

Project Name: Antarctica Ice Pier

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Organizations/People Involved:

Naval Support Force Antarctica

Public Works Department: LCDR Michael Weyler. Public Works Officer

Date: October to February, approximately every three years

Project Summary: Ships docking at the McMurdo Station, Antarctica ice pier rely upon USCG icebreakers opening a ship channel from Upper McMurdo Sound to Winter Quarters Bay off the southern tip of Ross Island. One or more icebreakers, depending upon seasonal conditions, will typically open a channel from eight to 50 miles long.

The ice piers deployed at McMurdo Station have grown in sophistication and size since 1973. A contemporary pier is approximately 800 feet long by 300 feet wide and 22 feet thick. Seabees from the Public Works Department create the floating pier during the austral winter. They build upon naturally occurring frozen seawater in McMurdo Sound after the sea ice reaches approximately 2.0 feet in thickness.

Public Works personnel then construct a snow berm to a depth of several feet along the perimeter of the soon-to-be ice pier. High-volume pumps then flood the pack ice with seawater to a depth of about 4 inches. The seawater typically freezes solid within 24 hours. Personnel repeat the flooding until they achieve a thickness of about 5 feet.

Next a reinforcement mat of approximately 6,900 feet of 1" steel cable is secured to 2" steel pipe embedded in the ice pier.

The Public Works personnel repeat the entire process three more times until the ice pier is approximately 22 feet thick, with approximately 20,700 feet of steel cable laid between ice layers as reinforcement.

Wooden utility poles drilled about four deep into the final ice pier support electrical and telephone service to the pier. Moreover, during the final construction phase, personnel mount shorter poles in the ice edge to serve as bollards to secure the pier to the shore at McMurdo. A 6–8 inch layer of volcanic gravel tops off the pier to provide a non-slip surface and to insulate the ice from the summer sun.

While the ice pier may be ready to receive cargo at the beginning of the austral summer, two more operations are necessary. First, a bridge between the land and the pier. Since the pier rises and falls with the tide, the bridge must also be able to move. A pontoon causeway section is placed between the land and the pier. It is anchored to the land with the volcanic gravel used for a transition ramp from pier to bridge. Because of tidal movement, the bridge ramp requires regular maintenance through the season.

Second, a flat, vertical outer surface for the pier must be created for the supply ships to tie up against for cargo discharge operations. This is accomplished by the Public Works Department personnel drilling a series of holes in the ice, in a straight line near the outer edge of the ice pier. Using a quarry blasting technique, explosive charges are placed inside the holes and simultaneously detonated, which creates a clean cut in the ice, allowing the rough outer edge of the pier to be pushed aside by the ice breakers. The cargo ships can then berth against a flat pier side.

Experience has shown that ice piers have a lifespan of three to five years. Factors such as stress cracking and erosion shorten the duration. In addition, storm surges, wave action, contact with vessels, and the warm water discharge from ships contribute to degradation of the pier's seaward edge. Since the ships' overboard discharge severely erode the flat face below the surface, the quarry blasting technique has to be repeated each succeeding year of the pier's life to create a new flat face a few feet from the previous year's pier face.



The ice pier with explosive charges set along the white line near the outer edge of the pier. The pontoon bridge is seen between the pier and the land at the right.



Explosive charges detonated.



Ice pier ready to receive cargo ship shown coming in. USCG Ice breaker is at upper left



Container ship offloading cargo onto waiting trucks. Bridge visible at lower left.

Project Report Link: See https://en.wikipedia.org/wiki/Ice_pier#Seawater_construction