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Challenges from Climate Change to Roads in Northern Canada

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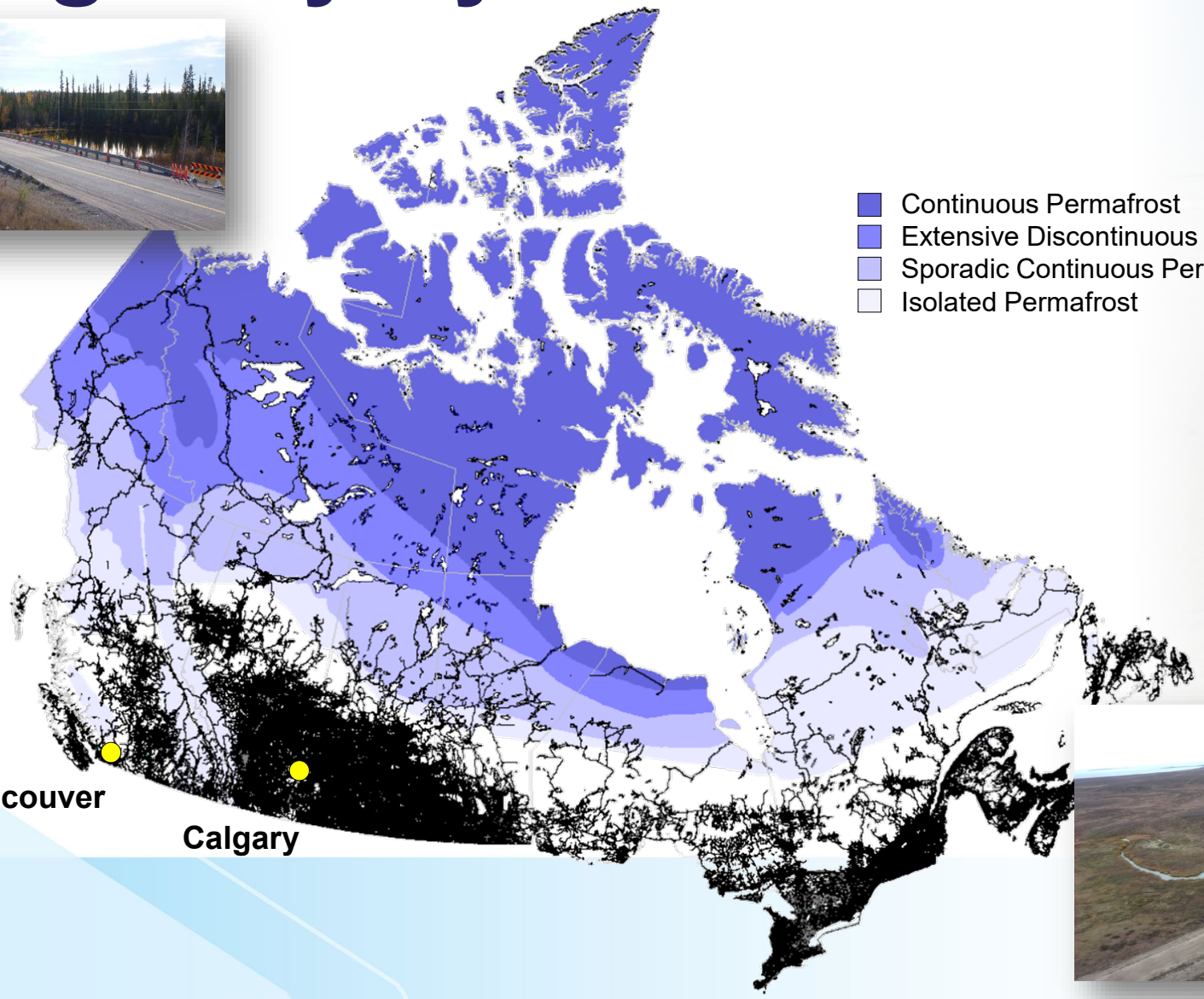
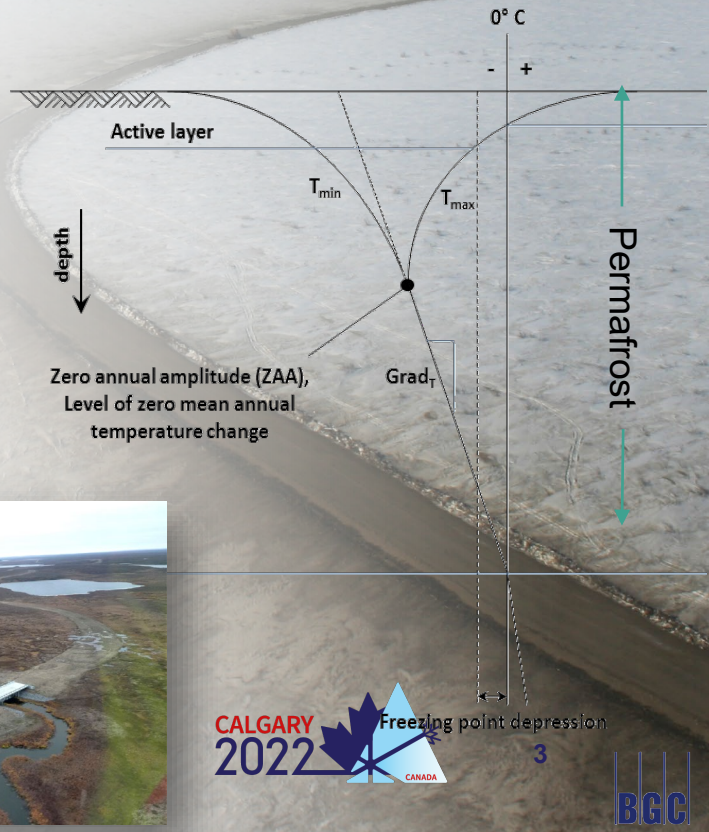
PIARC Calgary Canada

Synopsys – All Season Roads

- What is Permafrost?
- Canadas North and Associated Transportation Infrastructure
- Climate Change in the Arctic
- Challenges to Road Infrastructures
- Mitigation Options
- Conclusions

Highway System in Canada





Climate Change Challenges

- Design and construction of infrastructure in permafrost is challenging even w/o climate change.
- Every structure affects the thermal regime with a varying degree of uncertainty.
- Uncertainties related to climate change are very high because of higher order effects.
- Design is not based on average conditions.

External Hazards

Retrogressive thaw slump

Dempster Highway, NWT ~km 30

Icing / Aufeis - Drainage

Morse and Wolfe 2014

Flooding

Changes, Changes, Changes

- Active layer thickening
- Permafrost degradation – e.g., Sinkholes
- Aufeis formation
- New mass movements
- Flooding
- Coastal erosion

Donald Rumsfeld

New Hazards and new Risks

Higher Order Effects → Increased Uncertainty

Monitoring and Adaptation

Manage Risk & Manage Assets

Education of all stakeholders (Guidelines and Codes)

Static design for climate change is not feasible

Infrastructure design cannot address all uncertainties.

Permafrost protection should not always be the design objective.