COLD CLIMATE HOUSING RESEARCH CENTER
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Promoting and advancing the development of healthy, durable and sustainable shelter for Alaskans and other circumpolar people.

Frost Protected Shallow Foundations Research Study

By Paul V. Perreault M.S.C.E., P.E.
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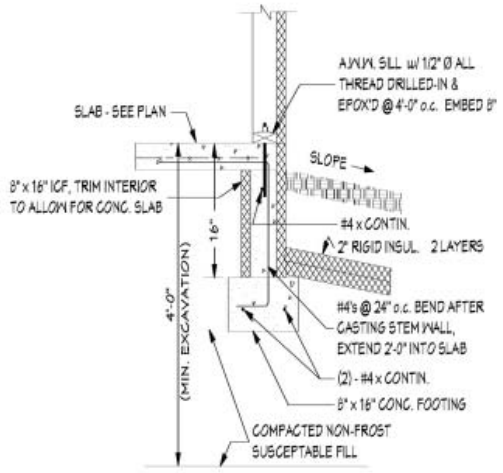
This study proposes to suggest how best to apply frost-protected shallow foundation techniques to Alaska's colder weather conditions.

A frost-protected shallow foundation (FPSF) is a building technique that places foam insulation outside of a shallow foundation to protect it from heaving due to seasonal freezing. The insulation helps contain some of the building's heat within the surrounding soil, which stops the soil below the footings from freezing.

Shallower foundations help reduce the amount of materials used and environmental impact on the area, which lowers building costs. The frost-protected shallow foundation technique has been used in Scandinavian countries for many years.



Cross-section drawing of a typical frost protected shallow foundation

Pictured is the construction of a frost protected shallow foundation

Current design standards have basic assumptions that do not apply to all of Alaska. The International Residential Code for FPSF has information for regions with air-freezing indexes up to 4000 degree Fahrenheit days. However, many areas in Alaska exceed this index, in particular the colder, interior climates.

This research expands the current design information and, when completed, will include a draft design guide based on correlations between the field-data and computer modeling. The guide will specifically address Alaska's colder, drier interior region.

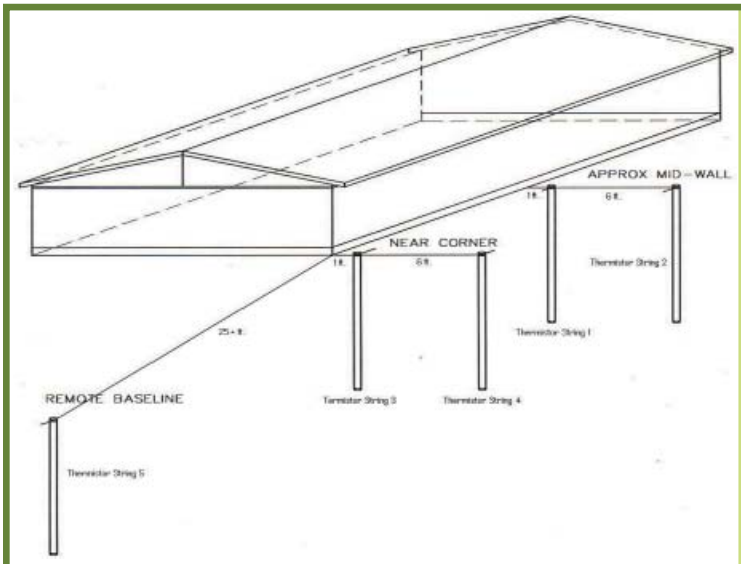
Related Topics:

Technical Report
- Frost Protected Shallow Foundation Final Report, RR 2008-03

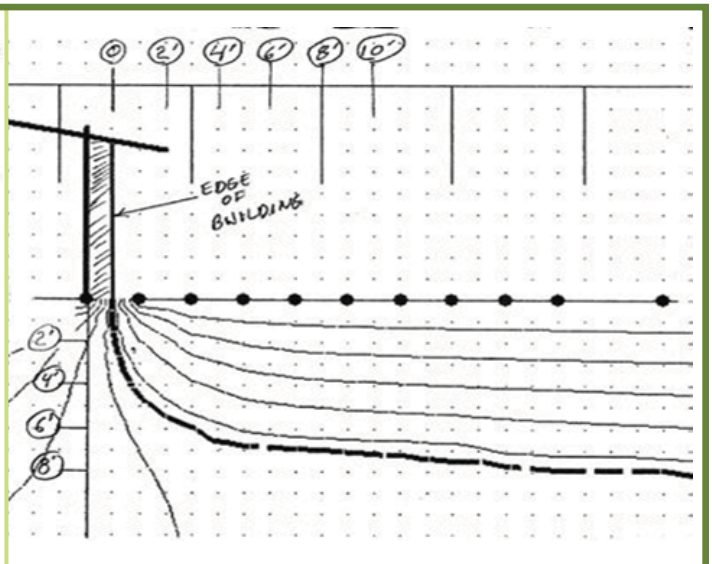
Snapshot
- Cold Weather Concrete, RS 2007-09

Project Approach

The "Frost Protected Shallow Foundation Study" (FPSF) will use funding from the Alaska Housing Finance Corporation to purchase equipment and drilling services to install and monitor five strings of thermistors at each of two houses. A thermistor is a ceramic device that measures temperature through electrical resistance. Each string extends 18 feet below the surface and has 18 thermistors attached at different depths. Two thermistor strings are located near a building center line, two are located near the building corner and one string is located away from the building as a base-line measurement. The data is collected at programmed, regular intervals & stored on site until retrieved. Data collected is compared to the results of computer modeling.



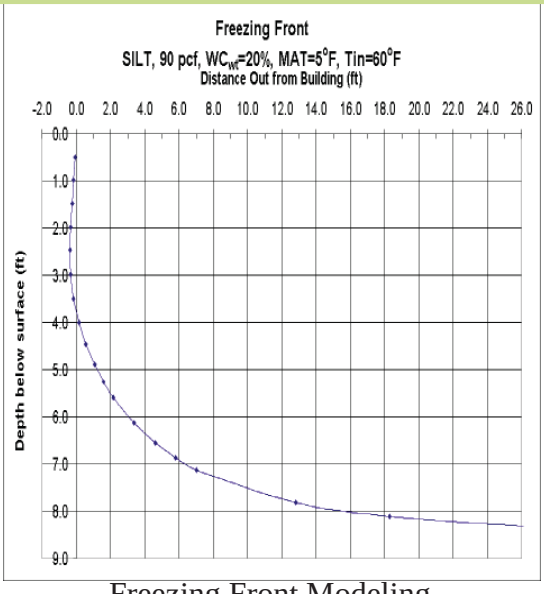
Thermistor String Location



Thermal Modeling with TEMP/W

Interim Results

A computer modeling program, 'Thermal Modeling with TEMP/W,' from Geo-Slope International of Alberta, Canada was used to compare modeled isotherm contour results with actual ones from the thermistor data. The building modeled is a simple building, without any insulation. The Freezing Front figure & the TEMP/W figure show a correlation between the model and the analytical data. Data from three different sites indicate that two of the three buildings may have freezing below the footings (see website for the current progress report). Other factors affecting frost heaving include interior building heat and the moisture and frost susceptibility of soils.



Freezing Front Modeling

Remaining work

continue installing data logging equipment to obtain data more frequently, continue with modeling by adding insulation to the model, and to write final technical reports for publication of the results.

About the researcher

Mr. Paul Perreault, is making this study his thesis project. He will collect isotherm data from the soil under actual houses, compare that data to the results of computer modeling, and write a draft specification for the FPSF for inclusion in residential building codes that would apply at air freezing indexes appropriate to Interior and Northern Alaska. The thesis work will take four years.