Infrastructure + Permafrost = Hassles
Anatomy of Terrestrial Permafrost

Surface features, e.g., polygonal ground, standing water, typical vegetation, extremely variable

Active layer - thaws and refreezes every year

Ice Wedges, may or may not be present

“Permanently” frozen soil - 2 yrs. or more

Graphic courtesy of Matthew Sturm
Permafrost in Alaska

Graphic derived from Kanevskiy et al., Quaternary Research 2011
What’s it look like?

Photos courtesy of Matthew Sturm
Building on thaw-unstable permafrost:
1) Keep it frozen, or
2) Thaw, then build
Engineering Considerations:

1) Disturbance of permafrost tends to cause thaw
2) “Over-designing” is very expensive
3) Infrastructure requires deep understanding at defined locations
4) Infrastructure has a relatively short design life:

- Bridges - 75 years
- Roads - 15 - 20 years
- Homes - 50 years
- Warehouses - 25 years
- Commercial Buildings - 50 years

Photo courtesy of Billy Connor
Arctic public infrastructure requires a broad interdisciplinary approach
Complex interactions/drivers indicate need for more geoscience

Photo courtesy of Alaska DOT&PF
Landscape Scale Obs. and Modelling

Work funded by NSF, DOE, NASA, ALCC, and others

Graphic derived from Liljedahl et al., Nature Geosci. 2016
Site-specific modelling and observation for geohazards

Work funded by USDOT, AKDOT&PF, NSF, USGS, others, in cooperation with Alaska DGGS

Photos courtesy of Margaret Darrow
Geophysics for Site-Scale Mapping of the Subsurface

Work funded by USDOT, Alaska DOT&PF, performed in cooperation with the USACE Cold Regions Research and Engineering Laboratory

Graphic courtesy of Richard Fortier
High-resolution thermal modelling for developing appropriate technologies

Photos courtesy of Billy Connor
Hydrology, atmospheric sciences, biogeosciences, cryosphere, etc. are all relevant for cold region infrastructure planning and design.
Thank you!

Find us online: http://ine.uaf.edu

525 Duckering Building
P.O. Box 755910
Fairbanks, AK 99775
(907) 474-5474

UAF is an AA/EO employer and educational institution