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Bureau de normalisation du Québec

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Geotechnical Site Investigations for Foundations of Building or Structure in Permafrost Zones



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Geotechnical Site Investigations for Foundations of Building or Structure in Permafrost Zones

Études géotechniques pour les fondations de bâtiments et d'ouvrages d'art dans les zones de pergélisol



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INTRODUCTION

Geotechnical site investigations are essential to select the appropriate design, construction and maintenance of buildings or structures. In permafrost zones, these investigations have an added level of complexity due to the following factors:

- a) potential presence of ice within the soil or bedrock whose properties are dependent on several parameters, including, but not limited to temperature and salinity;
- b) influence of climate change, which is modifying the ground thermal regime thereby changing the properties of the permafrost;
- c) presence of saline soils.

This standard was developed to establish a consistent methodology for geotechnical site investigations, including data collection as well as the evaluation and reporting of site conditions while accounting for seasonal, and interannual climate conditions and projected climate conditions over the service life of the foundations of buildings or structures. In the long term, as improper site evaluation can lead to permanent damage, this standard will help lessen persistent maintenance issues.

The level of detail of a geotechnical site investigation to obtain adequate site information to select and design appropriate foundations for a building or a structure in permafrost zones depends on many factors. This also applies for rehabilitation plans of existing foundations of buildings or structures located in permafrost zones.

This standard was developed taking into account the specific constraints of the North and the diverse nature of projects.

This standard also ensures that each project is carried out within a risk management framework for assessing impacts of climate change according to the document CSA PLUS 4011. Therefore, each project is assigned a risk level based on the sensitivity of the site to climate change and the consequence of potential failure of the foundations of buildings or structures. For moderate/highrisk projects, the level of detail of geotechnical site investigations will be substantially higher than for low/negligible-risk projects. This standard allows for some flexibility throughout the geotechnical site investigations, as the findings may influence the extent of work to be undertaken at the next stage. Additional, hazards and risks related to considerations other than climate change may be included in the geotechnical site investigation program but are not part of this standard.

More specifically, this standard defines a consistent methodology for performing a geotechnical site investigation, but since the level of detail required to obtain adequate site information depends on many factors, it relies on the geotechnical consultant's judgement to make the appropriate recommendations to the client. It also requires that the geotechnical consultant and the client take the appropriate steps to have a common understanding of all work to be



undertaken throughout the project. This two-way communication will ensure that the client is able to take risk-informed decisions in consultation with the geotechnical consultant.

This standard is the fifth in a suite of innovative National Standards of Canada (NSCs), aiming to foster the long-term sustainability and resiliency of Canada's Northern infrastructure. The four other NSCs, that were developed as part of the Northern Infrastructure Standardization Initiative (NISI), are:

- a) CSA S500 Thermosyphon Foundations for Buildings in Permafrost Regions;
- b) CSA S501 Moderating the Effects of Permafrost Degradation on Existing Building Foundations;
- c) CSA S502 Managing Changing Snow Load Risks for Buildings in Canada's North;
- d) CSA S503 Community Drainage System Planning, Design, and Maintenance in Northern Communities.

All of these NSCs are complementary and contribute towards achieving the same objective of helping Canada's North build a resilient infrastructure despite the uncertainties of a changing climate.

This is also true of the document CSA PLUS 4011 *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*. It is a key document that was first published in 2010 and reedited in 2019 for a better understanding of how climate change may affect Canada's Northern infrastructure.

1 <u>PURPOSE</u>

This standard combines guidance and requirements in order for activities (planning, conducting and reporting) included in geotechnical site investigations for foundations of buildings or structures in permafrost zones to be carried out in a proper and consistent way.

The purpose of this standard is to define a rigorous methodology for performing geotechnical site investigations aimed at obtaining adequate site information to select or rehabilitate foundations for a building or a structure with due consideration, in a climatic risk management framework, of the conditions prevailing on site, including:

- a) the distinctive characteristics of permafrost;
- b) the seasonal and interannual climate conditions as well as the projected climate conditions that affect the thermal regime of soils over the service life of the foundations of buildings or structures.