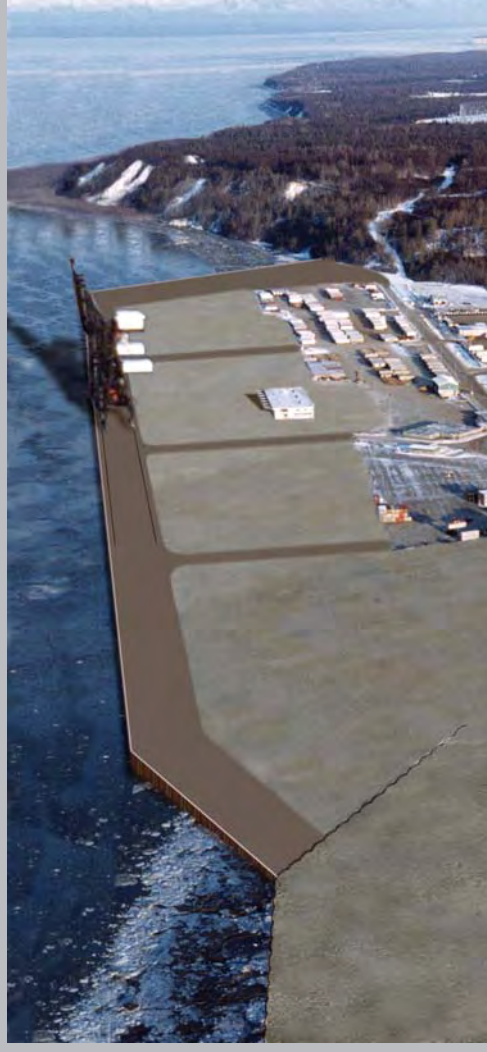


OPEN CELL
SHEET PILE® TECHNOLOGY

OPEN CELL® SYSTEM

The OPEN CELL bulkhead is used primarily on docks and similar structures. The system functions as a horizontally-tied membrane relying solely on the vertical flat sheet pile anchor wall (tailwall) to restrain a curved flat sheet pile arch face.

GERDAU & LB FOSTER

PND research has included working with Gerdau Ameristeel, a U.S. manufacturer of flat sheet piles. Gerdau Ameristeel produces an improved version of the original PS31 and PS27.5. Since Gerdau Ameristeel and its distributor, L.B. Foster Company, became interested in the OPEN CELL concept, they have actively promoted its use with their clients as a cost-reduction incentive on many projects.

PATENTS

PND has spent years testing, observing, and refining the OPEN CELL system and holds all related information to be proprietary. The OPEN CELL system is patented, holding patents # US-6, 715, 964 B2 and # US-7, 018, 141 B2.

ACCOLADES

"The City of Nome now has three OPEN CELL bulkheads in its port system. These structures are exposed to the open ocean environment where waves can reach 14 feet and sea ice can be 5 feet thick! After ten years of such exposure, the OPEN CELLS are performing well." - City of Nome (Alaska)

"Regarding the Barge Docking Facility in Council Bluffs, Iowa, we are pleased to inform you that we have finished offloading work of four barge shipments so far and will be receiving six more barge shipments this year. As designed very well by PND, we managed to offload the oversized cargoes from the barges at this Barge Docking Facility giving us efficent crane, self- propelled trailer work area as well as temporary cargo storage area with sufficent ground capacity." - Hitachi Transport System (America), Ltd.

"The OPEN CELL design provides an uncomplicated structure which saved considerable cost over the alternative tied-back cantilever wall system. The structure has required no significant maintenance - even with our heavy use. Our pile driving crew had no previous OPEN CELL experience - construction was completed successfully without significant problems." - KFM (Kiewit FCI Manson)

"OPEN CELL construction afforded us the opportunity to complete the intricate harbor installation ahead of schedule despite unforeseen ground conditions encountered over a significant portion of the project." - Richard Goettle, Inc.

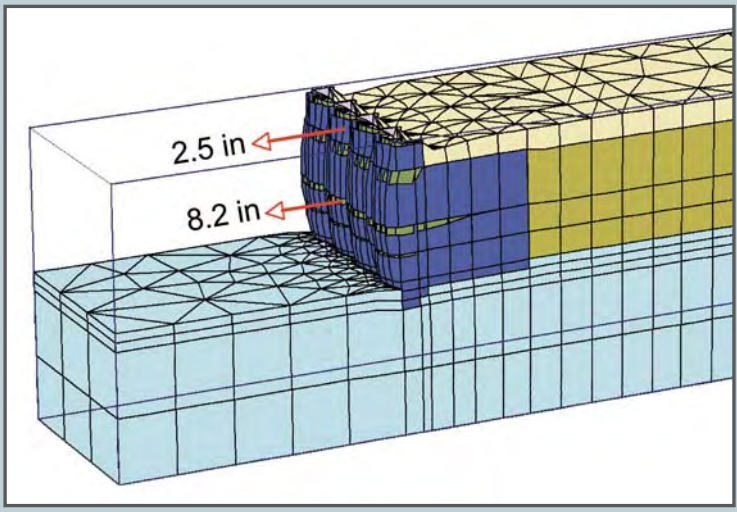
"The OPEN CELL bulkhead system permitted us to keep our project on schedule and was the lowest cost option for providing a grade change structure." - Burns & McDonnell

ON THE COVER:

PORT OF ANCHORAGE EXPANSION PROJECT ANCHORAGE, ALASKA
Port of Anchorage

Existing platform docks are being replaced with 8,000 feet of OPEN CELL SHEET PILE bulkhead dock creating 135 acres of upland staging area in five phases to be completed by 2015.

A rigorous geotechnical analysis included multiple methods involving both classic analysis and numerical methods that provided consensus of results. Due to seismic activity in the area, a subduction zone event was considered with time histories developed that extend for four minutes, with energy input larger than the 1964 Great Alaska Earthquake. The Maritime Administration, the local Geotechnical Advisory Committee, the Alaska district of the ACOE and the Engineering Research Development Center (a research arm of the ACOE) provided oversight.

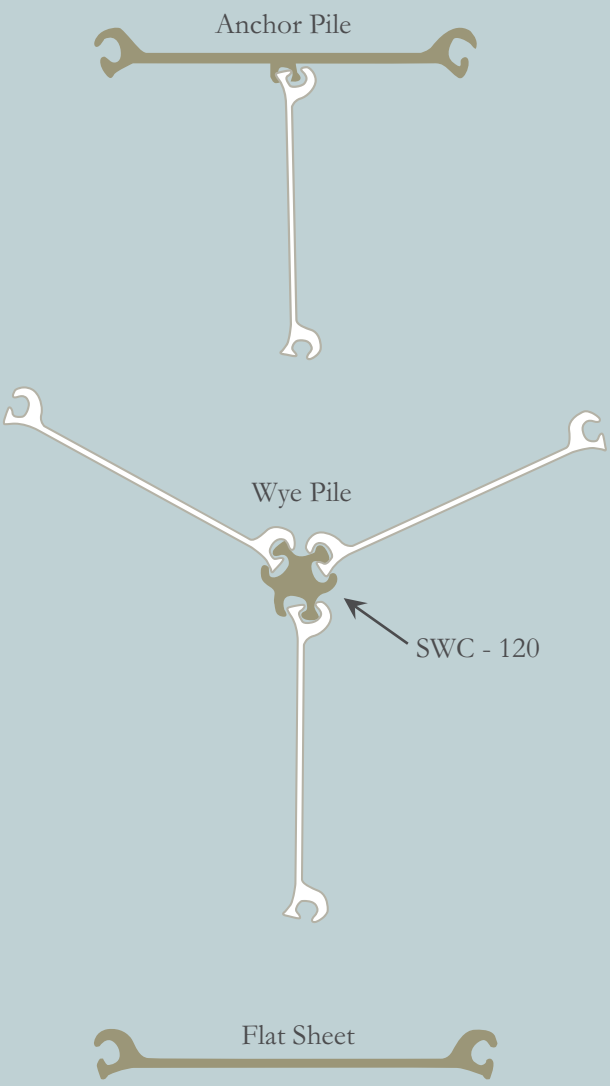


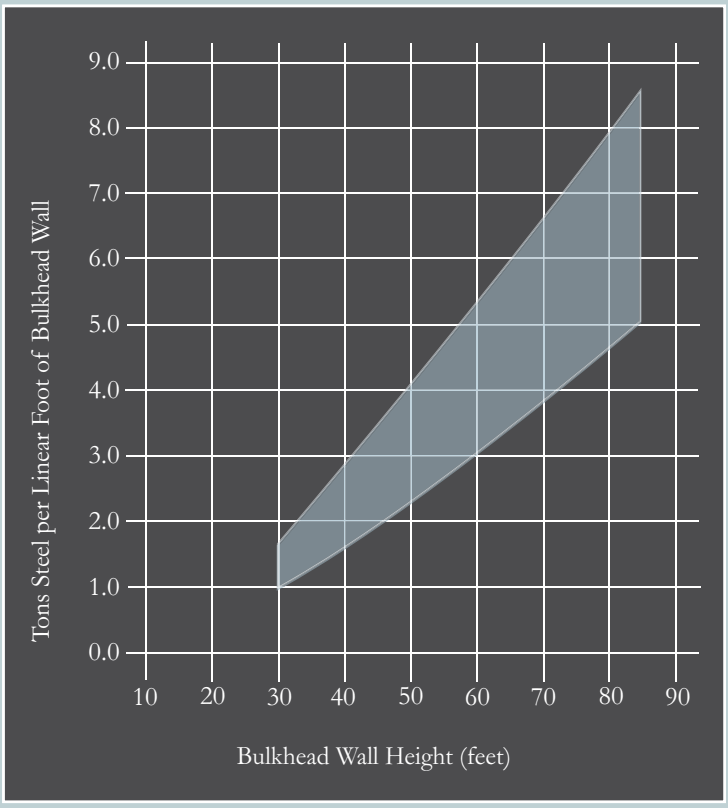
PROJECT LOCATIONS

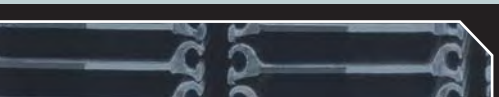
OPEN CELL structures are found throughout various locations with over 160 completed projects.

OPEN CELL® COMPONENTS

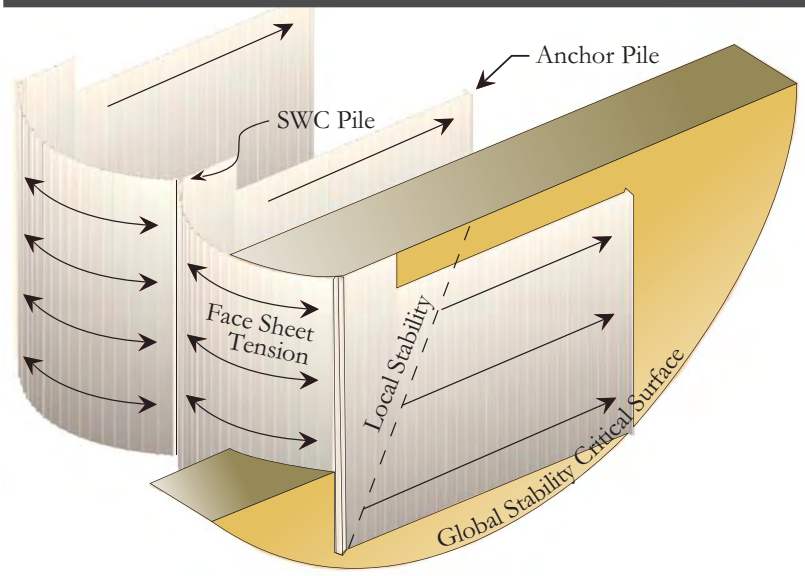
The OPEN CELL system utilizes flat sheet piles manufactured by Gerdau Ameristeel and extruded connectors manufactured by Pile Pro. The simplicity of the design and durability of the materials allow PND Engineers to adapt the OPEN CELL system to many uses and conditions.







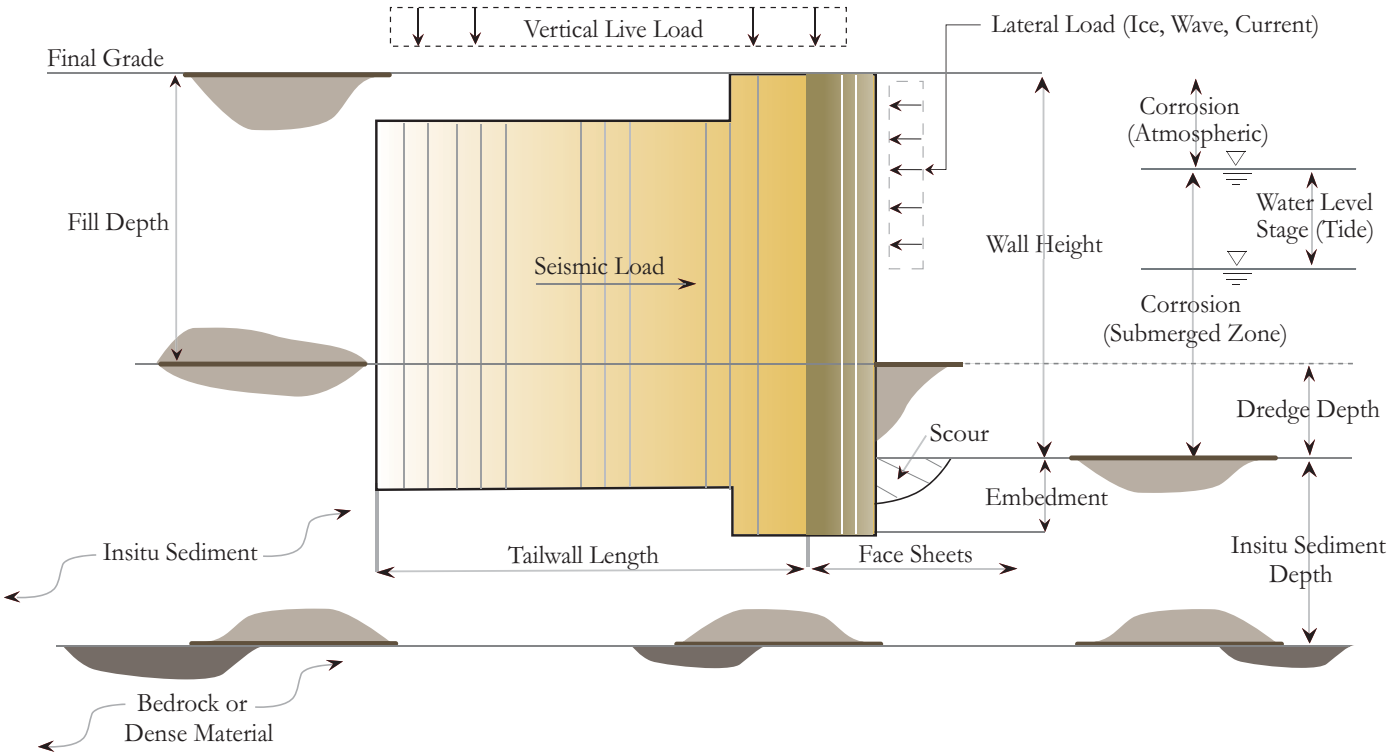
OPEN CELL STABILITY



OPEN CELL PERFORMANCE

The OPEN CELL system performs very well in a variety of conditions:

- High Loads
- Deep Water
- Soft Soils
- Minimal Embedment
- Scour
- Ice
- Seismic Conditions
- Long-Term Settlement



SABINE PASS LNG TERMINAL CAMERON PARISH, LOUISIANA
Cheniere Energy, LLC

PND provided design and construction support services for construction of an approximately 1,350-foot OPEN CELL bulkhead at the Cheniere Energy Sabine Pass LNG Terminal. The bulkhead was designed so it could be dredged or experience scour to elevation -45-ft creating a wall height of 55-ft.

ARGOSY CASINO BULKHEAD LAWRENCEBURG, INDIANA
Argosy Gaming Company

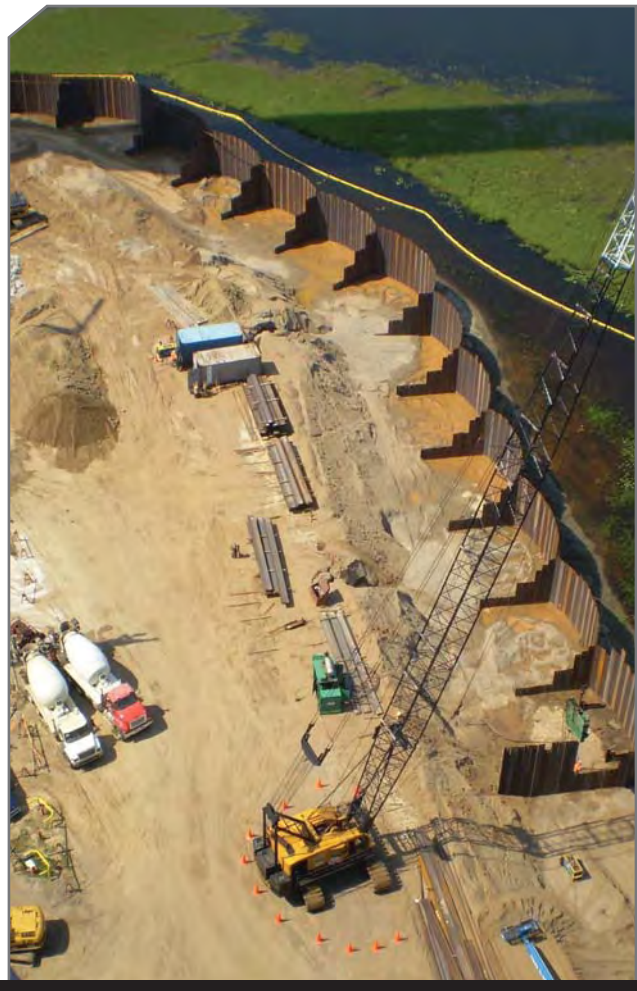
The facility in Lawrenceburg, Indiana has been expanded with a larger, second riverboat casino. PND designed a unique bulkhead to create a new slip for the larger floating casino, while keeping the original one in service. The OPEN CELL SHEET PILE system was used to create a 30-ft wide "back-to-back" wall between the existing slip and the new slip resulting in a more cost effective wall system than a closed cell system or combi wall. The new slip is 250 ft by 500 ft and entailed 2,000 lineal feet of steel sheet wall driven through the silt and clay soils. The sheetpiles were driven prior to dredging of the new slip.

TAMPA BERTHS 1 & 2 TAMPA, FLORIDA
Tampa Port Authority

An OPEN CELL bulkhead was used to encapsulate a failing bulkhead. In additon, the bulkhead design allowed for dredge depth to be increased from -28-feet to -38-feet which coincided with the level of bedrock. Tailwalls were extended through the existing bulkhead which was first separated with a splitter pile.

BOSWELL SITE BULKHEAD COHASSET, MINNESOTA
Minnesota Power - Duluth, Minnesota

PND provided Minnesota Power Authority and their lead consultant, Burns & McDonnell a containment wall around their newly expanded facility in Cohasset, Minnesota. PND reviewed the solution requirements and determined that an OPEN CELL SHEET PILE structure would be effective to both reduce the construction cost and bring the project in on schedule. Unique for this project, for a length of 300 feet, approximately 15 feet of peat was removed from below water and replaced with sands and gravels prior to driving the sheet piles. Following the sheet pile placement, this material was then vibracompacted for the final structure.



DUTCH HARBOR MARINE TERMINAL DUTCH HARBOR, ALASKA
DH Ports, LLC

The Dutch Harbor Marine Terminal was designed as a 100-year facility in a highly active seismic area and provides a dramatic advance in seafood trans-loading and cold storage technology for Dutch Harbor, the largest seafood producing port in the United States. The OPEN CELL SHEET PILE dock facility was determined to be 50 percent less expensive than the competing dock design and was developed from concept design to completed construction (quarry development, sheet pile and fill installation) within a nine-month period. The dock provides 46 feet of draft and created over three acres of usable uplands. Existing materials are characterized by soft soils over shallow bedrock.

NORTHSTAR ISLAND BEAUFORT SEA, ALASKA
BP Exploration (Alaska), Inc.

This project incorporated a 360-foot-long OPEN CELL bulkhead at the south end of Northstar Island. The dock provides deepwater access to the island while still providing ice resistance and scour protection. This project earned the Pile Driving Contractors Association's first "Driven Pile Project of the Year Award" in its inaugural competition in 2001.

NORTHSTAR DOCK ANCHORAGE, ALASKA
BP Exploration (Alaska), Inc.

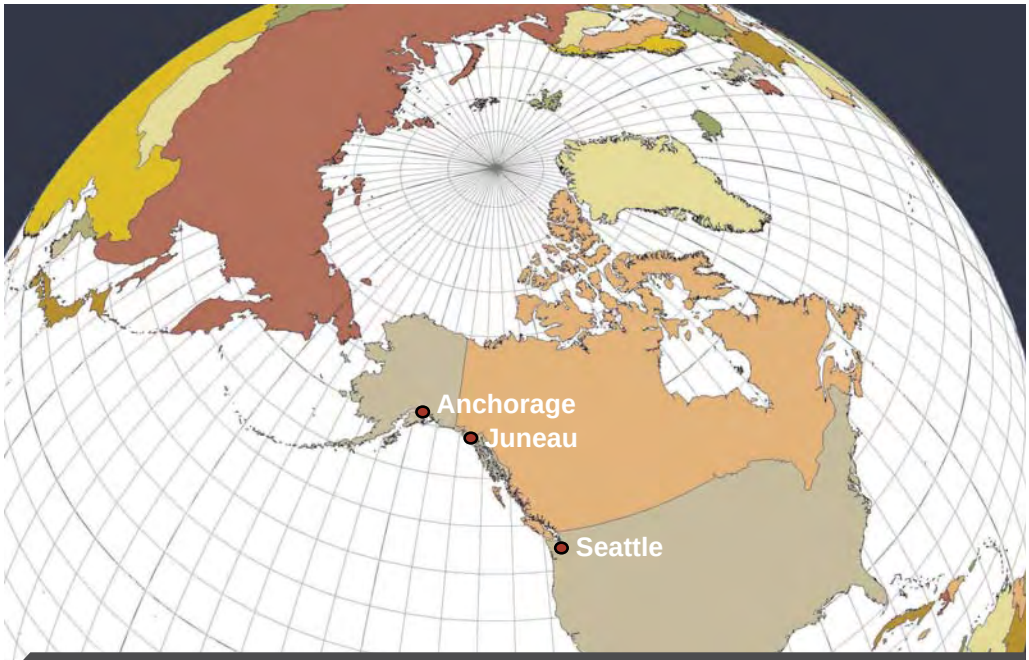
Underlying soft marine sediments were encountered at the Port of Anchorage site designated for prefabricated oil field modules bound for the North Slope. An OPEN CELL bulkhead provided the dock structure to support a transfer of 2,500-ton modules onto barges.

AMERICAN CONSTRUCTION BULKHEAD
TACOMA, WASHINGTON American Construction Company

The shoreline at this site in Tacoma was littered with a deteriorated timber bulkhead and stubs of broken treated timber piles. The new bulkhead encapsulated the existing piles and timber bulkhead and supports a rail mounted Whirley crane.

KFM STOCKTON BARGE SLIP STOCKTON, CALIFORNIA
KFM (Kiewit FCI Manson)

The barge slip was designed for the transportation of precast concrete bridge segments to be used for the East Span Replacement of the Oakland Bay Bridge. The OPEN CELL SHEET PILE barge dock was designed for a vehicle operating weight of 1,345 tons in the soft silty clay soils found at the site. The OPEN CELL SHEET PILE barge dock was utilized at this site because of its lower cost than other dock options, such as tied-back walls, that were investigated.



PND Office Locations

PND Engineers, Inc. is a consulting engineering firm that provides civil, marine, geotechnical, structural, surveying, construction engineering, and construction inspection services for a wide range of projects. The firm was founded in 1979, with offices located in Seattle, Washington, Anchorage and Juneau, Alaska.

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