alaska clean seas

Ice Safety Awareness

A Practical Guideline to
Ice Safety

Purpose

To familiarize response team members with:

Safe Ice Loading requirements and

Special considerations involved with working on fresh water and sea ice.

Objectives

Understand the tools by which responders determine safe working limits on ice.

Review special considerations and circumstances that occur when working on ice.

Learn how to survive a fall through ice.

Treading on thin ice…

Don’t be complacent, know the danger…


AFC
24-400

Preparation for On-Ice Operations

There are four things to focus on when planning work on the ice:

- Physical condition
- Clothing
- Equipment
- Procedures

Preparation for On-Ice Operations

Safety first, ice thickness must be determined.

Need To Know :

What type of ice is it?

Where is the ice located?

How thick is the ice?

Are any other forces currently affecting the ice?

Thickness must be known!

General Ice Safety Needs

Safety meetings and emergency procedures must be implemented.

If road is necessary to access spill site, reflectors need to be placed along road.

Equipment should have roof escape hatches.

Mark/Delineate both work and unsafe areas.

Operations outside of work area needs to be approved by supervisor.

Determination of Ice Conditions

Determine depth in multiple locations, starting near the shoreline.

Determine if ice will be capable of sustaining weight of equipment.


CAUTION
THIN ICE

Sea Ice Thickness

Table A.9-1 First-Year Undeformed Ice Sheet Thickness

Date	10 Year Minimum Ice Thickness (inch)	Average Ice Thickness (inch)	20-Year Maximum Ice Thickness (inch)
November 1	9	13	20
December 1	21	25	31
January 1	30	36	46
February 1	41	48	59
March 1	51	60	72
April 1	61	71	80
May 1	68	77	86
June 1	72	79	87

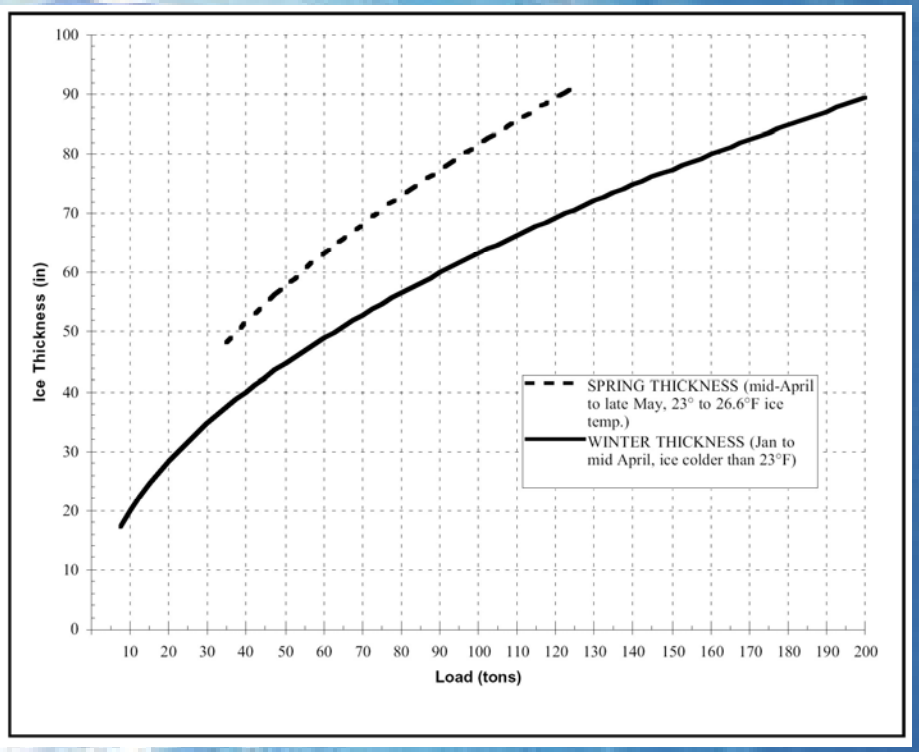
Alaska Clean Seas, Ice Access Guidelines for Spill Responders

Sea Ice Thickness Capacity

20 inches is starting thickness in early winter.

Curves are for moving vehicles or short term parking (4 hours).

Wheeled vehicle operations halt when the internal ice temperature at 1 to 2 ft depth rises above 26.6°F.



Short Term Loading

Short Term Loading should last no longer than 4 hours.

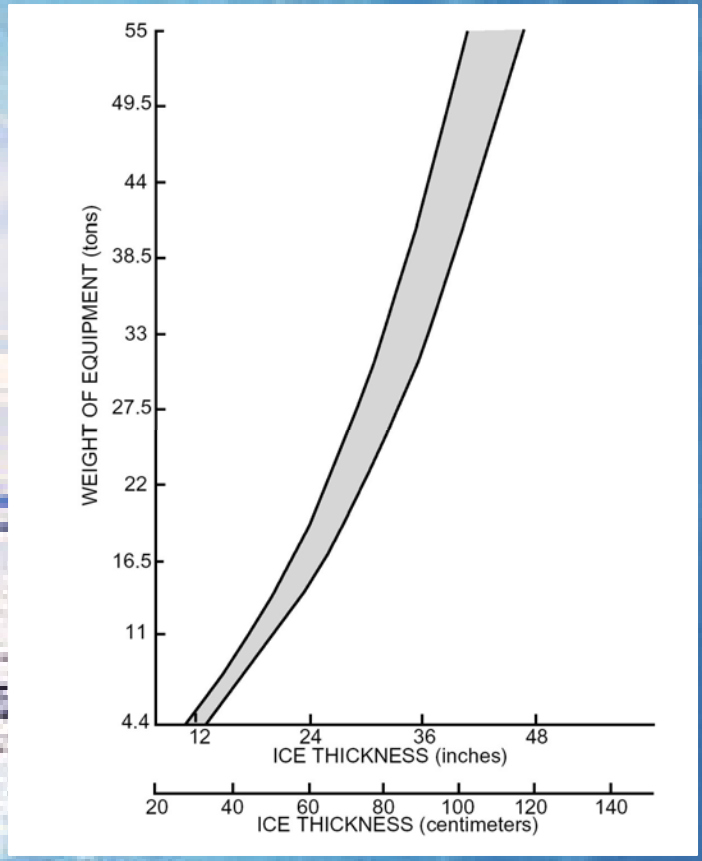
Equipment operations are not allowed at the edge of ice when a resonant wave can occur.

Special attention is needed when working in close proximity to other equipment.

Fresh Water Ice Thickness Capacity

Fresh water ice can support heavier loads than sea ice.

Be certain to use the correct table to reference load capacities.



Be conservative with graph information!

Weight for Selected Equipment

Identify both the weight of the equipment and the payload.

Remember to consider payload left behind.

	GROSS WEIGHT INCLUDING PAYLOAD (LB)	ESTIMATED PAYLOAD (LB)
Cat D-8	71,000	N/A
CATCO RD-85	56,000	30,000
Kenworth 953A	121,000	60,000
Grader 12G	29,000	N/A
DHC Twin Otter	12,500	4,500
C130H Hercules	155,000	51,000
Bell 212	11,000	5,000
Bell 214	17,500	8,000
Boeing Chinook	51,000	28,000
B-70	156,000	65,000
BV-107	19,000	11,500
Bobcat w/Trimmer	8,900	N/A
Bobcat w/Auger	7,900	N/A
Crew Cab Pickup	7,500	400
Ditch Witch R-100	9,500	N/A
Snowmachine w/Sled	545	200
966 Loader	47,000	10,000
Vac Truck	75,000	40,000
Max Haul	74,000	32,000
Tandem Trailer	52,000	22,000
Challenger Dozer	35,000	N/A

Ice Thickness Between Loads

When near wet cracks, use half weights.

If cracks intersect, suspend operations.

Minimum Ice Thickness	Load (pounds)				Short-Term Load Separation[4]
	Parked on 9x9 Area[1]		With Resonant Wave		
Feet	4 hours to 4 days	4 days to 4 months	Single load area[2]	Multiple load area[3]	Feet
1.5	Not reported	10,000[5]	10,000	Not reported	42
2	Not reported	15,000	18,000	25,000	54
2.5	27,000	17,000	25,000	30,000	64
3	43,000	27,000	40,000	50,000	72
4	88,000	56,000	70,000	80,000	90
5	156,000	92,000	Not reported	125,000	106
6	Not reported	131,000	Not reported	170,000	122
7	Not reported	178,000	Not reported	240,000	140

Control speed in shallow water to avoid flexural waves.

Long Term Loading

Long Term Loading can last either 4 hours to 4 days or 4 days to 4 months.

Long Term Loads cause the ice sheet to deflect downward and can cause surface to become submerged.

Be conservative when determining distances between equipment.

Short term stresses can impact load situation (travel over ice, dropping loads, etc.)

Additional snow load and temperature (28°F) changes in the ice can affect ice strength.

Special Circumstances

Sudden drop in air and ice temperatures will cause an ice sheet to contract causing leads and wet cracks to form. -10°F

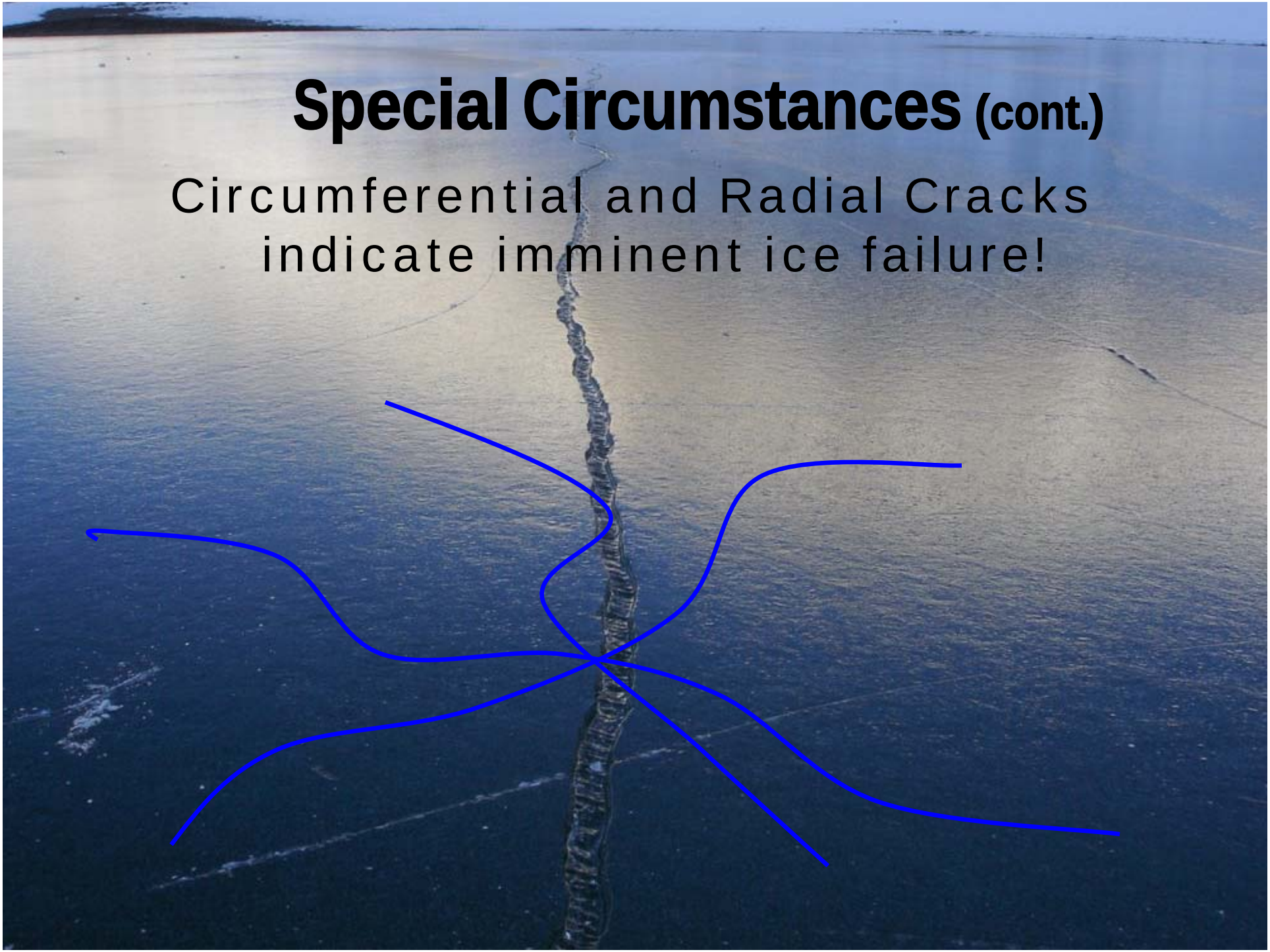
Sudden rise in air and ice temperatures will cause an ice to expand and exert pressure on fixed structures and the development of pressure ridges in the ice. + 10°F

Wind can affect the position of ice sheets.

Equipment operating during thawing temperatures requires continual ice monitoring.

Special Circumstances (cont.)

Circumferential and Radial Cracks indicate imminent ice failure!



Special Circumstances (cont.)

Ice temperatures are classed as warm or cold.

Do not travel over flooded ice or through water.

Removal of snow on floating ice can cause dangerous cracking by exposing the ice to the cold air temperatures.

Perform constant monitoring of ice conditions.

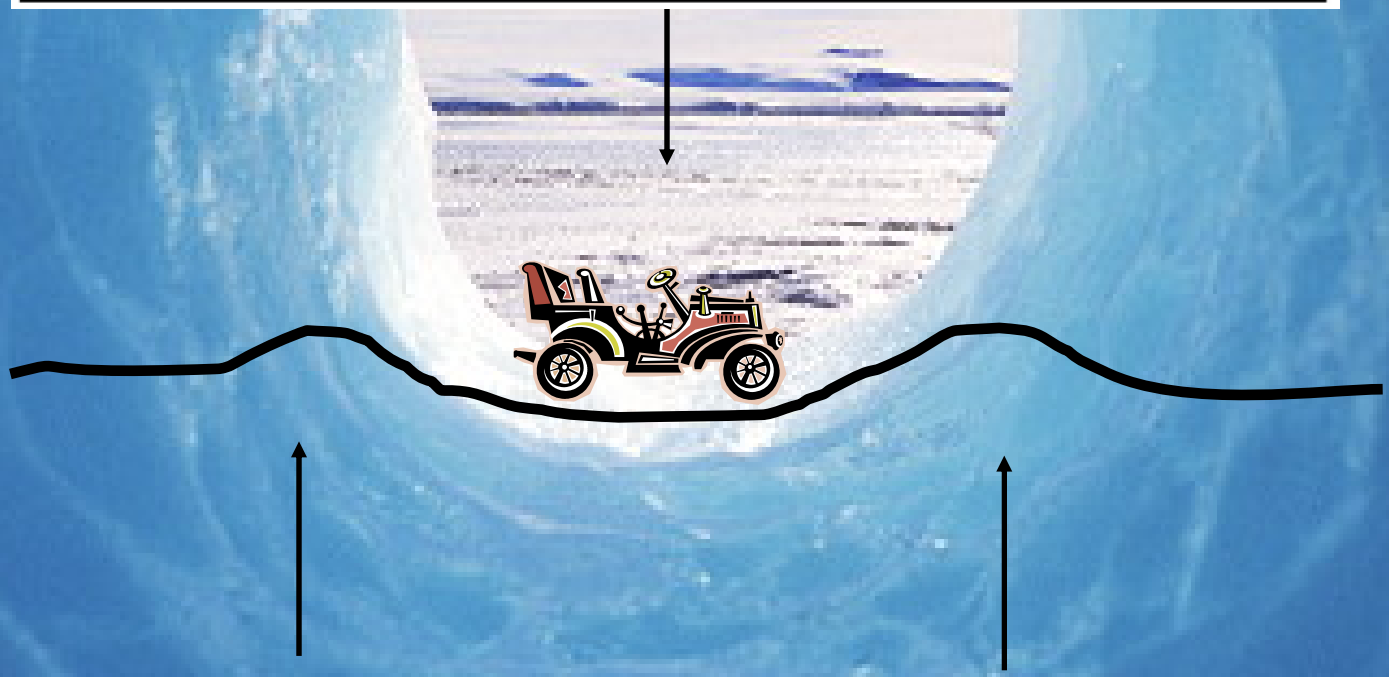
Dynamic Effect on Ice

Dynamic effect is when a vehicle is traveling at or near the velocity of the under-ice water wave.

When driving across ice, travel at speeds identified to avoid dynamic effect.

Dynamic Effect on Ice

	Water Depth	
	10 Feet	40 Feet
Max. Speed (mph) for Dynamic Effect	12	24
Speed (mph) to Avoid Dynamic Effect	8	17



Special Circumstances (cont.)

On-ice spill response activities may have the potential to compromise the consistent ice strength of the clean-up area. Some examples are:

- Burning oil
- Ice mining
- Trenching
- Augering

Caution must be taken with operating of equipment over the following crack types.

- Hair and refrozen cracks
- Intersecting and Non-intersecting dry cracks
- Non-intersecting wet cracks or leads
- Intersecting wet cracks or intersecting leads

Did You Know?

Consider the weight of product already on the ice …

Oil Saturated Snow contains 2.4bbls of oil per yd^3

Snow/Oil Mixtures weigh 40lb per ft^3

Ice Rescue

When a person falls through the ice, he or she should not attempt to climb out immediately, but rather, should kick to the surface where they went in and get horizontal in the water with their legs back of the torso, rather than underneath, in order to avoid jackknifing the body beneath the ice.