



**US Army Corps
of Engineers®**

Engineer Research and
Development Center

Facility

CRREL Ice Engineering Flume

Purpose

The Flume at the Cold Regions Research and Engineering Laboratory is a recirculating channel that supports river ice research and sediment transport studies. It is equipped with an X–Y computer-controlled instrumentation carriage for documenting test conditions and profiling the bed. The bottom of the Flume is refrigerated; freezing from below facilitates studies of the underside of a natural ice cover because, in effect, the ice sheet is turned upside down. Other studies conducted in the Flume include the formation of ice covers and frazil ice, the hydraulics of ice-covered rivers, the formation of ice jams, ice effects on sediment transport, and the effects of frazil ice on fish.

The Flume is housed in CRREL's Ice Engineering Facility, a unique research and testing complex; there is no equivalent facility in the world. At the IEF, the impacts of ice on civil works flood control and navigation structures and waterways are studied in three separate research areas: the test basin, the flume, and the research area. Refrigeration systems and computerized data acquisition systems provide state-of-the-art operation and capability, and separate temperature controls allow independent operation of each area.



The Flume is a perfect device for testing river processes, particularly those related to frazil ice and sediment transport.

Specifications

- 120 ft long × 4 ft wide × 2 ft deep (36.5 × 1.2 × 0.6 m)
- Room temperature can be regulated down to -20°F (-29°C)
- Tilts from 2 degrees normal to 1 degree adverse slope
- Recirculation rates of 5 and 9 cu ft/s (0.14 and 0.25 m³/s)
- Separate control of temperature at the bottom of the flume
- Sinusoidal wave-making capability

Benefits

The Flume is used to study fundamental ice processes in streams; the formation, evolution, and accumulation of frazil ice; the formation of anchor ice; ice jam initiation and development; and sediment transport and bed erosion under ice and debris. In the Flume, solutions can be modeled to specific river ice problems, including frazil ice, sheet ice, and model ice.

Success Stories

In a joint research program with the University of Waterloo, the effect of frazil ice on the respiratory system of fish was investigated. The effort included monitoring the vital signs of the fish as frazil ice was generated and as it accumulated in the flume. It was found that frazil ice did not affect fish mortality.



A wave maker was retrofitted in the flume to support a joint research program with Clarkson University to develop the relationship between wave period and amplitude and the production of frazil ice accumulations. The waves were attenuated as the frazil ice accumulated as pans and froze. The data acquired were used to develop and calibrate a numerical module of sea ice generation for the Arctic.

Point of Contact

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