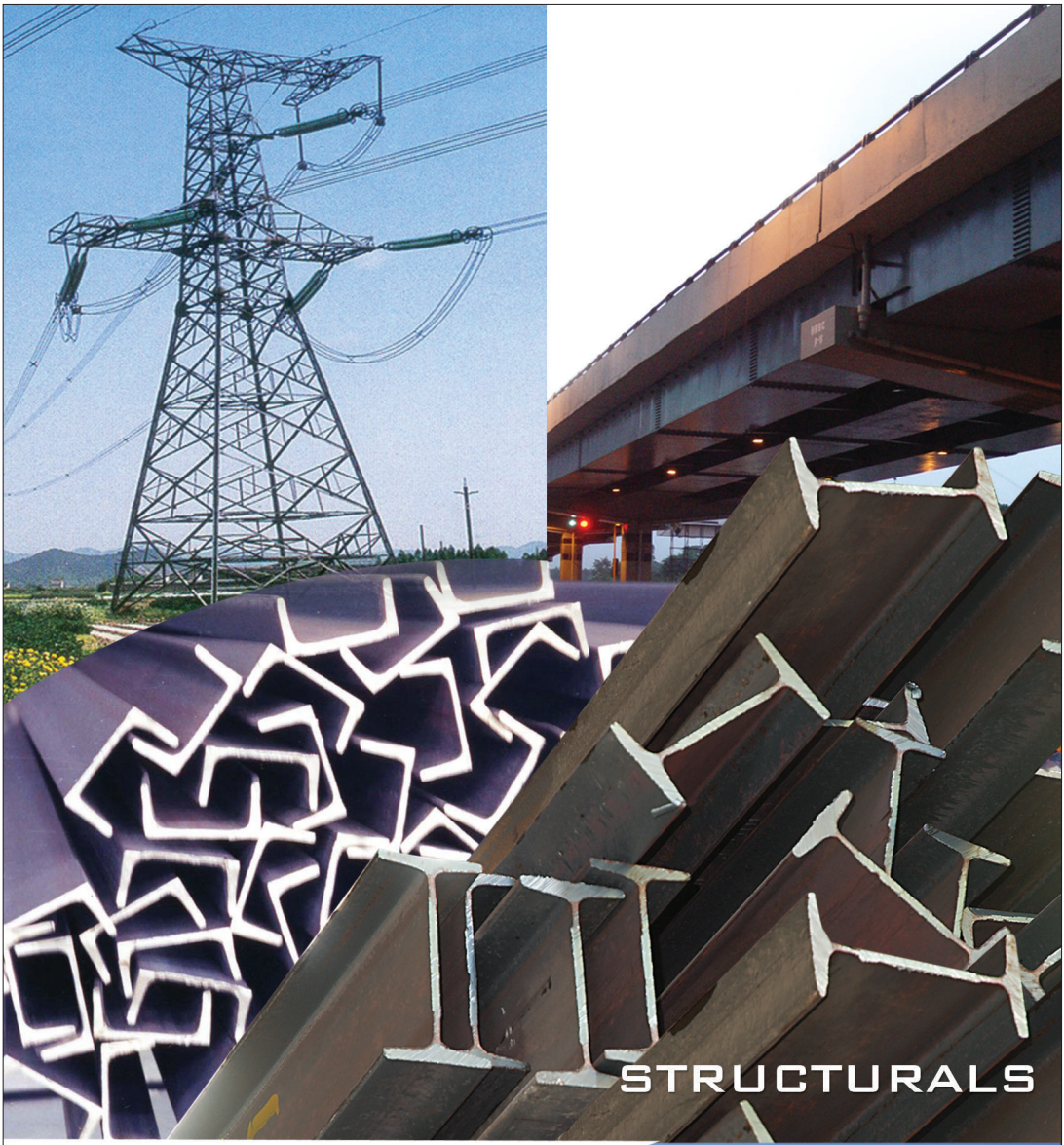

STRUCTURALS

Structurals

Rationalised sizes of Beams/Joists, Channels and Angles

Section	Dimensions mm	Sectional Weight kg/m	Length m
Beams/Joists	Durgapur Steel Plant		
	175 x 85 x 5.8	19.6	Std length
	200 x 100 x 5.7	25.4	10 - 13.5
	IISCO Steel Plant		
	250 x 125 x 6.9	37.3	11.5 & above
	300 x 140 x 7.7	46.0	
	350 x 140 x 8.1	52.4	
	400 x 140 x 8.9	61.5	
	450 x 150 x 9.4	72.4	
Beams	Bhilai Steel Plant		
	250 x 125 x 6.9	37.3	12 - 13.5 for all dimensions
	300 x 140 x 7.7	46.0	
	350 x 140 x 8.1	52.4	
	400 x 140 x 8.9	61.5	
	450 x 150 x 9.4	72.4	
	500 x 180 x 10.2	86.9	
	600 x 210 x 12	123.0	
Channels	Bhilai Steel Plant		
	75 x 40 x 4.8	7.14	12 & above
	100 x 50 x 5	9.56	
	Durgapur Steel Plant		
	125 x 65 x 5.3	13.10	Standard length 10 - 13.5
	125 x 66 x 6	13.70	
	150 x 75 x 5.7	16.80	
	150 x 76 x 6.5	17.70	
	175 x 75 x 6	19.60	
	200 x 75 x 6.2	22.30	
	200 x 76 x 7.5	24.30	
	Bhilai Steel Plant		
	250 x 82 x 9	34.2	12 - 13.5
	300 x 90 x 7.8	36.3	
	400 x 100 x 8.8	50.1	

Section	Dimensions mm	Sectional Weight kg/m	Length m
	IISCO Steel Plant		
	75 x 40 x 4.8	7.14	10 & above
	100 x 50 x 5	9.56	10 & above
	125 x 65 x 5.3	13.1	10 & above
	250 x 82 x 9	34.2	11.5 & above
	300 x 90 x 7.8	36.3	11.5 & above
Angles	Bhilai Steel Plant		
	50 x 50 x 5*	3.8	12 & above
	50 x 50 x 6	4.5	
	60 x 60 x 5/6/8*	4.5/5.4/7.0	
	65 x 65 x 5*	4.9	
	65 x 65 x 6/8/10	5.8/7.7/9.4	
	70 x 70 x 5/6*	5.3/ 6.3	
	75 x 75 x 5/ 6/ 8/ 10	5.7/6.8/8.9/11.0	
	80 x 80 x 6/8/10	7.3/9.6/11.8	
	90 x 90 x 6/8/10	8.2/10.8/13.4	
	Durgapur Steel Plant		
	100 x 100 x 10/12	14.9/17.7	10 - 11.5 for all dimensions
	110 x 110 x 10/12	16.6/19.7	
	130 x 130 x 10/12	19.7/23.5	
	150 x 150 x 12/16	22.9/27.3	
	Bhilai Steel Plant		
	150 x 150 x 16/ 20*	35.8/44.1	12 - 13 for all dimensions
Angles	IISCO Steel Plant		
	65 x 65 x 6	5.8	10 & above
	65 x 65 x 8	7.7	
	65 x 65 x 10	9.4	
	75 x 75 x 6	6.8	
	75 x 75 x 8	8.9	
	75 x 75 x 10	11.0	
	90 x 90 x 6	8.2	

Section	Dimensions mm	Sectional Weight kg/m	Length m
	90 x 90 x 8	10.8	10 to 13.5 for all dimensions
	90 x 90 x 10	13.4	
	90 x 90 x 12	15.8	
	100 x 100 x 6	9.2	
	100 x 100 x 8	12.1	
	100 x 100 x 10	14.9	
	100 x 100 x 12	17.7	
	150 x 150 x 12	27.3	
	150 x 150 x 16	35.8	
	150 x 150 x 20	44.1	
Unequal Angles	IISCO Steel Plant		
	125 x 75 x 8	12.1	10 & above
	125 x 75 x 10	14.9	10 & above
	150 x 115 x 10	20 .1	11.5 & above
	150 x 115 x 12	24.0	11.5 & above

* Can be produced, if sufficient orders are available.

Below 10m/11.5m length can also be supplied

While standard lengths are mentioned in tables above, BSP can supply material in any fixed length in the range 6-13 m and DSP can supply in any fixed length in the range 5.5-11.5 m

Common grades : IS 2062/2006 and SAILMA

Copper bearing structurals are also rolled as per customer's specifications. High strength light structurals are also available as per the needs of TLT manufacturers.

Structurals are also available in the following **foreign specifications :**

ASTM-A-36, JIS-G-3101-SS400, BS-4360 Grades 40A, 43A, 43B, 43C, 50B, 50C, EN-10025, Grades S-275 JO, JR, S-355 JO, JR, DIN-17100 ST 37.2/44.2 (all in semi-killed quality), if sufficient orders are available.

Rolling tolerance for Structural Steel sections as per IS1852/1985

Beams

Depth	Tolerance	Width of flange	Tolerance
Up to 200 mm	+ 3.0, - 2.0 mm	Up to 100 mm	± 2.0 mm
>200 to 400 mm	± 3.0 mm	>100 to 125 mm	± 2.5 mm
>400 to 600 mm	± 4.0 mm	>125 to 250 mm	± 4.0 mm

Tolerance on weight per metre shall be ± 2.5% or alternatively +4, -1% of the weight per metre. The permissible limits for camber and sweep shall be 0.2% of the length.

Channels

Depth	Tolerance	Width of flange	Tolerance
Up to 200 mm	± 2.5 mm	Up to 100 mm	± 2 mm
> 200 to 400 mm	± 3.0 mm		

Tolerance on weight per metre shall be ± 2.5% or alternatively +4, -1% of the standard weight per metre up to 200 mm depth. The permissible limits for camber and sweep shall be 0.2% of the length.

Angles

Leg length	Tolerance	Leg length	Camber
Up to 45 mm	± 1.5 mm	< 100 mm	As per agreement
>45 mm to 100 mm	± 2.0 mm	100 mm	0.2% of length
>100 mm	± 2%		

Tolerance on Sectional Weight

Thickness	Tolerance
Up to 3 mm	± 5%
Over 3 mm	+ 5%, -3%

Structurals with closer tolerance can be supplied by mutual agreement.

Chemical Composition IS 2062/2011

Grade Designation	Quality	Ladle Analysis, % Max					Carbon Equivalent (CE), Max	Method of Deoxidation
		C	Mn	S	P	S1		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E 250	A	0.23	1.50	0.045	0.045	0.40	0.42	Semi Killed/Killed
	BR BO	0.22	1.50	0.045	0.045	0.40	0.41	Killed
	C	0.20	1.50	0.040	0.040	0.40	0.39	Killed
E 300	A	0.20	1.30	0.045	0.045	0.45	0.40	Semi Killed/Killed
	BR BO C							Killed
E 350	A	0.20	1.50	0.045	0.045	0.45	0.42	Semi Killed/Killed
	BR BO C							Killed
E 410	A	0.20	1.60	0.045	0.045	0.45	0.46	Semi Killed/Killed
	BR BO C							Killed
E 450	A	0.22	1.60	0.045	0.045	0.45	0.48	Semi Killed/Killed
	BR							Killed
E 550	A	0.22	1.65	0.020	0.025	0.50	0.50	Killed
	BR							
E 600	A	0.22	1.70	0.020	0.025	0.50	0.50	Semi Killed/Killed
	BR							
E 650	A	0.22	1.70	0.015	0.025	0.50	0.52	Killed
	BR							
SAILMA								Nb + Ti + V%
Grade	C max	Mn max	S max	P max	Al min	Si max	CE max.	MAE max.
300	0.20	1.50	0.045	0.045	0.02	0.45	0.44	≤ 0.25
300 HI	0.20	1.50	0.040	0.040	0.02	0.45	0.43	≤ 0.25
350	0.20	1.55	0.045	0.045	0.02	0.45	0.46	≤ 0.25
350 HI	0.20	1.55	0.040	0.040	0.02	0.45	0.45	≤ 0.25
410	0.20	1.60	0.045	0.045	0.02	0.45	0.47	≤ 0.25
410 HI	0.20	1.60	0.040	0.040	0.02	0.45	0.46	≤ 0.25
450	0.20	1.65	0.045	0.045	0.02	0.45	0.48	≤ 0.25
450HI	0.20	1.65	0.040	0.040	0.02	0.45	0.47	≤ 0.25
550	0.20	1.65	0.020	0.025	0.02	0.50	0.54	≤ 0.25
550HI	0.20	1.65	0.015	0.025	0.02	0.50	0.54	≤ 0.25
600	0.22	1.70	0.015	0.025	0.02	0.50	0.54	≤ 0.25
HCRS (Cu-P)		0.15 max		0.25-0.8	0.07-0.15		0.03 max	Cu:0.20 min

Straightening and Despatch

At BSP's Merchant Mill and Rail & Structural Mill every piece of each section is straightened through a straightening machine. Heavy structurals from R&S Mill are despatched piece wise while light structurals from Merchant Mill are clubbed in bundles of 8-12 tonnes in fixed length. Angles from Merchant Mill for TLT manufacturers can be nested and packetted, after piece by piece inspection. Customers are requested to specify this, if required.

At DSP's Section Mill 100% products are straightened.

Micro alloying elements like Nb, V may be added singly or in combinatiion up to 0.25% max, Cu may be present between 0.20 to 0.35%, if desicred by the purchaser.

Mechanical Properties

Grade Designation	Quality	Tensile Strength Rm Min Mpa	Yield Stress			Percentage Elongation A, at Gauge Length, L=5.65 √S Min	Internal Bend Diameter Min (See Note 2)		Charpy Impact Test (See Note 3 & 4)	
			t<20	20-40	>40		<25	>25	Temp °C	Min
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
E-250	A	410	250	240	230	23	2t	3t	–	–
	BR								RT	27
	BO								0	27
	C								(-) 20	27
E-300	A	440	300	290	280	22	2t	–	–	–
	BR								RT	27
	BO								0	27
	C								(-) 20	27
E-350	A	490	350	330	320	22	2t	–	–	–
	BR								RT	27
	BO								0	27
	C								(-) 20	27
E-410	A	540	410	390	380	20	2t	–	–	–
	BR								RT	25
	BO								0	25
	C								(-) 20	25
E-450	A	570	450	430	420	22	2.5t	–	–	–
	BR								RT	20
	BO								0	20
	C								(-) 20	20
E-550	A	650	550	530	520	12	3.0t	–	–	–
	BR								RT	15
E-600	A	730	600	580	570	12	3.5t	–	–	–
	BR								RT	15
E-650	A	780	650	630	620	12	4.0t	–	–	–
	BR								RT	15

Mechanical Properties

SAILMA

Grade	YS MPa min	UTS, MPa min	% EI min 5.65/AO	Internal Bend Diameter, min		Charpy Impact Test	
				<25 mm	>25 mm	Temp °C	J, min
SAILMA 300	300	440	24	2t	–	–	–
SAILMA 300 HI	300	440	24	2t	–	0	40
SAILMA 350	350	490	24	2t	–	–	–
SAILMA 350 HI	350	490	24	2t	–	0 -20	40 30
SAILMA 410	410	540	22	2t	–	–	–
SAILMA 410 HI	410	540	22	2t	–	0 -20	35 25
SAILMA 450	450	570	22	2.5t	–	–	–
SAILMA 450 HI	450	570	22	2.5t	–	0 -20	30 20
SAILMA 550	550	650	14	3t	–	–	–
SAILMA 550 HI	550	650	14	3t	–	0 -20	25 15
SAILMA 600	600	730	14	3.5t	–	–	–

Specification	Grade	Yield stength Min MPa	Ultimate Tensile Strength Min MPa	Elongation % in gauge Length 5.65 S_o Min	Charpy Impact Value Joules Min	Bend Test
HCRS (Cu-P)	–	340	480	21		1T

Impact will be given for any one temperature. For 450 HI & above impact is for>10 mm.
For <12 mm. impact to be given only if specified.

Mechanical Properties

Chemical Composition IS 2062/2006

Crane Rails

Profile	Sectional Wt, kg/m	Standard Length, m	Mill
CR - 80*	64.2	13	Rail & Structural Mill, Bhilai
CR - 100*	89.0	13	Rail & Structural Mill, Bhilai
CR -120*	118.0	13	Rail & Structural Mill, Bhilai

* Denotes head width

Specification	Ladle Analysis %					
	C	Mn	P Max	S Max	Si	Hydrogen
Crane Rails	0.65-0.75	1.0 to 1.3	0.040	0.040	0.10 to 0.50	Less than 3 ppm

Properties

UTS	:	850 MPa min
Elongation	:	8% min
Hardness	:	250 BHN min
Micro Structure	:	Pearlitic
Inclusion rating	:	3.0 max (worst field) Sulphide, Alumina, Silicate & Globular oxide individually
Supply condition		
CR 80, 100	:	Straightened
CR 120	:	Unstraightended

Special Sections

Z - Section Centre Sill

Ixx	23624 cm^4
ZTOP	1442 cm^3
ZBTM	1448 cm^3
Section	327 x 174 x 101.5 mm
Sectional Weight	55.211 kg/m
Weight per metre	110.422 kg
Area of Section	140.945 cm^2
Stress Ratio Top	0.0071
Stress Ratio Bottom	0.0071

Applications : Railway Wagons

Standard Length : 11.5 m and above

Length below 11.5 m can also be supplied

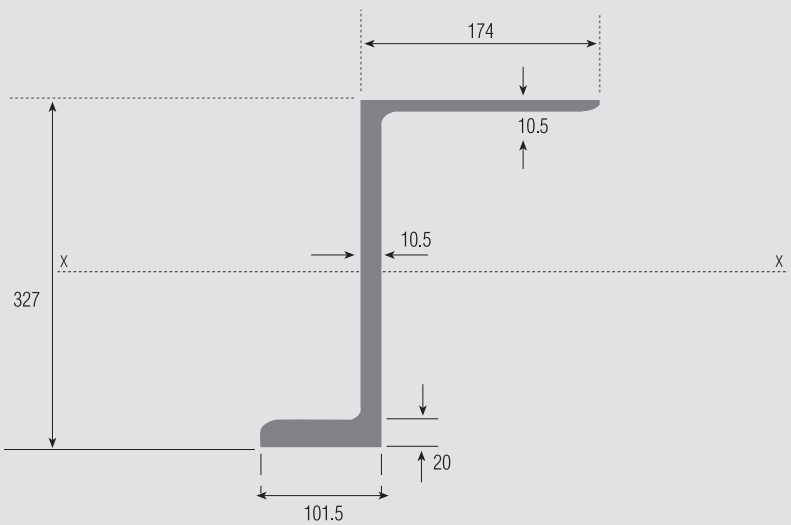
Rolling Tolerance

Long Flange	+ 5 mm	- 3.0 mm
Short Flange	+ 4.0 mm	- 6.0 mm
Sectional Weight	+ 5%	- 3%

Steel Quality

IS 2062/2006 Gr. E-250 Cu orE-410 Cu.

IS 8500/1991 Fe490/540 with or without Cu.



Z - Type Sheet-piling Section

Section (mm)	400 x 185 x 7.5/8.5
Weight per meter of pile	49.25 kg
Weight per sqare meter of wall	12312 kg
Section Modules per meter wall	1021 cm^3
Moment of inertia per meter of wall	9448.5 cm^4
Section area per meter of wall	157 cm^2
Perimeter per meter of wall	283 cm
Distance of joints (centre to centre)	400 mm
Depth of section	185 mm
Web thickness	7.5 mm
Flange thickness	8.5 mm

Applications : Leak proof retaining wall in construction of dams, bridge foundation, construction in ports.

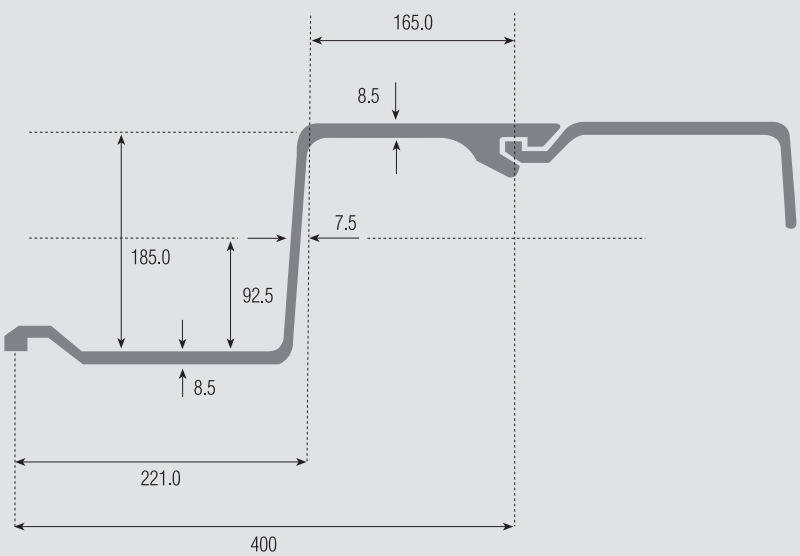
Advantages : Sharp edged lock may be considered as being tight. Due to self-locking facilities these can be erected very easily and quickly without any extra fixing details, Z-Piling retaining wall can resist higher amount of transverse thrust in comparison to wall of other equivalent structural sections.

Typical Length : 11 metres and above.

Steel Quality

IS 2062/2006 Gr. E-250 A (SK) with or without Cu.

Tolerance on Sectional weight + 4% - 2.5%



M S Arch

Sectional Wt.	28.2 kg/m
Zxx	93. 1 cm^3
Ixx	540 cm^4
rxx	3.89 cm
Sectional Area	3570 mm^2
Zyy	89 cm^3
Iyy	620 cm^4
ryy	4.17 cm
Min YS	250 MPa
Max YS	410 MPa
Max. Rolling Length	12.5 m (approx)

Applications : To support underground galleries in collieries and for constructions of tunnels in hydroelectric projects etc.

Advantages : Can resist higher amount of axial compresive load in comparison to equivalent ISMB joist sections.Due to its configuration, it can be bent to arch shape without any corrugation. Sliding joint facility helps to release excess overburden load.

Typical Length : 11.5 metres and above. Length below 11.5 m can also be supplied.

Steel Quality

IS 2062/2006 Gr. E-250 A (SK) with or without Cu.

Tolerance on Sectional weight + 2.5%