KEYSTONE® HARDSCAPES

CASE STUDY MaxLock Paver

Completed Dutch Harbor UMC Dock Replacement project | *Source: PND Engineers*

City of Unalaska's Dutch Harbor Dock Replacement Project

Unalaska, AK

Situated on a remote island in the Aleutian chain on the stormy Bering Sea, the International Port of Dutch Harbor has become one of the busiest commercial fishing ports in the United States. Eight hundred air miles from Anchorage, it sits on a mile-long spit of land extending from the northeast end of Amaknak Island. The port is owned and operated by the City of Unalaska and is the economic heart and soul of this remote hamlet that spans both Amaknak and Unalaska islands.

ALASKA

Project:	Unalaska's Dutch Harbor Dock Replacement
Location:	Unalaska, AK
Owner:	City of Unalaska
Keystone Product:	MaxLock L-10 120mm Interlocking Paver
Producer:	Keystone Hardscapes
Total Paver Area:	105,000 sq.ft.
Civil Engineer:	PND Engineers
Installer:	BC Pavers

UMC dock replacement area | *Source: PND Engineers presentation to the public, 2016*

Docks in need of modernizing

In recent years the demand for Dutch Harbor's services has been steadily growing. Port authorities and the city council decided a major upgrade of the Unalaska Marine Center (UMC) was needed, one that would handle the increased traffic and larger container ships, more efficiently perform fishing vessel offloads, accommodate increasing cruise ship traffic, and improve safety. They contracted with PND Engineers, Inc., a full-service consulting engineering firm specializing in waterfront engineering, to begin conceptual planning that focused on two of the dock positions, aging structures that urgently needed modernizing. By early 2017, a massive $35 million replacement and expansion project was launched.

To modernize the UMC with a continuous, high-capacity dock along the entire dock structure, a PND proprietary OPEN CELL SHEET PILE™ bulkhead design was employed, a robust dock platform that matched several adjacent marine facilities. The upgrade plan included fender and mooring systems, 680 linear feet of pile supported crane rail, and 105,000 square feet of paver surfacing. PND performed the planning, design, permitting, construction administration and on-site inspection, with construction services rendered by Turnagain Marine Construction. On-site work began in mid-May of 2017 and was completed in January of 2019, a noteworthy achievement for all parties.

Multiple challenges involved in dock surfacing

The challenge for the dock surfacing aspect of the project was daunting: design a pavement behind a 50-foot-tall bulkhead fill dock that would perform well under the unusually high stress loads of large forklifts that maneuver ocean cargo containers, and accommodate minor settlement due to anticipated

UMC, after demolition of existing facility and halfway through the construction of the Open Cell bulkhead | *Source: Turnagain Marine Construction*

seismic activity in the area. The pavement system selected must withstand the continual stresses of forklift steer axles. It must also withstand the test of time in unfavorable climate conditions in a remote location that negatively impacts the ease of making repairs. And it must conform to the project budget.

Dock surfacing in the Aleutian Islands

Beyond seismic conditions, forklift pavement stress and climate conditions, the location of the port in the remote Aleutian Islands posed additional challenges for a traditional ready-mix concrete pavement option:

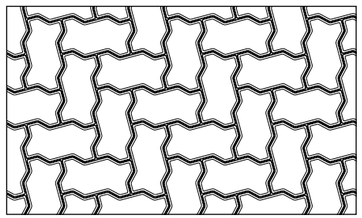
- Lack of quality raw materials on the island: any raw material sand and cement used in concrete construction would have to be barged to the island.
- Few suppliers and no asphalt plants on the island.
- Heavy annual rain and snowfall, and low overnight temperatures make scheduling poured-in-place concrete construction risky.
- An extremely high cost for ready-mix concrete because of these logistical obstacles.

Concrete block pavers prove to be the optimal solution

The many concerns had PND examining alternatives to concrete or asphalt surfacing. The bulkhead dock fill structure design provided stiff subsurface conditions which meant that a pavement system using pavers could be considered to surface the entire 2.5-acre dock extension without subgrade modification.

Ultimately, interlocking concrete pavers were selected during the design phase. PND implemented the lower-cost and more efficiently installed technology that is new to Alaska marine industries and saved the City an estimated $2 million. The specific paver chosen was the Keystone Hardscapes MaxLock L-10, a dentated paver with a 120 mm (4.72-inch) thickness. The paver series generates superior lockup and resistance to rotation and displacement, making it an ideal choice for industrial and other heavy-duty performance applications.

The paver mold was fabricated so that the pavers could be mechanically installed in a herringbone pattern.



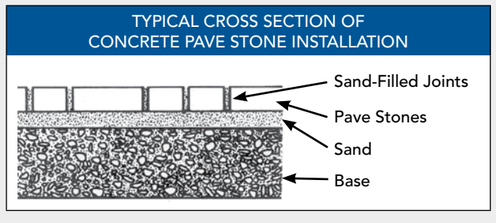
Herringbone Pattern

The high cost of ready-mix concrete for the dock surface caused PND to opt for interlocking pavers | *Source: PND Engineers*

Keystone's MaxLock pavers were the lower-cost, more efficiently installed pavement, and new to Alaska marine industries | *Source: Keystone Hardscapes*

Keystone Hardscapes MaxLock paver series

Unit height sizes:
60mm, 80mm, 120mm



Interlocking concrete pavers offer several distinct advantages over alternative poured-in-place pavements.

ADVANTAGES:

- Short of a heavy rain event or frozen subgrade conditions, pavers can be installed without delays or interruptions.
- Pavers are manufactured in climate-controlled conditions; temperature and rain on the day of installation have no effect on the psi strength of the pavement, resulting in consistent high quality.
- Interlocking concrete paver pavements can be designed as a 30-year pavement.
- For underground utility repairs, pavers can be pulled up and then re-installed when the work is complete, leaving no visual evidence of the repair.
- Additional economies are possible by purchasing and transporting pavers to the site in large lots. They can be stored for future installation as time and budgets permit.

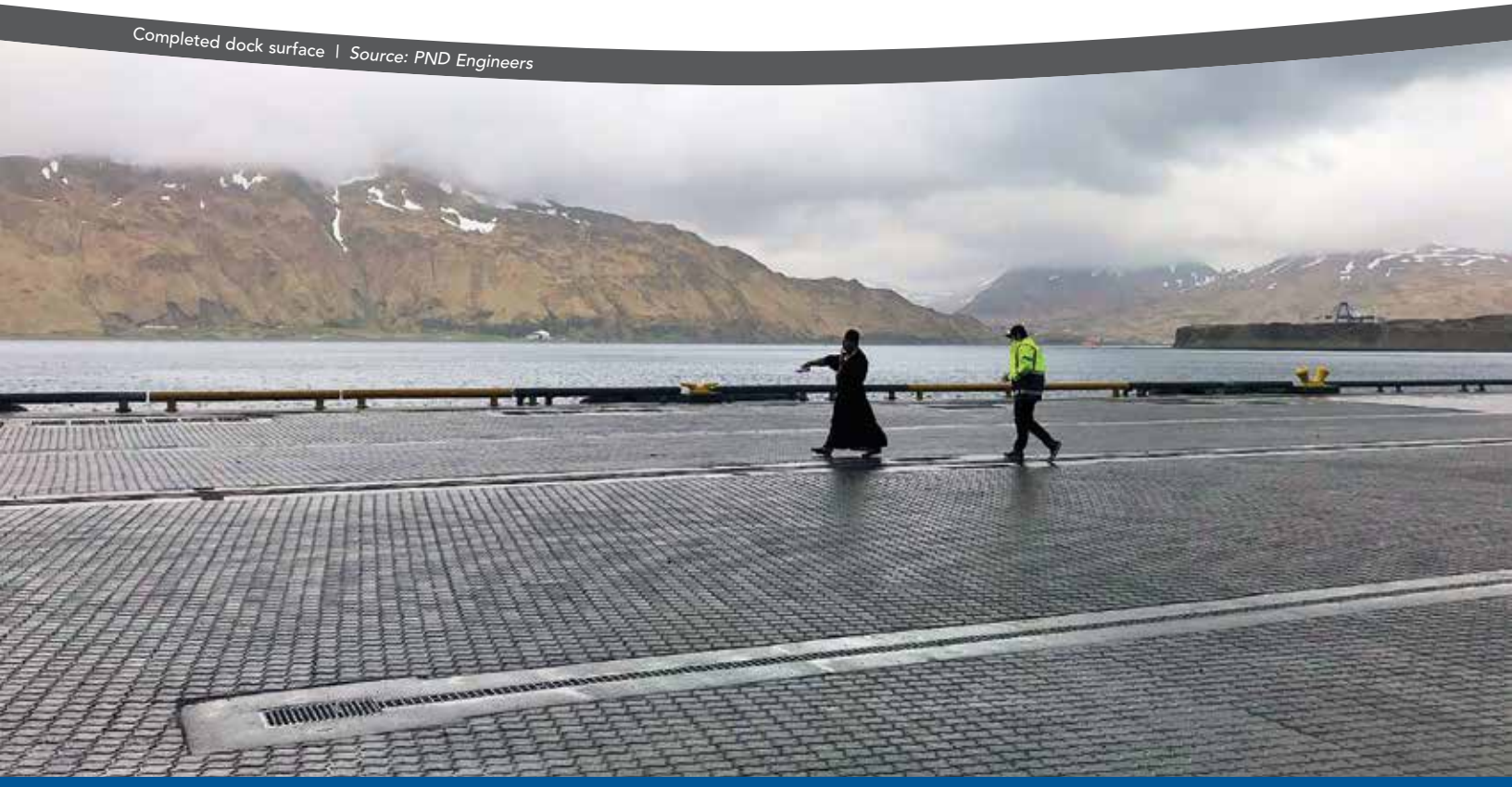
Paver units were manufactured in Portland, Oregon, and transported to Seattle. When all one hundred truckloads were staged, Turnagain Marine Construction, the general contractor, arranged a single barge to make the 1,800-mile voyage to Dutch Harbor. BC Pavers, Renton, Washington, was awarded the subcontract to install the pavers. Installation began in October 2018 and was completed before year-end.

Great expectations for Unalaska's port

A novel approach to the dock replacement surfacing proved to be an important technological and cost-saving design innovation. At the ribbon-cutting ceremony marking completion of the two-year project, optimism and favorable forecasts abounded. Port Director Peggy McLaughlin and Robert Lund, city engineer at the time, agreed that the paver surfacing has been performing to expectations. Port administrators for the other forty ports and docks in Alaska noted this first use of interlocking concrete pavers and may explore the option on future port renovations and expansions.

MaxLock paver pavement was installed in a herringbone pattern | *Source: PND Engineers*

Paver installation - 90% complete | *Source: PND Engineers*



Completed dock surface | *Source: PND Engineers*