HOWICK

INNOVATION... READY TO ROLL

DESIGN CAPACITY TABLES

for

89 x 41 Lipped Channels - Nestable

to

AS/NZS 4600

Version 02

January 2019

www.howickltd.com

Howick Ltd 117 Vincent St Howick Auckland 2014 New Zealand • Telephone: +64 9 4534 5569 • Internet: www.howickltd.com

Howick Ltd

Design Capacity Tables for 89 x 41 Lipped Channels - Nestable to AS/NZS 4600

Published by
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RELEVANCE OF INFORMATION CONTAINED IN THIS PUBLICATION:

Users of this publication should note that the design capacities, calculations, tabulations and other information contained in this publication are specifically relevant to cold-formed steel sections manufactured on Howick roll-forming machines.

Consequently, the information contained in this publication cannot be readily used for cold-formed sections produced on machines by other manufacturers, as those sections may vary significantly in geometry and material Standard compliance.

Contents

About Howick Ltd

Howick Ltd is a well-established and respected, 35 year, family enterprise based in Auckland, New Zealand.

Howick Ltd personifies the concept of "Kiwi ingenuity" showcasing technical experties and creativity and that essential "can do" philosophy that underpins the company's world-leading innovation and quality. Given this success, Howick Ltd is often described as producers of "the world's best steel framing machines".

We are a design and manufacturing company with a global philosophy and reach. Our emphasis is on unique research and development and sophisticated design technology enabling cost-effective, efficient end to end construction systems, across a variety of steel framed projects.

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09/01/2019

Howick Ltd
117 Vincent Street, Howick
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2014

RE: DESIGN CAPACITY TABLES for 89 x 41 Lipped Channel Nestable to AS/NZS 4600:2018 Version 02 January 2019

Att: Nick Coubray,

As requested, Engineering Design Global Enterprise (EDGE Consulting Engineers), has undertaken a peer review of the documentation provided by Howick Ltd for the 89 x 41 Lipped Channel Nestable Sections as manufactured by Howick LTD. EDGE has been provided with the following documents:

- "Howick 89 x 41 LCN – DCT [2] 2018-10-24" and associated calculations.
- "89x41 LCN Properties & Capacities v08.xlsx"
- "89x41 LCN – Lips Removed Properties & Capacities v06.xlsx"

These documents have been technically reviewed against the relevant standards.

The design capacity tables provided have been compared to the results within the reviewed spreadsheets and calculations and reviewed in accordance with AS/NZS 4600:2018. All calculations and capacity tables comply with AS/NZS 4600:2018.

Yours faithfully,

Tim Peters
BEng Meng MIEAust CPEng
67334 RBP RPEQ 5496 MIPENZ MIEPNG

Registered as Engineering Design Global Enterprise Pty Ltd (ABN: 15 610 150 957)

Notations & Abbreviations

Symbol	Description
A_g	gross area of a cross-section
b	flat width of a flange excluding radii
b_{f1}	overall width of the larger flange
b_{f2}	overall width of the smaller flange
C_b	bending coefficient dependent on moment
C_s	coefficient for moment about the cnetroidal axis perpendicular to the symmetry axis
C_{TF}	coefficient for unequal end moment
c	distance from the end of a beam to the edge of the bearing force
d	overall depth of a section
d_1	depth of the flat portion of a web measured along the plane of the web
d_L	overall depth of a lip
E	Young's modulus of elasticity
EOF	End One Flange (concentrated load or reaction on a beam)
ETF	End Two Flange (concentrated load or reaction on a beam)
f_u	minimum tensile strength used in design
f_y	minimum yield stress used in design
G	shear modulus of elasticity
I_w	warping constant for a cross-section
I_x	second moment of area about the major principal x-axis
I_y	second moment of area about the minor principal y-axis
IOF	Interior One Flange (concentrated load or reaction on a beam)
ITF	Interior Two Flange (concentrated load or reaction on a beam)
J	torsion constant for the cross-section
L_b	actual length of bearing
L_e	effective length of a member
L_{ex}	effective length for buckling about the major principal x-axis
L_{ey}	effective length for buckling about the minor principal y-axis
L_{ez}	effective length for torsional buckling about the longitudinal z-axis

Symbol	Description
M^*	design bending moment
M_x^*	design bending moment about the x-axis
M_y^*	design bending moment about the y-axis
M_b	nominal member moment capacity
M_{bdx}	nominal moment capacity about the x-axis for distortional buckling
M_{bdyL}	nominal moment capacity about the y-axis for distortional buckling (lips in compression)
M_{bdyW}	nominal moment capacity about the y-axis for distortional buckling (web in compression)
M_{bx}	nominal member moment capacity about the x-axis
M_{by}	nominal member moment capacity about the y-axis
M_{byL}	nominal member moment capacity about the y-axis (lips in compression)
M_{byW}	nominal member moment capacity about the y-axis (web in compression)
M_{sx}	nominal section moment capacity about the x-axis
M_{sxf}	nominal yield moment capacity about the x-axis
M_{syfL}	nominal yield moment capacity about the y-axis (tension in the lips)
M_{syfT}	nominal yield moment capacity about the y-axis (tension in the toes)
M_{syfW}	nominal yield moment capacity about the y-axis (tension in the web)
M_{syL}	nominal section moment capacity about the y-axis (lips in compression)
M_{syT}	nominal section moment capacity about the y-axis (toes in compression)
M_{syW}	nominal section moment capacity about the y-axis (web in compression)
M_y	moment causing initial yield at the extreme compression fibre of a full section
N^*	design axial force (tension or compression)
N_c	nominal member capacity of a member in compression
N_{cd}	nominal capacity of a member in compression for distortional buckling
N_{ex}	elastic buckling load about the major principal x-axis
N_{ey}	elastic buckling load about the minor principal y-axis
N_s	nominal section capacity of a member in compression

Symbol	Description
N_t	nominal section capacity of a member in tension
r_i	inside corner radius
r_{o1}	polar radius of gyration of the cross-section about the shear centre
r_x	radius of gyration about the major principal x-axis
r_y	radius of gyration about the minor principal y-axis
t	nominal base metal thickness of a section exclusive of coatings
V_{vx}	nominal shear capacity of the cross-section perpendicular to the x-axis
V_{vy}	nominal shear capacity of the cross-section perpendicular to the x-axis
V_x^*	design shear force
V_y^*	design shear force
w_h	total hole width
x	major principal axis of the cross-section
x_c	co-ordinate of the centroid from the back of the web along the x-axis
x_o	co-ordinate of the shear centre from the centroid along the x-axis
y	minor principal axis of the cross-section
Z_x	elastic section modulus about the major principal x-axis
Z_{yL}	elastic section modulus about the minor principal y-axis (lips in compression)
Z_{yW}	elastic section modulus about the minor principal y-axis (web in compression)
α_T	coefficient of thermal expamsion
β_y	monosymmetry section constant about the y-axis
ϕ_b	capacity reduction factor for bending
ϕ_c	capacity reduction factor for compression
ϕ_t	capacity reduction factor for tension
ϕ_v	capacity reduction factor for shear
ϕ_w	capacity reduction factor for bearing
ν	Poisson's ratio (= 0.3 for steel)
ρ	density of steel

INTRODUCTION

Scope

These Design Capacity Tables have been prepared for the following nestable lipped channel cold-formed sections manufactured on Howick Ltd. steel roll-forming machines.

89 x 41 x 1.55 LCN
89 x 41 x 1.15 LCN
89 x 41 x 0.95 LCN
89 x 41 x 0.75 LCN

The values presented in the tables and graphs are only applicable to sections manufactured on Howick Ltd. machines, and for the specified steel grades complying with AS 1397.

All of the dimensions and section properties required for design are provided, as well as design aids in the form of tables and graphs for members subject to the following design actions:

Bending
Axial Compression
Axial Tension
Combined Actions

These design aids will allow engineers to design most structures without having to refer to the design standard AS/NZS 4600.

Design Method

The Tables and Graphs in this publication have been calculated generally in accordance with the Australian and New Zealand standard AS/NZS 4600 Cold-Formed steel Structures. The Direct Strength Method (DSM) has been used to determine the capacities for axial compression and bending, based on the results of finite strip analyses using the computer program “Thin-Wall” from The University of Sydney.

Where appropriate, the method of calculating capacities in the transition region between local and distortional buckling in accordance with the AISI publication “Direct Strength Mothod” has been used. This is an extension of what is given in AS/NZS 4600.

Limit States Design

All values presented in these Design Capacity Tables are limit state values in accordance with the Limits State Design requirements of AS/NZS 4600 and AS/NZS 1170.0.

Units

The units in the Tables are consistent with those in the SI (metric) system. The base units used in the tables and graphs are:

Property	Units	Symbol
Force	Newton	N
Length	metre	m
Mass	kilogram	kg
Stress	Megapascal	MPa

Except for some minor exceptions, all values in the Tables are rounded to three (3) significant figures.

Properties of Steel

The properties of steel used for the calculation of capacities in these Tables are given in the table below. The coefficient of expansion for steel is also listed.

Property	Symbol	Value
Young’s Modulus of Elasticity	E	200 x 10^3 MPa
Shear Modulus	G	80 x 10^3 MPa
Poisson’s Ratio	ν	0.3
Density	ρ	7850 kg/m^3
Coefficient of Thermal Expansion	α_T	11.7 x 10^{-6} per ˚C

The steel grades and mechanical properties used for design in accordance with AS/NZS 4600 are given in the table below. Note that the yield stress and tensile strength for thin sections of Grade G550 steel are reduced as required by this standard.

Section	Grade	Yield Stress f_y (MPa)	Tensile Strength f_u (MPa)
89 x 41 x 1.55 LCN	G450	450	480
89 x 41 x 1.15 LCN	G500	500	520
89 x 41 x 0.95 LCN	G550	550	550
89 x 41 x 0.75 LCN	G550	495	495

References

Referenced Standards

AS 1397-2011, Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium, Standards Australia

AS/NZS 1170.1: 2002, Structural Design Actions Part 0: General Principles, Standards Australia.

AS/NZS 4600: 2018, Cold-Formed Steel Structures, Standards Australia.

Other References

AISI 2006, Direct Strength Method (DSM) Design Guide, American Iron and Steel Institute, January 2006.

Centre of Advanced Structural Engineering (CASE) 2001, "THIN-WALL," Computer Program.

Part 1:
Dimensions & Section Properties

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Part 1: Dimensions & Section Properties

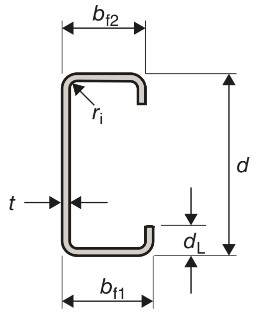
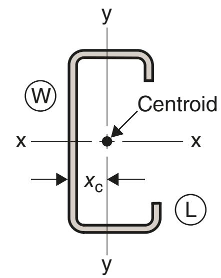


Table 1.1

DIMENSIONS & SECTION PROPERTIES

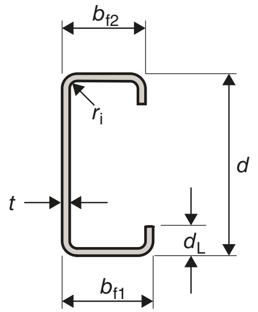


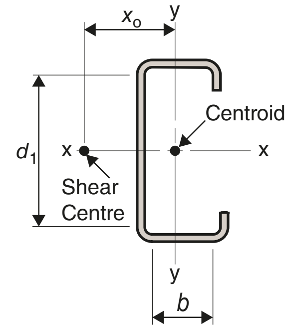
DIMENSIONS									SECTION PROPERTIES							
Designation	Depth	Large Flange Width	Small Flange Width	Lip Depth	Thick.	Inside Corner Radius	Co-ord. of Centroid	Mass per metre	Gross Section Area	About x-axis			About y-axis			
	d	b_{f1}	b_{f2}	d_L	t	r_i	x_c		A_g	I_x	Z_x	r_x	I_y	Z_{yL}	Z_{yW}	r_y
	mm	mm	mm	mm	mm	mm	mm	kg/m	mm^2	10^6mm^4	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm
89 x 41 x 1.55 LCN - G450	89.0	41.3	39.0	10.0	1.55	1.5	12.6	2.18	278	0.347	7.81	35.4	0.0584	2.12	4.62	14.5
89 x 41 x 1.15 LCN - G500	89.0	41.3	39.0	10.0	1.15	1.5	12.6	1.64	208	0.264	5.92	35.6	0.0450	1.63	3.55	14.7
89 x 41 x 0.95 LCN - G550	89.0	41.3	39.0	10.0	0.95	1.5	12.6	1.36	173	0.220	4.95	35.7	0.0378	1.38	2.99	14.8
89 x 41 x 0.75 LCN - G550	89.0	41.3	39.0	10.0	0.75	1.5	12.7	1.08	137	0.176	3.95	35.8	0.0304	1.11	2.40	14.9

NOTES:
1. Calculations of section properties are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Properties are calculated for an equal flange lipped channel using the average flange width.

Table 1.2

SECTION PROPERTIES TO CALCULATE MEMBER STABILITY





	DIMENSIONS									RATIOS		PROPERTIES					MATERIAL		
Designation	Depth d	Large Flange Width b_{f1}	Small Flange Width b_{f2}	Lip Depth d_L	Thick-ness t	Inside Corner Radius r_i	Flat Web Depth d_1	Flat Flange Width b	Mass per metre	Web d_1/t	Flange b/t	Shear Centre Co-ord. x_o	Polar Rad. of Gyration about S.C. r_{o1}	Mono-Symmetry Constant β_y	Torsion Constant J	Warping Constant I_w	Grade	Design Yield Stress f_y	Design Tensile Strength f_u
	mm	mm	mm	mm	mm	mm	mm	mm	kg/m			mm	mm		mm^4	10^6mm^6		MPa	MPa
89 x 41 x 1.55 LCN - G450	89.0	41.3	39.0	10.0	1.55	1.5	82.9	34.1	2.18	53.5	22.0	30.1	48.7	101	222	96.0	G450	450	480
89 x 41 x 1.15 LCN - G500	89.0	41.3	39.0	10.0	1.15	1.5	83.7	34.9	1.64	72.8	30.3	30.6	49.1	101	91.8	74.6	G500	500	520
89 x 41 x 0.95 LCN - G550	89.0	41.3	39.0	10.0	0.95	1.5	84.1	35.3	1.36	88.5	37.1	30.8	49.4	102	52.0	63.1	G550	550	550
89 x 41 x 0.75 LCN - G550	89.0	41.3	39.0	10.0	0.75	1.5	84.5	35.7	1.08	113	47.5	31.0	49.6	102	25.7	50.9	G550	495	495

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. The flat flange width is the average of the flanges.
6. Properties are calculated for an equal flange lipped channel using the average flange width.

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Part 2:
MEMBERS SUBJECT TO BENDING

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Part 2: Members subject to Bending

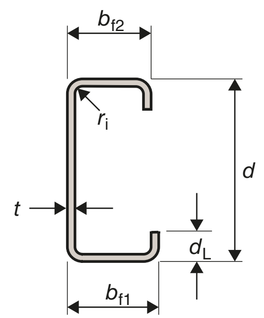


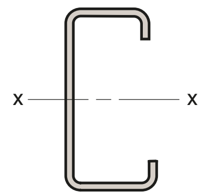
Table 2.1

MEMBER MOMENT CAPACITY

Members without Full Lateral Restraint

bending about x-axis

$C_b = 1.0$



Designation	Mass per metre	Buckling Capacities		Design Member Moment Capacity, $\phi_b M_{bx}$ (kNm)													
		Local $\phi_b M_{sx}$	Distortional $\phi_b M_{bdx}$	Effective Length (L_e) in metres													
	kg/m	kNm	kNm	0.2	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3	3.3	3.6	4
89 x 41 x 1.55 LCN - G450	2.18	3.16	2.81	2.96	2.81	2.81	2.81	2.52	2.01	1.48	1.13	0.907	0.749	0.635	0.549	0.483	0.416
89 x 41 x 1.15 LCN - G500	1.64	2.56	2.03	2.39	2.03	2.03	2.03	2.02	1.52	1.08	0.815	0.641	0.521	0.435	0.371	0.322	0.273
89 x 41 x 0.95 LCN - G550	1.36	2.01	1.65	2.01	1.66	1.65	1.65	1.62	1.26	0.892	0.667	0.520	0.420	0.348	0.294	0.253	0.212
89 x 41 x 0.75 LCN - G550	1.08	1.27	1.12	1.27	1.17	1.12	1.12	1.07	0.878	0.690	0.524	0.406	0.325	0.267	0.225	0.192	0.159

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for a uniform bending moment (C_b = 1.0).
6. Refer to Graph 2.1 for the limits of the local and distortional design moment capacities.
7. The effective length $L_e = L_{ey} = L_{ez}$.
8. Capacities are calculated for an equal flange lipped channel using the average flange width.

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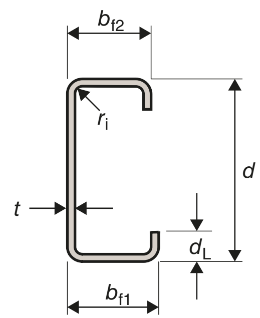
Graph 2.1

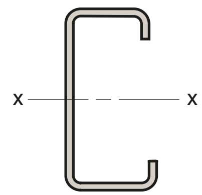


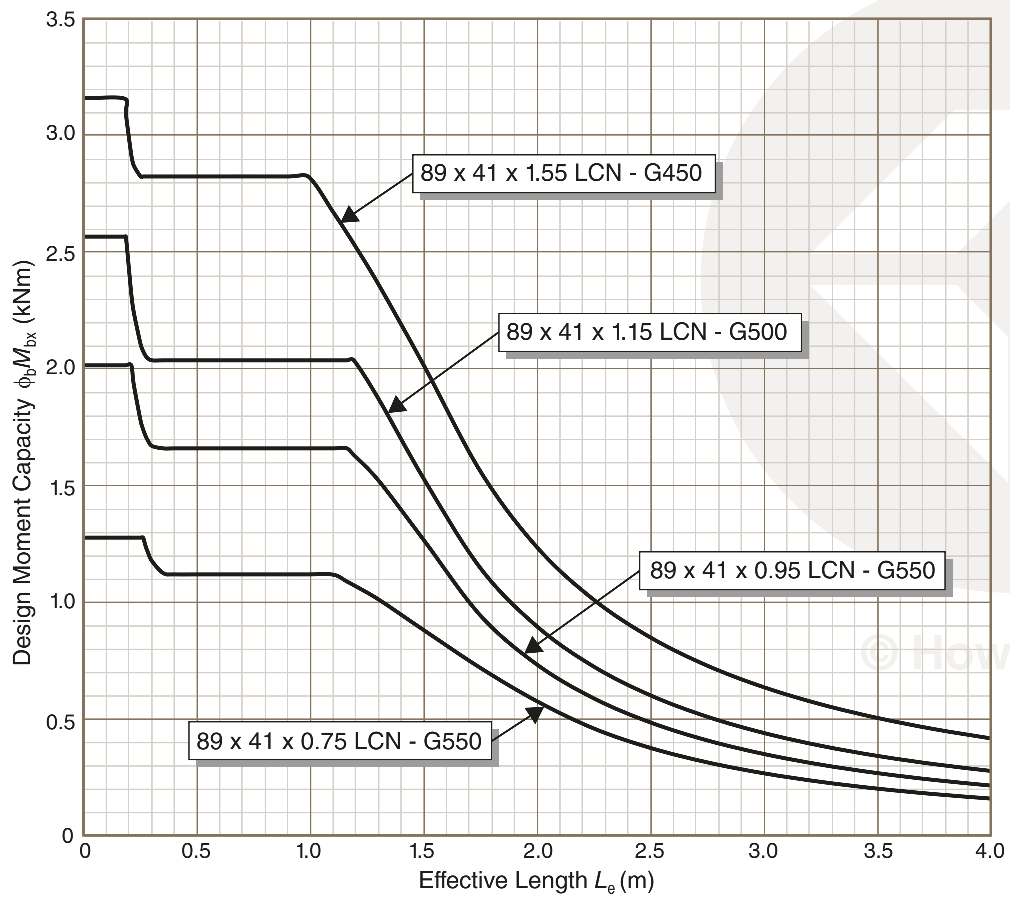
MEMBER MOMENT CAPACITY

Members without Full Lateral Restraint

bending about x-axis

$C_b = 1.0$





NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for a uniform bending moment (C_b = 1.0).
6. The effective length $L_e = L_{ey} = L_{ez}$.
7. Capacities are calculated for an equal flange lipped channel using the average flange width.

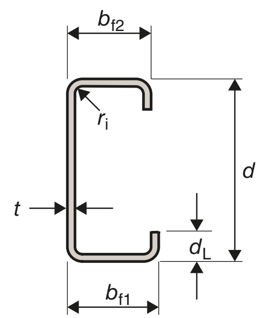


Table 2.2

MEMBER MOMENT CAPACITY

Members without Full Lateral Restraint

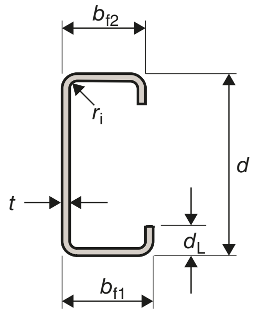
bending about y-axis

(Lips in Compression)

Designation	Mass per metre	Buckling Capacities		Design Member Moment Capacity, $\phi_b M_{byL}$ (kNm)													
		Local $\phi_b M_{syL}$	Distortional $\phi_b M_{bdyL}$	Effective Length (L_e) in metres													
	kg/m	kNm	kNm	0.2	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	4.0
89 x 41 x 1.55 LCN - G450	2.18	0.860	0.804	0.860	0.804	0.804	0.804	0.780	0.697	0.609	0.520	0.436	0.375	0.332	0.299	0.274	0.249
89 x 41 x 1.15 LCN - G500	1.64	0.736	0.590	0.736	0.594	0.590	0.590	0.590	0.551	0.450	0.351	0.283	0.236	0.203	0.178	0.159	0.140
89 x 41 x 0.95 LCN - G550	1.36	0.681	0.486	0.681	0.511	0.486	0.486	0.486	0.477	0.366	0.278	0.221	0.182	0.154	0.133	0.117	0.102
89 x 41 x 0.75 LCN - G550	1.08	0.483	0.330	0.483	0.372	0.330	0.330	0.330	0.330	0.283	0.213	0.167	0.136	0.113	0.0964	0.0838	0.0711

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for C_s = 1.0 and for a uniform bending moment (C_{TF} = 1.0).
6. Refer to Graph 2.2 for the limits of the local and distortional design moment capacities.
7. The effective length $L_e = L_{ex} = L_{ez}$.
8. Capacities are calculated for an equal flange lipped channel using the average flange width.



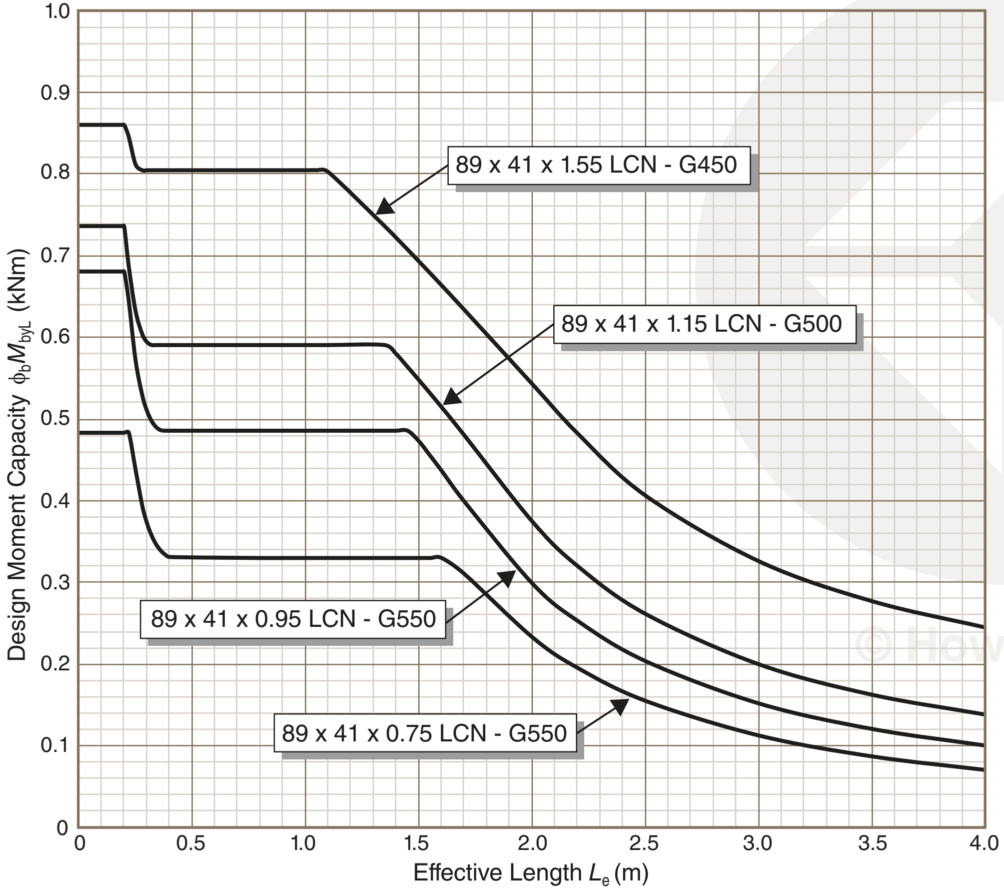
Graph 2.2

MEMBER MOMENT CAPACITY

Members without Full Lateral Restraint

bending about y-axis

(Lips in Compression)



NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for C_s = 1.0 and for a uniform bending moment (C_{TF} = 1.0).
6. The effective length $L_e = L_{ex} = L_{ez}$.
7. Capacities are calculated for an equal flange lipped channel using the average flange width.

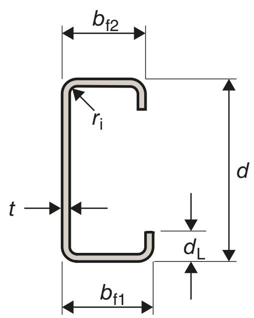


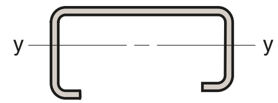
Table 2.3

MEMBER MOMENT CAPACITY

Members without Full Lateral Restraint

bending about y-axis

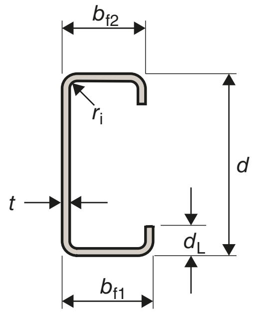
(Web in Compresion)



Designation	Mass per metre	Buckling Capacities		Design Member Moment Capacity, $\phi_b M_{byW}$ (kNm)													
		Local $\phi_b M_{syW}$	Distortional $\phi_b M_{bdyW}$	Effective Length (L_e) in metres													
	kg/m	kNm	kNm	0.2	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	4.0
89 x 41 x 1.55 LCN - G450	2.18	0.846	N.A.	0.846	0.846	0.846	0.846	0.846	0.846	0.846	0.846	0.846	0.846	0.846	0.846	0.846	0.846
89 x 41 x 1.15 LCN - G500	1.64	0.574	N.A.	0.574	0.574	0.574	0.574	0.574	0.574	0.574	0.574	0.574	0.574	0.574	0.574	0.574	0.574
89 x 41 x 0.95 LCN - G550	1.36	0.450	N.A.	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
89 x 41 x 0.75 LCN - G550	1.08	0.286	N.A.	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.286

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for C_s = 1.0 and for a uniform bending moment (C_{TF} = 1.0).
6. Refer to Graph 2.3 for the limits of the local and distortional design moment capacities.
7. The effective lengths $L_e = L_{ex} = L_{ez}$.
8. Capacities are calculated for an equal flange lipped channel using the average flange width.



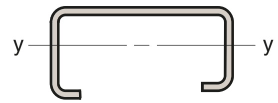
Graph 2.3

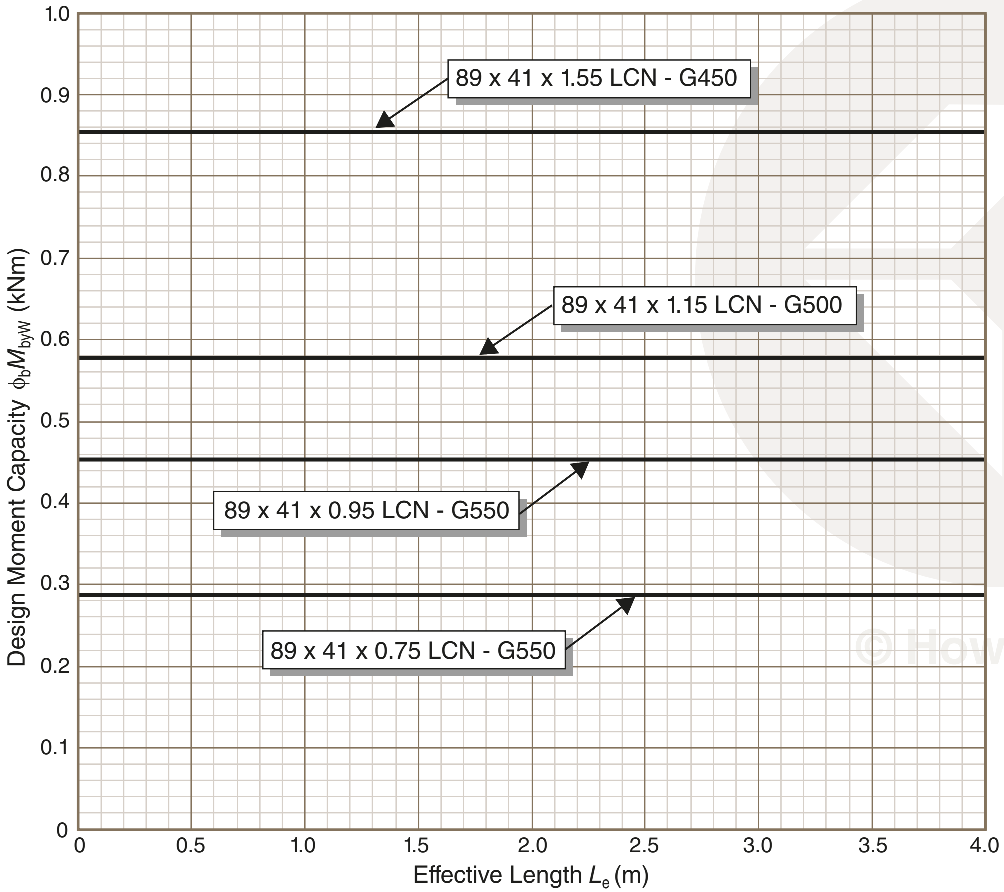
MEMBER MOMENT CAPACITY

Members without Full Lateral Restraint

bending about y-axis

(Web in Compression)





NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for C_s = 1.0 and for a uniform bending moment (C_{TF} = 1.0).
6. The effective length $L_e = L_{ex} = L_{ez}$.
7. Capacities are calculated for an equal flange lipped channel using the average flange width.

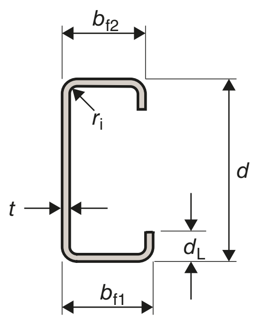
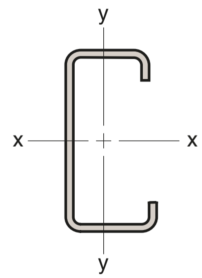


Table 2.4

SHEAR CAPACITIES



Designation	Mass per metre	Shear Capacity	
		x-axis	y-axis
		$\phi_v V_{vx}$	$\phi_v V_{vy}$
	kg/m	kN	kN
89 x 41 x 1.55 LCN - G450	2.18	30.3	27.4
89 x 41 x 1.15 LCN - G500	1.64	15.8	23.1
89 x 41 x 0.95 LCN - G550	1.36	8.87	21.2
89 x 41 x 0.75 LCN - G550	1.08	4.34	14.9

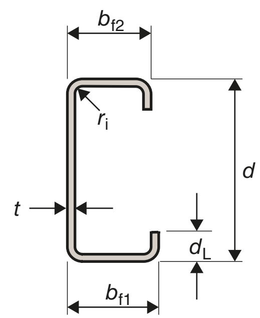
NOTES:

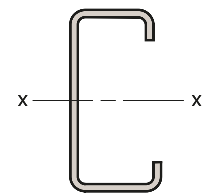
1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

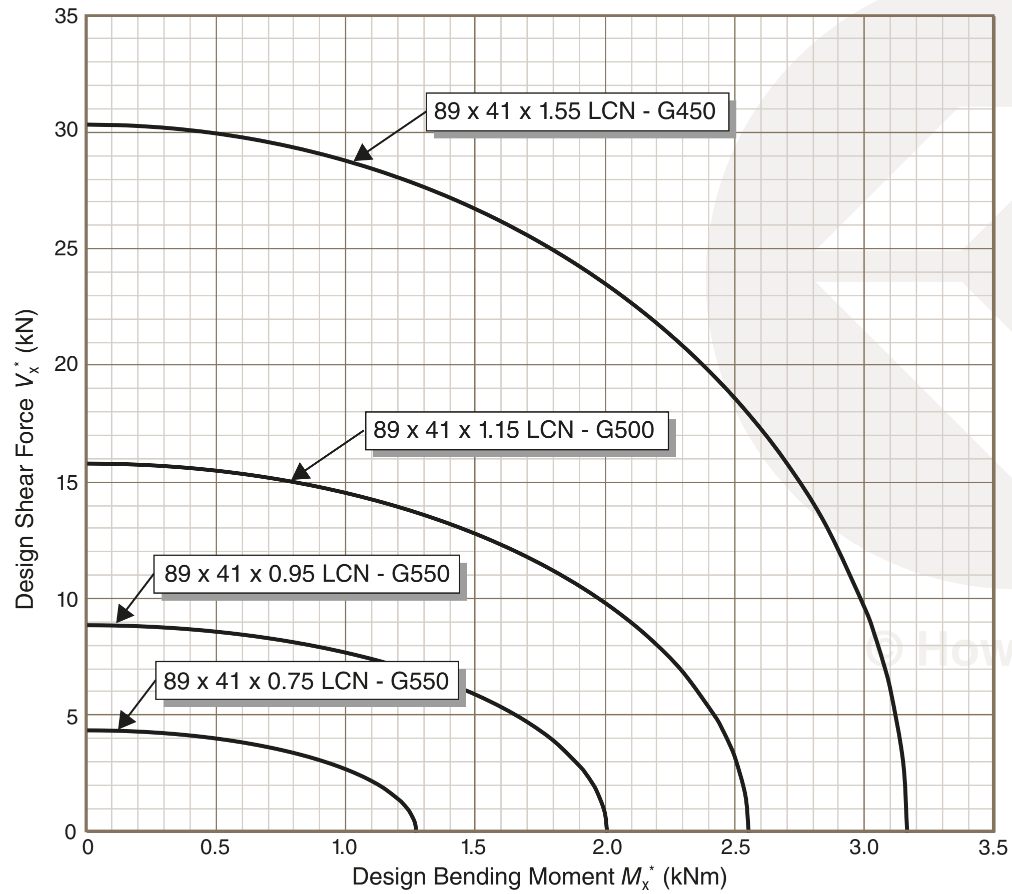
Graph 2.4

COMBINED BENDING & SHEAR

bending about x-axis

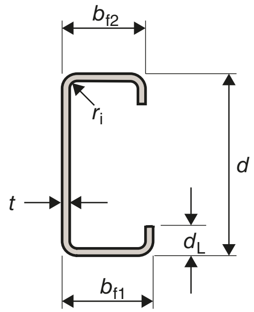






NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

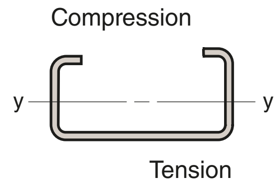


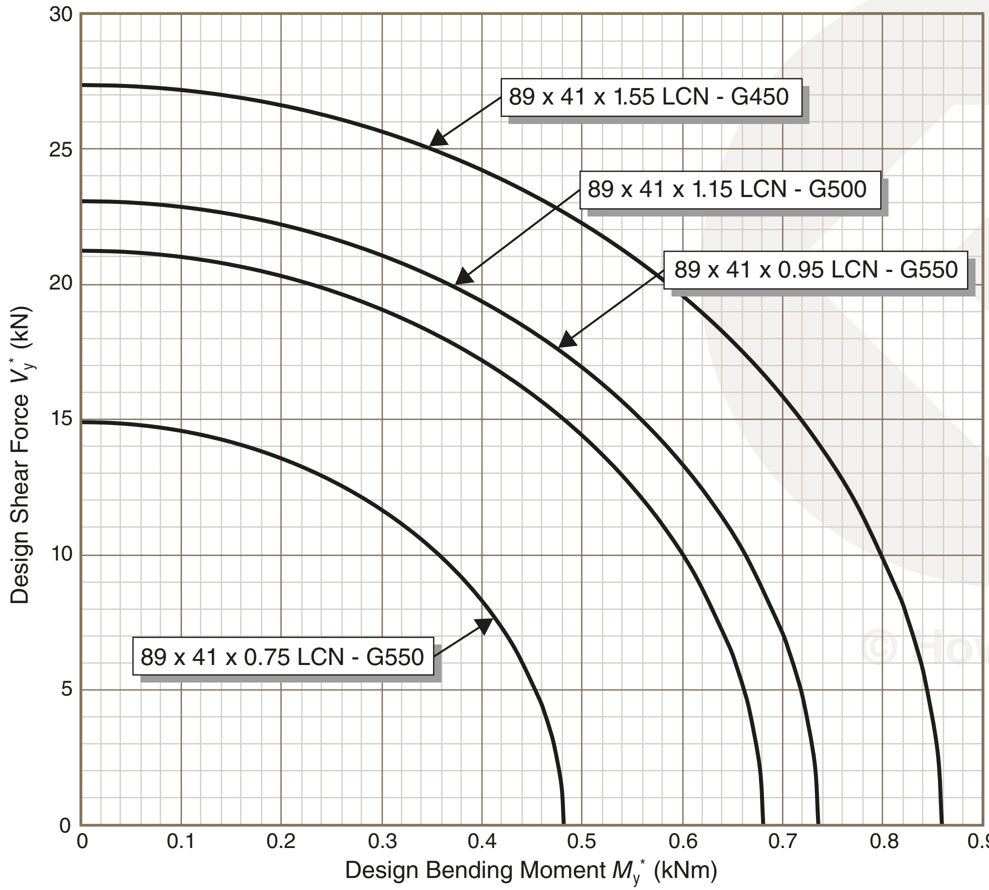
Graph 2.5

COMBINED BENDING & SHEAR

bending about y-axis

(Lips in Compression)





NOTES:

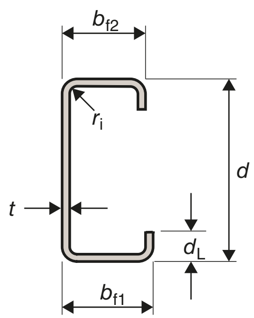
1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

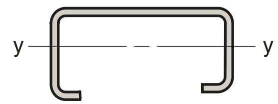
Graph 2.6

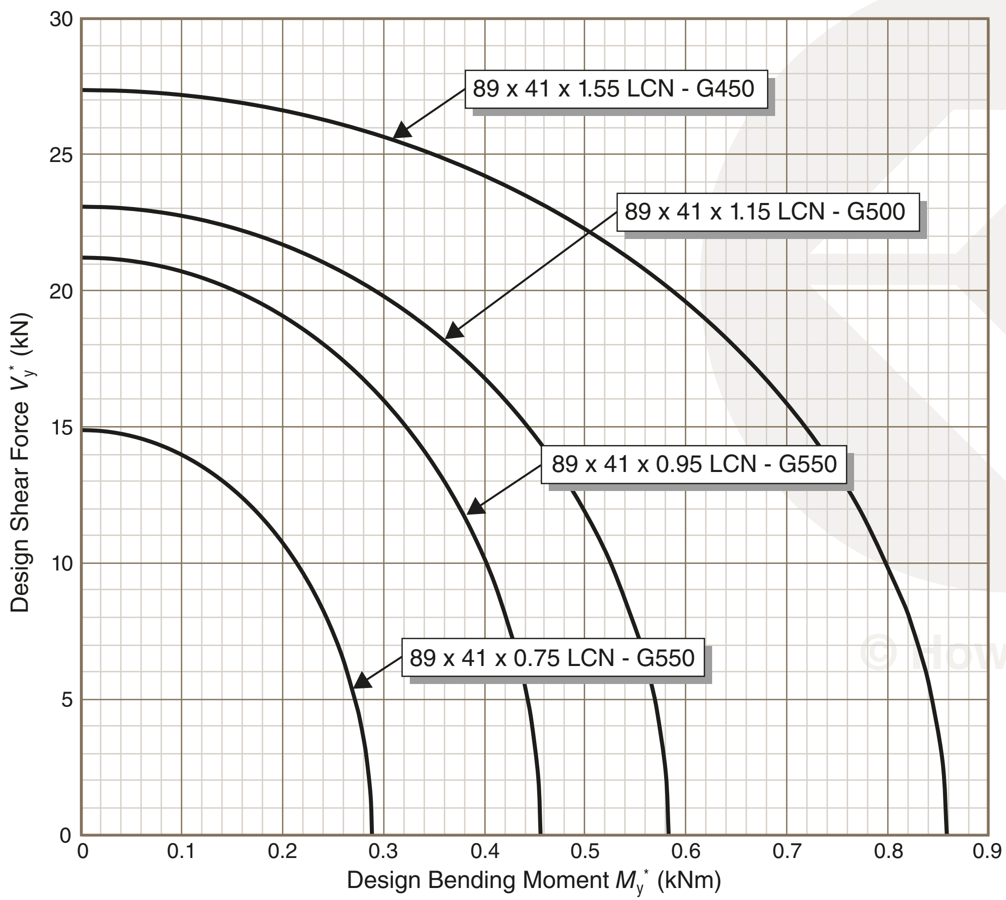
COMBINED BENDING & SHEAR

bending about y-axis

(Web in Compression)







NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

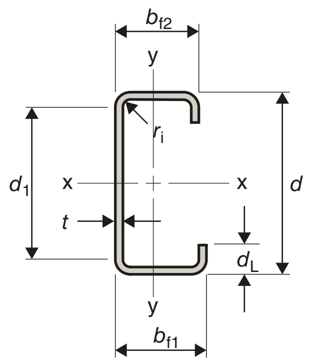
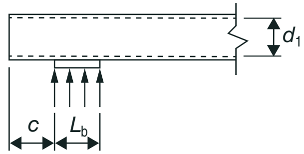


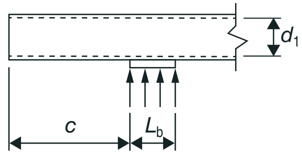
Table 2.5

WEB BEARING CAPACITY

One Flange Loading or Reaction



End Bearing ($c < 1.5\ d_1$)



Interior Bearing ($c \geq 1.5\ d_1$)

Designation	Mass per metre	1.5 d_1	Design Web Bearing Capacity, $\phi_w R_{bx}$ (kN)											
			End Bearing ($c < 1.5\ d_1$)						Interior Bearing ($c \geq 1.5\ d_1$)					
			Bearing Length, L_b (mm)						Bearing Length, L_b (mm)					
	kg/m	mm	25	50	75	100	125	150	25	50	75	100	125	150
89 x 41 x 1.55 LCN - G450	2.18	124.4	6.13	7.61	8.75	9.71	10.6	11.3	14.2	16.3	17.9	19.3	20.5	21.6
89 x 41 x 1.15 LCN - G500	1.64	125.6	3.88	4.88	5.64	6.29	6.85	7.37	8.62	10.0	11.1	12.0	12.8	13.6
89 x 41 x 0.95 LCN - G550	1.36	126.2	2.97	3.76	4.37	4.88	5.33	5.74	6.43	7.54	8.39	9.11	9.75	10.3
89 x 41 x 0.75 LCN - G550	1.08	126.8	1.70	2.17	2.53	2.84	3.11	3.35	3.55	4.21	4.72	5.14	5.52	5.85

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

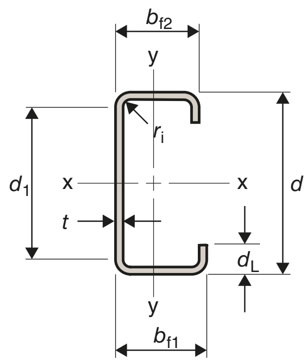
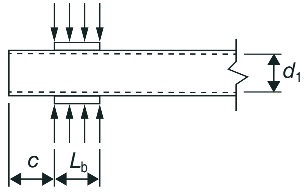


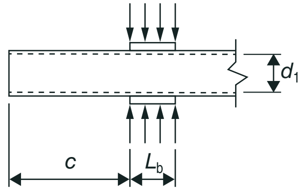
Table 2.6

WEB BEARING CAPACITY

Two Flange Loading or Reaction



End Bearing ($c < 1.5\ d_1$)

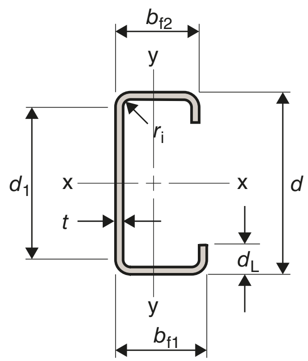


Interior Bearing ($c \geq 1.5\ d_1$)

Designation	Mass per metre	1.5 d_1	Design Web Bearing Capacity, $\phi_w R_{bx}$ (kN)											
			End Bearing ($c < 1.5\ d_1$)						Interior Bearing ($c \geq 1.5\ d_1$)					
			Bearing Length, L_b (mm)						Bearing Length, L_b (mm)					
	kg/m	mm	25	50	75	100	125	150	25	50	75	100	125	150
89 x 41 x 1.55 LCN - G450	2.18	124.4	7.36	7.87	8.26	8.59	8.89	9.15	16.1	18.6	20.6	22.2	23.6	24.9
89 x 41 x 1.15 LCN - G500	1.64	125.6	3.99	4.30	4.54	4.74	4.92	5.08	8.69	10.2	11.3	12.3	13.1	13.9
89 x 41 x 0.95 LCN - G550	1.36	126.2	2.72	2.95	3.13	3.28	3.41	3.53	5.79	6.83	7.63	8.31	8.90	9.44
89 x 41 x 0.75 LCN - G550	1.08	126.8	1.32	1.45	1.54	1.62	1.69	1.75	2.61	3.11	3.50	3.82	4.11	4.37

NOTES:

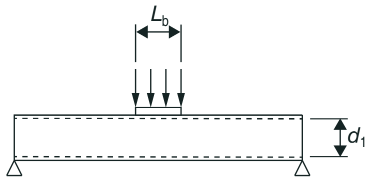
1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

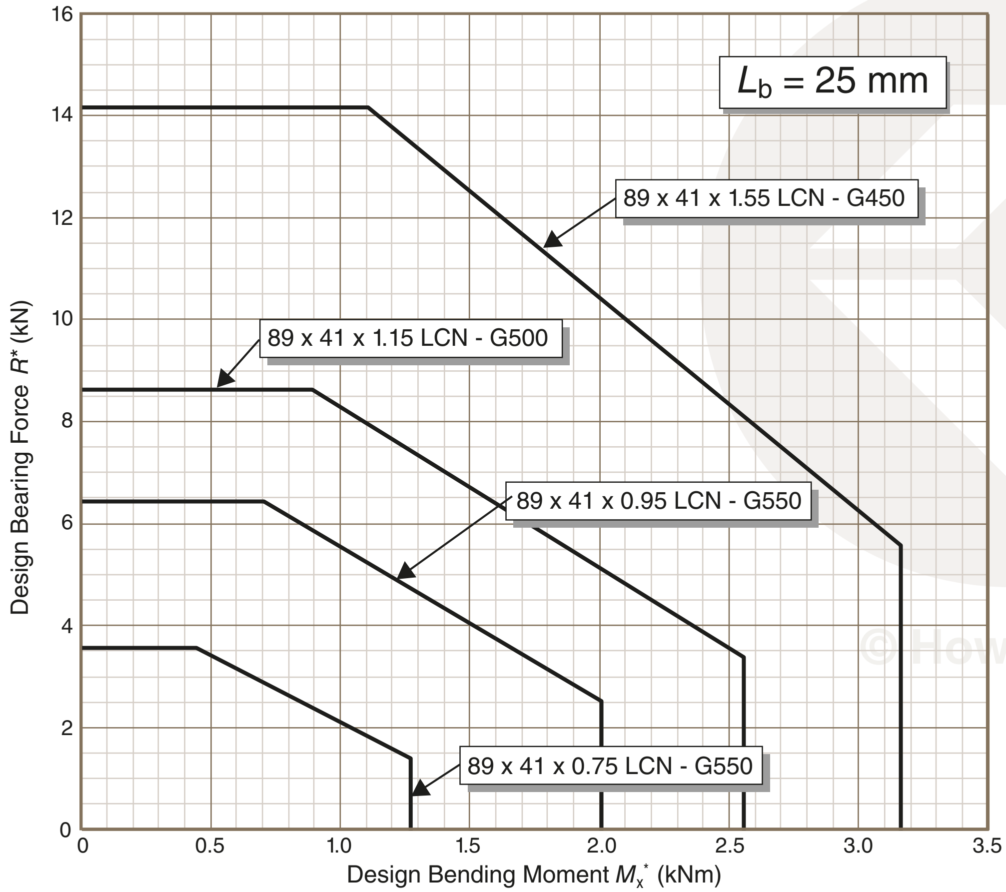


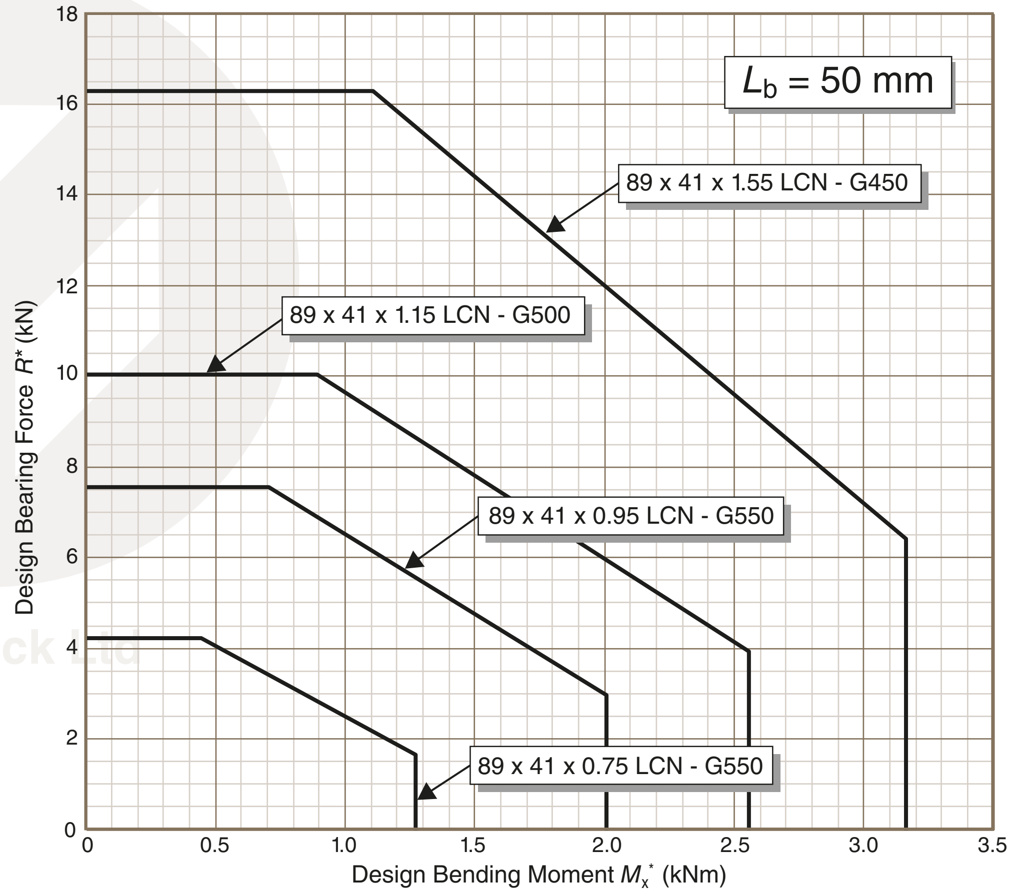
Graph 2.7

COMBINED BENDING & BEARING

bending about x-axis



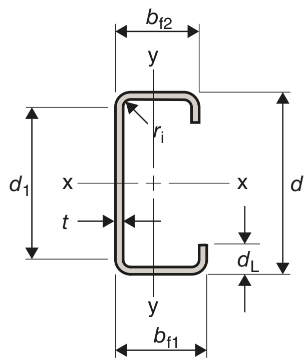


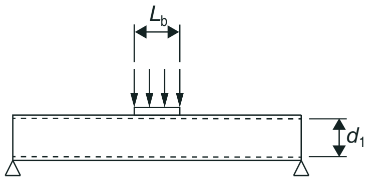


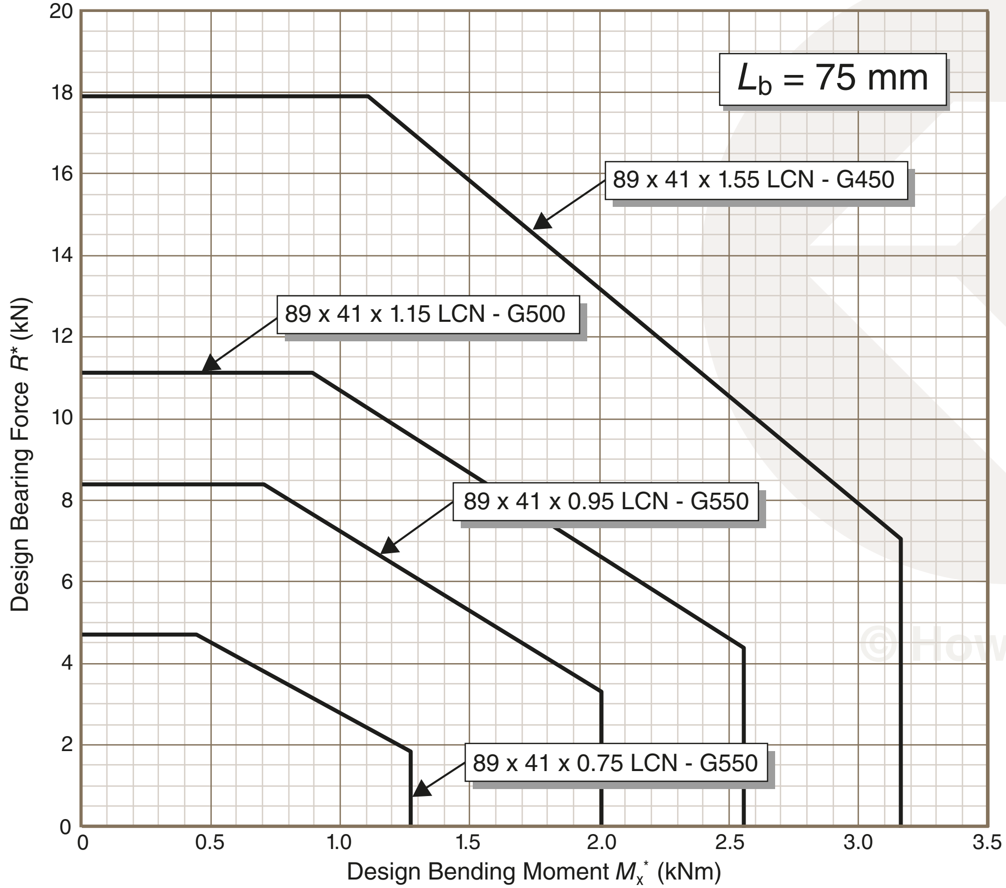
Graph 2.8

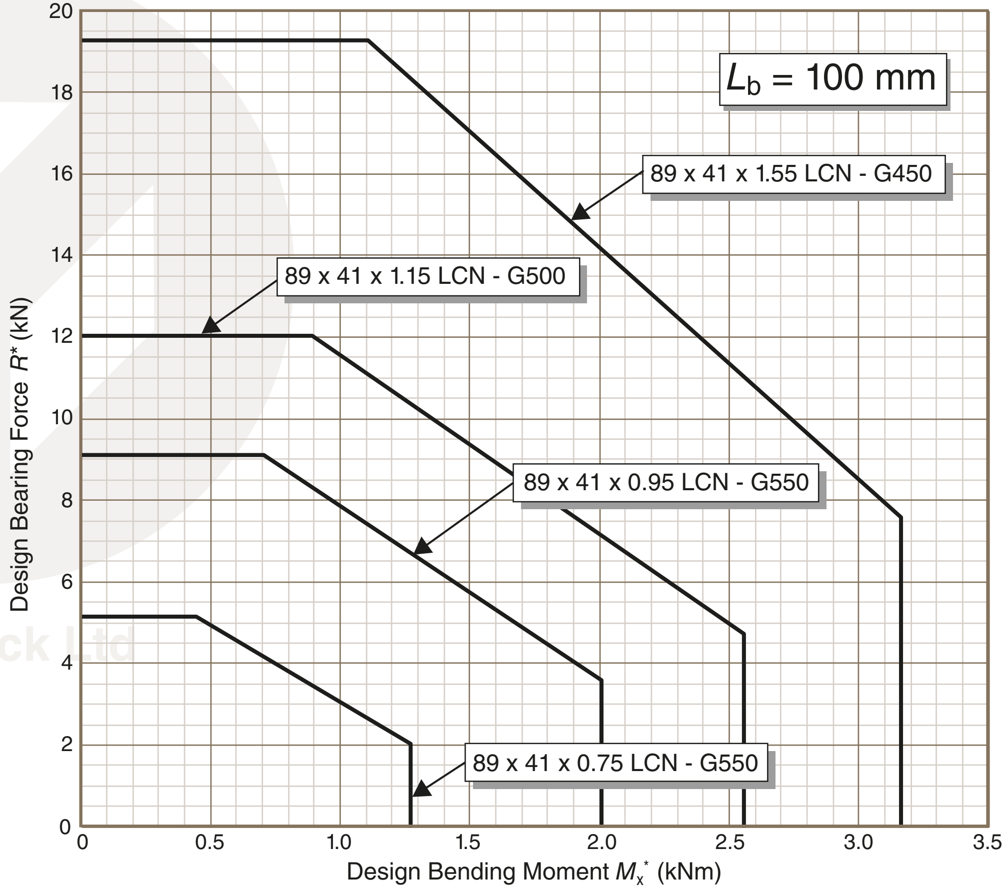
COMBINED BENDING & BEARING

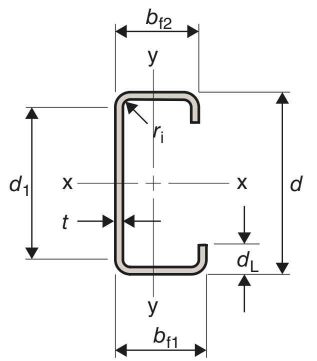
bending about x-axis







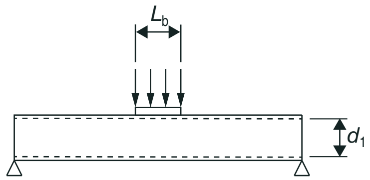


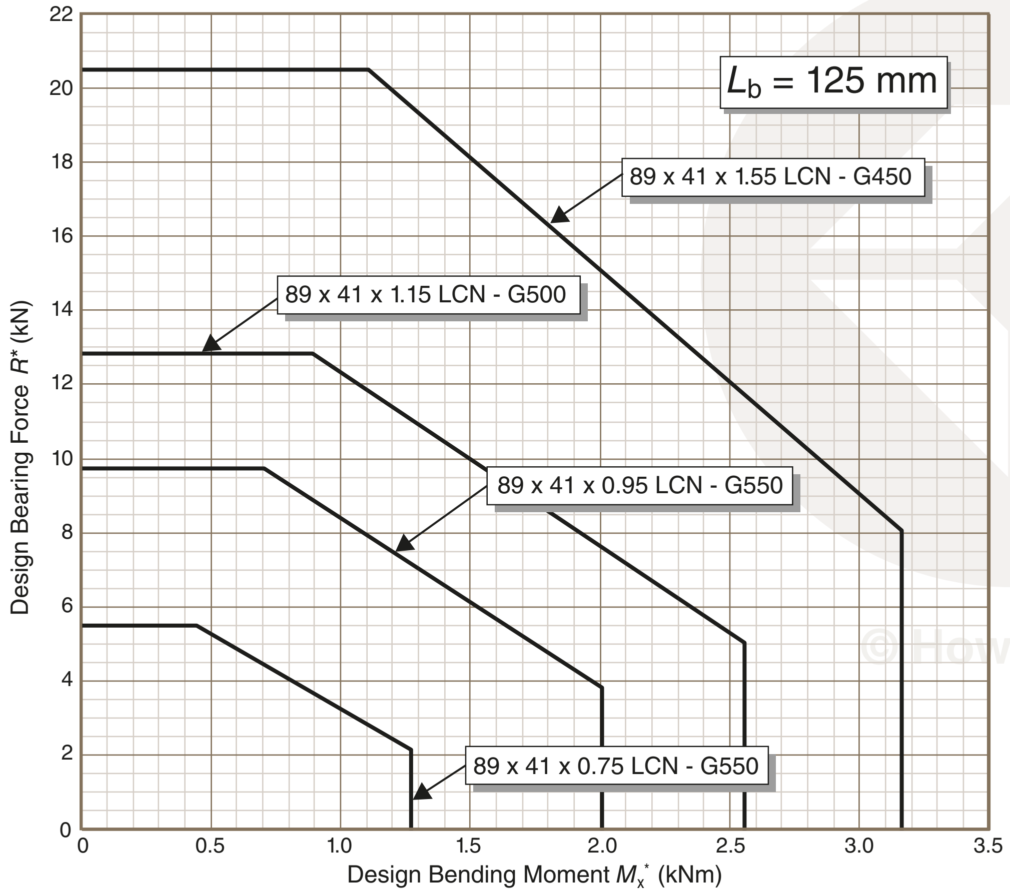


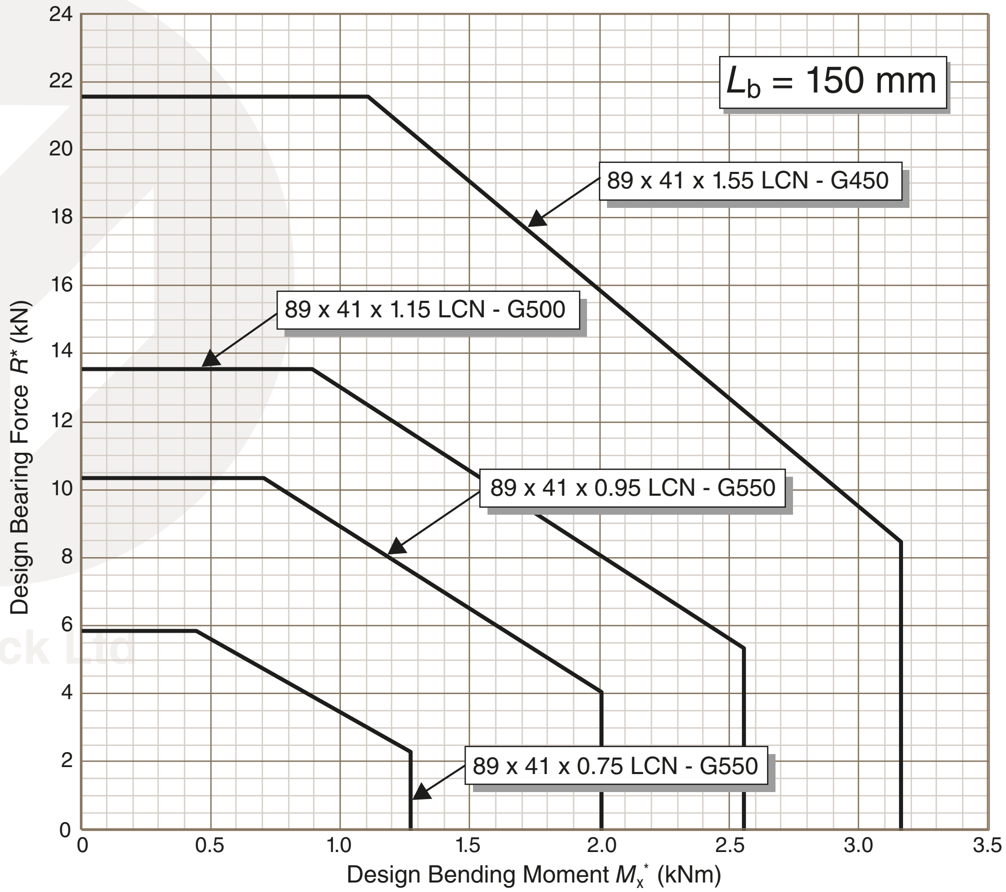
Graph 2.9

COMBINED BENDING & BEARING

bending about x-axis







Part 3: Members subject to Axial Compression

CONTENTS

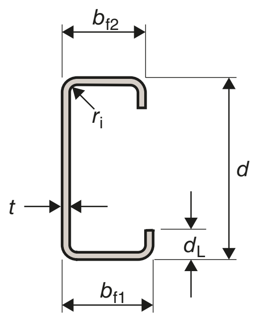
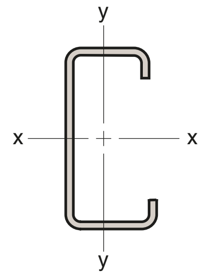


Table 3.1

AXIAL COMPRESSION CAPACITY

$L_{ex} = L_{ey} = L_{ez}$



Designation	Mass per metre	Buckling Capacities		Design Axial Compression Capacities, $\phi_c N_c$ (kN)													
		Local $\phi_c N_s$	Distortional $\phi_c N_{cd}$	Effective Length (L_e) in metres													
	kg/m	kN	kN	0.2	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	4.0
89 x 41 x 1.55 LCN - G450	2.18	80.4	74.7	78.9	77.2	68.6	56.9	44.3	30.3	22.6	17.9	14.8	11.8	9.55	7.89	6.63	5.37
89 x 41 x 1.15 LCN - G500	1.64	52.3	50.4	51.3	50.1	44.1	35.8	26.9	20.4	15.4	11.9	9.55	7.96	6.82	5.98	5.10	4.13
89 x 41 x 0.95 LCN - G550	1.36	40.2	39.5	39.4	38.4	33.4	26.6	19.5	14.7	11.7	9.37	7.44	6.11	5.17	4.46	3.93	3.39
89 x 41 x 0.75 LCN - G550	1.08	25.1	25.9	24.6	24.0	21.2	17.3	13.0	9.83	7.82	6.44	5.46	4.54	3.78	3.22	2.79	2.37

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Refer to Graph 3.1 for the limits of the local and distortional design moment capacities.
6. The effective length $L_e = L_{ex} = L_{ey} = L_{ez}$.
7. Capacities are calculated for an equal flange lipped channel using the average flange width.

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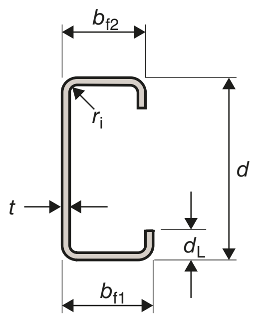
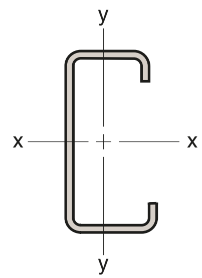
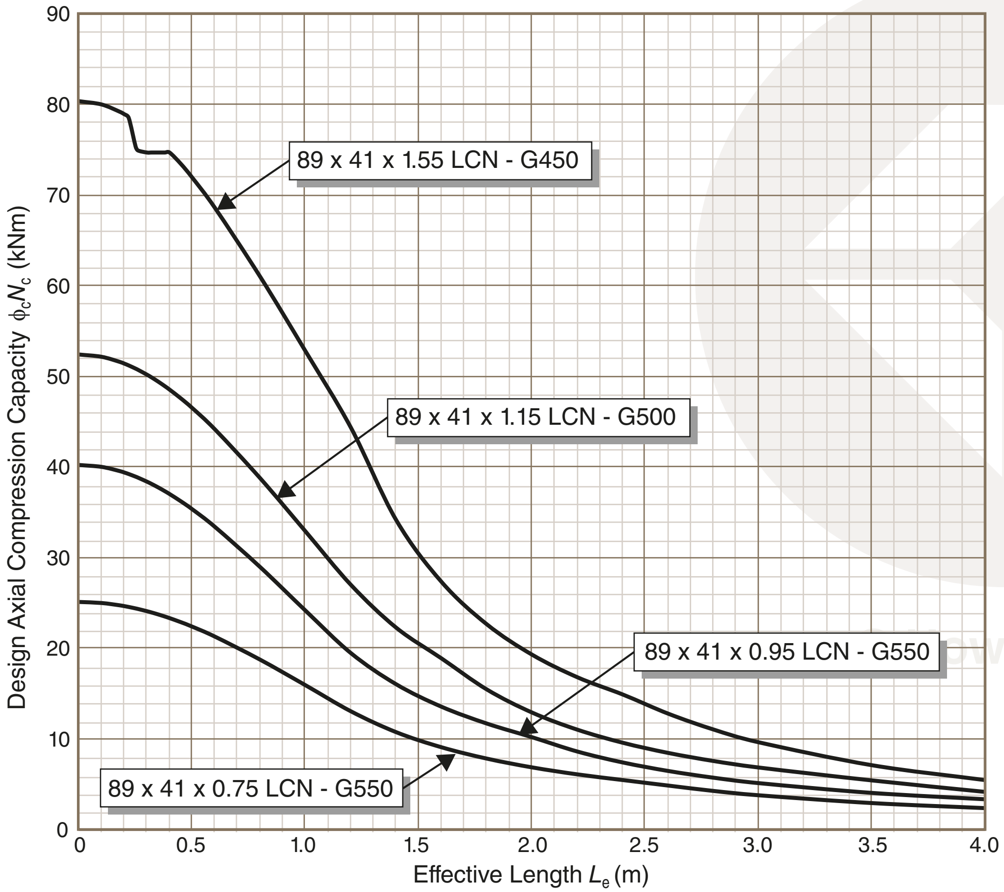


Graph 3.1

AXIAL COMPRESSION CAPACITY

$L_{ex} = L_{ey} = L_{ez}$





NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. The effective length $L_e = L_{ex} = L_{ey} = L_{ez}$.
6. Capacities are calculated for an equal flange lipped channel using the average flange width.

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Part 4: Members subject to Axial Tension

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Part 4: Members subject to Axial Tension

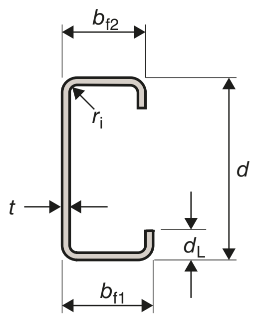
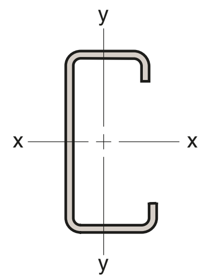


Table 4.1

AXIAL TENSION CAPACITIES

with and without holes



Designation	Mass per metre	Design Axial Tension Capacity, $\phi_t N_t$ (kN)														
		Uniform Tension	Web Connected							Both Flanges Connected						
			Total hole Width, w_h (m)							Total hole Width, w_h (m)						
	kg/m	(NO Holes)	0	10	20	25	30	35	40	0	10	20	25	30	35	40
89 x 41 x 1.55 LCN - G450	2.18	112.5	86.7	81.9	77.0	74.6	72.2	69.8	67.3	86.7	81.9	77.0	74.6	72.2	69.8	67.3
89 x 41 x 1.15 LCN - G500	1.64	93.7	70.4	66.5	62.7	60.7	58.8	56.8	54.9	70.4	66.5	62.7	60.7	58.8	56.8	54.9
89 x 41 x 0.95 LCN - G550	1.36	85.6	61.9	58.5	55.1	53.4	51.7	50.0	48.3	61.9	58.5	55.1	53.4	51.7	50.0	48.3
89 x 41 x 0.75 LCN - G550	1.08	61.2	44.2	41.8	39.4	38.2	37.0	35.7	34.5	44.2	41.8	39.4	38.2	37.0	35.7	34.5

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

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Part 5: Members subject to Combined Actions

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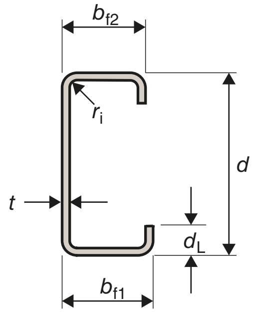
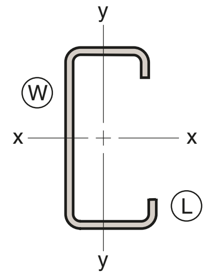


Table 5.1

SECTION & YIELD CAPACITIES



Designation	Mass per m	Design Section Axial Capacities		Design Section Moment Capacities			Design Yield Moment Capacities (Tension)		
		Tension	Compression	about x-axis	about y-axis		about x-axis	about y-axis	
		$\phi_t N_t$	$\phi_c N_s$	$\phi_b M_{sx}$	$\phi_b M_{syL}$	$\phi_b M_{syW}$	$\phi_b M_{sxf}$	$\phi_b M_{syfL}$	$\phi_b M_{syfW}$
	kg/m	kN	kN	kNm	kNm	kNm	kNm	kNm	kNm
89 x 41 x 1.55 LCN - G450	2.18	112	80.4	3.16	0.860	0.846	3.16	0.860	1.87
89 x 41 x 1.15 LCN - G500	1.64	93.7	52.3	2.56	0.736	0.574	2.67	0.736	1.60
89 x 41 x 0.95 LCN - G550	1.36	85.6	40.2	2.01	0.681	0.450	2.45	0.681	1.48
89 x 41 x 0.75 LCN - G550	1.08	61.2	25.1	1.27	0.483	0.286	1.76	0.493	1.07

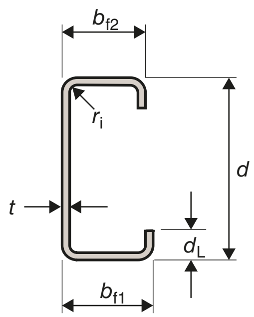
NOTES:

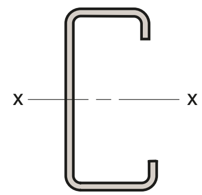
1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. $\phi_b M_{syL}$ and $\phi_b M_{syW}$ refer to bending about the y-axis causing compression in the lips and web of the channel respectively.
6. $\phi_b M_{syfL}$ and $\phi_b M_{syfW}$ are the design yield moments for bending about the y-axis causing tension in the lips and web of the channel respectively.
7. Capacities are calculated for an equal flange lipped channel using the average flange width.

Table 5.2

ELASTIC BUCKLING LOAD

buckling about x-axis





Designation	Mass per metre	Elastic Buckling Load, N_{ex} (kN)													
		Effective Length, L_{ex} (m)													
	kg/m	0.2	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	4.0
89 x 41 x 1.55 LCN - G450	2.18	17147	7621	1905	847	476	305	212	156	119	94.1	76.2	63.0	52.9	42.9
89 x 41 x 1.15 LCN - G500	1.64	13006	5781	1445	642	361	231	161	118	90.3	71.4	57.8	47.8	40.1	32.5
89 x 41 x 0.95 LCN - G550	1.36	10863	4828	1207	536	302	193	134	98.5	75.4	59.6	48.3	39.9	33.5	27.2
89 x 41 x 0.75 LCN - G550	1.08	8670	3853	963	428	241	154	107	78.6	60.2	47.6	38.5	31.8	26.8	21.7

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

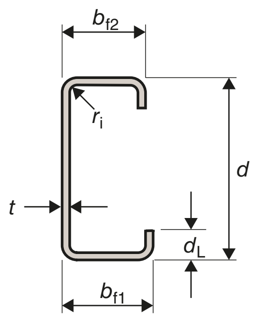
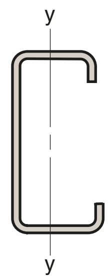


Table 5.3

ELASTIC BUCKLING LOAD

buckling about y-axis



Designation	Mass per metre	Elastic Buckling Load, N_{ey} (kN)													
		Effective Length, L_{ey} (m)													
	kg/m	0.2	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	4.0
89 x 41 x 1.55 LCN - G450	2.18	2882	1281	320	142	80.1	51.2	35.6	26.1	20.0	15.8	12.8	10.6	8.89	7.20
89 x 41 x 1.15 LCN - G500	1.64	2218	986	246	110	61.6	39.4	27.4	20.1	15.4	12.2	9.86	8.15	6.85	5.55
89 x 41 x 0.95 LCN - G550	1.36	1866	830	207	92.2	51.8	33.2	23.0	16.9	13.0	10.2	8.30	6.86	5.76	4.67
89 x 41 x 0.75 LCN - G550	1.08	1501	667	167	74.1	41.7	26.7	18.5	13.6	10.4	8.23	6.67	5.51	4.63	3.75

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Capacities are calculated for an equal flange lipped channel using the average flange width.

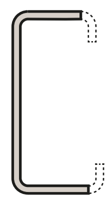
Part 6: MEMBERS with LIPS REMOVED

CONTENTS

Part 6: Members with Lips Removed

GENERAL

When these lipped channel sections are used in frames and trusses, there will be instances where the lips of the sections are removed at the location of the connections. This part of the document provides design tables and graphs which will aid in the design of the unlipoped sections produced by removing the lips. The diagram below illustrates the portion of the section which is removed.



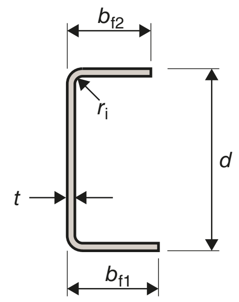
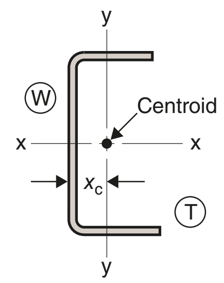


Table 6.1

DIMENSIONS & SECTION PROPERTIES

Lips Removed



DIMENSIONS								SECTION PROPERTIES							
Designation	Depth	Large Flange Width	Small Flange Width	Thick.	Inside Corner Radius	Co-ord. of Centroid	Mass per metre	Gross Section Area	About x-axis			About y-axis			
	d	b_{f1}	b_{f2}	t	r_i	x_c		A_g	I_x	Z_x	r_x	I_y	Z_{yL}	Z_{yW}	r_y
	mm	mm	mm	mm	mm	mm	kg/m	mm^2	10^6mm^4	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm
89 x 41 x 1.55 LCN-LR - G450	89.0	38.3	36.0	1.55	1.50	9.12	1.92	245	0.296	6.65	34.7	0.0325	1.161	3.56	11.5
89 x 41 x 1.15 LCN-LR - G500	89.0	38.7	36.4	1.15	1.50	9.10	1.44	184	0.225	5.05	35.0	0.0252	0.889	2.77	11.7
89 x 41 x 0.95 LCN-LR - G550	89.0	38.9	36.6	0.95	1.50	9.09	1.20	153	0.188	4.22	35.1	0.0213	0.745	2.34	11.8
89 x 41 x 0.75 LCN-LR - G550	89.0	39.1	36.8	0.75	1.50	9.09	0.952	121	0.150	3.37	35.2	0.0172	0.598	1.90	11.9

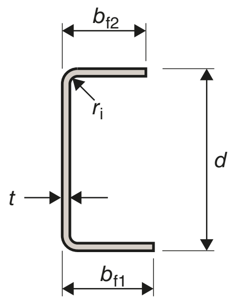
NOTES:

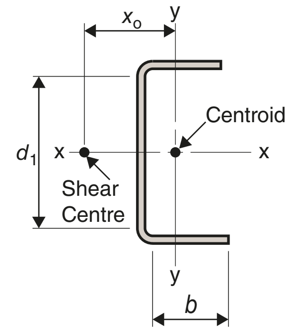
1. Calculations of section properties are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Properties are calculated for an equal flange lipped channel using the average flange width.

Table 6.2

SECTION PROPERTIES TO CALCULATE MEMBER STABILITY

Lips Removed





DIMENSIONS									RATIOS		PROPERTIES					MATERIAL		
Designation	Depth d	Large Flange Width b_{f1}	Small Flange Width b_{f2}	Thick-ness t	Inside Corner Radius r_i	Flat Web Depth d_1	Flat Flange Width b	Mass per metre	Web d_1/t	Flange b/t	Shear Centre Co-ord. x_o	Polar Rad. of Gyration about S.C. r_{o1}	Mono-Symmetry Constant β_y	Torsion Constant J	Warping Constant I_w	Grade	Design Yield Stress f_y	Design Tensile Strength f_u
	mm	mm	mm	mm	mm	mm	mm	kg/m			mm	mm		mm^4	10^6mm^6		MPa	MPa
89 x 41 x 1.55 LCN-LR - G450	89.0	38.3	36.0	1.55	1.50	82.9	34.1	1.92	53.5	22.0	21.2	42.3	98.3	196.3	44.0	G450	450	480
89 x 41 x 1.15 LCN-LR - G500	89.0	38.7	36.4	1.15	1.50	83.7	34.9	1.44	72.8	30.3	21.7	42.8	98.9	81.1	34.5	G500	500	520
89 x 41 x 0.95 LCN-LR - G550	89.0	38.9	36.6	0.95	1.50	84.1	35.3	1.20	88.5	37.1	21.9	43.0	99.2	46.0	29.3	G550	550	550
89 x 41 x 0.75 LCN-LR - G550	89.0	39.1	36.8	0.75	1.50	84.5	35.7	0.952	113	47.5	22.1	43.2	99.5	22.7	23.7	G550	495	495

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. Properties are calculated for an equal flange lipped channel using the average flange width.

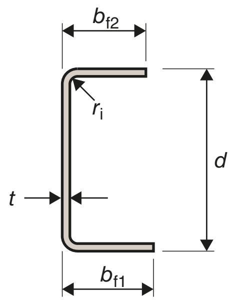
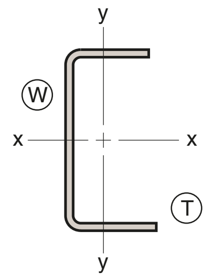


Table 6.3

SECTION & YIELD CAPACITIES

Lips Removed



Designation	Mass per m	Design Section Axial Capacities		Design Section Moment Capacities			Design Yield Moment Capacities (Tension)		
		Tension	Compression	about x-axis	about y-axis		about x-axis	about y-axis	
		$\phi_t N_t$	$\phi_c N_s$	$\phi_b M_{sx}$	$\phi_b M_{syT}$	$\phi_b M_{syW}$	$\phi_b M_{sxf}$	$\phi_b M_{syfT}$	$\phi_b M_{syfW}$
	kg/m	kN	kN	kNm	kNm	kNm	kNm	kNm	kNm
89 x 41 x 1.55 LCN-LR - G450	1.92	99.3	61.4	2.01	0.400	0.470	2.69	0.470	1.44
89 x 41 x 1.15 LCN-LR - G500	1.44	82.8	39.5	1.31	0.265	0.352	2.27	0.400	1.25
89 x 41 x 0.95 LCN-LR - G550	1.20	75.6	30.2	1.01	0.205	0.277	2.09	0.369	1.16
89 x 41 x 0.75 LCN-LR - G550	0.952	54.0	18.7	0.629	0.129	0.176	1.50	0.266	0.844

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600 Clause 1.5.1.1 where appropriate.
5. $\phi_b M_{syT}$ and $\phi_b M_{syW}$ refer to bending about the y-axis causing compression in the toes and web of the channel respectively.
6. $\phi_b M_{syfT}$ and $\phi_b M_{syfW}$ are the design yield moment capacities for bending about the y-axis causing tension in the toes and web of the channel respectively.
7. All section moment capacities are applicable for unrestrained lengths up to 400 mm. Lips removed for more than this length is not expected.
8. Capacities are calculated for an equal flange channel using the average flange width.

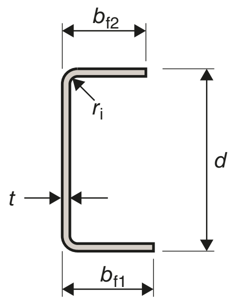
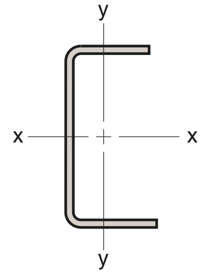


Table 6.4

AXIAL COMPRESSION CAPACITY

$L_{ex} = L_{ey} = L_{ez}$

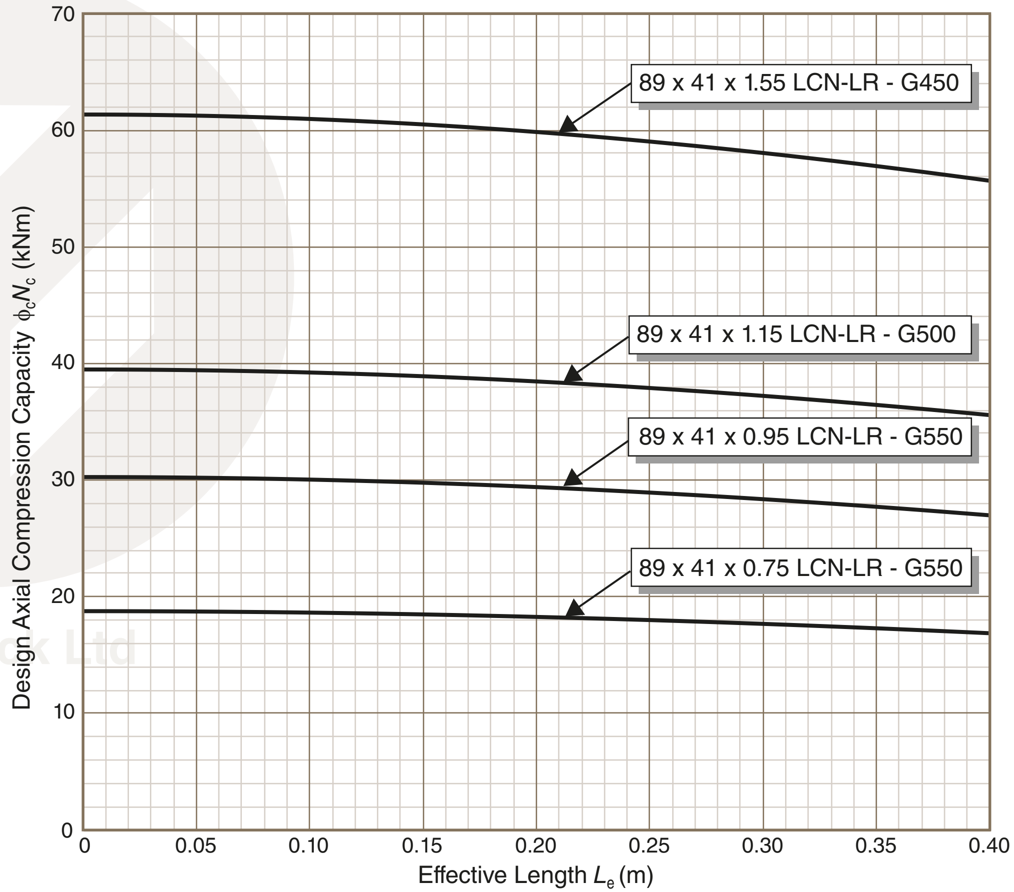
Lips Removed



Designation	Mass per metre	Design Axial Compression Capacity, $\phi_c N_c$ (kN)					
		Effective Length (L_e) in metres					
	kg/m	0.0	0.10	0.20	0.30	0.35	0.40
89 x 41 x 1.55 LCN-LR - G450	1.92	61.4	61.0	59.9	58.1	56.9	55.6
89 x 41 x 1.15 LCN-LR - G500	1.44	39.5	39.3	38.5	37.2	36.4	35.5
89 x 41 x 0.95 LCN-LR - G550	1.20	30.2	30.0	29.3	28.3	27.6	26.9
89 x 41 x 0.75 LCN-LR - G550	0.952	18.7	18.6	18.3	17.7	17.3	16.9

NOTES:

1. Calculations of section capacities are in accordance with AS/NZS 4600.
2. Thickness refers to the base metal thickness (BMT).
3. Steel grades are in accordance with AS 1397.
4. The design yield stress and design tensile strength are reduced in acccordance with AS/NZS 4600.
5. Refer to Graph 3.1 for the limits of the local and distortional design moment capacities.
6. The effective length $L_e = L_{ex} = L_{ey} = L_{ez}$.
7. Capacities are calculated for an equal flange lipped channel using the average flange width.

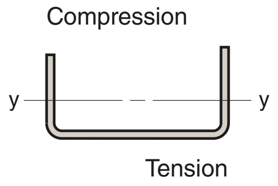


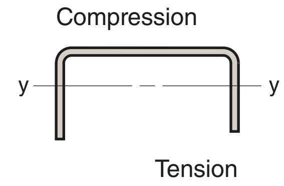
Graph 6.1

COMBINED BENDING & SHEAR

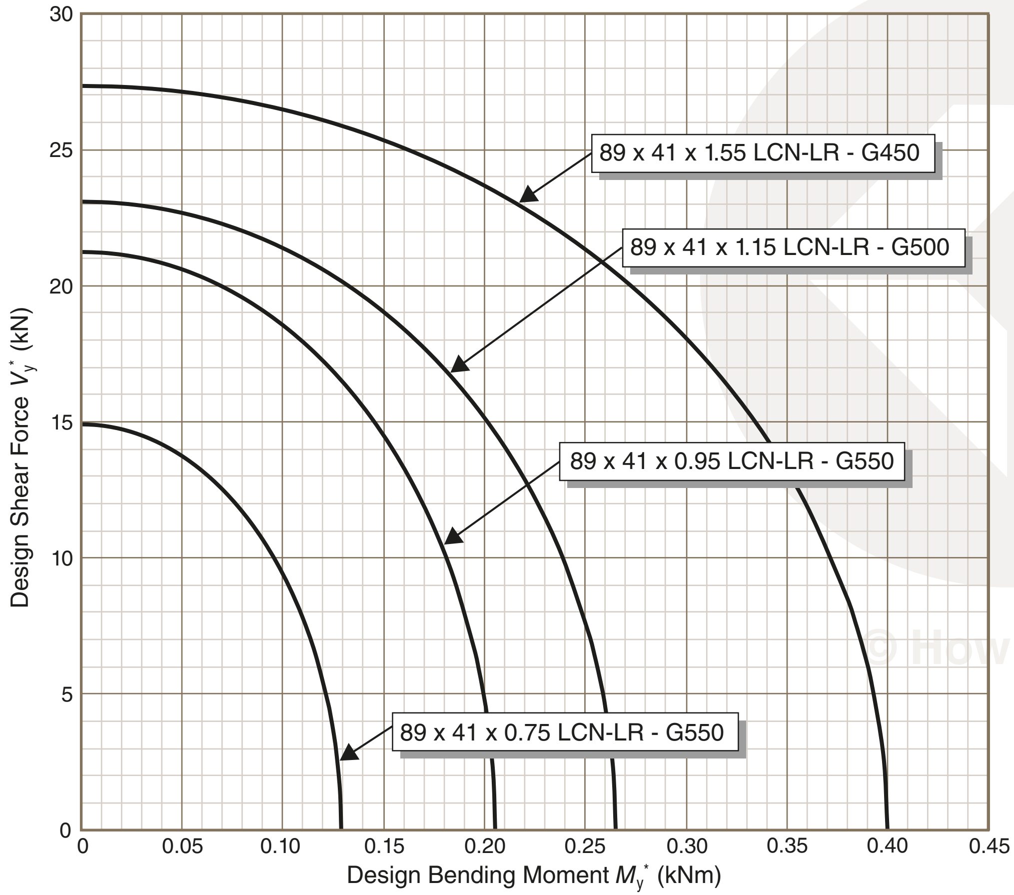
bending about y-axis

Lips Removed

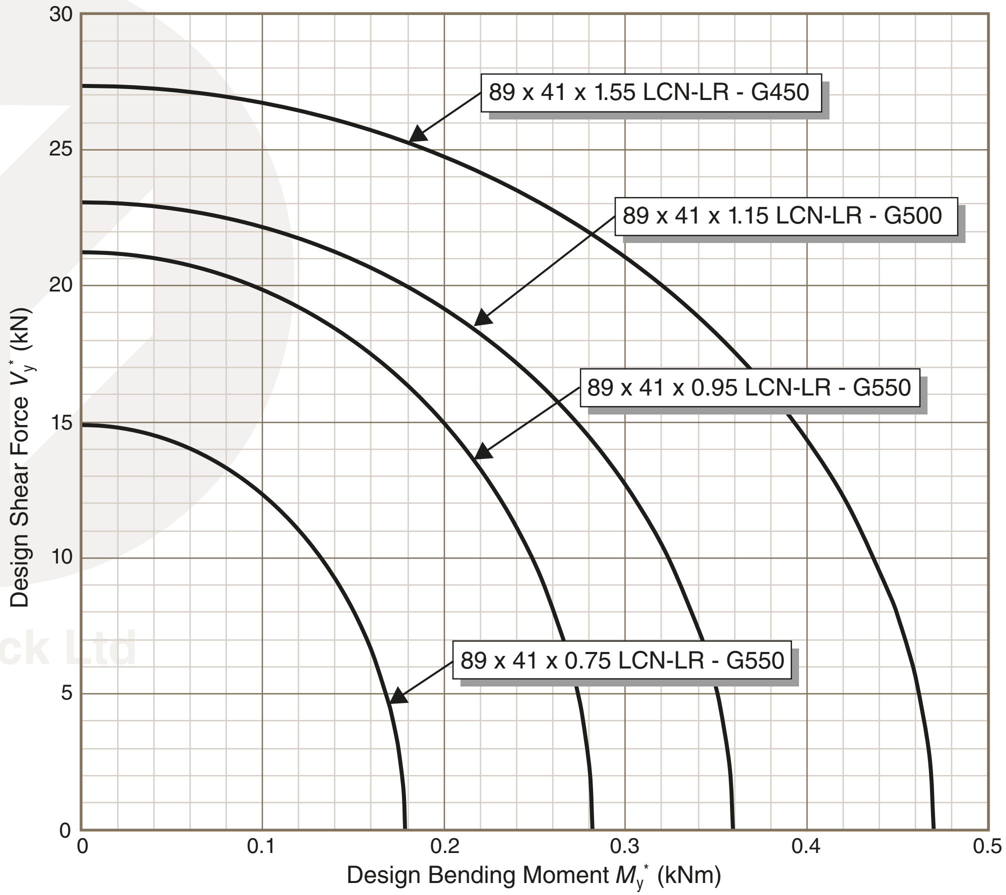




Toes in Compression



Web in Compression



Part 7: Wall Framing Design Capacities

CONTENTS

GENERAL

This part of the Design Capacity tables provide capacities which may be used for the design of the sections as wall studs and wall plates. Three typical wall heights are specified for the wall studs.

The NASH wall stud and plate classifications for both Australia and New Zealand are also included in the tables for each section. These are based on the minimum properties and capacities given in the NASH references.

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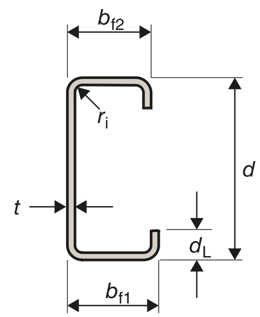
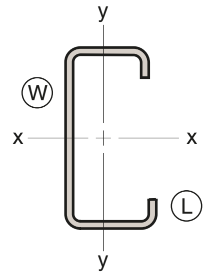


Table 7.1

WALL STUD
DESIGN CAPACITIES

Unclad



Designation	Mass per metre	Design Properties and Capacities									NASH Wall Stud Classification	
		Lateral Actions				Compression		Tension	Combined Actions			
		I_x	$\phi_b M_{sx}$	$\phi_b M_{bx}$	$\phi_v V_{vx}$	$\phi_c N_s$	$\phi_c N_c$	$\phi_t N_t$	$\phi_b M_{sxf}$	N_{ex}		
	kg/m	$10^6 mm^4$	kNm	kNm	kN	kN	kN	kN	kNm	kN	Australia	New Zealand
Stud Height 2440 mm												
89 x 41 x 1.55 LCN - G450	2.18	0.347	3.16	2.83	30.3	80.4	49.6	86.7	3.16	144	SC	SD
89 x 41 x 1.15 LCN - G500	1.64	0.264	2.56	2.03	15.8	52.3	30.8	70.4	2.67	108	SC	SD
89 x 41 x 0.95 LCN - G550	1.36	0.220	2.01	1.65	8.87	40.2	22.6	61.9	2.45	89.6	SC	SD
89 x 41 x 0.75 LCN - G550	1.08	0.176	1.27	1.12	4.34	25.1	15.0	44.2	1.76	71.1	SB	SB
Stud Height 2740 mm												
89 x 41 x 1.55 LCN - G450	2.18	0.347	3.16	2.83	30.3	80.4	43.5	86.7	3.16	114	SC	SD
89 x 41 x 1.15 LCN - G500	1.64	0.264	2.56	2.03	15.8	52.3	26.9	70.4	2.67	85.6	SC	SD
89 x 41 x 0.95 LCN - G550	1.36	0.220	2.01	1.65	8.9	40.2	19.5	61.9	2.45	71.1	SC	SD
89 x 41 x 0.75 LCN - G550	1.08	0.176	1.27	1.12	4.34	25.1	13.1	44.2	1.76	56.4	SB	SB
Stud Height 3040 mm												
89 x 41 x 1.55 LCN - G450	2.18	0.347	3.16	2.83	30.3	80.4	50.5	86.7	3.16	92.7	SC	SD
89 x 41 x 1.15 LCN - G500	1.64	0.264	2.56	2.03	15.8	52.3	31.7	70.4	2.67	69.5	SC	SD
89 x 41 x 0.95 LCN - G550	1.36	0.220	2.01	1.65	8.9	40.2	23.3	61.9	2.45	57.7	SC	SD
89 x 41 x 0.75 LCN - G550	1.08	0.176	1.27	1.12	4.34	25.1	15.4	44.2	1.76	45.8	SB	SB

Wall Stud Design Assumptions

Effective Lengths for Design			
Stud Height (mm)	2440	2740	3040
No. of Noggings	1	1	2
L_{ex} (mm)	1952	2192	2432
L_{ey} (mm)	976	1096	810
L_{ez} (mm)	976	1096	810

NOTES:

1. Noggings are equally spaced.
2. Lateral restraint is assumed to be provided by noggings only. Additional lateral restraint provided by cladding is ignored.
3. Both flanges of the stud are restrained by the top and bottom plates and the noggings.
4. Effective lengths are taken as 80% of the distance between restraints in accordance with NASH Handbook Clause 3.4.2.
5. No allowance has been made for holes in the web of the stud.

Symbol	Description
I_x	second moment of area about the major principal x-axis
$\phi_c N_s$	design section capacity of a member in compression
$\phi_c N_c$	design member capacity of a member in compression
$\phi_b M_{sx}$	design section moment capacity about the x-axis
$\phi_b M_{bx}$	design member moment capacity about the x-axis
$\phi_b M_{sxf}$	design yield moment capacity about the x-axis
$\phi_v V_{vx}$	design shear capacity of the cross-section perpendicular to the x-axis
N_{ex}	elastic buckling load about the major principal x-axis
$\phi_t N_t$	design section capacity of a member in tension
L_{ex}	effective length for buckling about the major principal x-axis
L_{ey}	effective length for buckling about the minor principal y-axis
L_{ez}	effective length for torsional buckling about the longitudinal z-axis

References

AS/NZS 4600 Cold-Formed Steel Structures.

NASH Standard (NZ), Residential and Low-Rise Steel Framing, Part 1: Design Criteria.

NASH Standard (Aust.), Residential and Low-Rise Steel Framing, Part 2: Design Solutions.

NASH Handbook (Aust.), Best Practice for Design and Construction of Residential and Low-Rise Steel Framing, Chapter 3.

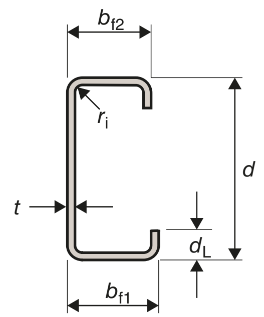
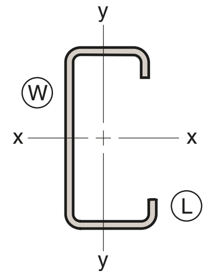


Table 7.2

WALL STUD
DESIGN CAPACITIES

Clad Both Sides



Designation	Mass per metre	Design Properties and Capacities									NASH Wall Stud Classification	
		Lateral Actions				Compression		Tension	Combined Actions			
		I_x	$\phi_b M_{sx}$	$\phi_b M_{bx}$	$\phi_v V_{vx}$	$\phi_c N_s$	$\phi_c N_c$	$\phi_t N_t$	$\phi_b M_{sxf}$	N_{ex}		
	kg/m	$10^6 mm^4$	kNm	kNm	kN	kN	kN	kN	kNm	kN	Australia	New Zealand
Stud Height 2440 mm												
89 x 41 x 1.55 LCN - G450	2.18	0.347	3.16	2.83	30.3	80.4	60.7	86.7	3.16	144	SC	SD
89 x 41 x 1.15 LCN - G500	1.64	0.264	2.56	2.03	15.8	52.3	38.7	70.4	2.67	107.9	SC	SD
89 x 41 x 0.95 LCN - G550	1.36	0.220	2.01	1.65	8.87	40.2	29.0	61.9	2.45	89.6	SC	SD
89 x 41 x 0.75 LCN - G550	1.08	0.176	1.27	1.12	4.34	25.1	18.7	44.2	1.76	71.1	SC	SC
Stud Height 2740 mm												
89 x 41 x 1.55 LCN - G450	2.18	0.347	3.16	2.83	30.3	80.4	58.0	86.7	3.16	114	SC	SD
89 x 41 x 1.15 LCN - G500	1.64	0.264	2.56	2.03	15.8	52.3	36.9	70.4	2.67	85.6	SC	SD
89 x 41 x 0.95 LCN - G550	1.36	0.220	2.01	1.65	8.9	40.2	27.5	61.9	2.45	71.1	SC	SD
89 x 41 x 0.75 LCN - G550	1.08	0.176	1.27	1.12	4.34	25.1	17.9	44.2	1.76	56.4	SC	SC
Stud Height 3040 mm												
89 x 41 x 1.55 LCN - G450	2.18	0.347	3.16	2.83	30.3	80.4	55.0	86.7	3.16	92.7	SC	SD
89 x 41 x 1.15 LCN - G500	1.64	0.264	2.56	2.03	15.8	52.3	34.8	70.4	2.67	69.5	SC	SD
89 x 41 x 0.95 LCN - G550	1.36	0.220	2.01	1.65	8.9	40.2	25.9	61.9	2.45	57.7	SC	SD
89 x 41 x 0.75 LCN - G550	1.08	0.176	1.27	1.12	4.34	25.1	17.0	44.2	1.76	45.8	SC	SC

Wall Stud Design Assumptions

Effective Lengths for Design			
Stud Height (mm)	2440	2740	3040
No. of Noggings	1	1	2
L_{ex} (mm)	1952	2192	2432
L_{ey} (mm)	600	600	600
L_{ez} (mm)	600	600	600

NOTES:

1. Noggings are equally spaced.
2. Lateral restraint is assumed to be provided the cladding.
3. Both flanges of the stud are restrained by the top and bottom plates, the nogging, and the cladding
4. Effective length L_{ex} is taken as 80% of the ength of the stud in accordance with NASH Handbook Clause 3.4.2.
5. Effective lengths L_{ey} and L_{ez} are assumed to be as per the table above.
6. No allowance has been made for holes in the web of the stud.

Symbol	Description
I_x	second moment of area about the major principal x-axis
$\phi_c N_s$	design section capacity of a member in compression
$\phi_c N_c$	design member capacity of a member in compression
$\phi_b M_{sx}$	design section moment capacity about the x-axis
$\phi_b M_{bx}$	design member moment capacity about the x-axis
$\phi_b M_{sxf}$	design yield moment capacity about the x-axis
$\phi_v V_{vx}$	design shear capacity of the cross-section perpendicular to the x-axis
N_{ex}	elastic buckling load about the major principal x-axis
$\phi_t N_t$	design section capacity of a member in tension
L_{ex}	effective length for buckling about the major principal x-axis
L_{ey}	effective length for buckling about the minor principal y-axis
L_{ez}	effective length for torsional buckling about the longitudinal z-axis

References

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NASH Handbook (Aust.), Best Practice for Design and Construction of Residential and Low-Rise Steel Framing, Chapter 3.

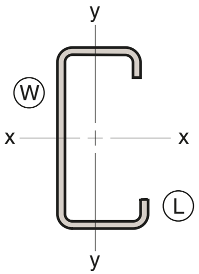
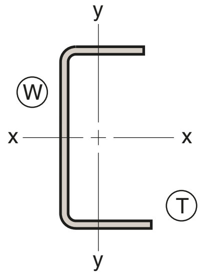


Table 7.3

WALL PLATE
DESIGN CAPACITIES



Designation	Mass per metre	Design Properties and Capacities								NASH Wall Plate Classification	
		Full Lipped Channel (at midspan)				Channel Lips Removed (at supports)					
		I_y	$\phi_c N_c$	$\phi_b M_{byL}$	$\phi_b M_{byW}$	$\phi_c N_s$	$\phi_b M_{syT}$	$\phi_b M_{syW}$	$\phi_v V_{vy}$		
	kg/m	$10^6 mm^4$	kN	kNm	kNm	kN	kNm	kNm	kN	Australia	New Zealand
89 x 41 x 1.55 LCN - G450	2.18	0.0584	68.6	0.804	0.856	61.4	0.400	0.470	27.4	PC	PD
89 x 41 x 1.15 LCN - G500	1.64	0.0450	44.1	0.590	0.579	39.5	0.265	0.352	23.1	PB	PC
89 x 41 x 0.95 LCN - G550	1.36	0.0378	33.4	0.486	0.509	30.2	0.205	0.277	21.2	PB	PC
89 x 41 x 0.75 LCN - G550	1.08	0.0304	21.2	0.345	0.287	18.7	0.129	0.176	14.9	PA	PA

NOTES:

1. The capacities for the full lipped channels are based on an effective length L_e = 0.6 m.
2. The capacities of channels with lips removed are section capacities.
3. No allowance has been made for holes in the web of the plate in the determination of I_y.
4. The NASH Classifications are based on the capacities of the full lipped channels.
5. The second moment of area I_y for the full lipped channel is used for the NASH Australia classification.

Symbol	Description
I_y	second moment of area about the minor principal y-axis
$\phi_c N_s$	design section capacity of a member in compression
$\phi_c N_c$	design member capacity of a member in compression
$\phi_b M_{byL}$	design member moment capacity about the y-axis (lips in compression)
$\phi_b M_{byW}$	design member moment capacity about the y-axis (web in compression)
$\phi_b M_{syT}$	design section moment capacity about the y-axis (toes in compression)
$\phi_b M_{syW}$	design section moment capacity about the y-axis (web in compression
$\phi_v V_{vy}$	design shear capacity of the cross-section perpendicular to the y-axis
L_e	effective length ($L_{ex} = L_{ey} = L_{ez}$)

Appendix A: SIGNATURE CURVES

CONTENTS

GENERAL

This appendix provides the signature curves for each of the sections contained in these Design Capacity Tables. The signature curves were produced in the Thin-Wall buckling analysis program developed by The University of Sydney, and form the basis of design using the Direct Strength Method (DSM). They are included here to provide a clear picture of the buckling behaviour of the sections under the following loading conditions:

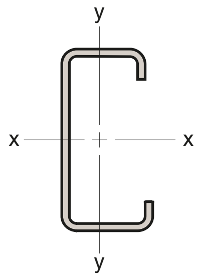
- axial compression
- bending about the x-axis
- bending about the y-axis (lips in compression)
- bending about the y-axis (web in compression)

Graph A.1

SIGNATURE CURVE

89 x 41 x 1.55 LCN

Axial Compression

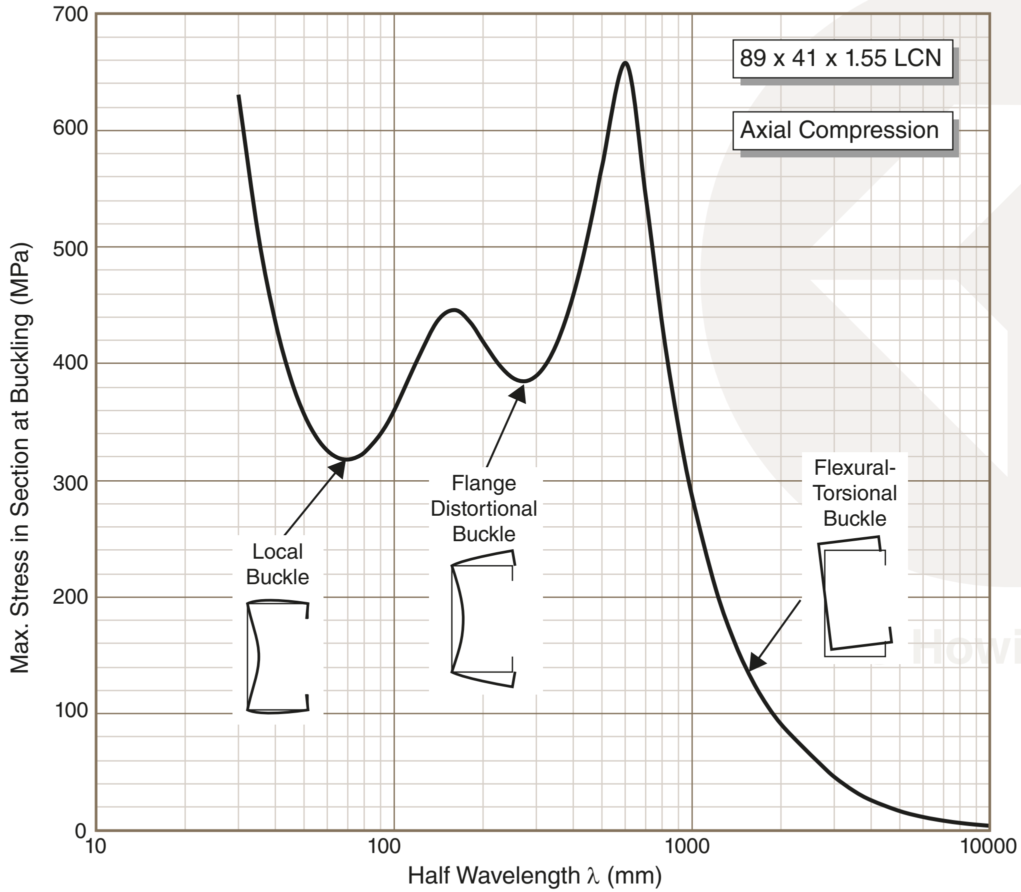


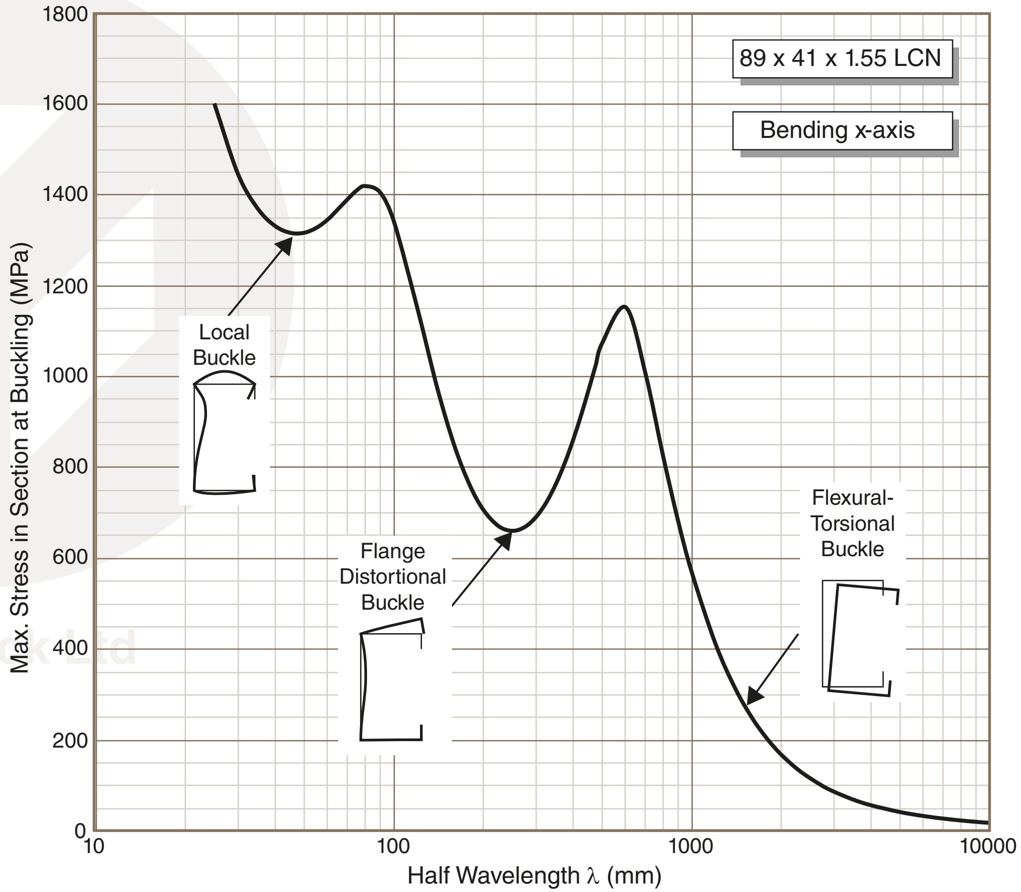
Graph A.2

SIGNATURE CURVE

89 x 41 x 1.55 LCN

Bending about x-axis





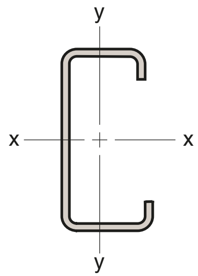
Graph A.3

SIGNATURE CURVE

89 x 41 x 1.55 LCN

Bending about y-axis

(Lips in Compression)



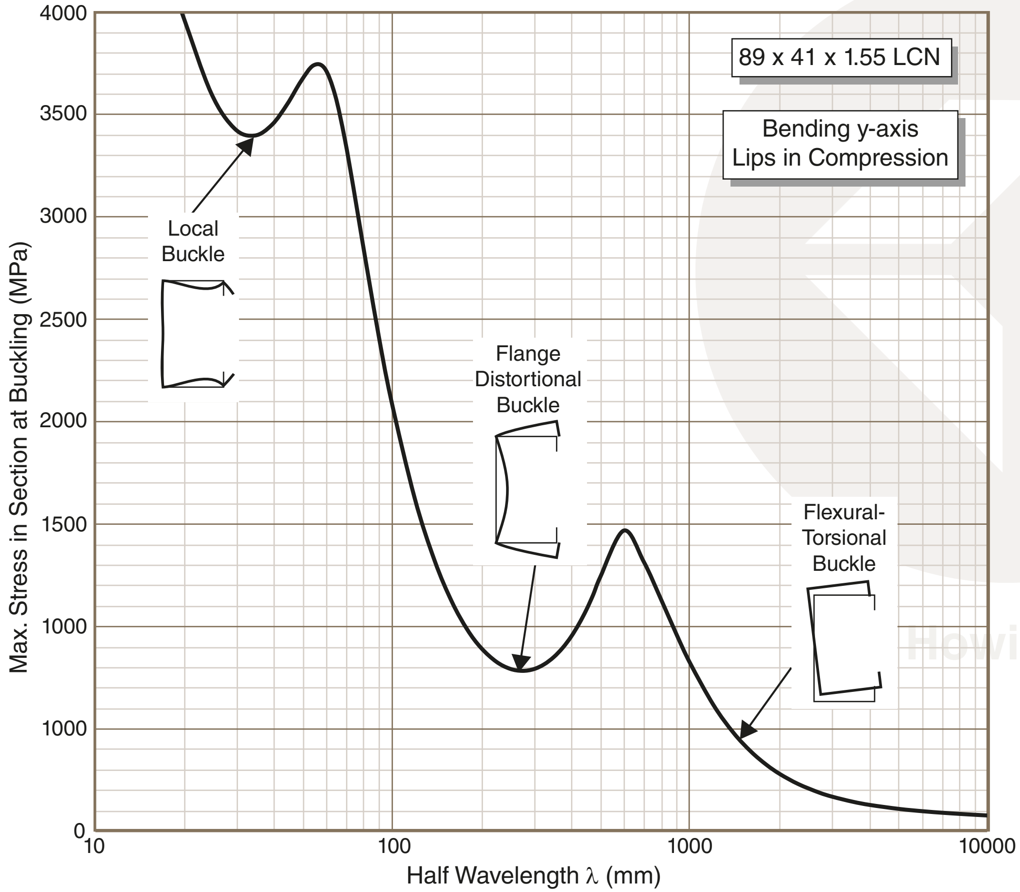
Graph A.4

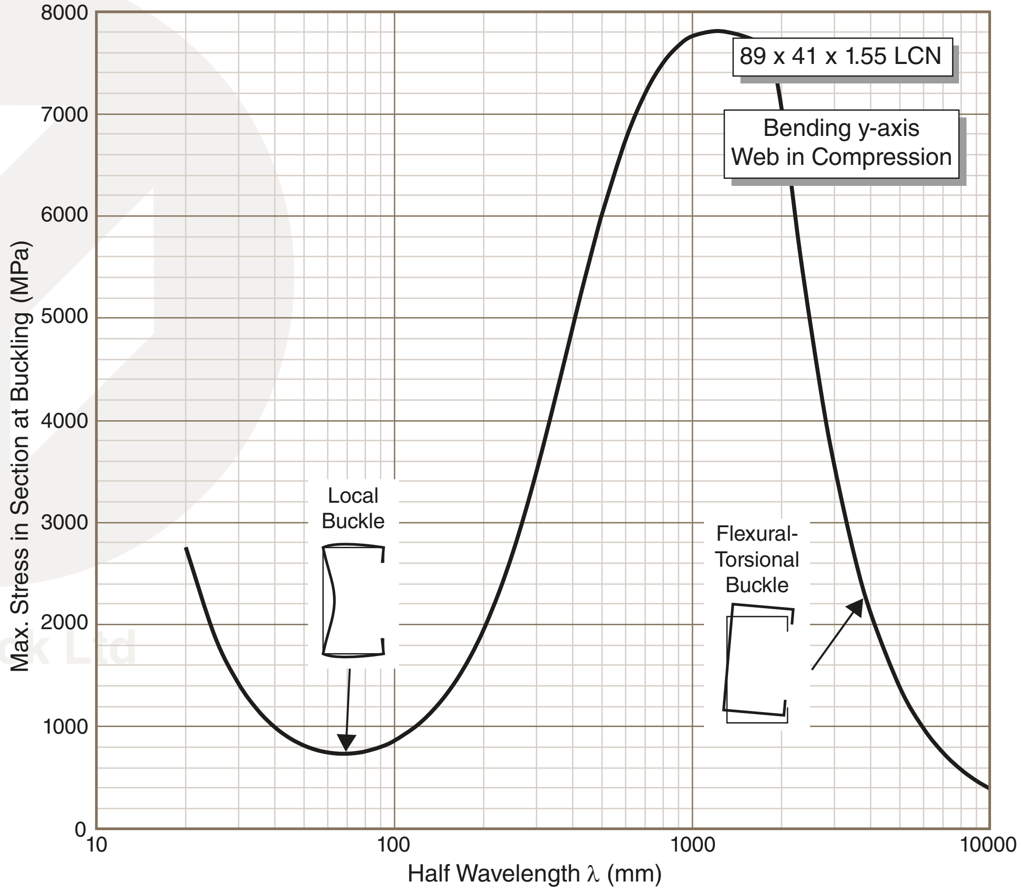
SIGNATURE CURVE

89 x 41 x 1.55 LCN

Bending about y-axis

(Web in Compression)



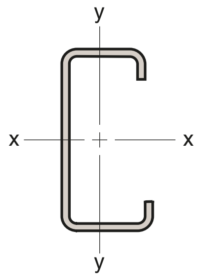


Graph A.5

SIGNATURE CURVE

89 x 41 x 1.15 LCN

Axial Compression

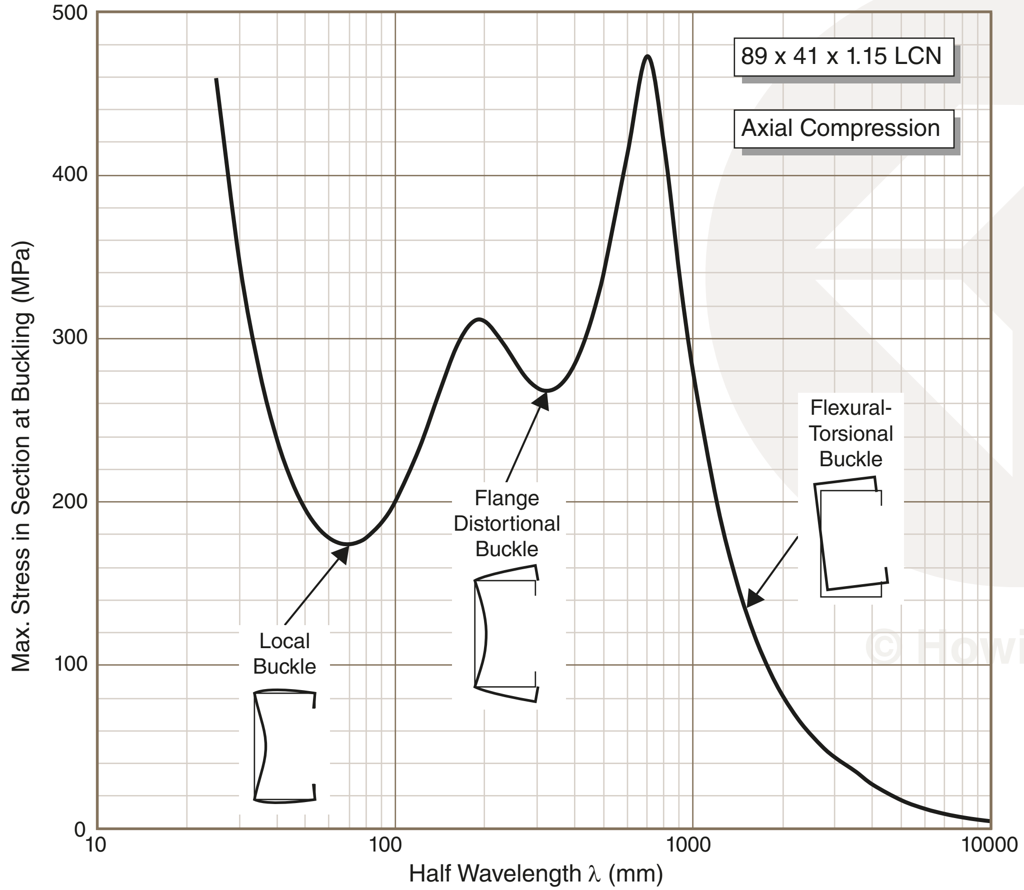


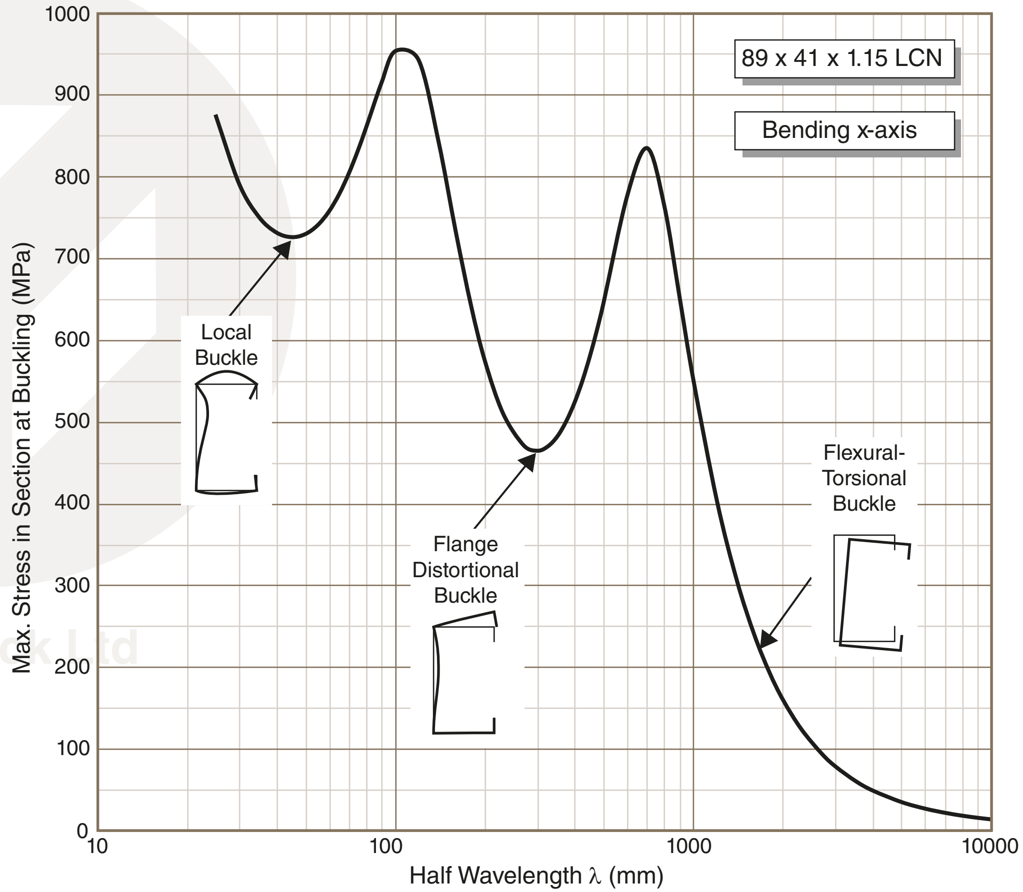
Graph A.6

SIGNATURE CURVE

89 x 41 x 1.15 LCN

Bending about x-axis





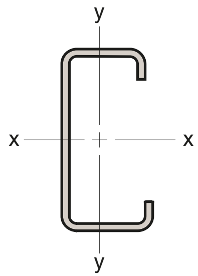
Graph A.7

SIGNATURE CURVE

89 x 41 x 1.15 LCN

Bending about y-axis

(Lips in Compression)



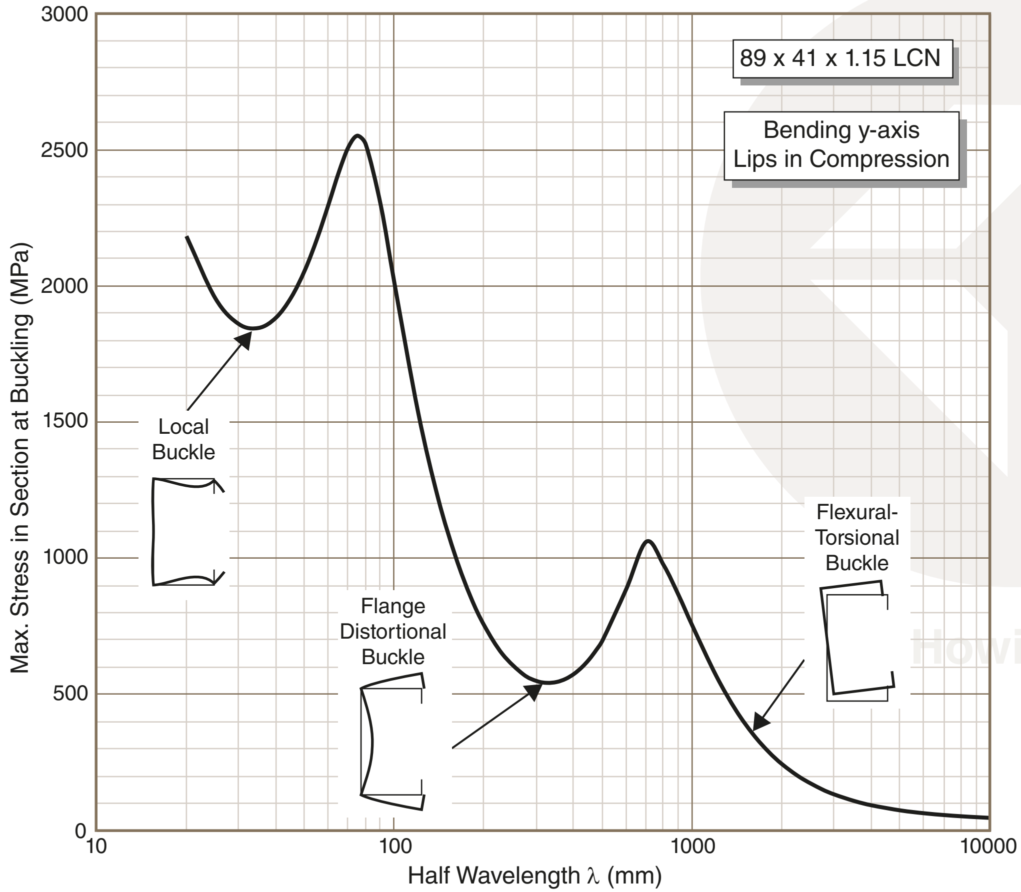
Graph A.8

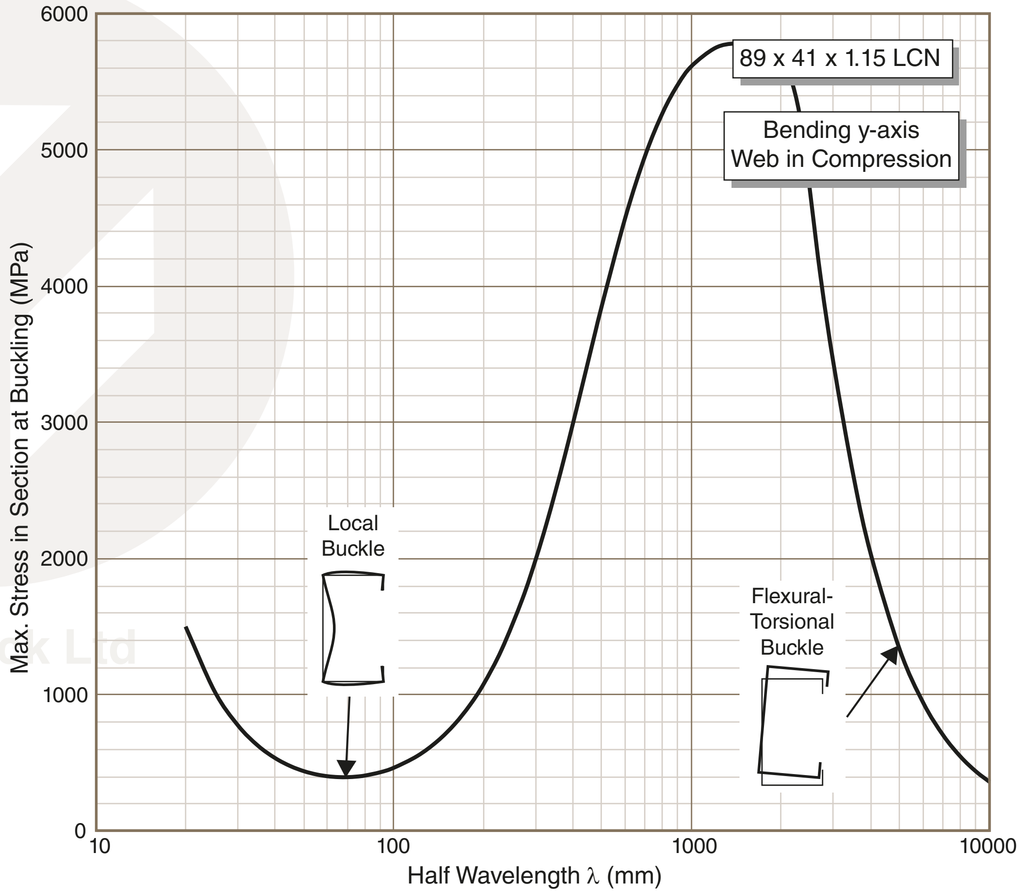
SIGNATURE CURVE

89 x 41 x 1.15 LCN

Bending about y-axis

(Web in Compresssion)



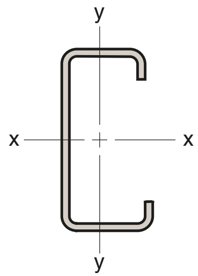


Graph A.9

SIGNATURE CURVE

89 x 41 x 0.95 LCN

Axial Compression

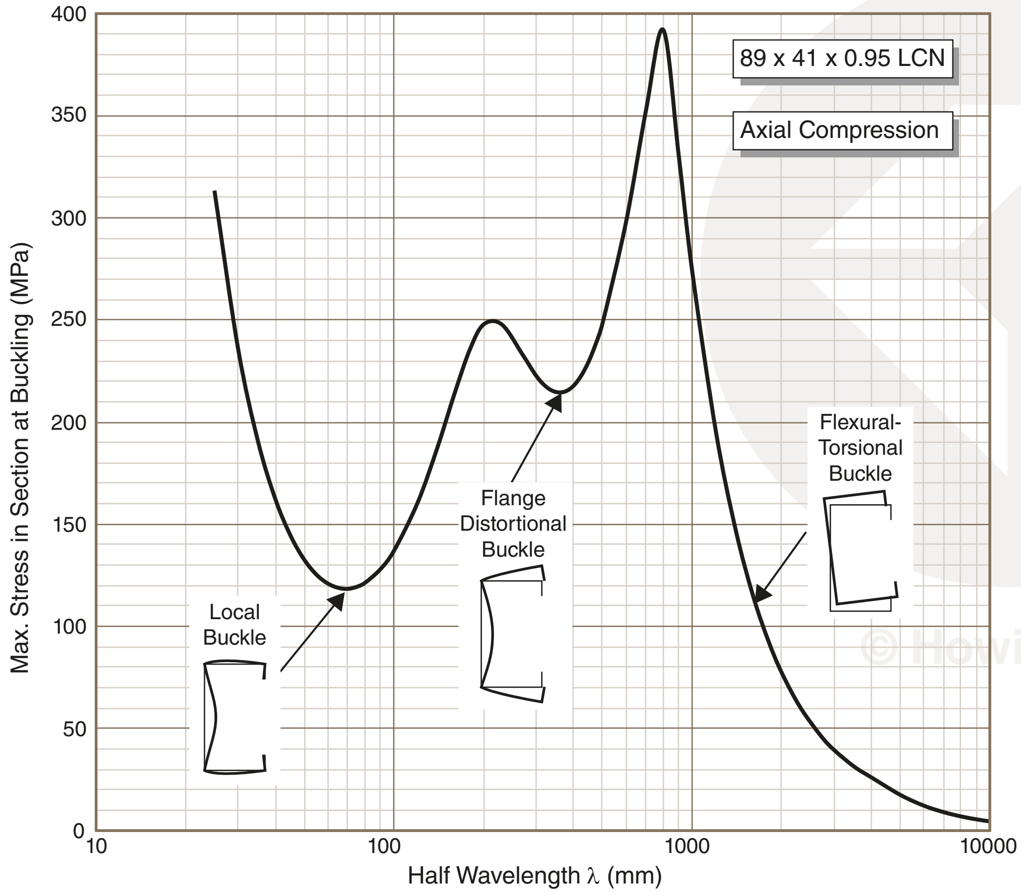


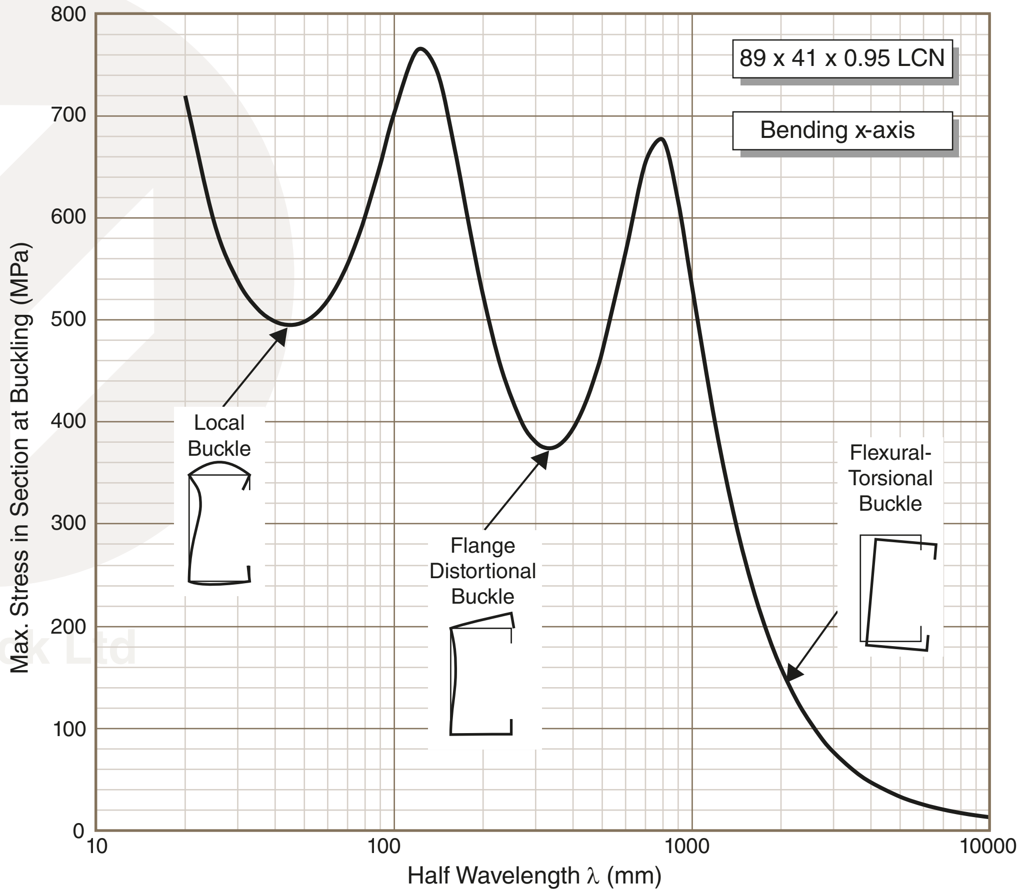
Graph A.10

SIGNATURE CURVE

89 x 41 x 0.95 LCN

Bending about x-axis





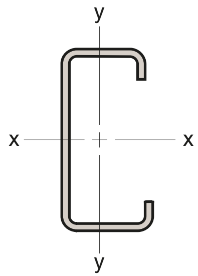
Graph A.11

SIGNATURE CURVE

89 x 41 x 0.95 LCN

Bending about y-axis

(Lips in Compression)



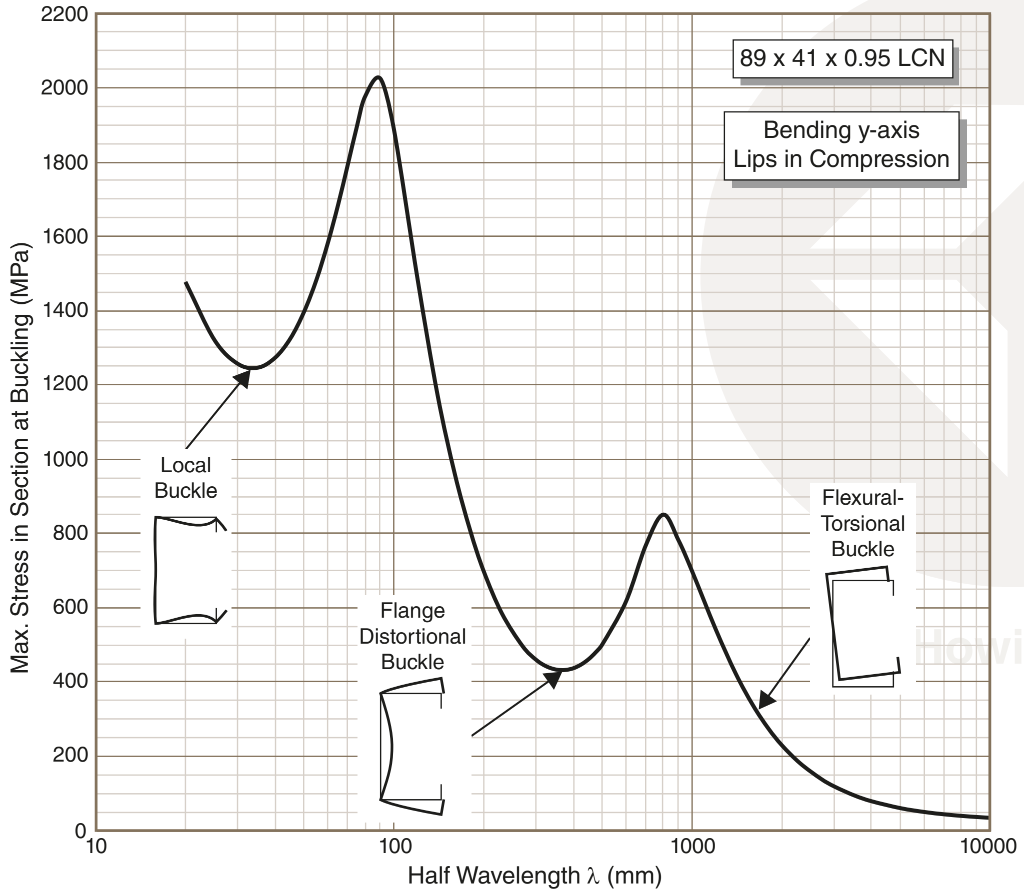
Graph A.12

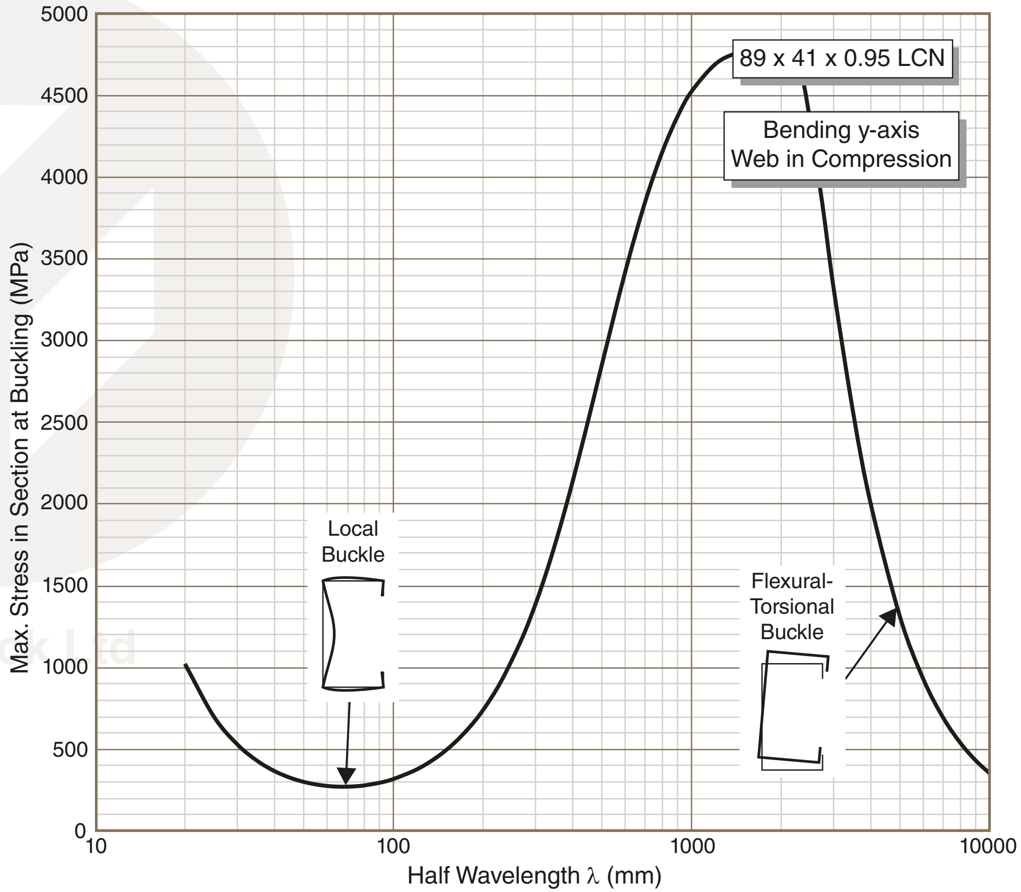
SIGNATURE CURVE

89 x 41 x 0.95 LCN

Bending about y-axis

(Web in Compression)



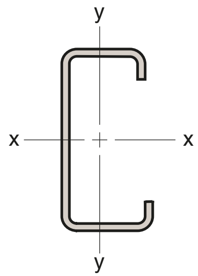


Graph A.13

SIGNATURE CURVE

89 x 41 x 0.75 LCN

Axial Compression

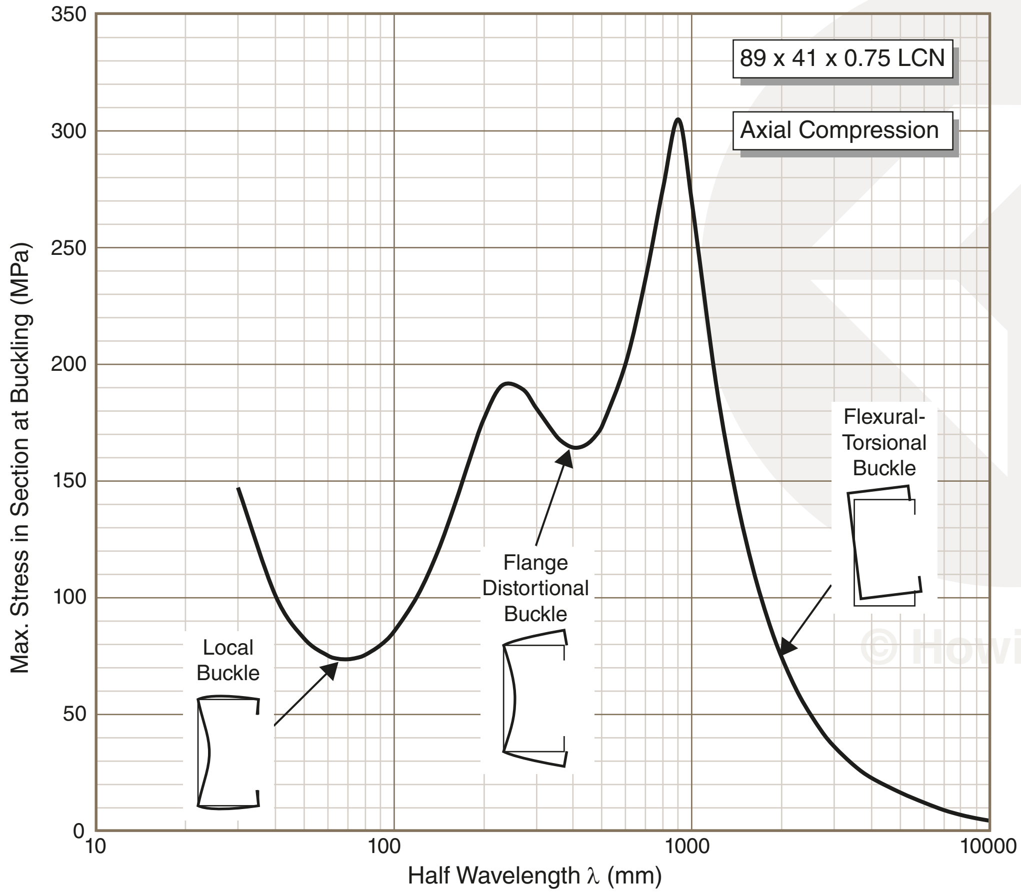


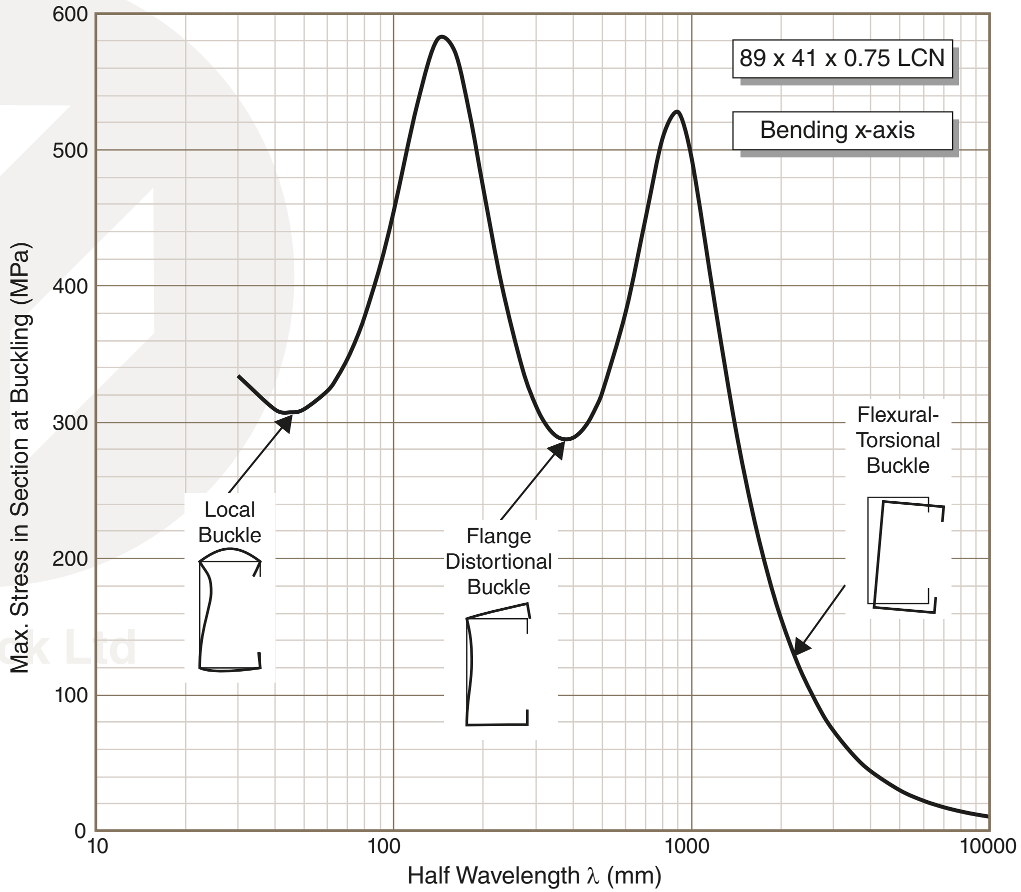
Graph A.14

SIGNATURE CURVE

89 x 41 x 0.75 LCN

Bending about x-axis





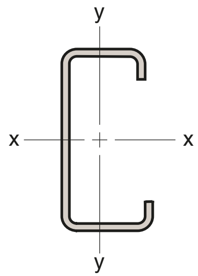
Graph A.15

SIGNATURE CURVE

89 x 41 x 0.75 LCN

Bending about y-axis

(Lips in Compression)



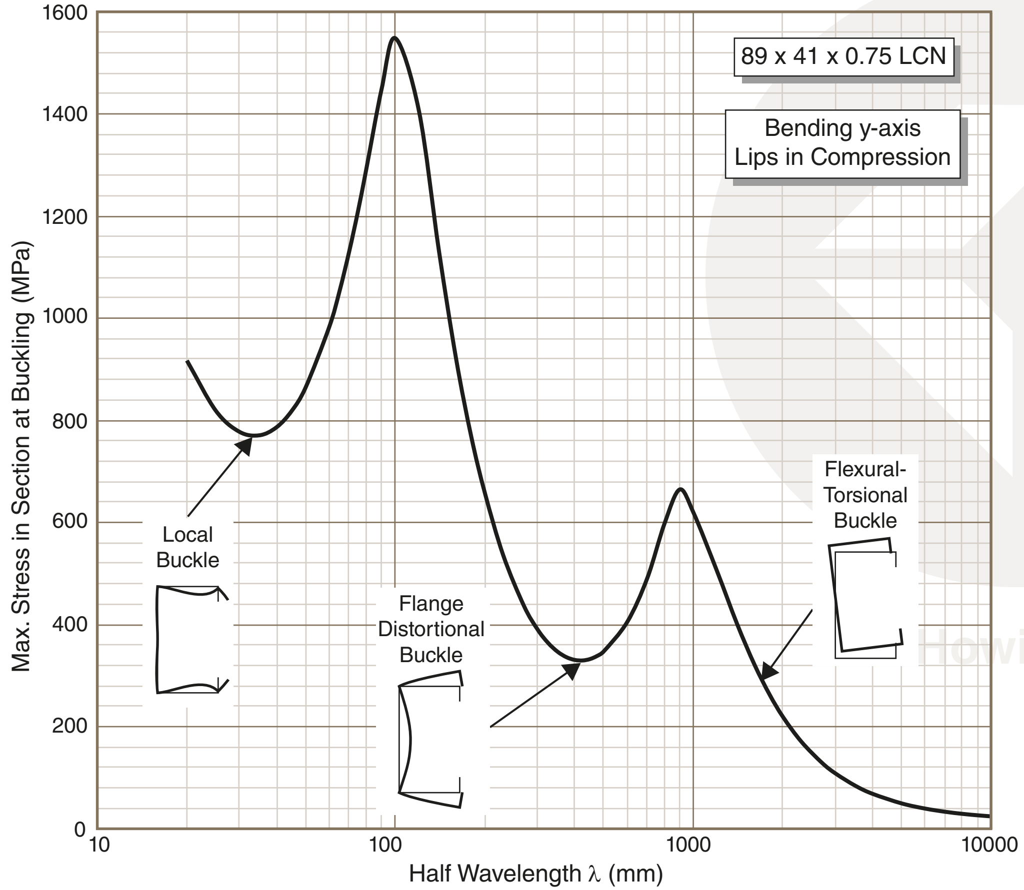
Graph A.16

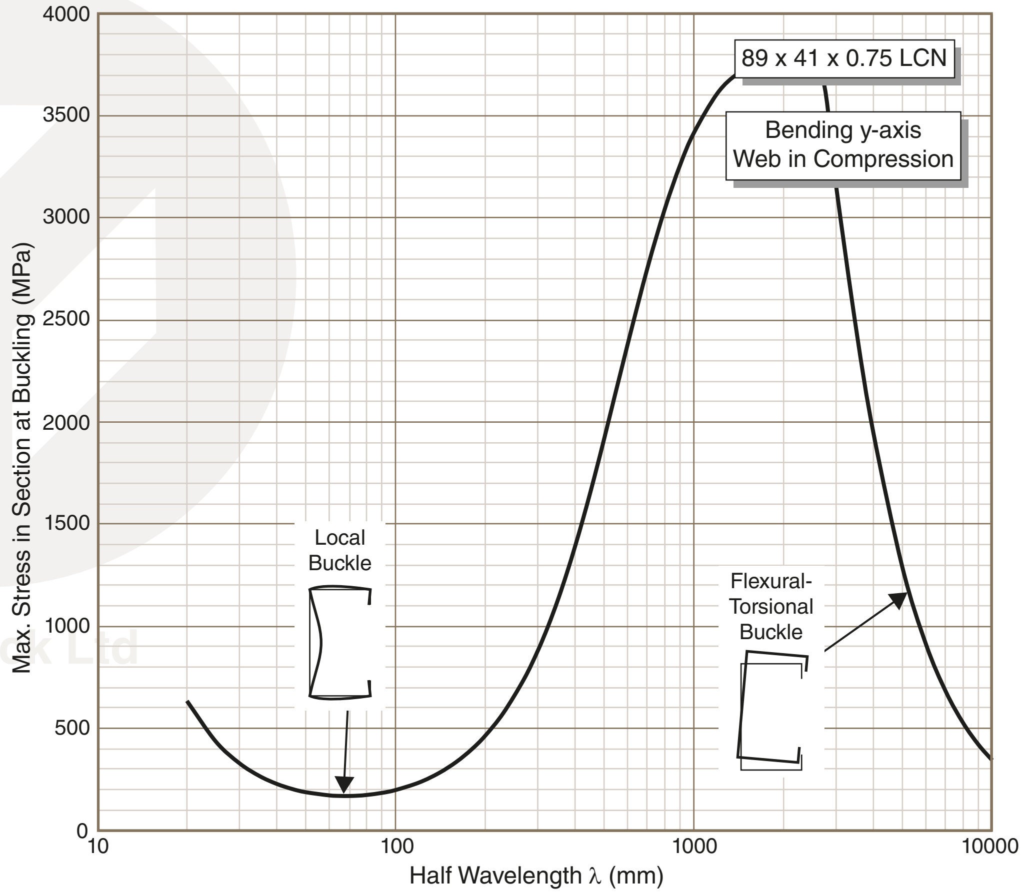
SIGNATURE CURVE

89 x 41 x 0.75 LCN

Bending about y-axis

(Web in Compression)





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