OPEN CELL SHEET PILE® TECHNOLOGY

Presentation to Alaska State Legislature,
House Finance Committee

PND ENGINEERS, INC.

OPEN CELL SHEET PILE® Technology

Retaining Wall System

ARRC Dock, Seward, Alaska

- Low sensitivity to scour
- Easy modifications
- Minimal embedment required
- Stable in large seismic events
- High load capacity
- Allows high wall heights
- Accommodates soft soil or shallow bedrock

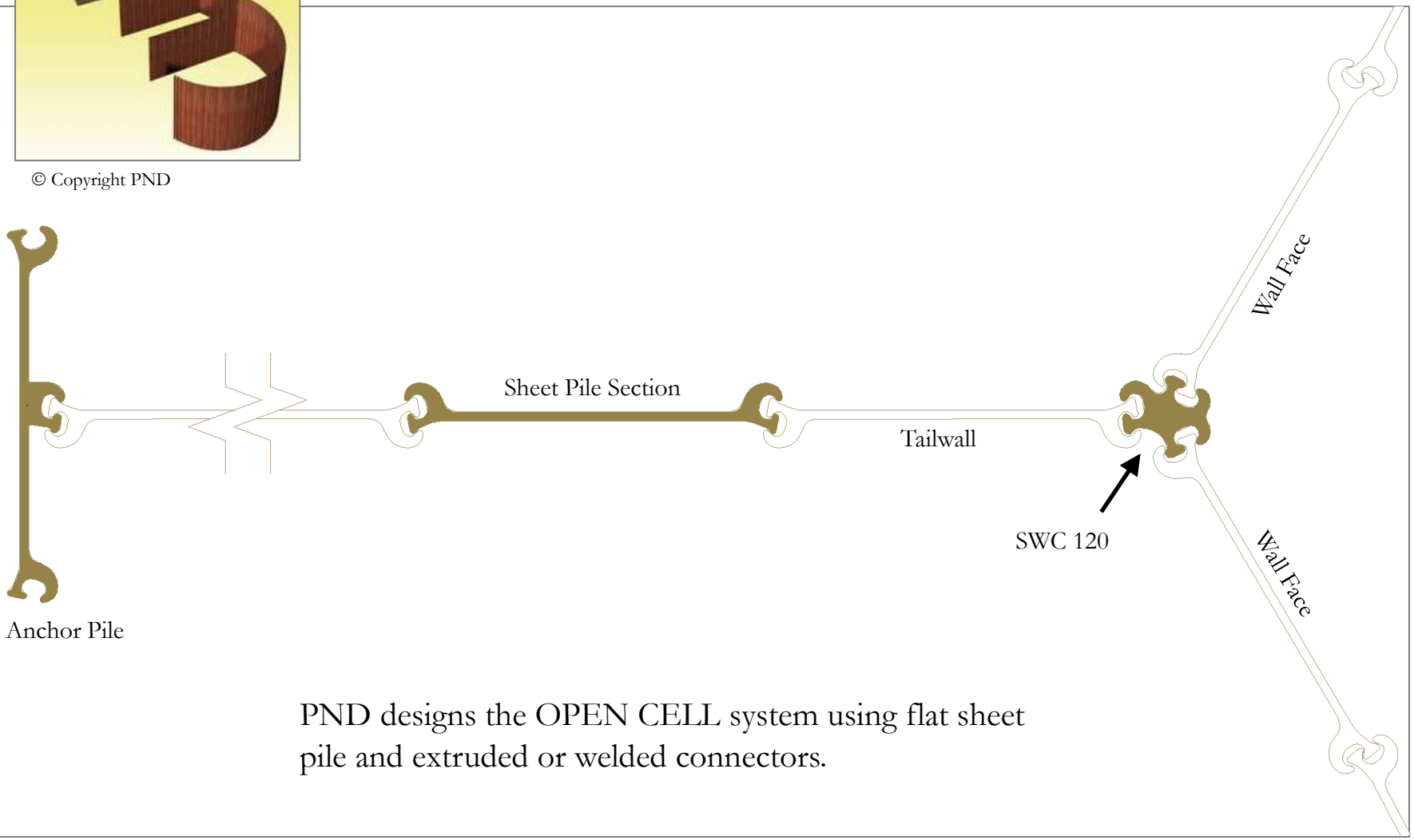
Patents Obtained by PND Engineers

Patent 6.715.964 B2

Patent 7.018.141 B2

Patent 7.488.140 B2

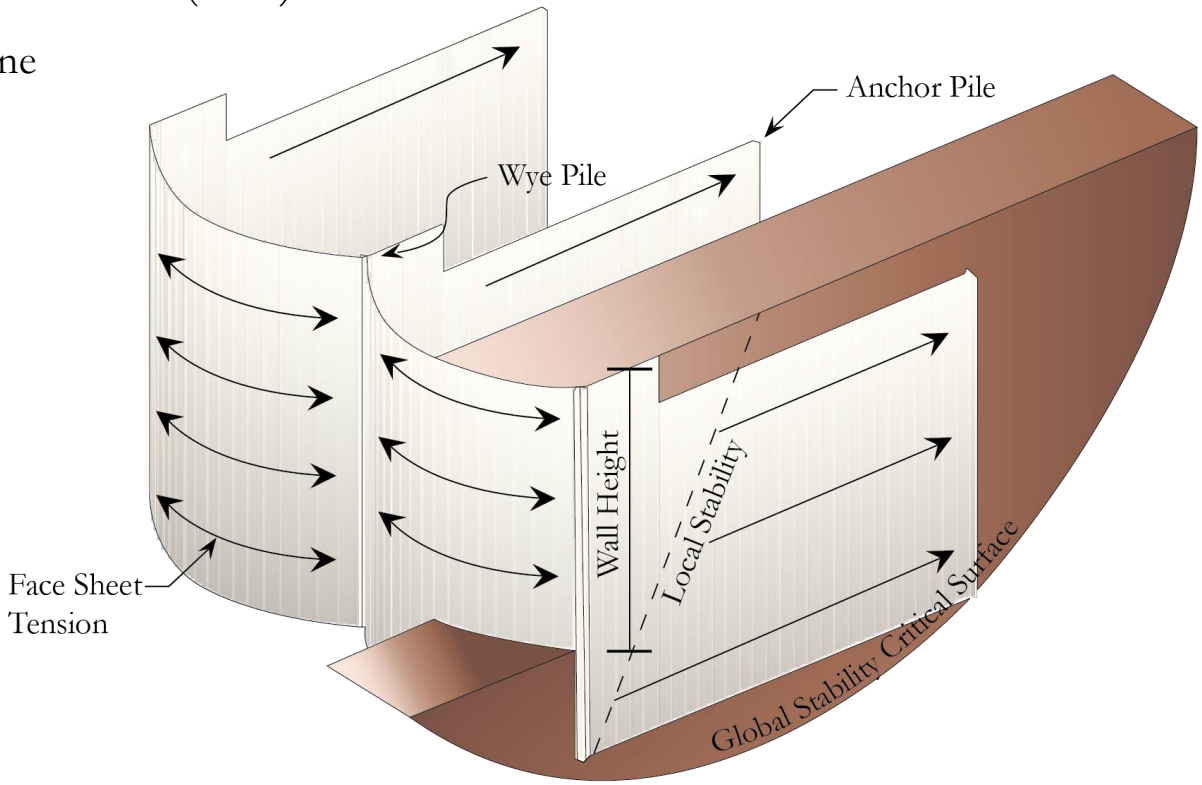
OPEN CELL Components



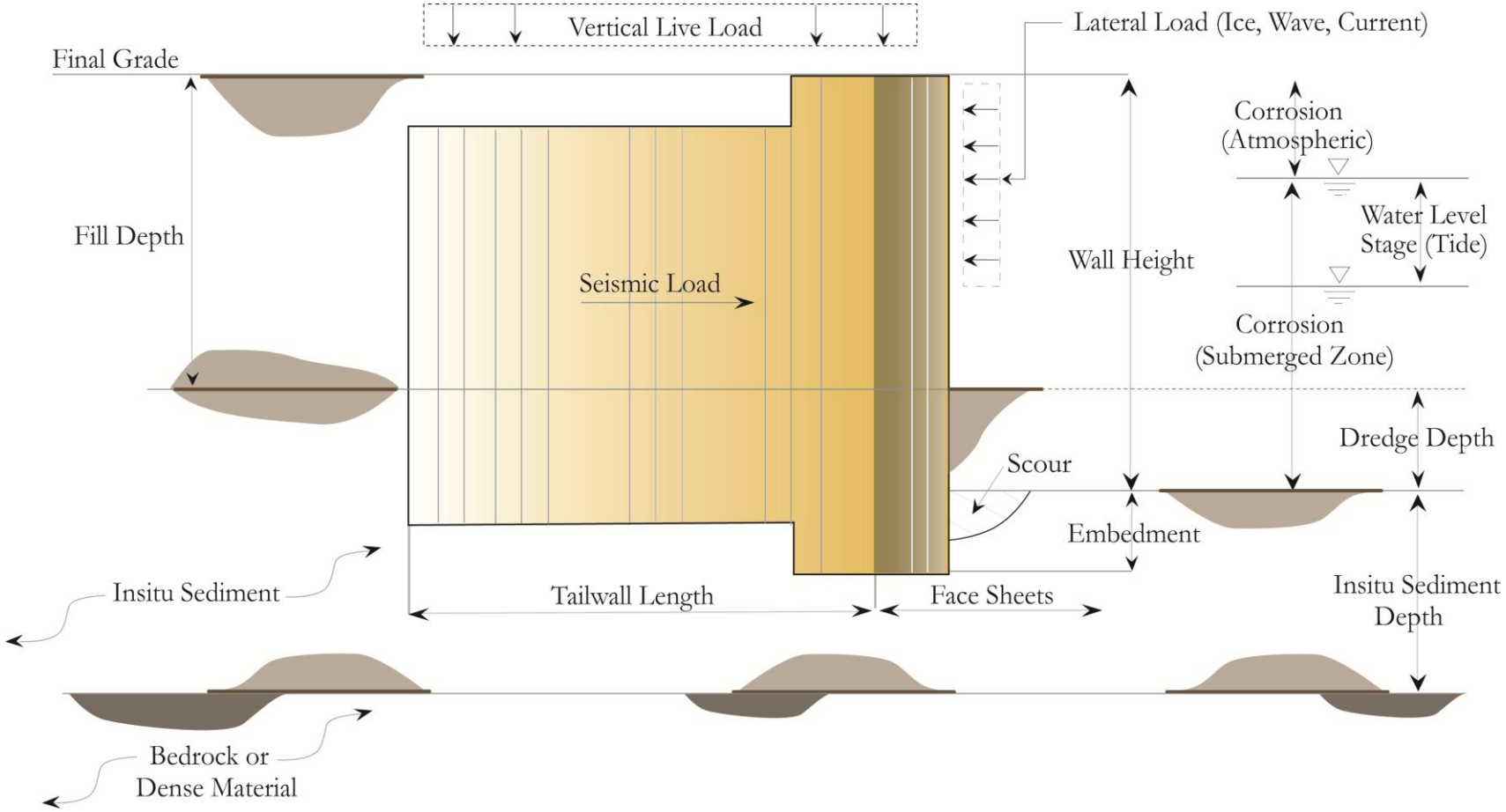
PND designs the OPEN CELL system using flat sheet pile and extruded or welded connectors.

OPEN CELL Structural Stability

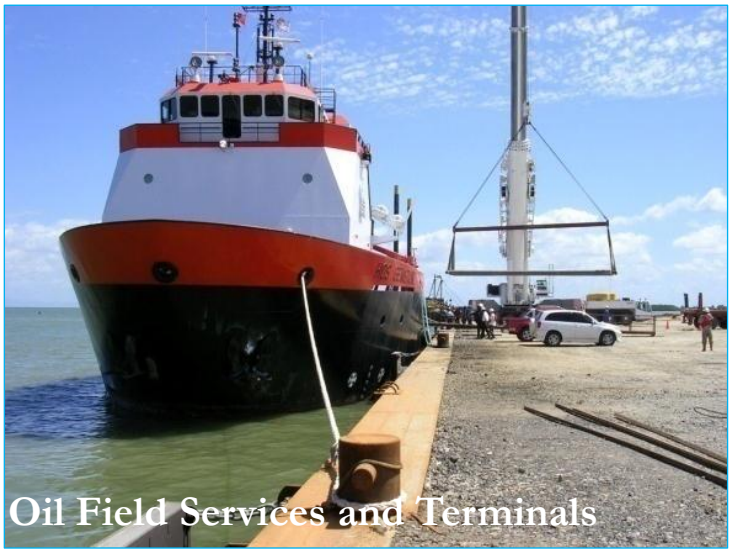
- Retaining Structure
- Mechanically Stabilized Embankment (MSE)
- Horizontally Tied Membrane
- Vertical Anchor Wall
- Arched Face

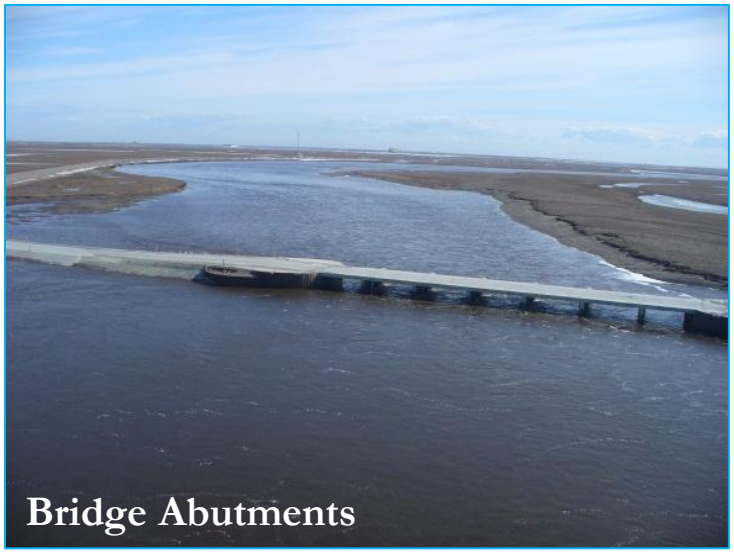


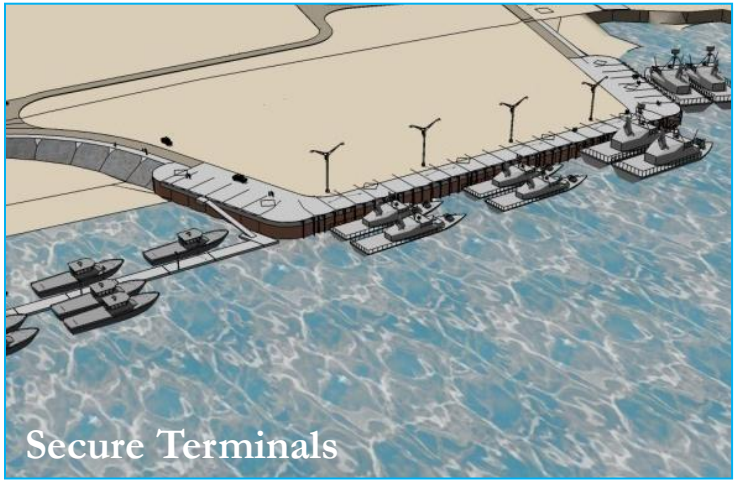
OPEN CELL Performance



OPEN CELL® Applications


Oil Field Services and Terminals


Bridge Abutments

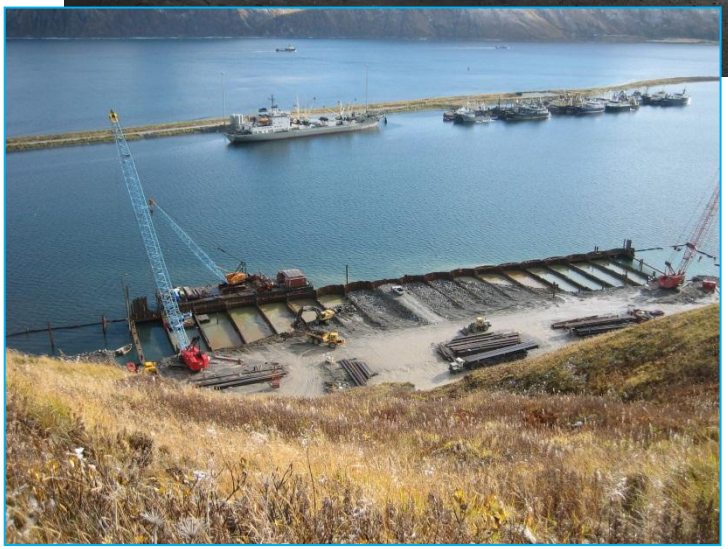

Secure Terminals


LNG Terminals

OPEN CELL System Locations

OPEN CELL structures can be found around the world, with over 185 completed structures
(Projects outside North America, and in planning phases, are not shown)

Kloosterboer Dutch Harbor Marine Terminal | Dutch Harbor, AK



- Seismic activity
- Soft soils
- Shallow bedrock
- Cost savings
- Fast construction, 9 months
- Wall height: 52 feet (+12 to -40)

Port MacKenzie Deep Draft Dock | Cook Inlet, AK

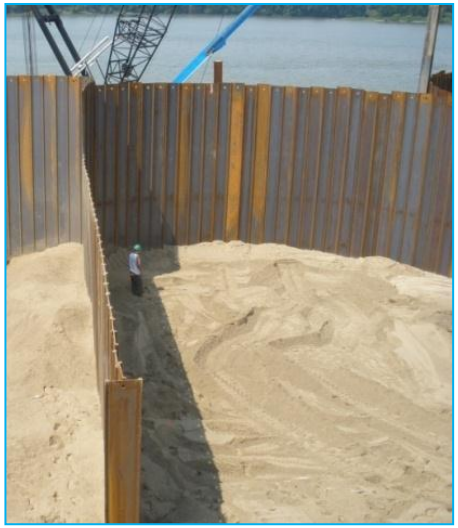
- Port MacKenzie (built offshore) used granular fill to depths of 20 m (65 feet). Material below the waterline was vibracompacted, while upper layers were roller compacted.

Liberty SDI Development | Prudhoe Bay, AK

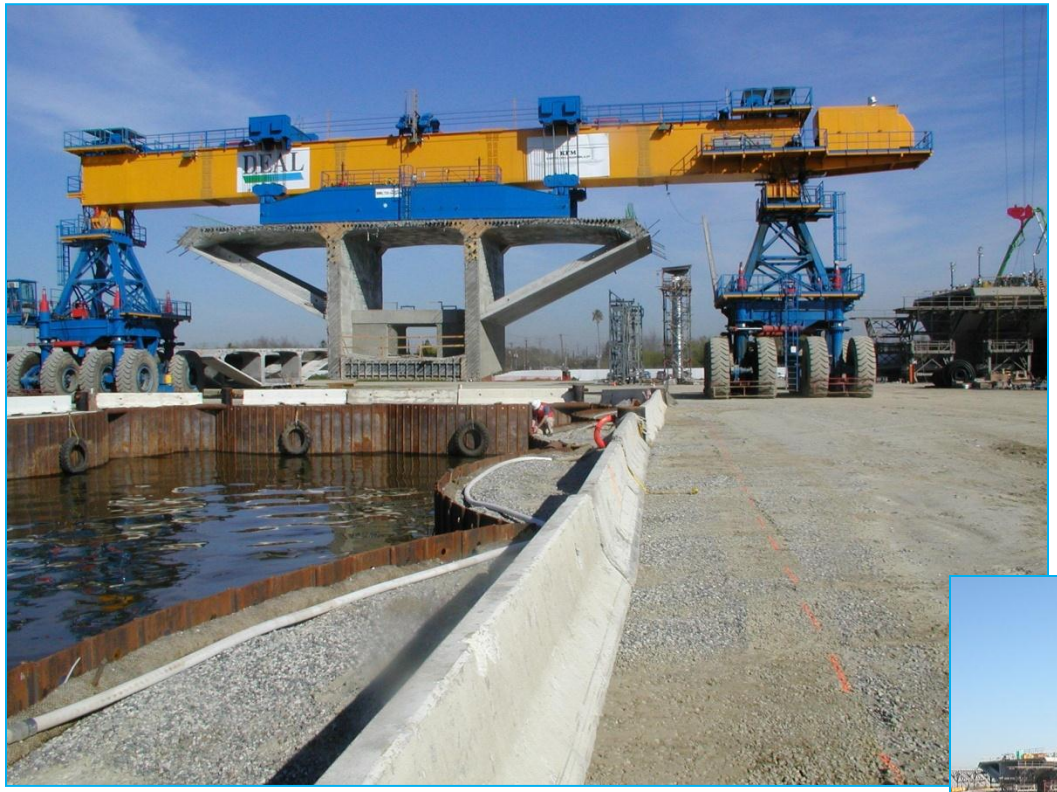
- Gravel island expansion designed and constructed to support BPXA's Liberty Development
- PND design effort consisted of the 200-foot-long OPEN CELL SHEET PILE perimeter, heavy load capacity dock, conductor piles, and module foundations
- Wall height: approx. 25 feet
- Designed to withstand impact from sea ice

Owensboro Riverwall | Owensboro, KY

- VE Project
- Waterfront park & land reclamation
- Variable soil conditions
- Wall height varies across site, from 8 to 31 feet

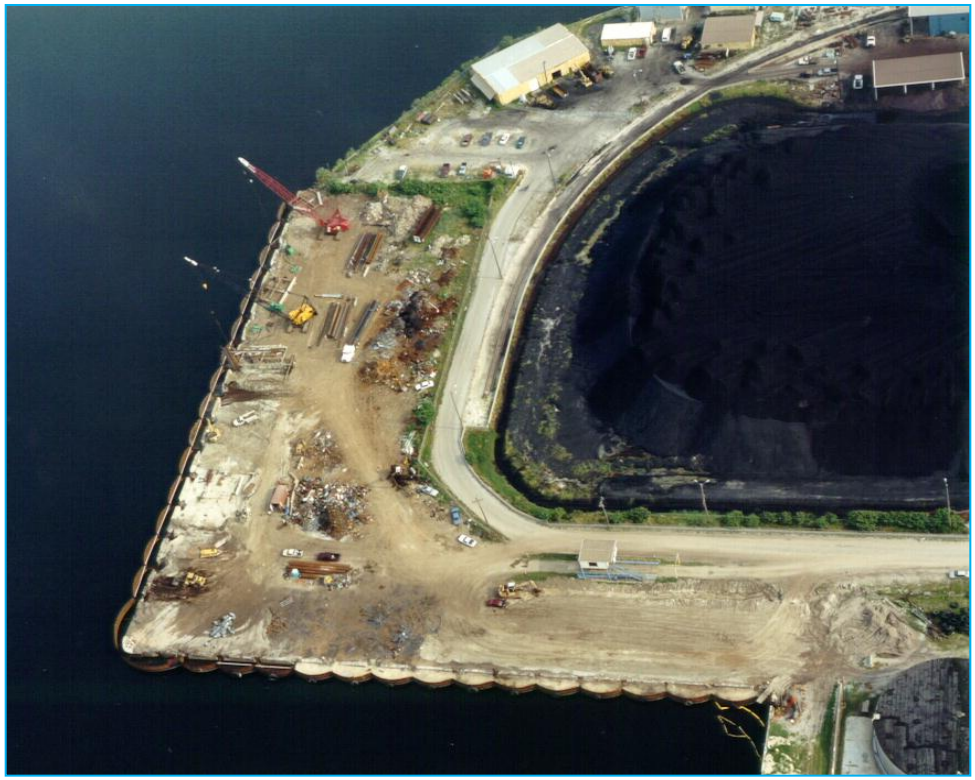


K-F-M Loadout Slip | Stockton, CA



- This bulkhead created a barge slip at a casting yard for Oakland Bay Bridge precast elements and accommodated 1,400-ton traveling loads, equivalent to 10 ksf.
- Wall height: 28.5 feet
- Temporary facility – has been removed, site returned to previous condition

Tampa Port Berths 1&2 | Tampa, FL



- Encapsulated existing bulkhead
- Increased dredge depth
- Wall height: approx. 40 feet

Sabine Pass LNG Terminal | Cameron Parish, LA

Expansion of LNG Terminal Ship Basin

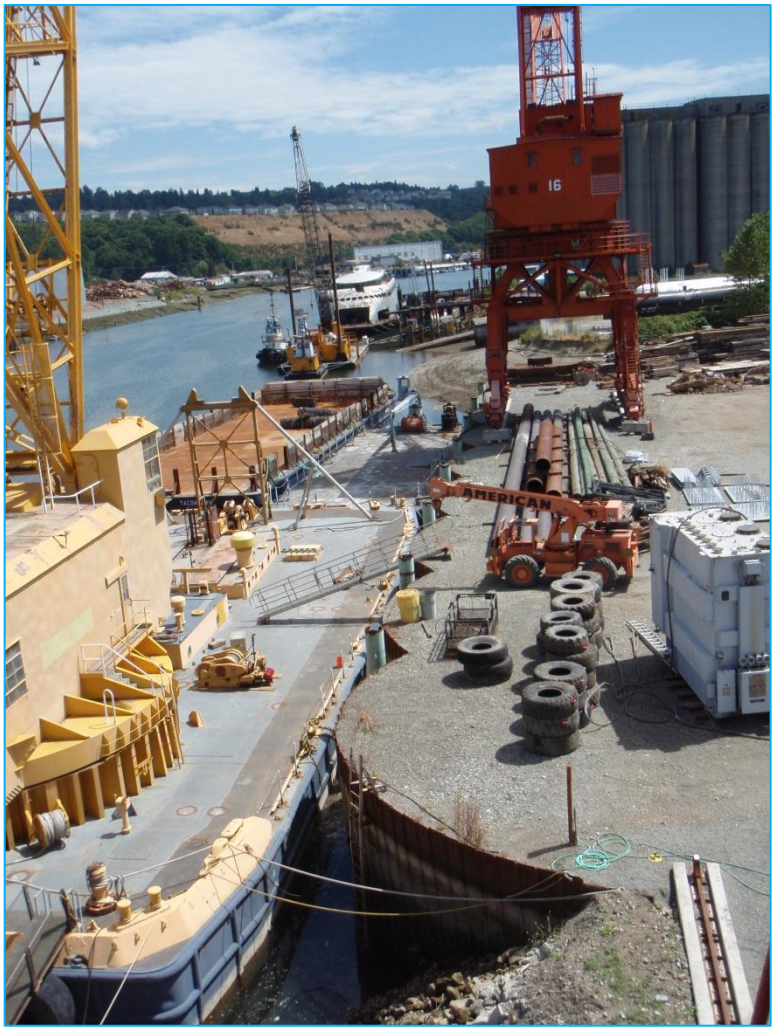
- Soft soils
- Excavated
- 45-foot face

Minnesota Power Station Bulkhead | Cohasset, MN

- Expanded site into Blackwater Lake
- Partially filled over peat
- 787-foot long wall

American Construction Dock | Tacoma, WA

This 266-foot long OPEN CELL bulkhead encapsulated contaminated materials and an existing creosote-treated timber bulkhead. It was designed to support a crane rail system



Hugo Neu Schnitzer Bulkhead | New York Harbor, NJ

Before

After

- Recycling facility
- Replaced dilapidated, existing timber structure
- Provided more upland area for facility, heavy equipment, and recyclable materials
- Built within six months

Port of Anchorage Terminal | Anchorage, AK

- Container Terminal
- 90-foot face; 1,745 feet long
- High seismic

Argosy Riverboat Casino Terminal | Laurenceburg, IN

- Back-to-back OPEN CELL wall
- 2,187-foot long slip for permanently moored floating casino

Umm Qasr Pier and Seawall | Umm Qasr, Iraq

- Iraq Navy facility, first to be completed in post-war Iraq
- Soft soils, with minimal geotechnical information
- 1,200-foot long OPEN CELL seawall

OPEN CELL Technology: Unique Applications | Skagway, AK

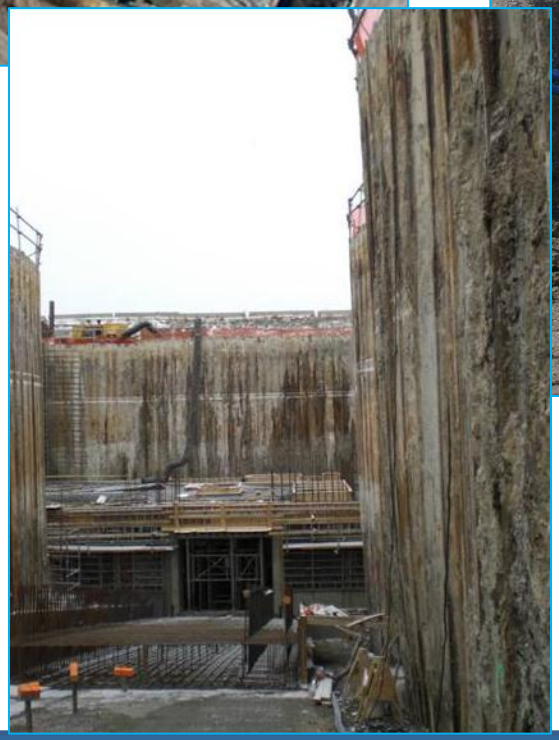
Broadway Cruise Ship Dock OPEN CELL Bulkhead

OPEN CELL bulkhead under construction with culvert penetration

Fish ladder after construction

- Pipelines and utilities can penetrate the OPEN CELL sheets.

OPEN CELL System Applications: Cofferdam



- Deep excavation development
- Eliminated need for expensive shoring work
- 40-foot high walls
- 100-foot trench

OPEN CELL System: Construction Sequence

PND co-founder Dennis Nottingham on-site of OPEN CELL construction at Northstar Island

OPEN CELL Structure Construction

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Offshore Islands

Northstar Island Offshore Oil Production Island

- 360-foot-long bulkhead, OPEN CELL expansion in progress
- Deepwater access, ice resistance, scour protection
- High load module offload

Alternative Intake Structures

- 540-foot long bulkhead
- Part of a water intake structure

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