Construction in Arctic Climates

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Arctic Challenges

Arctic Communities are very remote:

• There are summer barges but most of the year the area is fly in only

• Shipping can be up to 50% of the cost of materials
Arctic Challenges

Permafrost
• Soils that have been below 0°C for at least 2 years
• Provides a solid foundation, unless it thaws
• Warming temperatures are speeding up thaw
• Surface changes exacerbate thaw

Photo by T. Douglas, CRRE
Arctic Challenges

Aging infrastructure

• The Alaska oil pipeline is 20 years beyond its service life

• Much of the infrastructure in Alaska was built around the same time as the pipeline
Arctic Challenges

Extreme Cold Climate

- The ASHRAE design temperature is -40°C and colder
- Utqiagvik, Alaska (Barrow) has 10,930°C (19,674 °F) heating degree days
Alaska: a Case Study
Remote Logistics

Fly in supplies
Lack of onsite heavy machinery
No temporary housing
Building on Permafrost

If it’s frozen, keep it frozen
Living with Thawing Permafrost

Infrastructure on permafrost needs constant maintenance
Aging Infrastructure

Alaska’s bridges are on average 35 years old
51% of homes in Alaska were built in the 1970s and 80s
Fairbanks, Alaska has one of the oldest and the newest operating coal fired power plants in the nation

http://akula.lksd.org/


Living in Extreme Cold

Space heating is the single greatest energy cost for buildings in Alaska

Alaska’s EUI is close to double the EUI for the rest of the US

Source: Alaska Housing Finance Corporation, 2014
Building Envelopes for Extreme Cold

Thick thermal envelope
Minimal air leakage
Pay attention to building science
Thank you for listening

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