



**POLYTECHNIQUE
MONTRÉAL**

UNIVERSITÉ
D'INGÉNIERIE

Course Syllabus

CIV8760E - Transport Data Management

Departement Civil, geological and mining Engineering

Fall 2024

3 Credits

Schedule Triplet: 3 - 1.5 - 4.5

[Moodle Site](#)

Contact Details and Availability

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Course Outline

Main stages of transport data collection: planning, management, validation, analysis and dissemination. Databases and data relevant to the study of transport problems. Types and properties of spatiotemporal data. Data models. Methods and tools for data processing, analysis, modeling and visualization. Geographic information systems: projection systems, concepts and integration. Spatial analysis methods applicable to transport data and relevant tools. New transport data collection technologies and analysis potential. Data mining, machine learning and econometric models.

PREREQUISITES	CO-REQUISITES	SUBSEQUENTS COURSES
CIV2710		

The Transport Data Management course is an engineering course offered in the transportation orientation along with four other courses: Transportation and Society (CIV8710), Pavement Construction and Restoration (CIV8730), Circulation (CIV8740) Sustainable Transportation Planning (CIV8750).

BCAPG Qualities

1 Engineering knowledge	2 Problem analysis	3 Investigation	4 Conception	5 Engineering Tools usage	6 Ind. work and teamwork
AP	AP	AP	AP	AP	AP
7 Communication	8 Professionalism	9 Impacts on society and env.	10 Equity and Ethics	11 Economy and project management	12 Continuous learning
AP	AP	IN	IN	IN	AP

In particular, students learn to design data models that take into account the needs for collecting, processing and analyzing this data.

Learning Objectives

From the course analysis.

Objectives	Correspondances with the BCAPG qualities
select the most relevant data acquisition methods according to different types of transport problems and design a process of realization	3, 5
master the nomenclature associated with carrying out major surveys on the mobility of people	3, 5
define data types according to their spatial, temporal and semantic properties	1, 2
create and manipulate geographic information layers using different software	3, 5
design transport data models and develop processes for treating and analyzing these data sets	2, 3, 4
apply the main methods of spatial analysis and spatio-temporal analysis to transport data to model different transport problems	1, 2, 4
design tools for consultation and analytical visualization of data	4,5
develop critical thinking on the methods seen in class and their results	5, 9, 10, 12
Practical Assignments: create spatio-temporal information layers and structure a geographic information system integrating different types of objects, apply spatial analysis techniques using different computer tools to model transport problems, design interactive tools for analytical data visualization using computer tools (spreadsheet, etc.), apply techniques for estimating statistical models with spatial components, extract and interpret information from transport databases, using database management systems and data mining tools	2, 3, 4, 5

Course Usefulness

Data is everywhere in transport and it is not possible to analyze it manually or with simple tools like spreadsheets. The objective of the course is to be familiar with and know how to apply data processing, analysis and modeling methods for the planning, design and management of transport systems. Upon completion of this course, you will be able to design an information system and data handling processes for various transportation problems.

Teaching Methods

Teaching methods are traditional. The course sessions rely on examples (including different types of content such as videos, animations and software) to introduce the concepts, and exercises to implement them and test understanding. The course takes place in a computer room so that everyone can use the computer to do certain examples and exercises. Participation in class is very strongly encouraged, especially since the number of students is relatively smaller than in the common core civil engineering courses. Moodle is the central point for monitoring the course and the students understanding. Every Friday before the next Tuesday lesson, the learning objectives, documents to consult and preparation activities before the course will be indicated. The site's forum will be the main point of exchange for the course, in particular for questions of general interest on the course or a practical exercise. There will be activities, quizzes and documentary research between lessons to check understanding.

The Moodle site is the central point for following the course. Each Friday before the week will be indicated the learning objectives, the documents to consult and the preparatory activities before the course. The forum of the site will be the main point of exchange of the course, in particular for questions of general interest on the course or a PA.

The practical assignments will take place in the Polytechnique computer labs. Lab sessions begin with a short introduction to the topic, then students work on their own. Other explanations are given to the whole class according to questions and needs.

Regarding generative artificial intelligence (AI) systems (GAIS) like ChatGPT or GitHub Copilot, these tools can be used in all works. However, you must declare their use and ensure the quality of the work rendered: you remain entirely responsible for your work. It is also authorized to pour course material into these tools to summarize it or obtain explanations (without guarantee of the result). Note however the issues related to the use of these tools: confidentiality of what you share with these tools, impacts on the environment (energy consumption) and use of materials without authorization from their authors.

Evaluations

Nature	Number	Mode (individual/team)	Weight	Date
Activities and quizzes	11	ind. Moodle	10 %	each week
PA	5	team Moodle	30 %	given before the next PA
MidTerm	1	ind.	30 %	Octobre 22
Final exam	1	ind.	30 %	TBD

Any delay in the rendering of the work will result in the loss of points (10 % of the grade per day of delay). In the event of an absence from the midterm, its weight will be carried over to the final exam (which will then count for 60% of the overall mark).

Evaluation criteria

The course is based on knowledge, but above all on methods and tools to be applied to various problems. The exercises will be graded taking into account both the reasoning and the result of the problem posed. Exercises, other than direct application exercises, rarely have a single right answer. You have to make assumptions, justify the answers and always ask yourself questions about the plausibility of your results.

An excellent student will master the knowledge of the course and will be able to apply it appropriately, while knowing its limits. A person who does well in the course will have a good knowledge of the course and will know how to apply the methods and tools to most problems. A student with an average mark will not always make the link between knowledge, theory, and the problems posed, and will be mistaken in the application of methods and tools. A failing student will show significant gaps in understanding the basics of the course, will not be able to apply basic knowledge (definitions) and methods and will not make the connection with the concrete aspects of the subject.

In addition, I would like to insist on the writing quality of the work, because future engineers who graduate from Polytechnique will also be judged on their presentation skills in professional life. Reports must follow the civil engineering writing guide.

Documentation

Course material is on the [Moodle course site](#). The [GitHub](#) has :

- a group of [Jupyter notebooks](#) that propose examples and activities in Python ;
- [Ressources](#) to install and learn the Python language.

Other complementary ressources on [coding](#) and [data science](#) are available on Poly's Wiki (in English).

Calendar

Week or Course	Themes	Lab, PA	Lectures and prep. exercices	Evaluation
Week 1	Course Presentation and introduction			quiz
Week 2	Data Collection Methods	Carrying out and analysing data acquisition		quiz
Week 3	Data processing			quiz
Week 4	Databases (models)	Data Models		quiz
Week 5	Databases (SQL)			quiz
Week 6	Spatial data	Spatial Data and Databases		quiz
Week 7		Spatial Data and Statistics		quiz
Week 8	Break			
Week 9	Midterm			quiz
Week 10	Statistical Analysis			quiz
Week 11	Statistical Models			quiz
Week 12	Data Vizualisation			quiz
Week 13	Data Mining 1			quiz
Week 14	Data Mining 2			quiz
Week 15	Spatial Analysis			quiz

Workload**

The course is rated as requiring four and a half hours of personal work per week, which may vary from week to week, depending on the handovers of practical work reports and proximity to classroom assessments (midterm and final exam) . It is essential to do the activities every week, in particular to use the quizzes or small exercises of each week to validate your understanding of the course, and to come back to the points that have not been understood.

** This information is given for information purposes only. Some people may need to invest more or less time.

Fraud : rules and sanctions

As future engineers, students must adopt an exemplary professional attitude. Article 8 of the regulations for undergraduate studies presents Polytechnique Montréal's position with regard to fraud based on the principle of zero tolerance. Here are some elements [taken from the regulations](#).

By fraud, we mean any form of plagiarism, cheating or any other illicit means used by a student to obtain an undeserved evaluation result or to influence a decision relating to an academic file.

As examples of fraud :

- the total or partial, literal or disguised use of a work of others, including any extract from an electronic medium, passing it off as his own or without reference indication on the occasion of a examination, work or any other activity being assessed;
- non-compliance with instructions during a test, examination, work or any other activity subject to evaluation;
- soliciting, offering or exchanging information during an examination or examination;
- falsifying the results of an assessment or any document forming part of it;
- possession or use during a test or examination of any unauthorized document, material or equipment including another student's examination paper.

Depending on the seriousness of the offense and the existence of mitigating or aggravating circumstances, the student may be subject to a sanction corresponding to, among other things, the awarding of grade 0 for the exam, the or any other activity subject to an evaluation that is in question, the assignment of the grade F for the course in question, the assignment of the grade F to all the courses taken during the term.

In the case of team work, the students of the same work team as recognized by the teacher are in solidarity with the material produced in the name of the team. If a team member produces and delivers work on behalf of the team and that work is found to be fraudulent all team members are subject to punishment unless it is proven unambiguously that the violation is the act of one or a few members of the team in particular.

Ressources and services for students

The [Student Services](#) (SEP) consists of qualified professionals and a Student Squad, dedicated to promoting your well-being and your success at Polytechnique Montréal, academically, personally and socially. Whether in the form of individual meetings, practical workshops or programs such as tutoring and mentoring, the services offered will help you reach your full potential during your studies at Polytechnique Montréal. Feel free to contact them. You have everything to gain !

The [Office for Intervention and Prevention of Conflicts and Violence](#) (BIPCV), welcomes you, guides you and supports you in sexual violence, harassment or any issue relating to respect for persons. The BIPCV is an independent office, providing a service that respects confidentiality and listens without judgement. Contact them: bipcv@polymtl.ca 514 340-4711 Ext. 5151.