Part 2
MATERIALS

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2.1 General

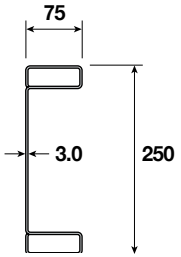
Australian Tube Mills (ATM) manufactures the LiteSteel beam to an in-house specification with a high strength steel which is the most appropriate for the forming process, welding and grade requirements. The specification details required by structural engineers are outlined in this part of the publication. Compliance with this specification (ATM 0402 – LiteSteel beam Specification) is controlled by the ATM Quality Assurance Procedures.

Because it is a cold-formed steel product, the design of the LSB in structures must comply with AS/NZS 4600 Cold-formed steel structures.

The designation for the LSB is illustrated in the following example:

$250 \times 75 \times 3.0$ LSB

Where
250 = depth (mm)
75 = flange width (mm)
3.0 = thickness (mm)
LSB = LiteSteel beam



2.2 Properties of Steel

The properties of steel adopted in this publication are shown in the table below. Other properties such as Poisson's Ratio and Coefficient of Thermal Expansion are also listed.

Property	Symbol	Value
Young's Modulus of Elasticity	E	200×10^3 MPa
Shear Modulus of Elasticity	G	80×10^3 MPa
Density	ρ	7850 kg/m^3
Poisson's Ratio	ν	0.25
Coefficient of Thermal Expansion	α_T	11.7×10^{-6} per °C

2.3 LiteSteel beam (LSB)

2.3.1 Dimensions and Section Properties

The dimensions and section properties of the full range of LSB sections are provided in Tables 2.1-1 and 2.1-2. Further information including section and member capacities for structural engineers are available in the Design Capacity Tables (LST 2007a).

2.3.2 Mechanical Properties

The DuoSteel grade LiteSteel beam is manufactured from a base steel which has a yield stress f_y = 380 MPa and a tensile strength f_u = 490 MPa. The cold-forming process enhances the yield stress and tensile strength of the flanges of the LSB in the same way it does for the rectangular hollow sections, producing a formed section which complies with the following requirements:

Location	Minimum Yeild Stress f_y MPa	Minimum Tensile Strength f_u MPa	Minimum Elongation as a proportion of Gauge Length $5.65\sqrt{S_o}$ %
Web	380	490	14
Flanges	450	500	14

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2.4 Hot Rolled Angles, Flats and Plates

Steel angles, flats and plate are used for connection components. It is generally more economical to use flats rather than plate, so standard flat sizes have been specified wherever possible in this publication. The minimum yield stresses and tensile strengths of the standard grades of angle, flat and plate are given in the table below. These have been used for design in this publication.

Australian Standard	Form	Steel Grade	Thickness t mm	Minimum Yield Stress f_y MPa	Minimum Tensile Strength f_u MPa
AS/NZS 3679.1	Angles Flats	300	$t < 11$	320	440
			$11 \le t \le 17$	300	440
			$t > 17$	280	440
AS/NZS 3678	Plate	250	$t \le 8$	280	410
			$8 < t \le 12$	260	410
			$12 < t \le 50$	250	410

2.5 Bolts

Bolt material and grades used in this manual are listed in the following table:

Bolt Type	Australian Standard	Bolt Grade	Minimum Bolt Tensile Strength f_{uf} (MPa)
High Strength Bolts, Nuts, Washers (≥ M16)	AS 1252	8.8	830
Precision Bolts, Nuts, Washers (< M16)	AS 1110.1 AS 1112.1 AS 1237.1	8.8	800
Commercial Bolts, Nuts, Washers	AS 1111.1 AS 1112.3 AS 1237.1	4.6	400

2.6 Welding Consumables

The welding consumables in the table below are applicable to the LSB and the connection designs in this manual.

Welding Process	Australian Standard	Consumables	Nominal Weld Tensile Strength f_{uw} (MPa)
MMAW (Manual Metal Arc Welding)	AS 1553.1	E48XX	480
GMAW (Gas Metal Arc Welding)	AS 2717.1	W50X	480
FCAW (Flux Cored Arc Welding)	AS 2203.1	W50X	480

2.7 Screws

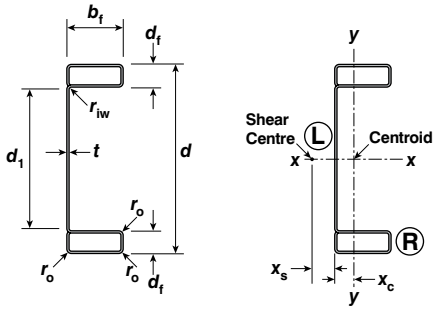
Screws are not used for any of the connection designs presented in this manual, but guidance is given for the design and detailing of screwed connections to the LSB in accordance with AS/NZS 4600. All screws must comply with AS 3566.1 and AS 3566.2.

TABLE 2.1-1

LiteSteel beam

DIMENSIONS AND FULL SECTION PROPERTIES

Dimensions											Properties											
Designation			Mass per metre	Flange Depth	Outside Flange Radius	Inside Web Radius	Web Flat Depth	Coord. of Centroid	Coord. of Shear Centre	External Surface Area	Gross Area of Section	about x-axis			about y-axis				Torsional Rigidity of Flange	Torsion Constant	Warping Constant
d	b_f	t		d_f	r_o	r_{iw}	d_1	x_c	x_s		A_g	I_x	Z_x	r_x	I_y	Z_{yL}	Z_{yR}	r_y	GJ_f	J	I_w
mm	mm	mm		kg/m	mm	mm	mm	mm	mm	mm	m^2/m	mm^2	10^6mm^4	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6Nmm^2	10^3mm^4	10^9mm^6
300 × 75 ×	3.0	LSB	14.5	25.0	6.00	3.00	244	22.7	26.8	0.877	1840	24.6	164	116	1.23	54.3	23.5	25.9	13000	328	17.1
	2.5	LSB	12.2	25.0	5.00	3.00	244	22.8	27.1	0.881	1550	20.8	139	116	1.06	46.6	20.3	26.2	11400	287	14.7
300 × 60 ×	2.0	LSB	8.80	20.0	4.00	3.00	254	16.4	20.5	0.825	1110	14.5	96.8	114	0.466	28.5	10.7	20.5	4670	118	6.47
250 × 75 ×	3.0	LSB	13.3	25.0	6.00	3.00	194	24.6	27.9	0.777	1690	15.9	127	96.9	1.16	47.1	23.0	26.2	13000	328	11.1
	2.5	LSB	11.2	25.0	5.00	3.00	194	24.7	28.2	0.781	1420	13.4	107	97.2	0.998	40.5	19.8	26.5	11400	286	9.58
250 × 60 ×	2.0	LSB	8.00	20.0	4.00	3.00	204	17.9	21.5	0.725	1010	9.38	75.0	96.4	0.440	24.6	10.4	20.9	4670	117	4.24
200 × 60 ×	2.5	LSB	8.86	20.0	5.00	3.00	154	19.7	22.3	0.621	1120	6.74	67.4	77.5	0.490	24.9	12.1	20.9	5500	138	3.00
	2.0	LSB	7.21	20.0	4.00	3.00	154	19.7	22.6	0.625	910	5.50	55.0	77.7	0.408	20.7	10.1	21.2	4670	117	2.51
200 × 45 ×	1.6	LSB	4.95	15.0	3.20	3.00	164	13.0	15.9	0.568	624	3.67	36.7	76.8	0.150	11.5	4.68	15.5	1550	39.1	0.923
150 × 45 ×	2.0	LSB	5.31	15.0	4.00	3.00	114	14.7	16.8	0.465	670	2.26	30.1	58.1	0.163	11.0	5.38	15.6	1820	45.8	0.560
	1.6	LSB	4.32	15.0	3.20	3.00	114	14.8	17.0	0.468	544	1.84	24.6	58.2	0.136	9.20	4.51	15.8	1550	39.0	0.469



Notes:

1. **Always ensure that you are using current information on the LSB product range. This can be verified by comparing the document version date (noted at the bottom of the page) with the current version date of each publication. The current version date and downloadable versions of all LSB publications can be obtained by referring to www.litesteelbeam.com.au or by contacting LST.**
2. Steel grade DuoSteel (flange f_{yf} = 450 MPa and f_{uf} = 500 MPa; web f_{yw} = 380 MPa and f_{uw} = 490 MPa).
3. Full section properties are calculated in accordance with AS/NZS 4600.

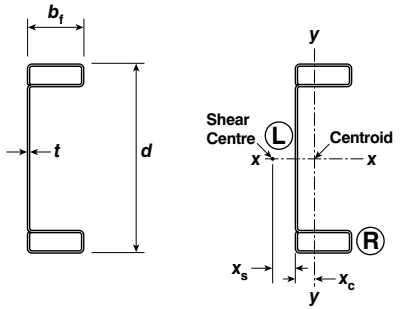
See page (ii) for the appropriate use of this publication.

TABLE 2.1-2

LiteSteel beam

EFFECTIVE SECTION PROPERTIES

Designation			Mass per metre	Yield Stress		Axial Compression		Bending					
				Flange	Web	Effective Area	Coord. of Centroid	about x-axis		about y-axis			
d	b_f	t		f_{yf}	f_{yw}	A_e	x_c	I_{ex}	Z_{ex}	I_{eyL}	Z_{eyL}	I_{eyR}	Z_{eyR}
mm	mm	mm	kg/m	MPa	MPa	mm^2	mm	10^{6}mm^4	10^{3}mm^3	10^{6}mm^4	10^{3}mm^3	10^{6}mm^4	10^{3}mm^3
300 × 75 × 3.0 LSB			14.5	450	380	1450	22.7	24.6	164	1.09	22.4	1.23	23.5
		2.5 LSB	12.2	450	380	1180	22.8	20.8	139	0.901	19.0	1.06	20.3
300 × 60 × 2.0 LSB			8.80	450	380	763	16.4	14.5	96.8	0.379	9.84	0.466	10.7
250 × 75 × 3.0 LSB			13.3	450	380	1440	24.6	15.9	127	1.06	22.1	1.16	23.0
		2.5 LSB	11.2	450	380	1180	24.7	13.4	107	0.881	18.8	0.998	19.8
250 × 60 × 2.0 LSB			8.00	450	380	760	17.9	9.38	75.0	0.371	9.75	0.440	10.4
200 × 60 × 2.5 LSB			8.86	450	380	967	19.7	6.74	67.4	0.453	11.7	0.490	12.1
		2.0 LSB	7.21	450	380	755	19.7	5.50	55.0	0.361	9.64	0.408	10.1
200 × 45 × 1.6 LSB			4.95	450	380	462	13.0	3.67	36.7	0.127	4.38	0.150	4.68
150 × 45 × 2.0 LSB			5.31	450	380	587	14.7	2.26	30.1	0.153	5.23	0.163	5.38
		1.6 LSB	4.32	450	380	458	14.8	1.84	24.6	0.122	4.31	0.136	4.51



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2. Steel grade DuoSteel (flange f_{yf} = 450 MPa and f_{uf} = 500 MPa; web f_{yw} = 380 MPa and f_{uw} = 490 MPa).
3. Effective section properties are calculated in accordance with AS/NZS 4600.
4. I_{eL} and Z_{eL} are for bending about the y-axis that causes compression in the web "L".
5. I_{eR} and Z_{eR} are for bending about the y-axis that causes compression in the flange tips "R".

See page (ii) for the appropriate use of this publication.

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