



ASAD YARAHMADI

POSITION

Ph.D.

BACKGROUND

Graduate diploma in
Natural Resources Engineering,
GIS and Remote Sensing

SUPERVISED BY

Catherine Morency
Martin Trépanier

DATA DRIVEN APPROACH TO QUANTIFY THE VARIABILITY OF VEHICLE EMISSIONS

PROJECT GOALS

- Develop a framework to model the influence of factors affecting vehicle emissions
- Improve the accuracy of vehicle emissions estimation and assess level of variability throughout the network and across travel conditions
- Model vehicle emissions at the link level and use this as input for route and global emission estimation

PROJECT DESCRIPTION

Driving behavior and travel conditions have an important impact on vehicle emissions. The variability and inherent uncertainty in this relationship remains however as a gap in the literature. This project develops a data-driven framework to model this uncertainty and increase the accuracy of vehicular emissions estimation. The project will propose a method to allocate relevant driving cycles to the Montreal road segments, for various conditions. It will assess the impacts on the overall estimations. Inclusion in the MOVES model for Montréal will also be tested at the link level.

CHALLENGES

- MOVES relies on various input parameters to measure the emissions, namely adapted driving cycles
- Complexity of data driven method is another challenge, mostly since access to required data is not easy
- Down-scaling existing emissions datasets, as a validation dataset, into the link-level to validate result of developed model





**CAMILLE
GARNIER**

POSITION

Ph.D.

BACKGROUND

B.Eng. Industrial Engineering

SUPERVISED BY

Martin Trépanier
Catherine Morency

METHODOLOGIES FOR IMPROVING PARATRANSIT SERVICES

PROJECT GOALS

- Adjust dwell time for paratransit services with a multiple linear regression model
- Forecast medium-term demand for paratransit services by considering the demographics and the evolution of the mobility behaviors of the target population
- Plan the integration of paratransit trips with the regular transit network

PROJECT DESCRIPTION

Paratransit is a door-to-door ridesharing service for people with limitations that prevent them from using the regular transit network. The aim of this project is to develop methodologies to optimize operational, tactic and strategic aspects of paratransit services of the Société de transport de Montréal (STM).

CHALLENGES

- To use and analyse big data on paratransit demand in combination with demographic data from Statistics Canada
- Integration of paratransit into regular service planning tools
- Evolution of paratransit supply in regards with the disturbances in the taxi industry





ELODIE DESCHAINTRÉS

POSITION

Ph.D.

BACKGROUND

Graduate diploma in
Engineering
M.A.Sc. Civil Engineering

SUPERVISED BY

Catherine Morency
Martin Trépanier

MODELING INTERACTIONS BETWEEN MODES OF TRANSPORT

PROJECT GOALS

- Highlight different types of interactions between modes at the individual and systemic levels from various data sources
- Develop indicators to quantify the multimodality of mobility behavior and the complementarity (or competitiveness) of different modes
- Build a longitudinal model to forecast multimodal transport demand

PROJECT DESCRIPTION

In a context where mobility is increasingly multimodal, this research aims to better understand the interdependencies between modes. To this end, a data integration procedure will first be developed in order to longitudinally monitor the use of several modes. Indicators will then be proposed to measure the diversity of use of these modes and their interactions. In addition, causal inference methods will be applied to assess the effect of various factors on these indicators. Finally, a longitudinal and multivariate model will be built to model transportation demand.

CHALLENGES

- Merge data from a regional household survey and passive data streams
- Assess the impact of planning strategies on modal shares and multimodality of mobility behavior
- Foster an integrated vision of all modes of transport





GABRIEL LEFEBVRE-ROPARS

POSITION

Ph.D.

BACKGROUND

B.Sc. Urban Planning
M.A.Sc. Civil Engineering

SUPERVISED BY

Catherine Morency
Paula Negron-Poblete

A METHODOLOGY FOR THE ASSESSMENT OF STREET SPACE AND TIME ALLOCATION

PROJECT GOALS

- Develop measures of urban street space and time allocation
- Assess the equity of street and time allocation in Montréal
- Model the impacts of current allocation parameters (safety, mode choice...)

PROJECT DESCRIPTION

This project aims at developing an automated tool to measure the allocation of space and time of urban streets to users according to the mode they use and the activities they carry out. Once the allocation is measured, its equity will be assessed using indicators developed for this purpose. The impacts of the current allocation parameters on mode choice and road safety will also be modelled. Alternate scenarios based on these models will then allow to make recommendations on the reallocation of space and time in urban streets.

CHALLENGES

- Fusion of large datasets
- Application of equity frameworks to street space and time allocation
- Treatment of both spatial and temporal dimensions of the street





**JÉRÔME
LAVIOLETTE**

POSITION

Ph.D.

BACKGROUND

B.Eng. Civil Engineering
M.A.Sc. Civil Engineering

SUPERVISED BY

Catherine Morency
Owen Waygood

MODELING THE FACTORS INFLUENCING CAR OWNERSHIP EVOLUTION

PROJECT GOALS

- To assess the factors influencing the evolution of car ownership
- To define indicators of car dependencies
- To elaborate car ownership and car dependency reduction scenarios

PROJECT DESCRIPTION

The 1st contribution aims to model the evolution of car ownership at a fine aggregate level using administrative data and a range of explanatory variables (sociodemographic, built environment, transport supply). The 2nd contribution aims to define indicators to quantify different components of car dependency, mainly the captivity to the automobile and the psychological attachment to the car. The 3rd contribution aims to elaborate car ownership and car dependency reduction scenarios.

CHALLENGES

- Gather and prepare historical datasets to estimate explanatory variables of car ownership evolution in the last 15 years
- Evaluate and quantify how these various car dependencies act as barriers in the transition towards sustainable mobility
- Develop a survey to better understand people's psychological link with the car





MOHAMED KHACHMAN

POSITION

Ph.D.

BACKGROUND

Graduate diploma in
Engineering
M.A.Sc. Civil Engineering

SUPERVISED BY

Catherine Morency
Francesco Ciari

SPATIAL POPULATION SYNTHESIS METHOD

PROJECT GOALS

- Define and test different synthesis methods for a population of individuals and households
- Define and test spatialization methods of the different types of synthetic households at the housing unit scale
- Develop indicators to measure the quality of synthesis and spatial disaggregation

PROJECT DESCRIPTION

This project aims to develop a spatialized synthesis method of a population of households and individuals based on the OD survey sample and the public use micro-data files to support travel demand forecasting in Quebec. The method will be tested for the Montreal area. First, a synthetic population of individuals and households is generated. Then, households are spatialized according to the spatial distribution of household types in the OD survey. Finally, indicators are developed to measure the quality of the synthetic population.

CHALLENGES

- Application of population synthesis approaches to travel demand forecasting in Quebec
- Adaptation of spatial analysis methods (regression, filtering and expansion) to the population synthesis exercise
- Including totals fit and resemblance of joint distributions in quality indicators





**ANJELI
NARRAINEN**

POSITION

M.A.Sc.

BACKGROUND

Graduate diploma in
Mechanical and Industrial
Engineering

SUPERVISED BY

Catherine Morency

DEVELOPMENT OF A TAXI CONSULTATION AND ANALYSIS PLATFORM

PROJECT GOALS

- Refine the estimation of indicators characterising the supply and demand of taxi journeys in the light of data available in the Taxi Register
- Automate the extraction and processing of data from the register and the computation of indicators
- Develop a platform for consultation and analysis of these indicators that will act as a strategic planning tool

PROJECT DESCRIPTION

This project aims to better understand the current role and potential of the taxi in daily mobility. A preliminary research project has made it possible to test the data flows of three in-service intermediaries and to identify the mechanisms required to process them. Data from the Taxi Register will now be documented and analysed to support the development of systematic and automated data processing and indicator estimation procedures. A dashboard-type consultation and analysis platform can then be developed.

CHALLENGES

- Uncertainty regarding taxi services following the deregulation policy of the taxi industry
- Processing of large datasets
- Design and development of the platform to meet the needs of a variety of users





ANTONIN DARROU

POSITION

M.A.Sc.

BACKGROUND

Graduate diploma in
Engineering

SUPERVISED BY

Catherine Morency
Martin Trépanier

MODELLING TRANSIT RIDERSHIP

PROJECT GOALS

- Identify factors influencing the variations in bus ridership
- To develop a model allowing to forecast ridership for strategic use (medium-term)
- Develop scenarios regarding the evolution of various explanatory factors

PROJECT DESCRIPTION

The Société de transport de l'Outaouais (STO) is one of the major transportation company of the Ottawa–Gatineau region. In the recent years, its ridership has significantly increased, generating important strategic planning needs. Forecasting ridership on a transit network allows to anticipate what improvements are required as well as the necessity to invest in equipment and infrastructures. STO is aiming to better understand the factors having an incidence on its ridership in order to be more agile in the adaptation and bonification of its services.

CHALLENGES

- Picture current status in terms of transport, land-use and demography of the Ottawa–Gatineau region
- Assess the performance of several forecasting models to select the most relevant and fitted ones to the study context
- Develop scenarios concerning the recovery of travel habits following current disruptive events





**CHARLOTTE
POIRIER**

POSITION

M.A.Sc.

BACKGROUND

B.Sc. Urban Planning

SUPERVISED BY

Catherine Morency

IMPACT OF QUALITY AND DIVERSITY OF ALTERNATIVES ON MODE CHOICE

PROJECT GOALS

- Develop a method to assess the quality of alternatives (paths) for various OD pairs
- Evaluate the diversity of alternatives and identify deserts of alternatives
- Validate that adding an access mode improves the quality and diversity of transit alternatives

PROJECT DESCRIPTION

This project aims to validate the assumption that quality and diversity of alternatives (quality and diversity of routes) has an impact on mode choice. The underlying assumption is that transit attractiveness increases when more than one alternative is available for a given OD pair. To validate this assumption, alternatives will be generated and evaluated for OD pairs and will then be filtered according to their quality and diversity. The impact of adding a transit access mode will also be assessed with respect to its contribution to improve quality and diversity of available routes.

CHALLENGES

- There is few research on the diversity of alternatives
- Threshold distances to access public transportation for each mode are often set arbitrarily
- Considering the frequency of transit in the analysis is complex





FOROUZ ALAHYARI FARD

POSITION

M.A.Sc.

BACKGROUND

B.Eng. Civil Engineering

SUPERVISED BY

Geneviève Boisjoly
Catherine Morency

TAXI DEMAND MODELING FROM A SUSTAINABILITY PERSPECTIVE

PROJECT GOALS

- Propose zonal and trip-based methods to model taxi demand, accounting for various explanatory factors
- Analyze the competitiveness of taxi in comparison with other modes
- Identify the contribution of taxis to sustainable development

PROJECT DESCRIPTION

This project aims to develop travel demand forecasting models, zonal and trip-based, using observed taxi trips. In addition to these models, it proposes to elaborate supply scenarios and assess efficiency of current operations. The question of latent demand will also be explored since some trips may not occur due to inadequacy between supply and demand. Competitiveness of taxi vs other modes will contribute to the understanding of the current and potential mode share of taxis. Finally, a methodology to evaluate the contribution of taxis to sustainable development will be proposed.

CHALLENGES

- Taxi is often used for irregular and occasional trips, making it harder to identify explanatory factors
- No demographic information is available regarding the taxi user
- Estimating taxi latent demand is a complex task





**HAMED
ALI ZADEH**

POSITION

M.A.Sc.

BACKGROUND

B.Eng. Civil Engineering

SUPERVISED BY

Catherine Morency
Martin Trépanier

INTERCITY TRAVEL IN QUEBEC

PROJECT GOALS

- Propose a typology of corridors for intercity trips in Quebec
- Develop a method to estimate travel demand in the main intercity Quebec corridors
- Propose various service supply scenarios and assess the applicability of various mobility options

PROJECT DESCRIPTION

The project is defined to improve the public transport mobility in inter-city level for the main corridors of Quebec. In this context a survey will be conducted to evaluate the current travel pattern of people between the main areas in Quebec province. Also, other data sources will be taken into account to achieve more precise analyses. In the next step, different models will be used to predict the travel demand in main areas in Quebec, so that it can be used to have a more efficient public transportation system for inter-city travels.

CHALLENGES

- Develop a more precise understanding of intercity travel, often composed of irregular trips
- Develop a travel demand forecasting model for intercity trips in the main corridors
- Propose a relevant and adaptable definition, for the various regions, on long-distance travel in Quebec





**JOLIANN
MORISSETTE**

POSITION

M.A.Sc.

BACKGROUND

B.B.A. (trilingual track)

SUPERVISED BY

Martin Trépanier
Catherine Morency

ASSESSING THE ENVIRONMENTAL IMPACTS OF CARSHARING

PROJECT GOALS

- Evaluate the environmental impacts of carsharing services in Montreal
- Evaluate the reduction in car ownership resulting from the decision to join a carsharing service
- Estimate GHG emissions of carsharing members and assess potential impacts of membership scenarios

PROJECT DESCRIPTION

The project aims to better evaluate the contributions of carsharing to GHG reductions. On the one hand, it aims to better understand the travel behaviours of carsharing users and to assess the impacts of adhering to the service on the transformation of these behaviours. On the other hand, it aims to better estimate the potential contributions of carsharing to GHG reduction through the evaluation of various membership scenarios using various datasets: Origin-Destination survey, satisfaction survey among members and Communauto transaction data.

CHALLENGES

- Characterise carsharing membership's activity systems and compare them with those of non-members with similar features
- Evaluate the impacts of carsharing on GHG emissions and car ownership, accounting for home location
- Propose an annualisation strategy allowing to estimate the GHG reductions resulting from carsharing services





**JULIEN
DOUVILLE**

POSITION

M.A.Sc.

BACKGROUND

B.Eng. Civil Engineering

SUPERVISED BY

Catherine Morency

CHARACTERIZATION AND MODELLING OF INDIVIDUAL ACTIVITY SYSTEMS

PROJECT GOALS

- Identify activity patterns that are typical on a weekday among the population
- Propose a method to assign individuals to one of the activity patterns based on their attributes, including the kind of household they belong to
- Identify major trends in the activity patterns and propose a forecasting method at different horizons

PROJECT DESCRIPTION

This project aims to improve the travel demand forecasting process currently used at the Ministère des transport du Québec (MTQ) by using the activity-based models. Based on the OD travel survey data, the goal is to segment the population of Greater Montreal along the similarity of their activity patterns during a typical weekday. Thus, the different activity patterns that are typical among the population can be identified and a model can be developed to evaluate the probability that an individual adopt one of the activity patterns according to its attributes.

CHALLENGES

- Describe the activity system of an individual to define similarity with other activity systems
- Select the most relevant attributes of an individual to predict the type of activity pattern that he will adopt
- Integrate the results of this project into the process currently used at the MTQ





MARC-ANTOINE GAUTHIER

POSITION

M.A.Sc.

BACKGROUND

B.Eng. Civil Engineering

SUPERVISED BY

Catherine Morency

IMPACT OF COMFORT ON ROUTE CHOICE IN TRANSIT NETWORKS

PROJECT GOALS

- Understand the impact of comfort on the transit route choice
- Develop a method of diagnosis of comfort on a transit network
- Develop travel time multipliers to obtain the perceived time related to comfort

PROJECT DESCRIPTION

The project focuses on the impact of comfort on the routes choice in public transport networks. To do this, a preference survey has been developed to determine people's comfort preferences. Subsequently, a choice model was developed to calculate travel time multipliers to deduce the perceived time (related to comfort components). Ultimately, this project will allow the comfort aspect to be taken into account in route choice algorithms.

CHALLENGES

- Comfort is a subjective subject and its perception varies across individuals
- Have a clean questionnaire that will be interesting to answer
- Have access to reliable data to make a relevant diagnosis of comfort on a public transit network





**MOHAMED
SAUDI HASSANI**

POSITION

M.A.Sc.

BACKGROUND

B.Eng. Civil Engineering

SUPERVISED BY

Catherine Morency

ANALYSING THE INTERACTIONS BETWEEN URBAN SPRAWL AND TRAVEL BEHAVIOUR

PROJECT GOALS

- To inventory the indicators used to quantify urban sprawl and to assess their relevance
- Propose a methodology to assess the impacts of urban sprawl on individual (time, distance) and collective (externalities) transportation costs
- Propose a cross-analysis of the urban sprawl and transportation supply (road, transit) trends

PROJECT DESCRIPTION

The goal of this project is to analyse the interactions between urban sprawl and travel behaviours. It first aims to propose an inventory of indicators describing urban sprawl. It then proposes a diagnosis of urban sprawl in the Greater Montreal Area using the most relevant indicators. The project hence proposes a cross-analysis of the trends with respect to urban sprawl and transportation supply (road and transit). This will lead to the development of a methodology to estimate the impacts of urban sprawl on individual and collective travel costs.

CHALLENGES

- Being able to measure the relevance and scope of the multiple urban sprawl indicators
- Determine a methodology to clarify the correlation between urban sprawl and the development of infrastructure and transport networks
- Integrate the results into a viable model allowing short and long term projections





NASIM SHARBATDAR

POSITION

M.A.Sc.

BACKGROUND

B.Eng. Computer Engineering

SUPERVISED BY

Jinghui Cheng
Catherine Morency

TRAFFIC CONGESTION DATA UNCERTAINTY VISUALIZATION

PROJECT GOALS

- Understanding transportation decision-makers' needs, challenges, and practices in monitoring and analyzing traffic conditions on the road network
- Designing a new tool for monitoring and analyzing traffic conditions on the road network based on the users' needs
- Visualize data uncertainty on the road network

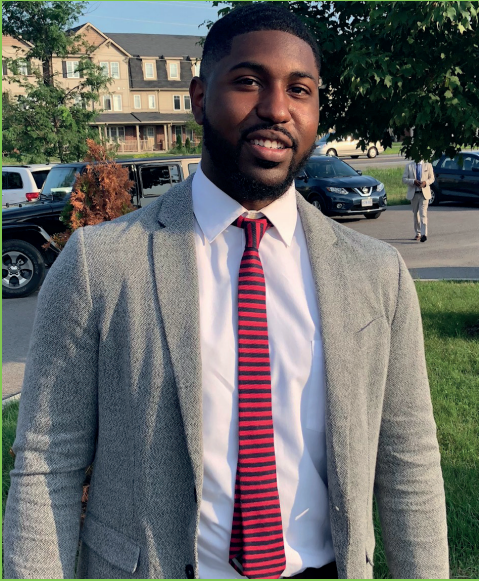
PROJECT DESCRIPTION

This project aims to understand the needs, challenges, and practices of transportation decision-makers at the Ministère des Transports du Québec (MTQ) and to then design a new tool for monitoring and analyzing traffic conditions on the road network. This project also focuses on different data visualization methods and specifically visualizing data uncertainty on the road network.

CHALLENGES

- Consider missing data on the road network when designing data visualizations
- Take into account users' needs that wouldn't cause the tool to be inefficient or too slow
- Identify the different levels of data uncertainty





**YVES DARLY
MATHIEU**

POSITION

M.A.Sc.

BACKGROUND

B.A.Sc. Civil Engineering

SUPERVISED BY

Catherine Morency

TAXI TRIPS: CHARACTERIZATION AND COMPETITIVENESS STUDY

PROJECT GOALS

- Identification of the available alternatives (other transportation modes) for each taxi trip, accounting for origin and destination points
- Development of competitiveness indexes for taxi trips for various trips, versus various transportation modes
- Propose an explanatory model of the competitiveness of taxi trips (using competitiveness ratios)

PROJECT DESCRIPTION

This project aims to enrich knowledge, with respect to taxi trip demand. The research relies on various data sources, namely those from the BTM Taxi Registry. Following an availability analysis of alternatives (various transportation modes), at origin and destination points of taxi trips, and the development of competitiveness indexes, a classification of taxi trips is proposed. Finally, a regression analysis, based on competitiveness ratios, will allow to identify variables having an impact on the decision to use taxis for various trips.

CHALLENGES

- Estimation of transportation costs correctly representing the various modes
- Propose rules to assess the feasibility of every mode for all trips
- Inclusion of relevant explanatory variables for modeling purposes, which may explain competitiveness ratios





**AXEL
GRANTE**

POSITION

Research internship

BACKGROUND

B.Eng. Civil Engineering

SUPERVISED BY

Catherine Morency

STUDY ON THE CONCEPT OF WALKABILITY AND CYCLABILITY

PROJECT GOALS

- Develop / adapt indicators describing the quality of pedestrian and cycling routes
- Propose a synthesis of the impedance (perceived time) related to factors having an impact on the walkability and the cyclability of active trips
- Assess the variability of routes obtained using various impedances for infrastructures such as sidewalk, pedestrian crossing, cycling path, etc.)

PROJECT DESCRIPTION

The project focuses on the concepts of walkability and cyclability. It first proposes a synthesis of factors having an impact on the level of walkability and cyclability. It then aims to understand the possible impacts of various types of infrastructures and amenities on perceived travel times. It aims to calibrate generalised cost functions used in route choice algorithms to identify the best alternative. An analysis of the sensitivity of routes obtained using various impedances for different segments of the route will also be carried out.

CHALLENGES

- Identify the factors currently considered in available walkability and cyclability indicators
- Identify plausible values of impedances for various types of infrastructures and amenities
- Account for the heterogeneity of individual preferences





**FRÉDÉRIQUE
ROY**

POSITION

Research internship

BACKGROUND

B.Eng. Software Engineering

SUPERVISED BY

Catherine Morency

MODEL OF ENERGY CONSUMPTION AND GHG EMISSIONS OF MOTORIZED VEHICLES

PROJECT GOALS

- Develop GPS data processing procedures for different types of vehicles
- Construct driving cycles specific to the city of Montreal
- Estimate travel energy consumption and associated emissions

PROJECT DESCRIPTION

The project involves developing a model of energy consumption and GHG emissions of motorized vehicles. Different sets of GPS data will be analyzed and a GPS data processing procedure will be developed to generate driving cycles. These driving cycles are key elements to assess the energy consumption associated with each travel and they will allow to estimate the GHG savings generated by various strategies such as bus lanes, preferential measures at intersections or reduced speed.

CHALLENGES

- Overcome limitations due to the low accuracy of GPS data
- Consider the elevation of the road when estimating energy consumption
- Take into account exogenous factors such as traffic congestion, weather conditions and roadway properties





GRÉGOIRE CATIMEL- MARCHAND

POSITION

Research internship

BACKGROUND

B.Eng. Software Engineering

SUPERVISED BY

Catherine Morency

ENCAPSULATING NETWORK ASSESSMENT MEASURES IN TRANSITION

PROJECT GOALS

- Support equity analysis by accounting for user profiles and factors related to vulnerability
- Evaluate user profiles to put an emphasis on underprivileged areas
- Integration of the algorithm within the TransiTion platform

PROJECT DESCRIPTION

Correctly assessing the quality of a transit network requires many metrics allowing to evaluate and compare various scenarios (configuration and level of service). This project aims to develop a procedure that will support the autonomous estimation of equity of accessibility to transit indicators (as proposed by Michaud 2019). The proposed method will be integrated to the TransiTion platform, currently under development by the Mobilité Chair' research team.

CHALLENGES

- Define a flexible algorithm allowing to encapsulate the estimation of accessibility to transit measures
- Ensuring intuitive, flexible and reproducible estimations
- Deploying the metric within the TransiTion platform





**LOUIS
ARMAND**

POSITION

Research internship

BACKGROUND

B.Eng. Civil Engineering

SUPERVISED BY

Catherine Morency

ANALYSING TRAFFIC QUEUES ON THE ROAD NETWORK

PROJECT GOALS

- Contribute to the development of indicators to characterise queues traffic
- Develop a methodology to identify and describe deceleration events using GPS data
- Propose visualisation strategies to include in the traffic monitoring tool

PROJECT DESCRIPTION

The project aims to contribute to the description of traffic queues on the road network. A literature review will help identify indicators to describe traffic queues as well as methods to estimate them. A method to systematically identify deceleration events using GPS data will then be developed. A sensitivity analysis (with regard to weather conditions, incidents, interchanges) will also be conducted. Strategies to visualise the spatial-temporal evolution of traffic queues will then be proposed. The project will contribute to improve the congestion analysis tool developed for the MTQ.

CHALLENGES

- Identify strategies to identify and describe traffic queues and decelerations
- Assess the relevance of congestion measurement strategies
- Propose visualisation objects which are both relevant and easy to understand





**MÉRÉDITH
LACOMBE**

POSITION

Research internship

BACKGROUND

B.Eng. Civil Engineering
Certificate in Ecology

SUPERVISED BY

Catherine Morency

SCENARIOS OF IMPROVED ACCESSIBILITY TO LOCAL SERVICES

PROJECT GOALS

- Develop scenarios improving the accessibility to opportunities for leisure and shopping activities in Montreal
- Estimate the impacts of such scenarios on GHG emissions and the potential of active modes
- Evaluate the equity of accessibility resulting from the scenarios for various population segments

PROJECT DESCRIPTION

This project aims to evaluate the impacts related to scenarios improving accessibility to leisure and shopping opportunities. Scenarios improving availability of activity locations will be defined in order to estimate their potential impact on travel distances and mode choice, resulting in potential reduction in GHG emissions and increased potential for active modes. Then, accessibility to opportunities, for various population segments, will be compared in order to evaluate the equity level of the scenarios.

CHALLENGES

- Define scenarios improving accessibility to locations for leisure and shopping activities based on objective measures
- Develop a reproducible method for measuring the impacts associated with scenarios for various services and population segments
- Define the services composing the basket of goods analyzed, and the population segments to compare in an equity assessment

