

ICE BRIDGING

**When
the temperature
plunges below zero, the
23d Engineer Company puts
Mother Nature to work.**

by 1LT Mark L. Prah1

It doesn't take magic for a man, a jeep or even a 27-ton bulldozer to cross deep water in winter. All it takes is ingenuity, hard work and some frigid weather to make an ice bridge.

The first step in building an ice bridge is site reconnaissance because there are important location characteristics to consider in positioning the bridge.

The river channel should be straight and fairly wide, more than 60 feet if possible. Areas with unstable currents or temperatures, such as rapids and hot springs, are avoided. Normally, a straight, wide channel will have a slower flow and a level ice surface, and the channel should lie so prevailing winds won't drift snow across the bridge. Routing the bridge between sandbars yields shorter,

stronger spans.

The area upstream is also examined. There should be no significant inflow channels directly upstream (closer than 2 km) which may disrupt normal flow.

The bridge should be as close to existing roads as possible because it merely continues those roads. However, for safety, ease of construction and maintenance, the crossing loca-



An ice bridge built in Alaska by the 23d Engineer Co. The 23d built three ice bridges during Brim Frost 83.

tion has a higher selection priority than its distance to roads, as long as the bridge is easily accessible to wheeled vehicles.

A final primary consideration is the near and far banks. A gradual slope to the stream is best because it ensures ease of access by vehicles. If the banks are too steep, ramps are built from the banks to the stream.

After the bridge location has been chosen, the final check before construction is measuring (profiling) the ice. The profile is the most important step in ice bridging and must be conducted diligently and without shortcuts. All safety precautions must be observed and immediate aid ready in case of ice failure while crews are working.

A profile crew is two or more people, with the lead person tied to the rest of the crew by a line. The lead



A profiling crew testing ice thickness.

man bores test holes at 10-foot intervals with an auger or ice-chopper. As he crosses the river, the following persons (the recording crew) relay

him and are prepared to assist if he breaks through. Data is recorded for each hole, including its location, ice thickness, snow cover, channel depth and ice quality.

If the profile crew encounters ice 4 inches thick or less, they don skis or snowshoes for safety before continuing. Ice less than 3 inches is too thin; a different site or a standard fixed bridge must be used.

When the profile is complete, all information necessary to decide on accepting the ice bridge location has been collected and construction may begin.

Ice bridge construction is the process of artificially increasing the rate of ice formation on the bridge surface.

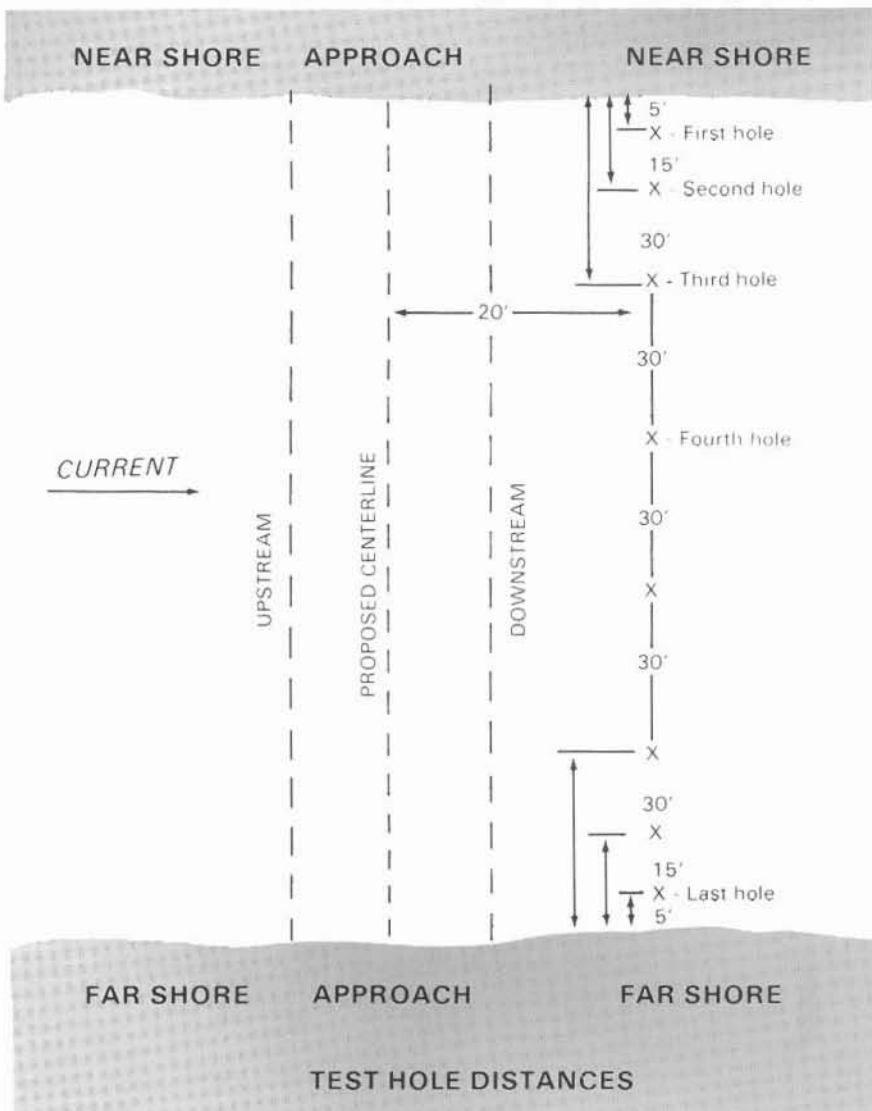
The first step is dealing with snow covering the crossing strip. The snow is cleared in a lane 30 meters wide. The roadway is standard military road width, but a 30-meter lane ensures plenty of ice to support it. The snow may be cleared entirely off of the bridge or be compacted to no more than 2 inches thick. Compacting may be done with snowmobiles, skis, or snowshoes. Any snow removed from the bridge must be distributed to avoid snow berms higher than 12 inches on the edges of the bridge.

Whether the snow is cleared or compacted, the next step is flooding. Hand-operated or gas-powered ice augers are used to drill 12-inch wide holes in the ice on the downstream side of the bridge. The river or lake becomes the water source for a pumping operation.

"We pump water up from below and flood the ice about an inch deep, let it freeze, then flood it again, until we get the thickness we want," explains SFC Lincoln V. Thompson, operations and training NCO, 23d Engineer Company (Combat) (Heavy), 172d Infantry Brigade. "We've crossed a D7 'cat' on 32 inches of ice and it weighs 54,200 pounds with its bullblade."

The 23d Engineer Company uses three commercial, electric submersible pumps (each powered by a five-kilowatt generator), or gasoline-powered centrifugal pumps to raise layers of water.

"The commercial pumps are better for this job than the centrifugal ones," says Thompson. "The electric



A typical arrangement of profile holes.

pumps are self-priming and won't freeze in extreme cold. We just drill a hole in the ice, drop it in and start pumping."

"How fast we can build a bridge depends on temperature and how long the bridge must be," explains CPT Christopher M. Turletes, 23d Engineer company commander. "We figure one squad with one pump can freeze 100 feet of bridge per hour at -10°F."

With the slowness of clearing snow and freezing water, ice bridging can't be considered a hasty crossing for combat use.

"Tactically, ice bridges are used on main supply routes and lines of communication," says Turletes. "They are deliberate crossings used when the area beyond is secured and ready to be opened for resupply."

Like the pumps they use, some of the 23d Engineer Company's ice-bridging techniques deviate from standard Army procedure.

"We've built a lot of ice bridges and done considerable research with the Corps' Cold Regions Research Laboratory (CRRL)," explains Turletes. "There's also a lot of research being done commercially on the North

Slope with ice bridges, and we've used that, too.

"Figures in TM 5349, *Arctic Construction*, indicate a 200-foot width for ice bridges," Turletes says. "Of course, the wider the bridge, the stronger it is. But the TM tends to be conservative. Our experience and CRRL's research shows that an ice bridge over 14 inches thick is strong enough to resist bending, and that 30 meters is a good width to work with."

Some experts recommend replacing three or four inches of snow on the bridge as a treadway.

"Snow is an insulator and tends to protect the ice bridge from cold air," says Turletes. "After the bridge is constructed, we replace no more than one inch of snow for a wearing surface."

Other experts advocate freezing timbers into the ice to reinforce the bridge.

"Our research and experience shows that logs, planks and straw don't really strengthen an ice bridge," says Turletes. "They are darker, absorb solar heat and could weaken the bridge. We often use logs for ramps and treadways, but not frozen into the ice itself."

After the 23d Engineer Company builds their ice bridges, they maintain several safety factors. "When in doubt, profile," is the rule. They measure the ice thickness every eight hours not only to monitor the thickness of the ice, but also the distance to the bottom of the channel. "If the ice builds up too thick below, the water dams up behind the bridge and the pressure can cause shears at any weak point," says Thompson.

The 23d Engineer Company built three ice bridges at Fort Greely, Alaska, during exercise Brim Frost 83. Their mission during the exercise was to operate, maintain and upgrade the exercise's main supply route.

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TITLE	OFFICE	TITLE	OFFICE
M9 ACE Effectiveness Analysis (Aug 80)	ATZA-CDE	Poster FB 123 - Soviet Combat Engineer Tactics, Groupings and Techniques (Jul 82)	ATZA-PAA-A
Countermining Functional Area Analysis (Jun 82)	ATZA-CDE	Poster FB 124 - Soviet Engineer Equipment - Division and Below (Jul 82)	ATZA-PAA-A
Functional Area Analysis of Land-mine Warfare (Jun 82)	ATZA-CDE	Poster FB 125 - Soviet Combat Engineer Organizations Below Divisions (Jul 82)	ATZA-PAA-A
Points of Contact (USAES) (Jun 82)	ATZA-CDE		
USAES DCD Periodic Intelligence Report (PERINTREP) (Quarterly)	ATZA-CDC		

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TITLE	OFFICE	TITLE	OFFICE
TRADOC Pam 525-18, US Army Operational Concept for Countermining Operations (Jun 82)	ATDO-ZD	TRADOC Pam 525-19, US Army Operational Concept for Land-mine Warfare (Jun 82)	ATDO-ZD

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