

Corus International Projects

Foundations



Introduction

Corus is one of the world's leading steel suppliers. Formed in 1999 by the merger of British Steel and Koninklijke Hoogovens. Corus employs around 45,000 people worldwide with the capacity to produce 21 million tonnes of steel a year. Corus also processes and distributes metal products and provides related services in design, technology and consultancy.

Corus International Projects is the specialist supply chain management business unit with annual sales of 7.5 million tonnes of steel and a worldwide network of offices. Furthermore, we are continually expanding our reach and evaluating new markets for which a presence would bring local advantage.

Our scope of supply extends across the full range of steel products, but our commercial teams retain sector-specific focus. Within this model, our teams have also developed relationships with third-party sources in order to be able to offer a more flexible solution. These external partners are fully-integrated into our processes and maintain close interaction with our commercial and technical personnel before, during and after outsourced production.

Furthermore, according to our ISO 9001:2000 quality system, we only procure from companies with audited quality systems. In addition, we have stockholding facilities in North America, the Middle East and the Far East.

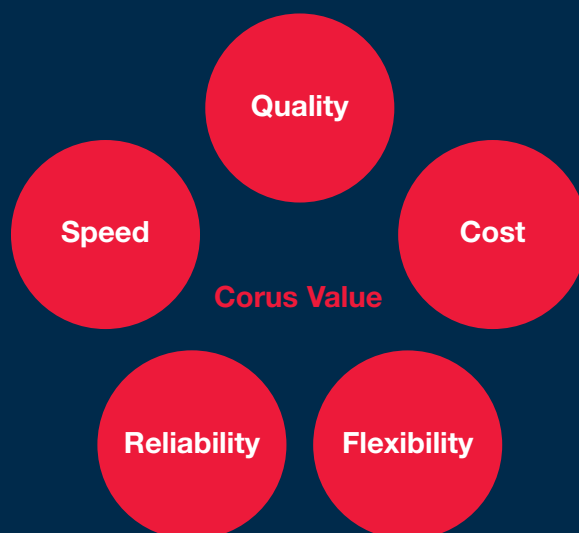
Our service covers the full scope of building support and retention products, such as Bearing Piles, Tubular Piles, Sheet Piling, Rebar and Mesh, coupled with logistical, technical, finance and documentation support. As such, Corus International Projects is in an excellent position to offer tailored foundations solutions to projects around the world, as proven by a long and successful track record of supplying these products to our customers far and wide.

It is by combining our expertise and services innovatively and effectively, that we are able to offer our customers a complete solution, whatever the project requirements, wherever in the world. We provide the flexibility and dynamism of Corus International Projects, whilst retaining our roots within Corus as a respected partner. This gives a unique dual strength to our operations, which is supported by our ability to source materials in established and emerging markets across the globe.



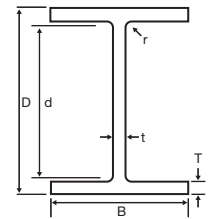
Corus International network

A comprehensive steel supply service delivered throughout our worldwide network.



Bearing piles

‘H’ section piles are the ideal solution when foundations are required in difficult installation conditions or when a low displacement pile is needed. Their inherent strength and wide range permit optimal solutions.



Universal Bearing Piling in accordance with ASTM A6/A6M and BS4: Part 1

ASTM Size	Mass per foot	Metric/BS4 Equivalent	Mass per metre	Depth of Section	Width of Section	Thick-ness of Web	Thick-ness of Flange	Root Radius	Depth between fillets	Ratios for Local Buckling		Second Moment of Area	
										Flange B/2T	Web d/t	Axis xx cm ⁴	Axis yy cm ⁴
in	lb		kg	D mm	B mm	t mm	T mm	r mm	d mm			cm ⁴	cm ⁴
UP14x14 ¹ / ₂	121	356x368x180	180.0	362.9	378.8	21.1	21.1	15.2	290.2	9.00	13.8	51770	20720
HP14x14 ¹ / ₂	117	356x368x174	173.9	361.4	378.5	20.3	20.4	15.2	290.2	9.28	14.3	51010	18460
HP14x14 ¹ / ₂	102	356x368x152	152.0	356.4	376.0	17.8	17.9	15.2	290.2	10.5	16.3	43970	15880
HP14x14 ¹ / ₂	89	356x368x133	133.0	352.0	373.8	15.6	15.7	15.2	290.2	11.9	18.6	37980	13680
HP14x14 ¹ / ₂	73	356x368x109	108.9	346.4	371.0	12.8	12.9	15.2	290.2	14.4	22.7	30630	10990
UP12x12	150	305x305x223	222.9	337.9	325.7	30.3	30.4	15.2	246.7	5.36	8.14	52700	17580
UP12x12	125	305x305x186	186.0	328.3	320.9	25.5	25.6	15.2	246.7	6.27	9.67	42610	14140
UP12x12	100	305x305x149	149.1	318.5	316.0	20.6	20.7	15.2	246.7	7.63	12.0	33070	10910
HP12x12	84	305x305x126	126.1	312.3	312.9	17.5	17.6	15.2	246.7	8.89	14.1	27410	9002
HP12x12	74	305x305x110	110.0	307.9	310.7	15.3	15.4	15.2	246.7	10.1	16.1	23560	7709
HP12x12	63	305x305x95	94.9	303.7	308.7	13.3	13.3	15.2	246.7	11.6	18.5	20040	6529
UP12x12	59	305x305x88	88.0	301.7	307.8	12.4	12.3	15.2	246.7	12.5	19.9	18420	5984
HP12x12	53	305x305x79	78.9	299.3	306.4	11.0	11.1	15.2	246.7	13.8	22.4	16440	5326
HP10x10	57	254x254x85	85.1	254.3	260.4	14.4	14.3	12.7	200.3	9.1	13.9	12280	4215
UP10x10	48	254x254x71	71.0	249.7	258.0	12.0	12.0	12.7	200.3	10.8	16.7	10070	3439
HP10x10	42	254x254x63	63.0	247.1	256.6	10.6	10.7	12.7	200.3	12.0	18.9	8860	3016
HP8x8	36	203x203x54	53.9	204.0	207.7	11.3	11.4	10.2	160.8	9.11	14.2	5027	1705
UP8x8	30	203x203x45	44.9	200.2	205.9	9.5	9.5	10.2	160.8	10.8	16.9	4100	1384

Case Study – Alumina Refinery, Guinea

- 15,000 tonnes of Bearing Piles
- Piles required for an alumina refinery in Guinea
- Worldwide search for most appropriate offer
- First shipment made within 8 weeks of signing the order
- Three separate shipments, all delivered on time and in full
- Flexible contract terms negotiated
- Local Corus presence both at point of manufacture and at contractor HQ

Corus = Quality + Cost + Speed + Reliability + Flexibility



Universal Bearing Piling in accordance with ASTM A6/A6M and BS4: Part 1

Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	ASTM Size	Mass per foot
Axis xx	Axis yy	Axis xx	Axis yy	Axis xx	Axis yy	u	x	H	J	cm ²	in	lb
cm	cm	cm ²	cm ²	cm ²	cm ²			dm ⁶	cm ⁴			
15.2	9.10	2923	1011	3306	1552	0.821	15.3	5.59	367	229	UP14x14 ^{1/2}	121
15.2	9.13	2823	976	3186	1497	0.821	15.8	5.37	330	221	HP14x14 ^{1/2}	117
15.1	9.05	2468	845	2767	1293	0.821	17.8	4.55	223	194	HP14x14 ^{1/2}	102
15.0	8.99	2158	732	2406	1118	0.822	20.1	3.87	151	169	HP14x14 ^{1/2}	89
14.9	8.90	1769	592	1956	903	0.823	24.2	3.05	84.6	139	HP14x14 ^{1/2}	73
13.6	7.87	3119	1079	3653	1680	0.826	9.55	4.15	943	284	UP12 x12	150
13.4	7.73	2596	881	3003	1366	0.827	11.1	3.24	560	237	UP12x12	125
13.2	7.58	2076	691	2370	1065	0.828	13.5	2.42	295	190	UP12x12	100
13.1	7.49	1755	575	1986	885	0.829	15.7	1.95	182	161	HP12x12	84
13.0	7.42	1531	496	1720	762	0.830	17.7	1.65	122	140	HP12x12	74
12.9	7.35	1320	423	1475	648	0.830	20.2	1.38	80.0	121	HP12x12	63
12.8	7.31	1221	389	1361	595	0.830	21.6	1.25	64.2	112	UP12x12	59
12.8	7.28	1099	348	1218	531	0.832	23.9	1.11	46.9	100	HP12x12	53
10.6	6.24	966	324	1092	498	0.825	15.6	0.6071	81.8	108	HP10x10	57
10.6	6.17	807	267	904	409	0.826	18.4	0.486	48.4	90.4	UP10x10	48
10.5	6.13	717	235	799	360	0.827	20.5	0.421	34.3	80.2	HP10x10	42
8.55	4.98	493	164	557	252	0.827	15.8	0.158	32.7	68.7	HP8x8	36
8.46	4.92	410	134	459	206	0.827	18.6	0.126	19.2	57.2	UP8x8	30



Tubular piles

The range of production capabilities relating to Diameter, Wall Thickness and Length gives engineers a wide variety of options, which can be tailored to the design load required. Corus International Projects can supply piles from all manufacturing solutions and can also provide further fabrication, such as: interlocks, stiffening plates etc.

They are also a key component in a Combiwall design, whereby tubular and sheet piles are driven together to create the required wall.



Corus = Quality + Cost + Speed + Reliability + Flexibility

Tubular piles have been used for many years in marine structures as free-standing elements and more recently as part of a combination with sheet piles. The range of tubular piles has increased continuously to meet a growing demand.

Typical tubular piles

Typical application	Typical size range	Typical grades	Typical supply options	Typical length range
General purpose	Up to 600mm	S355J2H	Longitudinal	6m – 15m
Crane rail piles	600mm to 1,000mm	B/X42/X70	Longitudinal / Spiral	6m – 15m
Quay wall	1,000mm to 3,500mm	X65/X70	Longitudinal / Spiral / Circ	6m – 35m
Dolphin/mooring	2,000mm to 4,000mm	X42 – RQT701	Longitudinal / Circ	6m – 40m

Formulae for carbon steel round tubes

Weight (kg/mtr)

$$[\text{OD}(\text{mm}) - \text{WT}(\text{mm})] \times \text{WT}(\text{mm}) \times 0.0246615 = \text{kg/mtr}$$

Freight Factor (m³/tonne)

$$\left(\frac{\text{OD}}{1000}\right)^2 \times \left(\frac{1000}{\text{kg/m}}\right) = \text{m}^3/\text{tonne}$$

Section modulus (cm³/mtr)

$$\frac{\pi (\text{OD}^4 - \text{ID}^4)}{32000\text{OD}} = \text{cm}^3/\text{mtr}$$

where OD and ID = mm

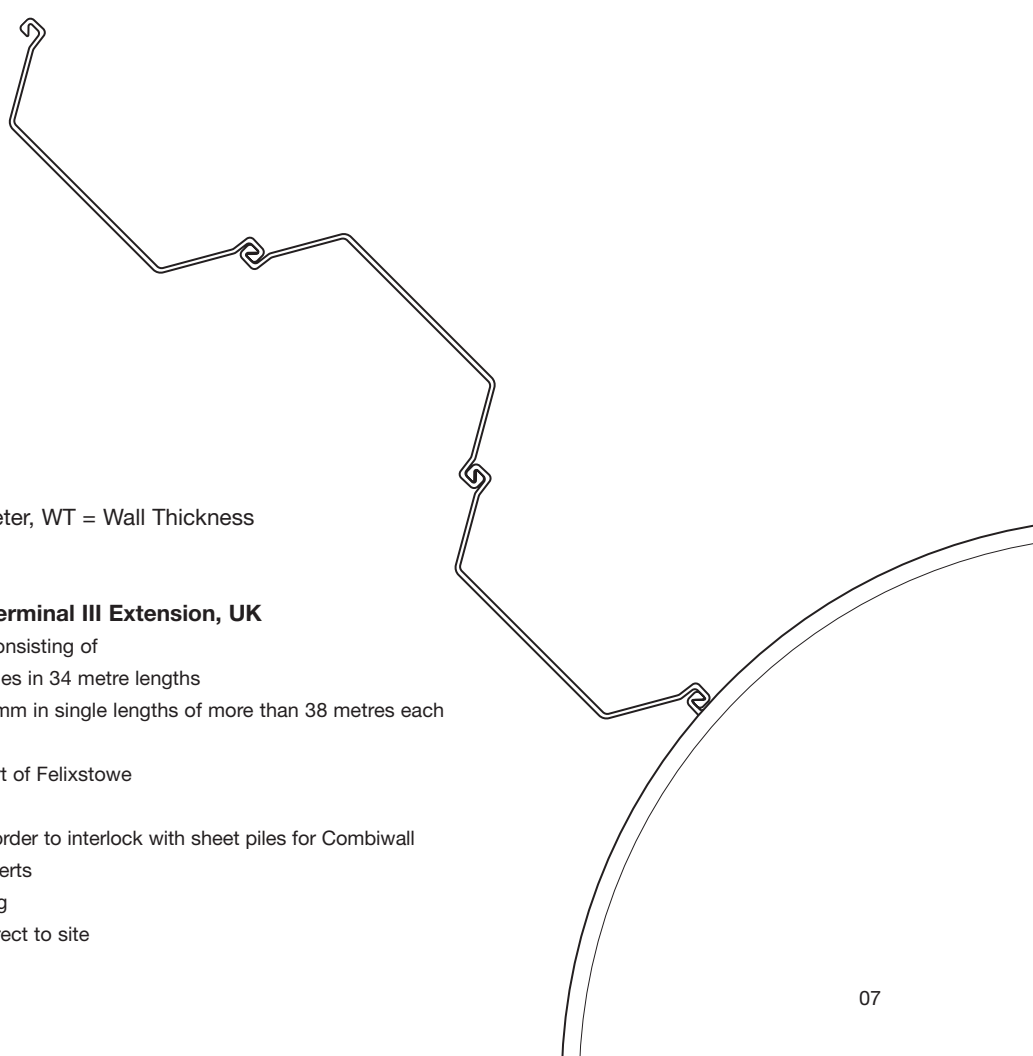
Moment of inertia (cm⁴/mtr)

$$\frac{\pi (\text{OD}^4 - \text{ID}^4)}{640000} = \text{cm}^4/\text{mtr}$$

OD = Outside Diameter, ID = Internal Diameter, WT = Wall Thickness

Case Study – Port of Felixstowe Trinity Terminal III Extension, UK

- 2,500 tonnes of large diameter tubular piles, consisting of
 - Rear Crane Rail Piles and Main Quay Wall Piles in 34 metre lengths
 - Multi-thickness Dolphin Piles from 20 – 47.5mm in single lengths of more than 38 metres each
- 1,000 tonnes of sheet piling
- Extension of existing dock at the container port of Felixstowe
- Material sourced from three European mills
- Tubular Piles required with welded clutches in order to interlock with sheet piles for Combiwall plus additional fabrication of stiffening plate inserts
- First delivery within 6 weeks of contract signing
- Phased shipments over a six month period, direct to site





Sheet piling

Steel sheet piling is the universal choice where there is a need for retaining walls, cofferdams or other forms of supported excavation on land or in water.

The strength, speed and flexibility of sheet piling makes it ideal for all forms of temporary and permanent works, the durability and ease of extraction means that sheet piling can be re-used in sustainable construction.

In many cases, however, the use of a steel sheet piling supporting structure can actually eliminate the need for temporary works with the sheet piles performing the permanent function concerned: e.g. Bridge abutments, basement walls etc... Sheet piling can also be designed to cope with high vertical as well as horizontal loads typical in applications such as ports and harbours.

All sheet piles are available in steel specifications: JIS A5528; ASTM A328, A572 and A690; and, EN 10248.



Case Study – Maldives Quay Wall Upgrade

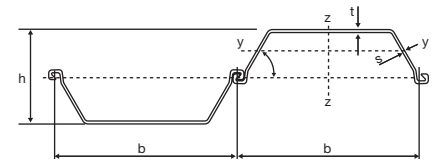
- 4,000 tonnes of Sheet Piles with a section modulus of 2500cm³ per metre
- Upgrade of existing quay wall
- Package included walings and tie rods
- Material brought together from three sources
- Consolidation of materials package and shipping to obscure port

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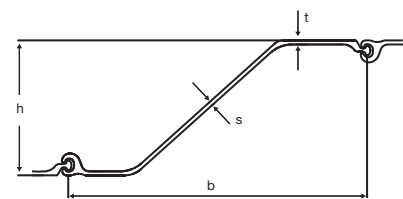
U piles

section	width of one pile	height of wall	thickness of the flange	thickness of the web	mass		elastic section modulus Wyy cm ³ /m	combined moment of inertia Iyy cm ⁴ /m
	b mm	h mm	t mm	s mm	kg/m	kg/m ²		
602	600	310	8.2	8.0	54.3	90.5	845	13075
603	600	310	9.7	8.4	64.8	108.0	1180	18251
603k	600	310	10	9.0	68.1	113.5	1220	18900
604	600	380	10.5	9.0	74.1	123.5	1620	30726
605	600	410	12.8	9.0	82.4	137.3	2006	41127
606	600	420	16.5	9.2	94.8	158.0	2506	52631
SX10	600	260	10.3	-	61.8	103.0	1000	13000
SX18	600	360	13.4	-	81.6	136.0	1800	32400
SX27	600	420	18.0	-	106.0	177.0	2700	56700



Z piles

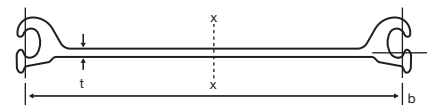
section	width of one pile	height of one pile	thickness of the flange	thickness of the web	mass		elastic section modulus Wyy cm ³ /m	combined moment of inertia Iyy cm ⁴ /m
	b mm	h mm	t mm	s mm	kg/m	kg/m ²		
PZ22	559	235	9.5	9.5	61.8	110.6	990	11620
PZ27	457	307	9.5	9.5	61.8	135.1	1660	25580
PZ35	575	384	15.4	12.7	98.2	170.8	2635	50455
PZ40	500	417	15.2	12.7	97.6	195.2	3300	68645
PZC 13	708	319	9.5	9.5	75.1	106.0	1300	20755
PZC 18	635	387	9.5	9.5	75.1	118.2	1800	34890
PZC 26	708	450	15.2	13.3	110.0	155.4	2600	58460
PZC 36	630	506	16.6	15.2	121.7	193.2	3600	91140



Straight web

section	width of one pile	height of one pile	thickness of the web	mass		elastic section modulus Wyy cm ³ /m	combined moment of inertia Iyy cm ⁴ /m
	b mm	h mm	t mm	kg/m	kg/m ²		
PS27.5	500	-	10.2	67.1	134.2	103	414
PS31	500	-	12.7	75.7	151.4	103	414

grade	minimum interlock strength ⁽¹⁾	minimum swing ⁽²⁾
A328	2,800 kN/m	10 degrees
A572-50	3,500 kN/m	10 degrees
A572-65	4,200 kN/m	10 degrees



Note

⁽¹⁾ These minimum ultimate interlock strengths assume proper interlocking of sheets. To verify the strength of PS sheet piling, both yielding of the web and failing of the interlock should be considered.

⁽²⁾ Higher interlock strengths are available but swing will be reduced in interlock strengths above 4,200kNm. Swing reduces 1.5 degrees for each 3 metres in lengths over 21 metres.

Open Cell™ structures



High Load Capacity Structures suitable for Deep Water, Soft Soils or Shallow Bedrock and Seismic Conditions.

Open Cell Technology

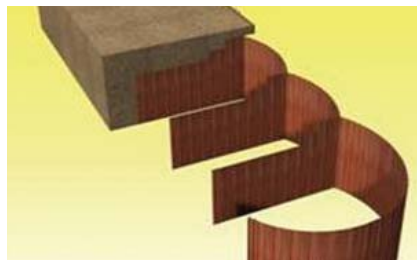
The Open Cell bulkhead is a cellular flat sheet pile structure, in which each cell's sheet piles are driven in the shape of a 'U' (when viewed from above). This technology is used primarily on docks and similar structures.

Readily adaptable, this system is suitable for ship berths, erosion control, bridge abutments, artificial islands and other uses where the following might be required or encountered;

- Face wall heights to 30m
- High loads (vertical/horizontal)
- Soft or dense soils
- Ice impact

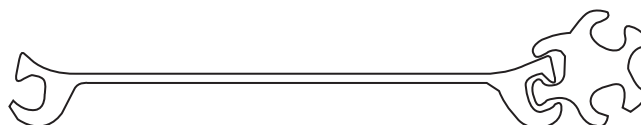
Significant savings can be achieved by using Open Cell structures over traditional designs through reduced construction time, construction from land and reduced material costs.

The simplicity of the system is an advantage during construction, because Open Cells require relatively few critical steps, which translates into a more efficient speed of construction and thereby provides a combination of low cost with high performance.



Case Study – Oakland Bay Bridge Project, California

- 750 tonnes of straight web sheet piles
- Material used for an Open Cell Bulkhead Barge Load-out Slip
- Temporary structure to be removed when project complete
- Solution provided to overcome heavy load and difficult soil conditions
- The Open Cell System eliminated the need for the relieving platforms and reduced the overall cost of the slip by approximately 40%



Straight web section with interlock

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Reinforcing products

Corus International Projects can supply a wide variety of reinforcing products including Re-bar, D-bar and reinforcing mesh for the construction industry.

Rebar and mesh

All products are in accordance with common international specifications such as BS 4449, DIN 488 and ASTM A615. The bar materials can be supplied either plain or ribbed, (see diagram) and in cut lengths or bar-in-coil.

Rebar

Size range	Supply type
6 and 8mm	Typically in coil form and straight lengths up to 12 metres
10 - 40mm	Typically in straight lengths up to 12 metres



Figure 1
Example of rib pattern of grade 460A with four transverse rib series.

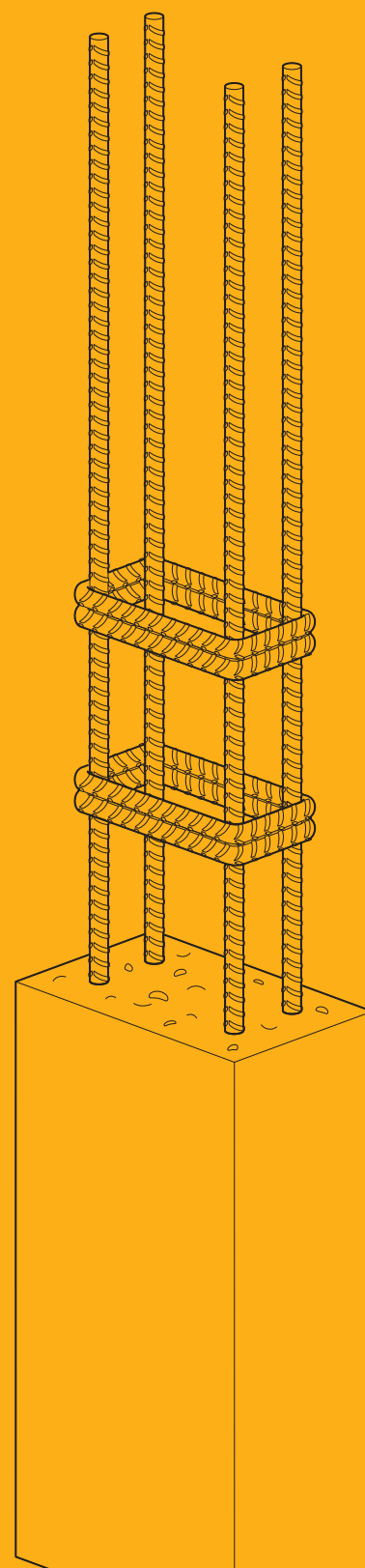


Figure 2
Example of rib pattern of grade 460B with four transverse rib series.



Case Study – LNG plant, West Africa

- 9,500 tonnes of reinforcing bars
- 1,500 tonnes of reinforcing mesh
- Material used for foundation work on extension to existing LNG plant
- Production commenced within 8 weeks of contract signing
- Flexible contract terms negotiated
- Sourcing from two European mills
- Phased shipments over a four year period



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