

the  
futurebuild®  
range

FUTUREBUILD®  
STRUCTURAL LVL

hy  
ONE®

FUTUREBUILD®  
STRUCTURAL LVL

hy  
SPAN®

FUTUREBUILD®  
LVL TRUSS CHORDS

hy  
CHORD®

FUTUREBUILD®  
STRUCTURAL LVL  
BEAMS

hy  
90®

FUTUREBUILD®  
LVL ENGINEERED  
P-JOISTS

hy  
JOIST®

FUTUREBUILD®  
LVL SCAFFOLD  
PLANKS

hy  
PLANK®

FUTUREBUILD®  
LVL FORMWORK  
BEAMS

tru  
FORM®

FUTUREBUILD®  
LVL FORMWORK  
EDGE BOARDS

edge  
FORM®

# FUTUREBUILD® LVL SPECIFIC ENGINEERING DESIGN GUIDE

AUGUST 2018

Information contained within is specific to the Futurebuild® range of LVL products and must not be used with any other LVL products no matter how similar they may appear.

# FUTUREBUILD LVL SPECIFIC ENGINEERING DESIGN GUIDE

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## 1.0 LAMINATED VENEER LUMBER

Laminated Veneer Lumber (LVL) is an engineered wood material with defined and reliable strength and stiffness properties. It is suited to a wide range of structural applications, including critical elements such as large span portal frames and primary or secondary beams in commercial buildings.

### 1.1 FUTUREBUILD® LVL

Manufactured by Futurebuild® in Northland, New Zealand, the Futurebuild LVL range is New Zealand's largest range of LVL. The Futurebuild LVL range of products features specific material property 'recipes'. As such the information contained within this literature is specific to the Futurebuild LVL range and must not be used with any other LVL products no matter how similar they may appear.

For designers Futurebuild LVL offers:

- Consistent structural performance with low variability.
- Third party certification of conformance with AS/NZS 4357 by the Engineered Wood Products Association of Australasia (EWPAA)<sup>1</sup>.
- Long lengths and large cross-sectional dimensions.
- Dimensionally stable product, which is easily installed on site.

<sup>1</sup>Some products, including non standard I-Joists, may not carry EWPAA certification.

This literature contains general design information and material properties intended for use where members are specifically engineered for applications not covered by Futurebuild product brochures. For design information for standard applications visit [www.futurebuild.co.nz](http://www.futurebuild.co.nz).

Futurebuild LVL products must be competently installed in accordance with good building practices and sound design principles to satisfy the requirements of the Building Act 2004, the New Zealand Building Code, and applicable New Zealand Standards. This is the responsibility of building owners and the design professionals and builders that they engage. This document contains information, limitations, and cautions regarding the properties, handling, installation, usage, and the maintenance of Futurebuild LVL products. However, to the maximum extent permitted by law, Futurebuild assumes no legal liability to you in relation to this information.

When specifying or installing any Futurebuild LVL product visit [www.futurebuild.co.nz](http://www.futurebuild.co.nz) or call 0800 585 244 to ensure you have current specification material and any relevant technical notes.

*The information contained in this document is current as at August 2018. It is your responsibility to ensure you have the most up to date information available.*

*The information contained in this publication relates specifically to Futurebuild® LVL products manufactured by Carter Holt Harvey LVL Limited and must not be used with any other LVL manufacturer's product no matter how similar they may appear.*

*Alternative LVL products can differ in a number of ways which may not be immediately obvious and substituting them for Futurebuild LVL products is not appropriate and could in extreme cases lead to premature failure and/or buildings which do not meet the requirements of the New Zealand Building Code.*

## 1.2 RESIDENTIAL BUILDINGS

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Software for the design of members for use in residential construction can be downloaded from [www.chhsoftware.com](http://www.chhsoftware.com).

### 1.2.1 designIT® for houses

designIT® for houses is a tool for building industry professionals involved in designing houses and similar structures using the Futurebuild® range of engineered wood products and other selected materials. Quick and simple to use, subject to the terms of a licence agreement, the deceptively powerful designIT software is useful for the selection of beam sizes.

### 1.2.2 layITout® for houses

layITout® for houses is an integrated design and layout tool that allows users to enter a house plan, propose, and then design a floor joist or rafter layout for a fully integrated engineered system.

### 1.2.3 designIT site

designIT site is a smartphone app developed as a handy reference tool for the specifier or tradesman on the go. The designIT site app is a trimmed down version of designIT for houses.

### 1.2.4 floorIT site

floorIT site is a smartphone app to aid specifiers in the specification, selection and estimation of quantities for a range of flooring applications.

## 1.3 COMMERCIAL & INDUSTRIAL BUILDINGS

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The Preliminary Design Service is an LVL focused initiative to provide design tools and specialised products for the development of portal frame structures using the Futurebuild LVL range of products. Futurebuild LVL solutions include software platforms, engineering design tools and advice, a commercial product range and a network of experienced

pre-fabricators to provide cost effective LVL portal frames to the market.

To access the tools below visit [www.chhsoftware.com](http://www.chhsoftware.com) or call 0800 585 244 to speak to an experienced timber design engineer.

## 1.4 ENGINEERING DESIGN TOOLS

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The following design tools are available for the Futurebuild LVL range.

### 1.4.1 Fully Worked Design Example

A fully worked design example of a portal frame structure including design computations, standards references and design and practical application tips. This example covers member design and specification, connections to and from secondary and primary framing members and lateral support components.

### 1.4.2 Engineering Support

We have an in-house engineering team consisting of Chartered Professional Engineers with many years of combined consultancy experience with an emphasis on Timber Engineering. They are available to speak to you about issues ranging from design and specification to the suitability of details for fabrication and erection advice.

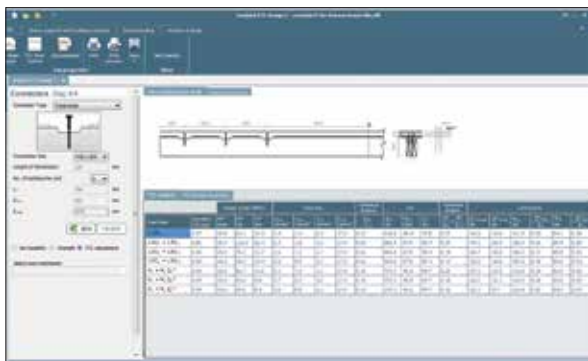
### 1.4.3 computelT® Software Suite

The computelT® software suite consists of software packages; computelT for beams and computelT toolKIT. It is designed to aid in the specification of heavy structural members and non-residential structural systems. It enables engineers, even those unfamiliar with the specifics of timber engineering to produce high quality, reliable specifications.

### 1.4.4 computelT® for beams

computelT® for beams is a beam analysis package that enables engineers to develop design solutions for a range of engineered wood products, including Timber Concrete Composite (TCC) Floors design using EXPAN® technology to provide composite action between concrete and Laminated Veneer Lumber (LVL). Developed by engineers for engineers, computelT for beams allows engineers the flexibility of making design decisions using LVL based structural solutions. computelT for beams provides users with an easy to use interface that allows engineers to:

- Enter complex beam design situations, including statically indeterminate beams and cantilevers.
- Enter a number of different load types including point loads, UDL's and trapezoidal/triangular loads.
- Enter beam restraint information for calculation of capacities in accordance with AS 1720.1:2010.
- Make engineering decisions based on engineering outputs including, deflection, bending moment and shear force diagrams.
- Design connections using a number of common connection details.
- Analyse a number of different members to produce cost effective design solutions.
- View graphical representations of beam geometry, loading and design action effect diagrams.
- Select loading combinations to AS/NZS 1170.
- Apply design actions from other members within a job.
- Create a job specific Engineering Analysis Report including designed members and connections.
- Optimise TCC Floor design using all three shear connections: trapezoidal notch with coach bolts, triangular notch with coach bolts and an un-notched shear connector using angled SFS screws.



computelT® for Beams: TCC Floor Design - Analysis and Design.

### 1.4.5 computelT toolkit

computelT toolkit is a series of design tools to allow engineers the flexibility to quickly and easily design solid and box section structural beam and column members including moment resisting connections, beam and column members subject to combined actions, and purlins and girts.

Included in the computelT toolkit is Expan Quick Connect moment resisting connection design technology. The Quick Connect technology uses a threaded rod, washers and nuts for easy connection on site through factory fitted LVL sleeves. It also provides engineers with alternate moment resisting connections such as nail and screw rings used in portal frame solutions.

Developed by experienced timber design engineers using the most up to date information from design standards, the computelT toolkit provides users with the opportunity to:

- Design moment resisting connections with commonly available materials and connectors.
- Design solid and built up members subject to combined actions easily, considering the effects of alternate restraint options.
- Select loading combinations for analysis to AS/NZS 1170, with automatic selection of duration of load factor.
- Analyse different members to determine cost effective options
- Design solid and i-beam purlins and girts, including support and restraint details.
- Create a job specific Engineering Analysis Report including designed members and connections.



computelT Toolkit: Composite Member Design.

### 1.4.6 designIT® for commercial floors

designIT® for commercial floors gives building industry professionals a tool for designing commercial, industrial and other heavily loaded floors with the Futurebuild® LVL range of engineered wood products and other selected materials.

## 1.5 FUTUREBUILD® PRODUCT RANGE

Futurebuild® LVL products for the commercial market include:

- hySPAN® sizes and gusset options to provide solid section solutions to 30m clear span.
  - a. 900 x 90 hySPAN.
  - b. 42mm X-BAND hySPAN sheets for gusset connection.
- Cross band (x-band) LVL for building spans over and above 30m where composite, built up sections may be required.
- Made to order composite plywood/LVL I-beams with design aids to suit.
- Thicknesses of Futurebuild LVL ranging from 28mm through to 90mm.

**Table 1: Commonly Manufactured Futurebuild® LVL Thicknesses**

Thickness	Available in 2 x-band	Available in 4 x-band
28mm	✓	
35mm	✓	
38mm	✓	
42mm	✓	✓
45mm	✓	✓
63mm	✓	✓
75mm		
90mm		

## 1.6 GRADES

There is a wide range of Futurebuild LVL products suitable for use in LVL structural systems including:

- hyONE®** (E=16.0GPa)
- hySPAN®** (E=13.2GPa)
- hyCHORD®** (E=11.0GPa)
- truFORM®** (E=10.7GPa), and
- hy90®** (E=9.5GPa)

These products are available for design and specification in any of the thicknesses specified<sup>1</sup>, however for commercial applications we recommend the use of hySPAN for primary members and hyCHORD® or hyJOIST® for secondary members. These tend to be more efficient from a cost perspective.

For the complete range of Characteristic Design Properties refer to section 3.0.

<sup>1</sup>Lead times apply.

## 1.7 CROSS BANDED FUTUREBUILD LVL (X-BAND)

Cross banded LVL is generally used for one of two different reasons:

- Dimensional stability, where sections exhibit a depth to breadth ratio of > 10. The x-bands restrict the movement of moisture across the section effectively removing the cupping phenomenon.
- The creation of connections, where the direction of the grain of the members being connected drives the nail spacing of the member (as typically applied in a plywood gusset).

There are also some other practical and theoretical reasons why cross bands are generally required in the creation of built up sections.

These reasons include:

- Additional crosswise stiffness – The x-bands provide additional stiffness and strength across the grain. Typically, LVL is no different to timber in the fact that the cells run in the direction of the grain meaning that timber can be relatively easily broken across the grain. The existence of cross bands effectively ties these together. This is also advantageous from a practical perspective when handling product that can be up to 18.2m long as it increases the sturdiness of the sections.
- X-bands enhance the shear capacity of 'panels', the cross laminates break up the tubular structure and provide additional resistance to shear. It should also be noted that the webs of a box beam are components that are required to carry shear, as well as bending and compression.

## 1.8 PURLIN DESIGN

Purlin design in LVL buildings is currently limited to readily available I-joists and solid sections. Typically I-joists have weight, strength (lateral restraint) and stiffness advantages over solid section purlins, however for smaller bays, solid sections can have installation advantages.

The software package computeIT® toolKIT includes the ability to design and specify Futurebuild LVL products as purlins and girts.

**Table 2: Purlin Span Guidance**

Product	Span
<b>hyJOIST®</b> (Composite plywood & LVL I-beam)	> 7.0m
<b>hySPAN®</b> (Solid LVL section)	< 7.0m
<b>SG</b> (Solid pine sections)	< 4.8m

## 1.9 MADE TO ORDER I-BEAM

Futurebuild® has the ability to provide made to order composite plywood/LVL I-beam. The standard hyJOIST® range was developed to target use in floor joists in houses with purlin spans

up to 10.0m. hyJOIST may not be suitable for purlin spans above 10.0m.

Contact us for more information.

## 1.10 PRE-FABRICATION NETWORK

Pre-fabricators develop cost effective supply solutions using the Futurebuild LVL range (including specific design products) in 100mm increments.

Contact us to discuss your options.

## 1.11 NON STANDARD SIZES & LENGTHS

For commercial quantities, specific engineering designed product can be manufactured in sections up to 1200mm deep in thicknesses from 28mm thick through to 90mm thick, and in lengths up to 18.2m long. Practical limitations apply to the supply

of product such as limiting cupping by keeping depth to breadth ratios at a maximum of 10 for non-cross banded LVL. Minimum order quantities and larger lead times apply to non-standard product. Contact us for more information.

## 1.12 FUTUREBUILD® LVL RANGE SPECIFICATIONS

Futurebuild LVL products are manufactured in accordance with AS/NZS 4357 and have the structural design properties specified in Tables 7, 9, 11 and 13. The following information relates to general Futurebuild LVL production.

**Table 3: Veneer Structural Design Properties**

<b>Veneer Properties</b>	
<b>Thickness</b>	3-4mm
<b>Joints Face</b>	Scarf
<b>Joints Other</b>	Lap/Scarf
<b>Moisture</b>	
<b>Moisture Content at Time of Leaving Mill</b>	8-15%
<b>Nominal Dimensional Tolerances</b>	
<b>Depth</b>	-0mm, + 2mm
<b>Thickness (&lt;90)</b>	-0mm, + 2mm
<b>Thickness (≥90)</b>	-2mm, + 2mm
<b>Mass</b>	
<b>Mass (approximate)</b>	600kg/m <sup>3</sup>
<b>Adhesive &amp; Bond</b>	
<b>Refer AS/NZS 2098 &amp; AS 2754</b>	Phenolic adhesive Type "A" (marine) bond

## 2.0 GENERAL DESIGN CONSIDERATIONS

Design responsibility relies with the building owner and the professionals that the owner engages. The Specifier for the project must ensure that Futurebuild® LVL is an appropriate

product for their individual project. The Specifier must also provide their own specific design or detailing for any areas that fall outside the scope and specifications of this literature.

### 2.1 CHARACTERISTIC STRESSES

The Futurebuild LVL characteristic stresses published are determined in accordance with Section 4 of AS/NZS 4063.2:2010 and so comply with the provisions of the New Zealand Building Code through clause 2.3, and further noted in commentary clause C2.3 in NZS 3603.

Note that:

- Characteristic Stresses may be different for use on flat or on edge as detailed.
- Modules of Elasticity (MOE) is a mean value which includes an allowance for shear deformation.

- Because of the low variability of LVL a lower bound E is not required for most applications, however where required, the lower 5th percentile Modulus of Elasticity may be taken as 0.85 E.
- Selection of Characteristics Stress Values should take into account the allowance for the representativeness of the sample population, allowance for levels of control of process and quality, amongst other things.

**Substitution with similar properties from alternate manufacturers may not provide the calculated design performance. The characteristic stresses of Futurebuild® LVL products are not for use with products from alternative manufacturers.**

### 2.2 STRENGTH REDUCTION FACTOR Ø

The strength reduction factor for calculating the Design Capacity of Structural Members should be taken from Table 4 below,

extracted from Table 2.1 AS1720.1-2010.

**Table 4: Strength Reduction Factors**

	Application of Structural Member		
	Category 1	Category 2	Category 3
	<b>Structural Timber Material</b>	Structural members for houses for which failure would be unlikely to affect an area' greater than 25m <sup>2</sup> ; OR secondary members in structures other than houses	Primary structural members in structures other than houses; OR elements in houses for which failure would be likely to affect an area' greater than 25m <sup>2</sup>
Value of Strength Reduction Factor Ø			
<b>Structural Plywood – AS/NZS 2269.0</b>	0.95	0.85	0.75
<b>Structural Laminated Veneer Lumber – AS/NZS 4357.0</b>	0.95	0.90	0.80

<sup>1</sup>In this context area should be taken as plan area.

### 2.3 DURATION OF LOAD FACTOR

Duration of load factors  $k_1$  for strength and  $k_2$  for stiffness should be as for solid timber in accordance with NZS 3603,

Clause 2.7, Modification factors,  $k_1$  and  $k_2$  for duration of load.

### 2.4 BEARING AREA

Bearing area factor  $k_3$  is as per NZS 3603.





## 2.5 LOAD SHARING

Load sharing factors  $k_4 = k_5 = k_6 = 1.0$ .  
Therefore Futurebuild® LVL is much less variable than sawn lumber, the load sharing relationships in NZS 3603 do not hold.

For example, two pieces of LVL from a batch have very similar strengths whereas in timber  $k_4, k_5, k_6$  recognise that a random stronger piece supports a random weaker piece. Lamination factors do not apply.

## 2.6 STABILITY

Stability factor  $k_8$  – as per NZS 3603. Appendix C of NZS 3603 provides alternate solutions for the determination of slenderness coefficients for beams where built up sections are used, or

where the distribution of design action effects may provide more accurate, less conservative, results.

## 2.7 TEMPERATURE

LVL may be affected when it is exposed to consistent temperatures above 55°C. Specific consideration should be taken for building systems where temperatures exceed 55°C.

Refer to the Technical Note “Design for Durability and Moisture”, downloadable from [www.futurebuild.co.nz](http://www.futurebuild.co.nz).

## 2.8 MOISTURE CONTENT

Where LVL is used in an environment that raises the average moisture content above 15% for periods of 12 months or more, refer to the modification factor  $k_{14}$  in NZS 3603, figure 6.1.

Refer to the Technical Note “Design for Durability and Moisture”, downloadable from [www.futurebuild.co.nz](http://www.futurebuild.co.nz).

Under these conditions LVL may be subjected to a decay hazard.

For use in dry conditions where moisture content remains below 15%, no modification is required.

## 2.9 FACE GRAIN ANGLE

When a design includes cut, sloped or curved edges, the grain orientation factors  $k_{15}$  (for strength) and  $k_{16}$  (for stiffness) should be taken from Table 5.

For stiffness,  $k_{16}$  has the same value as  $k_{15}$  for tension, but the angle is assessed as the average of the two cut edges.

**Table 5: Grain Orientation Factor  $k_{15}$  and  $k_{16}$  for Cut Edges**

Angle of Cut Edge (°)	0	3	5	10	15	20	30	45
Edge in Tension	1.00	0.92	0.80	0.50	0.31	0.21	0.11	0.06
Edge in Compression	1.00	0.97	0.93	0.79	0.65	0.55	0.42	0.32

Futurebuild LVL is made from thin parallel laminated veneers. It is very strong along the grain, but stress perpendicular to the grain should be avoided just as in solid timber. Wide sections

must be handled carefully. The use of cross banded LVL provides significant advantages where tapering, chamfering and notching is to be considered.

## 2.10 SIZE FACTOR

The characteristic values for bending and tension shall include consideration of the section size for which they are intended to apply. The characteristic values for the Futurebuild LVL range for bending and tension shall be modified as follows:

- For beam sections of depth 95mm or less – no adjustment.
- For beam sections of depth exceeding 95mm – multiply the published characterised value for bending by  $(95/d)^{0.154}$ , where  $d$  is the depth of the beam.

- For tension members with width 150mm or less – no adjustment.
- For tension members with the largest cross-sectional dimension exceeding 150mm – multiply the published characterised value for tension by  $(150/d)^{0.167}$ , where  $d$  is the largest cross-sectional dimension of the tension member.

## 2.11 JOINT GROUP

The joint strength group is dependent on the Futurebuild® LVL product, the type of fastener and the grain orientation at the joint.

Table 6 is to be read in conjunction with NZS 3603 Table 4.1: Classification of timber species for joint design.

**Table 6: Classification of LVL Products for Joint Design**

Product	Nails & Screws in Lateral Load	Type 17 Screws in Lateral Load	Nails & Screws in Withdrawal		Type 17 Screws in Withdrawal	Bolts & Coach Screws in Lateral Load Driven into Face	
			Edge	Face	Edge & Face	Parallel to Grain	Perpendicular to Grain
hyONE®	J5	J4	J4	J4	J3	J3	J1
hySPAN®	J5	J4	J4	J4	J3	J3	J1
hyCHORD®	J5	J4	J4	J4	J3	J3	J2
hy90®	J5	J4	J4	J4	J4	J4	J3
hyJOIST® (flange)	J5	J4	J4	J4		not suitable	

The higher performing joint strength groups for Futurebuild LVL are due to the interlocking effect of adjacent veneers aligned at small angles.

## 2.12 FIRE RESISTANCE

The method for calculating the fire resistance of LVL products is described in NZS 3603 section 9. This method is applicable for sections at least 90mm in all dimensions. Recommendations derived from a testing programme on Futurebuild LVL at the University of Canterbury are:

- The design method used for predicting the fire performance of Futurebuild LVL exposed to post-flashover fires is to use the experimentally found char rate  $\beta = 0.72\text{mm/minute}$  to determine a reduced cross-section, and design using normal

temperature properties without considering a heat-affected layer of wood below the char line.

- Design using the char rate  $\beta = 0.65\text{mm/minute}$  (complying with NZS 3603) to calculate a reduced cross section which can be used with normal temperature properties, with an allowance for a 7.5mm zero-strength layer of Futurebuild LVL below the char line.

This data has not been tested on, and is not applicable to LVL made by other manufacturers.

## 3.0 CHARACTERISTIC PROPERTIES

### 3.1 STANDARD SECTION SIZES & CHARACTERISTIC MATERIAL PROPERTIES

We manufacture five Futurebuild® LVL product lines for structural applications, each with specific properties and section sizes.



hySPAN® is our most versatile LVL product: it has high structural properties and is available in the largest range of sizes and lengths. hySPAN is typically specified for structural beams and is also used for lintels, rafters and floor joists in residential structures.

hy90® is a LVL product manufactured primarily for lintels or beams to fit within 90mm light timber frame walls. It has lower structural properties than hySPAN but its thickness offers better member stability when used as long span structural beams or columns.

hyONE® is a 90mm thick high stiffness LVL product manufactured primarily for lintels or floor beams where large spans or depth restrictions apply.

hyCHORD® is available in smaller section sizes to match ordinary kiln-dried timber. hyCHORD is primarily specified as roof truss chords, but can also be used for lintels, rafters, purlins, floor joists, wall studs or other members where smaller section sizes are required.

hyJOIST® is an engineered 'I-beam' utilising LVL flanges and a plywood web. It is ideally suited to floor joist and rafter applications due to its light weight, straightness and the ability to cut large holes through the web (e.g. for services or ventilation).

## 3.2 hySPAN® LIMIT STATE DESIGN CHARACTERISTIC PROPERTIES

**Table 7: Characteristic Limit State Design Stresses and Elastic Moduli for hySPAN®**

Property		Edge MPa	Flat MPa
Modulus Of Elasticity	E	13,200	13,200
Modulus Of Rigidity	G	660	660
Bending	$f_b^1$	50.0	42.0
Tension Parallel to Grain	$f_t^2$	30.0	30.0
Compression Parallel to Grain	$f_c$	42.0	42.0
Shear In Beams	$f_s$	4.6	3.5
Bearing Perpendicular to Grain	$f_p$	12.0	12.0
Joint Group	See Table 6		

Size Factors:

<sup>1</sup>For beams exceeding 95mm – multiply the published characteristic value for bending by  $(95/d)^{0.154}$  where d is the depth of the beam.

<sup>2</sup>For tension members with the largest cross-sectional dimension exceeding 150mm – multiply the published characteristic value for tension by  $(150/d)^{0.167}$ , where d is the largest cross sectional dimension of the tension member.

**Table 8: hySPAN Section Sizes, Properties and Design Capacities**

Dimensions (mm x mm)	Mass (kg/m)	$I_{xx}$ ( $10^6\text{mm}^4$ )	$Z_{xx}$ ( $10^3\text{mm}^3$ )	J ( $10^6\text{mm}^4$ )	$EI_x$ ( $10^9\text{Nmm}^2$ )	$\phi f_b Z_x^*$ (kNm)
150 x 45	4.2	12.7	169	3.7	167	7.1
170 x 45	4.7	18.4	217	4.3	243	8.9
200 x 45	5.6	30.0	300	5.2	396	12.0
240 x 45	6.7	51.8	432	6.4	684	16.9
300 x 45	8.4	101	675	8.3	1337	25.5
360 x 45	10.0	175	972	10.1	2309	35.6
400 x 45	11.2	240	1200	11.3	3168	43.3
150 x 63	6.0	17.7	236	9.2	234	9.9
200 x 63	7.8	42.0	420	13.4	554	16.9
240 x 63	9.4	72.6	605	16.7	958	23.6
300 x 63	11.7	142	945	21.7	1871	35.6
360 x 63	14.1	245	1361	26.7	3233	49.9
400 x 63	15.6	336	1680	30.0	4435	60.6
450 x 63	17.6	478	2126	34.2	6315	75.3
600 x 63	23.4	1134	3780	46.7	14969	128.1

\*  $\phi = 0.9$ , for category 2 applications (Refer to Table 4).

hySPAN® is readily available in lengths up to 13.2 metres. Contact us for availability of non-standard sizes and lengths.



### 3.3 hy90® LIMIT STATE DESIGN CHARACTERISTIC PROPERTIES

**Table 9: Characteristic Limit State Design Stresses and Elastic Moduli for hy90®**

Property		Edge MPa	Flat MPa
Modulus Of Elasticity	E	9,500	9,500
Modulus Of Rigidity	G	475	475
Bending	$f_b^1$	34.0	30.0
Tension Parallel to Grain	$f_t^2$	22.0	22.0
Compression Parallel to Grain	$f_c$	36.6	36.6
Shear In Beams	$f_s$	4.6	2.6
Bearing Perpendicular to Grain	$f_p$	12.0	12.0
Joint Group		See Table 6	

Size Factors:

<sup>1</sup>For beams exceeding 95mm – multiply the published characteristic value for bending by  $(95/d)^{0.154}$  where d is the depth of the beam.

<sup>2</sup>For tension members with the largest cross-sectional dimension exceeding 150mm – multiply the published characteristic value for tension by  $(150/d)^{0.167}$ , where d is the largest cross sectional dimension of the tension member.

**Table 10: hy90 Section Sizes, Properties and Design Capacities**

Dimensions (mm x mm)	Mass (kg/m)	$I_{xx}$ (10 <sup>6</sup> mm <sup>4</sup> )	$Z_{xx}$ (10 <sup>3</sup> mm <sup>3</sup> )	J (10 <sup>6</sup> mm <sup>4</sup> )	$EI_x$ (10 <sup>9</sup> Nmm <sup>2</sup> )	$\phi f_b Z_x^*$ (kNm)
150 x 90	8.4	24.8	330	21.5	235	9.4
200 x 90	11.2	58.7	587	32.8	557	16.0
240 x 90	13.4	101	845	41.9	963	22.4
300 x 90	16.7	198	1320	55.6	1881	33.8
360 x 90	20.1	342	1901	69.2	3250	47.4
400 x 90	22.3	469	2347	78.3	4459	57.6

\*  $\phi = 0.9$ , for category 2 applications (Refer to Table 4).

hy90® is available in lengths up to 7.2 metres. Contact us for availability of non-standard sizes and lengths.

### 3.4 hyONE® LIMIT STATE DESIGN CHARACTERISTIC PROPERTIES

**Table 11: Characteristic Limit State Design Stresses and Elastic Moduli for hyONE®**

Property		Edge MPa	Flat MPa
<b>Modulus Of Elasticity</b>	E	16,000	16,000
<b>Modulus Of Rigidity</b>	G	800	800
<b>Bending</b>	$f_b^1$	65.0	52.0
<b>Tension Parallel to Grain</b>	$f_t^2$	30.0	30.0
<b>Compression Parallel to Grain</b>	$f_c$	48.0	48.0
<b>Shear In Beams</b>	$f_s$	4.6	3.2
<b>Bearing Perpendicular to Grain</b>	$f_p$	12.0	12.0
<b>Joint Group</b>		<b>See Table 6</b>	

Size Factors:

<sup>1</sup>For beams exceeding 95mm – multiply the published characteristic value for bending by  $(95/d)^{0.154}$  where d is the depth of the beam.

<sup>2</sup>For tension members with the largest cross-sectional dimension exceeding 150mm – multiply the published characteristic value for tension by  $(150/d)^{0.167}$ , where d is the largest cross sectional dimension of the tension member.

**Table 12: hyONE Section Sizes, Properties and Design Capacities**

Dimensions (mm x mm)	Mass (kg/m)	$I_{xx}$ ( $10^6\text{mm}^4$ )	$Z_{xx}$ ( $10^3\text{mm}^3$ )	J ( $10^6\text{mm}^4$ )	$EI_x$ ( $10^9\text{Nmm}^2$ )	$\phi f_b Z_x^*$ (kNm)
<b>240 x 90</b>	13.4	101	845	41.9	1622	42.9
<b>300 x 90</b>	16.7	198	1320	55.6	3168	64.7
<b>360 x 90</b>	20.1	342	1901	69.2	5474	90.6
<b>400 x 90</b>	22.3	469	2347	78.3	7509	110.0

\*  $\phi = 0.9$ , for category 2 applications (Refer to Table 4).

hyONE® is available in lengths up to 7.2 metres. Contact us for availability of non-standard sizes and lengths.

### 3.5 hyCHORD® LIMIT STATE DESIGN CHARACTERISTIC PROPERTIES

**Table 13: Characteristic Limit State Design Stresses and Elastic Moduli for hyCHORD®**

Property		Edge MPa	Flat MPa
Modulus Of Elasticity	E	11,000	11,000
Modulus Of Rigidity	G	550	550
Bending	$f_b^1$	40.0	40.0
Tension Parallel to Grain	$f_t^2$	25.2	25.2
Compression Parallel to Grain	$f_c$	32.6	32.6
Shear In Beams	$f_s$	4.4	2.5
Bearing Perpendicular to Grain	$f_p$	11.1	11.1
Joint Group		See Table 6	

Size Factors:

<sup>1</sup>For beams exceeding 95mm – multiply the published characteristic value for bending by  $(95/d)^{0.154}$  where d is the depth of the beam.

<sup>2</sup>For tension members with the largest cross-sectional dimension exceeding 150mm – multiply the published characteristic value for tension by  $(150/d)^{0.167}$ , where d is the largest cross sectional dimension of the tension member.

**Table 14: hyCHORD Section Sizes, Properties and Design Capacities**

Dimensions (mm x mm)	Mass (kg/m)	$I_{xx}$ ( $10^6\text{mm}^4$ )	$Z_{xx}$ ( $10^3\text{mm}^3$ )	J ( $10^6\text{mm}^4$ )	$EI_x$ ( $10^9\text{Nmm}^2$ )	$\phi f_b Z_x^*$ (kNm)
90 x 35	1.9	2.13	47.3	1.0	23.4	1.7
90 x 45	2.4	2.73	60.8	1.9	30.1	2.2
115 x 45	3.1	5.70	99.2	2.6	62.7	3.5
140 x 45	3.8	10.3	147	3.4	113	5.0
190 x 45	5.1	25.7	271	4.9	283	8.8

\*  $\phi = 0.9$ , for category 2 applications (Refer to Table 4).

hyCHORD® is available in lengths up to 7.2 metres. Contact us for availability of non-standard sizes and lengths.

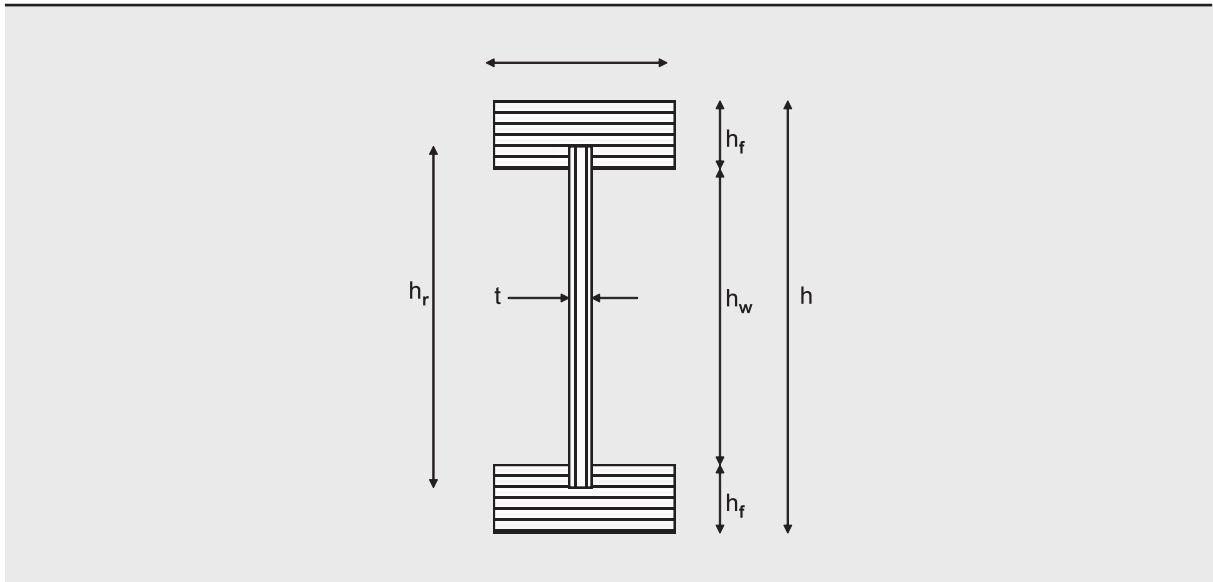
### 3.6 hyJOIST® LIMIT STATE DESIGN CHARACTERISTIC PROPERTIES

Table 15: hyJOIST® Section Sizes

hyJOIST® Product Code	Overall Depth $h$ (mm)	Flange Width $b$ (mm)	Flange Thickness $h_f$ (mm)	Nominal Web Thickness $t$ (mm)	Web Height $h_r$ (mm)	Distance Between Flanges $h_w$ (mm)	Mass (kg/m)
HJ200 45	200	45	45	9	152	128	3.2
HJ240 63	240	63	45	9	192	168	4.4
HJ240 90	240	90	45	12	198	168	5.9
HJ300 63	300	63	45	9	252	228	4.8
HJ300 90	300	90	45	12	258	228	6.2
HJ360 63	360	63	45	9	312	288	5.1
HJ360 90	360	90	45	12	318	288	6.6
HJ400 90	400	90	45	12	358	328	6.8

hyJOIST® is available in lengths up to 13.2 metres.

Figure 1: hyJOIST® Section Terminology



#### Structural Design with hyJOIST®

The designIT® software enables a significant amount of specific design to be carried out which utilises strength and rigidity properties determined from extensive testing of each hyJOIST® section. There may however be some instances where engineers wish to carry out their own specific design. For these applications

we have developed computeIT® for beams. computeIT for beams allows users to design hyJOIST in beam applications taking into account timber engineering phenomena such as shear deflection, creep and restraint considerations, whilst still allowing engineers to make design decisions based on deflection, bending moment and shear force diagrams. To download computeIT for beams visit [www.chhsoftware.com](http://www.chhsoftware.com).



## 4.0 REFERENCES

- New Zealand Building Code.
- AS/NZS 4357.0:2005 Structural laminated veneer lumber – Specifications.
- AS/NZS 4357.1:2005 Structural laminated veneer lumber – Methods of test for manufacturer of dimensions and shape.
- AS/NZS 4357.2:2006 Structural laminated veneer lumber – Determination of structural properties – Test methods.
- AS/NZS 4357.3:2006 Structural laminated veneer lumber – Determination of structural properties – Evaluation methods.
- AS/NZS 4357.4:2005 Structural laminated veneer lumber – Determination of formaldehyde emissions.
- NZS 3603:1993 Timber Structures Standards.
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- AS/NZS 4063.2:2010 Characterisation of structural timber – Determination of characteristic values.
- AS 1649-2001 Timber – Methods of test for mechanical fasteners and connectors – Basic working loads and characteristic strengths.

## 5.0 LIMITATIONS

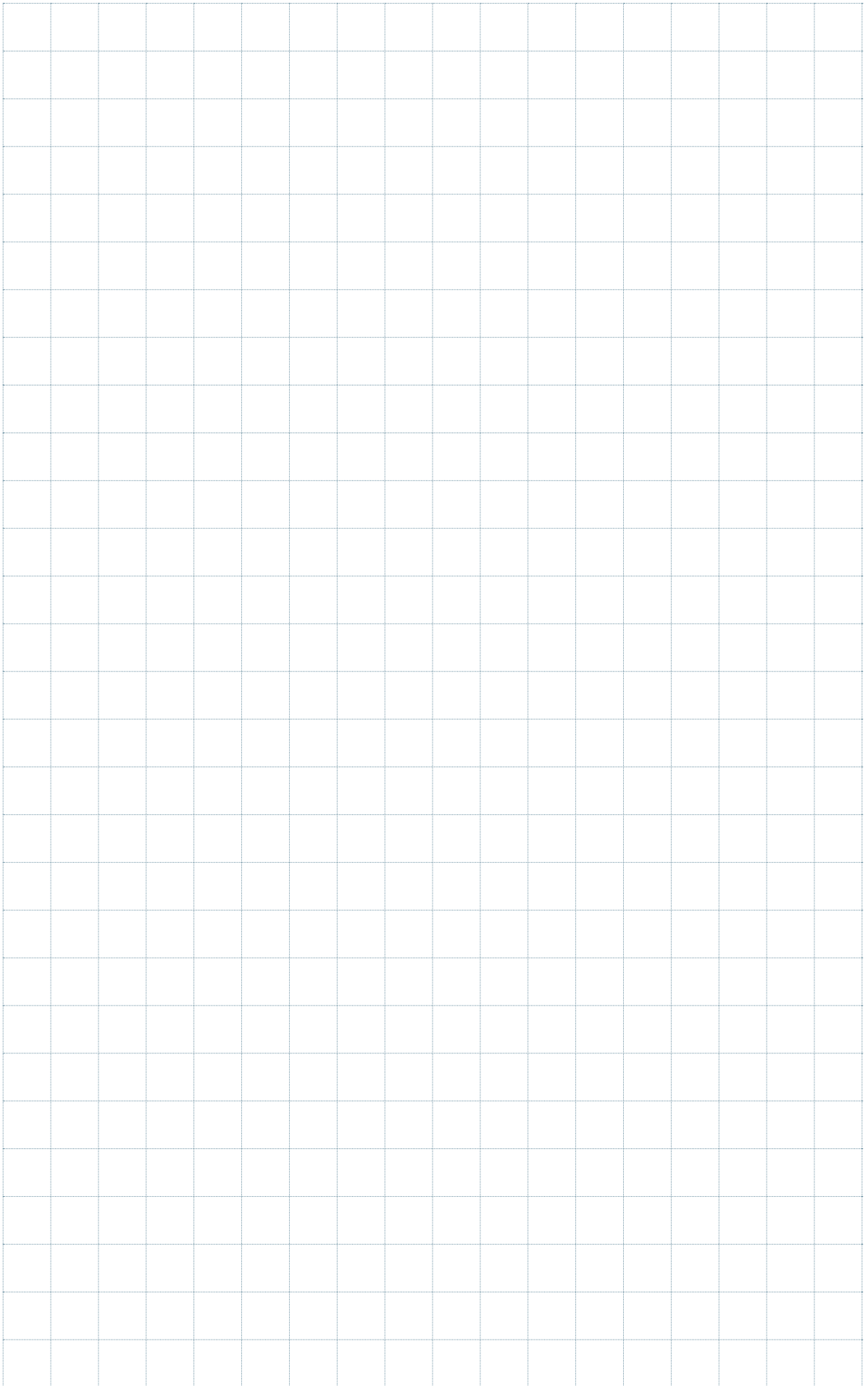
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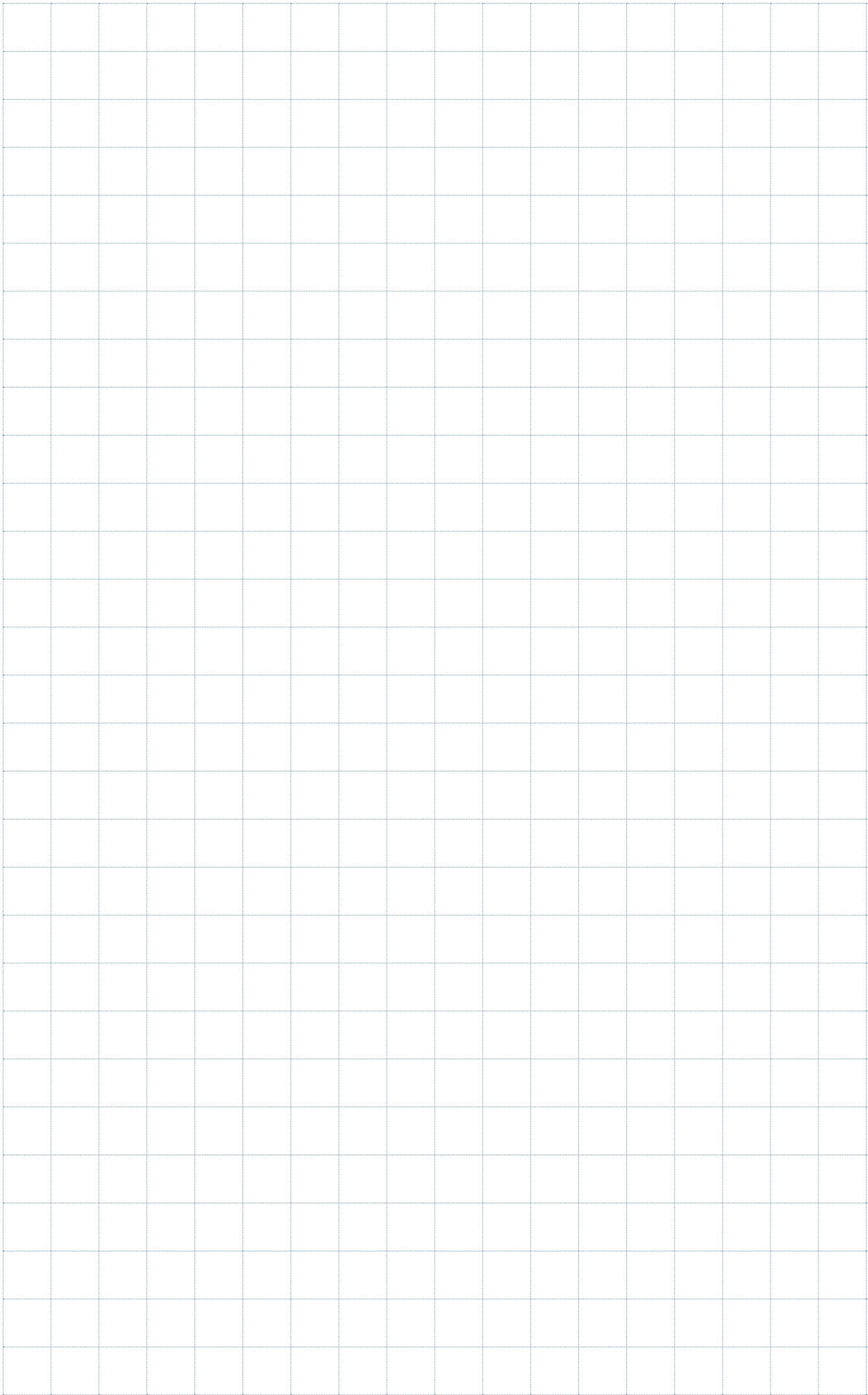
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