There are unique challenges associated with designing, installing and monitoring foundations in permafrost regions. Fugro provides integrated solutions to measure, model and interpret the sub-surface conditions and potential geohazards that could influence the critical integrity of infrastructure.

**CONTEXT**
Ground temperature can significantly impact the ability of structural piles to retain their Pile Bearing Capacity (PBC). In areas of permafrost, where sub-surface temperatures can fluctuate, this may lead to non-uniform load transmissions, pile deformation and/or displaced foundations.

Fugro’s geotechnical expertise and resources deliver accurate, reliable insight on ground temperatures, mechanical properties and conditions, helping to improve foundation design and maintain the long-term integrity of structures in permafrost regions.

**SERVICES**
Fugro provides a range of services designed to measure, characterise and monitor the sub-surface conditions in permafrost regions, including:

- Desktop studies and data compilation
- Immediate temperature measurement
- Soil strength profile measurement
- Permafrost geohazard mapping
- Data interpretation and reporting
- Pile bearing capacity evaluation
- Temperature monitoring installation
- Themosyphon operation check-ups
- In situ permafrost testing (IPT)
- Pile foundation maintenance (geomonitoring) during the life of the project
In permafrost regions, our geophysical solutions include:

- Electrical Resistivity Tomography (ERT)
- Ground Penetrating Radar (GPR)
- Seismic refraction & multi-channel analysis of surface waves (MASW)

**LOAD CELLS**
Fugro’s O-Cells are an accurate, practical and cost-effective way of checking pile bearing capacity both during construction and later, during the lifetime of a structure within a permafrost region.

**CPT**
Fugro’s Cone Penetration Testing (CPT) capability provides a range of measurement and monitoring services that quickly and reliably characterise sub-surface conditions prior to the development and installation of foundations.

**GEOTHERMAL ANALYSIS**
Thermal Modelling is an important forecasting tool enabling soil temperature distribution to be evaluated in time and space. Potential risks from associated permafrost geohazards can then be estimated and managed.

**GEOMONITORING**
We provide a range of geomonitoring techniques, including:

- Total station
- Laser scanning
- Strain gauge/load cell
- Temperature monitoring
- Cone penetration testing

**EXPERIENCE**
Fugro’s proven experience in conducting geotechnical and geophysical site surveys and engineering investigations applies equally to extreme geographical and environmentally sensitive locations. We have collected, interpreted and modelled our findings, and provided advice to facilitate decision-making, engineering design and risk management on projects around the world.

In permafrost locations, our success at identifying and characterising potential geohazards has been rewarded with many extended contracts and repeat business, and we continue to invest in new technology and techniques to further our capability.