

T5-MSc4

Title: Sustainable culvert design over degrading permafrost, Hudson Bay railway

Anticipated start: September 2021 (flexible)

Supervisory team: Dr. Shawn Kenny and Dr. Ryley Beddoe

The performance and integrity of northern linear infrastructure, such as railway lines and road networks, may be affected by ground deformation geohazards (e.g. subsidence, slope instability, permafrost degradation), which may be influenced by hydrology and climate change effects.

Recent flooding events caused an extensive disruption to service on the Hudson Bay rail line, with damage to bridges and culverts, and failure of the rail bed due to washout. A significant effort was undertaken to restore railway operations that included the installation of several culverts. The significance of climate change effects, such as future flood events and permafrost degradation, on the future performance of the railway culvert infrastructure requires further assessment. From this perspective, the research study will assess the resilience of current design standards and practices for railway culverts located in permafrost environments. Supported by the research effort of other team members in the PermafrostNet network, site characterization (e.g. topographic, meteorological, hydrological, geotechnical, geophysical, permafrost attributes) of several culvert locations, for both original and recent installations, will be established. Centrifuge physical modelling and numerical simulation techniques may be used to assess these failure events, based on available knowledge, and estimate future performance, based on climate scenarios developed within the PermafrostNet research activities

We are seeking a highly motivated and engaged MSc candidate, to be enrolled in a civil engineering graduate studies program, with academic interests in the fields of geotechnical and permafrost sciences, site or field investigations, physical modelling and numerical simulation. The MSc candidate will be an integral team member of a multi-disciplinary supervisory committee and collaborate with other team members within the PermafrostNet network. All applications will be reviewed by the selection committee with respect to academic qualifications and integration within the network through the PermafrostNet lens on equity, diversity and inclusion. For more information on this project, please contact shawn.kenny@carleton.ca.