



## Alaska: Cold-Weather Construction Research

### *Monitoring permafrost and foundations*



*Research and Test Facility (RTF) located on the campus of the University of Alaska, Fairbanks*

Campbell Scientific and Geo-Watersheds Scientific are research partners with the Cold Climate Housing Research Center (CCHRC). The CCHRC is a nonprofit research and testing organization that promotes healthy, durable, energy-efficient, affordable homes, along with building products and designs for cold climates.

Applied science and environmental data generated through cooperation among these organizations is used to help improve living conditions for Alaskans throughout the state. These same advances have potential to improve conditions in other parts of the world as well. Benefits may include better construction techniques, improved use of water resources, and integration of energy resources.

The CCHRC recently completed its new Research and Test Facility (RTF) on the campus of the University of Alaska, Fairbanks. The facility is built on an area with underlying permafrost at various depths. Permafrost is perennially frozen ground, which presents many foundation and structural design challenges. This is a major area of study at the RTF.

The RTF is instrumented with a variety of monitoring sensors under the building, in the foundations, in flooring systems, and throughout the wall and roof areas. There is also a weather and geotechnical station nearby to help improve the understanding of permafrost, foundations, and thermal control of the subsurface building envelope.

The foundation system was built to allow future releveling in case of degradation of underlying permafrost. Jacking pads under the foundations are used to adjust the concrete beams that support the building walls and lower-level floor system.

Various floor and foundation types were used in the construction of the building so that different temperature-profile sections could be monitored for thermal analysis of the

### Case Study Summary

#### Application

Permafrost and building foundation monitoring

#### Location

Fairbanks, Alaska

#### Products Used

CR10X, RF310, CR1000

#### Contributors

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#### Participating Organizations

Cold Climate Housing Research Center

#### Measured Parameters

Soil profile and foundation temperature, temperatures in concrete foundation components and basement floor test sections (GWS-YSI thermistors), unfrozen volumetric soil-water content (CS616 probes), room temperature (Siemens Building Technologies, Inc.)

#### Participating Consultants/Integrators

Geo-Watersheds Scientific

building heat flow to underlying permafrost. The numerous thermistors and CS616 soil moisture probes are handled by Campbell AM16/32A multiplexers that expand the capacity of the CR10X and CR1000 dataloggers' input channels.

In addition to studying foundation systems, the CCHRC expends major effort researching building envelopes, energy systems, and green roofs at the RTF. The data collected for this project will be used for operations, education, and research. For more information on this project, visit [www.cchrc.org](http://www.cchrc.org).

## Basement Station

(CR1000, 3 multiplexers)

- › Basement foundation sensors
- › Center jacking pad/grade beam floor thermal test section
- › Center floating concrete floor thermal test section
- › Insulated concrete foundation (ICF)

## Wall Thermal Test Section

- › ICF outer soils thermal and soil moisture test section
- › Eastern foundation and permafrost thermal profile test section

## South Bay Station

(CR1000, 3 multiplexers)

- › South bay foundation sensors
- › South bay flooring thermal test section
- › South bay southern wall thermal test section
- › Ceiling and green roof thermal test section
- › Mezzanine window sill thermal and moisture test section
- › Southwest permafrost thermal profile test section

## North Bay Station

(CR1000, 2 multiplexers)

- › North bay foundation sensors
- › North bay flooring thermal test section
- › Northwest foundation insulation thermal test section

## Utilidor Station

(CR1000, 1 multiplexer)

- › Utilidor foundation sensors
- › Center floating concrete floor/jacking pad thermal test section

- › Sewage treatment plant monitoring sensors

## Meteorological Station

(CR10X, 1 multiplexer)

- › Meteorological sensors
- › Permafrost thermal profile test section (2)



*Weather and geotechnical station near the Research and Test Facility (RTF)*



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