Thawing Permafrost and Highways Integrity

Assessing the vulnerability of the north Alaska Highway to climate change

CONTEXT
This project has examined the potential impacts of climate change on permafrost underlying the northwestern 200 km of the Alaska Highway in Canada. This stretch falls within the traditional territories of the White River First Nation and Kluane First Nation, and passes through the communities of Destruction Bay, Burwash Landing and Beaver Creek. The highway is a crucial part of Yukon’s transportation infrastructure, linking these communities to the south, as well as to Alaska, and supporting local and national trade and livelihoods. Permafrost thaw along this section of highway significantly increases maintenance costs.

OBJECTIVE
Recognising the challenges posed by permafrost, the Government of Yukon’s Department of Highways and Public Works (HPW) partnered with the Northern Climate ExChange (NCE), part of the Yukon Research Centre at Yukon College to characterize and map the thaw sensitivity of permafrost underneath the Alaska Highway, consider the potential effects of climate change on the permafrost, and developed design options for reconstruction of one to two-kilometre long sections of the highway to pilot techniques that stabilize and cool permafrost.

APPROACH
This project used geophysical data, geotechnical reports, HPW maintenance records, air photos and field investigations to identify and evaluate thaw-sensitive areas under the highway. This information was combined with future climate scenarios to inform decision-making.

Knowledge gained from the Beaver Creek permafrost test section and a review of leading international practices informed the development of preliminary designs to remediate permafrost thaw.

RESULTS
This project has helped HPW advance its understanding of the impacts of climate change on Yukon’s highway infrastructure. HPW is using this information to plan maintenance of the north Alaska Highway and to help prioritize sections for rebuilding.

Overall, for the 200-km section between Burwash Landing and the Yukon/Alaska border, 42.7 per cent is highly vulnerable to permafrost thaw, 38.5 per cent has moderate vulnerability, and 18.8 per cent has low vulnerability.

At each of four sites, three preliminary design options have been developed to mitigate thaw and stabilize permafrost. These are being considered for implementation by HPW.

Significance
Exploring how permafrost thaw impacts the North Alaska Highway corridor will result in increased transportation security for Yukon.

Partners
- Highways and Public Works, Government of Yukon
- Northern Climate ExChange, Yukon Research Centre
- Centre for Northern Studies, Université Laval
- Climate Change Secretariat, Government of Yukon
- Indigenous and Northern Affairs Canada

MORE INFO
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