

The Canadian
Geotechnical Society



La Société Canadienne
de Géotechnique

CGS Luncheon Presentation

Challenges and Innovations in Arctic Highways

Presented by:

Dr. Marolo Alfaro, P.Eng.

Professor, Department of Civil Engineering, University of Manitoba

Presentation Abstract:

The northern environment and increasing effects of climate warming pose serious challenges in the construction and serviceability of highways in northern Canada. Such is the case of the newly-opened Inuvik-Tuktoyaktuk Highway (ITH) in the Northwest Territories. The ITH is an all-weather transportation link that now extends road network to include Pacific, Atlantic, and Arctic coasts.

Typical 'cut and fill' techniques for highway construction were not suitable for the ITH. Avoiding the use of cuts protects permafrost terrain along the highway alignment. To comply with vertical road geometry requirements, embankment fill heights can exceed 5m. High fills cause problems of side-slope sloughing and embankment cracking. In addition, highways are typically constructed in winter for logistical and environmental issues. There is uncertainty about the behaviour of highway embankments that are initially compacted with fill that is frozen, and then experiences natural thawing during subsequent summers. Highways in arctic regions traverse polygonal-patterned ground containing ice-wedges. During summer, heat is transmitted to the permafrost particularly through the ice wedges, making them preferential paths for water flow beneath the embankments and causing further thawing of ice wedges. Once the ice wedges thaw, they create 'voids' in the ground, resulting in depressions at the road surface or collapse of the embankment. They result in significant maintenance needs and safety hazards.

This presentation discusses the research findings of Dr. Alfaro and his team on the use of wicking geotextiles to improve the structural stability of high embankments and the use of geofoam-geogrid composite material for stabilizing embankments on polygonal ground. It reports the analysis and synthesis of the three-year performance of the embankment test sections along the ITH.

About the Presenter:

Marolo Alfaro is a professor in the Department of Civil Engineering at the University of Manitoba. He obtained his PhD from Saga University, Japan, and received postdoctoral fellowships from the Royal Military College of Canada and the University of Calgary.

Dr. Alfaro's research interests include geosynthetics for civil engineering applications, ground improvement techniques, hydroelectric earth dams, road embankments on soft foundations, stabilization of natural and engineered slopes, northern infrastructure impacted by climate change, and cold regions engineering. He has published widely in technical journals and in conference proceedings. He has co-authored a book and published two book chapters.

Dr. Alfaro served as Vice-President for Canada of the North American Geosynthetics Society, Executive Board Member of the Canadian Geotechnical Society, Canadian representative to the Committee on Ground Improvement of the International Society of Soil Mechanics and Geotechnical Engineering, and Associate Head of the Department of Civil Engineering at the University of Manitoba.

Date: Thursday, March 1, 2018

Time: Lunch at 12:00 PM, Presentation at 12:20 PM

Location: Holiday Inn South, 1330 Pembina Highway

RSVP: 12:00 PM, Monday, February 26, 2018

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