

Seasonal and Ice Roads (From Guidelines to Miles of New Roads)



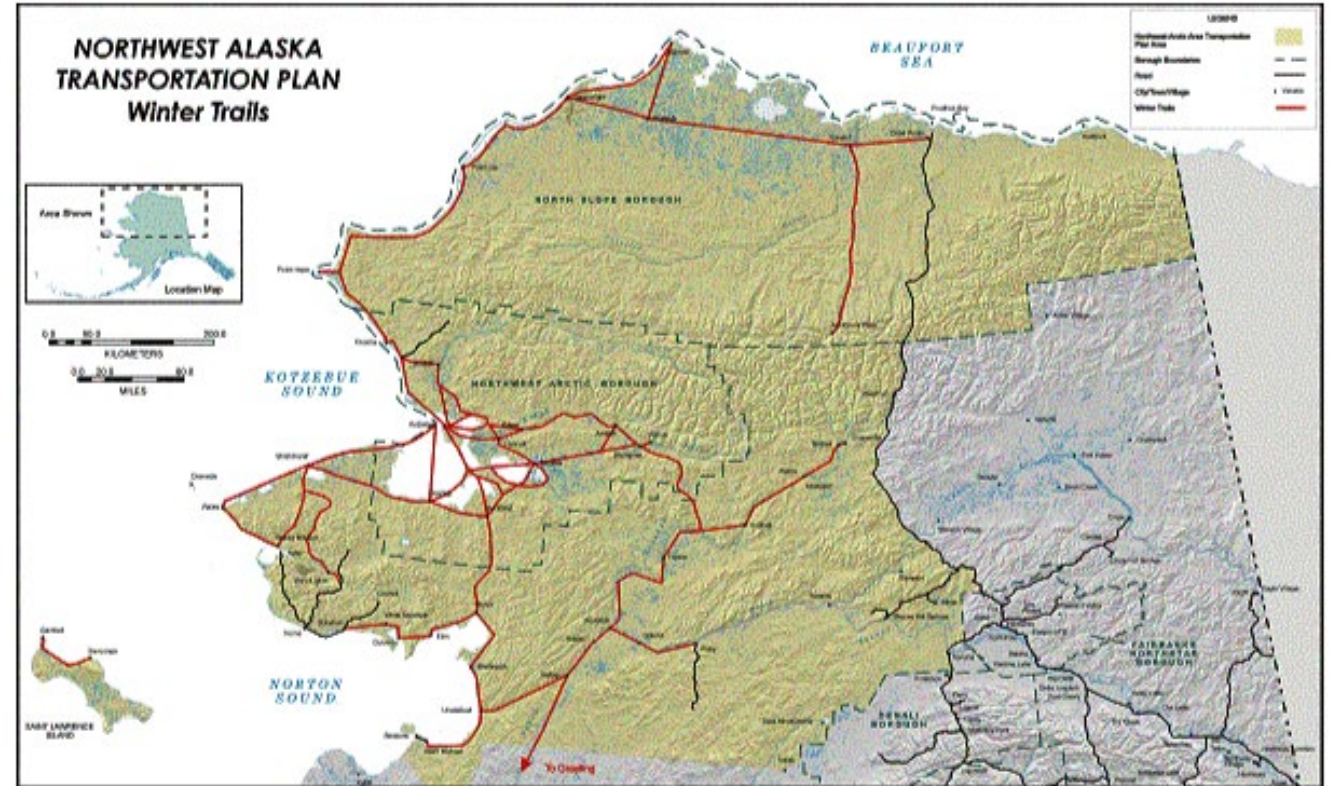
Changing Desires of the Tribes

- The current generation demands connectivity, both electronically and in person.
- The pandemic showed the frailties of the air taxis and their ability to provide reliable service.
- Cost of airfares and freight are rising rapidly.
- Desire to connect to jet service.

Hub	Village	Flight Time	Distance	One Way Cost	Cost/Mile
Bethel	Kalskag	45 min	71 miles	\$200	\$2.81
Nome	Unalakleet	50 min	147 miles	\$292	\$1.98
Barrow	Pt. Lay	70 min	300 miles	\$322	\$1.07
Fairbanks	Anchorage	45 min	261 miles	\$169	\$0.64
Fairbanks	Seattle	313 min	1533 miles	\$330	\$0.22

Winter Trails

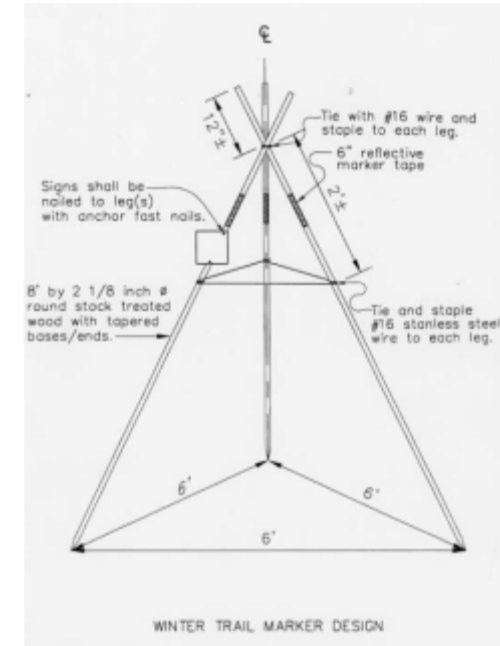
- Local Service Road and Trails program (1970's - mid 1980's)
 - Primarily funded trail marking
- Northwest Alaska Transportation Plan identified about 4700 miles of trail in Northwestern Alaska



Suggested trail markers

Trail markers will be installed at maximum intervals of 500 feet. The distance between specific markers will vary with terrain, wind, and soil conditions as determined by the local residents performing the installation. Installers place markers as close as 100 feet where/when terrain and white-out conditions warrant. Installers place markers at the edge of rivers, lakes, and the coast to alert travelers to ice danger.

While easily constructed and erected, these markers have not proven durable. They are damaged by animals, blown over by wind and scavenged for firewood.





In reality no enforced standards for trail markers

- Basically , use what you have.



The Northwest Alaska Transportation Plan winter trails funding and management recommendations are:

- Maintain funding through the Statewide Transportation Improvement Program (STIP) for the construction of winter trails to complete the winter trail system, particularly in the Seward Peninsula/Norton Sound and Northwest Arctic Borough subregions. Both areas have numerous trails connecting communities that are inadequately marked and maintained.
- Attempt to use local labor for projects to provide much-needed employment of area residents and reduce overall project costs.
- Establish maintenance agreements for trail markers with communities or tribal organizations.

Clearly there is agreement that trails are an important transportation mode and that they should be funded. So what's next.

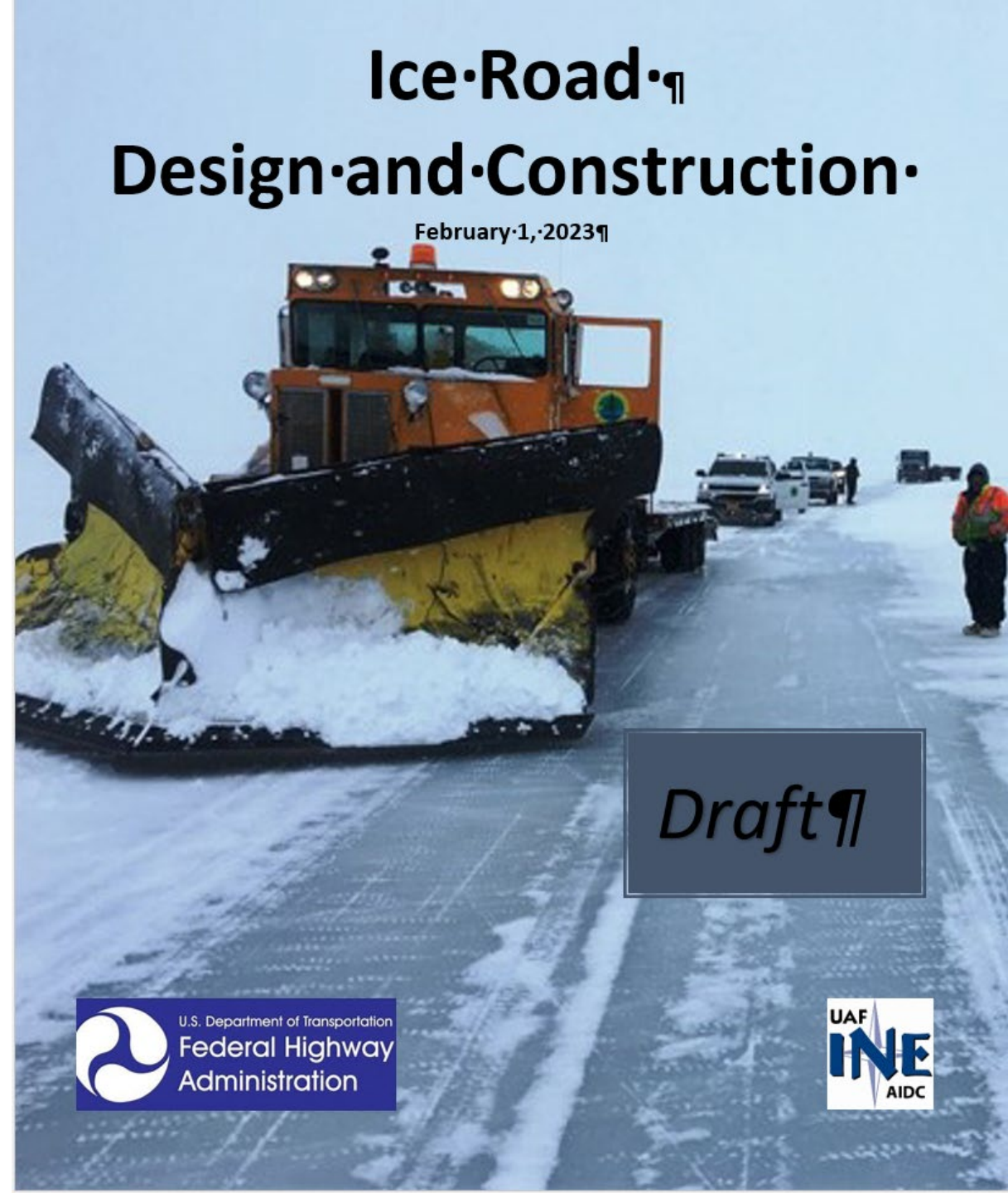


DOT&PF allocated \$2 million in FY 23 and \$4 million in FY 24 for ice roads and winter trails.



Ice Road Design and Construction Guidelines Funded by FHWA

The primary purpose of this manual is to provide for the safe and efficient design, construction, maintenance, and operation of an ice road over freshwater.



Ice Road Design and Construction

February 1, 2023

Draft



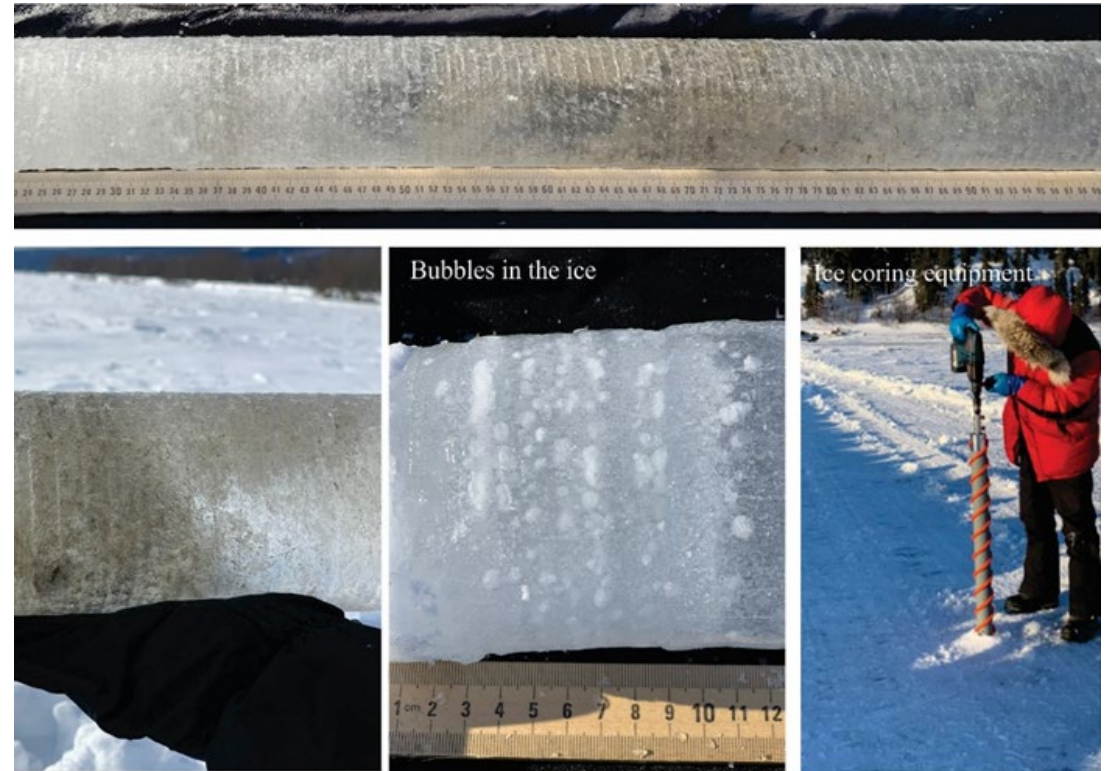
Why Develop Guidelines?

- Safety
 - Reduce crashes, Reduce the number of lost travelers, Enhance rescue efforts
 - Encourage appropriate user behavior
- Standards
 - Trail markers, Shelters, Speed limits, Geometrics, Signage
- Provide design, construction and maintenance guidance
- Establishes Grant Requirements and Expectations

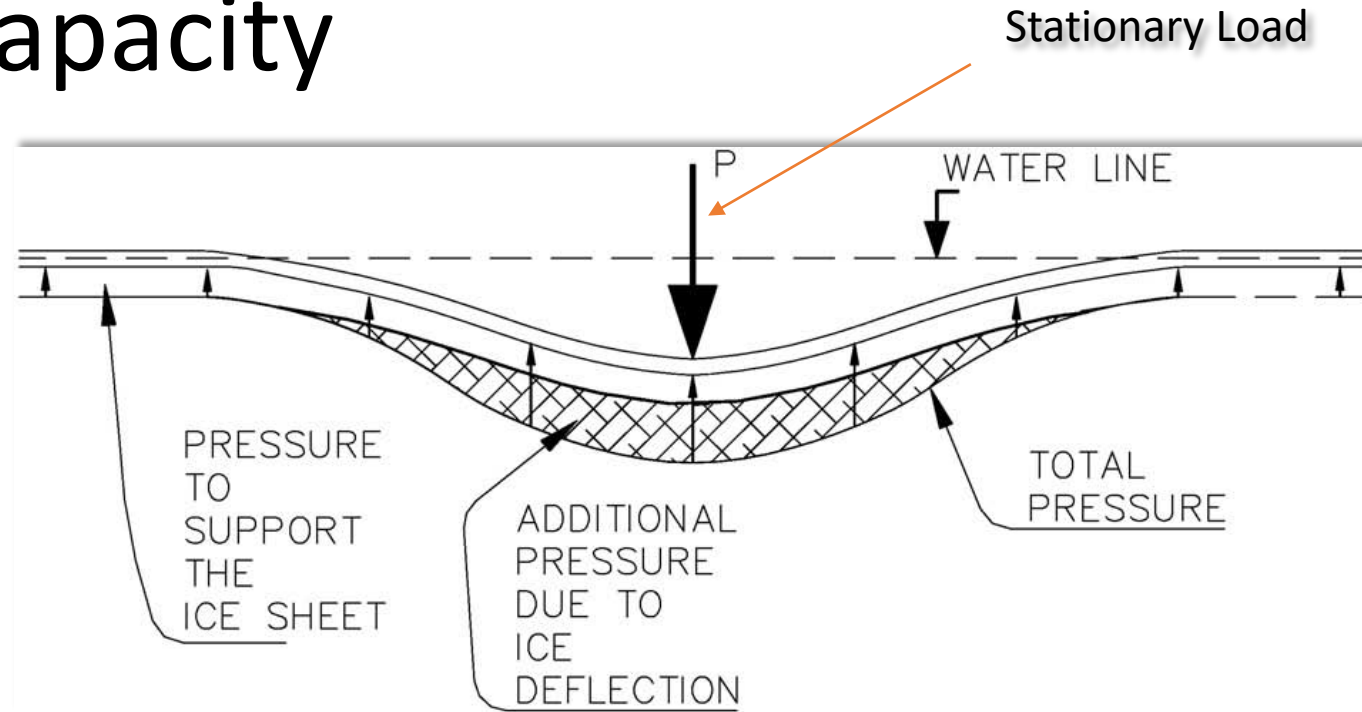


Ice Road Philosophy

- Safety above all.
- The manual seeks to blend science, experience and judgement into tables, graphics and standards to ensure those responsible provide a safe transportation facility.
- Determination of safe ice thicknesses and vehicle speeds are based on risk management.
- As risk increases so does the need for monitoring.



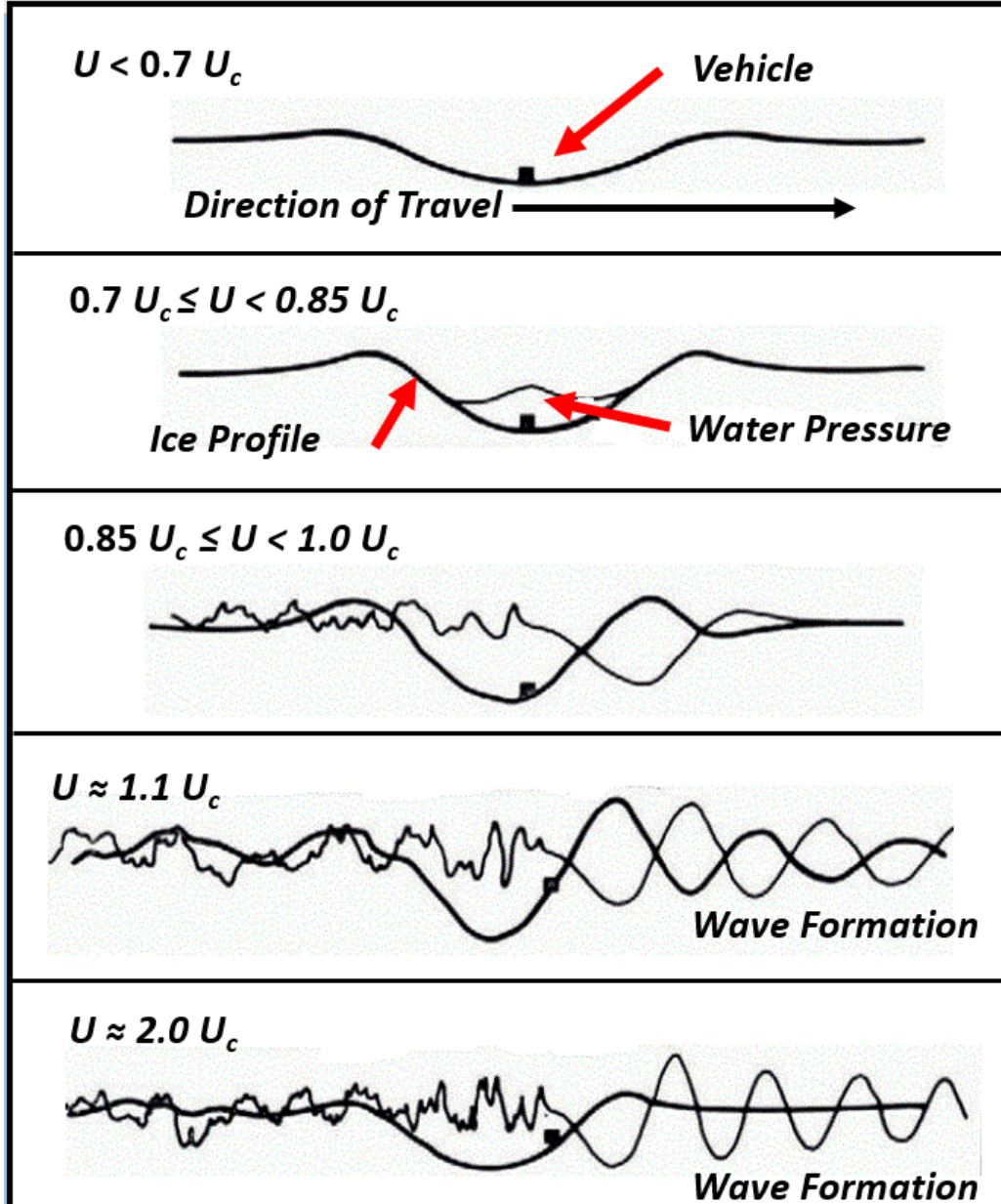
Bearing Capacity



The ability of the ice cover to support a load is the *bearing capacity* of the ice cover.

The water pressure at the bottom of the ice cover creates buoyancy, the source of bearing capacity.

Bearing Capacity: Moving Loads

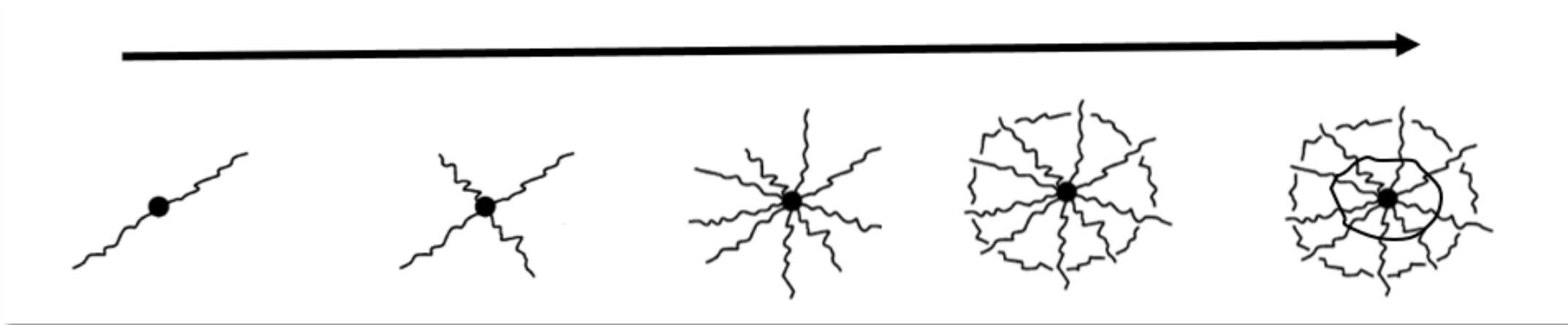


The critical speed is where the deflection is a maximum

Water pressure waves form at speeds above the critical speed

The greatest risks occur when moving loads transit from deep water to shallow water over a short distance.

Progressive Ice Cover Failure



First Crack Criterion: Ice loads are managed so that no cracks form.

Maximum flexural stress \ll Ice bending strength

Slowly moving loads; no creep

Ice Types

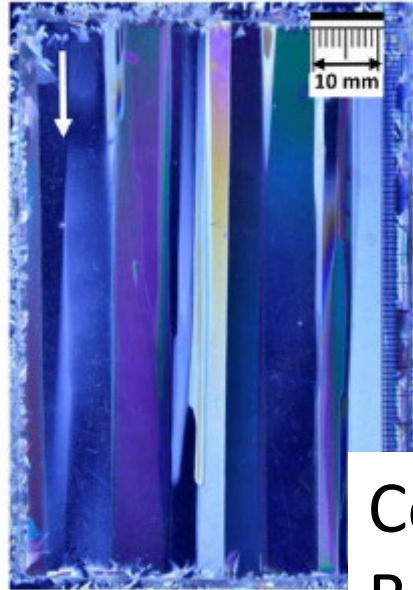


Fine grain Ice
Frazil Ice



White Ice
Snow Ice

Controversial
-only include $\frac{1}{2}$ thickness
-include entire thickness



Columnar Ice
Blue or Black Ice

Excluded Ice Types

- visible water lenses
- incompletely frozen frazil (slush) ice.
- Ice layer that is not completely frozen to the adjoining layer.
- Ice that has wet cracks.

Causes of Crack Formation: Vehicles

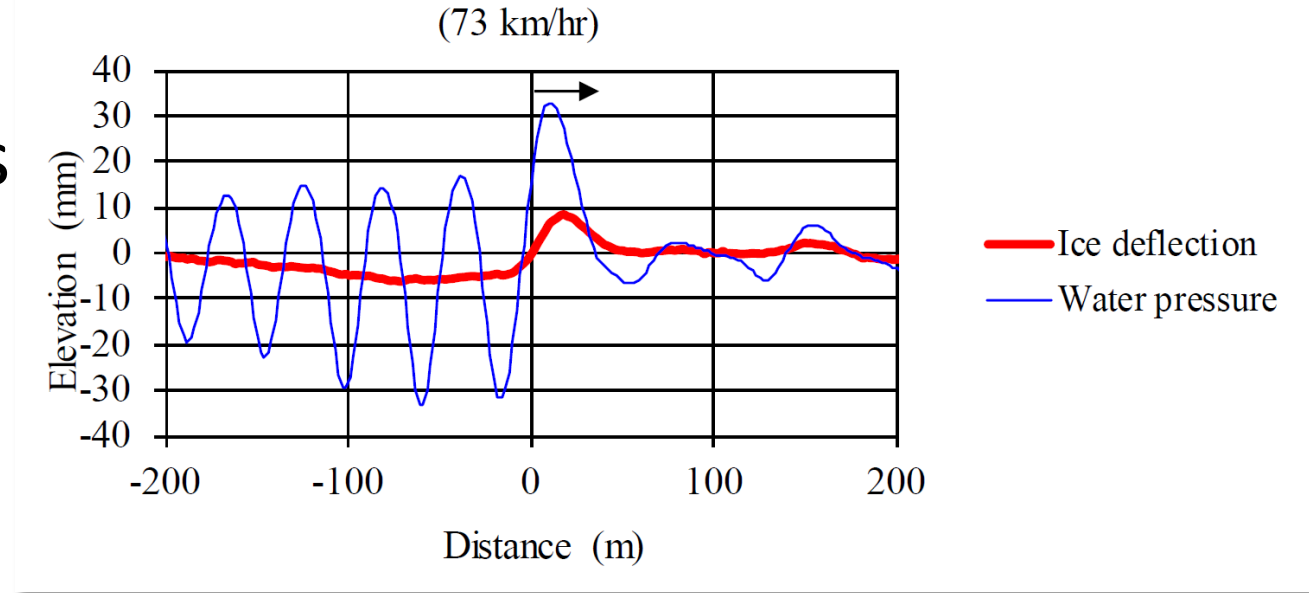
Moving Loads

Moving loads at excessive speeds that are transiting between deep water and shallow water

Shoals

Ice frozen to bottom

Shoreline



Maximum speed limits are presented in Chapter 8, Ice Road Vehicle Control.

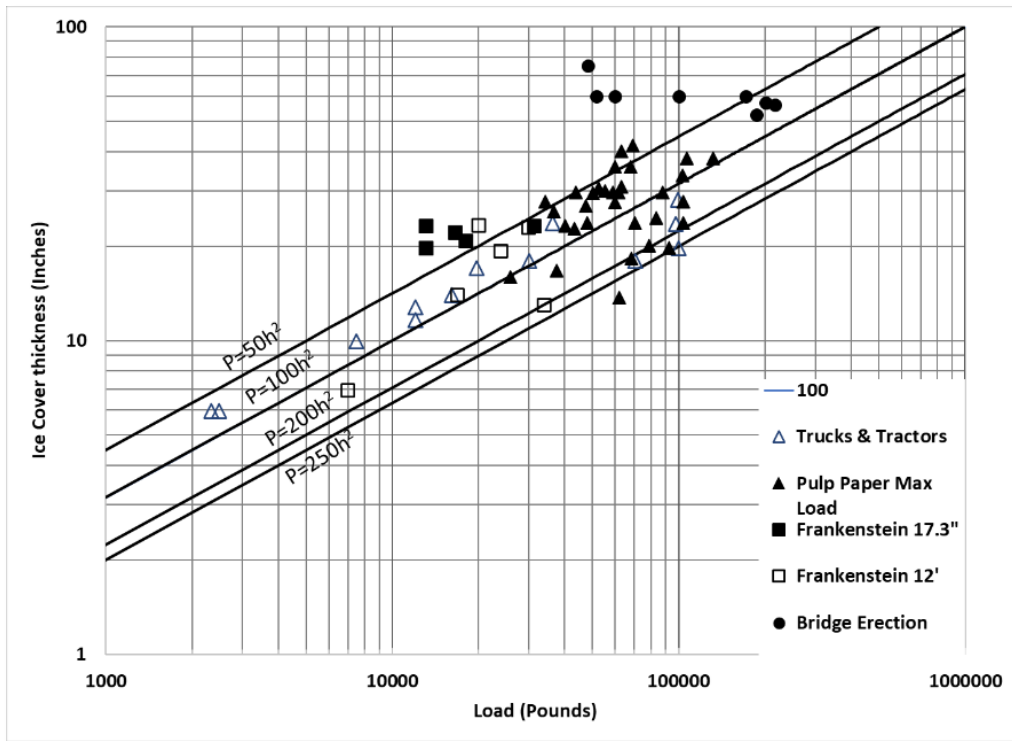
Table 8.1 Maximum Speed Limits¶

Vehicle Situation¶	Maximum Speed Limit¶	¶
Vehicle operating at the minimum ice thickness for its weight¶	15 mph (25 km/h)¶	¶
Vehicle operating at 2 x minimum ice thickness for its weight¶	25 mph (35 km/h)¶	¶
Approaching or leaving shore access points¶	5 mph (10 km/h)¶	¶
Meeting oncoming vehicles¶	5 mph (10 km/h)¶	¶
Passing work crews¶	5 mph (10 km/h)¶	¶
GPR Profiling¶	5 mph (10 km/h)¶	¶



Table 8.2 Minimum Distances Between Vehicles¶

Vehicle Weight¶	Minimum Distances¶	Time Spacing at 25 mph¶
Vehicles < 11,000 lbs¶	660 ft (200m)¶	18 seconds¶
Vehicles > 11,000 lbs¶	1,640 ft (500m)¶	45 seconds¶



Gold's Formula

$$P = Ah^2$$

P = load (lbs),

A = risk factor,

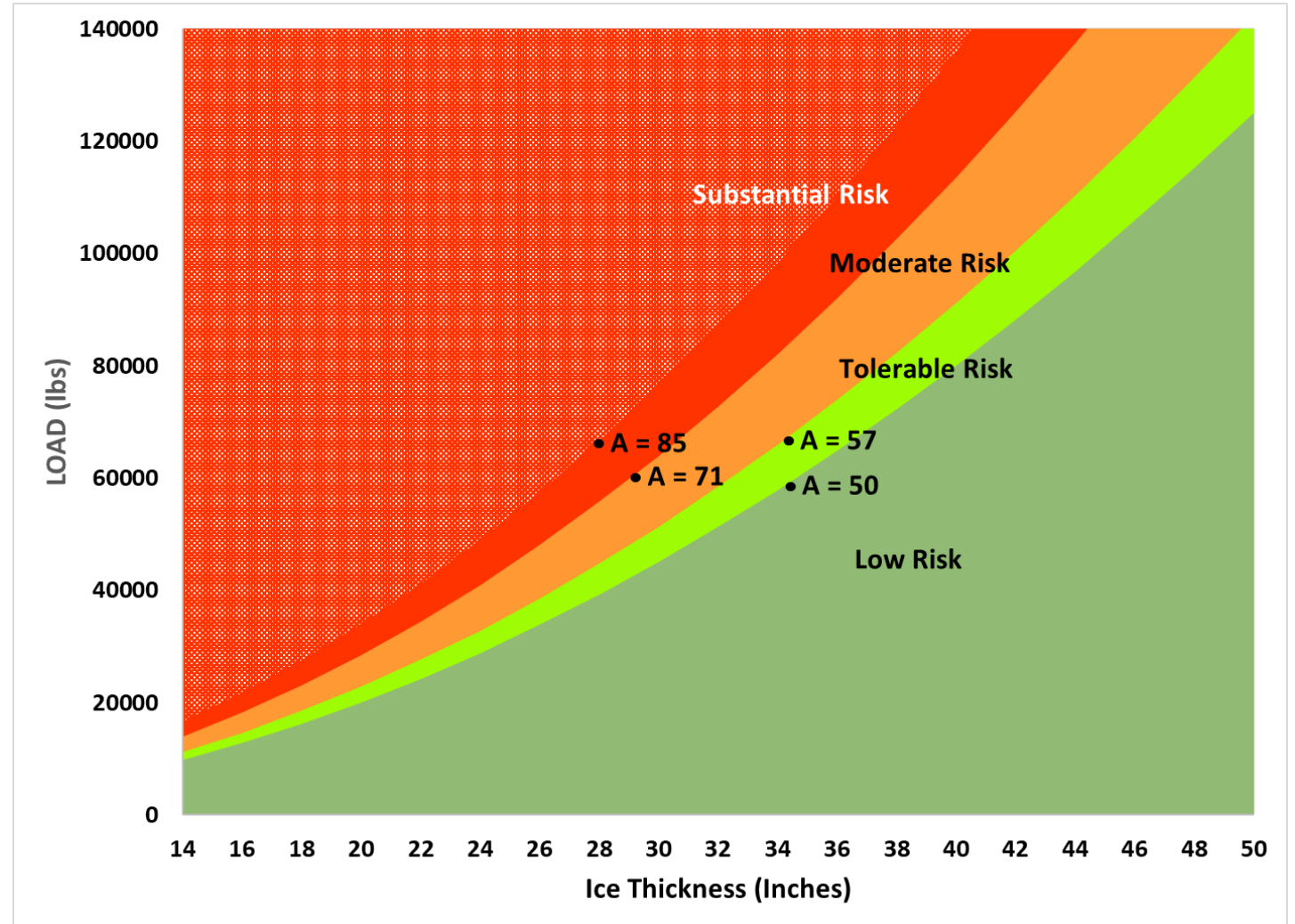
h = ice thickness (inches)

A	Risk Level
50	Low
57	Tolerable
71	Moderate
85	Substantial

Northwest Territories, Saskatchewan, Alberta,
Ontario

Traffic Loads

- Moving loads on ice
- Creep is not an issue
- Vehicle speed is not an issue – low speed
- Traffic Loads range from 11,000 lbs to 142,000 lbs.



Drifting Snow

- Adds weight to the ice
- Reduces thickness due to insulation.
- Increases potential for additional drifting.



Measuring Ice Thickness

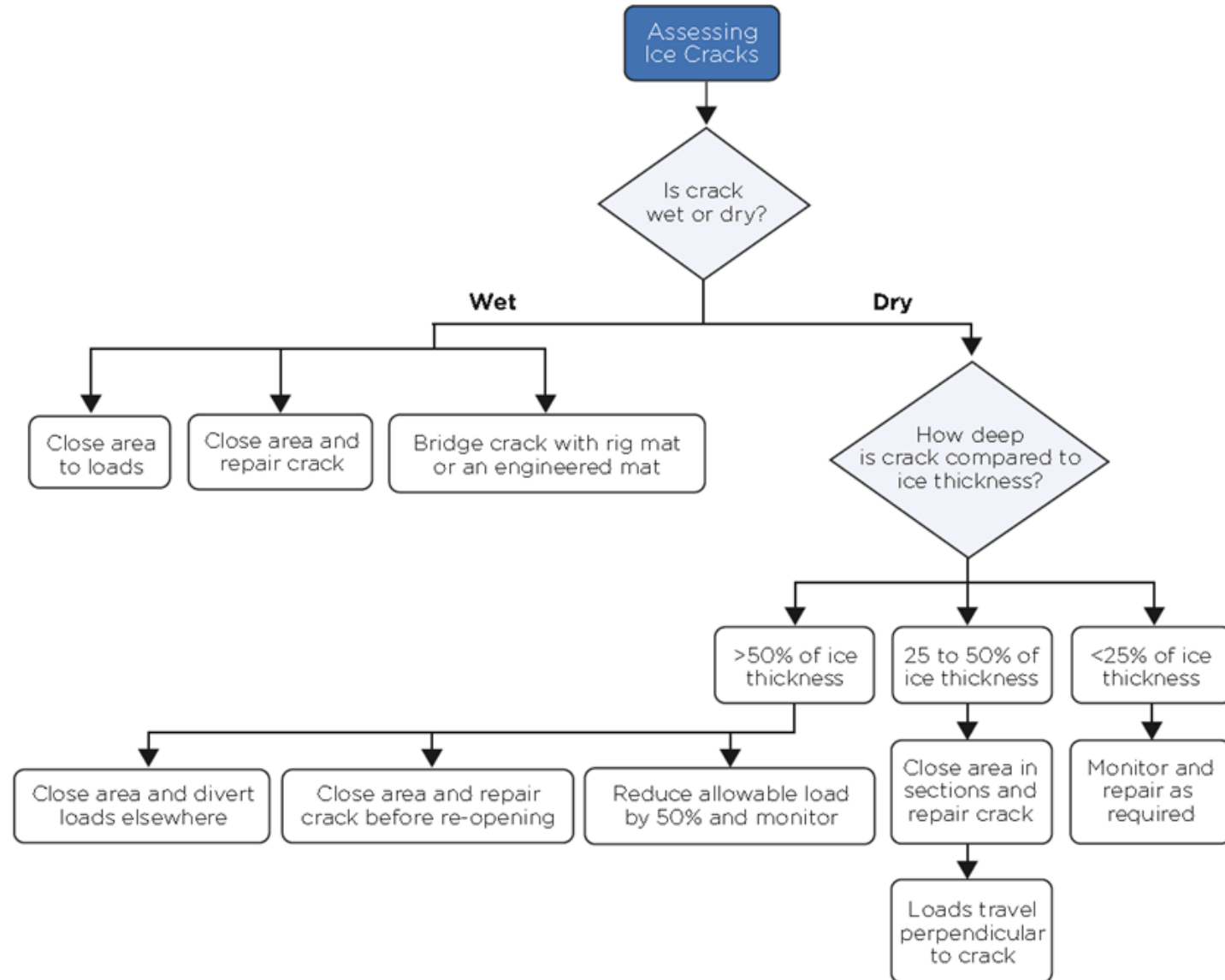
- Hand, battery and gas-powered augers
 - Quick and cheap
- Cores
 - Requires more time and more expertise
- Ground Penetrating Radar
 - Provides continuous data
 - Requires more expertise
 - Equipment expensive
 - Requires ground truthing



Monitoring Program

A Value	Level of Risk	Visual Inspection	Surveying
50	Low	-At least once every three days -checking of ice quality	-Manual measurements every 10-14 days
57	Tolerable	-Regular Ice quality monitoring program	-Program of regular manual ice measurements
71	Moderate	-Daily Ice quality monitoring program	-Daily program of regular ice measurements or program for regular GPR ice profiling plus manual ice measurements
85	Substantial – Special Procedures	-Daily Ice quality monitoring program	-Daily program of regular ice measurements or program for regular GPR ice profiling plus manual ice measurements

Assessing Cracks for Maintenance



Planning for Closure

- All the information in this manual applies.
- Have closing procedures in place well before anticipated closure.
 - The ice will melt from both top and bottom
 - Keep the public informed.
 - Where will updates be posted?
 - Who to call?
 - Anticipated timeframe.
 - Will the entire ice road be closed at once or in segments?
- How will access be closed and marked?
- Removal of signage.
- Putting emergency procedures in place.
- How will ice road be monitored.

There's an app for that.

- An iPhone app was developed which contains critical information from the manual.
- We are finding that the ice thickness calculator is being used by many who are crossing ice.



Training

- Two trainings, one in Fairbanks and one in Anchorage
- About 35 in each class.
- Due to popular request another is being scheduled for August 2024.



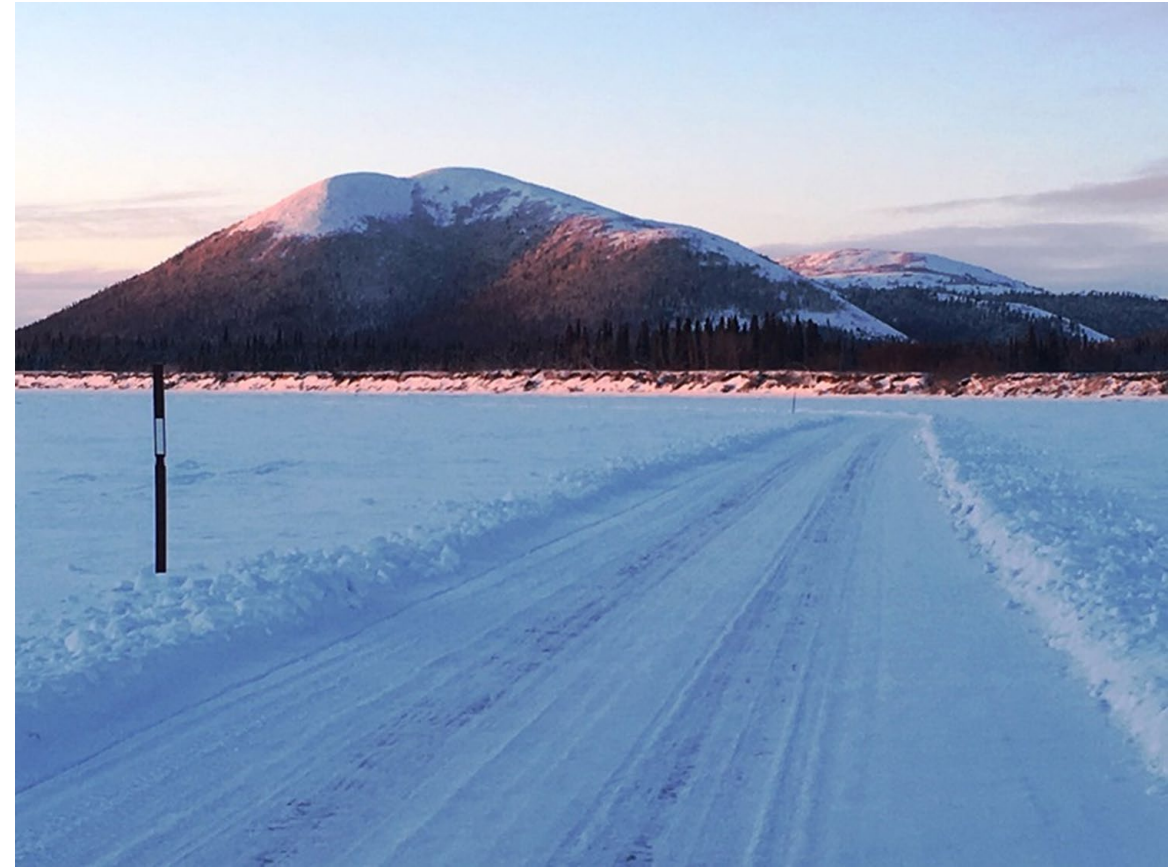
The Ice Roads

- The guideline has become the primary resource for many villages when building and maintaining ice roads.
- DOT&PF refers to the guideline in the winter roads and trail RFP.
- TTAP is working to publish as and official FHWA TTAP publication.
- We have inquiries from northern tier states about providing training.
- We are keeping a list of potential updates.



Summary

- Ice roads and winter trails provide a cost effective alternative to air travel for villages.
- Guidelines
 - establish standards, processes and expectations which in turn simplify awarding and administering grants.
 - improve safety.
 - provides the basis for planning, scoping, and preparing cost estimates.



Ongoing work

- UAF is developing guidelines for village roads and streets. Expected summer 2024
- We are developing guidelines for applying Calcium Chloride in villages.
- We are getting numerous requests to develop guidelines for sea ice and for winter trails. Looking for funding.

