Ice Bridges

Forest Management Practices Fact Sheet
Crossing Options Series #4

Best Management Practices (BMPs) can prevent or minimize the impact of forestry activities on rivers, lakes, streams, groundwater, wetlands, and visual quality.

Introduction

During harvesting or other forest management operations, it is sometimes necessary to move equipment across streams. Ice bridges can provide acceptable temporary access across streams during winter.

Ice bridges are made by pushing and packing snow into streams and applying water to freeze the structures solid so vehicles can drive across. Use is limited to winter under continuous freezing conditions. Operators may need permits before an ice bridge crossing can be built.

Where Used

Ice bridges are for temporary use in streams with low flow rates, thick ice, or dry channels during winter. They may not be appropriate on streams with large or high-velocity spring flows.

Application

Before beginning, check with the appropriate regulatory or natural resource agency in your state to see if permits are required.

When constructing an ice bridge:

- Choose a period with night temperatures below 0° F.
- Choose a site that has low flow, is completely frozen or dry, or has a layer of ice on top of the flowing water. Approaches should be level or nearly level.
- Push snow that is free of dirt and debris into the channel and pack it down. Add water to ice the structure. Don't add brush or other vegetation to the ice bridge. This will weaken the structure. It can also dam the stream when the bridge melts.
- Let the surface freeze, then repeat the process until the crossing reaches the desired thickness and width. The bridge should be thick enough to permit a level approach. The ice also must be thick enough to support the weight and speed of anticipated traffic (see Table 1).

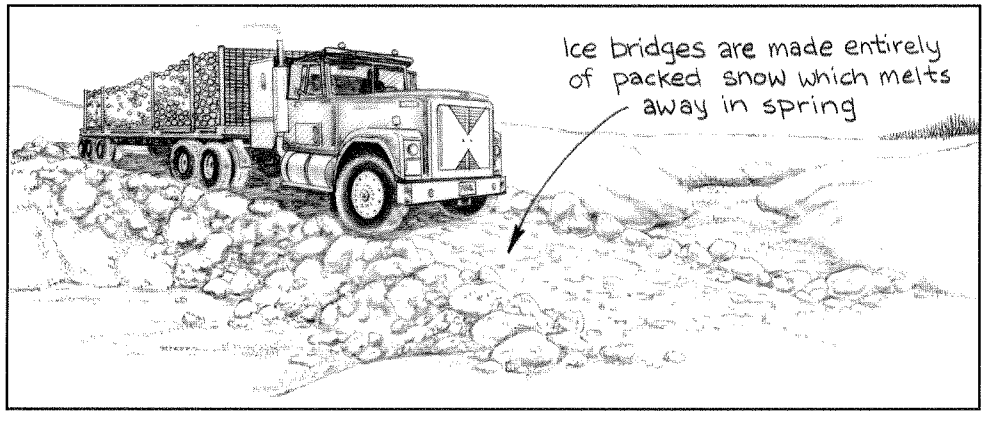

Table 1. Minimum ice thickness required to support a given load above a flowing river or stream or on a lake (Haynes and Carey 1996).[1]

Vehicle class[2] (tons)	Minimum ice thickness (inches)	Minimum distance between vehicles[3] (feet)
0.1	2	17
1	4	34
2	6	48
3	7	58
4	8	67
5	9	75
10	13	106
20	18	149
30	22	183
40	26	211

[1] Information in this table assumes clear, sound ice. White, bubble-filled ice should be twice as thick as clear ice. If the air temperature has been above freezing for at least 6 of the previous 24 hours, multiply the vehicle class by 1.3 to obtain a much larger minimum thickness. If the air temperature stays above freezing for 24 hours or more, the ice begins to lose strength and the table no longer represents safe conditions. It is recommended that operators drive below 15 miles per hour.

[2] Vehicle class equals the total weight of the vehicle plus its load in tons (2,000 lbs), not the vehicle's load capacity.

[3] At thicknesses greater than the minimum ice thickness, the spacing between vehicles can be reduced on sound ice.

Source: Haynes, F. D., and K. L. Carey. 1996. Safe loads on ice sheets. U.S. Army Cold Regions Research and Engineering Laboratory, Ice Engineering Number 13. 4 p.

Advantages

Ice bridges are easy to build and don't need to be removed at the end of an operation.

Disadvantages

There are many conditions where ice bridges won't work. The bridge must be inspected often, since weather and water flow can affect its strength.

Maintenance

Inspect ice bridges often. Look for problems such as water dammed above the bridge or openings in the ice near the bridge. In high-risk areas, you may need to cut a hole through the ice above or below the bridge often during each day to determine its thickness and condition.

Related Fact Sheets in This Series

Temporary Stream Crossing Options (FS-7001); *Fords* (FS-7002); *Culverts* (FS-7003); *Timber Bridges* (FS-7005); *Railroad Car, Steel, and Prestressed Concrete Bridges* (FS-7006); and *PVC or HDPE Pipe Bundle Crossings* (FS-7007).

Cooperators

University of Minnesota Extension Service, Minnesota Department of Natural Resources, Minnesota Logger Education Program, Michigan Department of Natural Resources, Michigan State University Extension, USDA Forest Service, and Wisconsin Department of Natural Resources.

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