

Module 5 – Ice engineering properties and measurements of ice strength with borehole jack tests

Contact:

Dr. Dan Masterson, Ph.D., P.Eng.

Bachelor's and Masters degree in Civil Engineering from University of Windsor
Ph.D. from Queen's University in Civil Engineering

DMASTERSON@chevron.com

Brief overview of module (more details provided in lecture and relevant publications – available for download at [ftp.gi.alaska.edu /pub/eicken/G695/Module5](http://ftp.gi.alaska.edu/pub/eicken/G695/Module5))

The UAF unit provided by myself will consist of a presentation on ice strength testing, both small and large scale. The relevance and use of each is described in reasonable detail. Thereafter, a series of strength tests on sea ice will be conducted using a borehole jack. The jack conducts strength tests on the sides of a 150 mm (6 inch) hole drilled in the ice. Tests are normally conducted at intervals of 250 mm to 300 mm over the depth of the hole. For each test both the pressure applied to the ice and the displacement of the jack test plate will be recorded at regular intervals. The pressure is applied to the jack and thus to the ice using a hydraulic pump which pumps oil into the jack. Displacement of the jack plates is measured by reading an extensometer mounted in the jack which can be read via a multi-meter at surface. Hand recording of the displacement will take place at pre-determined pressure intervals. The readings are entered into a spreadsheet and plotted on a graph. Ice yield strength and ultimate strength are obtained from the plots. By testing at regular intervals down the hole, it is possible to obtain a strength and stiffness profile of the ice through its depth.

If the tests are done in a core hole, the core temperature and salinity can be obtained and plots of temperature, salinity and brine volume vs. depth can be produced. Brine volume and strength are related as shown in the profiles below.

