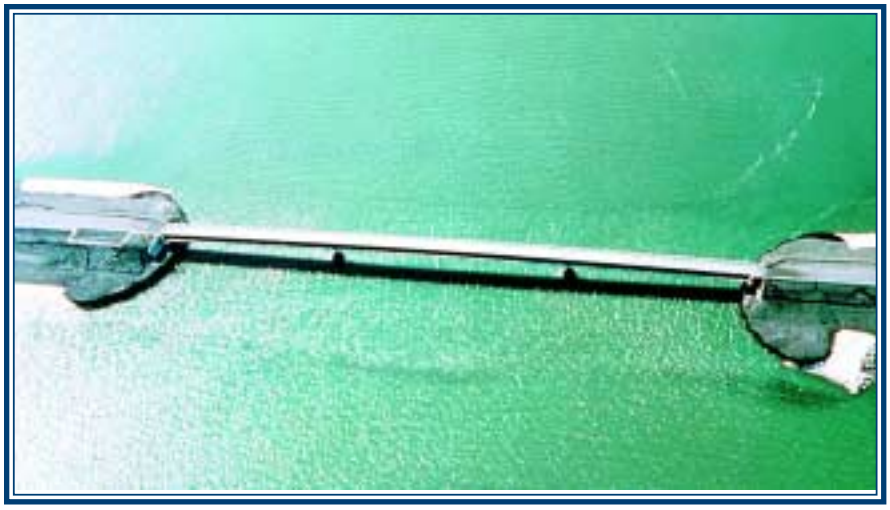
1996 Merit Bridge Award: Special Purpose Endicott Causeway Breach



Project Data

Steel wt./sq. ft. of deck:
120 lbs.

Cost:
$9 million

Steel Tonnage:
700

The construction of long, offshore gravel causeways from Alaska's North Slope oil fields has long been a concern of environmental groups, local fishermen and federal agencies. Because existing causeways have openings that total only a small percentage of their lengths, these groups have been concerned that natural fish migration has been impacted by these man-made barriers. After considerable negotiations, an agreement was made to require additional breaches. The bridge design and construction over these breaches is important since delays can have a significant cost and schedule impact on normal oil field operations.

A new 650' breach was recently opened in the Endicott gravel causeway in the Beaufort Sea near the North Slope of Alaska. Originally, the owner considered modifying the design of an existing 500' plate girder bridge along the same causeway to bridge the new breach. However, a value engineering study showed that a twin box-girder bridge, made of A-599 weathering steel, would have distinct advantages, including: reducing overall project costs by $8 million; allowing shipment of materials by truck instead of barge, which reduced shipping costs by $250,000; faster assembly due to a modular design using high-strength bolted splice plates with each piece limited to 60' so it could be trucked; and reduced maintenance costs due to the use of weathering steel. The bridge is designed for loadings of B-70 gravel haulers weighing 130 tons.

Fabrication and partial erection of the welded box girders was a critical element of the project. Careful match marking of girder splice plates and preassembly of girders and diaphragms allowed bridge erection to be accomplished under extreme weather conditions without fit-up problems.

Nelson studs were pre-welded to girders because the erection schedule would have required welding to have been conducted in the winter, which would have

required tenting against the cold and preheat of the girders. Weather conditions during bridge construction regularly reached -20 degrees F or less and wind speeds typically ranged from 15 to 20 mph.

Construction and field welding was performed during the winter because it was more cost effective to work from grounded ice than from barges or temporary fill. Installation of six foundation piles at a 2:1 (horizontal to vertical) batter to approximately 100' depths at each pier was the important first step of the project. Once the foundation piles and pier caps were installed, bridge erection could begin. Foundation piles were double-jointed to reduce field welding requirements and the pile caps, which were shop fabricated, were made with closely spaced internal radial stiffeners to provide a rigid pile cap against ice loads.

Once the pier and abutment caps were installed, sections of the three-span (215', 215' & 270') twin-girder bridge were erected. Partial girder assemblies were supported by welded temporary trestle towers. Erected girders were covered with temporary buildings and heat was applied to allow grouting of concrete panels to welded shear studs. After the bridge was erected, the frozen gravel causeway was then blasted and excavated leaving the original seabed elevation. The 16" diameter pipeline was then rerouted back onto the bridge. Total construction was approximately five months.

Project Team

Designer:
Petratrovich, Nottingham & Drage, Inc.
Anchorage

General Contractor:
Alaska Interstate Construction, LLC
Anchorage

Fabricator:
Westbridge Corporation
Vancouver, BC
Canada

Erector:
Sandstrom & Sons
Anchorage

Owner:
BP Exploration (Alaska), Inc.
Anchorage

Judges Comments:

"A very successful execution given the extremely challenging construction conditions"