steel&tube
STRONGER IN EVERYWAY

DESIGN GUIDE

PURLINS & GIRTS

Updated to include PS1
Click here to view

S&T029N

JUL 2013

Building Code Clause(s) B1 & B2......

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance notes on the use of this form are printed on the reverse side)*

ISSUED BY: HFC: Civil & Structural (North) Ltd ....
(Design Firm)

TO: Steel and Tube Roofing Products LTD ....
(Owner/Developer)

TO BE SUPPLIED TO: Any BCA in New Zealand ....
(Building Consent Authority)

IN RESPECT OF: Steel and Tube Span Charts within the Design Guide "Purlins and Girts" dated July 2013 ....
(Description of Building Work)

AT: Anywhere in New Zealand ....
(Address)

.... **LOT** .... **DP** .... **SO** ....

We have been engaged by the owner/developer referred to above to provide Purlin and Girt Capacities for single, double continuous and lapped spans based on a uniform load on all spans. .... services in respect of the requirements of
(Extent of Engagement)
Clause(s) B1 .... of the Building Code for
◉ All or ○ Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

☑ Compliance Documents issued by Department of Building & Housing AS/NZS 4600 ....
(verification method / acceptable solution)
.... or

☐ Alternative solution as per the attached schedule ....

The proposed building work covered by this producer statement is described on the drawings titled S&T Design Guide "Purlins and Girts" dated July 2013 .... and numbered n/a ....;
together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:

(i) Site verification of the following design assumptions Design Engineer to follow Design Information pages 4&5

(ii) All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code.

I, Rob J Foster .... am: ☑ CPEng 173329 ....#
(Name of Design Professional)
☐ Reg Arch ....#

I am a Member of : ☑ IPENZ ☐ NZIA and hold the following qualifications: BE MIPENZ Cpeng IntPeng ....

The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*.
The Design Firm is a member of ACENZ ◉ YES ○ NO

SIGNED BY Rob J Foster .... ON BEHALF OF HFC:Civil and Structural (North) Ltd ....
(Design Firm)

Date 10/3/2014 .... *(signature)* ....

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

GUIDANCE ON USE OF PRODUCER STATEMENTS

Producer statements were first introduced with the Building Act 1992. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects, Institution of Professional Engineers New Zealand, Association of Consulting Engineers New Zealand in consultation with the Building Officials Institute of New Zealand. The original suite of producer statements has been revised at the date of this form as a result of enactment of the Building Act (2004) by these organisations to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with reasonable grounds for the issue of a Building Consent or a Code Compliance Certificate, without having to duplicate design or construction checking undertaken by others.

PS1 Design	Intended for use by a suitably qualified independent design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;
PS2 Design Review	Intended for use by a suitably qualified independent design professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;
PS3 Construction	Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2003[1] or Schedules E1/E2 of NZIA's SCC 2007 [2]
PS4 Construction Review	Intended for use by a suitably qualified independent design professional who undertakes construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate. This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACENZ, IPENZ and NZIA to interpret the Producer Statement.

Competence of Design Professional

This statement is made by a Design Firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its designers.

A competent design professional will have a professional qualification and proven current competence through registration on a national competence-based register, either as a Chartered Professional Engineer (CPEng) or a Registered Architect.

Membership of a professional body, such as the Institution of Professional Engineers New Zealand (IPENZ)or the New Zealand Institute of Architects (NZIA), provides additional assurance of the designer's standing within the profession. If the design firm is a member of the Association of Consulting Engineers New Zealand (ACENZ), this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent design professional".

*** Professional Indemnity Insurance**

As part of membership requirements, ACENZ requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI insurance minimum stated on the front of this form reflects standard, small projects. If the parties deem this inappropriate for large projects the minimum may be up to $500,000.

Professional Services during Construction Phase

There are several levels of service which a Design Firm may provide during the construction phase of a project (CM1-CM5)[3] (OL1-OL4)[2]. The Building Consent Authority is encouraged to require that the service to be provided by the Design Firm is appropriate for the project concerned.

Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

Attached Particulars

Attached particulars referred to in this producer statement refer to supplementary information appended to the producer statement.

Refer Also:

1 *Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2003*

2 *NZIA Standard Conditions of Contract SCC 2007 (1st edition)*

3 *Guideline on the Briefing & Engagement for Consulting Engineering Services (ACENZ/IPENZ 2004)*

www.acenz.org.nz
www.ipenz.org.nz
www.nzia.co.nz

IPENZ ENGINEERS NEW ZEALAND — NEW ZEALAND INSTITUTE OF ARCHITECTS INCORPORATED — ACENZ

CONTENTS

ACKNOWLEDGMENTS

This *Purlin & Girts Design Guide* has been developed with the help of HFC Consultants. Load tables were produced by HFC consultants using computer programs Purlin and Purlin 4600, developed by the University of Sydney.

The Speed Channel bracing technology is based on intellectual property of Dimond, a division of Fletcher Steel Limited, and is used for the HST purlin and girt system under licence to Dimond.

DISCLAIMER

This publication is intended to provide information to the best of our knowledge in regard to HST cold-formed sections. It does not constitute a complete description of the goods or an express statement about their suitability for any particular purpose. It is intended as a general guide and not as a substitute for professional technical advice.

steel&tube

North Island: 09 271 9280
South Island: 03 341 3977
www.steelandtube.co.nz

GENERAL INFORMATION

INTRODUCTION

HST Steel Purlins & Girts are high-strength lipped profile sections manufactured by Steel & Tube, incorporating optimised enhancements to the traditional Cee shape. This brochure has been developed taking into consideration the trend towards more complex span configurations and varying end-uses of lightweight cold-formed sections, to give easier and more accurate access to design information for different applications.

The load tables have been produced by HFC Consultants using two computer programs developed by the University of Sydney. These programs, Purlin and Purlin 4600, enable more thorough analysis of cold-formed purlin capacities in differing load cases and combinations.

DESCRIPTION

Steel & Tube's ***HST*** sections are continuously rollformed from zinc coated high-tensile steel, punched in-line and cut-to-length. Accessories are also zinc-coated and are either made to custom lengths or supplied as a standard component.

The optimized dimensions of ***HST*** purlins, together with the widest range of depths and thicknesses, make ***HST*** purlins the top performer in lightweight cold-formed steel sections.

MATERIALS/FINISH

HST Purlins & Girts are rolled from galvanised high strength steel strip complying with AS 1397:2001, in the following thicknesses and grades:

STEEL THICKNESS	GRADE	ZINC WEIGHT*
1.15 – 1.45mm	G500 (MPa)	275 g/m^2
1.75 – 1.95mm	G450 (MPa)	275 g/m^2
2.4 – 3.0mm	G450 (MPa)	275 g/m^2

*Other coating weights are available subject to supply considerations. Refer: Durability.

The load tables are formulated using the minimum yield strength and ultimate strength for the specified grade, which is below typical yield strength achieved with these materials.

LENGTH

Standard rates and transport arrangements apply to lengths up to 18 metres. For lengths in excess of 18 metres, the available transport and site handling facilities should be considered.

TOLERANCES

Web Depth ± 2mm	Flange Width ± 2mm
Lip ± 1mm	Hole Centers ± 1.5mm
Web/Flange Angle 88-93°	Length ± 3mm

Some acceptable "bell mouthing" outside these tolerances may occur at the ends of a purlin as a result of the manufacturing process.

BRACING

The ***HST*** Purlin & Girt system utilises speed channel or bolted brace/sag rod components as required by the load tables. These should be located in the correct positions, as shown on page 26 otherwise lower load values may result.

All ***HST*** brace channels are manufactured with end-brackets custom fitted to suit the purlin size and spacing. Sag rods are hot dip galvanised 12 or 16mm diameter rod with double nuts and washers at each end. All bracing components are fabricated from grade G250 galvanised steel.

Standard brace channel is 100 x 32 lipped channel in 0.95 thickness. Where greater load capacity is required capacities for brace channel in 0.95 and 1.15 thickness are given on page 24.

DURABILITY

In a dry internal environment, service life will exceed 50 years, complying with the durability requirements of NZBC Clause B2 – Durability.

For applications exposed to moisture, salt spray or industrial contaminants, maintenance of the coating may be required to achieve a 50 year service life, or the purlins can be painted prior to erection in accordance with AS/NZS 2312:2002.

Heavier zinc coating weights of 450 and 550 g/m^2 can also be provided, subject to minimum order quantity and lead times.

Please refer to New Zealand Steel Durability and Maintenance statement for Galvanised Steel.

LIMITATIONS

These documents and tables only apply to Steel & Tube ***HST*** purlins.

DESIGN INFORMATION

APPLICABLE STANDARDS

HST Purlin & Girt loads are presented in Limit State format consistent with AS/NZS 1170.0:2002 "Structural Design Actions". All the design information in this brochure should be used in conjunction with AS/NZS 4600:2005.

DESIGN ASSUMPTIONS

The load capacities given in the "Ultimate Uniformly Distributed Load" tables are the design load capacities for ultimate limit state ($\phi_b w_{bx}$) in kilonewtons per metre of span (kN/m) where uniformly distributed loads are continuous along the full span. For other load situations, specific design is required. Loads for intermediate spans may be determined by linear interpolation.

The purlins are supported by cleat plates and no bolt slip or member rotation has been allowed at fixed points. Where the axial load applies, the engineer should check the bolt capacity.

The serviceability load capacities (w_s) are the uniformly distributed load (kN/m) at which the midspan deflection equals span/150. Deflections at other loads can be determined by direct proportion and corresponding serviceability limit states checked accordingly. The serviceability load capacities are calculated by using the average of the gross and effective second moment of area.

DESIGN CRITERIA

Strength reduction factors are included in the design load capacity and have been determined from AS/NZS 4600:2005 as follows:

Bending	ϕ_b = 0.90	(ϕ_b = 0.95 for section moment capacity)
Compression	ϕ_c = 0.85	
Shear	ϕ_v = 0.90	

The self-weight of ***HST*** purlin is not included in the load tables and should be calculated along with other dead loads.

ROOF SHEETING

Screw-fastened sheeting which is regularly attached to one flange of the purlins or girts, provides a continuous diaphragm shear restraint against minor axis rotation Kry (but no torsional restraint). This has been assumed in determining the "Ultimate Uniformly Distributed Load" and the "Ultimate Axial Compression Load" tables. A value for Kry of 100,000 Nmm/mm is used. If clip-fastened sheeting is fixed to purlin, specific design is required.

LOAD COMBINATIONS

The Limit State method of design is recommended with combinations of factored loads for each limit state in accordance with AS/NZS 1170. This should include permanent, imposed, wind, snow, earthquake and other loads.

Loads are assumed to act at the flange where the cladding is attached. For roof pitches over 10°, the design engineer shall allow for the resultant force in the plane of the roof due to dead, live and snow loads.

For walls, provided the maximum spacing between brace struts/sag rods is limited to 3000 mm and the wall cladding is screw fixed to the girts, the dead load of the girts and cladding may be assumed to be carried directly by the bracing system. Accordingly, the girts may be designed for face loads only. The design engineer should ensure that the loads in the bracing system can be supported either by an eaves member or directly by the foundations.

AXIAL COMPRESSION LOADS AND COMBINED BENDING AND AXIAL COMPRESSION ACTIONS

The load capacities given in "Ultimate Axial Compression Load" tables are the design load capacities for ultimate limit state ($\phi_c N_c$) in kilonewtons (kN) for axial compression forces passing through the centroid of the simply supported ***HST*** section. The elastic buckling loads (N_e) in kilonewtons (kN) are also included.

Where ***HST*** purlins are required to support axial compression loads as well as bending loads, such as when they act as bracing struts or are required to transmit end wall loads to the roof bracing system, the interaction equations set out below are recommended, as taken from AS/NZS 4600:2005 section 3.5.

If $N^*/\phi_c N_c \leq 0.15$, the following interaction equation may be used:

$$\frac{N^*}{\phi_c N_c} + \frac{w_x^*}{\phi_b w_{bx}} \leq 1.0$$

This is usually the case when purlins are used primarily as bending members near capacity and are also required to take a nominal level of axial compression.

If $N^*/\phi_c N_c > 0.15$, then the following equations may be used:

a) $$\frac{N^*}{\phi_c N_c} + \frac{c_{mx} w_x^*}{\phi_b w_{bx} \alpha_{nx}} \leq 1.0$$

b) $$\frac{N^*}{\phi_c N_s} + \frac{w_x^*}{\phi_b w_{bx}} \leq 1.0$$

N^*	=	Applied ultimate limit state axial compression load (kN)
$\phi_c N_c$	=	Design member capacity for members subject to axial compression (kN) from charts
$\phi_c N_s$	=	Design section capacity for members subject to axial compression (kN) from charts
w_x^*	=	Applied ultimate limit state uniformly distributed load about the X axis (kN/m)
$\phi_b w_{bx}$	=	Design load capacity for uniformly distributed load (kN/m) from charts
c_{mx}	=	Load coefficients (refer to Clause 3.5.1 of AS/NZS 4600:2005)
α_{nx}	=	$(1 - N^*/N_{ex})$, moment amplification factor about the X axis
N_{ex}	=	Elastic buckling load about the X axis, as given by the "Ultimate Axial Compression Load" table (kN)

Note the ***HST*** purlin is assumed to have zero distribution load about the Y axis of bending. Where biaxial bending occurs, then specific guidance should be sought from Steel & Tube.

Refer to AS/NZS 4600:2005 for axial tension and combined bending and axial tension design.

IDENTIFICATION OF SPAN TYPE

SINGLE SPAN

A Single Span occurs where a purlin is simply supported between supports.

DOUBLE SPAN

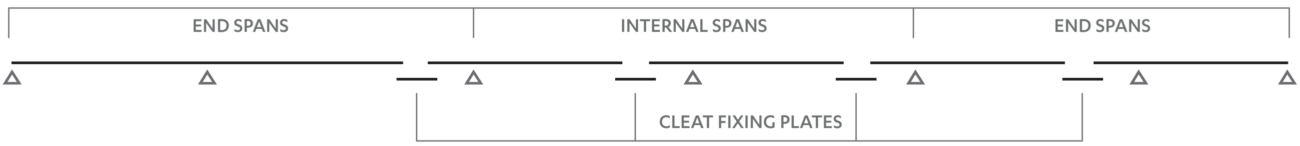
A Double Span condition exists where purlins are continuous over two spans. Where a lapped Double Span occurs, specific design is required.

CONTINUOUS SPAN

Continuous spans are generally achieved by splicing the ends of abutting purlins at a point in their span where moment is close to zero, typically 25% of span approximately. A standard connection splice is shown on page 17.

Continuous Span End. End spans refer to the first and last two spans of any continuous run.

Continuous Span Internal. Internal spans are spans beyond two ends of a continuous run.

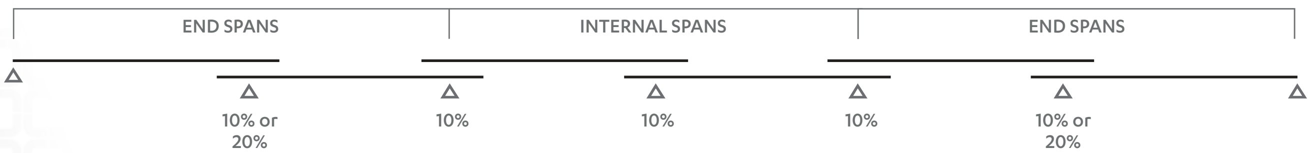


LAPPED SPAN

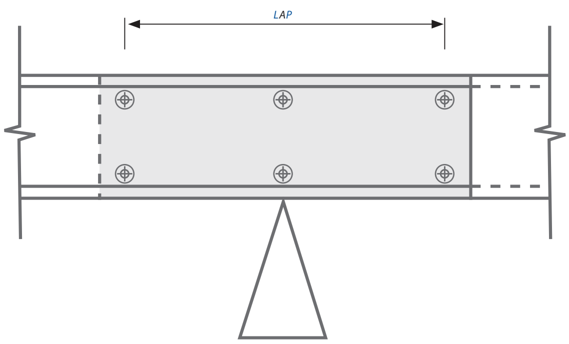
Lapped spans occur where purlins are lapped over supports. The minimum lap length is the greater of 10% (or 20%) of the span or 300mm each side of the support.

Lapped Span End. This applies to the first and last two spans of any continuous run. Figures are given for end spans lapped 10% and 20%.

Lapped Span Internal. This span type occurs where purlins are lapped 10% of their span over supports in internal bays. Figures are given for 10% laps; figures for other lap lengths are available on request.



Lap length is distance between two outermost bolts.



ULTIMATE UNIFORMLY DISTRIBUTED LOAD: 4.0 – 7.0 M

		***HST* 150/12**				***HST* 150/15**				***HST* 150/18**				***HST* 200/12**				***HST* 200/15**			
		$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s
		(kN/m)				(kN/m)				(kN/m)				(kN/m)				(kN/m)			
SPAN	**(M)**	**0B**	**1B**	**2B**	**DEF**	**0B**	**1B**	**2B**	**DEF**	**0B**	**1B**	**2B**	**DEF**	**0B**	**1B**	**2B**	**DEF**	**0B**	**1B**	**2B**	**DEF**
SINGLE SPAN	**4.0**	2.00	3.01	3.01	2.08	2.64	4.09	4.09	2.67	3.17	4.87	4.87	3.26	3.56	4.35	4.35	4.45	4.79	5.98	5.98	5.72
	4.5	1.31	2.36	2.38	1.46	1.70	3.23	3.23	1.87	2.04	3.80	3.85	2.29	2.38	3.44	3.44	3.12	3.16	4.72	4.72	4.02
	5.0	0.90	1.82	1.93	1.06	1.14	2.49	2.62	1.37	1.38	2.93	3.12	1.67	1.63	2.78	2.78	2.28	2.15	3.83	3.83	2.93
	5.5	0.63	1.42	1.59	0.80	0.80	1.93	2.17	1.03	0.97	2.29	2.58	1.25	1.16	2.30	2.30	1.71	1.52	3.16	3.16	2.20
	6.0	0.46	1.11	1.34	0.62	0.58	1.50	1.82	0.79	0.71	1.78	2.17	0.97	0.84	1.87	1.93	1.32	1.09	2.56	2.66	1.70
	6.5	0.34	0.87	1.14	0.48	0.43	1.16	1.55	0.62	0.53	1.39	1.84	0.76	0.63	1.49	1.65	1.04	0.81	2.04	2.26	1.33
	7.0	0.26	0.68	0.95	0.39	0.33	0.90	1.31	0.50	0.41	1.08	1.54	0.61	0.48	1.20	1.42	0.83	0.61	1.62	1.95	1.07
DOUBLE SPAN	**4.0**	2.96	2.96	2.96	4.99	3.95	4.09	4.09	6.41	4.51	4.87	4.87	7.83	3.38	3.38	3.38	10.70	5.52	5.52	5.52	13.76
	4.5	2.31	2.38	2.38	3.51	3.05	3.23	3.23	4.50	3.48	3.85	3.85	5.50	2.86	2.86	2.86	7.51	4.59	4.59	4.59	9.66
	5.0	1.84	1.93	1.93	2.56	2.41	2.62	2.62	3.28	2.75	3.12	3.12	4.01	2.45	2.45	2.45	5.48	3.64	3.83	3.83	7.04
	5.5	1.49	1.59	1.59	1.92	1.95	2.17	2.17	2.47	2.23	2.58	2.58	3.01	2.12	2.12	2.12	4.11	2.94	3.16	3.16	5.29
	6.0	1.19	1.34	1.34	1.48	1.60	1.82	1.82	1.90	1.83	2.17	2.17	2.32	1.85	1.85	1.85	3.17	2.41	2.66	2.66	4.08
	6.5	0.96	1.14	1.14	1.16	1.29	1.55	1.55	1.49	1.52	1.85	1.85	1.82	1.56	1.63	1.63	2.49	2.01	2.26	2.26	3.21
	7.0	0.78	0.97	0.98	0.93	1.04	1.34	1.34	1.20	1.24	1.57	1.59	1.46	1.30	1.42	1.42	2.00	1.69	1.95	1.95	2.57
CONTINUOUS END	**4.0**	3.32	3.32	3.32	3.93	4.39	4.78	4.78	5.05	5.02	5.68	5.68	6.16	3.64	3.64	3.64	8.42	6.06	6.06	6.06	10.82
	4.5	2.59	2.72	2.72	2.76	3.37	3.77	3.77	3.54	3.84	4.49	4.49	4.33	3.10	3.10	3.10	5.91	5.07	5.07	5.07	7.60
	5.0	2.04	2.25	2.25	2.01	2.66	3.06	3.06	2.58	3.02	3.64	3.64	3.15	2.67	2.67	2.67	4.31	3.99	4.30	4.30	5.54
	5.5	1.58	1.86	1.86	1.51	2.13	2.53	2.53	1.94	2.42	3.01	3.01	2.37	2.33	2.33	2.33	3.24	3.19	3.69	3.69	4.16
	6.0	1.22	1.56	1.56	1.16	1.62	2.12	2.12	1.50	1.93	2.51	2.53	1.83	2.04	2.04	2.04	2.49	2.60	3.10	3.10	3.21
	6.5	0.93	1.29	1.33	0.92	1.22	1.76	1.81	1.18	1.47	2.07	2.15	1.44	1.64	1.81	1.81	1.96	2.15	2.64	2.64	2.52
	7.0	0.71	1.07	1.15	0.73	0.93	1.46	1.56	0.94	1.12	1.72	1.86	1.15	1.28	1.61	1.61	1.57	1.70	2.28	2.28	2.02
CONTINUOUS INTERNAL	**4.0**	4.05	4.05	4.05	8.56	5.42	5.91	5.91	11.00	6.20	7.03	7.03	13.43	4.39	4.39	4.39	18.34	7.35	7.35	7.35	23.59
	4.5	3.19	3.33	3.33	6.01	4.16	4.67	4.67	7.72	4.74	5.56	5.56	9.43	3.75	3.75	3.75	12.88	6.16	6.16	6.16	16.57
	5.0	2.51	2.78	2.78	4.38	3.27	3.78	3.78	5.63	3.71	4.50	4.50	6.87	3.24	3.24	3.24	9.39	4.92	5.24	5.24	12.08
	5.5	1.94	2.30	2.30	3.29	2.61	3.13	3.13	4.23	2.98	3.72	3.72	5.17	2.82	2.82	2.82	7.06	3.93	4.50	4.50	9.07
	6.0	1.50	1.93	1.93	2.54	2.00	2.63	2.63	3.26	2.38	3.10	3.13	3.98	2.48	2.48	2.48	5.43	3.20	3.84	3.84	6.99
	6.5	1.16	1.58	1.65	1.99	1.54	2.17	2.24	2.56	1.85	2.55	2.66	3.13	2.02	2.20	2.20	4.27	2.64	3.27	3.27	5.50
	7.0	0.90	1.31	1.42	1.60	1.19	1.79	1.93	2.05	1.43	2.11	2.30	2.51	1.59	1.96	1.96	3.42	2.14	2.82	2.82	4.40
LAPPED 10% END	**4.0**	4.12	4.33	4.33	4.18	5.23	6.45	6.45	5.37	5.89	7.67	7.67	6.55	4.37	4.37	4.37	8.95	7.54	7.54	7.55	11.51
	4.5	3.09	3.48	3.48	2.92	3.90	4.91	4.91	3.75	4.38	5.84	5.84	4.58	3.69	3.68	3.68	6.25	5.78	6.23	6.23	8.04
	5.0	2.40	2.84	2.84	2.12	3.01	3.86	3.86	2.72	3.37	4.60	4.60	3.32	3.15	3.15	3.15	4.54	4.42	5.23	5.23	5.84
	5.5	1.82	2.29	2.29	1.59	2.39	3.12	3.12	2.04	2.66	3.71	3.71	2.49	2.72	2.73	2.72	3.40	3.47	4.44	4.44	4.37
	6.0	1.34	1.84	1.89	1.22	1.75	2.52	2.57	1.56	2.10	2.95	3.06	1.91	2.28	2.38	2.38	2.61	2.79	3.76	3.76	3.35
	6.5	1.01	1.50	1.61	0.96	1.31	2.05	2.19	1.23	1.56	2.42	2.61	1.50	1.81	2.11	2.11	2.05	2.29	3.20	3.20	2.64
	7.0	0.77	1.23	1.39	0.77	0.99	1.68	1.89	0.98	1.19	1.99	2.25	1.20	1.40	1.89	1.89	1.64	1.84	2.76	2.76	2.11
LAPPED 20% END	**4.0**	4.13	4.75	4.75	4.23	5.24	6.70	6.70	5.44	5.95	7.98	7.98	6.64	4.39	4.63	4.64	9.07	7.57	8.11	8.11	11.66
	4.5	3.10	3.87	3.87	2.97	3.91	5.28	5.28	3.82	4.46	6.28	6.28	4.66	3.71	4.01	4.01	6.37	5.78	6.92	6.92	8.19
	5.0	2.41	3.14	3.14	2.16	3.02	4.27	4.27	2.78	3.44	5.08	5.08	3.40	3.18	3.52	3.51	4.64	4.42	5.97	5.97	5.97
	5.5	1.82	2.52	2.59	1.63	2.39	3.45	3.52	2.09	2.71	4.05	4.19	2.55	2.74	3.11	3.10	3.48	3.48	5.13	5.13	4.48
	6.0	1.34	2.02	2.17	1.25	1.76	2.76	2.96	1.61	2.18	3.25	3.52	1.96	2.29	2.76	2.76	2.68	2.79	4.31	4.31	3.45
	6.5	1.01	1.63	1.85	0.98	1.32	2.22	2.52	1.26	1.64	2.63	3.00	1.55	1.82	2.48	2.47	2.11	2.29	3.68	3.68	2.71
	7.0	0.77	1.32	1.60	0.79	1.00	1.79	2.17	1.01	1.25	2.13	2.57	1.24	1.41	2.22	2.23	1.69	1.85	3.05	3.17	2.17
LAPPED 10% INTERNAL	**4.0**	5.46	5.46	5.46	9.64	7.16	8.59	8.59	12.39	8.06	10.55	10.55	15.13	5.44	5.44	5.45	20.67	9.44	9.44	9.44	26.58
	4.5	4.17	4.38	4.38	6.64	5.26	6.66	6.66	8.54	5.90	7.92	7.92	10.42	4.58	4.58	4.58	14.24	7.78	7.78	7.78	18.31
	5.0	3.20	3.59	3.60	4.75	4.02	5.18	5.18	6.10	4.49	6.16	6.16	7.45	3.92	3.92	3.92	10.17	5.88	6.54	6.54	13.08
	5.5	2.40	2.98	2.98	3.53	3.15	4.15	4.15	4.53	3.52	4.90	4.93	5.54	3.38	3.38	3.38	7.56	4.58	5.54	5.54	9.73
	6.0	1.79	2.41	2.50	2.68	2.40	3.30	3.40	3.45	2.82	3.88	4.04	4.21	2.95	2.95	2.95	5.75	3.65	4.75	4.75	7.39
	6.5	1.36	1.96	2.13	2.11	1.79	2.68	2.89	2.71	2.14	3.16	3.44	3.31	2.42	2.63	2.63	4.52	3.00	4.18	4.18	5.82
	7.0	1.04	1.61	1.83	1.69	1.36	2.19	2.50	2.17	1.63	2.60	2.97	2.65	1.88	2.35	2.35	3.62	2.49	3.64	3.64	4.66

ULTIMATE UNIFORMLY DISTRIBUTED LOAD: 4.0 – 7.0 M

		***HST* 200/18**				***HST* 250/13**				***HST* 250/15**				***HST* 250/18**				***HST* 300/15**			
		$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s
		(kN/m)				(kN/m)				(kN/m)				(kN/m)				(kN/m)			
SPAN	**(M)**	**0B**	**1B**	**2B**	**DEF**	**0B**	**1B**	**2B**	**DEF**	**0B**	**1B**	**2B**	**DEF**	**0B**	**1B**	**2B**	**DEF**	**0B**	**1B**	**2B**	**DEF**
SINGLE SPAN	**4.0**	5.83	7.18	7.18	7.02	6.17	6.17	6.17	8.66	8.27	8.27	8.27	10.20	10.00	10.00	10.00	12.54	7.43	7.43	7.43	17.14
	4.5	3.93	5.67	5.67	4.93	5.33	5.33	5.33	6.08	6.53	6.53	6.53	7.16	7.90	7.90	7.90	8.81	6.60	6.60	6.60	12.03
	5.0	2.62	4.59	4.59	3.60	4.32	4.32	4.32	4.43	5.29	5.29	5.29	5.22	6.40	6.40	6.40	6.42	5.94	5.94	5.94	8.77
	5.5	1.82	3.80	3.80	2.70	3.57	3.57	3.57	3.33	4.37	4.37	4.37	3.92	5.29	5.29	5.29	4.82	5.34	5.34	5.34	6.59
	6.0	1.31	3.05	3.19	2.08	3.00	3.00	3.00	2.56	3.68	3.68	3.68	3.02	4.44	4.44	4.44	3.72	4.49	4.49	4.49	5.08
	6.5	0.97	2.45	2.72	1.64	2.55	2.55	2.55	2.02	3.13	3.13	3.13	2.38	3.79	3.79	3.79	2.92	3.83	3.83	3.83	3.99
	7.0	0.73	1.97	2.34	1.31	2.15	2.20	2.20	1.62	2.63	2.70	2.70	1.90	3.15	3.27	3.27	2.34	3.30	3.30	3.30	3.20
DOUBLE SPAN	**4.0**	6.93	7.18	7.18	16.88	4.28	4.28	4.28	20.81	6.06	6.06	6.06	24.52	8.76	8.76	8.76	30.15	5.41	5.41	5.41	41.19
	4.5	5.31	5.67	5.67	11.86	3.69	3.69	3.69	14.61	5.17	5.17	5.17	17.22	7.32	7.32	7.33	21.18	4.71	4.71	4.71	28.93
	5.0	4.18	4.59	4.59	8.64	3.21	3.21	3.21	10.65	4.46	4.46	4.46	12.56	6.20	6.20	6.20	15.44	4.14	4.14	4.14	21.09
	5.5	3.36	3.80	3.80	6.49	2.82	2.82	2.82	8.00	3.88	3.88	3.88	9.43	5.29	5.29	5.29	11.60	3.67	3.67	3.67	15.85
	6.0	2.75	3.19	3.19	5.00	2.49	2.49	2.49	6.17	3.41	3.41	3.41	7.27	4.44	4.44	4.44	8.93	3.28	3.28	3.28	12.21
	6.5	2.29	2.72	2.72	3.93	2.22	2.22	2.22	4.85	3.01	3.01	3.01	5.71	3.79	3.79	3.79	7.03	2.94	2.94	2.94	9.60
	7.0	1.93	2.34	2.34	3.15	1.99	1.99	1.99	3.88	2.68	2.68	2.68	4.58	3.27	3.27	3.27	5.63	2.66	2.66	2.66	7.69
CONTINUOUS END	**4.0**	7.68	8.31	8.31	13.28	4.53	4.53	4.53	16.37	6.47	6.47	6.47	19.29	9.55	9.55	9.55	23.72	5.68	5.68	5.68	32.41
	4.5	5.84	6.62	6.62	9.33	3.92	3.91	3.92	11.50	5.56	5.54	5.56	13.55	8.05	8.03	8.05	16.66	4.96	4.95	4.96	22.76
	5.0	4.56	5.36	5.36	6.80	3.43	3.43	3.43	8.38	4.82	4.82	4.82	9.88	6.86	6.86	6.86	12.15	4.38	4.38	4.38	16.59
	5.5	3.64	4.43	4.43	5.11	3.03	3.03	3.03	6.30	4.22	4.22	4.22	7.42	5.91	5.90	5.91	9.13	3.90	3.89	3.90	12.47
	6.0	2.96	3.72	3.72	3.94	2.70	2.70	2.70	4.85	3.73	3.73	3.73	5.72	5.14	5.14	5.14	7.03	3.50	3.50	3.50	9.60
	6.5	2.45	3.17	3.17	3.10	2.41	2.41	2.41	3.82	3.31	3.31	3.31	4.50	4.42	4.42	4.42	5.53	3.16	3.15	3.16	7.55
	7.0	2.05	2.73	2.73	2.48	2.17	2.17	2.17	3.06	2.96	2.96	2.96	3.60	3.81	3.81	3.81	4.43	2.86	2.86	2.86	6.05
CONTINUOUS INTERNAL	**4.0**	9.48	10.15	10.15	28.95	5.44	5.44	5.44	35.68	7.79	7.79	7.79	42.05	11.57	11.57	11.57	51.71	6.80	6.80	6.80	70.65
	4.5	7.20	8.19	8.19	20.33	4.72	4.72	4.72	25.06	6.70	6.70	6.70	29.53	9.76	9.76	9.76	36.32	5.94	5.94	5.94	49.62
	5.0	5.62	6.64	6.64	14.82	4.14	4.14	4.14	18.27	5.82	5.82	5.82	21.53	8.34	8.34	8.34	26.48	5.25	5.25	5.25	36.17
	5.5	4.49	5.48	5.48	11.14	3.66	3.66	3.66	13.73	5.11	5.11	5.11	16.18	7.20	7.20	7.20	19.89	4.68	4.68	4.68	27.18
	6.0	3.65	4.61	4.61	8.58	3.26	3.26	3.26	10.57	4.52	4.52	4.52	12.46	6.27	6.27	6.27	15.32	4.21	4.21	4.21	20.93
	6.5	3.01	3.93	3.93	6.75	2.92	2.92	2.92	8.32	4.02	4.02	4.02	9.80	5.47	5.47	5.47	12.05	3.80	3.80	3.80	16.46
	7.0	2.51	3.39	3.39	5.40	2.63	2.63	2.63	6.66	3.60	3.60	3.60	7.85	4.72	4.72	4.72	9.65	3.45	3.45	3.45	13.18
LAPPED 10% END	**4.0**	8.97	10.84	10.84	14.13	5.29	5.30	5.30	17.42	7.68	7.68	7.68	20.52	11.76	11.76	11.76	25.24	6.54	6.54	6.54	34.48
	4.5	6.60	8.61	8.61	9.87	4.53	4.53	4.53	12.17	6.52	6.51	6.51	14.34	9.78	9.78	9.77	17.63	5.64	5.64	5.64	24.09
	5.0	5.03	6.77	6.77	7.16	3.94	3.94	3.94	8.83	5.62	5.62	5.62	10.40	8.26	8.26	8.26	12.79	4.95	4.95	4.95	17.48
	5.5	3.95	5.47	5.47	5.36	3.46	3.45	3.46	6.61	4.89	4.88	4.89	7.79	7.05	7.05	7.05	9.57	4.38	4.37	4.38	13.08
	6.0	3.15	4.51	4.51	4.12	3.06	3.06	3.06	5.07	4.29	4.29	4.28	5.98	6.08	6.08	6.07	7.35	3.91	3.91	3.90	10.04
	6.5	2.57	3.84	3.84	3.24	2.76	2.75	2.75	3.99	3.84	3.83	3.83	4.70	5.35	5.35	5.35	5.78	3.54	3.54	3.54	7.90
	7.0	2.13	3.31	3.31	2.59	2.49	2.49	2.49	3.19	3.45	3.45	3.45	3.76	4.62	4.62	4.62	4.63	3.23	3.23	3.23	6.32
LAPPED 20% END	**4.0**	8.97	11.71	11.71	14.31	5.57	5.57	5.57	17.64	8.11	8.12	8.11	20.79	12.59	12.60	12.59	25.57	6.85	6.85	6.85	34.93
	4.5	6.61	9.26	9.26	10.05	4.88	4.87	4.87	12.39	7.06	7.06	7.06	14.60	10.80	10.80	10.80	17.95	6.03	6.03	6.02	24.52
	5.0	5.04	7.48	7.48	7.32	4.31	4.31	4.31	9.03	6.21	6.21	6.21	10.64	9.36	9.36	9.36	13.08	5.36	5.36	5.36	17.87
	5.5	3.95	6.17	6.17	5.50	3.85	3.85	3.85	6.78	5.52	5.51	5.52	7.99	8.19	8.19	8.19	9.82	4.82	4.81	4.82	13.42
	6.0	3.16	5.18	5.18	4.24	3.46	3.46	3.47	5.22	4.93	4.93	4.93	6.15	7.20	7.20	7.20	7.56	4.35	4.35	4.36	10.34
	6.5	2.57	4.40	4.41	3.33	3.14	3.13	3.14	4.11	4.44	4.44	4.44	4.84	6.15	6.15	6.15	5.95	3.97	3.96	3.97	8.13
	7.0	2.13	3.63	3.81	2.67	2.86	2.86	2.85	3.29	4.02	4.02	4.02	3.87	5.30	5.30	5.30	4.76	3.64	3.64	3.63	6.51
LAPPED 10% INTERNAL	**4.0**	12.26	13.65	13.65	32.62	6.58	6.58	6.58	40.21	9.56	9.56	9.56	47.38	14.70	14.70	14.70	58.26	8.11	8.11	8.11	79.60
	4.5	8.88	10.96	10.96	22.47	5.61	5.61	5.61	27.70	8.10	8.10	8.10	32.64	12.19	12.19	12.19	40.14	6.98	6.98	6.98	54.84
	5.0	6.70	8.98	8.98	16.06	4.88	4.88	4.88	19.79	6.96	6.96	6.96	23.32	10.31	10.31	10.31	28.68	6.11	6.11	6.11	39.18
	5.5	5.25	7.27	7.27	11.94	4.27	4.27	4.27	14.72	6.05	6.05	6.05	17.34	8.78	8.78	8.78	21.33	5.39	5.39	5.39	29.14
	6.0	4.15	5.95	5.95	9.07	3.78	3.77	3.77	11.19	5.31	5.31	5.31	13.18	7.57	7.56	7.56	16.21	4.81	4.81	4.81	22.14
	6.5	3.41	5.07	5.07	7.14	3.40	3.40	3.40	8.80	4.75	4.75	4.75	10.37	6.68	6.67	6.67	12.75	4.36	4.36	4.36	17.42
	7.0	2.81	4.36	4.38	5.71	3.08	3.09	3.09	7.04	4.28	4.28	4.28	8.30	5.94	5.95	5.95	10.21	3.98	3.98	3.98	13.94

ULTIMATE UNIFORMLY DISTRIBUTED LOAD: 7.5 – 10.5 M

		HST 200/12				*HST* 200/15				*HST* 200/18				*HST* 250/13				*HST* 250/15			
		$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s
		(kN/m)				(kN/m)				(kN/m)				(kN/m)				(kN/m)			
SPAN	**(M)**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**
SINGLE SPAN	**7.5**	0.96	1.24	1.24	0.68	1.29	1.70	1.70	0.87	1.58	2.04	2.04	1.07	1.77	1.92	1.92	1.31	2.16	2.35	2.35	1.55
	8.0	0.76	1.09	1.09	0.56	1.01	1.49	1.49	0.72	1.27	1.79	1.79	0.88	1.46	1.69	1.69	1.08	1.78	2.07	2.07	1.28
	8.5	0.61	0.96	0.96	0.46	0.81	1.31	1.32	0.60	1.00	1.55	1.59	0.73	1.20	1.49	1.49	0.90	1.45	1.83	1.83	1.06
	9.0	0.50	0.82	0.86	0.39	0.66	1.12	1.18	0.50	0.80	1.34	1.42	0.62	0.98	1.33	1.33	0.76	1.18	1.63	1.63	0.90
	9.5	0.41	0.70	0.77	0.33	0.54	0.96	1.06	0.43	0.65	1.15	1.27	0.52	0.81	1.20	1.20	0.65	0.96	1.47	1.47	0.76
	10.0	0.34	0.61	0.70	0.29	0.44	0.83	0.96	0.37	0.53	0.99	1.15	0.45	0.67	1.08	1.08	0.55	0.80	1.32	1.32	0.65
	10.5	0.28	0.52	0.63	0.25	0.37	0.71	0.87	0.32	0.44	0.86	1.04	0.39	0.56	0.94	0.98	0.48	0.66	1.15	1.20	0.56
DOUBLE SPAN	**7.5**	1.24	1.24	1.24	1.62	1.70	1.70	1.70	2.09	2.04	2.04	2.04	2.56	1.79	1.79	1.79	3.16	2.35	2.35	2.35	3.72
	8.0	1.09	1.09	1.09	1.34	1.49	1.49	1.49	1.72	1.79	1.79	1.79	2.11	1.62	1.62	1.62	2.60	2.07	2.07	2.07	3.07
	8.5	0.96	0.96	0.96	1.12	1.32	1.32	1.32	1.43	1.59	1.59	1.59	1.76	1.47	1.47	1.47	2.17	1.83	1.83	1.83	2.56
	9.0	0.85	0.86	0.86	0.94	1.16	1.18	1.18	1.21	1.38	1.42	1.42	1.48	1.33	1.33	1.33	1.83	1.63	1.63	1.63	2.15
	9.5	0.73	0.77	0.77	0.80	1.00	1.06	1.06	1.03	1.20	1.27	1.27	1.26	1.20	1.20	1.20	1.55	1.47	1.47	1.47	1.83
	10.0	0.64	0.70	0.70	0.68	0.87	0.96	0.96	0.88	1.04	1.15	1.15	1.08	1.08	1.08	1.08	1.33	1.32	1.32	1.32	1.57
	10.5	0.55	0.63	0.63	0.59	0.75	0.87	0.87	0.76	0.91	1.04	1.04	0.93	0.98	0.98	0.98	1.15	1.19	1.20	1.20	1.36
CONTINUOUS END	**7.5**	1.44	1.44	1.44	1.28	1.98	1.98	1.98	1.64	2.38	2.38	2.38	2.02	1.97	1.96	1.97	2.48	2.66	2.66	2.66	2.93
	8.0	1.24	1.27	1.27	1.05	1.70	1.74	1.74	1.35	2.03	2.09	2.09	1.66	1.79	1.79	1.78	2.05	2.40	2.40	2.40	2.41
	8.5	1.05	1.12	1.12	0.88	1.44	1.54	1.54	1.13	1.72	1.85	1.85	1.38	1.63	1.63	1.63	1.71	2.14	2.14	2.14	2.01
	9.0	0.89	1.00	1.00	0.74	1.22	1.38	1.38	0.95	1.47	1.65	1.65	1.17	1.49	1.49	1.49	1.44	1.91	1.91	1.91	1.69
	9.5	0.76	0.90	0.90	0.63	1.02	1.24	1.24	0.81	1.25	1.48	1.48	0.99	1.36	1.37	1.37	1.22	1.66	1.71	1.71	1.44
	10.0	0.64	0.81	0.81	0.54	0.85	1.12	1.12	0.69	1.06	1.34	1.34	0.85	1.18	1.26	1.26	1.05	1.44	1.54	1.54	1.24
	10.5	0.53	0.74	0.74	0.47	0.71	1.01	1.01	0.60	0.89	1.21	1.22	0.73	1.02	1.14	1.14	0.91	1.25	1.40	1.40	1.07
CONTINUOUS INTERNAL	**7.5**	1.75	1.75	1.75	2.78	2.46	2.46	2.46	3.58	2.94	2.95	2.95	4.39	2.38	2.38	2.38	5.41	3.24	3.24	3.24	6.38
	8.0	1.52	1.57	1.57	2.29	2.09	2.16	2.16	2.95	2.49	2.59	2.59	3.62	2.17	2.17	2.17	4.46	2.93	2.93	2.93	5.26
	8.5	1.29	1.39	1.39	1.91	1.77	1.91	1.91	2.46	2.11	2.30	2.30	3.02	1.98	1.98	1.98	3.72	2.65	2.65	2.65	4.38
	9.0	1.10	1.24	1.24	1.61	1.49	1.70	1.70	2.07	1.80	2.05	2.05	2.54	1.81	1.81	1.81	3.13	2.36	2.36	2.36	3.69
	9.5	0.93	1.11	1.11	1.37	1.26	1.53	1.53	1.76	1.53	1.84	1.84	2.16	1.67	1.67	1.67	2.66	2.04	2.12	2.12	3.14
	10.0	0.79	1.01	1.01	1.17	1.06	1.38	1.38	1.51	1.31	1.66	1.66	1.85	1.45	1.54	1.54	2.28	1.76	1.91	1.91	2.69
	10.5	0.66	0.91	0.91	1.01	0.89	1.25	1.25	1.30	1.11	1.49	1.50	1.60	1.25	1.41	1.41	1.97	1.53	1.73	1.73	2.33
LAPPED 10% END	**7.5**	1.70	1.70	1.70	1.34	2.33	2.40	2.40	1.72	2.78	2.89	2.89	2.11	2.27	2.27	2.27	2.60	3.12	3.12	3.12	3.06
	8.0	1.43	1.54	1.54	1.10	1.95	2.11	2.11	1.41	2.34	2.54	2.54	1.74	2.07	2.07	2.07	2.14	2.83	2.83	2.83	2.52
	8.5	1.20	1.36	1.36	0.92	1.63	1.87	1.87	1.18	1.97	2.25	2.25	1.45	1.90	1.90	1.90	1.78	2.58	2.58	2.58	2.10
	9.0	1.00	1.22	1.22	0.77	1.34	1.67	1.67	0.99	1.65	2.00	2.00	1.22	1.74	1.74	1.74	1.50	2.21	2.31	2.31	1.77
	9.5	0.82	1.09	1.09	0.66	1.10	1.50	1.50	0.85	1.37	1.80	1.80	1.04	1.56	1.61	1.61	1.28	1.90	2.07	2.07	1.51
	10.0	0.68	0.97	0.98	0.56	0.91	1.33	1.35	0.72	1.12	1.58	1.62	0.89	1.33	1.49	1.49	1.10	1.61	1.87	1.87	1.29
	10.5	0.57	0.85	0.89	0.49	0.76	1.17	1.23	0.63	0.93	1.40	1.47	0.77	1.13	1.38	1.38	0.95	1.35	1.70	1.70	1.12
LAPPED 20% END	**7.5**	1.84	2.01	2.01	1.37	2.52	2.76	2.76	1.77	3.01	3.32	3.32	2.17	2.62	2.62	2.61	2.67	3.66	3.66	3.65	3.15
	8.0	1.52	1.77	1.77	1.13	2.07	2.43	2.43	1.46	2.50	2.91	2.91	1.79	2.40	2.40	2.40	2.20	3.29	3.34	3.34	2.60
	8.5	1.26	1.56	1.56	0.94	1.70	2.15	2.15	1.21	2.08	2.58	2.58	1.49	2.21	2.21	2.21	1.84	2.80	2.97	2.97	2.16
	9.0	1.04	1.39	1.40	0.79	1.39	1.91	1.92	1.02	1.72	2.28	2.30	1.25	1.94	2.05	2.05	1.55	2.37	2.65	2.65	1.82
	9.5	0.85	1.21	1.25	0.68	1.14	1.66	1.72	0.87	1.42	1.98	2.07	1.07	1.65	1.90	1.90	1.32	2.00	2.38	2.38	1.55
	10.0	0.71	1.05	1.13	0.58	0.94	1.44	1.55	0.75	1.16	1.72	1.87	0.91	1.39	1.75	1.75	1.13	1.68	2.15	2.15	1.33
	10.5	0.59	0.92	1.03	0.50	0.79	1.25	1.41	0.64	0.96	1.50	1.69	0.79	1.17	1.59	1.59	0.97	1.40	1.95	1.95	1.15
LAPPED 10% INTERNAL	**7.5**	2.12	2.12	2.12	2.94	3.05	3.17	3.17	3.79	3.64	3.81	3.81	4.65	2.81	2.81	2.81	5.73	3.87	3.87	3.87	6.75
	8.0	1.86	1.92	1.92	2.42	2.55	2.79	2.79	3.12	3.05	3.35	3.35	3.83	2.57	2.57	2.57	4.72	3.52	3.52	3.52	5.56
	8.5	1.56	1.74	1.74	2.02	2.13	2.47	2.47	2.60	2.56	2.97	2.97	3.19	2.35	2.35	2.35	3.93	3.21	3.21	3.21	4.64
	9.0	1.31	1.59	1.59	1.70	1.77	2.20	2.20	2.19	2.16	2.65	2.65	2.69	2.16	2.17	2.17	3.32	2.89	2.94	2.94	3.91
	9.5	1.09	1.44	1.44	1.45	1.47	1.98	1.98	1.86	1.81	2.38	2.38	2.29	2.00	2.00	2.00	2.82	2.47	2.70	2.68	3.32
	10.0	0.91	1.27	1.30	1.24	1.22	1.75	1.79	1.60	1.52	2.08	2.14	1.96	1.74	1.85	1.85	2.42	2.12	2.47	2.47	2.85
	10.5	0.77	1.12	1.18	1.07	1.02	1.53	1.62	1.38	1.26	1.82	1.95	1.69	1.49	1.72	1.72	2.09	1.80	2.24	2.24	2.46

ULTIMATE UNIFORMLY DISTRIBUTED LOAD: 7.5 – 10.5 M

		HST 250/18				*HST* 300/15				*HST* 300/18				*HST* 350/18				*HST* 400/20			
		$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s
		(kN/m)				(kN/m)				(kN/m)				(kN/m)				(kN/m)			
SPAN	**(M)**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**
SINGLE SPAN	**7.5**	2.60	2.84	2.84	1.90	2.87	2.87	2.87	2.60	3.72	3.72	3.72	3.19	4.50	4.50	4.50	4.63	6.13	6.13	6.13	7.25
	8.0	2.15	2.50	2.50	1.57	2.53	2.53	2.53	2.14	3.27	3.27	3.27	2.63	3.96	3.96	3.96	3.81	5.39	5.39	5.39	5.97
	8.5	1.78	2.21	2.22	1.31	2.23	2.24	2.24	1.79	2.81	2.90	2.90	2.19	3.51	3.51	3.51	3.18	4.77	4.77	4.77	4.98
	9.0	1.47	1.98	1.98	1.10	1.90	2.00	2.00	1.50	2.38	2.58	2.58	1.85	3.03	3.13	3.13	2.68	4.25	4.26	4.26	4.19
	9.5	1.21	1.77	1.77	0.94	1.61	1.79	1.79	1.28	2.02	2.32	2.32	1.57	2.59	2.81	2.81	2.28	3.62	3.82	3.82	3.57
	10.0	1.00	1.58	1.60	0.80	1.37	1.62	1.62	1.10	1.72	2.09	2.09	1.35	2.20	2.53	2.53	1.95	3.08	3.45	3.45	3.06
	10.5	0.83	1.38	1.45	0.69	1.16	1.47	1.47	0.95	1.45	1.90	1.90	1.16	1.86	2.30	2.30	1.69	2.62	3.13	3.13	2.64
DOUBLE SPAN	**7.5**	2.84	2.84	2.84	4.57	2.42	2.42	2.42	6.25	3.57	3.57	3.57	7.67	3.54	3.54	3.54	11.13	4.36	4.36	4.36	17.42
	8.0	2.50	2.50	2.50	3.77	2.20	2.20	2.20	5.15	3.23	3.23	3.23	6.32	3.24	3.24	3.24	9.17	4.01	4.01	4.01	14.36
	8.5	2.22	2.22	2.22	3.14	2.01	2.01	2.01	4.29	2.90	2.90	2.90	5.27	2.98	2.98	2.98	7.64	3.70	3.70	3.70	11.97
	9.0	1.98	1.98	1.98	2.65	1.85	1.85	1.85	3.62	2.58	2.58	2.58	4.44	2.74	2.75	2.74	6.44	3.43	3.43	3.43	10.08
	9.5	1.77	1.77	1.77	2.25	1.70	1.70	1.70	3.08	2.32	2.32	2.32	3.78	2.54	2.54	2.54	5.48	3.19	3.19	3.19	8.57
	10.0	1.60	1.60	1.60	1.93	1.57	1.57	1.57	2.64	2.09	2.09	2.09	3.24	2.35	2.35	2.35	4.69	2.97	2.97	2.97	7.35
	10.5	1.43	1.45	1.45	1.67	1.46	1.46	1.46	2.28	1.90	1.90	1.90	2.80	2.18	2.18	2.18	4.06	2.77	2.77	2.77	6.35
CONTINUOUS END	**7.5**	3.32	3.32	3.32	3.60	2.61	2.61	2.61	4.92	3.92	3.92	3.92	6.04	3.80	3.80	3.80	8.76	4.63	4.62	4.63	13.71
	8.0	2.92	2.92	2.92	2.97	2.39	2.39	2.39	4.05	3.56	3.56	3.56	4.97	3.49	3.49	3.49	7.21	4.27	4.27	4.27	11.30
	8.5	2.58	2.58	2.58	2.47	2.19	2.19	2.19	3.38	3.24	3.24	3.24	4.15	3.22	3.22	3.22	6.02	3.96	3.95	3.96	9.42
	9.0	2.30	2.30	2.30	2.08	2.02	2.02	2.02	2.85	2.97	2.97	2.97	3.49	2.98	2.98	2.98	5.07	3.68	3.68	3.68	7.93
	9.5	1.99	2.07	2.07	1.77	1.87	1.87	1.87	2.42	2.70	2.70	2.70	2.97	2.76	2.76	2.76	4.31	3.43	3.42	3.43	6.75
	10.0	1.73	1.87	1.87	1.52	1.73	1.73	1.73	2.07	2.44	2.44	2.44	2.55	2.57	2.57	2.57	3.69	3.20	3.20	3.20	5.78
	10.5	1.51	1.69	1.69	1.31	1.61	1.61	1.61	1.79	2.21	2.21	2.21	2.20	2.39	2.39	2.39	3.19	2.99	2.99	3.00	5.00
CONTINUOUS INTERNAL	**7.5**	4.11	4.11	4.11	7.84	3.15	3.15	3.15	10.72	4.75	4.75	4.75	13.16	4.58	4.58	4.58	19.08	5.56	5.56	5.56	29.88
	8.0	3.61	3.61	3.61	6.46	2.89	2.89	2.89	8.83	4.32	4.32	4.32	10.84	4.21	4.21	4.21	15.72	5.14	5.14	5.14	24.62
	8.5	3.20	3.20	3.20	5.39	2.65	2.65	2.65	7.36	3.94	3.94	3.94	9.04	3.89	3.89	3.89	13.11	4.76	4.76	4.76	20.53
	9.0	2.83	2.85	2.85	4.54	2.45	2.45	2.45	6.20	3.61	3.61	3.61	7.61	3.60	3.60	3.60	11.04	4.43	4.43	4.43	17.29
	9.5	2.45	2.56	2.56	3.86	2.27	2.27	2.27	5.27	3.32	3.32	3.32	6.47	3.34	3.34	3.34	9.39	4.13	4.13	4.13	14.70
	10.0	2.12	2.31	2.31	3.31	2.10	2.10	2.10	4.52	3.02	3.02	3.02	5.55	3.11	3.11	3.11	8.05	3.86	3.86	3.86	12.61
	10.5	1.84	2.10	2.10	2.86	1.95	1.95	1.95	3.91	2.74	2.74	2.74	4.80	2.90	2.90	2.90	6.95	3.62	3.62	3.62	10.89
LAPPED 10% END	**7.5**	4.02	4.02	4.02	3.76	2.96	2.96	2.96	5.14	4.53	4.53	4.53	6.31	4.27	4.27	4.27	9.15	5.14	5.14	5.14	14.33
	8.0	3.53	3.53	3.53	3.10	2.72	2.72	2.72	4.24	4.13	4.13	4.13	5.20	3.94	3.94	3.94	7.54	4.76	4.76	4.76	11.81
	8.5	3.09	3.13	3.13	2.59	2.51	2.51	2.51	3.53	3.78	3.78	3.78	4.34	3.65	3.65	3.65	6.29	4.43	4.43	4.43	9.85
	9.0	2.66	2.79	2.79	2.18	2.32	2.32	2.32	2.98	3.48	3.48	3.48	3.65	3.39	3.39	3.39	5.30	4.13	4.13	4.13	8.30
	9.5	2.29	2.51	2.51	1.85	2.16	2.15	2.15	2.53	3.21	3.20	3.20	3.11	3.15	3.15	3.15	4.50	3.86	3.86	3.86	7.05
	10.0	1.97	2.26	2.26	1.59	2.01	2.01	2.00	2.17	2.96	2.96	2.96	2.66	2.94	2.94	2.94	3.86	3.62	3.62	3.62	6.05
	10.5	1.68	2.05	2.05	1.37	1.87	1.87	1.87	1.87	2.64	2.68	2.68	2.30	2.75	2.75	2.75	3.34	3.40	3.40	3.40	5.22
LAPPED 20% END	**7.5**	4.62	4.62	4.62	3.87	3.35	3.35	3.34	5.29	5.23	5.23	5.22	6.50	4.79	4.79	4.79	9.42	5.71	5.71	5.70	14.75
	8.0	3.95	4.06	4.06	3.19	3.09	3.09	3.09	4.36	4.80	4.80	4.80	5.35	4.44	4.44	4.44	7.76	5.30	5.30	5.30	12.16
	8.5	3.36	3.60	3.60	2.66	2.87	2.87	2.87	3.63	4.42	4.42	4.42	4.46	4.13	4.13	4.13	6.47	4.94	4.95	4.94	10.13
	9.0	2.85	3.21	3.21	2.24	2.67	2.67	2.67	3.06	4.09	4.09	4.09	3.76	3.85	3.85	3.85	5.45	4.63	4.63	4.63	8.54
	9.5	2.43	2.88	2.88	1.91	2.49	2.49	2.49	2.60	3.74	3.76	3.76	3.20	3.60	3.60	3.60	4.64	4.34	4.34	4.34	7.26
	10.0	2.06	2.60	2.60	1.63	2.32	2.32	2.32	2.23	3.26	3.40	3.40	2.74	3.37	3.37	3.37	3.97	4.08	4.08	4.08	6.22
	10.5	1.75	2.35	2.36	1.41	2.18	2.18	2.18	1.93	2.84	3.08	3.08	2.37	3.17	3.16	3.17	3.43	3.85	3.85	3.85	5.38
LAPPED 10% INTERNAL	**7.5**	5.30	5.30	5.30	8.30	3.65	3.65	3.65	11.34	5.61	5.61	5.61	13.92	5.27	5.27	5.27	20.19	6.32	6.32	6.32	31.61
	8.0	4.67	4.67	4.67	6.84	3.36	3.36	3.36	9.34	5.12	5.12	5.13	11.47	4.86	4.86	4.86	16.63	5.86	5.86	5.86	26.05
	8.5	4.05	4.13	4.13	5.70	3.10	3.10	3.10	7.79	4.70	4.70	4.70	9.56	4.50	4.50	4.50	13.87	5.45	5.45	5.45	21.72
	9.0	3.47	3.69	3.69	4.80	2.87	2.87	2.87	6.56	4.32	4.32	4.32	8.05	4.18	4.18	4.18	11.68	5.08	5.08	5.08	18.29
	9.5	2.98	3.31	3.31	4.08	2.67	2.67	2.67	5.58	3.99	3.99	3.99	6.85	3.90	3.90	3.90	9.93	4.76	4.75	4.75	15.55
	10.0	2.56	2.99	2.99	3.50	2.48	2.48	2.48	4.78	3.69	3.69	3.69	5.87	3.64	3.64	3.64	8.52	4.46	4.46	4.46	13.34
	10.5	2.20	2.71	2.71	3.02	2.32	2.32	2.32	4.13	3.42	3.42	3.42	5.07	3.41	3.41	3.41	7.36	4.19	4.19	4.19	11.52

ULTIMATE UNIFORMLY DISTRIBUTED LOAD: 11.0 – 14.0 M

		HST 300/15				*HST* 300/18				*HST* 300/24				*HST* 300/30				*HST* 350/18			
		$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s
		(kN/m)				(kN/m)				(kN/m)				(kN/m)				(kN/m)			
SPAN	**(M)**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**
SINGLE SPAN	**11.0**	0.98	1.34	1.34	0.82	1.22	1.73	1.73	1.01	1.76	2.64	2.64	1.40	2.17	3.41	3.53	1.75	1.57	2.09	2.09	1.47
	11.5	0.83	1.22	1.22	0.72	1.04	1.58	1.58	0.89	1.48	2.37	2.42	1.23	1.82	3.03	3.23	1.53	1.33	1.92	1.92	1.28
	12.0	0.71	1.12	1.12	0.64	0.88	1.45	1.45	0.78	1.25	2.12	2.22	1.08	1.55	2.69	2.97	1.35	1.14	1.76	1.76	1.13
	12.5	0.61	1.03	1.03	0.56	0.76	1.30	1.34	0.69	1.06	1.89	2.05	0.96	1.32	2.40	2.74	1.19	0.97	1.62	1.62	1.00
	13.0	0.52	0.92	0.96	0.50	0.66	1.16	1.24	0.61	0.91	1.69	1.89	0.85	1.14	2.13	2.53	1.06	0.84	1.47	1.50	0.89
	13.5	0.46	0.83	0.89	0.45	0.57	1.04	1.15	0.55	0.79	1.51	1.75	0.76	0.98	1.90	2.35	0.95	0.73	1.32	1.39	0.79
	14.0	0.40	0.74	0.83	0.40	0.50	0.93	1.07	0.49	0.68	1.35	1.63	0.68	0.85	1.69	2.18	0.85	0.64	1.19	1.29	0.71
DOUBLE SPAN	**11.0**	1.34	1.34	1.34	1.98	1.73	1.73	1.73	2.43	2.64	2.64	2.64	3.37	3.51	3.53	3.53	4.21	2.03	2.03	2.03	3.53
	11.5	1.22	1.22	1.22	1.73	1.58	1.58	1.58	2.13	2.42	2.42	2.42	2.95	3.12	3.23	3.23	3.69	1.90	1.90	1.90	3.09
	12.0	1.12	1.12	1.12	1.53	1.45	1.45	1.45	1.87	2.18	2.22	2.22	2.60	2.79	2.97	2.97	3.24	1.76	1.76	1.76	2.72
	12.5	1.03	1.03	1.03	1.35	1.34	1.34	1.34	1.66	1.96	2.05	2.05	2.30	2.50	2.74	2.74	2.87	1.62	1.62	1.62	2.40
	13.0	0.96	0.96	0.96	1.20	1.21	1.24	1.24	1.47	1.76	1.89	1.89	2.04	2.24	2.53	2.53	2.55	1.50	1.50	1.50	2.14
	13.5	0.86	0.89	0.89	1.07	1.09	1.15	1.15	1.32	1.58	1.75	1.75	1.82	2.01	2.35	2.35	2.28	1.37	1.39	1.39	1.91
	14.0	0.78	0.83	0.83	0.96	0.98	1.07	1.07	1.18	1.43	1.63	1.63	1.64	1.80	2.18	2.18	2.04	1.24	1.29	1.29	1.71
CONTINUOUS END	**11.0**	1.50	1.50	1.50	1.56	2.02	2.02	2.02	1.91	2.95	3.08	3.08	2.65	3.75	4.12	4.12	3.31	2.23	2.23	2.23	2.78
	11.5	1.40	1.40	1.40	1.36	1.79	1.85	1.85	1.67	2.61	2.82	2.82	2.32	3.31	3.77	3.77	2.90	2.09	2.09	2.09	2.43
	12.0	1.26	1.31	1.31	1.20	1.59	1.70	1.70	1.47	2.31	2.59	2.59	2.04	2.92	3.46	3.46	2.55	1.96	1.96	1.96	2.14
	12.5	1.12	1.21	1.21	1.06	1.41	1.56	1.56	1.30	2.05	2.39	2.39	1.81	2.57	3.19	3.19	2.26	1.79	1.84	1.84	1.89
	13.0	0.99	1.12	1.12	0.94	1.24	1.44	1.44	1.16	1.81	2.21	2.21	1.61	2.24	2.95	2.95	2.01	1.59	1.73	1.73	1.68
	13.5	0.87	1.04	1.04	0.84	1.09	1.34	1.34	1.04	1.58	2.05	2.05	1.44	1.96	2.69	2.74	1.79	1.40	1.62	1.62	1.50
	14.0	0.76	0.96	0.96	0.76	0.96	1.25	1.25	0.93	1.38	1.90	1.90	1.29	1.70	2.45	2.55	1.61	1.23	1.51	1.51	1.35
CONTINUOUS INTERNAL	**11.0**	1.82	1.82	1.82	3.40	2.48	2.50	2.50	4.17	3.62	3.81	3.81	5.78	4.60	5.11	5.11	7.22	2.71	2.71	2.71	6.05
	11.5	1.70	1.70	1.70	2.97	2.20	2.28	2.28	3.65	3.20	3.49	3.49	5.06	4.05	4.67	4.67	6.32	2.54	2.54	2.54	5.29
	12.0	1.55	1.59	1.59	2.62	1.94	2.10	2.10	3.21	2.83	3.21	3.21	4.45	3.57	4.29	4.29	5.56	2.38	2.38	2.38	4.66
	12.5	1.37	1.49	1.49	2.32	1.72	1.93	1.93	2.84	2.51	2.95	2.95	3.94	3.15	3.95	3.95	4.92	2.20	2.24	2.24	4.12
	13.0	1.22	1.38	1.38	2.06	1.52	1.79	1.79	2.53	2.22	2.73	2.73	3.50	2.78	3.65	3.66	4.37	1.95	2.11	2.11	3.66
	13.5	1.08	1.28	1.28	1.84	1.35	1.66	1.66	2.26	1.96	2.53	2.53	3.13	2.44	3.31	3.39	3.91	1.73	1.99	1.99	3.27
	14.0	0.95	1.19	1.19	1.65	1.19	1.54	1.54	2.02	1.73	2.36	2.36	2.80	2.15	3.01	3.15	3.50	1.53	1.87	1.87	2.93
LAPPED 10% END	**11.0**	1.75	1.75	1.75	1.63	2.32	2.44	2.44	2.00	3.38	3.73	3.73	2.77	4.27	5.00	5.00	3.46	2.58	2.58	2.58	2.90
	11.5	1.63	1.64	1.64	1.43	2.04	2.24	2.24	1.75	2.97	3.42	3.42	2.43	3.71	4.57	4.57	3.03	2.42	2.42	2.42	2.54
	12.0	1.42	1.54	1.54	1.26	1.78	2.05	2.05	1.54	2.58	3.14	3.14	2.14	3.20	4.20	4.20	2.67	2.28	2.28	2.28	2.24
	12.5	1.24	1.44	1.44	1.11	1.55	1.89	1.89	1.36	2.24	2.89	2.89	1.89	2.76	3.81	3.87	2.36	1.99	2.15	2.15	1.98
	13.0	1.07	1.35	1.35	0.99	1.34	1.75	1.75	1.21	1.92	2.67	2.67	1.68	2.37	3.43	3.58	2.10	1.72	2.03	2.03	1.76
	13.5	0.93	1.25	1.25	0.88	1.16	1.62	1.62	1.08	1.66	2.43	2.48	1.50	2.05	3.10	3.32	1.87	1.50	1.91	1.91	1.57
	14.0	0.81	1.17	1.17	0.79	1.02	1.51	1.51	0.97	1.44	2.21	2.31	1.35	1.78	2.81	3.08	1.68	1.31	1.81	1.81	1.41
LAPPED 20% END	**11.0**	1.96	2.04	2.04	1.68	2.47	2.81	2.81	2.06	3.58	4.29	4.29	2.85	4.48	5.74	5.74	3.56	2.98	2.98	2.98	2.99
	11.5	1.71	1.92	1.92	1.47	2.14	2.57	2.57	1.80	3.11	3.92	3.92	2.50	3.86	5.16	5.25	3.12	2.73	2.81	2.81	2.61
	12.0	1.48	1.81	1.81	1.29	1.86	2.36	2.36	1.59	2.69	3.60	3.60	2.20	3.32	4.62	4.82	2.75	2.38	2.65	2.65	2.30
	12.5	1.28	1.68	1.68	1.14	1.60	2.17	2.17	1.40	2.31	3.24	3.32	1.95	2.85	4.14	4.44	2.43	2.06	2.51	2.51	2.03
	13.0	1.11	1.55	1.55	1.02	1.39	2.00	2.01	1.25	1.98	2.92	3.07	1.73	2.45	3.71	4.11	2.16	1.78	2.38	2.38	1.81
	13.5	0.96	1.43	1.44	0.91	1.21	1.80	1.86	1.11	1.71	2.63	2.85	1.54	2.12	3.33	3.81	1.93	1.55	2.25	2.25	1.62
	14.0	0.84	1.29	1.34	0.81	1.05	1.63	1.73	1.00	1.49	2.37	2.65	1.38	1.84	2.99	3.54	1.73	1.35	2.06	2.10	1.45
LAPPED 10% INTERNAL	**11.0**	2.17	2.17	2.17	3.59	3.03	3.18	3.18	4.41	4.41	4.93	4.93	6.11	5.56	6.58	6.60	7.64	3.20	3.20	3.20	6.40
	11.5	2.03	2.03	2.03	3.14	2.66	2.95	2.95	3.86	3.86	4.51	4.51	5.35	4.85	6.04	6.04	6.68	3.00	3.00	3.00	5.60
	12.0	1.86	1.91	1.91	2.77	2.33	2.71	2.71	3.40	3.39	4.14	4.14	4.71	4.23	5.54	5.54	5.88	2.83	2.83	2.83	4.93
	12.5	1.63	1.80	1.80	2.45	2.04	2.50	2.50	3.01	2.97	3.82	3.82	4.17	3.69	4.99	5.11	5.20	2.62	2.67	2.67	4.36
	13.0	1.43	1.69	1.69	2.18	1.79	2.31	2.31	2.67	2.59	3.52	3.53	3.70	3.20	4.49	4.72	4.63	2.29	2.52	2.52	3.88
	13.5	1.25	1.60	1.60	1.94	1.56	2.14	2.14	2.39	2.25	3.18	3.27	3.31	2.78	4.06	4.38	4.13	2.00	2.38	2.38	3.46
	14.0	1.09	1.51	1.51	1.74	1.36	1.98	1.99	2.14	1.95	2.89	3.04	2.97	2.42	3.67	4.07	3.71	1.75	2.25	2.25	3.10

ULTIMATE UNIFORMLY DISTRIBUTED LOAD: 11.0 – 14.0 M

		HST **350/24**				***HST*** **350/30**				***HST*** **400/20**				***HST*** **400/24**				***HST*** **400/30**			
		$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s
		(kN/m)				(kN/m)				(kN/m)				(kN/m)				(kN/m)			
SPAN	**(M)**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**
SINGLE SPAN	**11.0**	2.25	3.21	3.21	2.05	2.77	4.32	4.32	2.57	2.22	2.85	2.85	2.30	2.80	3.78	3.78	2.86	3.44	5.09	5.09	3.60
	11.5	1.89	2.94	2.94	1.80	2.33	3.83	3.95	2.25	1.88	2.61	2.61	2.01	2.35	3.46	3.46	2.51	2.89	4.66	4.66	3.15
	12.0	1.60	2.69	2.69	1.58	1.97	3.41	3.63	1.98	1.60	2.39	2.39	1.77	1.98	3.17	3.17	2.20	2.44	4.20	4.28	2.77
	12.5	1.36	2.40	2.49	1.40	1.68	3.04	3.34	1.75	1.37	2.21	2.21	1.57	1.69	2.93	2.93	1.95	2.08	3.75	3.94	2.45
	13.0	1.17	2.15	2.30	1.24	1.44	2.71	3.09	1.56	1.18	2.04	2.04	1.39	1.45	2.65	2.71	1.73	1.79	3.34	3.64	2.18
	13.5	1.01	1.92	2.13	1.11	1.25	2.41	2.87	1.39	1.03	1.86	1.89	1.24	1.25	2.38	2.51	1.55	1.54	2.98	3.38	1.95
	14.0	0.87	1.72	1.98	1.00	1.08	2.15	2.66	1.25	0.89	1.67	1.76	1.11	1.08	2.13	2.33	1.39	1.34	2.66	3.14	1.75
DOUBLE SPAN	**11.0**	3.21	3.21	3.21	4.94	4.32	4.32	4.32	6.19	2.59	2.59	2.59	5.52	3.78	3.78	3.78	6.88	5.09	5.09	5.09	8.65
	11.5	2.94	2.94	2.94	4.32	3.94	3.95	3.95	5.42	2.43	2.43	2.43	4.83	3.46	3.46	3.46	6.02	4.66	4.66	4.66	7.57
	12.0	2.70	2.70	2.70	3.80	3.52	3.63	3.63	4.77	2.28	2.28	2.28	4.25	3.17	3.17	3.17	5.30	4.28	4.28	4.28	6.66
	12.5	2.48	2.49	2.49	3.36	3.15	3.34	3.34	4.22	2.14	2.14	2.14	3.76	2.93	2.93	2.93	4.69	3.88	3.94	3.94	5.90
	13.0	2.23	2.30	2.30	2.99	2.83	3.09	3.09	3.75	2.02	2.02	2.02	3.35	2.71	2.71	2.71	4.17	3.48	3.64	3.64	5.24
	13.5	2.01	2.13	2.13	2.67	2.54	2.87	2.87	3.35	1.89	1.89	1.89	2.99	2.47	2.51	2.51	3.72	3.12	3.38	3.38	4.68
	14.0	1.81	1.98	1.98	2.39	2.28	2.66	2.66	3.00	1.74	1.76	1.76	2.68	2.23	2.33	2.33	3.34	2.80	3.14	3.14	4.20
CONTINUOUS END	**11.0**	3.73	3.75	3.75	3.88	4.74	5.04	5.04	4.87	2.81	2.81	2.81	4.35	4.32	4.32	4.33	5.41	5.84	5.94	5.94	6.81
	11.5	3.31	3.43	3.43	3.40	4.19	4.61	4.61	4.26	2.64	2.64	2.64	3.80	4.03	4.03	4.03	4.74	5.16	5.43	5.43	5.96
	12.0	2.93	3.15	3.15	2.99	3.70	4.23	4.23	3.75	2.48	2.48	2.48	3.35	3.62	3.70	3.70	4.17	4.56	4.99	4.99	5.24
	12.5	2.60	2.90	2.90	2.65	3.26	3.90	3.90	3.32	2.34	2.34	2.34	2.96	3.21	3.41	3.41	3.69	4.02	4.60	4.60	4.64
	13.0	2.30	2.68	2.68	2.35	2.85	3.61	3.61	2.95	2.21	2.21	2.21	2.63	2.84	3.16	3.16	3.28	3.52	4.25	4.25	4.12
	13.5	2.02	2.49	2.49	2.10	2.49	3.34	3.34	2.63	1.97	2.09	2.09	2.35	2.50	2.93	2.93	2.93	3.08	3.94	3.94	3.68
	14.0	1.76	2.31	2.31	1.88	2.17	3.10	3.11	2.36	1.73	1.98	1.98	2.11	2.18	2.72	2.72	2.63	2.69	3.67	3.67	3.30
CONTINUOUS INTERNAL	**11.0**	4.59	4.64	4.64	8.46	5.82	6.23	6.23	10.61	3.40	3.40	3.40	9.47	5.26	5.26	5.26	11.80	7.17	7.35	7.35	14.83
	11.5	4.06	4.24	4.24	7.41	5.13	5.70	5.70	9.29	3.19	3.19	3.19	8.29	4.91	4.91	4.91	10.33	6.32	6.72	6.72	12.98
	12.0	3.59	3.90	3.90	6.52	4.53	5.24	5.24	8.18	3.01	3.01	3.01	7.30	4.44	4.59	4.59	9.09	5.58	6.18	6.18	11.43
	12.5	3.18	3.59	3.59	5.77	3.99	4.83	4.83	7.23	2.84	2.84	2.84	6.46	3.93	4.23	4.23	8.04	4.93	5.69	5.69	10.11
	13.0	2.82	3.32	3.32	5.13	3.52	4.46	4.46	6.43	2.68	2.68	2.68	5.74	3.48	3.91	3.91	7.15	4.35	5.26	5.26	8.99
	13.5	2.50	3.08	3.08	4.58	3.10	4.14	4.14	5.74	2.42	2.54	2.54	5.12	3.09	3.62	3.62	6.38	3.83	4.88	4.88	8.03
	14.0	2.21	2.86	2.87	4.11	2.73	3.81	3.85	5.15	2.15	2.41	2.41	4.59	2.73	3.37	3.37	5.72	3.37	4.54	4.54	7.20
LAPPED 10% END	**11.0**	4.29	4.54	4.54	4.06	5.41	6.10	6.10	5.09	3.20	3.20	3.20	4.54	5.04	5.04	5.04	5.66	6.67	7.19	7.19	7.12
	11.5	3.77	4.15	4.16	3.55	4.71	5.58	5.58	4.46	3.01	3.01	3.01	3.98	4.65	4.72	4.72	4.95	5.83	6.58	6.58	6.23
	12.0	3.29	3.82	3.82	3.13	4.08	5.13	5.13	3.92	2.85	2.85	2.85	3.50	4.08	4.43	4.43	4.36	5.05	6.04	6.04	5.48
	12.5	2.86	3.52	3.52	2.77	3.51	4.73	4.73	3.47	2.69	2.69	2.69	3.10	3.54	4.14	4.14	3.86	4.36	5.57	5.57	4.85
	13.0	2.46	3.25	3.25	2.46	3.02	4.34	4.37	3.08	2.43	2.55	2.55	2.75	3.05	3.82	3.82	3.43	3.75	5.15	5.15	4.31
	13.5	2.12	3.02	3.02	2.20	2.61	3.93	4.05	2.75	2.11	2.42	2.42	2.46	2.63	3.55	3.55	3.06	3.24	4.78	4.78	3.85
	14.0	1.84	2.80	2.80	1.97	2.27	3.55	3.77	2.47	1.84	2.30	2.30	2.20	2.28	3.30	3.30	2.75	2.81	4.38	4.44	3.45
LAPPED 20% END	**11.0**	4.56	5.22	5.22	4.18	5.69	7.01	7.01	5.24	3.63	3.63	3.64	4.68	5.61	5.89	5.89	5.83	7.04	8.26	8.26	7.32
	11.5	3.96	4.77	4.77	3.66	4.92	6.41	6.41	4.59	3.44	3.44	3.43	4.09	4.90	5.54	5.54	5.10	6.08	7.56	7.56	6.41
	12.0	3.43	4.38	4.38	3.22	4.24	5.83	5.89	4.04	3.26	3.26	3.26	3.60	4.25	5.15	5.15	4.49	5.25	6.94	6.94	5.64
	12.5	2.96	4.04	4.04	2.85	3.64	5.23	5.43	3.57	2.90	3.09	3.09	3.19	3.67	4.75	4.75	3.97	4.51	6.40	6.40	4.99
	13.0	2.54	3.69	3.74	2.53	3.12	4.70	5.02	3.17	2.52	2.94	2.94	2.83	3.15	4.39	4.39	3.53	3.87	5.78	5.92	4.44
	13.5	2.19	3.34	3.46	2.26	2.70	4.22	4.65	2.83	2.19	2.80	2.80	2.53	2.72	4.07	4.07	3.15	3.34	5.20	5.49	3.96
	14.0	1.90	3.01	3.22	2.03	2.34	3.80	4.33	2.54	1.91	2.67	2.67	2.27	2.36	3.71	3.79	2.83	2.90	4.69	5.10	3.55
LAPPED 10% INTERNAL	**11.0**	5.59	6.00	6.00	8.95	7.05	8.06	8.06	11.23	3.95	3.95	3.94	10.02	6.26	6.26	6.26	12.48	8.69	9.50	9.50	15.69
	11.5	4.91	5.49	5.49	7.83	6.16	7.37	7.37	9.82	3.72	3.73	3.73	8.77	5.87	5.87	5.87	10.93	7.60	8.69	8.69	13.73
	12.0	4.31	5.04	5.04	6.90	5.38	6.77	6.77	8.65	3.52	3.52	3.52	7.72	5.33	5.51	5.51	9.61	6.64	7.98	7.98	12.09
	12.5	3.78	4.64	4.64	6.10	4.69	6.24	6.24	7.65	3.33	3.33	3.33	6.83	4.67	5.18	5.18	8.51	5.80	7.36	7.36	10.69
	13.0	3.30	4.29	4.29	5.42	4.08	5.69	5.77	6.80	3.16	3.16	3.16	6.07	4.09	4.89	4.89	7.56	5.05	6.80	6.80	9.51
	13.5	2.88	3.98	3.98	4.84	3.55	5.14	5.35	6.07	2.83	3.00	3.00	5.42	3.57	4.61	4.61	6.75	4.39	6.31	6.31	8.49
	14.0	2.50	3.66	3.70	4.34	3.08	4.64	4.97	5.45	2.47	2.85	2.85	4.86	3.10	4.36	4.36	6.05	3.80	5.72	5.86	7.61

ULTIMATE UNIFORMLY DISTRIBUTED LOAD: 14.5 – 17.5 M

		HST 300/15				**HST 300/18**				**HST 300/24**				**HST 300/30**				**HST 350/18**			
		$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s
		(kN/m)				(kN/m)				(kN/m)				(kN/m)				(kN/m)			
SPAN	**(M)**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**
SINGLE SPAN	**14.5**	0.35	0.66	0.77	0.36	0.44	0.83	1.00	0.44	0.60	1.21	1.52	0.61	0.75	1.50	2.01	0.77	0.56	1.07	1.21	0.64
	15.0	0.31	0.59	0.72	0.33	0.38	0.74	0.93	0.40	0.52	1.08	1.42	0.55	0.66	1.34	1.84	0.69	0.49	0.95	1.13	0.58
	15.5	0.27	0.53	0.67	0.29	0.34	0.66	0.87	0.36	0.46	0.96	1.32	0.50	0.58	1.18	1.68	0.63	0.43	0.85	1.06	0.52
	16.0	0.24	0.47	0.63	0.27	0.30	0.59	0.82	0.33	0.41	0.85	1.21	0.46	0.51	1.05	1.55	0.57	0.38	0.76	0.99	0.48
	16.5	0.22	0.42	0.59	0.24	0.26	0.53	0.77	0.30	0.36	0.75	1.12	0.42	0.46	0.93	1.42	0.52	0.34	0.68	0.93	0.44
	17.0	0.19	0.38	0.56	0.22	0.24	0.47	0.71	0.27	0.32	0.67	1.03	0.38	0.41	0.83	1.30	0.47	0.30	0.61	0.88	0.40
	17.5	0.17	0.34	0.52	0.21	0.21	0.42	0.65	0.25	0.29	0.60	0.95	0.35	0.37	0.74	1.20	0.44	0.27	0.54	0.82	0.36
DOUBLE SPAN	**14.5**	0.70	0.77	0.77	0.87	0.88	1.00	1.00	1.06	1.28	1.52	1.52	1.47	1.62	2.03	2.03	1.84	1.12	1.21	1.21	1.54
	15.0	0.63	0.72	0.72	0.78	0.79	0.93	0.93	0.96	1.16	1.42	1.42	1.33	1.45	1.90	1.90	1.66	1.01	1.13	1.13	1.39
	15.5	0.57	0.67	0.67	0.71	0.71	0.87	0.87	0.87	1.04	1.33	1.33	1.21	1.30	1.75	1.78	1.51	0.91	1.06	1.06	1.26
	16.0	0.51	0.63	0.63	0.64	0.64	0.82	0.82	0.79	0.94	1.25	1.25	1.10	1.17	1.61	1.67	1.37	0.82	0.99	0.99	1.15
	16.5	0.46	0.59	0.59	0.59	0.58	0.77	0.77	0.72	0.84	1.16	1.17	1.00	1.05	1.48	1.57	1.25	0.74	0.93	0.93	1.05
	17.0	0.41	0.56	0.56	0.54	0.52	0.72	0.72	0.66	0.75	1.07	1.11	0.91	0.94	1.36	1.48	1.14	0.66	0.88	0.88	0.96
	17.5	0.37	0.53	0.53	0.49	0.46	0.68	0.68	0.60	0.67	0.99	1.04	0.84	0.84	1.26	1.40	1.05	0.59	0.83	0.83	0.88
CONTINUOUS END	**14.5**	0.67	0.90	0.90	0.68	0.84	1.16	1.16	0.84	1.20	1.75	1.77	1.16	1.49	2.23	2.37	1.45	1.08	1.41	1.41	1.21
	15.0	0.59	0.84	0.84	0.62	0.74	1.09	1.09	0.76	1.05	1.59	1.66	1.05	1.31	2.03	2.22	1.31	0.95	1.31	1.31	1.09
	15.5	0.52	0.79	0.79	0.56	0.66	1.00	1.02	0.68	0.93	1.46	1.55	0.95	1.15	1.85	2.08	1.18	0.84	1.23	1.23	0.99
	16.0	0.47	0.73	0.74	0.51	0.58	0.92	0.95	0.62	0.82	1.34	1.46	0.86	1.02	1.69	1.95	1.08	0.75	1.16	1.16	0.90
	16.5	0.42	0.67	0.69	0.46	0.52	0.84	0.90	0.57	0.73	1.22	1.37	0.79	0.91	1.54	1.83	0.98	0.67	1.06	1.09	0.82
	17.0	0.37	0.61	0.65	0.42	0.47	0.77	0.84	0.52	0.65	1.12	1.29	0.72	0.81	1.41	1.73	0.90	0.60	0.98	1.02	0.75
	17.5	0.33	0.56	0.62	0.39	0.42	0.70	0.80	0.48	0.58	1.03	1.22	0.66	0.73	1.28	1.61	0.82	0.53	0.90	0.97	0.69
CONTINUOUS INTERNAL	**14.5**	0.84	1.11	1.11	1.48	1.05	1.44	1.44	1.82	1.52	2.15	2.19	2.52	1.89	2.74	2.94	3.15	1.35	1.74	1.74	2.64
	15.0	0.74	1.04	1.04	1.34	0.93	1.34	1.34	1.64	1.33	1.96	2.05	2.28	1.66	2.49	2.75	2.85	1.19	1.63	1.63	2.39
	15.5	0.65	0.97	0.97	1.21	0.82	1.23	1.26	1.49	1.17	1.79	1.92	2.07	1.46	2.27	2.57	2.58	1.05	1.52	1.52	2.16
	16.0	0.58	0.89	0.91	1.10	0.73	1.12	1.18	1.35	1.04	1.64	1.80	1.88	1.29	2.07	2.41	2.35	0.94	1.42	1.43	1.97
	16.5	0.52	0.82	0.86	1.01	0.65	1.03	1.11	1.24	0.92	1.50	1.70	1.71	1.15	1.89	2.27	2.14	0.83	1.30	1.34	1.79
	17.0	0.47	0.75	0.81	0.92	0.58	0.94	1.05	1.13	0.82	1.37	1.60	1.57	1.03	1.72	2.13	1.96	0.75	1.20	1.27	1.64
	17.5	0.42	0.69	0.76	0.84	0.52	0.86	0.99	1.04	0.73	1.25	1.51	1.44	0.92	1.57	1.98	1.79	0.67	1.10	1.20	1.50
LAPPED 10% END	**14.5**	0.71	1.09	1.09	0.71	0.89	1.38	1.41	0.87	1.26	2.00	2.15	1.21	1.56	2.54	2.88	1.51	1.15	1.70	1.70	1.27
	15.0	0.63	0.99	1.02	0.64	0.79	1.25	1.31	0.79	1.10	1.82	2.01	1.09	1.37	2.30	2.69	1.37	1.01	1.58	1.59	1.14
	15.5	0.56	0.91	0.95	0.58	0.70	1.14	1.23	0.72	0.97	1.66	1.88	0.99	1.20	2.09	2.52	1.24	0.89	1.44	1.49	1.04
	16.0	0.50	0.83	0.89	0.53	0.62	1.04	1.16	0.65	0.86	1.51	1.77	0.90	1.07	1.88	2.34	1.13	0.79	1.32	1.40	0.94
	16.5	0.44	0.75	0.84	0.48	0.55	0.94	1.09	0.59	0.76	1.36	1.66	0.82	0.95	1.69	2.16	1.03	0.71	1.20	1.32	0.86
	17.0	0.40	0.67	0.79	0.44	0.50	0.84	1.02	0.54	0.68	1.23	1.56	0.75	0.85	1.51	1.99	0.94	0.63	1.09	1.24	0.79
	17.5	0.36	0.61	0.75	0.41	0.45	0.76	0.97	0.50	0.61	1.10	1.45	0.69	0.76	1.35	1.84	0.86	0.57	0.98	1.17	0.72
LAPPED 20% END	**14.5**	0.74	1.17	1.25	0.73	0.93	1.47	1.62	0.90	1.30	2.14	2.47	1.25	1.61	2.69	3.29	1.56	1.19	1.87	1.96	1.30
	15.0	0.65	1.06	1.17	0.66	0.82	1.33	1.51	0.81	1.14	1.93	2.31	1.13	1.41	2.41	3.02	1.41	1.05	1.70	1.83	1.18
	15.5	0.58	0.95	1.09	0.60	0.72	1.20	1.41	0.74	1.00	1.74	2.16	1.02	1.24	2.17	2.77	1.27	0.93	1.53	1.71	1.07
	16.0	0.51	0.86	1.03	0.54	0.64	1.08	1.33	0.67	0.88	1.57	1.99	0.93	1.10	1.94	2.55	1.16	0.82	1.38	1.61	0.97
	16.5	0.46	0.77	0.96	0.50	0.57	0.97	1.25	0.61	0.78	1.41	1.84	0.85	0.98	1.74	2.34	1.06	0.73	1.25	1.51	0.88
	17.0	0.41	0.70	0.91	0.45	0.51	0.87	1.16	0.56	0.70	1.26	1.70	0.77	0.87	1.55	2.15	0.97	0.65	1.12	1.42	0.81
	17.5	0.37	0.62	0.85	0.42	0.46	0.78	1.07	0.51	0.63	1.12	1.56	0.71	0.78	1.39	1.98	0.89	0.59	1.01	1.34	0.74
LAPPED 10% INTERNAL	**14.5**	0.96	1.43	1.43	1.57	1.20	1.80	1.86	1.93	1.70	2.62	2.84	2.67	2.11	3.32	3.80	3.34	1.54	2.14	2.14	2.79
	15.0	0.84	1.30	1.34	1.42	1.06	1.63	1.74	1.74	1.49	2.38	2.65	2.41	1.85	3.00	3.55	3.01	1.35	2.03	2.03	2.52
	15.5	0.75	1.18	1.26	1.28	0.94	1.48	1.63	1.58	1.31	2.16	2.48	2.19	1.63	2.72	3.32	2.73	1.20	1.89	1.93	2.29
	16.0	0.66	1.08	1.18	1.17	0.83	1.35	1.53	1.43	1.16	1.96	2.33	1.99	1.45	2.46	3.06	2.48	1.06	1.72	1.84	2.08
	16.5	0.59	0.98	1.11	1.07	0.74	1.22	1.43	1.31	1.03	1.78	2.19	1.81	1.29	2.22	2.83	2.26	0.95	1.57	1.74	1.90
	17.0	0.53	0.89	1.04	0.97	0.66	1.11	1.35	1.19	0.92	1.62	2.04	1.66	1.15	2.01	2.61	2.07	0.85	1.42	1.64	1.73
	17.5	0.48	0.80	0.99	0.89	0.60	1.01	1.28	1.09	0.82	1.46	1.89	1.52	1.03	1.81	2.41	1.90	0.76	1.29	1.54	1.59

ULTIMATE UNIFORMLY DISTRIBUTED LOAD: 14.5 – 17.5 M

		HST 350/24				*HST* 350/30				*HST* 400/20				*HST* 400/24				*HST* 400/30			
		$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s	$\phi_b w_{bx}$			w_s
		(kN/m)				(kN/m)				(kN/m)				(kN/m)				(kN/m)			
SPAN	**(M)**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**	**1B**	**2B**	**3B**	**DEF**
SINGLE SPAN	**14.5**	0.76	1.54	1.85	0.90	0.94	1.92	2.48	1.12	0.77	1.49	1.64	1.00	0.94	1.91	2.17	1.25	1.17	2.37	2.93	1.57
	15.0	0.67	1.38	1.73	0.81	0.83	1.70	2.32	1.02	0.68	1.34	1.53	0.91	0.82	1.71	2.03	1.13	1.02	2.11	2.74	1.42
	15.5	0.59	1.23	1.62	0.73	0.73	1.51	2.13	0.92	0.59	1.20	1.44	0.82	0.72	1.52	1.90	1.02	0.90	1.88	2.56	1.29
	16.0	0.52	1.09	1.52	0.67	0.65	1.34	1.96	0.84	0.52	1.07	1.35	0.75	0.64	1.35	1.79	0.93	0.80	1.66	2.41	1.17
	16.5	0.46	0.97	1.42	0.61	0.57	1.19	1.80	0.76	0.46	0.96	1.27	0.68	0.57	1.20	1.68	0.85	0.71	1.47	2.21	1.07
	17.0	0.41	0.86	1.30	0.56	0.51	1.06	1.65	0.70	0.41	0.85	1.19	0.62	0.51	1.07	1.58	0.78	0.63	1.31	2.04	0.98
	17.5	0.37	0.77	1.20	0.51	0.46	0.94	1.52	0.64	0.37	0.77	1.13	0.57	0.45	0.95	1.48	0.71	0.56	1.17	1.87	0.89
DOUBLE SPAN	**14.5**	1.63	1.85	1.85	2.15	2.04	2.48	2.48	2.70	1.57	1.64	1.64	2.41	2.01	2.17	2.17	3.00	2.52	2.93	2.93	3.78
	15.0	1.47	1.73	1.73	1.95	1.83	2.32	2.32	2.44	1.41	1.53	1.53	2.18	1.81	2.03	2.03	2.71	2.26	2.74	2.74	3.41
	15.5	1.32	1.62	1.62	1.76	1.65	2.17	2.17	2.21	1.28	1.43	1.43	1.97	1.63	1.90	1.90	2.46	2.03	2.56	2.56	3.09
	16.0	1.19	1.52	1.52	1.60	1.48	2.03	2.04	2.01	1.15	1.35	1.35	1.80	1.47	1.79	1.79	2.24	1.82	2.41	2.41	2.81
	16.5	1.07	1.43	1.43	1.46	1.32	1.87	1.92	1.83	1.04	1.27	1.27	1.64	1.32	1.68	1.68	2.04	1.63	2.26	2.26	2.56
	17.0	0.95	1.35	1.35	1.34	1.18	1.72	1.81	1.68	0.93	1.19	1.19	1.50	1.18	1.58	1.58	1.86	1.45	2.12	2.13	2.34
	17.5	0.85	1.25	1.27	1.23	1.06	1.59	1.71	1.54	0.84	1.13	1.13	1.37	1.05	1.49	1.49	1.71	1.30	1.96	2.01	2.15
CONTINUOUS END	**14.5**	1.53	2.16	2.16	1.70	1.89	2.82	2.90	2.13	1.52	1.88	1.88	1.90	1.90	2.54	2.54	2.36	2.34	3.42	3.42	2.97
	15.0	1.34	2.02	2.02	1.53	1.66	2.57	2.71	1.92	1.34	1.78	1.78	1.71	1.66	2.37	2.37	2.14	2.05	3.16	3.19	2.68
	15.5	1.18	1.85	1.89	1.39	1.46	2.35	2.54	1.74	1.18	1.67	1.67	1.55	1.46	2.22	2.22	1.94	1.81	2.89	2.99	2.43
	16.0	1.04	1.69	1.77	1.26	1.29	2.14	2.38	1.58	1.05	1.57	1.57	1.41	1.29	2.08	2.08	1.76	1.60	2.64	2.81	2.21
	16.5	0.93	1.55	1.67	1.15	1.15	1.96	2.24	1.44	0.93	1.48	1.48	1.29	1.15	1.91	1.96	1.60	1.42	2.41	2.64	2.02
	17.0	0.82	1.42	1.57	1.05	1.02	1.79	2.11	1.32	0.84	1.37	1.39	1.18	1.02	1.75	1.85	1.47	1.26	2.20	2.49	1.84
	17.5	0.74	1.30	1.48	0.96	0.92	1.63	1.99	1.21	0.75	1.26	1.31	1.08	0.91	1.61	1.74	1.34	1.13	2.01	2.35	1.69
CONTINUOUS INTERNAL	**14.5**	1.94	2.67	2.67	3.69	2.39	3.46	3.59	4.63	1.90	2.28	2.28	4.13	2.40	3.14	3.14	5.15	2.96	4.23	4.23	6.48
	15.0	1.70	2.48	2.50	3.34	2.10	3.16	3.35	4.19	1.68	2.17	2.17	3.74	2.11	2.93	2.93	4.65	2.60	3.89	3.96	5.85
	15.5	1.50	2.27	2.34	3.03	1.85	2.88	3.14	3.79	1.48	2.06	2.06	3.39	1.85	2.75	2.75	4.22	2.29	3.55	3.70	5.30
	16.0	1.32	2.08	2.19	2.75	1.64	2.63	2.95	3.45	1.32	1.95	1.95	3.08	1.64	2.56	2.58	3.83	2.02	3.24	3.47	4.82
	16.5	1.17	1.90	2.06	2.51	1.45	2.40	2.77	3.15	1.17	1.83	1.83	2.81	1.45	2.35	2.43	3.50	1.79	2.95	3.27	4.40
	17.0	1.04	1.74	1.94	2.29	1.30	2.19	2.61	2.88	1.05	1.68	1.72	2.57	1.29	2.15	2.28	3.20	1.60	2.70	3.08	4.02
	17.5	0.93	1.59	1.83	2.10	1.16	2.00	2.46	2.64	0.94	1.54	1.63	2.35	1.15	1.97	2.16	2.93	1.43	2.46	2.90	3.68
LAPPED 10% END	**14.5**	1.60	2.54	2.61	1.77	1.98	3.22	3.51	2.22	1.61	2.19	2.18	1.98	1.99	3.07	3.07	2.47	2.45	3.97	4.14	3.11
	15.0	1.40	2.31	2.44	1.60	1.73	2.92	3.28	2.01	1.42	2.08	2.08	1.79	1.74	2.85	2.87	2.23	2.14	3.60	3.87	2.81
	15.5	1.23	2.10	2.29	1.45	1.53	2.65	3.07	1.82	1.25	1.98	1.98	1.62	1.53	2.60	2.69	2.02	1.89	3.27	3.62	2.54
	16.0	1.09	1.91	2.15	1.32	1.35	2.39	2.88	1.65	1.11	1.85	1.89	1.48	1.35	2.37	2.52	1.84	1.67	2.96	3.40	2.31
	16.5	0.97	1.74	2.02	1.20	1.20	2.15	2.71	1.51	0.99	1.68	1.79	1.35	1.20	2.15	2.37	1.68	1.48	2.66	3.20	2.11
	17.0	0.86	1.56	1.90	1.10	1.07	1.93	2.52	1.38	0.88	1.53	1.69	1.23	1.07	1.94	2.24	1.53	1.32	2.39	3.01	1.93
	17.5	0.77	1.40	1.79	1.01	0.96	1.73	2.33	1.26	0.78	1.38	1.59	1.13	0.95	1.74	2.11	1.41	1.18	2.14	2.84	1.77
LAPPED 20% END	**14.5**	1.65	2.72	3.00	1.82	2.04	3.41	4.03	2.29	1.67	2.54	2.54	2.04	2.05	3.35	3.53	2.54	2.53	4.22	4.76	3.20
	15.0	1.45	2.45	2.81	1.65	1.79	3.07	3.77	2.07	1.47	2.36	2.43	1.84	1.80	3.03	3.30	2.30	2.21	3.79	4.44	2.89
	15.5	1.28	2.21	2.63	1.49	1.58	2.76	3.50	1.87	1.30	2.14	2.32	1.67	1.58	2.74	3.09	2.08	1.95	3.41	4.16	2.62
	16.0	1.13	2.00	2.47	1.36	1.40	2.47	3.22	1.70	1.15	1.94	2.19	1.52	1.40	2.47	2.90	1.89	1.72	3.06	3.91	2.38
	16.5	1.00	1.80	2.32	1.24	1.24	2.21	2.96	1.55	1.02	1.75	2.06	1.39	1.24	2.23	2.73	1.73	1.53	2.75	3.64	2.17
	17.0	0.89	1.61	2.14	1.13	1.10	1.98	2.73	1.42	0.90	1.58	1.94	1.27	1.10	2.00	2.57	1.58	1.36	2.46	3.35	1.98
	17.5	0.79	1.44	1.98	1.04	0.99	1.77	2.51	1.30	0.81	1.42	1.83	1.16	0.98	1.79	2.42	1.45	1.22	2.20	3.09	1.82
LAPPED 10% INTERNAL	**14.5**	2.18	3.32	3.45	3.91	2.69	4.20	4.64	4.90	2.17	2.71	2.71	4.37	2.70	4.06	4.06	5.45	3.32	5.18	5.47	6.85
	15.0	1.91	3.02	3.22	3.53	2.35	3.81	4.33	4.43	1.91	2.58	2.58	3.95	2.36	3.73	3.79	4.92	2.91	4.69	5.11	6.19
	15.5	1.68	2.74	3.02	3.20	2.07	3.45	4.06	4.01	1.69	2.46	2.46	3.58	2.08	3.39	3.55	4.46	2.56	4.25	4.78	5.61
	16.0	1.48	2.49	2.83	2.91	1.83	3.12	3.81	3.65	1.50	2.35	2.35	3.25	1.84	3.08	3.33	4.06	2.27	3.86	4.49	5.10
	16.5	1.31	2.27	2.66	2.65	1.63	2.83	3.57	3.33	1.33	2.19	2.25	2.97	1.63	2.80	3.13	3.70	2.01	3.49	4.22	4.65
	17.0	1.17	2.06	2.51	2.42	1.45	2.56	3.30	3.04	1.19	2.00	2.15	2.71	1.45	2.55	2.95	3.38	1.79	3.16	3.98	4.25
	17.5	1.05	1.87	2.37	2.22	1.30	2.31	3.05	2.79	1.06	1.82	2.06	2.49	1.29	2.31	2.79	3.10	1.60	2.86	3.75	3.90

ULTIMATE AXIAL COMPRESSION LOAD – CONCENTRIC

HST 150

SPAN (M)	*HST* 150/12				*HST* 150/15				*HST* 150/18			
	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)
	0B	1B	2B		0B	1B	2B		0B	1B	2B	
4.0	28.12	75.29	75.29	170.11	35.24	103.92	103.92	212.20	42.43	131.57	141.08	253.31
4.5	22.45	74.08	75.29	134.40	28.30	100.24	103.92	167.60	34.29	115.45	141.08	200.11
5.0	18.39	65.47	75.29	108.90	23.32	85.70	103.92	135.80	28.46	99.94	141.08	162.11
5.5		56.93	75.29	89.96		71.85	103.92	112.20		85.31	141.08	134.00
6.0		48.86	75.29	75.60		60.82	103.92	94.31		72.39	131.36	112.60
6.5		41.96	75.29	64.42		52.20	103.92	80.35		62.30	120.55	95.93
7.0		36.36	71.08	55.54		45.33	95.31	69.28		54.25	109.97	82.71
7.5		31.83	65.33	48.39		39.78	85.48	60.35		47.76	99.70	72.05
8.0		28.12	59.56	42.53		35.24	76.00	53.04		42.43	89.87	63.33
8.5		25.04	53.92	37.67		31.46	67.64	46.99		38.00	80.40	56.11
9.0		22.45	48.73	33.60		28.30	60.64	41.91		34.29	72.18	50.04
9.5		20.26	43.99	30.16		25.61	54.68	37.62		31.15	65.21	44.91
10.0		18.39	39.83	27.22		23.32	49.59	33.95		28.46	59.25	40.53
10.5			36.25	24.69			45.20	30.79			54.11	36.76

HST 200

SPAN (M)	*HST* 200/12				*HST* 200/15				*HST* 200/18			
	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)
	0B	1B	2B		0B	1B	2B		0B	1B	2B	
4.0	42.43	78.86	78.86	370.11	52.86	109.85	109.85	462.51	63.10	133.46	133.46	553.11
4.5	33.75	78.86	78.86	292.40	42.13	109.85	109.85	365.40	50.46	133.46	133.46	437.00
5.0	27.50	78.86	78.86	236.91	34.44	109.85	109.85	296.00	41.39	133.46	133.46	354.00
5.5	22.87	76.34	78.86	195.80	28.73	105.72	109.85	244.60	34.67	126.09	133.46	292.51
6.0		67.72	78.86	164.51		91.71	109.85	205.51		109.40	133.46	245.80
6.5		60.05	78.86	140.20		79.03	109.85	175.11		93.89	133.46	209.51
7.0		53.63	78.86	120.80		68.45	109.85	151.00		81.44	133.46	180.60
7.5		47.63	78.86	105.31		59.89	109.85	131.51		71.37	133.46	157.31
8.0		42.43	78.86	92.53		52.85	109.70	115.60		63.10	131.56	138.31
8.5		37.73	73.33	81.96		47.02	101.04	102.40		56.23	120.11	122.51
9.0		33.75	67.56	73.11		42.13	91.46	91.35		50.46	109.08	109.31
9.5		30.38	62.30	65.61		37.98	82.87	81.99		45.57	98.42	98.06
10.0		27.50	57.65	59.22		34.44	75.01	73.99		41.39	89.15	88.49
10.5		25.02	53.50	53.71		31.38	68.24	67.11		37.79	81.21	80.27

HST 250

SPAN (M)	*HST* 250/13				*HST* 250/15				*HST* 250/18			
	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)
	1B	2B	3B		1B	2B	3B		1B	2B	3B	
4.0	96.33	96.33	96.33	722.11	119.70	119.70	119.70	833.40	147.39	147.39	147.39	998.31
4.5	96.33	96.33	96.33	570.60	119.70	119.70	119.70	658.51	147.39	147.39	147.39	788.71
5.0	96.33	96.33	96.33	462.20	119.70	119.70	119.70	533.40	147.39	147.39	147.39	638.91
5.5	96.33	96.33	96.33	381.91	119.70	119.70	119.70	440.80	147.39	147.39	147.39	528.00
6.0	96.33	96.33	96.33	320.91	119.70	119.70	119.70	370.40	147.39	147.39	147.39	443.71
6.5	92.89	96.33	96.33	273.51	114.84	119.70	119.70	315.60	144.08	147.39	147.39	378.00
7.0	83.59	96.33	96.33	235.80	102.98	119.70	119.70	272.11	127.35	147.39	147.39	326.00
7.5	75.49	96.33	96.33	205.40	92.46	119.70	119.70	237.11	111.50	147.39	147.39	283.91
8.0	68.53	96.33	96.33	180.51	82.42	119.70	119.70	208.40	98.53	147.39	147.39	249.60
8.5	62.50	96.33	96.33	159.91	73.72	119.70	119.70	184.60	87.72	147.39	147.39	221.11
9.0	56.70	96.33	96.33	142.60	65.98	119.70	119.70	164.60	78.60	147.39	147.39	197.20
9.5	51.47	95.84	96.33	128.00	59.44	118.54	119.70	147.80	70.87	147.39	147.39	177.00
10.0	46.78	89.53	96.33	115.51	53.82	110.54	119.70	133.40	64.25	138.37	147.39	159.71
10.5	42.54	83.40	96.33	104.80	48.98	102.74	119.70	121.00	58.53	126.95	147.39	144.91

ULTIMATE AXIAL LOAD – CONCENTRIC

HST 300

SPAN (M)	*HST* 300/15				*HST* 300/18				*HST* 300/24				*HST* 300/30			
	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)
	1B	2B	3B		1B	2B	3B		1B	2B	3B		1B	2B	3B	
5.0	121.16	121.16	121.16	904.80	159.25	159.25	159.25	1085.00	247.70	247.70	247.70	1466.00	347.45	347.45	347.45	1809.00
5.5	121.16	121.16	121.16	747.80	159.25	159.25	159.25	896.60	247.70	247.70	247.70	1212.00	347.45	347.45	347.45	1495.00
6.0	121.16	121.16	121.16	628.31	159.25	159.25	159.25	753.40	247.70	247.70	247.70	1018.00	347.45	347.45	347.45	1256.00
6.5	121.16	121.16	121.16	535.40	159.25	159.25	159.25	641.91	247.70	247.70	247.70	867.80	341.50	347.45	347.45	1070.00
7.0	121.16	121.16	121.16	461.60	159.25	159.25	159.25	553.51	247.70	247.70	247.70	748.20	309.65	347.45	347.45	922.80
7.5	121.16	121.16	121.16	402.11	159.25	159.25	159.25	482.11	229.26	247.70	247.70	651.80	279.00	347.45	347.45	803.91
8.0	114.48	121.16	121.16	353.40	149.46	159.25	159.25	423.80	205.35	247.70	247.70	572.91	249.40	347.45	347.45	706.51
8.5	104.09	121.16	121.16	313.11	135.73	159.25	159.25	375.40	182.88	247.70	247.70	507.40	222.48	347.45	347.45	625.91
9.0	96.42	121.16	121.16	279.31	122.60	159.25	159.25	334.80	163.98	247.70	247.70	452.60	199.77	347.45	347.45	558.20
9.5	88.92	121.16	121.16	250.60	110.92	159.25	159.25	300.51	147.93	247.70	247.70	406.20	180.45	347.45	347.45	501.00
10.0	82.26	121.16	121.16	226.20	100.45	159.25	159.25	271.20	134.15	247.70	247.70	366.60	163.97	330.18	347.45	452.20
10.5	75.70	121.16	121.16	205.20	91.39	159.25	159.25	246.00	122.26	247.70	247.70	332.51	149.70	308.98	347.45	410.11
11.0	69.64	121.16	121.16	186.91	83.52	159.25	159.25	224.11	111.93	236.84	247.70	303.00	137.28	288.40	347.45	373.71
11.5	64.20	120.58	121.16	171.00	76.64	157.84	159.25	205.11	102.89	220.59	247.70	277.20	126.40	268.40	347.45	341.91
12.0	59.08	114.23	121.16	157.11	70.59	149.14	159.25	188.31	94.93	204.74	247.70	254.60	116.88	248.70	347.45	314.00
12.5	54.57	107.76	121.16	144.80	65.23	140.17	159.25	173.60	87.91	189.35	247.70	234.60	108.40	230.20	343.30	289.40
13.0	50.56	101.72	121.16	133.80	60.49	130.76	159.25	160.51	81.65	175.71	247.70	216.91	100.90	213.80	326.60	267.60
13.5	46.98	96.20	121.16	124.11	56.24	122.26	159.25	148.80	76.08	163.49	247.70	201.20	94.22	199.17	310.20	248.11
14.0	43.78	91.10	121.16	115.40	52.45	114.44	159.25	138.40	71.08	152.55	241.49	187.11	88.22	186.05	294.14	230.71
14.5	40.88	86.42	121.16	107.60	49.03	106.93	159.25	129.00	66.58	142.69	228.80	174.40	82.81	174.20	278.40	215.11
15.0	38.29	82.05	118.88	100.51	45.94	100.14	155.50	120.51	62.52	133.77	216.30	162.91	77.93	163.49	263.14	201.00
15.5		77.68	113.96	94.15		93.98	148.77	112.91		125.68	204.01	152.60		153.78	247.85	188.20
16.0		73.38	108.90	88.36		88.36	141.81	105.91		118.32	192.03	143.20		144.96	233.38	176.60
16.5		69.44	104.10	83.09		83.26	134.47	99.62		111.61	181.05	134.71		136.90	220.27	166.11
17.0		65.82	99.62	78.27		78.60	127.49	93.84		105.44	171.02	126.91		129.50	208.20	156.51
17.5		62.23	95.43	73.86		74.32	121.07	88.56		99.84	161.84	119.71		122.76	197.15	147.71

HST 350

SPAN (M)	*HST* 350/18				*HST* 350/24				*HST* 350/30			
	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)
	1B	2B	3B		1B	2B	3B		1B	2B	3B	
5.0	158.10	158.10	158.10	1584.00	248.00	248.00	248.00	2994.00	339.90	339.90	339.90	2648.00
5.5	158.10	158.10	158.10	1309.00	248.00	248.00	248.00	2475.00	339.90	339.90	339.90	2188.00
6.0	158.10	158.10	158.10	1100.00	248.00	248.00	248.00	2079.00	339.90	339.90	339.90	1839.00
6.5	158.10	158.10	158.10	937.51	248.00	248.00	248.00	1772.00	339.90	339.90	339.90	1567.00
7.0	158.10	158.10	158.10	808.31	248.00	248.00	248.00	1528.00	339.90	339.90	339.90	1351.00
7.5	158.10	158.10	158.10	704.11	248.00	248.00	248.00	1331.00	309.90	339.90	339.90	1177.00
8.0	158.10	158.10	158.10	618.91	246.50	248.00	248.00	1170.00	277.20	339.90	339.90	1034.00
8.5	151.42	158.10	158.10	548.20	223.45	248.00	248.00	1036.00	247.32	339.90	339.90	916.11
9.0	136.87	158.10	158.10	489.00	200.70	248.00	248.00	924.20	222.00	339.90	339.90	817.20
9.5	123.93	158.10	158.10	438.91	181.10	248.00	248.00	829.40	200.55	339.90	339.90	733.40
10.0	112.20	158.10	158.10	396.11	164.20	248.00	248.00	748.60	182.07	339.90	339.90	661.91
10.5	102.10	158.10	158.10	359.31	149.60	248.00	248.00	679.00	166.15	339.90	339.90	600.40
11.0	93.30	158.10	158.10	327.31	136.90	248.00	248.00	618.60	152.28	320.27	339.90	547.00
11.5	85.61	158.10	158.10	299.51	125.80	248.00	248.00	566.00	140.10	298.22	339.90	500.51
12.0	78.83	158.10	158.10	275.11	115.98	245.90	248.00	519.80	129.43	276.46	339.90	459.60
12.5	72.84	155.65	158.10	253.51	107.30	230.10	248.00	479.11	119.95	255.99	339.90	424.31
13.0	67.52	146.03	158.10	234.40	99.58	215.10	248.00	442.91	111.54	237.70	339.90	391.70
13.5	62.75	136.50	158.10	217.31	92.67	200.18	248.00	410.71	104.00	221.40	339.90	363.20
14.0	58.51	127.84	158.10	202.11	86.49	186.70	248.00	381.91	97.27	206.76	326.60	337.71
14.5	54.67	119.45	158.10	188.40	80.91	174.60	248.00	356.00	91.20	193.50	309.30	314.80
15.0	51.21	111.88	158.10	176.00	75.87	163.70	248.00	332.71	85.72	181.56	292.40	294.20
15.5		104.98	158.10	164.91	71.31	153.80	245.20	311.60		170.73	275.55	275.51
16.0		98.73	157.37	154.71	67.15	144.75	232.90	292.40		160.80	259.50	258.60
16.5		93.03	150.16	145.51	63.37	136.50	221.50	275.00		151.80	244.85	243.11
17.0		87.80	142.38	137.11	59.90	128.96	209.30	259.00		143.57	231.44	229.00
17.5		83.01	135.18	129.31	56.73	122.00	198.10	244.40		136.00	219.10	216.11

ULTIMATE AXIAL LOAD – CONCENTRIC

HST 400

SPAN (M)	*HST* 400/20				*HST* 400/24				*HST* 400/30			
	N_c (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)	$\phi_c N_c$ (kN)			N_{ex} (kN)
	1B	2B	3B		1B	2B	3B		1B	2B	3B	
5.0	182.92	182.92	182.92	2454.00	248.00	248.00	248.00	2994.00	337.80	337.80	337.80	3700.00
5.5	182.92	182.92	182.92	2028.00	248.00	248.00	248.00	2475.00	337.80	337.80	337.80	3058.00
6.0	182.92	182.92	182.92	1704.00	248.00	248.00	248.00	2079.00	337.80	337.80	337.80	2570.00
6.5	182.92	182.92	182.92	1452.00	248.00	248.00	248.00	1772.00	337.80	337.80	337.80	2189.00
7.0	182.92	182.92	182.92	1252.00	248.00	248.00	248.00	1528.00	337.80	337.80	337.80	1888.00
7.5	182.92	182.92	182.92	1091.00	248.00	248.00	248.00	1331.00	337.80	337.80	337.80	1645.00
8.0	182.92	182.92	182.92	958.50	246.50	248.00	248.00	1170.00	304.20	337.80	337.80	1445.00
8.5	175.70	182.92	182.92	849.00	223.45	248.00	248.00	1036.00	271.40	337.80	337.80	1280.00
9.0	160.31	182.92	182.92	757.30	200.70	248.00	248.00	924.20	243.65	337.80	337.80	1142.00
9.5	146.88	182.92	182.92	679.70	181.10	248.00	248.00	829.40	220.00	337.80	337.80	1025.00
10.0	135.07	182.92	182.92	613.40	164.20	248.00	248.00	748.60	199.70	337.80	337.80	925.11
10.5	124.10	182.92	182.92	556.40	149.60	248.00	248.00	679.00	182.20	337.80	337.80	839.11
11.0	113.48	182.92	182.92	507.00	136.90	248.00	248.00	618.60	166.90	337.80	337.80	764.51
11.5	104.13	182.92	182.92	463.80	125.80	248.00	248.00	566.00	153.50	327.00	337.80	699.51
12.0	95.97	182.92	182.92	426.00	115.98	245.90	248.00	519.80	141.70	303.30	337.80	642.40
12.5	88.66	180.88	182.92	392.60	107.30	203.20	248.00	479.11	131.30	280.90	337.80	592.00
13.0	82.21	169.92	182.92	363.00	99.58	215.10	248.00	442.91	122.00	260.80	337.80	547.40
13.5	76.46	159.89	182.92	336.60	92.67	200.18	248.00	410.71	113.70	242.90	337.80	507.60
14.0	71.27	150.79	182.92	313.00	86.49	186.70	248.00	381.91	106.22	226.80	337.80	472.00
14.5	66.61	142.38	182.92	291.80	80.91	174.60	248.00	356.00	99.56	212.30	337.80	440.00
15.0	62.42	134.73	182.92	272.60	75.87	163.70	248.00	332.71	93.50	199.10	320.70	411.11
15.5		127.59	182.92	255.30		153.80	245.20	311.60		187.20	302.30	385.00
16.0		120.02	182.92	239.60		144.75	232.90	292.40		176.30	284.70	361.40
16.5		113.14	174.25	225.30		136.50	221.50	275.00		166.40	268.70	339.80
17.0		106.76	166.09	212.30		128.96	209.30	259.00		157.30	254.00	320.11
17.5		100.98	158.44	200.30		122.00	198.10	244.40		149.00	240.40	302.11
18.0		95.63	151.47	189.30		115.60	187.70	231.00		141.30	228.00	285.51

BOLT JOINT CAPACITY

The following table sets out the bolt connection capacity for the different steel thicknesses used with ***HST*** purlins when checked for bearing and end tearout.

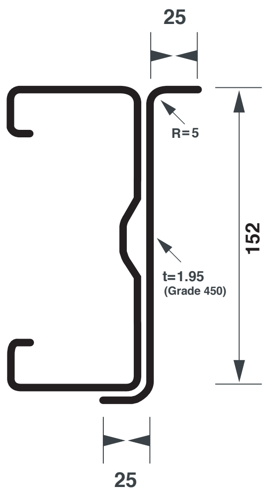
BOLT SIZES	M12		M12 BOLT SHEAR		M16		M16 BOLT SHEAR	
PLATE THICKNESS	BEARING	TEAROUT	GRADE 4.6	GRADE 8.8	BEARING	TEAROUT	GRADE 4.6	GRADE 8.8
(mm)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)
1.15	12.7	13.6	15.1	31.4	15.0	13.6	28.6	59.3
1.25	14.0	14.8	15.1	31.4	17.0	14.8	28.6	59.3
1.45	16.3	17.2	15.1	31.4	21.0	17.2	28.6	59.3
1.75	18.1	19.2	15.1	31.4	24.2	19.2	28.6	59.3
1.95	20.2	21.3	15.1	31.4	27.0	21.3	28.6	59.3
2.4	24.9	26.3	15.1	31.4	33.2	26.3	28.6	59.3
3.0	49.8	49.3	15.1	31.4	66.4	49.3	28.6	59.3

Notes:
1. The bearing and tearout capacities for thicknesses 1.15 - 2.4 are calculated in accordance with AS/NZS 4600:2005.
   The bearing and tearout capacities for thickness 3.0 are calculated in accordance with NZS 3404:1997.
2. The capacities should only be used for the member subject to nominal ductility or no ductility demand.
3. Washers should be used under both bolt head and nut, or flanged bolts should be used.
4. A 38mm edge distance was assumed for tearout capacity calculations.
5. The bolt capacities are based on AS 1111:2000 and AS 1252:1996.
6. M16 bolts are recommended to be used for cleat connection. The connection capacity should be checked by engineers when M12 bolts are used.

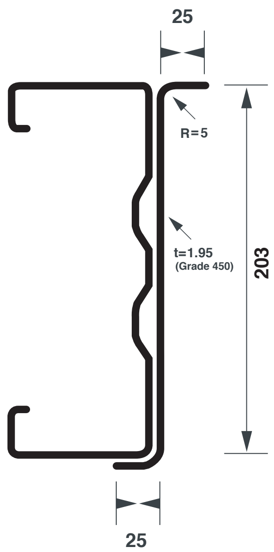
SPLICE JOINTS

SPLICE DESIGN

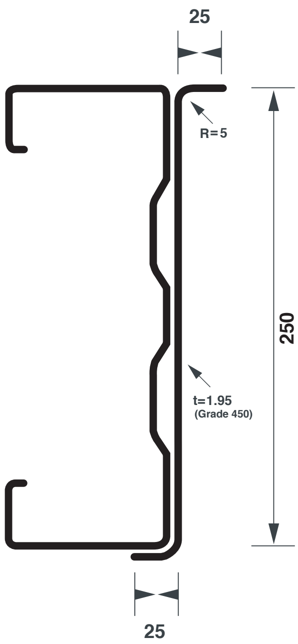
HST 150



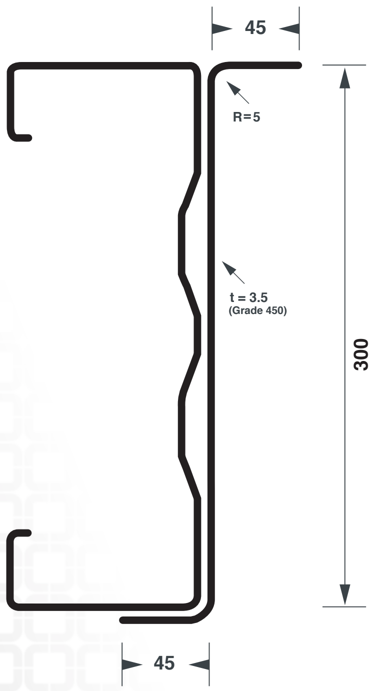
HST 200



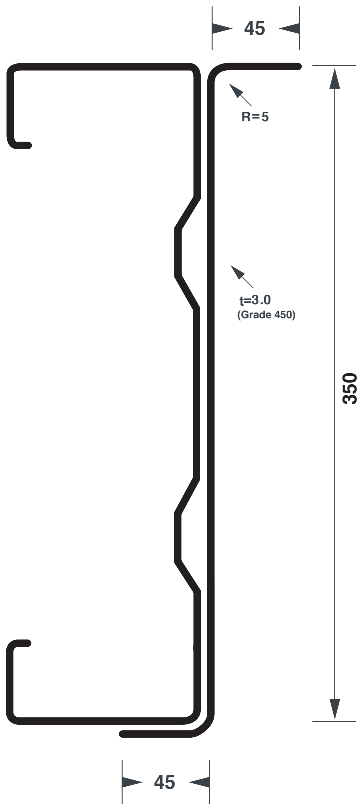
HST 250



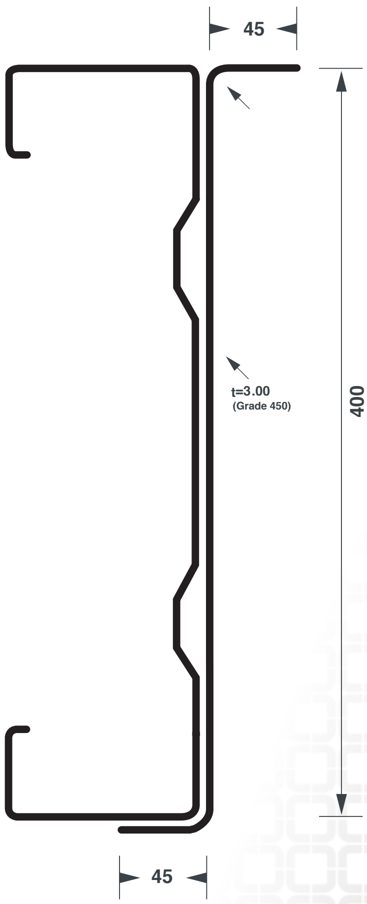
HST 300



HST 350



HST 400



SPLICE JOINTS

SPLICE JOINTS CAPACITIES TABLE

The design moment and shear force at center of bolt groups should be less than the capacities given in the table.

HST	ϕM (kN.m)	ϕV_v (kN)
150/12	3.01	5.49
150/15	4.09	10.48
150/18	4.87	17.77
200/12	4.35	4.30
200/15	5.98	8.13
200/18	7.18	13.69

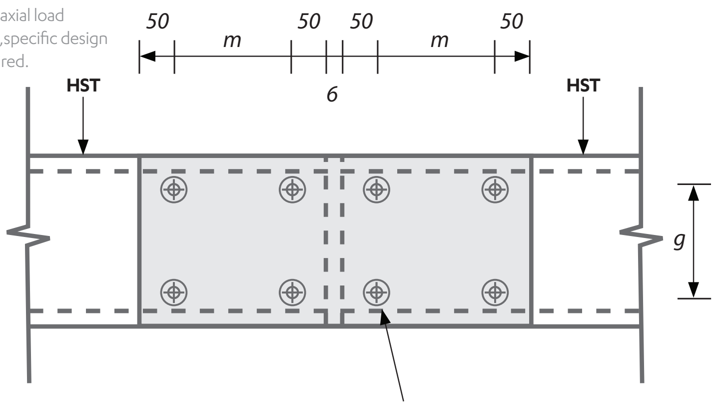
HST	ϕM (kN.m)	ϕV_v (kN)
250/13	6.75	4.94
250/15	8.27	7.37
250/18	10.00	12.28
300/15	10.10	5.94
300/18	13.07	9.92
300/24	19.97	23.66
300/30	26.73	43.96

HST	ϕM (kN.m)	ϕV_v (kN)
350/18	15.84	8.30
350/24	24.29	19.83
350/30	32.64	36.90
400/20	21.54	9.59
400/24	28.57	17.04
400/30	38.48	31.76

HOLE LOCATION

HST 150, *HST* 200, *HST* 250

Where axial load applies,specific design is required.

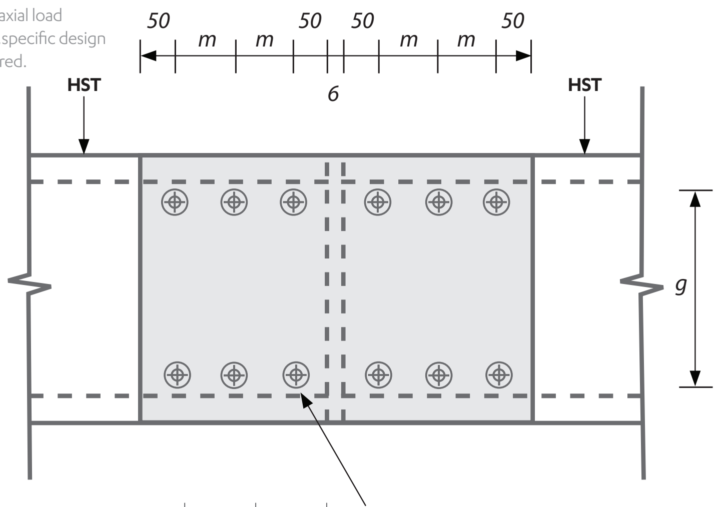


	g(mm)	m(mm)
***HST* 150**	80	120
***HST* 200**	120	120
***HST* 250**	160	180

M16 Grade 4.6
Washers under both bolt head and nut.

HST 300, *HST* 350, *HST* 400

Where axial load applies,specific design is required.



	g(mm)	m(mm)
***HST* 300**	200	120
***HST* 350**	240	120
***HST* 400**	280	120

M16 Grade 4.6 for 1.45mm, 1.75mm and 1.85mm think HST.
M16 Grade 8.8 for 2.4mm and 3mm think HST Washers under both bolt head and nut.

SECTIONAL PROPERTIES

PURLIN SIZE	AREA	WEIGHT	SECOND MOMENT OF AREA (GROSS SECTION)		SECTION MODULUS		RADIUS OF GYRATION		TORSION CONSTANT	WARPING FACTOR
	A_s	W_t	I_x	I_y	Z_x	Z_y	r_x	r_y	J	I_w
HST	MM^2	KN/M	10^6MM^4	10^6MM^4	10^3MM^3	10^3MM^3	MM	MM	MM^4	10^9MM^6
100/12	253	0.019	0.423	0.092	8.38	2.78	40.9	19.1	111	0.21
100/15	316	0.024	0.525	0.114	10.45	3.44	40.8	18.9	222	0.26
100/19	400	0.031	0.658	0.141	13.14	4.29	40.6	18.7	456	0.31
150/12	386	0.030	1.38	0.249	18.1	6.14	59.8	25.4	170	1.54
150/15	483	0.037	1.72	0.308	22.6	7.61	59.7	25.2	338	1.87
150/18	578	0.044	2.05	0.364	27.0	9.01	59.6	25.1	590	2.19
200/12	478	0.037	3.00	0.392	29.6	8.04	79.2	28.6	211	3.93
200/15	598	0.046	3.75	0.486	36.9	9.98	79.2	28.5	419	4.83
200/18	717	0.055	4.48	0.577	44.2	11.90	79.1	28.4	732	5.67
250/13	625	0.048	5.85	0.655	46.8	11.90	96.8	32.4	325	10.4
250/15	722	0.056	6.76	0.753	54.0	13.7	96.7	32.3	506	11.9
250/18	866	0.067	8.09	0.897	64.7	16.3	96.6	32.2	885	14.0
300/15	847	0.065	11.5	1.23	76.4	18.5	116	38.1	594	26.4
300/18	1018	0.078	13.7	1.46	91.6	22	116	37.9	1039	31.2
300/24	1382	0.106	18.6	1.95	124	29.5	116	37.6	2653	41.1
300/30	1711	0.132	22.9	2.38	153	36.0	116	37.3	5134	49.4
350/18	1123	0.086	20.1	1.63	115	24	134	38.1	1146	46.7
350/24	1526	0.117	27.2	2.17	155	32.1	133	37.7	2930	61.6
350/30	1891	0.146	33.5	2.65	192	39.3	133	37.4	5674	74.3
400/20	1365	0.105	31.1	1.97	155	28.6	151	38.0	1730	73.1
400/24	1670	0.128	37.9	2.39	190	34.7	151	37.8	3206	87.7
400/30	2071	0.159	46.9	2.92	234	42.5	150	37.5	6214	106

Note: All section properties are for the gross section.

SECTION CAPACITIES

PURLIN SIZE	SECTION MOMENT CAPACITY	DISTORTIONAL BUCKLING MOMENT CAPACITY	FLEXI-TORSIONAL BUCKLING MOMENT CAPACITY $\phi_b M_{fbx}$ EFFECTIVE LENGTH (LE) IN METRES (kN.m)											SHEAR CAPACITY	AXIAL COMPRESSION SECTION CAPACITY
HST	$\phi_b M_{sx}$ (kN.m)	$\phi_b M_{dbx}$ (kN.m)	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**10.0**	**11.0**	**12.0**	$\phi_v V_v$ (kN)	$\phi_c N_s$ (kN)
150/12	7.0	6.0	5.7	3.7	2.2	1.5	1.0	0.8	0.6	0.5	0.4	0.4	0.3	13.7	125.7
150/15	9.7	8.2	7.8	4.9	2.8	1.9	1.3	1.0	0.8	0.7	0.6	0.5	0.4	26.2	176.6
150/18	11.2	9.7	9.2	5.8	3.4	2.3	1.6	1.3	1.0	0.8	0.7	0.6	0.6	44.4	212.4
200/12	10.9	8.7	9.3	6.7	4.2	2.9	2.0	1.5	1.2	0.9	0.8	0.6	0.6	10.7	142.0
200/15	15.0	12.0	12.8	9.1	5.5	3.6	2.5	1.9	1.5	1.2	1.0	0.8	0.7	20.3	201.5
200/18	17.6	14.4	15.2	11.2	6.6	4.3	3.1	2.3	1.8	1.5	1.3	1.1	0.9	34.2	246.2
250/13	17.2	13.5	15.5	12.5	8.4	5.7	4.1	3.1	2.4	1.9	1.6	1.3	1.1	12.3	176.4
250/15	21.3	16.5	19.0	15.3	10.0	6.8	4.8	3.6	2.8	2.2	1.8	1.5	1.3	18.4	224.4
250/18	25.0	20.0	22.6	18.4	12.5	8.2	5.8	4.3	3.4	2.7	2.2	1.9	1.6	30.7	277.4
300/15	26.2	20.2	24.7	21.7	17.2	11.9	8.7	6.6	5.1	4.1	3.3	2.8	2.4	14.9	218.7
300/18	34.0	26.1	31.9	27.7	21.6	14.9	10.8	8.0	6.2	4.9	4.0	3.4	2.9	24.8	296.0
300/24	49.8	39.9	46.7	40.3	31.2	20.8	14.6	10.9	8.5	6.8	5.7	4.8	4.1	59.1	476.3
300/30	64.0	53.5	59.9	51.6	38.7	25.6	18.2	13.7	10.7	8.7	7.3	6.2	5.4	109.9	642.8
350/18	41.6	31.7	39.2	34.5	27.6	19.1	13.8	10.2	7.9	6.3	5.1	4.3	3.6	20.7	320.5
350/24	62.7	48.6	59.0	51.1	39.9	26.6	18.7	13.9	10.8	8.6	7.1	6.0	5.1	49.6	525.3
350/30	81.3	65.3	76.3	65.2	49.4	32.7	23.1	17.3	13.5	10.9	9.0	7.6	6.6	92.3	706.7
400/20	58.5	43.1	55.2	48.5	38.7	26.9	19.1	14.1	10.9	8.6	7.1	5.9	5.0	24.0	369.2
400/24	76.2	57.1	71.8	62.6	49.4	33.1	23.2	17.2	13.3	10.6	8.7	7.3	6.2	42.6	504.6
400/30	99.6	77.0	93.6	80.3	61.2	40.7	28.6	21.3	16.6	13.3	11.0	9.3	7.9	79.4	688.9

Notes:

1. $\phi_b M_{sx}$ – Design section moment capacity about X axis.
2. $\phi_b M_{dbx}$ – Design member moment capacity about X axis subject to distortional buckling.
3. $\phi_b M_{fbx}$ – Design member moment capacity about X axis subject to lateral buckling. Values are based on the moment distribution of a uniform moment over entire unbraced segment at the centroid of ***HST***. Refer to AS/NZS 4600:2005 for the values of other moment distributions. No sheeting restraint has been considered in the calculation.
4. $\phi_v V_v$ – Design shear capacity of ***HST*** webs without service holes.
5. $\phi_c N_s$ – Design section capacity of the member in axial compression.
6. The table should be used in conjunction with AS/NZS 4600:2005.

WORKED EXAMPLES

The following design examples are based on loads calculated in limit state format, in accordance with AS/NZS 1170:2002.

EXAMPLE 1
SINGLE SPAN - ROOF

The example below considers a purlin in a typical portal frame building, with light weight metal cladding. The purlin is simply supported by portal rafters with purlin cleats.

LIMIT STATE LOADS FROM AS/NZS 1170:2002:

Dead load:	G	= 0.15 kPa
Live load:	Q	= 0.25 kPa
Design ultimate wind pressure:	P_u	= -0.69 kPa (uplift)
Design ultimate wind pressure:	P_u	= 0.44 kPa (downward)
Design serviceability wind pressure:	P_s	= -0.46 kPa (uplift)
Design serviceability wind pressure:	P_s	= 0.29 kPa (downward)

GEOMETRY:

Span: L = 9 m

Purlin Spacing: S = 1.9 m

a) **Check serviceability limit state (deflection) using w_s values in Design Capacity Tables:**

Serviceability load combinations (assume no ceiling attached to purlins):

$G + \psi_l Q$ = 0.15 + 0 x 0.25 = 0.15 kPa
P_s = -0.46 kPa (uplift)
P_s = 0.29 kPa (downward)

Calculate the maximum absolute uniform distributed loads:

w_s^* = 1.9 x 0.15 = 0.285 kN/m (dead load)
w_s^* = 1.9 x (-0.46) = -0.874 kN/m (wind)

Check wind load at deflection limit of L/150 from charts for *HST* 250/15, Single Span:

w_s = 0.90 kN/m > w_s^* (wind), OK

Check dead load at deflection limit of L/300 from charts for *HST* 250/15, Single Span:

w_s = 0.90 x 150/300 = 0.45 kN/m > w_s^* (dead load), OK

Therefore, use ***HST*** 250/15, Single Span.

b) **Check ultimate limit state using $\phi_b w_{bx}$ values in Design Capacity Tables:**

Ultimate load combinations:

1.35G	= 1.35 x 0.15	= 0.203 kPa
1.2G + 1.5Q	= 1.2 x 0.15 + 1.5 x 0.25	= 0.555 kPa
$1.2G + P_u$	= 1.2 x 0.15 + 0.44	= 0.620 kPa
$0.9G + P_u$	= 0.9 x 0.15 + (-0.69)	= -0.555 kPa

Calculate the maximum absolute uniform distributed loads:

w_x^* = 1.9 x 0.62 = 1.178 kN/m

Check ultimate limit state from charts for *HST* 250/15, Single Span:

$\phi_b w_{bx}$ = 1.63 kN/m (2B) > w_x^*, OK

Therefore, use ***HST*** 250/15, Single Span, with 2 rows of bracing.

EXAMPLE 2
SINGLE SPAN - WALL

The example below considers a girt in a typical portal frame building, with lightweight metal cladding. The girt is simply supported by portal legs with girt cleats.

LIMIT STATE LOADS FROM AS/NZS 1170:2002:

Design ultimate wind pressure:	P_u	= 0.86 kPa (Inward)
Design ultimate wind pressure:	P_u	= 0.43 kPa (Outward)
Design serviceability wind pressure:	P_s	= 0.57 kPa (Inward)
Design serviceability wind pressure:	P_s	= 0.28 kPa (Outward)

GEOMETRY:

Span: L = 10 m

Purlin Spacing: S = 1.8 m

a) **Check serviceability limit state (deflection) using w_s values in Design Capacity Tables:**

Serviceability load combinations (assume no internal lining attached to girts):

P_s = 0.57 kPa (Inward)

P_s = 0.28 kPa (Outward)

Calculate the maximum uniform distributed loads:

w_s^* = 1.8 x 0.57 = 1.026 kN/m

Check wind load at deflection limit of L/150 from charts for *HST* 300/15, Single Span:

w_s = 1.10 kN/m > w_s^* (wind), OK

Therefore, use ***HST*** 300/15, single span.

b) **Check ultimate limit state using $\phi_b w_{bx}$ values in Design Capacity Tables:**

Calculate the maximum uniform distributed loads:

w_x^* = 1.8 x 0.86 = 1.548 kN/m

Check ultimate limit state from charts for *HST* 300/15, Single Span:

$\phi_b w_{bx}$ = 1.62 kN/m (2B) > w_x^*, OK

Therefore, use ***HST*** 300/15, with 2 rows of standard bracing.

EXAMPLE 3
SINGLE SPAN – COMBINED BENDING AND AXIAL COMPRESSION

Consider the purlin of example 1 as a roof bracing strut, with an ultimate axial compression load N_c^* due to longitudinal wind. Assume no bending moment about y-axes. The purlin is simply supported by portal rafters with purlin cleats.

Design axial compression load: $N_c^* = 34$ kN

From Example 1: $w_x^* = 1.178$ kN/m

Check ultimate limit state using values in Design Capacity Tables.

a) Try *HST* 250/15 with 2 rows of braces:

From Single Span, Ultimate Axial Compression Load and Section Capacities tables:

Axial member compression capacity: $\phi_c N_c = 119.7$ kN

Axial section compression capacity: $\phi_c N_s = 224.4$ kN

Elastic bucking load: $N_{ex} = 164.6$ kN

Uniform member bending capacity (2B): $\phi_b w_{bx} = 1.63$ kN/m

$c_{mx} = 1.0$

$$\alpha_{nx} = 1.0 - \frac{N_c^*}{N_{ex}} = 1.0 - 34/164.6 = 0.793$$

$$\frac{N_c^*}{\phi_c N_c} = 0.284 \quad > 0.15\text{, therefore;}$$

$$\text{i)} \quad \frac{N^*}{\phi_c N_c} + \frac{c_{mx} w_x^*}{\phi_b w_{bx} \alpha_{nx}} = 1.20 > 1\text{, no good}$$

$$\text{ii)} \quad \frac{N^*}{\phi_c N_s} + \frac{w_x^*}{\phi_b w_{bx}} = 0.87 < 1\text{, OK}$$

Therefore, ***HST*** 250/15 (2B) is no good.

b) Try 2 x *HST* 250/15 (with 1 row of braces), purlins back to back:

Ultimate load to purlins:

Design axial load: $N_c^* = 17$ kN per purlin

From Example 1: $w_x^* = 0.589$ kN/m per purlin

From Single Span, Ultimate Axial Compression Load and Section Capacities tables

Axial member compression capacity: $\phi_c N_c = 65.98$ kN

Axial section compression capacity: $\phi_c N_s = 224.4$ kN

Elastic bucking load: $N_{ex} = 164.6$ kN

Uniform member bending capacity (2B): $\phi_b w_{bx} = 1.18$ kN/m

$c_{mx} = 1.0$

$$\alpha_{nx} = 1.0 - \frac{N_c^*}{N_{ex}} = 1.0 - 17/164.6 = 0.897$$

$$\frac{N_c^*}{\phi_c N_c} = 0.258 > 0.15\text{, therefore;}$$

$$\text{i)} \quad \frac{N^*}{\phi_c N_c} + \frac{c_{mx} w_x^*}{\phi_b w_{bx} \alpha_{nx}} = 0.81 < 1\text{, OK}$$

$$\text{ii)} \quad \frac{N^*}{\phi_c N_s} + \frac{w_x^*}{\phi_b w_{bx}} = 0.57 < 1\text{, OK}$$

Therefore, use 2 x ***HST*** 250/15 (1B) back to back, Single Span, for the purlins acting as roof bracing struts.

EXAMPLE 4
CONTINUOUS END PURLIN - ROOF

The example below considers a purlin in the end 2 bays of any continuous run of a portal frame building, with lightweight metal cladding. The purlin is supported by portal rafters with purlin cleats.

LIMIT STATE LOADS FROM AS/NZS 1170:2002:

Dead load: $G = 0.15$ kPa

Live load: $Q = 0.25$ kPa

Design ultimate wind pressure: $P_u = -0.91$ kPa (uplift)

Design ultimate wind pressure: $P_u = 0.44$ kPa (downward)

Design serviceability wind pressure: $P_s = -0.59$ kPa (uplift)

Design serviceability wind pressure: $P_s = 0.29$ kPa (downward)

GEOMETRY:

Span: $L = 9$ m

Purlin Spacing: $S = 2.4$ m

a) Check serviceability limit state (deflection) using w_s values in Design Capacity Tables:

Serviceability load combinations (assume no ceiling attached to purlins):

$G + \psi_l Q = 0.15 + 0 \times 0.25 = 0.15$ kPa
$P_s = -0.59$ kPa (uplift)
$P_s = 0.29$ kPa (downward)

Calculate the maximum absolute uniform distributed loads:

$w_s^* = 2.4 \times 0.15 = 0.360$ kN/m (dead load)
$w_s^* = 2.4 \times (-0.59) = -1.416$ kN/m (wind)

1) Where the purlin is only continuous (2 bays):

Check wind load at deflection limit of L/150 from charts for *HST* 250/18, Double Span:

$w_s = 2.65$ kN/m $> w_s^*$ (wind), OK

Check dead load at deflection limit of L/300 from charts for *HST* 250/18, Double Span

$w_s = 2.65 \times 150/300 = 1.325$ kN/m $> w_s^*$ (dead load), OK

Therefore, use ***HST*** 250/18, Double Span.

2) Where the purlins are continuous (more than 2 bays):

Check wind load at deflection limit of L/150 from charts for *HST* 250/15, Continuous End:

$w_s = 1.69$ kN/m $> w_s^*$ (wind), OK

Check dead load at deflection limit of L/300 from charts for *HST* 250/15, Continuous End:

$w_s = 1.69 \times 150/300 = 0.845$ kN/m $> w_s^*$ (dead load), OK

Therefore, use ***HST*** 250/15, Continuous End.

b) **Check Ultimate Limit State using $\phi_b w_{bx}$ values in Design Capacity Tables:**

Ultimate load combinations:

1.35G	=	1.35 x 0.15	=	0.203 kPa
1.2G +1.5Q	=	1.2 x 0.15 + 1.5 x 0.25	=	0.555 kPa
1.2G + P_u	=	1.2 x 0.15 + 0.44	=	0.620 kPa
0.9G + P_u	=	0.9 x 0.15 + (-0.91)	=	-0.775 kPa

Calculate the maximum absolute uniform distributed loads:

w_s^* = 2.4 x (-0.775) = -1.860 kN/m

1) Where the purlin is only continuous (2 bays):

Check ultimate limit state from charts for *HST* 250/18, Double Span:

$\phi_b w_{bx}$ = 1.98 kN/m (1B) > w_x^*, OK

Therefore, use ***HST*** 250/18, Double Span, with 1 row of standard braces.

2) Where the purlin is continuous (more than 2 bays):

Check ultimate limit state from charts for *HST* 250/15, Continuous End.

$\phi_b w_{bx}$ = 1.91kN/m (1B) > w_x^*, OK

Therefore, use ***HST*** 250/15, Continuous End, with 1 row of bracing.

EXAMPLE 5
LAPPED END PURLIN - ROOF

The example below considers purlins in the 2 end bays of any continuous run (no fewer than 3 bays) of a portal frame building, with lightweight metal cladding. The purlins are supported by portal rafters with purlin cleats.

LIMIT STATE LOADS FROM AS/NZS 1170:2002:

Dead load:	G	=	0.15 kPa
Live load:	Q	=	0.25 kPa
Design ultimate wind pressure:	P_u	=	-0.91 kPa (uplift)
Design ultimate wind pressure:	P_u	=	0.44 kPa (downward)
Design serviceability wind pressure:	P_s	=	-0.59 kPa (uplift)
Design serviceability wind pressure:	P_s	=	0.29 kPa (downward)

GEOMETRY:

Span:	L	=	10 m
Purlin Spacing:	S	=	2.0 m

a) **Check serviceability limit state (deflection) using w_s values in Design Capacity Tables:**

Serviceability load combinations (assume no ceiling attached to purlins).

$G + \psi_l Q$ = 0.15 + 0 x 0.25 = 0.15 kPa
P_s = -0.59 kPa
P_s = 0.29 kPa

Calculate the maximum absolute uniform distributed loads:

w_s^* = 2 x 0.15 = 0.300 kN/m (dead load)
w_s^* = 2 x (-0.59) = -1.180 kN/m (wind)

Option 1:
Where purlins are 10% lapped for more than 2 bays:

Check wind load at deflection limit of L/150 from charts for *HST* 250/18, Lapped 10% End:

w_s = 1.59 kN/m > w_s^* (wind), OK

Check dead load at deflection limit of L/300 from charts for *HST* 250/18, Lapped 10% End:

w_s = 1.59 x 150/300 = 0.795 kN/m > w_s^* (dead load), OK

Therefore, use ***HST*** 250/18, Lapped 10% End.

Option 2:
Where purlins are 20% lapped at the first internal supports and 10% lapped for others:

Check wind load at deflection limit of L/150 from charts for *HST* 250/15, Lapped 20% End:

w_s = 1.33 kN/m > w_s^* (wind), OK

Check dead load at deflection limit of L/300 from charts for *HST* 250/15, Lapped 20% End:

w_s = 1.33 x 150/300 = 0.665 kN/m > w_s^* (dead load), OK

Therefore, use ***HST*** 250/15, Lapped 20% End.

b) **Check ultimate limit state using $\phi_b w_{bx}$ values in Design Capacity Tables:**

Ultimate Load Combinations:

1.35G	=	1.35 x 0.15	=	0.203 kPa
1.2G + 1.5Q	=	1.2 x 0.15 + 1.5 x 0.25	=	0.555 kPa
1.2G + P_u	=	1.2 x 0.15 + 0.44	=	0.620 kPa
0.9G + P_u	=	0.9 x 0.15 + (-0.91)	=	-0.775 kPa

Calculate the maximum absolute uniform distributed loads:

w_x^* = 2 x (-0.775) = -1.550 kN/m

Option 1:
Check ultimate limit state from charts for *HST* 250/18, Lapped 10% End:

$\phi_b w_{bx}$ = 2.26 kN/m (2B) > w_x^*, OK

Therefore, use ***HST*** 250/18, Lapped 10% End, with 2 rows of bracing.

Option 2:
Check ultimate limit state from charts for *HST* 250/15, Lapped 20% End:

$\phi_b w_{bx}$ = 2.15 kN/m (2B) > w_x^*, OK

Therefore, use ***HST*** 250/15 , Lapped 20% End, with 2 rows of bracing.

EXAMPLE 6
INTERNAL SPAN PURLIN - ROOF

The example below considers purlins in the internal bays (excluding the first and last 2 bays) of any continuous run (no fewer than 5 bays) of a portal frame building, with lightweight metal cladding. The purlins are supported by portal rafters with purlin cleats.

LIMIT STATE LOADS FROM AS/NZS 1170:2002:

Dead load:	G	=	0.15kPa
Live load:	Q	=	0.25kPa
Design ultimate wind pressure:	P_u	=	-0.91 kPa (uplift)
Design ultimate wind pressure:	P_u	=	0.44 kPa (downward)
Design serviceability wind pressure:	P_s	=	-0.59 kPa (uplift)
Design serviceability wind pressure:	P_s	=	0.29 kPa (downward)

GEOMETRY:

Span:	L	=	10 m
Purlin Spacing:	S	=	2.4 m

a) **Check serviceability limit state (deflection) using w_s values in Design Capacity Tables:**

Serviceability Load Combinations (assume no ceiling attached to purlins):

$G + \psi_l Q$ = 0.15 + 0 x 0.25 = 0.15 kPa
P_s = -0.59 kPa
P_s = 0.29 kPa

Calculate the maximum absolute uniform distributed loads:

w_s^* = 2.4 x 0.15 = 0.360 kN/m (dead load)

w_s^* = 2.4 x (-0.59) = -1.416 kN/m (wind)

1) Where purlins are 10% lapped for no fewer than 5 bays:

Check wind load at deflection limit of L/150 from charts for *HST* 250/15, Lapped 10% Internal:

w_s = 2.85 kN/m > w_s^* (wind), OK

Check dead load at deflection limit of L/300 from charts for *HST* 250/15, Lapped 10% Internal:

w_s = 2.85 x 150/300 = 1.425 kN/m > w_s^* (dead load), OK

Therefore, use ***HST*** 250/15, Lapped 10% Internal.

2) Where purlins are continuous for no fewer than 5 bays:

Check wind load at deflection limit of L/150 from charts for *HST* 250/18, Continuous Internal:

w_s = 3.31 kN/m > w_s^* (wind), OK

Check dead load at deflection limit of L/300 from charts for *HST* 250/18, Continuous Internal:

w_s = 3.31 x 150/300 = 1.655 kN/m > w_s^* (dead load), OK

Therefore, use ***HST*** 250/18, Continuous Internal.

b) **Check ultimate limit state using $\phi_b w_{bx}$ values in Design Capacity Tables:**

Ultimate Load Combinations:

1.35G	=	1.35 x 0.15	=	0.203 kPa
1.2G + 1.5Q	=	1.2 x 0.15 + 1.5 x 0.25	=	0.555 kPa
1.2G + P_u	=	1.2 x 0.15 + 0.44	=	0.620 kPa
0.9G + P_u	=	0.9 x 0.15 + (-0.91)	=	-0.775 kPa

Calculate the maximum absolute uniform distributed loads:

w_x^* = 2.4 x (-0.775) = -1.860 kN/m

Option 1:
Check ultimate limit state from charts for *HST* 250/15, Lapped 10% Internal:

$\phi_b w_{bx}$ = 2.47 kN/m (2B) > w_x^*, OK

Therefore, use ***HST*** 250/15, Lapped 10% Internal, with 2 rows of bracing.

Option 2:
Check ultimate limit state from charts for *HST* 250/18, Continuous Internal:

$\phi_b w_{bx}$ = 2.31kN/m (2B) > w_x^*, OK

Therefore, use ***HST*** 250/18, Continuous Internal, with 2 rows of bracing.

BRACE CHANNEL CAPACITY

Where braces are subject to additional loads such as the support of reticulation systems, engineers should calculate axial and bending loads on the braces and then check the member for the combined axial bending and compression in accordance with the formula given on page 4 of the brochure and the following tables.

Brace channel subjected to additional loads should have bolted connections to purlins.

SECTIONAL PROPERTIES

	AREA	WEIGHT	SECOND MOMENT OF AREA (GROSS SECTION)		SECTION MODULUS		RADIUS OF GYRATION		TORSION CONSTANT	WARPING FACTOR
DESIGNATION	A_s mm^2	W_t kN/m	I_x 10^6mm^4	I_y 10^6mm^4	Z_x 10^3mm^3	Z_y 10^3mm^3	r_x mm	r_x mm	J mm^4	I_w 10^9mm^6
100x32x0.95	169	0.0133	0.249	0.0238	5.03	1.07	38.4	11.9	50.9	0.0499
100x32x1.15	204	0.016	0.298	0.0282	6.04	1.28	38.2	11.8	89.8	0.0588

Note: All section properties are for the gross section.

SECTIONAL CAPACITIES BENDING

	SECTION MOMENT CAPACITY	DISTORTIONAL BUCKLING MOMENT CAPACITY	FLEXI-TORSIONAL BUCKLING MOMENT CAPACITY (KN.M) $\phi_b M_{fbx}$ EFFECTIVE LENGTH (LE) IN METRES								
DESIGNATION	$\phi_b M_{sx}$ (kN.m)	$\phi_b M_{dbx}$ (kN.m)	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
100x32x0.95	1.18	1.11	1.05	0.941	0.814	0.667	0.522	0.42	0.348	0.293	0.252
100x32x1.15	1.42	1.34	1.25	1.13	0.977	0.809	0.638	0.517	0.431	0.366	0.316

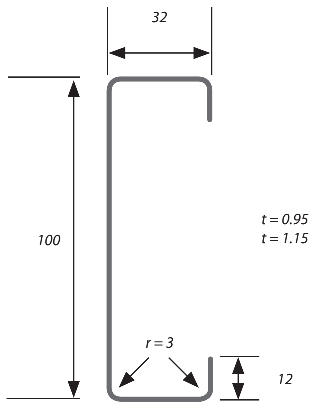
SECTIONAL CAPACITIES SHEAR AND AXIAL COMPRESSION

	SHEAR CAPACITY	AXIAL COMPRESSION SECTION CAPACITY	AXIAL COMPRESSION MEMBER CAPACITY (KN) $\phi_c N_c$ EFFECTIVE LENGTH (LE) IN METRES								
DESIGNATION	$\phi_v V_v$ (kN.m)	$\phi_c N_s$ (kN.m)	1	1.25	1. 5	1.75	2	2.25	2.5	2.75	3
100x32x0.95	8.1	26.4	19.2	16	12.9	10.1	8.05	6.6	5.51	4.63	3.89
100x32x1.15	12.4	33.7	24.4	20.4	16.4	12.8	10.1	8.18	6.63	5.47	4.6

SECTIONAL CAPACITIES ELASTIC BUCKLING

	AXIAL COMPRESSION MEMBER CAPACITY (KN) N_e EFFECTIVE LENGTH (LE) IN METRES								
DESIGNATION	1	1.25	1. 5	1.75	2	2.25	2.5	2.75	3
100x32x0.95	492	315	219	161	123	97.2	78.7	65. 1	54.7
100x32x1.15	589	377	262	192	147	116	94.2	77.9	65.4

BRACE CHANNEL DIMENSIONS



DETAILING AND INSTALLATION

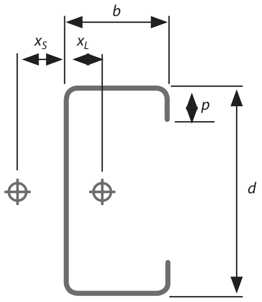
ORDERING

Orders may be placed at any Steel & Tube sales office on the standard form. Purlin size and length must be specified, along with hole size and placement. Holes are in pairs, symmetrical about the longitudinal axis in the web, or centerline of the flange.

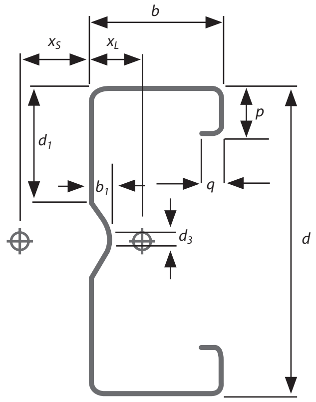
Delivery destination should be specified as it is the customer's responsibility to have unloading facilities available at time of delivery.

SECTION GEOMETRY

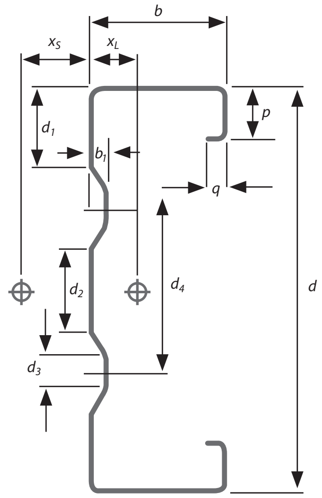
PROFILE I



PROFILE II



PROFILE III



PURLIN DIMENSIONS

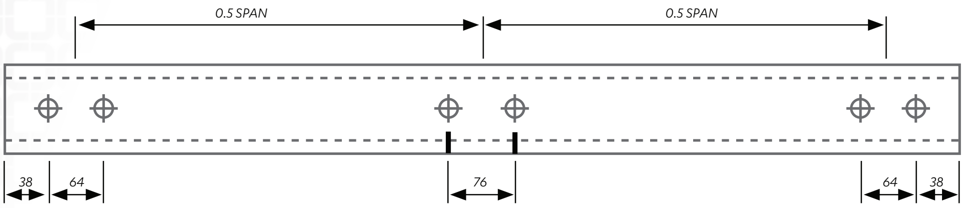
PROFILE	PURLIN SIZE *HST*	d MM	b MM	t MM	p MM	q MM	b_1 MM	d_1 MM	d_2 MM	d_3 MM	d_4 MM	x_L MM	x_s MM	AREA A_s MM^2	MASS KG/M
I	100/12	102	51	1.15	15							16.8	24.9	253	2.03
	100/15	102	51	1.45	15							16.6	24.7	316	2.54
	100/19	102	51	1.85	15							16.4	24.4	400	3.23
II	150/12	152	65	1.15	24	10	8	59		7		23.5	33.3	386	3.03
	150/15	152	65	1.45	24	10	8	59		7		23.2	32.9	483	3.79
	150/18	152	65	1.75	24	10	8	59		7		23	32.6	578	4.56
III	200/12	203	75	1.15	25	12	8	59	10	10	48	25.1	35.2	478	3.80
	200/15	203	75	1.45	25	12	8	59	10	10	48	24.9	35.1	598	4.76
	200/18	203	75	1.75	25	12	8	59	10	10	48	24.6	34.9	717	5.72
	250/13	250	85	1.25	33	12	10	59	14	25	73	28.7	37.8	625	5.01
	250/15	250	85	1.45	33	12	10	59	14	25	73	28.6	37.7	722	5.79
	250/18	250	85	1.75	33	12	10	59	14	25	73	28.3	37.6	866	6.96
	300/15	300	100	1.45	38	12	10	59	64	25	123	32.1	45.3	847	6.72
	300/18	300	100	1.75	38	12	10	59	64	25	123	31.9	45.1	1018	8.08
	300/24	300	100	2.4	38	12	10	59	64	25	123	31.4	44.8	1382	11.01
	300/30	300	100	3	38	12	10	59	64	25	123	30.9	44.5	1711	13.71
	350/18	350	100	1.75	43	12	10	70	92	25	151	30.4	45.1	1123	8.96
	350/24	350	100	2.4	43	12	10	70	92	25	151	29.9	44.8	1526	12.08
	350/30	350	100	3	43	12	10	70	92	25	151	29.5	44.5	1891	15.05
	400/20	400	100	1.95	48	12	10	75	132	25	191	29.1	45	1365	10.78
	400/24	400	100	2.4	48	12	10	75	132	25	191	28.8	44.8	1670	13.23
	400/30	400	100	3	48	12	10	75	132	25	191	28.3	44.4	2071	16.48

Notes:

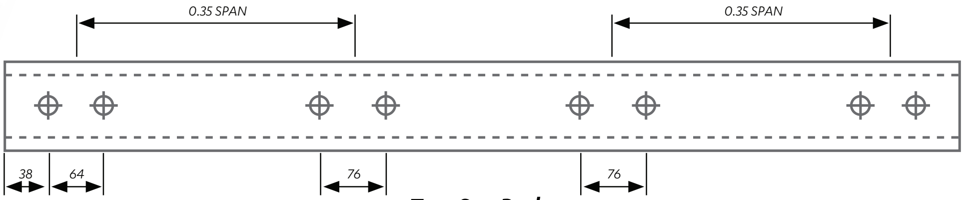
1. All section properties are for the gross section.
2. x_L = Centroid x_s = Shear Centre.

STANDARD HOLE LOCATIONS

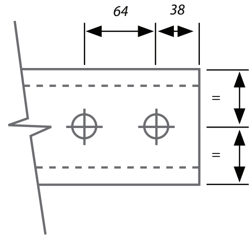
HST 100 (14mm holes only)



One Sag Rod

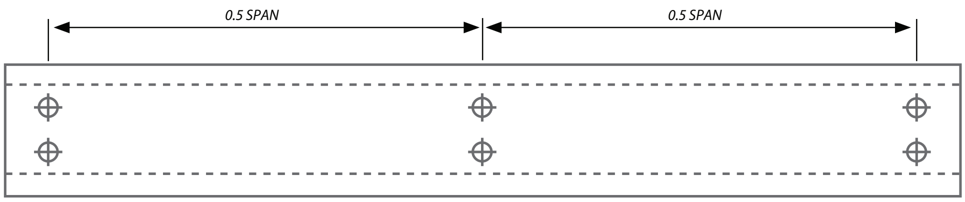


Two Sag Rods

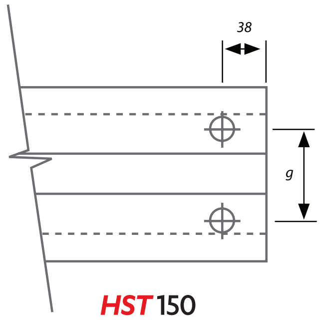


HST 100

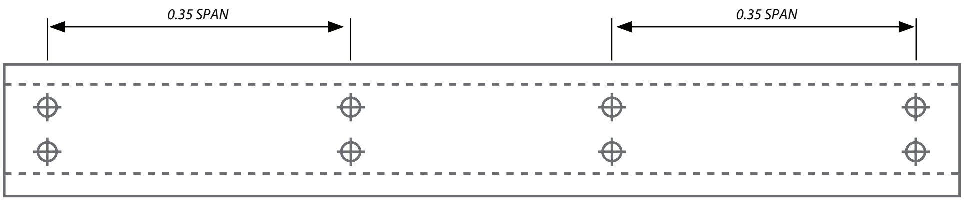
HST 150, HST 200, HST 250, HST 350, HST 400



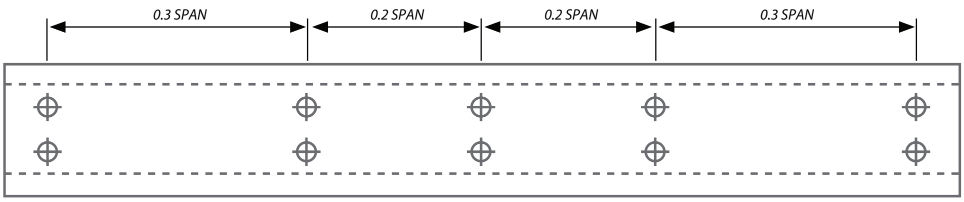
One Brace



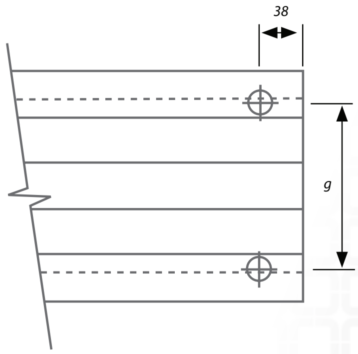
HST 150



Two Braces

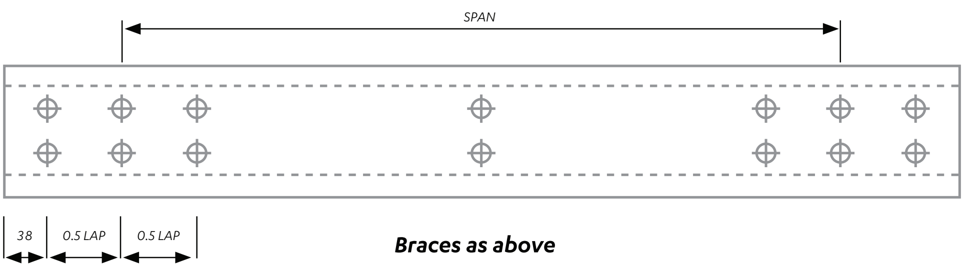


Three Braces



HST 200, HST 250,
HST 300, HST 350,
HST 400

LAPPED PURLINS



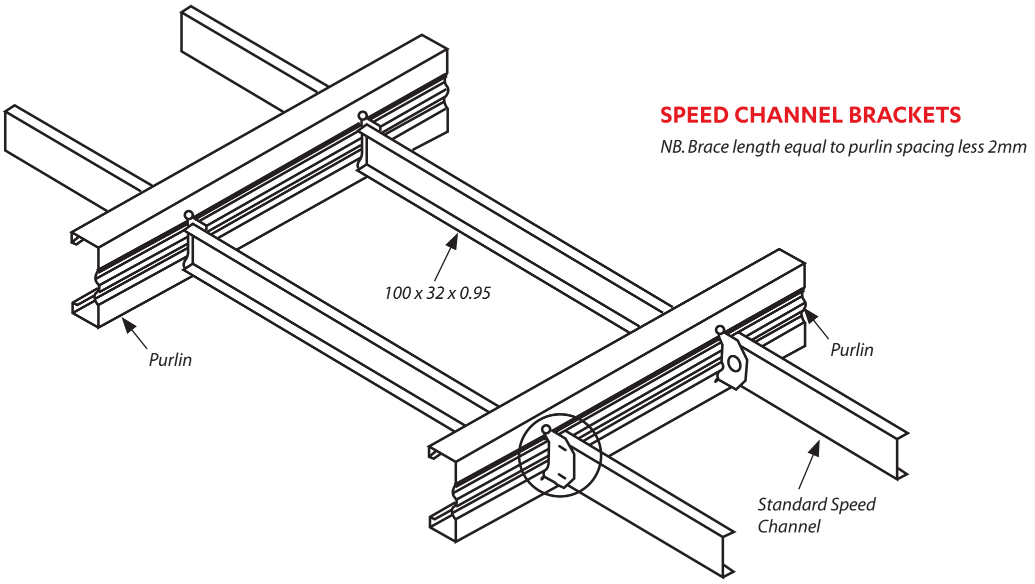
Braces as above

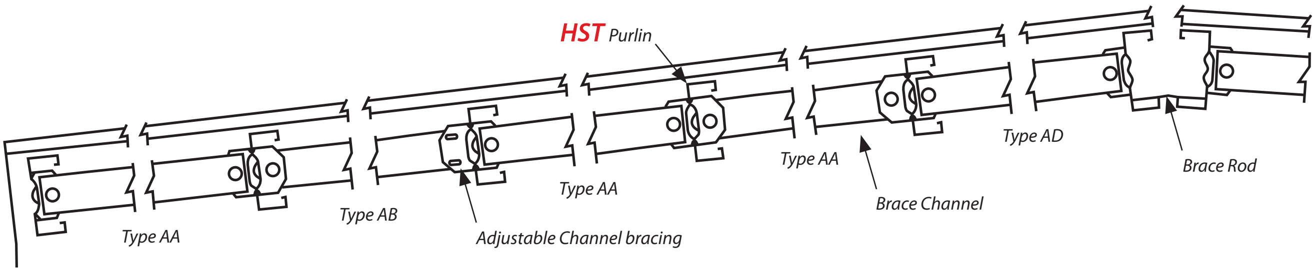
BRACING

SPEED CHANNEL

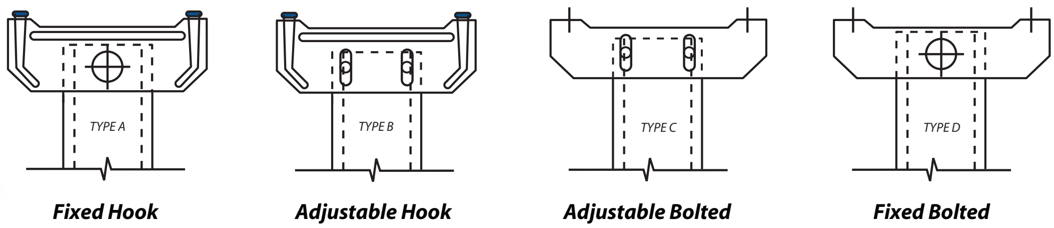
Speed Channel is designed to fit purlins pre-punched with round 18mm diameter holes. The apex purlin has a bolted connection, thereafter hook connections are used to the eaves. The eaves purlin has a bolted connection which can be supplied adjustable if required. To maintain a continuous line, the eaves and apex purlins require holes offset 25mm each side of the nominal bracing line. Speed Channel bracing length should be calculated at the purlin spacing less 2mm.

SPEED CHANNEL BRACKETS





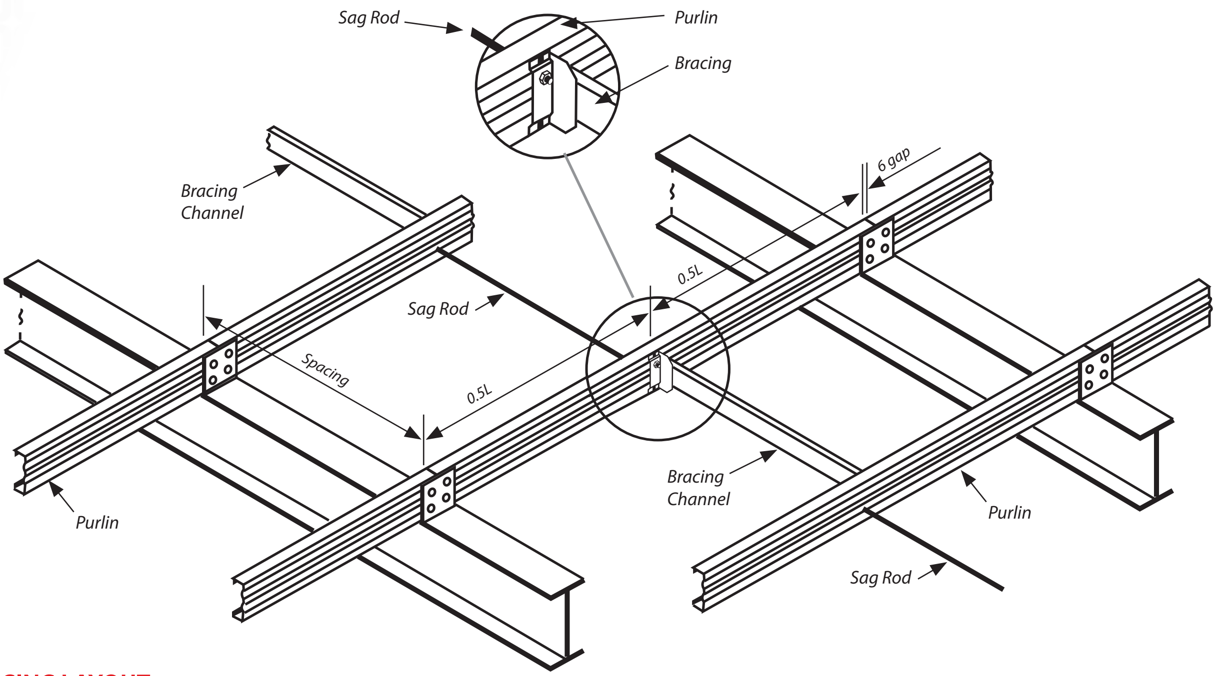
SPEEDBRACE END IDENTIFICATION



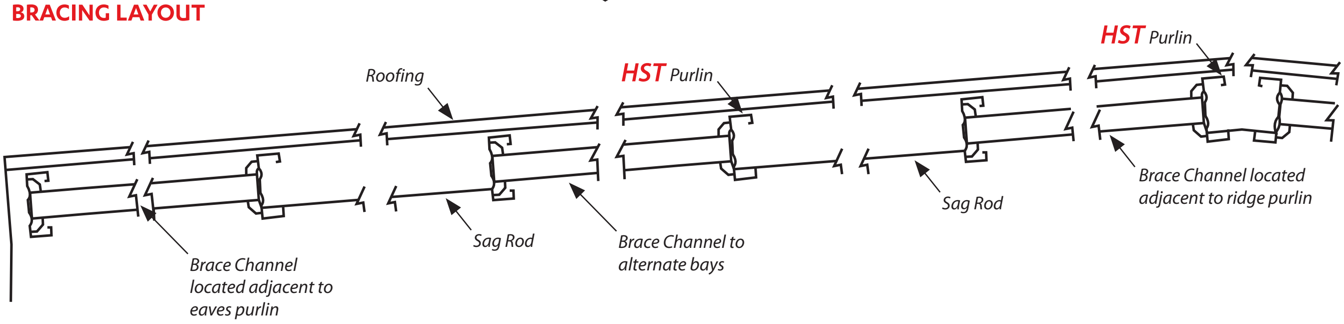
BRACING

CHANNEL/ROD BRACING

Channel/rod systems may be used with purlins punched with 14 or 18mm diameter holes, with alternating channels and rods. The top and bottom purlin bracing must consist of a channel in all instances.

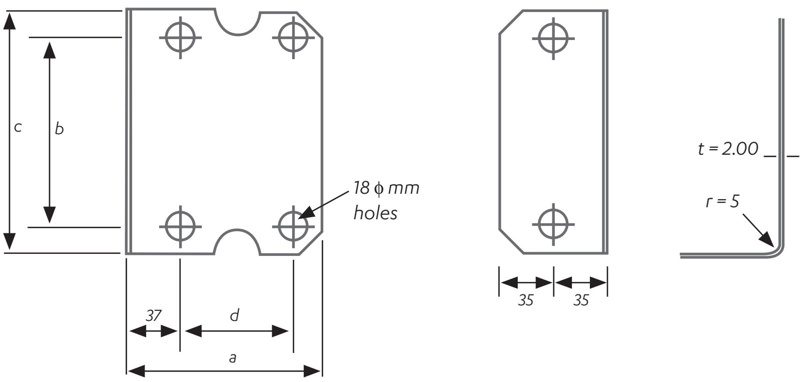


BRACING LAYOUT



GENERAL PURPOSE BRACKETS

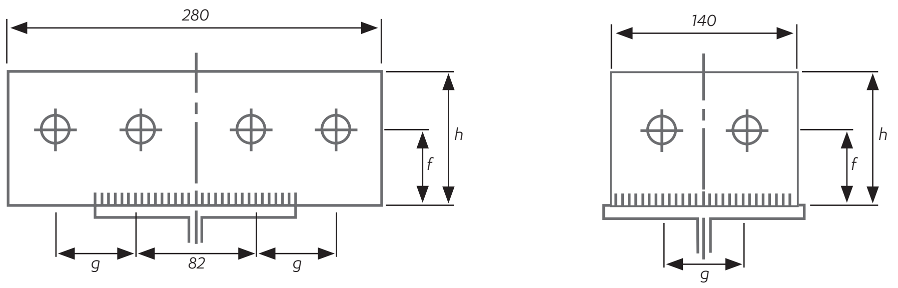
(NB. THIS CLEAT IS FOR NON STRUCTURAL PURPOSES ONLY)



PURLIN	DIMENSIONS			
	a	b	c	d
	mm	mm	mm	mm
HST 150	130	80	112	65
HST 200	130	120	155	75
HST 250	150	160	195	85
HST 300	150	200	250	95
HST 350	180	240	290	105
HST 400	180	280	330	115

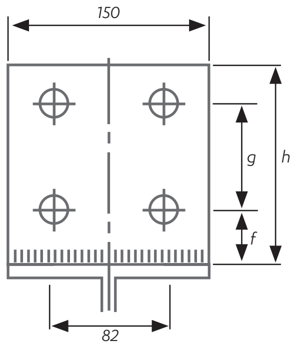
STANDARD CLEAT DETAILS

HST 100

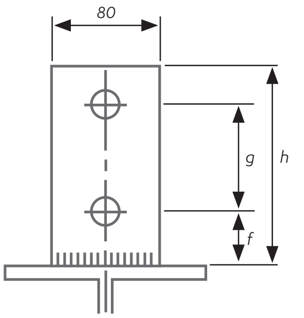


PURLIN	DIMENSIONS		
	f	***g***	***h***
HST 100	57	64	100
HST 150	41	80	150
HST 200	48	120	200
HST 250	53	160	250
HST 300	55	200	300
HST 350	60	240	340
HST 400	70	280	380

HST 150, 200, 250, 300, 350, 400

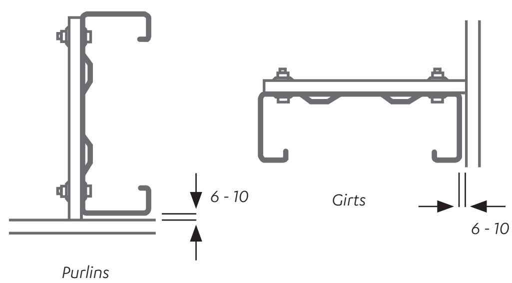


Cleats at internal supports



Cleats at end supports

FASTENING TO CLEATS



SITE HANDLING AND STORAGE

TRANSPORT AND HANDLING

Caution: Purlins may have sharp edges and appropriate gloves should be worn whenever handling.

Care should be taken when unloading and craning on site, and exclusion zones must be enforced.

Lengths up to 18 metres can be accommodated on our standard transport; longer lengths can be supplied subject to the cost and availability of suitable transport. Lengths will be supplied in bundles, and each bundle and purlin will have mark numbers inscribed.

Purlins must be unloaded without damaging the purlin or the zinc coating, and stored above ground on non-corrosive bearers. Water entrapment between closely stacked galvanised surfaces can lead to white rust or wet storage stain, and premature consumption of the galvanized protective coating. If purlins become wet on site they must be separated before the appearance of white rust, to allow air access to all surfaces.

Corrosive matter such as grinding swarf, chemicals and site debris must be prevented from contacting and affecting the galvanized surface.

SELECTION GUIDES

PURLIN SPAN INDICATOR

The following tables are indicative purlin sizes for enclosed buildings in different Wind Zones as described by NZS 3604:2011, for specific purlin spans and spacings. These are intended for the use of making initial costings only; in all cases specific advice should be obtained from a qualified design engineer before construction.

Please note that Wind Zone is affected by a number of factors including region, topography and ground roughness; for instance, buildings on the crest of a rise or adjacent to open terrain will experience higher wind loads.

Generally purlins will require 1 brace per span. Purlin sizing, bracing, spans or spacing may require adjustment at building peripheries and external corners.

MEDIUM WIND ZONE

PURLIN SPACING	PURLIN SPAN					
	5.000	6.000	7.000	8.000	9.000	10.000
0.900	***HST*** 150/12	***HST*** 150/15	***HST*** 200/12	***HST*** 250/15	***HST*** 250/15	***HST*** 300/15
1.200	***HST*** 150/12	***HST*** 200/12	***HST*** 200/15	***HST*** 250/15	***HST*** 300/15	***HST*** 300/18
1.500	***HST*** 150/15	***HST*** 200/12	***HST*** 250/15	***HST*** 300/15	***HST*** 300/18	***HST*** 350/18
1.800	***HST*** 150/15	***HST*** 200/15	***HST*** 250/15	***HST*** 300/15	***HST*** 300/18	***HST*** 400/20
2.400	***HST*** 200/12	***HST*** 250/15	***HST*** 300/15	***HST*** 300/18	***HST*** 350/18	***HST*** 400/20

HIGH WIND ZONE

PURLIN SPACING	PURLIN SPAN					
	5.000	6.000	7.000	8.000	9.000	10.000
0.900	***HST*** 150/12	***HST*** 200/12	***HST*** 200/15	***HST*** 250/15	***HST*** 300/15	***HST*** 300/18
1.200	***HST*** 150/15	***HST*** 200/15	***HST*** 250/15	***HST*** 300/15	***HST*** 300/18	***HST*** 350/18
1.500	***HST*** 200/12	***HST*** 250/15	***HST*** 250/18	***HST*** 300/15	***HST*** 350/18	***HST*** 400/20
1.800	***HST*** 200/15	***HST*** 250/15	***HST*** 300/15	***HST*** 300/18	***HST*** 400/20	***HST*** 400/24
2.400	***HST*** 200/15	***HST*** 300/15	***HST*** 300/18	***HST*** 350/18	***HST*** 400/20	***HST*** 400/30

VERY HIGH WIND ZONE

PURLIN SPACING	PURLIN SPAN					
	5.000	6.000	7.000	8.000	9.000	10.000
0.900	***HST*** 150/15	***HST*** 200/12	***HST*** 250/15	***HST*** 250/18	***HST*** 300/18	***HST*** 350/18
1.200	***HST*** 200/12	***HST*** 250/15	***HST*** 250/18	***HST*** 300/15	***HST*** 350/18	***HST*** 400/20
1.500	***HST*** 200/15	***HST*** 250/15	***HST*** 300/15	***HST*** 350/18	***HST*** 400/20	***HST*** 400/24
1.800	***HST*** 200/15	***HST*** 250/18	***HST*** 300/18	***HST*** 350/18	***HST*** 400/24	***HST*** 400/30
2.400	***HST*** 250/15	***HST*** 300/15	***HST*** 350/18	***HST*** 400/20	***HST*** 400/30	

FLOOR JOIST SPAN TABLE

HST	SINGLE SPAN (M) JOISTS SPACING (MM)			DOUBLE SPAN (M) JOISTS SPACING (MM)		
	400MM	450MM	600MM	400MM	450MM	600MM
IMPOSED FLOOR ACTIONS: UNIFORMLY DISTRIBUTED ACTIONS = 1.5 KPA OR CONCENTRATED ACTIONS = 1.8KN (GENERAL RESIDENTIAL BUILDING)						
15012	3.6	3.5	3.2	4.1	4.0	3.6
15015	4.0	3.8	3.5	4.5	4.3	3.9
15018	4.2	4.1	3.7	4.8	4.6	4.2
20012	4.7	4.5	4.1	5.3	5.1	4.6
20015	5.1	4.9	4.5	5.8	5.6	5.1
20018	5.5	5.3	4.8	6.1	6.0	5.4
25013	5.9	5.7	5.1	6.5	6.3	5.8
25015	6.1	6.0	5.4	6.7	6.5	6.1
25018	6.5	6.3	5.8	7.1	6.9	6.4
30015	7.0	6.8	6.3	7.7	7.4	6.9
30018	7.4	7.2	6.7	8.1	7.8	7.3
30024	7.7	7.4	6.9	8.3	8.1	7.5
30030	8.1	7.9	7.3	8.8	8.6	8.0
35018	7.7	7.5	7.0	8.4	8.2	7.6
35024	8.4	8.2	7.6	9.2	8.9	8.3
35030	8.9	8.7	8.1	9.7	9.4	8.8
40020	8.7	8.4	7.8	9.4	9.1	8.5
40024	9.2	8.9	8.3	9.9	9.7	9.0
40030	9.7	9.4	8.8	10.5	10.2	9.5
IMPOSED FLOOR ACTIONS: UNIFORMLY DISTRIBUTED ACTIONS = 3.0 KPA OR CONCENTRATED ACTIONS = 2.7KN (GENERAL OFFICE BUILDING)						
15012	3.0	2.9	2.6	3.4	3.3	3.0
15015	3.3	3.2	2.9	3.7	3.6	3.2
15018	3.5	3.4	3.1	4.0	3.8	3.5
20012	3.9	3.8	3.4	4.4	4.2	3.8
20015	4.3	4.1	3.7	4.8	4.6	4.2
20018	4.5	4.4	4.0	5.1	4.9	4.5
25013	4.9	4.7	4.3	5.5	5.3	4.8
25015	5.2	5.0	4.5	5.8	5.6	5.1
25018	5.5	5.3	4.8	6.2	6.0	5.4
30015	6.1	5.9	5.4	6.7	6.5	6.0
30018	6.4	6.2	5.8	7.0	6.8	6.3
30024	6.9	6.7	6.2	7.5	7.3	6.8
30030	7.3	7.1	6.6	7.9	7.7	7.1
35018	6.9	6.7	6.3	7.6	7.4	6.9
35024	7.6	7.3	6.8	8.3	8.0	7.4
35030	8.0	7.8	7.2	8.7	8.5	7.9
40020	7.8	7.5	7.0	8.5	8.3	7.7
40024	8.2	7.9	7.4	9.0	8.7	8.1
40030	8.7	8.4	7.9	9.5	9.2	8.6
IMPOSED FLOOR ACTIONS: UNIFORMLY DISTRIBUTED ACTIONS = 5.0 KPA OR CONCENTRATED ACTIONS = 4.5 KN (LIGHT STORAGE BUILDING)						
15012	2.6	2.5	2.3	2.9	2.8	2.6
15015	2.8	2.7	2.5	3.2	3.1	2.8
15018	3.0	2.9	2.6	3.4	3.3	3.0
20012	3.4	3.2	2.9	3.8	3.6	2.9
20015	3.7	3.5	3.2	4.1	3.9	3.6
20018	3.9	3.8	3.4	4.4	4.2	3.8
25013	4.2	4.0	3.7	4.7	4.4	3.5
25015	4.4	4.3	3.9	5.0	4.8	4.4
25018	4.8	4.6	4.2	5.4	5.2	4.7
30015	5.3	5.1	4.6	5.9	5.4	4.3
30018	5.7	5.4	4.9	6.3	6.1	5.6
30024	6.2	6.0	5.5	6.7	6.5	6.1
30030	6.5	6.3	5.8	7.1	6.9	6.4
35018	6.2	6.0	5.5	6.8	6.6	5.6
35024	6.8	6.6	6.1	7.4	7.2	6.7
35030	7.2	7.0	6.5	7.8	7.6	7.1
40020	7.0	6.8	6.3	7.6	7.4	6.6
40024	7.4	7.2	6.7	8.0	7.8	7.3
40030	7.8	7.6	7.1	8.5	8.3	7.7

Notes:

1. Floor joists designed to support the floor loads only. The above table assumes the use of standard particleboard or plywood for flooring.
2. The dynamic performance of the floor system meets the criteria in NASH Standard: Residential and Low-rise Steel Framing-Part 1 (2009).
3. For increased performance where ceilings are not installed, the use of a transverse brace is recommended (eg. Ceiling batten – CB20 or similar, to the underside of the floor joists at 3 metre centres typical).

STRONGER IN EVERYWAY

To find out more about our extensive range of products and services:

- Steel
- Pipe, Fittings & Valves
- Stainless Steel
- Fastenings
- Chain & Rigging
- Rural Products
- Industrial Products
- Reinforcing
- Roofing, Cladding, Rainwater Systems & Purlins

CONTACT US TODAY:
0800 478 335
www.steelandtube.co.nz

S&T029N