

Freeze-Thaw Effects on Alaskan Highways



Cornell Geotechnical Seminar Series

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Overview (Please Ask Questions!)

**Effects of
Freeze-Thaw**

**Mitigation
Techniques**

**Further
Application**

Dalton Highway: Lifeline of Alaska

- Supports economy and infrastructure
- Floods occurred in Spring 2015 led to **weeks-long closure!**



Understanding Freeze-Thaw Dynamics



Permafrost

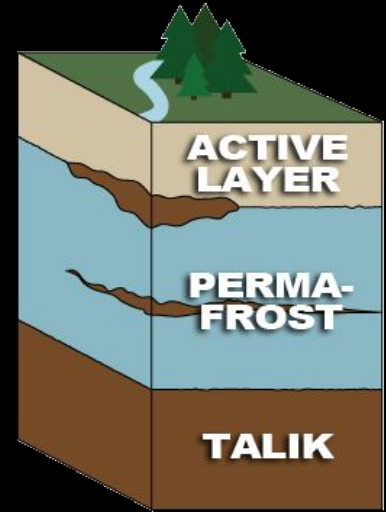


Aufeis



Permafrost

- **Permafrost:** a permanently frozen layer under Earth's surface
- Thawing leads to **huge infrastructure problems**



Why?

Aufeis (“Ice Lenses”)

- Groundwater keeps accumulating under ice layer
- **Pressure underneath increases**
- Diverts flow into new places

Why?



Impact of Extreme Flooding on Dalton Highway

- River flow diverted, area floods
- Prolonged closure
- Sinkage over time
- Greater pattern



Long-Term Permafrost Changes

- Flooding caused extreme sinking
- Vegetation growth helps combat heating issues



What causes thawing?

Highway Resilience Measures

1. Increase highway grade raise
2. Insulate Active Layer
3. Widen road surface
4. Protect utility lines



Other Highway Resilience Measures



5. Increase vegetation

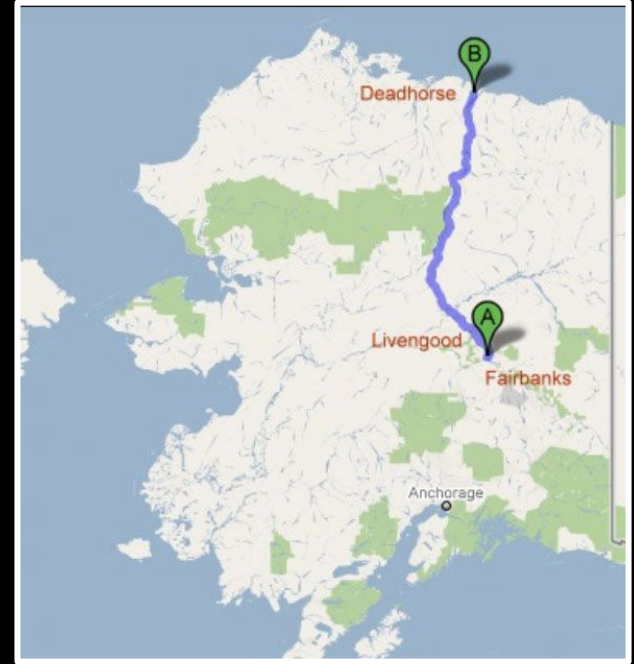
6. Paint roads white!!

Future Uncertainties

Increasing
climate-related
challenges

More
frequent
disruptions

Proactive measures and
ongoing maintenance needed



Thank you!

Any last questions?

References

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