Considering uncertainty from climate change impacts in modelling transportation infrastructure planning decisions

PROJECT DESCRIPTION

Northern Canada holds vast natural resources, and developing these resources is projected to be a major driver of economic growth in the next several decades. At the same time, the north's communities and highly fragile ecosystems are experiencing disproportionate impacts of a rapidly changing climate. These factors introduce unique and significant uncertainties into decision-making on enormously costly transportation investments. Without systematic consideration of these uncertainties, we will miss the opportunity to make better decisions: ones that balance serving communities and supporting natural resource development within a highly sensitive environment. Current analysis methods supporting transportation investment planning, available to northern governments and resource companies, fall short in adequately addressing the northern context's complex challenges and unique environment. Our project will deliver a data-driven decision-support modelling framework that explicitly considers uncertainty in supporting optimal, yet flexible transportation investment decisions in Northern Canada and the Arctic. Specifically, we will develop real options models for the Inuvik-Tuktoyaktuk Highway and the multimodal (marine and road) Mackenzie River transportation corridor, to help stakeholders determine optimal (i.e. most adaptive and flexible) transportation infrastructure options (routes, development stages) under uncertain and changing conditions (e.g., temperatures, thaw depth, transportation demands). We envision our modelling framework as a common platform for government, industry and communities to collaborate in the early stages of strategic transportation planning.

The expected outcomes of this project are: 1) identifying the key quantifiable parameters driving planning decisions on northern transportation infrastructure; 2) incorporating these parameters to build and demonstrate a real options-based methodology for transportation infrastructure decision analysis; and 3) providing an applied and structured platform for collaboration between northern governments (including indigenous groups) and the private sector.

The student will be required to assist graduate students on a project team. They will be asked to provide all types of research support, from literature review, data cleaning and analysis, network mathematical model development, probabilistic simulation, and coding (typically in Matlab, GIS, and CPLEX), and running (and assessing and presenting) model results using a

variety of software and platforms. Much coding work will be required to implement mathematical models and explore numerical results. They will also be expected to provide support in producing documents such as project reports, presentations, and journal and conference publications. It is a must that the student is able to work well in a team research environment, under the direct guidance of PhD and MSc students, and myself (supervisor). The student will attend research group meetings and other meetings pertaining to the project itself.

FACULTY-DEPARTMENT

Engineering - Civil & Environmental

OPEN TO STUDENTS FROM THE FOLLOWING INSTITUTIONS

Chinese universities participating in the *Double First-Class Initiative*.

DESIRED FIELD OF STUDENT STUDY

Quantitative: engineering (all), applied mathematics, geography

INTERNSHIP LOCATION

Edmonton Campus

NUMBER OF INTERNSHIP POSITIONS

1

INTERNSHIP DATES

Start: June/July, 2019

End: September, 2019

ARE THE DATES FLEXIBLE?

Yes, I am flexible regarding the internship dates. Selected students can contact me to request a date change.