CONTACT DETAILS:

ROD CAMERON

TEL: +27 21 851 0510
FAX: +27 21 851 0539
CELL: 082 878 7826
EMAIL: rod@bolandtimber.co.za

10, Cyclonite Street,
The Interchange, Somerset West 7130
Western Cape, South Africa

KVH - SOLID TIMBER BEAMS FOR CONSTRUCTION

TECHNICAL INFORMATION

1 KVH - The precise Building Material

Timber construction has a long tradition. Since man in the course of evolution left the cold and wet stone age grottos he has endeavored to achieve healthy living conditions using natural building materials. Buildings many centuries old accentuate this endeavour and also are living proof of the long life span of timber structures.

Higher Demands

Technical and physical specifications, a changing energy situation, and the higher demand for quality of timber structures demand high requirements from the building material.
The higher demands on quality for timber structures has simultaneously increased the requirements for high quality timber.
The modern timber construction demands dried timber manufactured to exact dimensional requirements.

Technical advantage

With the development of KVH beams technically dried, dimensionally exactly manufactured, timber beams are available in various cross sections and lengths for the use by architects and engineers.

Quality Product

KVH is protected by a registered trademark. The quality control of structural timber class KVH is strictly adhered to and audited by outside firms.
The contents of the quality control program are approved by the german control board (BDZ).

TENDER DOCUMENTATION

It is the aim of KVH that all technical and descriptive information is so precise and accurate in this document that clients asking for the products know exactly what they have to order and what they will receive.
In Germany the Spruce Timber Construction Industry is extremely well controlled by the vast number
of DIN specifications and the very demanding quality control systems.

KVH - SECTION AVAILABLE

18 x 8cm - 5m and 11.9m long

24x 10cm - 5m long and 11.9m log

All design tables are drawn up for the two sizes given, and will be expanded as the

number of cross sections imported increases.

DESIGN TABLES

gk = Own mass (dead load)

qk = Super-imposed load

L = Clear span between supports

e = Spacing of timber joints

A = Deflections less than span/200

B = Deflections less than 6mm

DESIGN EXAMPLE

1 **Timber Floor**

a) Spacing of timber beams = e = 625mm

b) Span centre to centre = e = 4500mm

2 **Design Parameters**

a) Own weight = gk = 1.75 KN/m²

b) Super-imposed load = qKN = 2.80 KN/m²

c) From Table 2.2 section = 8/24 or 12/24
If we choose 8/24, then a vibration analysis has to be done and the deflection will < span/200
If we choose 12/24, then no analysis is required and deflection will be < 6mm

3 **Load combinations**

Load 1	Combination		Specified combination	Loads	K mod
L1	g		1.35 x gk	1.75x1.35 = 2.36 =1.75x1.35 + 2.8x1.5	0.6
L2	g + q		1.35gk + 1.5qKN	= 6.56	0.8

K mod is a stress reduction factor required by the DIN specification
DIN 1052 : 2004-08,
Table A, used all over Europe.

A further factor of safety is to divide by 1.3 as shown below.
The case to be analyzed is load case 2 (L2) :

Bending stress = 24N/mm² (unfactored)
Shear stress = 2N/mm² (unfactored)
Modulus of elasticity = 11000N/mm²
Reduced stresses to be used in calculations :

Bending stress = $\frac{0.8 \times 24}{1.3}$ = 14.8 N/mm²
= fmd

Shear stress = $\frac{0.8 \times 2}{1.3}$ = 1.23 N/mm²
= fvd

4 Cross Section and End Reactions

Md = $\frac{6.56 \times 4.5^2}{8}$ x 0.625 =10.38 KNMm

Vd = 6.56 x $\frac{4.5}{2}$ = 9.23KN

End reactions = Agk = 1.75 x $\frac{4.5}{'2}$ = 3.94 KN

Aqk = 2.8 x $\frac{4.5}{'2}$ = 6.3 KN

5 Required moment and shear resistance

Wy = section modulus = $\frac{Md}{14.8 \times 10^3}$ = $\frac{10.38}{14.8 \times 10^3}$

= 701 cm³

from Table 1, choose
8/24, where Wy = 768 cm³

6 Checking of results

f_T = Tensile stress = $\frac{10.38}{768 \times 10^3}$ = 13,5 N/mm²

$\frac{f_T}{fmd}$ = $\frac{13.5}{14.8}$ = 0.91 < 1

vd = Shear stress = $\frac{1.5 \times 9.23}{192}$
= 0.72 N/mm²

$\frac{vd}{fvd}$ = $\frac{0.72}{'1.23}$ = 0.59 < 1

7 **Checking of "fitness" for purpose with limiting conditions**

a) Deflection - to be < span/300 for dead load
< span/200 for total load

$E = 11000 \times 9.216 = 10.14 \times 10^6 KNcm^2$

$$A_{(self\ wt)} = \frac{5}{3204} \times \frac{(1.75 \times 0.625) \times 10^{-2} \times 450^4}{10.14 \times 10^6}$$

$= 0.58cm. = span/489 < span/300$

$$A_{(total\ load)} = \frac{5 \times (2.8 \times 0.625) \times 10^{-2} \times +50^4}{384 \quad 10.14 \times 10^6}$$

$= 0.92\ cm = span/313$
$< span/200$

8 When the deflection is less than 6mm, then the frequency of the timber is above 8.Hz, which is a fitness for purpose specification of DIN 1052: 2004 - 0.8 para 9.3

In this example deflection = 0.58 + 0.3 x 0.92
= 0.86cm > 6mm

hence section insufficient.
(The factor 0.3 is specified for residential and office areas)

Hence use a section with moment inertia (using the width of the beam only)
$= \frac{8.6}{'6} \times 100 = 43\%$

Increasing from 8 to 12cm = 50%
Hence final choice = 12/24cm

This worked example shows that the sizes given on the attached table are absolutely reliable.

If a joist of 12/24cm had been chosen from the table, the deflection would automatically be < 6mm, and none of the above calculations are necessary.

T A B L E S

TABLE 1
DESIGN DATA TABLE

Cross-sections and other design parameters

Timber Size	Cross Sectional Area	Section Modules	Moment of Inertia	Resistance Moment	Shear
b/d cm	cm²	cm³	cm^4	KNm	KN
8/18	144	432	3888	6,30	15,95
10/24	240	960	11520	14,18	26,58
Example					
8/24	192	768	9216	11,34	21,27
12/24	288	1152	13824	17,01	31,9

TABLE 2

KVH FLOOR JOISTS - SINGLE SPANS

Dead Load = 1.75 KN/m²

Superimposed Load = 2.0, 2.8, 3.0 KN/m²

L = span in m

e = spacing of joists

Beam Cross Section = 180 x 80mm

Dead Load	**1.75 KN/m²**			**2.5 KN/m²**		
Superimposed Load	2.0 KN/m²	2.8 KN/m²	3.0 KN/m²	2.0 KN/m²	2.8 KN/m²	3.0 KN/m²
		e = 500m				
Max span	4.36	3.9	3.8	4.8	3.7	3.6
		e = 625m				
Max span	`	3.5	3.4	3.6	3.3	3.2

		e = 750m				
Max span	3.6	3.2	3.1	3.3	3	2.7
		e = 833m				
	3.4	3.1	3	3.1	2.8	2.7
	Continuous spans					
		e = 500m				
Max span	4.9	4.4	4.3	4.5	3.7	3.6
		e = 625m				
Max span	4.3	3.9	3.8	4	3.7	3.6
		e = 750m				
Max span	4	3.26	3.5	3.3	3	2.9
		e = 833m				
Max span	3.8	3.4	3.3	3.5	3.2	3.1

TABLE 3

CARRYING CAPACITY OF KVH COLUMNS, PINNED AT BOTH ENDS

VERTICAL LOAD (KN), DEPENDING ON SLENDERNESS RATIO

Height in meters								
Cross Section	2.5	3	3.5	4	4.5	5	5.5	6
180x80	32.56	23.17	17.28	13.37	10.65	8.68	7.21	6.08
240x100	80.87	58.48	43.96	34.71	27.29	22.29	18.54	15.66

TABLE 4.1

ROOF RAFTERS - SINGLE SPAN

Dead Load = 1.20 KN/m²
Superimposed Load = 0.85 KN/m²
Wind Load = 0.90 KN/m²
L = height of column (m)

Inclination												
	5° - 25°			26° - 35°			36° - 45°			46° - 55°		
Rafter Spacing (m)	0.625	0.75	0.833	0.625	0.75	0.833	0.625	0.75	0.833	0.625	0.75	0.833
L=2.5m												8/18
=3.0									8/18			
=3.5			8/18			8/18						
=4.0	8/18											
=4.5												
=2.5												10/24
=3.0												10/24
=3.5												10/24
=4.0									10/24	10/24		
=4.5									10/24	10/24		

TABLE 4.2

ROOF RAFTERS - CONTINUOUS SPANS

Dead Load = 1.2 KN/m²
Superimposed Load = 0.85 KN/m²
Wind Load = 0.90 KN/m²
L = height of column (m)

Degrees of Inclination												
Rates Span m	0.625	0.75	0.833	0.625	0.75	0.833	0.625	0.75	0.833	0.625	0.75	0.833
L=2.5												8/18
=3.0												8/18
=3.5									8/18		8/18	
=4.0						8/18			8/18			
=4.5			8/18				8/18					
=5.0	8/18											
=2.5												10/24
=3.0												10/24
=3.5												10/24
=4.0												10/24
=4.5												10/24
=5.0												10/24

CROSS SECTION IN CM

SORTING CRITERIA

Sorting characteristics and criteria for KVH*

Sorting Criteria	Requirements of KVH*		Comments
	Exposed KVH*-Si	Non-Exposed KVH*-Nsi	
Sorting class/ strength class	DIN 4074-1 Minimum grade S10TS Min. C 24 according to EN 338	DIN 4074-1 Minimum grade S10TS Min. C 24 according to EN 338	The material properties that determine load-bearing capacity are derived from EN 338.
Wood moisture content	15% ± 3%	15% ± 3%	The defined wood moisture content is the precondition for applications where chemical wood preservative should not be used as far as possible. It can also be the precondition for the production of finger-joint connections.
Type of conversion	Clear-heart Free of heart on request	Clear-heart	Clear-heart. Since the pith in the clean bole does not always run through the middle, clear-heart is defined as follows: in an ideally formed clean bole the pith is cut through when converted from both sides. Free of heart: Core plank of at least 40 mm in thickness.
Wane	Not permitted	Measured at an angle 10% of the smaller cross-section side	
Dimensional tolerance of the cross-section	DIN EN 336, dimension stability class 2 < 10cm = ± 1mm, > = ± 1.5mm		The dimensional tolerance for the longitudinal dimensions is to be agreed between the supplier and customer.
Knot condition	Loose and fallen knots not permitted.	DIN 4074-1" Grade S10	

Knotting	Occasionally faulty knots or parts of knots permitted with max. diameters of 20mm. S10: A < 2/5	S10: A <2/5	Knotting is determined according to DIN 4074-1. For machine-based sorting the following applies: - for KVH*-Nsi the sizes of the knots are irrelevant. - for KVH*Si: A < 2/5.
Ingrown bank	Not permitted	DIN 4074-1"	
Cracks and radial cracks caused by shrinking (drying cracks)	Width of crack < 3% of the cross-section side, subject to max. of 6mm.	DIN 4074-1"	
Resin gall	Width w < 5mm		
Discoloration	Not permitted	DIN 4074-1"	
Insect attack	Not permitted	DIN 4074-1"	
Twisting			The permitted degree of twisting is not defined is any more details since no un-acceptable degrees of twisting are to be expected if all other criteria are met.
Longitudinal wrapping	For clear-heart con-version < 8 mm/2 m For free of heart con-version < 4 mm/2 m	For clear-heart conversion < 8 mm/2 m	By comparison: DIN 4074-1, S10 and S13: < 8 mm/2m
Working of the ends	Trimmed at right-angles		
Surface finish	Planed and chamfered	Sized and chamfered	
Finger-jointing	DIN 68140-1 bzw. DIN EN 385		

1) The German standard DIN 4074-1, "Grading of timber by strength - Part 1: Softwood" sets out grading characteristics and classes as preconditions for the specification and use of characteristic values for the calculation of limit states of strength and performance capability. It meets the requirements of the European standard DIN EN 1408-1 "Timber buildings - Construction timber graded by strength for load-bearing applications with right-angled cross-sections - Part 1: General requirements".

2) The grade S 10 equates to strength class C 24 according to EN 338, "Construction timber for load-bearing

applications - Strength classes".

DIMENSIONAL STABILITY

Type of conversion

The type of conversion plays a decisive role in considerably reducing cracking, warping and twisting in the wood.
For cross-sections of up to 100mm a core plank of at least 40mm in thickness is removed for free of heart conversion.
For all cross-sections over 100mm and the entire KVH* range for non-exposed applications the specification is for clear-heart conversion.

Wood moisture content

KVH* solid structural timber is kiln-dried. The maximum moisture content is 15% ± 3%.
Once installed, therefore, KVH* retains its shape and fit outstandingly well. There is no further risk of any change in shape.

Finger-joining

Thanks to the friction-locked longitudinal connection of the individual pieces, sawn construction timber can be produced in virtually any length.
In Germany, finger-joining is permitted for both assortments of KVH* (exposed and non-exposed applications) and this is the only method used.
Finger-joints in KVH* do not need to be taken into account in stress calculations.
Thanks to modern-day color-neutral glues, the finger-joints can hardly be seen.

Chemical wood preservative

With a permanently low wood moisture content of 15% ± 3% there is no danger - subject to the wider construction conditions - of KVH* being infested by wood-destroying mould.
Moreover, thanks to the kiln drying process based now on many years of practical experience, there have also been no incidences of damage by insects.
The skin drying of the timber is therefore an indispensable precondition for doing without chemical wood preservative.

QUALITY CONTROLS AND IDENTIFICATION MARKINGS

Quality controlled production

The high requirements made of KVH* as a construction product are reflected in the production practices of the sawmills. They have formed the Organization for Quality Control of Solid Structural Timber in Germany.

The production of KVH* solid structural timber is subject to strict quality controls. These controls consist of the initial inspection
of the company and permanent internal controls and regular external inspections. The initial inspection and external inspections
are performed by independent certified inspection organizations.

The award of the KVH* compliance mark therefore shows that compliance with the quality and inspection requirements has been confirmed by external inspections.

KVH^{R} SOLID STRUCTURAL TMBER
THE CONSTRUCTION MATERIAL FOR MODERN TIMBER CONSTRUCTION

KVH^{R} Solid structural timber

The easiest and safest way of making sure you use the right type of construction timber for modern timber structures to choose KVH^{R} solid construction timber.

KVH$^{@}$ solid structural timber is high-quality sawn construction timber produced from softwood. Given the use to which it is put, it meets not only higher but supplementary requirements as well and is subject to strict controls in production for guaranteed consistently high quality.

The different assortments are offered, to cover different applications, the main differences being in the surface quality.

- KVH$^{@}$ -Si for exposed applications and
- KVH$^{@}$ -Nsi for non-exposed applications

KVH$^{@}$ is available in the native German wood species of spruce, fir, pine, larch and Douglas fir.

Characteristics and criteria

KVH$^{@}$ is largely used for constructions where the design calculations for he cross-section are based on structural strength.

Grading is in accordance with DIN 4074-1 ("Grading of timber by strength").

In addition, KVH$^{@}$ also meets special criteria in respect of the following, over and above the requirements of the DIN standard.

- Wood moisture content
- Type of conversion
- Dimensional stability of the cross-sections
- Knot condition
- Resin gall
- Surface quality

The results in products of a much higher quality, offering guaranteed conformity with all the requirements of construction timber.

SPECIFICATIONS FOR KVH

The specifications are all according to the various DIN codes of Germany, and the most important points are:

	Item	Specification
1	Moisture content	15% ± 3%
2	Side of tree trunk	Not allowed
3	Dimensional requirements	DIN EN 336
4	Branches	Only branches up to 20mm diameter can be included
5	Bark of trunk	Not allowed
6	Cracks	< 3% of diameter/smallest cross sectional dimension
7	Discoloration	Not allowed
8	Insects	Not allowed
9	Longitudinal bending	< 8mm / 2m
10	Surface preparation	Planed

Three-layer soft wood panel

Absolute top-quality made of wood. Quality monitored through ongoing research and extremely stringent controls. Environmental awareness in purchasing and processing. High functionality and easy processing.
Individual design scope for
kitchens, furniture, ceilings, floors, walls, doors, drawers, windowsills and lots more.
CE marking for load bearing building products in accordance with EN 13986, Panel type SWP/2 in accordance with EN 13353.

Wood type:	**Spruce**
Quality classes:	A/B, A/C, AB/B, AB/C, B/B, B/C+, C+/C+, C+/C, C/C
Lengths:	5000 mm (4500, 4000 mm)
Widths:	1250 mm, 2050 mm
Panel thicknesses:	13 mm, 15 mm
Top layer:	3,5 mm
Panel thicknesses:	19 mm, 22 mm, 26 mm
Top layer:	5,5 mm
Panel thicknesses:	27 mm, 32 mm, 42 mm
Top layer:	8 mm