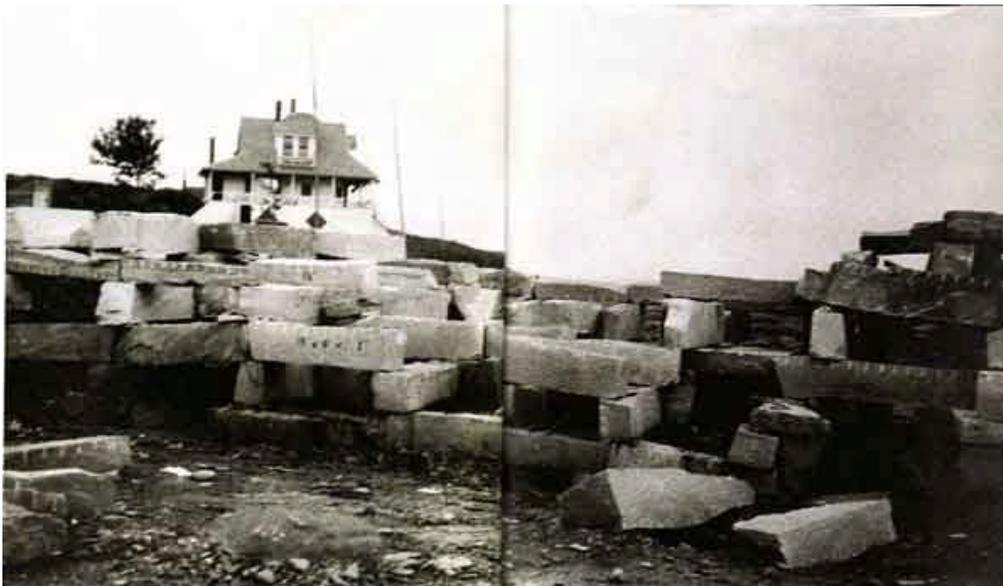


HISTORY LESSON

Stacking Stones: The Bailey Island Bridge

For two years, the residents of Bailey Island, slightly north of Portland off Maine's coast, watched as steam shovels and cranes placed levels of stone across a strait known locally as Will's Gut. These descendants of hardy fishermen would now find themselves socially and economically tied to the mainland by a bridge that would be as impervious to the depredations of the sea and the New England climate as they were. Designed by Maine's state bridge engineer, Llewellyn N. Edwards, the bridge was to be composed of stone ties arranged in a crisscrossing framework that would enable the tide to flow freely through the structure. With the exception of a girder span near the center that enabled boats to pass through, it was erected without the use of concrete, mortar, or adhesive, and it is the only bridge of its kind in the world.

The need for the bridge dated back to the founding of the town of Harpswell, in the 1720s. The township included a section of mainland, Bailey Island, and several other islands in Casco Bay. During calm weather, the fishermen and their families who lived on the island would cross in their fishing boats to the mainland part of Harpswell, which was to the north, or would travel 14 mi (22.53 km) southwest through the waters of Casco Bay to Portland. Nevertheless, when storms arose, battering the island's rocky shores with large waves, and when ice floes occupied the bay in winter, travel to and from the island



The bridge is supported by cribwork, above, formed by stacking thousands of granite ties of varying shapes and sizes on top of one another. The crossing enabled the tide to pass freely through it and did not require the use of any timber or mortar. The Bailey Island Bridge, below, crosses a strait known locally as Will's Gut. Its girder span, near the center, makes it possible for boats to pass beneath it. Designed by Llewellyn N. Edwards, the cribwork rests on a ledge that extends between Bailey Island and Orr's Island.

was impossible.

Proposals were made many times in the 18th and 19th centuries to construct a bridge that would link Bailey Island with its nearest neighbor, Orr's Island, situated approximately 2,000 ft (600 m) north of Bailey Island. Orr's Island was already connected to the mainland by a 50 ft (15.2 in) bridge at its north end. The proposals were made at town meetings, which in many New England towns are still an important aspect of local government. However, at those meetings many residents of the town who lived on the mainland refused to finance a bridge that, as they saw it, would benefit only a small portion of the town's population. And since the mainlanders constituted the majority and no state or federal financing was available at the time, the proposals were repeatedly rejected.

Another reason the bridge proposals never made progress was that many Harpswell residents did not consider Bailey Island part of their town. Contributing to this point of view was the fact that many islanders used a ferry that bypassed Harpswell as it plied the waters to and from Portland. But during inclement weather, the ferry was confined to its berth and so was not an adequate substitute for a bridge.

In 1883 Harpswell's townspeople granted their

officials, or, in New England parlance, selectmen, the authority to design, construct, and maintain a bridge that would connect the islands of Bailey and Orr's. But perhaps because of

continued opposition by some of the town's mainlanders, the project stalled. It was not revisited until 1912, when it was raised in conjunction with a road that was to cross the

two islands. Although a bridge was not expressly mentioned, the selectmen described a "way" that connected the southern tip of Orr's Island with the northern tip of Bailey Island. The May 2, 1912, edition of the *Journal of Automobile Progress and Construction* stated that the road through Orr's and Bailey islands would include the construction of a timber bridge costing \$3,000. The cost was increased to \$25,000 at a later town meeting, and the bridge's composition was changed to stone and concrete, according to the journal. To help mitigate the cost of the bridge, the state passed a law in 1915 that provided funding for the state's highway and bridge projects.

Despite these windfalls, however, the bridge project stalled again, perhaps because of the continued opposition of the mainlanders, the fact that the U.S. Army Corps of Engineers was considering a plan to deepen the strait, or the country's involvement in World War I. This time, however, a lawsuit was filed by George B. Merrill, who at the behest of the selectmen had drawn up plans for a bridge but had never been paid for his work. The case eventually reached Maine's Supreme Court, which in 1921 ruled in favor of Merrill, although his design—the details of which are not known—would never be used.

Residents of Bailey Island remained cautiously hopeful, and their hopes were brought to fruition in 1927, when the construction of a bridge moved forward. It was no coincidence that Edwards was chosen to undertake the design. In addition to being the bridge engineer for the Maine State Highway Commission, he had designed a variety of bridges and rail lines in Canada as well as in New England. Edwards earned degrees in civil engineering in 1898 and 1901 from the University of Maine and became a bridge designer for the Boston & Maine Railroad as well as the Chicago & North Western Railway. By 1912 he had become a structural engineer for Canada's Grand Trunk Railway and had designed and constructed five bridges for the railway's Maine branch. He continued to design

bridges in Canada until 1919, when he began working for the U.S. Bureau of Public Roads as a senior highway bridge engineer. Two years later he became the bridge engineer for the Maine State Highway Commission.

Under Edwards's direction, the commission surveyed Will's Gut and determined that a ledge or reef extended between Bailey Island and Orr's Island. Portions of the ledge were exposed at low tide and the parts not exposed were not far below the surface. Edwards realized that he could not construct a bridge out of solid fill material with only a small channel to address the ebb and flow of the tide. One reason was that the tide came in rapidly and would undoubtedly have eroded the sides of any man-made embankment. Furthermore, the water redirected through the channel would have created a current strong enough to prevent small fishing vessels from passing through. Another concern was the effect of ice floes colliding with a timber structure as well as the corrosive effects of seawater on any mortar or concrete that might be used.

In addressing these obstacles and concerns, Edwards produced a bridge unlike any he had designed before. It would enable the tide to pass freely through it and would not require any timber or mortar. The bridge was to be supported by cribwork made up of thousands of granite ties of varying shapes and sizes. The stones would be transported to the jobsite from quarries in nearby Yarmouth, and the stone cribwork would rest on the ledge that extended between the islands.

The stone would be cut into ties that resembled those used to construct the open timber cribbing employed in dams and piers. Unlike wooden ties, however, the slabs of granite were irregular. As they were stacked on top of one another, workers cut and placed flat or wedge-shaped "pinning stones" in the uneven gaps to help transfer the loads more uniformly from stone to stone.

"The granite slabs were sufficiently heavy to withstand

the buffeting of wind and wave and the open cribbing or cellular construction permitted the tide to ebb and flow freely without



increasing in any appreciable degree the normal tidal current," Edwards stated later in his book *A Record of History and Evolution of Early American Bridges*.

The bridge was to be 1,120 ft (341.4 m) long, not including the approaches, and was to feature a concrete roadway 18 ft (5.5 m) wide. To facilitate boat traffic through the deepest channel of Will's Gut, a fixed span 52 ft (15.85 m) long supported by concrete T beams was constructed approximately 10 ft (3.1 m) above the elevation of the mean high tide.

The bridge was completed and opened to traffic in 1928 at a cost of approximately \$139,000. In June 2008 the Maine Department of Transportation began a project to repair the superstructure of the bridge and replace the dilapidated concrete deck. To provide access to and from Bailey Island, the agency erected a temporary bridge across Will's Gut, and the project is to be completed by November 2010. The Bailey Island Bridge is listed in the National Register of Historic Places and has been formally recognized by ASCE's Historic Civil Engineering Landmark Program. —*Brett Hansen*

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