
CIVE 360 Sustainable Transportation Systems

Term – Fall 2020 (202009)

We acknowledge with respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.

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Office Hours

Please email me to request appointment

List all prerequisites and co-requisites

CIVE 210 AND ENGR 001 AND ONE OF MECH 200, CIVE 200, ELEC 200, AND STAT 254 OR STAT 260.

Course Objectives

In this course, you will learn about the safe systems approach to road safety. This entails learning about the role of human factors, the principles of good road design, the need for safe speeds, and the role of automobile design and how these four parts can function as a single system. For civil engineers who work in transportation, these are key frames that must be considered to design safe and sustainable transport systems.

You will also learn about sustainable land transportation systems, including multimodal transportation systems; various ways to address carbon and ecological harms from transport; the role of history in today's transportation design forms; the role of exposure to the automobile; the concept of induced demand; and the role of policies and markets as drivers of sustainable and unsustainable transport.

Learning Outcomes

After completing this course, you will be able to:

- Define sustainable transport and describe the importance and role and its various pillars.
- Defend the role of the safe systems approach including the role of each of its component parts in reducing trauma to people.
- Apply engineering principles to address the role of speed and speeding and their respective roles in producing human trauma.
- Design infrastructure for walking, cycling and motor vehicles, in both urban and rural contexts, to maximize safety and sustainability while adhering to essential elements of engineering guidance.

- Critically evaluate common methodologies used to assess the problem of carbon, environmental and ecological impacts associated with land transportation.
- Explain how the role of multimodal transport (including public transportation, movement of freight, and micro-mobility) connects to climate change mitigation and adaptation, assess its role as part of a sustainability framework and describe its co-benefits.
- Integrate findings about human factors and apply them to transportation engineering.
- Assess the implications of vehicle engineering for transportation engineering.

Syllabus

A-Section(s): A01/CRN #####

TAs: Hiva Viseh, Lia Codrington and Kevin Cant

Days: Wednesdays

Time: 5:30 PM to 8:30 PM

Location: Online

Required Text

Arason, N (2014), [*No Accident: Eliminating Injury and Death on Canadian Roads*](#). Waterloo, Wilfrid Laurier University Press.

Reference Materials

[*British Columbia Active Transportation Design Guide \(2019\)*](#) (free).

[*NACTO Design Guides*](#) (most but not all content available free).

[*NACTO Global Street Design Guide*](#) (free).

[*ITE Traffic Engineering Handbook \(2016\)*](#) (e-version available free through UVic library).

[*US Department of Transportation, Federal Highway Administration*](#) (free).

[*The National Cooperative Highway Research Program*](#) (free).

Assessments

Description	Weight	Date(s)
Individual assignments (3 x 10%)	30 %	Oct 11; Nov 1; Nov 15
Group Project	25 %	Dec 2
Mid-terms (3 x 15%)	45 %	Mid-term #1: Sept 30 Mid-term #2: Oct 21 Mid-term #3: Nov 25

Assignments

There are 3 term assignments as follows:			
Assign-ment #	Assignment Description	Suggested Start Date	Due (5 PM PDT)
1	Using AutoCad, or other electronic or paper means, design a roundabout and describe how it conforms to technical standards, which standards those are, and what features make is safe and attractive for all road users (max. drawing + one page).	Sep 23	Sun, Oct 11
2	Using AutoCad, design a major highway that is suitable for a maximum speed of 100 km/h and describe how it conforms to technical standards, which standards those are, what features make is safe for all road users, and how it supports reduced harms to the environment and surrounding ecosystems (max. drawing + one page)..	Sep 30	Sun, Nov 1
3	Compare the major modes of transport (e.g., walking, cycling, motor vehicle, public transport, light rail, heavy rail, etc.) from the perspective of their environmental, ecosystem and GHG impacts relative to various measures such as CO ₂ -eq emissions or energy intensity per tonne-kilometre and CO ₂ -eq emissions or energy intensity per passenger-kilometer (max. 2 pages).	Oct 7	Sun, Nov 15

Note: Late assignments are graded with a daily 10% penalty reduction unless an exception is made, based on student accommodation or reasonable grounds, in advance of the due date.

Laboratories (Description & Method of Delivery)

Lab #

Modules

Start

Due (5pm PDT)

The laboratory sessions will be used to complete any needed instruction and/or additional training on the use of computer-aided design (CAD) transportation software and the large Group Project. If time permits, the labs can also be used for working on the individual assignments.

Projects (Description & Method of Delivery)

The Major Group Project will consist of a comprehensive written report that among various elements includes a slide presentation made to the class and to a judging panel (that includes municipal officials) and text, images, plots, and tables needed to communicate an urban road redesign proposal using AutoCad. The intention is that most of this project work can be completed during lab time. This project is a real-world application and will utilize actual transportation problems currently facing the District of Saanich.

Your work on the Group Project starts on September 9 and is due December 2. No extensions are possible for this project since it includes an online presentation component that must take place on or before the last day of class on December 2.

There will be more detailed Group Project Assignment instructions to follow.

Course Schedule (Note: This course schedule and pre-readings are subject to change)

Topic	Pre-reading (and mid-term study materials)
<p><u>Class 1, Sep 9</u> Introduction, definition of sustainable transportation and introduction to safe system theory</p> <ul style="list-style-type: none"> - Course syllabus. - Grading rubric. - Introduce laboratory structure and topics. - Benefits and negative impacts of transportation. - Sustainable transportation definition. - The problem of deaths and serious injuries from road crashes. - The emergence of the Safe System Approach. 	<p>Foreword and Prologue, <i>No Accident</i></p> <p>Arason, N. (Winter 2018/19), The Safe Systems Approach for Road Safety <i>ITE Transportation Talk</i>, PP. 11 - 16.</p>
<p><u>Class 2, Sep 16</u> Speed and speeding</p> <ul style="list-style-type: none"> - The physics of speed and the non-linear quadratic function of speed. - Relationship between speed, crash risk and injury. - Factors needed to consider when setting speeds. - Myth of speed differential in crash causation. - The difference between ‘speed’ and ‘speeding’. - Relationship between speed and fuel consumption. - Intelligent speed management systems. - Speed as central tenet of safe system thinking. <p><i>Guest speaker:</i> Troy McKay, Eng.L, ASCT, District of Saanich, overview of Group Project.</p>	<p>Kumfer, W., LaJeunesse, S. et al. (April 2019), Speed, Kinetic Energy and the Safe System Approach to Safer Roadways, <i>ITE international Journal</i>. PP. 33-36.</p> <p>McCourt, R., Fitzpatrick, K. et al. (April 2019), Speed Limits: Leading to Change, <i>ITE international Journal</i>. PP. 38-42.</p>
<p><u>Class 3, Sep 23</u> Urban road design</p> <ul style="list-style-type: none"> - Vulnerable road user trauma. - Historical roots of select urban road designs. - Overview of the five urban design principles. - Road design guides. 	<p>Ch 3, <i>No Accident</i></p> <p>N.B.: See also Reference Materials on page 2 of this course outline.</p>

<p><u>Class 4, Sep 30</u> Rural road design <i>Mid-term #1 (To be scheduled following this class)</i></p> <ul style="list-style-type: none"> - Geometric design. - Low-cost road measures - Physical and geometric measures - Access management principles. - Highway speeds. - Intelligent highway systems. - Centre median barriers. - Intersection roundabout design. - Road safety audits. <p><i>Guest speaker:</i> Joy Sengupta, P. Eng., Ministry of Transportation and Infrastructure.</p>	<p>Ch 4, <i>No Accident</i></p> <p>N.B.: See also Reference Materials on page 2 of this course outline.</p>
<p><u>Class 5, Oct 7</u> Road ecology, GHG emissions from transport</p> <ul style="list-style-type: none"> - Overview of road ecology. - Transportation sector GHG contributions. - Benefits/disadvantages of various ST approaches using life cycle analysis. 	<p><i>Key Findings section and Part II of:</i> <i>SLoCaT (2018), Transport and Climate Change Global Status Report 2018</i></p> <p>Gota, S., Huizenga, C., Peet, K. et al. (2019), Decarbonizing transport to achieve Paris Agreement targets, <i>Energy Efficiency</i>, 12: 363.</p> <p>Coffin, A.W. (2007), From roadkill to road ecology: A review of the ecological effects of roads, <i>Journal of Transport Geography</i>, Vol. 15, Issue 5, PP. 396-406.</p>
<p><u>Class 6, Oct 14</u> Multi-modal transport</p> <ul style="list-style-type: none"> - Definition and role of MMT and its relationship to sustainable transportation, human health benefits, environmental health benefits, etc. - Role of MMT in climate mitigation and adaptation. - ‘Avoid, shift, improve’ framework. - Concept of induced demand. - Benefits and co-benefits of multi-modal transport. 	<p>None.</p>
<p><u>Class 7, Oct 21</u> <i>Mid-term #2 (To be scheduled following this class)</i> Public transportation and movement of freight</p> <ul style="list-style-type: none"> - Urban public transit. - Transit Oriented Development (TOD). 	<p><i>Urban Public Transport and Passenger and Freight Railways sections (PP. 61 – 71) of:</i> <i>SLoCaT, (2018), Transport and Climate Change Global Status Report 2018</i></p>

<ul style="list-style-type: none"> - Inter-city bus transport. - Bus transit. - Bus rapid transit. - Light rail. - Cable cars. - Heavy rail. - Freight transport. 	
<p><u>Class 8, Oct 28</u> Walking, cycling & micro-mobility</p> <ul style="list-style-type: none"> - Definitions. - Risk/denominator. - Co-benefits. - Design considerations. - Walking and cycling infrastructure design. - Concept of ‘first/last mile.’ - Integration with other modes. - Impacts from COVID-19. <p><i>Guest speaker:</i> Liliana Quintero, P. Eng., City of Vancouver.</p>	<p>Introduction (PP. 1 – 18) and Chapter 3 (PP. 65-102) of: P.D. Norton (2008), <i>Fighting traffic: The dawn of the motor age in the American City</i>, Cambridge, MA: MIT Press. Available online through at UVic library.</p> <p>Kristie, D. & Perrotta, K. (March 2017), <i>Prescribing Active Travel for Healthy People and a Healthy Planet: A Toolkit for Health Professionals</i>, Canadian Association of Physicians for the Environment.</p>
<p><u>Class 9, Nov 4</u> Human factors I</p> <ul style="list-style-type: none"> - Six driver types: young; careless and high risk; commercial drivers; medically unfit drivers; motorcyclists; everyone else. - Driver licensing and human rights issues associated with the right to drive and court rulings. 	<p>Ch 1, <i>No Accident</i></p>
<p><u>Reading Week (Nov 9 – 11) No Class</u></p>	
<p><u>Class 10, Nov 18</u> Human factors II</p> <ul style="list-style-type: none"> - Role of ‘ordinary’ human error. - Role of alcohol, drugs, distraction and fatigue. - Prevalence of drivers with alcohol or other drugs in their system. - Legislative programs for high-risk driving and distracted driving. - Traditional police enforcement of the rules of the road. - Smart/automated enforcement programs. <p><i>Guest speaker:</i> Dr. Jeff Brubacher, MD, UBC and Vancouver General Hospital.</p>	<p>Ch 2, <i>No Accident</i></p>

<p><u>Class 11, Nov 25</u> <u>Mid-term #3 (To be scheduled following this class)</u> Passive safety in automobile design</p> <ul style="list-style-type: none"> - Introduction to motor vehicle regulation - Historical perspective of the car. - An introduction to passive safety in automobile design. - Seat belts and air bags. - Vehicle-to-vehicle crash incompatibility. - Vehicle modifications. - Lack of regulation for trucks, buses, school buses and 15-passenger vans. - Passive vehicle safety design for pedestrian safety. - Federal motor vehicle regulatory loopholes such as the '15-year importation rule'. - Limitations to passive safety. <p>Active safety in automobile design</p> <ul style="list-style-type: none"> - Introduction to active safety. - Vehicle-enabled speed control. - Collision avoidance systems. - Automatic emergency response systems. - Vehicle data collection systems and black boxes. - Road design compatibility with vehicle crash avoidance systems and self-driving cars. 	<p>Ch 5, 6 & 7, <i>No Accident</i></p> <p>De Haven H. (2000), Mechanical analysis of survival in falls from heights of fifty to one hundred and fifty feet. 1942. <i>Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention</i>, 6(1), 62–68.</p>
<p><u>Class 12, Dec 2</u> Student Group Project presentations (with judging panel).</p>	

NOTE:

Failure to complete all laboratory requirements will result in a grade of N being awarded for the course. Failure to pass the final exam will result in a failing grade for the course.

Course Withdrawal Deadlines:

- September 22: Withdrawal with 100% reduction of tuition fees
- October 13: Withdrawal with 50% reduction of tuition fees
- October 31: Last day for withdrawal (no fees returned)

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

There will be no supplemental examination for this course.

Grading: Please see the Grading information in the current calendar at:
<https://www.uvic.ca/calendar/future/undergrad/index.php#/policies>

Course policies and guidelines

Late Assignments: *No late assignments will be accepted unless prior arrangements have been made with the instructor at least 48 hours before the assignment due date.*

Coursework Mark Appeals: *All marks must be appealed within 7 days of the mark being posted.*

Attendance: We expect students attend all lectures and labs. It is entirely the students' responsibility to recover any information or announcements presented in lectures from which they were absent.

Electronic devices in labs and lectures: No unauthorized *audio* or *video* recording of lectures is permitted.

Electronic devices in midterms and exams: Calculators are only permitted for examinations and tests if explicitly authorized and the type of calculator permitted may be restricted. No other electronic devices (e.g. cell phones, pagers, PDA, etc.) may be used during examinations or tests *unless explicitly authorized*.

Plagiarism: Submitted work may be checked using plagiarism detection software. Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the link given below for the UVic policy on academic integrity. Note that the university policy includes the statement that "*A largely or fully plagiarized assignment should result in a grade of F for the course.*"

Academic Integrity: You must make yourself aware of the University of Victoria guidelines and policy concerning fraud and academic integrity at this link, <https://www.uvic.ca/current-students/home/academics/academic-integrity/index.php>

Policy on Academic Integrity: <https://www.uvic.ca/calendar/future/undergrad/index.php#/policies>

Standards of Professional Behaviour: You are advised to read the Faculty of Engineering Document Standards for Professional Behaviour in current Undergraduate Calendar, which contains important information regarding conduct in courses, labs, and in the general use of facilities. Please find the document at this link:
<https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf>

Notes to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

University of Victoria Privacy Policy: If any student has concerns about their private information being stored or accessed outside of Canada, they are required to inform the course instructor about their concerns before the end of second week of classes.

Accommodation of Religious Observance: See entry in current Undergraduate Calendar.

Equality: This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to

contact the Centre for Accessible Learning located in the Campus Services Building, <https://www.uvic.ca/services/cal/>.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

Sexualized Violence Prevention and Response at UVic: UVic takes sexualized violence seriously, and has raised the bar for what is considered acceptable behaviour. We encourage students to learn more about how the university defines sexualized violence and its overall approach by visiting www.uvic.ca/svp. If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support please contact the sexualized violence resource office in Equity and Human Rights (EQHR). Whether or not you have been directly impacted, if you want to take part in the important prevention work taking place on campus, you can also reach out:

Where: Sexualized violence resource office in EQHR; Sedgewick C119

Phone: 250.721.8021

Email: svpcoordinator@uvic.ca

Web: www.uvic.ca/svp

Policy on Inclusivity and Diversity: See the entry in the current Undergraduate Calendar.

Course Lecture Notes

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

Syllabus statement

A note to remind you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone.

Counselling Services - *Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students.*

<https://www.uvic.ca/services/counselling/>

Health Services - *University Health Services (UHS) provides a full service primary health clinic for students, and coordinates healthy student and campus initiatives.* <http://www.uvic.ca/services/health/>

Centre for Accessible Learning - *The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations* <https://www.uvic.ca/services/cal/>. *The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.*

Elders' Voices - *The Office of Indigenous Academic and Community Engagement (IACE) has the privilege of assembling a group of Elders from local communities to guide students, staff, faculty and administration in Indigenous ways of knowing and being.*

<https://www.uvic.ca/services/indigenous/students/programming/elders/index.php>

The **Office of the Ombudsperson** is an independent and impartial resource to assist with the fair resolution of student issues. A confidential consultation can help you understand your rights and responsibilities. The Ombudsperson can also clarify information, help navigate procedures, assist with problem-solving, facilitate communication, provide feedback on an appeal, investigate and make recommendations.

Phone: 250-721-8357; Email: ombuddy@uvic.ca; Web: uvicombudsperson.ca.