignments 2 and 3*. Given that life can be unpredictable, students are allocated a one-time pass that can be used for one assignment, which allows you to turn it in up to four days late with no reduced credit. Any additional late submissions will be penalized 25% per day. Unsubmitted assignments and those four days late or more will receive no credit. Please note that writing quality will be considered in the grade. Writing must be technical and formal.

Reading Discussions

For each class, you will be required to post your questions and/or comments to a Google Form that goes over the reading. I will read the questions/comments anonymously to spark discussion.

Reading Responses

Reading responses are your opportunity to engage with the required readings and prepare you for class. You will be required to choose 4 readings from the Sustainability section of the course and 4 readings from the Resilience section of the course (for a total of 8 responses).

For each reading, you should provide:

1) A summary of the reading (1 average paragraph)
2) Reactions and discussion of the reading (1 average paragraph)

Please make sure your discussion is well-informed. You may bring in other resources to help support your reactions/discussion. Reading responses are due at the end of the two content sections of the course.

Project

The final project will be the culmination of this class. You are expected to use what you learned to develop, execute, and communicate a full research project. You will:

1) Identify a sustainable or resilient transportation problem
2) Develop several research questions that could help solve the problem
3) Develop a methodology for data collection and analysis
    a. You may use current data if collecting your own data is not feasible

   b. If you use current data, you will be graded more critically on your analysis
4) Collect data for analysis (if necessary)
   a. Examples include: big data, open data, surveys, intercepts, interviews, focus groups
5) Analyze data with engineering methods
   a. A wide range of methods can be used. A multi-method approach is recommended.
6) Create several policy implications and recommendations from your analysis
7) Present the methods, analysis, and conclusions

Your projects will be conducted in groups of 3-4 people. You may use your current research to do the project, but the project must be original.

An interim report is also required, which will include a summary of the research, a literature review, and methods. If you plan to use the project as part of your M.Sc. or M.A. thesis, you may work on your own, with the instructor's permission.

Participation

You are expected to attend the lecture every day and I will note who is present. You are expected to read the literature before the lecture (as noted in the syllabus). It is meant to prepare you for class. You are also expected to attend lectures. Moreover, you are expected to participate in class discussions. There will be a participation quiz at the beginning and end of some of the classes. Participation is worth 5% of your grade. Please note that I understand that you may not be able to attend all lectures. I will grant some leeway for this grade to make it more flexible. However, the participation grade here is for your benefit and to help you learn!

Training

To embed equitable research practices in the class, you are required to conduct two trainings.

1) **GBA+ Training** (https://women-gender-equality.canada.ca/en/gender-based-analysis-plus/take-course.html)
   a. The content of this course focuses on the basic introduction to gender-based analysis (GBA) Plus. You will familiarize yourself with the key concepts of GBA Plus and recognize how various identity and social factors can influence the experience of federal government initiatives affecting different people. You will learn to identify how GBA Plus can enhance the responsiveness, effectiveness and outcomes of federal

government initiatives while applying some foundational GBA Plus concepts and processes.

2) **TCPS 2 Tutorial** (https://tcps2core.ca/welcome)
   a. The Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2) provides ethics guidance that applies to all research involving human participants – including their data and/or biological materials – conducted under the auspices of an institution eligible for funding by the federal Agencies (CIHR, NSERC, SSHRC).

      The online tutorial CORE-2022 (Course on Research Ethics) is an introduction to the TCPS 2 for the research community. It focuses on the TCPS 2 ethics guidance that is applicable to all research involving human participants, regardless of discipline or methodology.

      The Panel on Research Ethics highly recommends that all researchers who intend to engage in research involving human participants, as well as REB members and administrators, successfully complete the new CORE-2022. Institutions may also have policies in place that make its completion mandatory.

Communication Suggestions

Please be professional in your communications. I will respond to emails within 1-2 business days; please include "CIVE 719" in your subject line. Also, I encourage you to drop in during office hours for questions about the class or about other things, especially transportation-related (jobs, grad school, specializations, etc.). Outside of my office hours, please make an appointment.

Academic Integrity

Make sure to read the "*Code of Student Behaviors*" by Dr. T.G. Joseph & Mr. C. Harper (see below for summary), which is also available in Canvas.

"*The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University*".

Support Services

Did you know that the U of A has various low to no-cost services to help students succeed? Visit http://www.deanofstudents.ualberta.ca/ for information about the academic, wellness, and various other support services available to students. It's never too early or too late to seek help! Please take care of yourself and your mental health. Learning should be fun, not a burden.

Accommodations

- If you need accommodations for this class, please review the procedures on this website. https://www.ualberta.ca/current-students/academic-success-centre/accessibility-resources/index.html.
- If you have religious obligations, please stop by for office hours to discuss the timing of assignments.
- If you need assistance in improving your writing, please see the following resources https://www.ualberta.ca/current-students/academic-resources/writing.html

Active Learning and Preparing for Class

One key goal of the class for you to gain a greater understanding of important transportation engineering and planning concepts, methods, and ideas. Your participation is important in the discussion in class. Please also ask questions!

Device Policy

- Mobile phone use is discouraged during class.
- Refrain from emailing, searching, or doing other work.
- ChatGPT and other AI-enabled language/writing software may not be used for this class except for brainstorming. If you do use ChatGPT for brainstorming, you must cite its usage.

Course Schedule[1]

#	Date	Topic	Assignment Due Dates	Readings
0	Canvas	Intro to Class (Recorded)		
1	7-Jan-25	Sustainability Concepts (Recorded)		Schiller, P. L., & Kenworthy, J. R. (2017). An introduction to sustainable transportation: Policy, planning and implementation. Routledge. (Chapter 2)
2	9-Jan-25	Resilience Concepts		Trapenberg Frick, K., & Forscher, E. (2018). Funding Resilient Infrastructure on the Quick: US Federal Transit Disaster Programs after Superstorm Sandy. *Natural Hazards Review*, *19*(4), 04018016.
3	14-Jan-25	Equity Concepts	Trainings due	Karner, A., Golub, A., Martens, K., & Robinson, G. (2017). Transportation and environmental justice: History and emerging practice. In *The Routledge handbook of environmental justice* (pp. 400-411). Routledge.
4	16-Jan-25	Public Policy and Research		Appleyard, B., Ferrell, C. E., Carroll, M. A., & Taecker, M. (2014). Toward livability ethics: A framework to guide planning, design, and engineering decisions. Transportation Research Record, 2403(1), 62-71.

5	21-Jan-25	Land Use and Housing		Kasraian, D., Raghav, S., & Miller, E. J. (2020). A multi-decade longitudinal analysis of transportation and land use co-evolution in the Greater Toronto-Hamilton Area. Journal of Transport Geography, 84, 102696.
6	23-Jan-25	Sustainable Fuels and Energy	A1: Essay	Lajunen, A., & Lipman, T. (2016). Lifecycle cost assessment and carbon dioxide emissions of diesel, natural gas, hybrid electric, fuel cell hybrid and electric transit buses. *Energy*, *106*, 329-342.
7	28-Jan-25	Shared Mobility		Rayle, L., Dai, D., Chan, N., Cervero, R., & Shaheen, S. (2016). Just a better taxi? A survey-based comparison of taxis, transit, and ridesourcing services in San Francisco. Transport Policy, 45, 168-178.
8	30-Jan-25	Public Transit		Boisjoly, G., Grisé, E., Maguire, M., Veillette, M. P., Deboosere, R., Berrebi, E., & El-Geneidy, A. (2018). Invest in the ride: A 14 year longitudinal analysis of the determinants of public transport ridership in 25 North American cities. Transportation Research Part A: Policy and Practice, 116, 434-445.
9	4-Feb-25	Walking and Micromobility		Pucher, J., Dill, J., & Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: an international review. Preventive medicine, 50, S106-S125.
10	6-Feb-25	Intelligent Transportation	Interim Report	Harb, M., Xiao, Y., Circella, G., Mokhtarian, P. L., & Walker, J. L. (2018). Projecting travelers into a world of self-driving vehicles: estimating travel behavior implications via a naturalistic experiment. *Transportation*, *45*(6), 1671-1685.
11	11-Feb-25	Highways/Auto		Noland, R. B. (2001). Relationships between highway capacity and induced vehicle travel. Transportation Research Part A: Policy and Practice, 35(1), 47-72.
12	13-Feb-25	Freight and Logistics		Wygonik, E., & Goodchild, A. V. (2018). Urban form and last-mile goods movement: Factors affecting vehicle miles travelled and emissions. *Transportation Research Part D: Transport and Environment*, *61*, 217-229.
-	18-Feb-25	Reading week		
-	20-Feb-25	Reading week		
13	25-Feb-25	Parking and Pricing	R1: Responses - Sustainability	Shoup, D. C. (1999). The trouble with minimum parking requirements. Transportation research part A: policy and practice, 33(7-8), 549-574.
14	27-Feb-25	Policy Review Presentations	A2: Policy Review	
15	4-Mar-25	Disasters, Chronic Disruptions, Incidents		Donovan, B., & Work, D. B. (2017). Empirically quantifying city-scale transportation system resilience to extreme events. Transportation Research Part C: Emerging Technologies, 79, 333-346.
16	6-Mar-25	Infrastructure		Markolf, S. A., Hoehne, C., Fraser, A., Chester, M. V., & Underwood, B. S. (2019). Transportation resilience to climate change and extreme weather events–Beyond risk and robustness. Transport policy, 74, 174-186.
17	11-Mar-25	Community Resilience		Asfaw, H. W., Nation, S. L. F., McGee, T. K., & Christianson, A. C. (2019). Evacuation preparedness and the challenges of emergency evacuation in Indigenous communities in Canada: The case of Sandy Lake First Nation, Northern Ontario. International journal of disaster risk reduction, 34, 55-63.
18	13-Mar-25	No class		
19	18-Mar-25	Evacuations		Parr, S. A., Acevedo, L. M., Murray-Tuite, P., & Wolshon, B. (2021). Methodology to Quantify Statewide Evacuations. Transportation Research Record, 03611981211046922.
20	20-Mar-25	Transportation Response in Disasters		Wong, S. D., Walker, J. L., & Shaheen, S. A. (2021). Trust and compassion in willingness to share mobility and sheltering resources in evacuations: A case study of the 2017 and 2018 California Wildfires. *International Journal of Disaster Risk Reduction*, *52*, 101900.
21	25-Mar-25	Recovery and the Future		Holguín-Veras, J., Jaller, M., Van Wassenhove, L. N., Pérez, N., & Wachtendorf, T. (2012). On the unique features of post-disaster

				humanitarian logistics. Journal of Operations Management, 30(7-8), 494-506.
22	27-Mar-25	Paper Review Presentations	A3: Paper Review	
23	1-Apr-25	Edmonton Context – Guest Lecture TBD		
24	3-Apr-25	Group Project Presentations		
25	8-Apr-25	Group Project Presentations	Final Report Due April 14	

[1] Lectures may be modified/replaced/supplemented with guest lectures, etc.

Grading Scale:

The following grading scale will be used to assign grades in this class.

Highest	Lowest	Letter
100.00 %	97.00 %	A+
96.99 %	93.00 %	A
92.99 %	90.00 %	A-
89.99 %	87.00 %	B+
86.99 %	83.00 %	B
82.99 %	80.00 %	B-
79.99 %	77.00 %	C+
76.99 %	73.00 %	C
72.99 %	70.00 %	C-
69.99 %	67.00 %	D+
66.99 %	60.00 %	D
59.99 %	0.00 %	F