O-Pile® Technology and Uses

Marine and Water Environments

Ports
- Quay Walls
- Dock Constructions
- Roll-on / Roll-off Facilities
- Dolphins

Waterways
- Waterway Supports
- Retaining Walls
- Erosion Control
- Berth Facilities
- Scour Protection

Water Engineering Structures
- Locks
- Weirs
- Bridge Abutments
- Culverts
- Safety Gates
- Flood Protection Walls
- Pier Foundations

Environmental

Pollution Control
- Landfills
- Enclosures
- Contaminated Sites
- Vertical-sealed Enclosure Walls
- Excavations for Soil Replacement
- Tank Enclosures
- Refuse Tipping Ramps

Water Protection
- Pumping Stations
- Sewage Works
- Storm Water Overflow
- Storm Water Retention Basins

Noise Abatement
- Noise Protection Walls

Civil

Civil Engineering
- Site Excavations
- Foundations
- Trench Piling
- Underground Parking
- Erosion Control

Transportation

Road and Rail
- Support Walls
- Bridge Abutments
- Ramps
- Sunken Roads
- Groundwater Retention

PilePro

O-Pile

Unmatched Efficiency
in High Capacity Walls

O-Pile.com

The O-Pile Alliance

The goal of O-Pile, as the authorized partner of Pipe Sheet Pile projects, is to establish franchises in global markets via local pipe plants whereby 75% of steel wall systems are sourced locally and the balance is provided by the O-Pile partners.

There are only a handful of countries in the world where Flat, Z- and U-shaped steel piles are manufactured, whereas pipe factories are abundant worldwide. Therefore, a construction project using Pipe Sheet Pile will almost always utilize over 75% locally produced pipe, thereby avoiding the arbitrary expense of costly importation fees. Either new or used steel pipes are abundant, low cost and easy to manufacture, so they offer a much more economical solution for large-scale construction projects when compared to traditional concrete or steel sheet pile alternatives.

O-Pile partners will utilize local pipe making capability to offer a far greater range of wall sizes, shapes, and load-bearing capacities than alternative options and one that can be dialed in to meet the specific specification needs for any project.

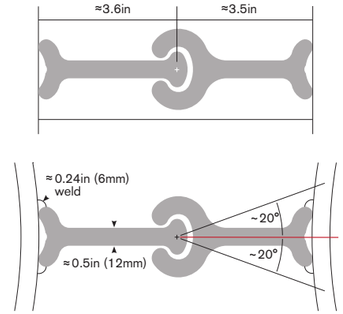
For your Pipe Sheet Pile systems, turn to O-Pile to get the job done right.

About Pipe Sheet Pile®

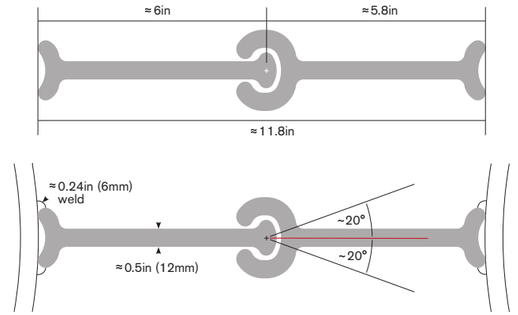
Pipe Sheet Pile is a rapidly expanding construction method that utilize pipe to pipe walls with welded-on connectors to form extremely strong foundations, barriers and retaining walls in a cost-effective way. O-Pile is the authorized partner to offer these pipe to pipe systems.

Recently, there has been a huge increase in the use of Pipe Sheet Pile systems on construction projects around the world, particularly with ports, retaining walls, and deep foundations, as well as on a variety of other large- and small-scale projects. Pipe Sheet Pile systems offer a stronger, more efficient, cost-effective alternative to high modulus walls that use beams and heavy Z- or U-type sheet piles.

WOM/WOF XL



WOM/WOF XXL



With Pipe Sheet Pile utilizing WOM and WOF interlock connectors, the design engineer, through the O-Pile alliance of partners, is able to utilize readily-available, locally-produced pipes to provide practical, cost-effective solutions.

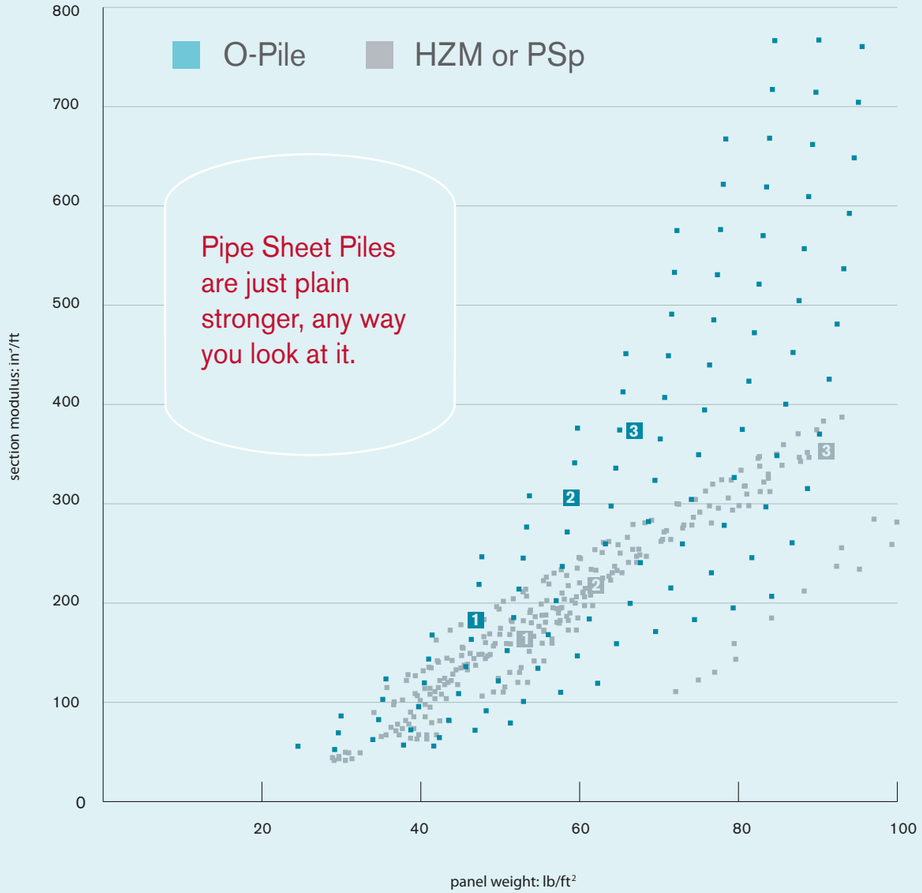
Technical Advantages

These are the four technical reasons why engineers and designers now consider the Pipe Sheet Pile system to be superior to other sheet pile or concrete options:

1. **Efficiency:** King pile systems using products like HZM or PSp increase in weight linearly as strength is increased, because there is little change in panel-width to offset the increasing weight as section size is increased. However, a pipe-to pipe system of a given wall thickness has almost negligible weight increase with gain in strength because strength gain is achieved by increasing diameter and not by simply using a heavier section..
2. **Capacity:** The vertical load-bearing capacity of Pipe Sheet Pile is significantly higher than standard U- or Z-type sheet piles or combined wall systems of similar weight.
3. **Connections:** Previous attempts at pipe to pipe were based on using some combination of 'angle and T' or 'CHS and T' connections that often proved difficult to weld, were prone to de-clutching in hard driving, and also required grouting.
4. **Surcharge:** Pipe Sheet Pile forms extremely effective and strong retaining walls for structures such as marine berths and highway or rail grade separation. They can also be effectively used in bridge abutments or as permanent walls of below grade parking structures.

Pipe Sheet Pile vs Combined Wall Systems

The introduction of the WOM/WOF connectors, designed specifically to resist high tension and rotational forces to more than 3400 kN/m, provid the user with a low-cost, high-capacity connection they did not have before.



Comparison No. 1	
Pipe Sheet Pile	Typical system
O 103 48" × .5"	HZ 880M C-24 + AZ 14-770
191 in³/ft	167 in³/ft
47 lb/ft²	54 lb/ft²

Comparison No. 2	
Pipe Sheet Pile	Typical system
O 165 60" × .625"	PSp 1117 (1023) + PZ612
306 in³/ft	211 in³/ft
59 lb/ft²	62 lb/ft²

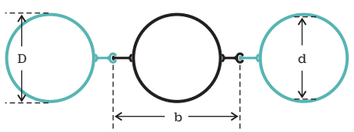
Comparison No. 3	
Pipe Sheet Pile	Typical system
O 201 66" × .6875"	HZ 1180M D-24 + AZ 26-700
374 in³/ft	356 in³/ft
65 lb/ft²	91 lb/ft²

Pipe Sheet Pile Solution Samples

	Imperial							Metric					
	name	G lb/ft³	Wy in³/ft	Jy in³/ft	b in	OD in	t in	G kg/m³	Wy cm³/m	Jy cm³/m	b mm	OD mm	t mm
XL	0 40	29.8	74.9	1,199	39.09	32	0.3125	145	4,028	163,715	993	813	7.94
	0 44	34.7	82.6	1,239	37.09	30	0.3750	169	4,441	169,208	942	762	9.53
	0 59	35.4	109.9	2,088	45.09	38	0.3750	173	5,908	285,113	1,145	965	9.53
	0 64	40.5	119.6	2,152	43.09	36	0.4375	198	6,429	293,927	1,094	914	11.11
	0 73	40.8	135.6	2,712	47.09	40	0.4375	199	7,289	370,293	1,196	1,016	11.11
	0 82	41.2	151.7	3,337	51.09	44	0.4375	201	8,154	455,632	1,298	1,118	11.11
	0 83	46.2	154.2	3,084	47.09	40	0.5000	225	8,291	421,206	1,196	1,016	12.70
	0 98	46.7	181.8	4,181	53.09	46	0.5000	228	9,774	570,995	1,348	1,168	12.70
	0 108	47.1	200.3	5,007	57.09	50	0.5000	230	10,767	683,686	1,450	1,270	12.70
	0 121	52.6	224.4	5,611	57.09	50	0.5625	257	12,067	766,258	1,450	1,270	14.29
	0 137	53.1	255.7	7,159	63.09	56	0.5625	259	13,747	977,692	1,602	1,422	14.29
	0 158	58.8	294.7	8,548	65.09	58	0.6250	287	15,847	1,167,264	1,653	1,473	15.88
	0 165	59.0	306.4	9,191	67.09	60	0.6250	288	16,471	1,255,059	1,704	1,524	15.88
	0 177	59.2	329.6	10,547	71.09	64	0.6250	289	17,720	1,440,288	1,806	1,626	15.88
	0 187	64.7	348.7	10,810	69.09	62	0.6875	316	18,748	1,476,187	1,755	1,575	17.46
	0 201	65.1	374.3	12,351	73.09	66	0.6875	318	20,123	1,686,681	1,856	1,676	17.46
	0 208	65.2	387.1	13,161	75.09	68	0.6875	318	20,811	1,797,230	1,907	1,727	17.46
	0 215	65.3	399.9	13,996	77.09	70	0.6875	319	21,500	1,911,315	1,958	1,778	17.46
	0 226	70.9	421.1	14,318	75.09	68	0.7500	346	22,640	1,955,198	1,907	1,727	19.05
	0 234	71.0	435.1	15,228	77.09	70	0.7500	347	23,391	2,079,475	1,958	1,778	19.05
	0 249	71.3	463.0	17,133	81.09	74	0.7500	348	24,895	2,339,600	2,060	1,880	19.05
	0 256	71.5	477.0	18,127	83.09	76	0.7500	349	25,647	2,475,448	2,110	1,930	19.05
	0 269	77.1	500.4	18,513	81.09	74	0.8125	376	26,901	2,528,131	2,060	1,880	20.64
	0 277	77.2	515.5	19,589	83.09	76	0.8125	377	27,716	2,675,106	2,110	1,930	20.64
	0 280	82.6	521.2	18,762	79.09	72	0.8750	403	28,020	2,562,115	2,009	1,829	22.23
	0 318	88.7	591.9	22,491	83.09	76	0.9375	433	31,822	3,071,412	2,110	1,930	23.81
XXL	0 33	27.6	61.4	922	41.81	30	0.3125	135	3,303	125,860	1,062	762	7.94
	0 64	35.0	118.3	2,483	53.81	42	0.3937	171	6,358	339,135	1,367	1,067	10.00
	0 70	38.4	131.0	2,751	53.81	42	0.4375	188	7,043	375,682	1,367	1,067	11.11
	0 109	44.8	203.1	5,483	65.81	54	0.5000	219	10,918	748,741	1,672	1,372	12.70
	0 122	50.0	227.7	6,147	65.81	54	0.5625	244	12,240	839,405	1,672	1,372	14.29

Formulas:

All formulas shown are in metric units.



D, d, e: use values in cm b: use values in m

(all weight calculations shown feature an intermediate length ratio of 60% for connectors and alternating king piles)

Section Modulus:

$$Jy = \frac{\pi}{64} \times \frac{D^4 - d^4}{b}$$

$$e = D / 2$$

$$Wy = Jy / e$$

Panel Weight:

$$A = \frac{\pi}{4} \times (D^2 - d^2)$$

$$G_{pipe} = A \times 0.785$$

$$G = \frac{\frac{G_{pipe} + R \times G_{pipe}}{2} + (12.66 + 17.8)}{b}$$

O-Pile Solution Samples by Pipe Specification

Pipe Diameter in	Pipe Thickness 5/16" 0.3125"	3/8" 0.375"	7/16" 0.4375"	1/2" 0.5"	9/16" 0.5625"	5/8" 0.625"	11/16" 0.6875"	3/4" 0.75"	13/16" 0.8125"
30	0 37 29.6								
32	0 40 29.8								
34	0 43 29.9	0 52 35.1							
36	0 46 30.0	0 55 35.2							
38	0 49 30.1	0 59 35.4							
40		0 63 35.5	0 73 40.8						
42		0 66 35.6	0 77 41.0						
44		0 70 35.7	0 82 41.2						
46		0 74 35.8	0 86 41.3	0 98 46.7					
48			0 90 41.4	0 103 46.9					
50			0 95 41.6	0 108 47.1					
52			0 99 41.7	0 113 47.2	0 126 52.7				
54			0 103 41.8	0 118 47.3	0 132 52.9				
56				0 123 47.5	0 137 53.1				
58				0 128 47.6	0 143 53.2	0 158 58.8			
60				0 133 47.7	0 149 53.3	0 165 59.0			
62				0 138 47.8	0 154 53.5	0 171 59.1	0 187 64.7		
64					0 160 53.6	0 177 59.2	0 194 64.9		
66					0 166 53.7	0 183 59.4	0 201 65.1		
68					0 171 53.8	0 190 59.5	0 208 65.2	0 226 70.9	
70					0 177 53.9	0 196 59.6	0 215 65.3	0 234 71.0	
72						0 202 59.7	0 222 65.5	0 241 71.2	
74						0 209 59.8	0 229 65.6	0 249 71.3	0 269 77.1
76							0 236 65.7	0 256 71.5	0 277 77.2

KEY:

0 40
146.2

O-Pile: cm^3/m
$100lb/m^2$

These are examples from an endless variety of possible pipe sheet piles. Pipes can slightly vary in diameter and steel thickness.

Visit **o-pile.com** for custom solutions and calculations in both contiguous and combined sheet pile formats.

Installing Pile Sheet Pile

Driving

Pipe Sheet Pile is much easier to drive than is often thought: A simple panel is used for pipe alignment; and vibratory hammers, impact hammers and even press-in methods can be used to bring the piles to grade. Driving obstacles can often be removed from inside the pipes by excavation, drilling, or jetting, without disturbing the environment. Usually, strict noise abatement standards can be easily met, even for urban settings.

Simply put, Pipe Sheet Pile can be driven quietly and effectively with a wide range of equipment

Waterproofing

If your Pipe Sheet Pile project involves cofferdams, de-watering, tunnels, cutoff walls for site If your project involves cofferdams, de watering, tunnels, cutoff walls for site remediation, or any application where water leakage presents a challenge, then sealed Pipe Sheet Pile is an excellent solution. WADIT®, a globally-proven sheet piling interlock sealant, is highly effective in Pipe Sheet Pile interlocks and can meet the most challenging waterproofing needs.

WADIT = Watertight

WOM/WOF connectors can be supplied already filled with WADIT, ready to be delivered to the pipe manufacturer, or to the job site, for welding onto the pipe piles. (The length from interlock to stem of the WOM/WOF ensures that the sealant is not affected by heat generated from welding.) Applying WADIT in a factory environment is preferred, as it eliminates site preparation and application, and it speeds up construction.

WADIT sealant, used in conjunction with Pipe Sheet Pile and connectors, is increasingly the “go-to” solution for engineers and designers looking for an effective waterproofing option that is strong, economical, safe and convenient, safe and convenient.

WADIT can be used in every possible environment (from tropical to arctic) and is particularly effective in marine conditions.

Durability

How well does Pipe Sheet Pile stand up to corrosion?

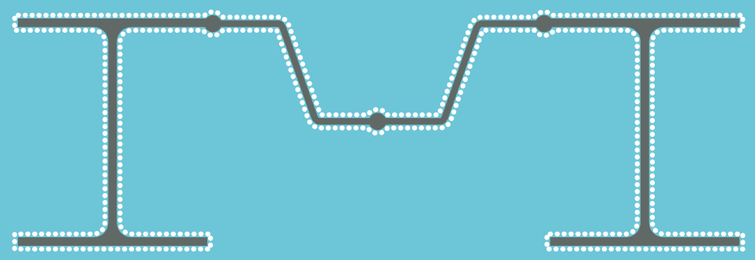
Along with their enormous strength-to weight ratio and overall cost-effectiveness, Pipe Sheet Pile has a distinct advantage over traditional steel sheet piles and that's their superior durability to other steel wall geometries.

Superior Geometry for Durability:

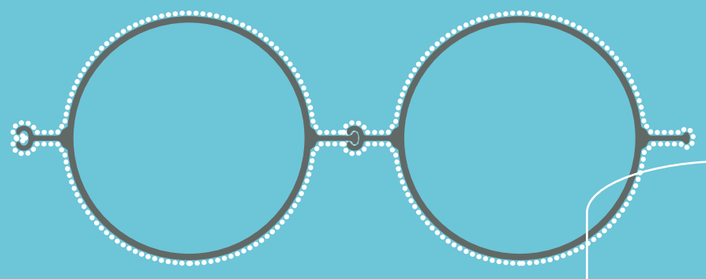
Pipe Sheet Pile cuts costs with its easier application of corrosion protection, and by having a minimized exposed surface relative to other king pile shapes. Additionally, the interior of the pipe can be sealed off (capped or filled) from oxygen infiltration in order to avoid inside corrosion. And, concrete can be poured inside the Pipe Sheet Pile itself, thus further increasing strength while also preventing oxidation or corrosion on the interior surface. With any or all of these techniques, Pipe Sheet Pile has only the exterior face exposed to corrosion, in contrast to a traditional beam, which has all of its surfaces exposed to corrosive elements.

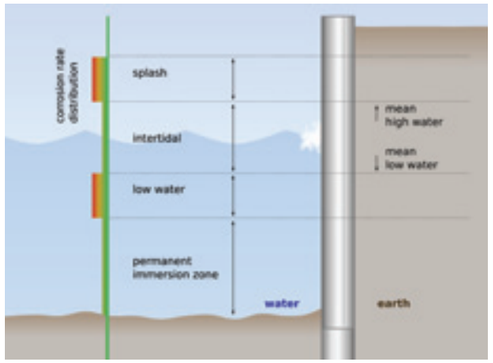
Pipe sheet pile that are used in corrosive soil and/or water need only have a corrosion allowance factored for the exterior surface of the pile.

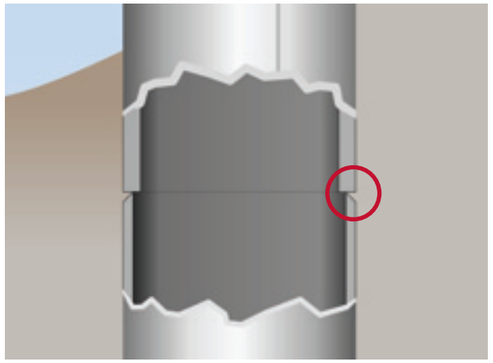
Standard Combined Wall Systems



Pipe Sheet Pile







Optimizing Durability with Sacrificial Thickness:

Sacrificial thickness is the number one choice for designers who need to meet design life criteria. Usually, additional steel is applied to the entire exposed structure, when it is actually only required on the most corrosion-vulnerable surfaces: the splash and low-water zones.

Why not just use a different grade of steel? Solutions utilizing steel grade compositions either work for the splash zone or the low-water zone, but not for both. Therefore, additional measures are often needed, such as coatings or cathodic protection, which can lead to additional expense and complication.

With Pipe Sheet Pile, an optimal solution with targeted design life can be obtained without special steel grades, additional coating, or wasted "extra" steel. Thicker pipe used above the seabed spliced to thinner pipe below allows the designer to target sacrificial thickness exactly where it is needed.

With the small production tolerances of pipes, Pipe Sheet Pile can be easily spliced, maintaining consistent external diameter and variable inner diameter as necessary for sacrificial thickness. This gives the most efficient use of steel and the most cost-effective solution for durability. The location of the splice is usually above the seabed where pile stresses are low.