

ENGINEERS REPORT

Report on a visual inspection of:

THE BARN AT
MANOR FARM
CARLTON ROAD
BARTON IN THE BEANS
LEICESTERSHIRE
CV13 0DE

Prepared for :

MESSRS SW JACKSON

DATE: 19 APRIL 2024

KSA Consulting Engineers Limited

CONSULTING CIVIL AND STRUCTURAL ENGINEERS

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23M01/23 April 2024

INTRODUCTION

This report has been prepared at the request of Messrs. SW Jackson to comment on the stability of a steel portal frame structure at Manor Farm, Carlton Road, Barton-in-the Beans, CV13 0DE.

All descriptions relating to position in this report assume that the structure is being viewed from the West side.

Our inspection of the building was limited to the parts of the structure which were visible at the time of our site inspection.

This report has been prepared specifically for the above-named client and their professional advisors and it should not be relied upon by others without the prior written agreement of this firm.



Figure 1: East elevation



Figure 2: North elevation

DESCRIPTION OF THE BUILDING

It is understood the building was constructed during the 1970's.

No design drawings or structural calculations for the building are available.

The building was a steel portal frame structure with a corrugated asbestos cement sheeted roof and concrete floor.

There were a series of 8 portal frames at approximately 4.57m centers.

Stability bracing had been provided to the roof next to the West elevation.

The Eastern elevation comprised, profiled metal sheeting.

The Northern elevation was partially boarded with a concrete wall below this.

The Western elevation was partially boarded and partially open.

The roof sheeting was supported by timber purlins spanning between the main portal frames.

The portal frame rafters were haunched at the eaves and ridge.



Figure 3: West elevation



Figure 4: Foundation trial hole

TOPOGRAPHY

The building was located on a level site, with the surrounding ground levels sloping downwards very gradually towards the West.

GEOLOGY AND PAST COAL MINING ACTIVITY

The geological records for this area show that the Superficial Deposits beneath the site comprise Oadby Member. A Sedimentary deposit formed during the Quaternary Period. A poorly sorted grey / brown sediment characterised by rock fragments and subordinate lenses of sand and gravel, clay and silt.

The underlying Solid Geology comprises Gunthorpe Member. A Sedimentary Mudstone bedrock formed during the Triassic Period. A reddish / brown Mudstone with subordinate Dolomitic siltstone and fine-grained Sandstone. At shallow depths the material normally weathers to a reddish-brown silty clay of medium shrinkage potential.



Figure 5: Internal trial hole

There are no published borehole logs within the vicinity of the site in the British Geological records.

Boreholes to the West of the site reveal topsoil underlain by sandy pebbly clay to around 3 meters below ground level, with red / grey mudstone beneath this.

To the East of the site, records show topsoil underlain by a brown stoney clay to a depth of

around 3 meters. This material being underlain by a red marl with green Skerries bands.

The interactive map of the Coal Authority Indicates that the site lies outside the coal mining reporting area.

There is no evidence of any past surface mining within the vicinity of the site.

There has been extensive deep coal mining activity to the East of Nailstone, none of which would be expected to affect the stability of the ground within the support area of the site.



Figure 6: Portal frame rafter

TRIAL HOLES

A trial hole had been excavated prior to our site inspection.

This trial hole exposed a portal frame base on the North elevation. The trial hole revealed the base of the foundation was 1.5m below ground level. The foundation pads were approximately 0.75m wide and 1m long.



Figure 7: Portal frame eaves connection



Figure 8: Portal frame ridge connection



Figure 9: Roof purlins

OBSERVATIONS

The building is thought to be around 50 years old.

The portal columns and rafters comprised 356 x 127 x 33UB's, haunched at the eaves and ridge.

The gable post comprised 178 X102UB's.

The roof stability bracing comprised 70 X 70 x 7 RSA.

The purlins comprised 75mm x 200mm timber sections.

The general condition of the steelwork was good.

There was widespread surface rust on the exposed steelwork. But this will not have any significant impact on the performance of the structure.

There was more serious deterioration of the columns below and just above ground level, where corrosion, section loss and delamination were present.

The rafters will receive a degree of lateral restraint from the timber purlins, but no lateral torsional buckling restraints had been provided. This is often found in agricultural buildings.

The gable frames comprised full portal frames rather than gable framing.



Figure 10: Delaminated column



Figure 11: Floor slab

STRUCTURAL ANALYSIS

The structure has been analysed using Scia Engineer 22.1, a 3-Dimensional Finite Element Structural Analysis programme. This analysis has been based on Eurocode 3. A check analysis has also been carried out using CADS Smart Portal 3d, a portal frame analysis suite. This analysis has been based on BS5950. This software is used for new builds and doesn't allow the use of timber purlins. However, it does provide a very accurate frame analysis. The structure was most probably designed to BS5950, which was withdrawn in 2010 but it is still widely used.

Wind loadings have been derived in accordance with BS6399 and EC1.

The principal elements of the structure have been checked for adequacy, but not the individual connections.



Figure12: Base of gable post

Measurements have been taken from the existing plans and elevations drawing prepared by Ritchie and Ritchie LLP.

The results of this analysis are included in the Appendices of this report.



Figure 13: Section loss of column



Figure 14: Building interior



Figure 15: Column pocket base



Figure 16: Roof bracing and gable posts

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The building was a steel framed structure which is thought to be around 50 years old.

The structure comprised 8No portal frames with haunched eaves and ridge connections. The asbestos cement roof sheeting was supported by timber purlins spanning between the main portal frames. Stability bracing for the roof was provided in the West Bay. The external cladding was a combination of asbestos cement and steel sheeting, together with ventilated timber boarding and concrete walls.

The gable end frames were full portal frames with UB gable posts.

The floor slab was of concrete construction at different levels.

The portal frame foundations appeared to have been constructed as pocket bases and appeared to be reasonably sized.

Agricultural buildings such as this were normally designed to BS5502, which allowed lower imposed loadings to be used when compared with residential buildings. This was because of the less significant consequences of any damage or failure for such buildings. This type of building was also not subject to approval under the Building Regulations. Therefore, buildings of this type should not automatically be assumed to be suitable to form part of a residential development. The only way to confirm whether this type of building is suitable is to carry out a detailed structural analysis.

We understand that no additional loading will be applied to the existing structure, but that it will provide an enclosure to the new residential development. However, the existing structure will still be required to resist the environmental loadings (wind and snow).

The detailed structural analysis which has been carried out, confirms that the structure is robust and should be considered satisfactory as an enclosure for the proposed residential development.

The results of the Scia Engineer structural analysis indicate a slight overstressing of the portal frame columns (approximately 12%). However, this figure is based on an analysis using the latest Eurocodes and the building would have most probably been designed to BS5950 or possibly even BS449.

The results from the CADS Smart Portal 3D do not indicate any overstressing of the columns.

The results from both analyses indicate additional lateral torsional buckling restraints are required to the rafters. These restraints are small, short sections (typically 600mm long, 50mmx50mm angles) bolted to the purlins and the bottom flange of the rafters. Whilst these restraints are small, they are effective at preventing the rafters from buckling. This should be considered to be minor but important remedial work.

The condition of the structural steelwork was generally good, with light surface corrosion to most members. This would be expected for such a structure. This will require surface preparation and painting. However, the condition of the main portal columns and gable posts below ground level and just above ground level, was poor.

There was significant corrosion, section loss and delamination of the steelwork in these areas. These areas will require remedial work with welded steel plates being fitted to the affected steel columns. This will need to be carried out on a column-by-column, basis following a detailed inspection of each column.

This work should be considered routine maintenance work, in order to keep the structure in a satisfactory condition. Work such as this is normally carried out as part of permitted development.

The foundations appeared to be reasonably sized for the anticipated loadings and ground conditions. There was no evidence of any excessive settlement of the building's foundations.

The timber purlins generally appeared to be in a satisfactory condition, however, considering their age, localised repairs may be anticipated in areas where the timber has decayed. This should also be considered to be routine maintenance work.

There was no stability bracing for the main elevation walls. This function being performed by the existing walls and cladding. Depending on the construction of the external walls of the proposals, it may be necessary to introduce wall bracing.

Portal frames are very flexible structures which undergo significant deflections under imposed and wind loading. Therefore, it is important that the proposed internal structure is isolated from the existing portal frames.

RECOMMENDATIONS

The following remedial work is recommended:

- Provide 90x90x10 RSA cross bracing to the North and South walls of the West Bay (depending on the final construction details).
- Plate the existing column bases.
- Provide additional rafter stays.
- Corrosion protection to the steel frame

Signed by:



Date:

19 April 2024

Kevin Saxton BSc (Hons) CEng MICE
KSA Consulting Engineers Limited

APPENDIX 1
Structural Calculations



STRUCTURAL CALCULATIONS FOR

MANOR FARM

2 CARLTON ROAD

BARTON IN THE BEANS

CV13 0DE

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23M01/23 March 2024



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Job No:

23M01/23

Sheet No:

01

Rev:

Project:

MANOR

Calculation by:

ES

Date:

MAR 24

Checked by:

INPUT

Dimensions used in these calculation sheets are design dimensions and are not to be used for construction

OUTPUT

STRUCTURAL CALCULATIONS FOR
MANOR FARM, CARLTON ROAD,
BACUP IN THE BEARS, CUZODE
LOADINGS

ROOF

A/C sheeting
rails
rafters
imposed

= 0.16

k/m²

= 0.05

k/m²

= 0.05

k/m²

= 0.00

k/m²

WIND

Att = 130m

Dist = 107km

Vb = 21.3 m/s

h = 3m

b = 20m

L = 32m



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Job No:

23M01/23

Sheet No:

02

Rev:

Project:

MAJOR FM

Calculation by:

KS

Date:

MAR 20

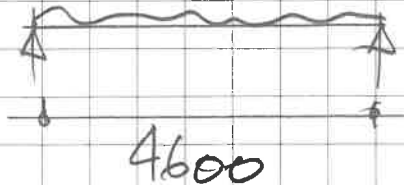
Checked by:

INPUT

Dimensions used in these calculation sheets are design dimensions and are not to be used for construction

OUTPUT

PURLINS



$$UDL = (0.16 \times 1.385) = 0.22 \text{ kN/m}$$

$$(0.60 \times 1.385) = 0.83 \text{ kN/m}$$

Assume existing timber on C22

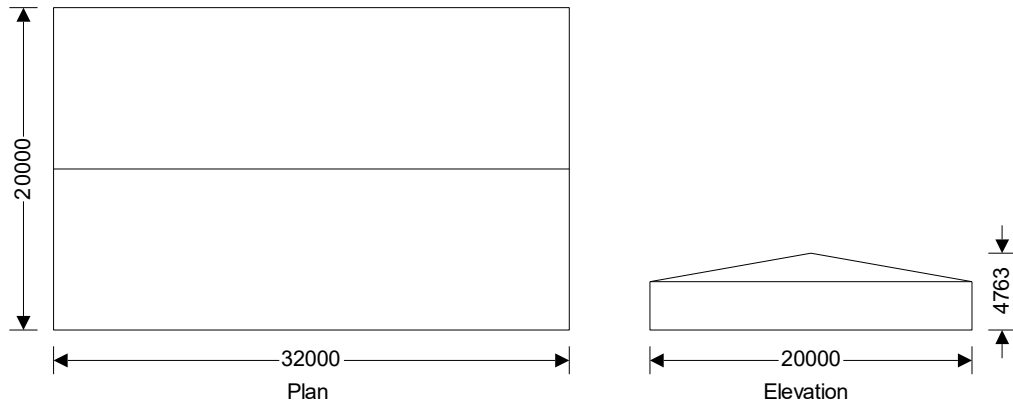
Existing slope = $\pm 10^\circ$

< Existing 75 x 200 purlins satisfactory
neglecting deflection criteria. Deflection
will not be detrimental to the proposed
structure use.

 KSA Consulting Engineers Ltd 1 Central Road Hugglescote LE67 2 FH	Project Manor Farm, Barton in the Beans, Carlton Road, CV13 0DE				Job no. 23M01/23	
	Calcs for Wind loading				Start page no./Revision 1	
	Calcs by KS	Calcs date April 24	Checked by	Checked date	Approved by	Approved date

WIND LOADING (EN1991-1-4)

TEDDS calculation version 3.0.13



Building data

Type of roof	Duopitch
Length of building	L = 32000 mm
Width of building	W = 20000 mm
Height to eaves	H = 3000 mm
Pitch of roof	$\alpha_0 = 10.0$ deg
Total height	h = 4763 mm

Basic values

Location	Aberdeen
Wind speed velocity (FigureNA.1)	$V_{b,map} = 21.3$ m/s
Distance to shore	$L_{shore} = 107.00$ km
Altitude above sea level	$A_{alt} = 130.0$ m
Altitude factor	$C_{alt} = A_{alt} \times 0.001m^{-1} + 1 = 1.130$
Fundamental basic wind velocity	$V_{b,0} = V_{b,map} \times C_{alt} = 24.1$ m/s
Direction factor	$C_{dir} = 1.00$
Season factor	$C_{season} = 1.00$
Shape parameter K	K = 0.2
Exponent n	n = 0.5
Probability factor	$C_{prob} = [(1 - K \times \ln(-\ln(1-p)))/(1 - K \times \ln(-\ln(0.98)))]^n = 1.00$
Basic wind velocity (Exp. 4.1)	$V_b = C_{dir} \times C_{season} \times V_{b,0} \times C_{prob} = 24.1$ m/s
Reference mean velocity pressure	$q_b = 0.5 \times \rho \times V_b^2 = 0.355$ kN/m ²

Orography

Orography factor not significant	$c_o = 1.0$
Terrain category	Country
Displacement height (sheltering effect excluded)	$h_{dis} = 0$ mm

The velocity pressure for the windward face of the building with a 0 degree wind is to be considered as 1 part as the height h is less than b (cl.7.2.2)

The velocity pressure for the windward face of the building with a 90 degree wind is to be considered as 1 part as the height h is less than b (cl.7.2.2)

Peak velocity pressure - windward wall - Wind 0 deg and roof

Reference height (at which q is sought)	z = 3000 mm
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Displacement height (sheltering effects excluded) $h_{dis} = 0$ mm
Exposure factor (Figure NA.7) $C_e = 1.62$
Peak velocity pressure $q_p = C_e \times q_b = 0.57$ kN/m²

Structural factor

Structural damping $\delta_s = 0.050$
Height of element $h_{part} = 3000$ mm
Size factor (Table NA.3) $C_s = 0.89$
Dynamic factor (Figure NA.9) $C_d = 1.01$
Structural factor $C_s C_d = C_s \times C_d = 0.898$

Peak velocity pressure - windward wall - Wind 90 deg and roof

Reference height (at which q is sought) $z = 4763$ mm
Displacement height (sheltering effects excluded) $h_{dis} = 0$ mm
Exposure factor (Figure NA.7) $C_e = 1.88$
Peak velocity pressure $q_p = C_e \times q_b = 0.67$ kN/m²

Structural factor

Structural damping $\delta_s = 0.050$
Height of element $h_{part} = 4763$ mm
Size factor (Table NA.3) $C_s = 0.90$
Dynamic factor (Figure NA.9) $C_d = 1.02$
Structural factor $C_s C_d = C_s \times C_d = 0.916$

Structural factor - roof 0 deg

Structural damping $\delta_s = 0.050$
Height of element $h_{part} = 4763$ mm
Size factor (Table NA.3) $C_s = 0.88$
Dynamic factor (Figure NA.9) $C_d = 1.01$
Structural factor $C_s C_d = C_s \times C_d = 0.896$

Peak velocity pressure for internal pressure

Peak velocity pressure – internal (as roof press.) $q_{p,i} = 0.67$ kN/m²

Pressures and forces

Net pressure $p = C_s C_d \times q_p \times C_{pe} - q_{p,i} \times C_{pi}$
Net force $F_w = p_w \times A_{ref}$

Roof load case 1 - Wind 0, $C_{pi} 0.20$, $-C_{pe}$

Zone	Ext pressure coefficient C_{pe}	Peak velocity pressure $q_{p,i}$ (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
F (-ve)	-1.45	0.67	-1.00	4.61	-4.61
G (-ve)	-1.00	0.67	-0.73	26.35	-19.27
H (-ve)	-0.50	0.67	-0.43	293.98	-127.11
I (-ve)	-0.45	0.67	-0.40	293.98	-118.32
J (-ve)	-1.10	0.67	-0.79	30.96	-24.49

Total vertical net force $F_{w,v} = -289.33$ kN

Total horizontal net force $F_{w,h} = -1.42$ kN

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Walls load case 1 - Wind 0, c_{pi} 0.20, $-c_{pe}$

Zone	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p , (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
A	-1.20	0.67	-0.85	6.04	-5.14
B	-0.80	0.67	-0.61	30.54	-18.71
C	-0.50	0.67	-0.43	41.05	-17.77
D	0.70	0.57	0.23	96.00	21.90
E	-0.30	0.57	-0.29	96.00	-27.68

Overall loading

Equiv leeward net force for overall section

$$F_l = F_{w,WE} = -27.7 \text{ kN}$$

Net windward force for overall section

$$F_w = F_{w,WD} = 21.9 \text{ kN}$$

Lack of correlation (cl.7.2.2(3) – Note)

$$f_{corr} = 0.85 \text{ as } h/W \text{ is } 0.238$$

Overall loading overall section

$$F_{w,D} = f_{corr} \times (F_w - F_l + F_{w,h}) = 40.9 \text{ kN}$$

Roof load case 2 - Wind 0, c_{pi} -0.3, $+c_{pe}$

Zone	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p , (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
F (+ve)	0.10	0.67	0.26	4.61	1.20
G (+ve)	0.10	0.67	0.26	26.35	6.85
H (+ve)	0.10	0.67	0.26	293.98	76.40
I (+ve)	-0.45	0.67	-0.07	293.98	-20.28
J (+ve)	-1.10	0.67	-0.46	30.96	-14.17

Total vertical net force

$$F_{w,v} = 49.24 \text{ kN}$$

Total horizontal net force

$$F_{w,h} = 20.65 \text{ kN}$$

Walls load case 2 - Wind 0, c_{pi} -0.3, $+c_{pe}$

Zone	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p , (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
A	-1.20	0.67	-0.52	6.04	-3.13
B	-0.80	0.67	-0.28	30.54	-8.53
C	-0.50	0.67	-0.10	41.05	-4.08
D	0.70	0.57	0.56	96.00	53.91
E	-0.30	0.57	0.05	96.00	4.34

Overall loading

Equiv leeward net force for overall section

$$F_l = F_{w,WE} = 4.3 \text{ kN}$$

Net windward force for overall section

$$F_w = F_{w,WD} = 53.9 \text{ kN}$$

Lack of correlation (cl.7.2.2(3) – Note)

$$f_{corr} = 0.85 \text{ as } h/W \text{ is } 0.238$$

Overall loading overall section

$$F_{w,D} = f_{corr} \times (F_w - F_l + F_{w,h}) = 59.7 \text{ kN}$$

Roof load case 3 - Wind 90, c_{pi} 0.20, $-c_{pe}$

Zone	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p , (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
F (-ve)	-1.80	0.67	-1.23	4.61	-5.68

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Zone	Ext pressure coefficient C_{pe}	Peak velocity pressure $q_{p,}$ (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
F (-ve)	-1.80	0.67	-1.23	4.61	-5.68
G (-ve)	-1.30	0.67	-0.93	9.67	-8.98
H (-ve)	-0.60	0.67	-0.50	77.39	-38.70
I (-ve)	-0.45	0.67	-0.41	553.14	-225.91

Total vertical net force $F_{w,v} = -275.02$ kN

Total horizontal net force $F_{w,h} = 0.00$ kN

Walls load case 3 - Wind 90, c_{pi} 0.20, $-C_{pe}$

Zone	Ext pressure coefficient C_{pe}	Peak velocity pressure $q_{p,}$ (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
A	-1.20	0.57	-0.77	5.72	-4.38
B	-0.80	0.57	-0.55	22.86	-12.69
C	-0.50	0.57	-0.40	67.42	-26.75
D	0.70	0.67	0.29	77.63	22.85
E	-0.30	0.67	-0.32	77.63	-24.59

Overall loading

Equiv leeward net force for overall section $F_l = F_{w,WE} = -24.6$ kN

Net windward force for overall section $F_w = F_{w,wD} = 22.9$ kN

Lack of correlation (cl.7.2.2(3) – Note) $f_{corr} = 0.85$ as h/L is 0.149

Overall loading overall section $F_{w,D} = f_{corr} \times (F_w - F_l + F_{w,h}) = 40.3$ kN

Roof load case 4 - Wind 90, c_{pi} -0.3, $+C_{pe}$

Zone	Ext pressure coefficient C_{pe}	Peak velocity pressure $q_{p,}$ (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
F (+ve)	0.10	0.67	0.26	4.61	1.20
G (+ve)	0.10	0.67	0.26	9.67	2.53
H (+ve)	0.10	0.67	0.26	77.39	20.21
I (+ve)	0.10	0.67	0.26	553.14	144.48

Total vertical net force $F_{w,v} = 165.87$ kN

Total horizontal net force $F_{w,h} = 0.00$ kN

Walls load case 4 - Wind 90, c_{pi} -0.3, $+C_{pe}$

Zone	Ext pressure coefficient C_{pe}	Peak velocity pressure $q_{p,}$ (kN/m ²)	Net pressure p (kN/m ²)	Area A_{ref} (m ²)	Net force F_w (kN)
A	-1.20	0.57	-0.43	5.72	-2.47
B	-0.80	0.57	-0.22	22.86	-5.06
C	-0.50	0.57	-0.06	67.42	-4.27
D	0.70	0.67	0.63	77.63	48.74
E	-0.30	0.67	0.02	77.63	1.30

Overall loading

Equiv leeward net force for overall section $F_l = F_{w,WE} = 1.3$ kN

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Net windward force for overall section

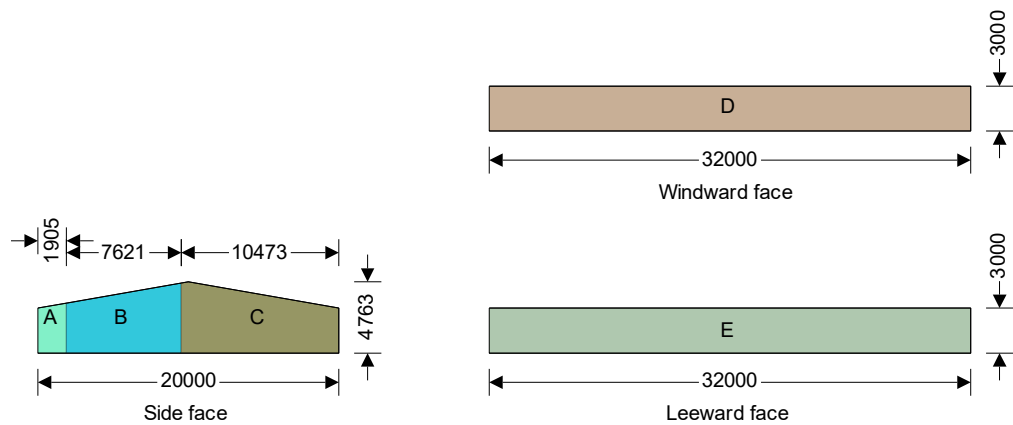
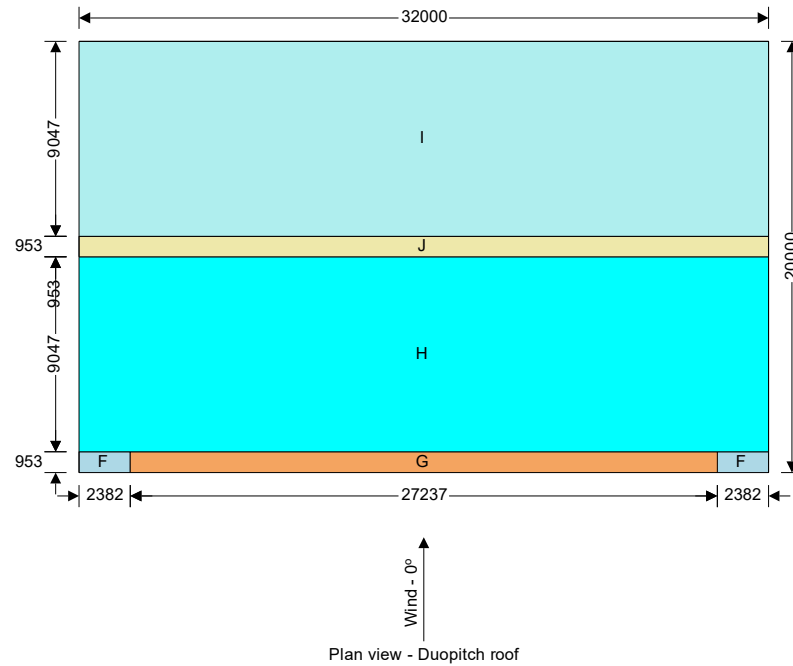
$$F_w = F_{w,wD} = 48.7 \text{ kN}$$

Lack of correlation (cl.7.2.2(3) – Note)

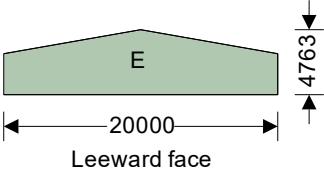
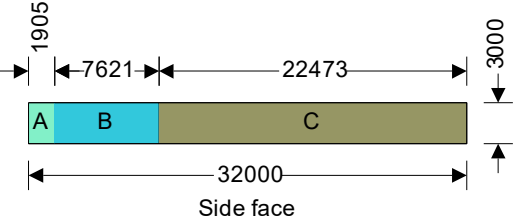
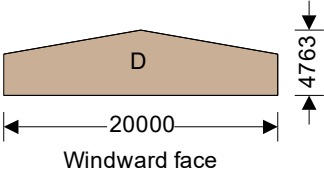
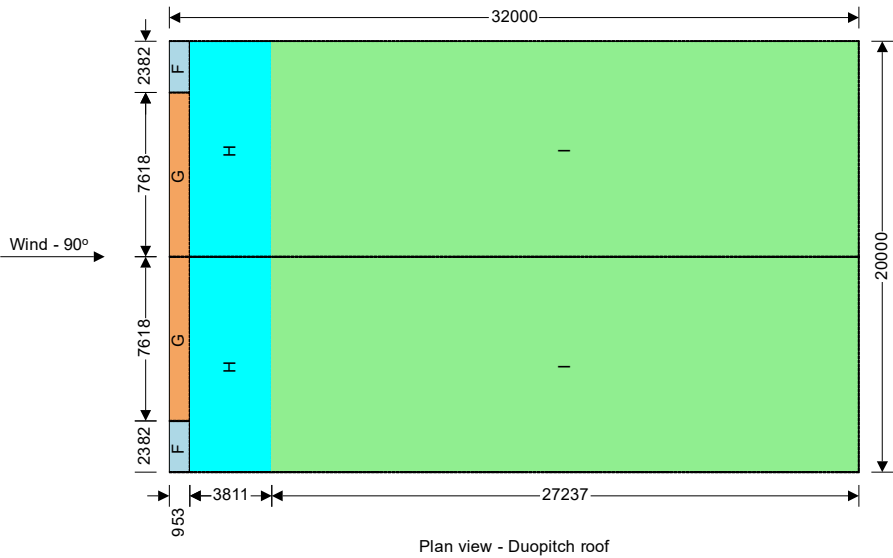
$$f_{corr} = 0.85 \text{ as } h/L \text{ is } 0.149$$

Overall loading overall section

$$F_{w,D} = f_{corr} \times (F_w - F_l + F_{w,h}) = 40.3 \text{ kN}$$



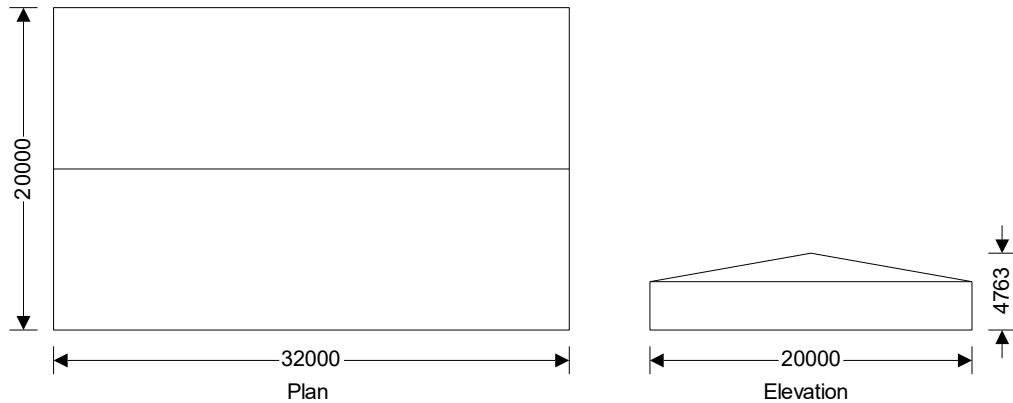
 KSA Consulting Engineers Ltd 1 Central Road Hugglescote LE67 2 FH	Project Manor Farm, Barton in the Beans, Carlton Road, CV13 0DE				Job no. 23M01/23	
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WIND LOADING (BS6399)

TEDDS calculation version 3.0.14



Building data

Type of roof	Duopitch
Length of building	L = 32000 mm
Width of building	W = 20000 mm
Height to eaves	H = 3000 mm
Pitch of roof	$\alpha_0 = 10.0$ deg
Reference height	H _r = 4763 mm

Dynamic classification

Building type factor (Table 1)	K _b = 1.0
Dynamic augmentation factor (1.6.1)	C _r = [K _b × (H _r / (0.1 m)) ^{0.75}] / (800 × log(H _r / (0.1 m))) = 0.01

Site wind speed

Location	Barton in the beans
Basic wind speed (Figure 6 BS6399:Pt 2)	V _b = 21.3 m/s
Site altitude	Δ _s = 130 m
Upwind distance from sea to site	d _{sea} = 107 km
Direction factor	S _d = 1.00
Seasonal factor	S _s = 1.00
Probability factor	S _p = 1.00
Critical gap between buildings	g = 5000 mm
Topography not significant	
Altitude factor	S _a = 1 + 0.001 × Δ _s / 1m = 1.13
Site wind speed	V _s = V _b × S _a × S _d × S _s × S _p = 24.1 m/s
Terrain category	Country
Displacement height (sheltering effect excluded)	H _d = 0mm

The velocity pressure for the windward face of the building with a 0 degree wind is to be considered as 1 part as the height h is less than b (cl.2.2.3.2)

The velocity pressure for the windward face of the building with a 90 degree wind is to be considered as 1 part as the height h is less than b (cl.2.2.3.2)

Dynamic pressure - windward wall - Wind 0 deg and roof

Reference height (at which q is sought)	H _{ref} = 3000mm
Effective height	H _e = max(H _{ref} - H _d , 0.4 × H _{ref}) = 3000mm

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Fetch factor (Table 22) $S_c = 0.776$
Turbulence factor (Table 22) $S_t = 0.207$
Gust peak factor $g_t = 3.44$
Terrain and building factor $S_b = S_c \times (1 + (g_t \times S_t) + S_h) = 1.33$
Effective wind speed $V_e = V_s \times S_b = 32.0$ m/s
Dynamic pressure $q_s = 0.613 \text{ kg/m}^3 \times V_e^2 = 0.628 \text{ kN/m}^2$

Dynamic pressure - windward wall - Wind 90 deg and roof

Reference height (at which q is sought) $H_{ref} = 4763\text{mm}$
Effective height $H_e = \max(H_{ref} - H_d, 0.4 \times H_{ref}) = 4763\text{mm}$
Fetch factor (Table 22) $S_c = 0.869$
Turbulence factor (Table 22) $S_t = 0.194$
Gust peak factor $g_t = 3.44$
Terrain and building factor $S_b = S_c \times (1 + (g_t \times S_t) + S_h) = 1.45$
Effective wind speed $V_e = V_s \times S_b = 34.9$ m/s
Dynamic pressure $q_s = 0.613 \text{ kg/m}^3 \times V_e^2 = 0.746 \text{ kN/m}^2$

Size effect factors

Diagonal dimension for gablewall $a_{eg} = 20.6$ m
External size effect factor gablewall $C_{aeg} = 0.893$
Diagonal dimension for side wall $a_{es} = 32.1$ m
External size effect factor side wall $C_{aes} = 0.860$
Diagonal dimension for roof $a_{er} = 33.6$ m
External size effect factor roof $C_{aer} = 0.856$
Room/storey volume for internal size effect factor $V_i = 0.125 \text{ m}^3$
Diagonal dimension for internal size effect factors $a_i = 10 \times (V_i)^{1/3} = 5.000$ m
Internal size effect factor $C_{ai} = 1.000$

Pressures and forces

Net pressure $p = q_s \times C_{pe} \times C_{ae} - q_s \times C_{pi} \times C_{ai}$
Net force $F_w = p \times A_{ref}$

Roof load case 1 - Wind 0, $C_{pi} 0.20$, $-C_{pe}$

Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A (-ve)	-1.45	0.75	0.856	-1.08	9.22	-9.91
B (-ve)	-1.00	0.75	0.856	-0.79	21.74	-17.12
C (-ve)	-0.50	0.75	0.856	-0.47	293.98	-137.71
E (-ve)	-1.10	0.75	0.856	-0.85	9.22	-7.85
F (-ve)	-0.60	0.75	0.856	-0.53	21.74	-11.57
G (-ve)	-0.45	0.75	0.856	-0.44	293.98	-128.32

Total vertical net force $F_{w,v} = -307.73$ kN

Total horizontal net force $F_{w,h} = -2.95$ kN

Walls load case 1 - Wind 0, $C_{pi} 0.20$, $-C_{pe}$

Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A	-1.59	0.75	0.893	-1.21	6.04	-7.27

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Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A	-1.59	0.75	0.893	-1.21	6.04	-7.27
B	-0.90	0.75	0.893	-0.75	30.54	-22.77
C	-0.88	0.75	0.893	-0.74	41.05	-30.19
w	0.60	0.63	0.860	0.20	96.00	19.02
I	-0.50	0.63	0.860	-0.40	96.00	-37.95

Overall loading

Equiv leeward net force for overall section

$$F_l = F_{w,wl} = -37.9 \text{ kN}$$

Net windward force for overall section

$$F_w = F_{w,ww} = 19.0 \text{ kN}$$

Overall loading overall section

$$F_{w,w} = 0.85 \times (1 + C_r) \times (F_w - F_l + F_{w,h}) = 46.5 \text{ kN}$$

Roof load case 2 - Wind 0, c_{pi} -0.3, $+c_{pe}$

Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A (+ve)	0.10	0.75	0.856	0.29	9.22	2.65
B (+ve)	0.10	0.75	0.856	0.29	21.74	6.25
C (+ve)	0.10	0.75	0.856	0.29	293.98	84.54
E (+ve)	-1.10	0.75	0.856	-0.48	9.22	-4.41
F (+ve)	-0.60	0.75	0.856	-0.16	21.74	-3.47
G (+ve)	-0.45	0.75	0.856	-0.06	293.98	-18.70

Total vertical net force

$$F_{w,v} = 65.85 \text{ kN}$$

Total horizontal net force

$$F_{w,h} = 20.84 \text{ kN}$$

Walls load case 2 - Wind 0, c_{pi} -0.3, $+c_{pe}$

Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A	-1.59	0.75	0.893	-0.83	6.04	-5.02
B	-0.90	0.75	0.893	-0.37	30.54	-11.38
C	-0.88	0.75	0.893	-0.36	41.05	-14.88
w	0.60	0.63	0.860	0.51	96.00	49.15
I	-0.50	0.63	0.860	-0.08	96.00	-7.82

Overall loading

Equiv leeward net force for overall section

$$F_l = F_{w,wl} = -7.8 \text{ kN}$$

Net windward force for overall section

$$F_w = F_{w,ww} = 49.2 \text{ kN}$$

Overall loading overall section

$$F_{w,w} = 0.85 \times (1 + C_r) \times (F_w - F_l + F_{w,h}) = 67.0 \text{ kN}$$

Roof load case 3 - Wind 90, c_{pi} 0.20, $-c_{pe}$

Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A (-ve)	-1.80	0.75	0.856	-1.30	9.67	-12.56
B (-ve)	-1.30	0.75	0.856	-0.98	9.67	-9.47

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Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A (-ve)	-1.80	0.75	0.856	-1.30	9.67	-12.56
B (-ve)	-1.30	0.75	0.856	-0.98	9.67	-9.47
C (-ve)	-0.60	0.75	0.856	-0.53	77.39	-41.19
D (-ve)	-0.45	0.75	0.856	-0.44	553.14	-241.44

Total vertical net force $F_{w,v} = -300.04$ kN

Total horizontal net force $F_{w,h} = 0.00$ kN

Walls load case 3 - Wind 90, c_{pi} 0.20, $-c_{pe}$

Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A	-1.59	0.63	0.860	-0.98	5.72	-5.61
B	-0.90	0.63	0.860	-0.61	22.86	-13.91
C	-0.88	0.63	0.860	-0.60	67.42	-40.48
w	0.60	0.75	0.893	0.25	77.63	19.45
l	-0.50	0.75	0.893	-0.48	77.63	-37.44

Overall loading

Equiv leeward net force for overall section $F_l = F_{w,wl} = -37.4$ kN

Net windward force for overall section $F_w = F_{w,ww} = 19.5$ kN

Overall loading overall section $F_{w,w} = 0.85 \times (1 + C_r) \times (F_w - F_l + F_{w,h}) = 49.0$ kN

Roof load case 4 - Wind 90, c_{pi} -0.3, $-c_{pe}$

Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A (-ve)	-1.80	0.75	0.856	-0.93	9.67	-8.95
B (-ve)	-1.30	0.75	0.856	-0.61	9.67	-5.87
C (-ve)	-0.60	0.75	0.856	-0.16	77.39	-12.34
D (-ve)	-0.45	0.75	0.856	-0.06	553.14	-35.19

Total vertical net force $F_{w,v} = -61.40$ kN

Total horizontal net force $F_{w,h} = 0.00$ kN

Walls load case 4 - Wind 90, c_{pi} -0.3, $-c_{pe}$

Zone	Ext pressure coefficient, C_{pe}	Dynamic pressure, q_s (kN/m ²)	External size factor, C_{ae}	Net Pressure, p (kN/m ²)	Area, A_{ref} (m ²)	Net force, F_w (kN)
A	-1.59	0.63	0.860	-0.67	5.72	-3.81
B	-0.90	0.63	0.860	-0.29	22.86	-6.73
C	-0.88	0.63	0.860	-0.29	67.42	-19.32
w	0.60	0.75	0.893	0.62	77.63	48.40
l	-0.50	0.75	0.893	-0.11	77.63	-8.49

Overall loading

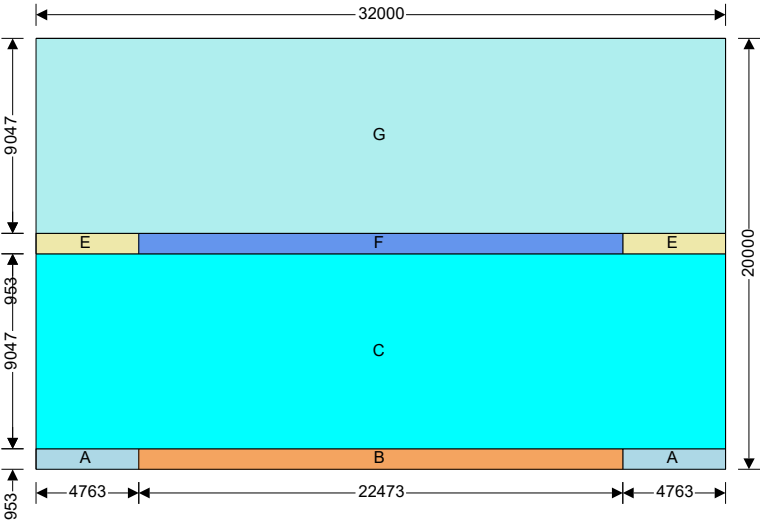
Equiv leeward net force for overall section $F_l = F_{w,wl} = -8.5$ kN

Net windward force for overall section $F_w = F_{w,ww} = 48.4$ kN

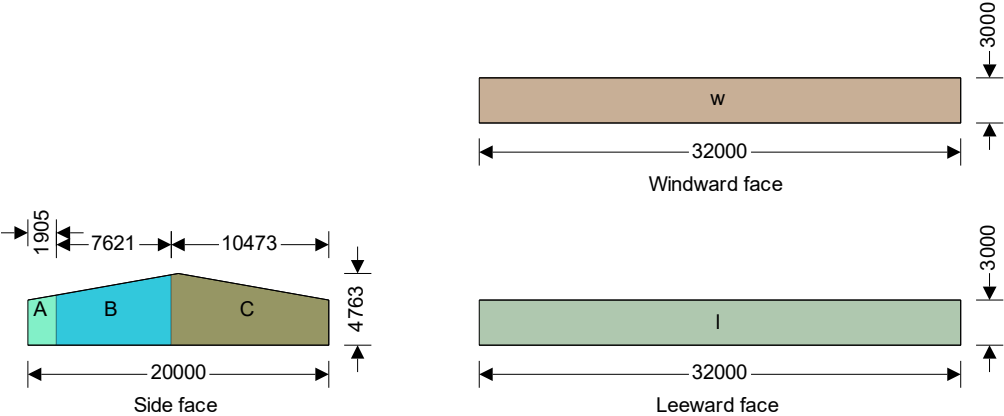
 KSA Consulting Engineers Ltd 1 Central Road Hugglescote LE67 2 FH	Project				Job no.	
	Manor Farm, Barton in the Beans, Carlton Road, CV13 0DE				23M01/23	
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	Wind loading				5	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	KS	April 24				

Overall loading overall section

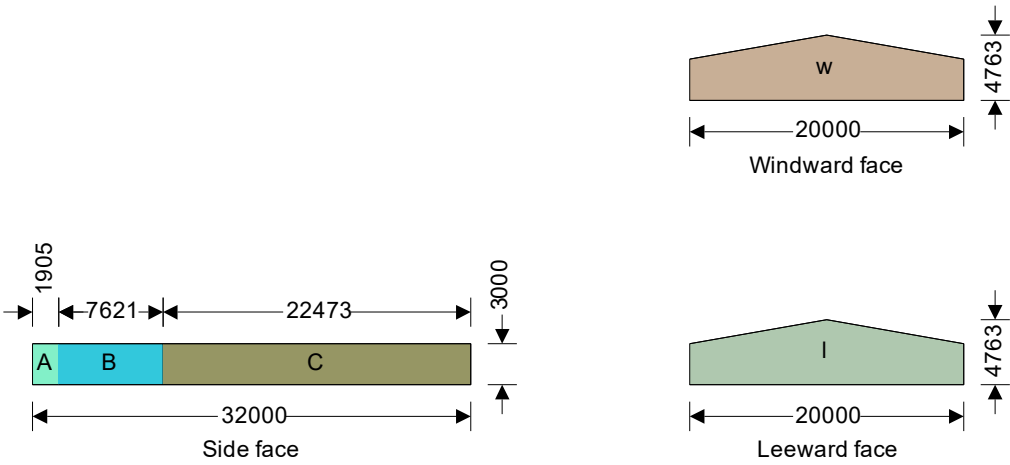
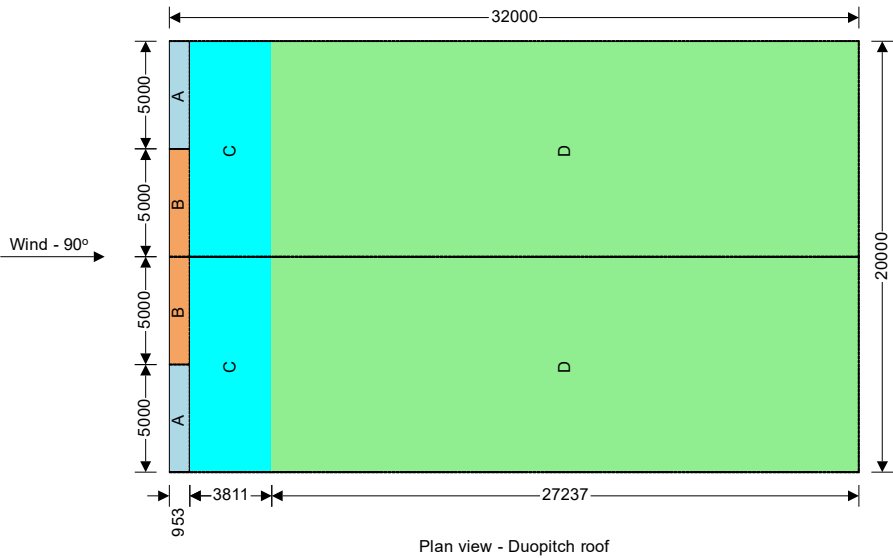
$F_{w,w} = 0.85 \times (1 + C_r) \times (F_w - F_l + F_{w,h}) = 49.0 \text{ kN}$



Wind - 0°
Plan view - Duopitch roof



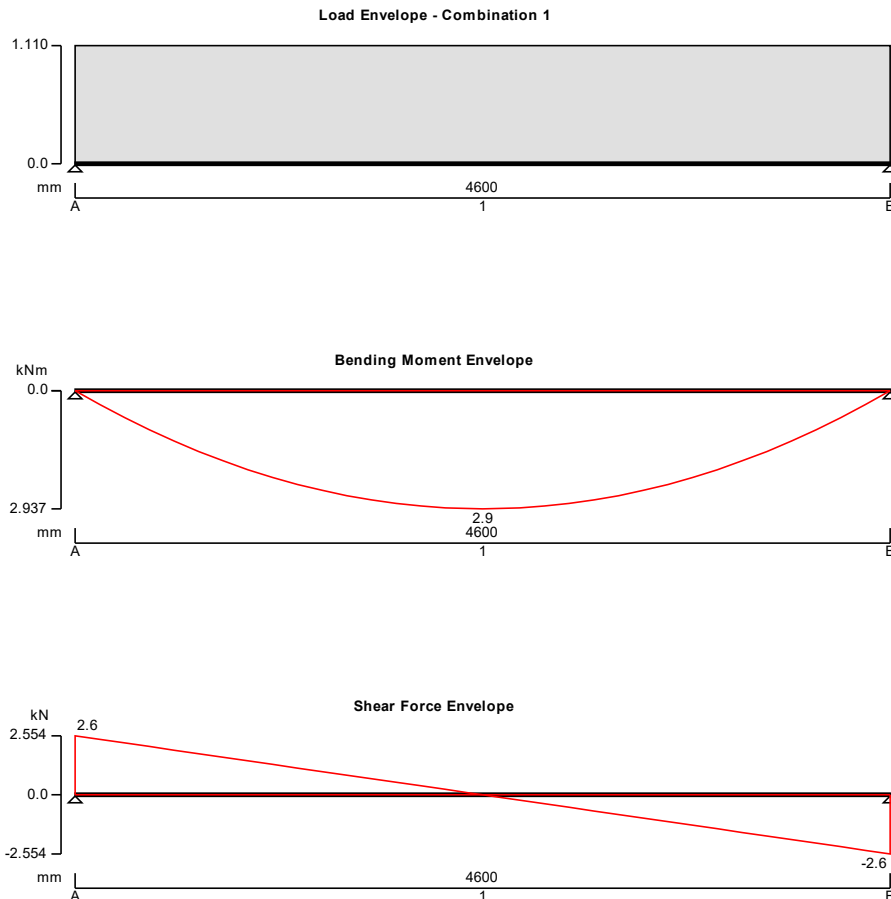
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TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.5.07



Applied loading

Beam loads

DL	Dead full UDL 0.220 kN/m
IL	Imposed full UDL 0.830 kN/m
DL	Dead self weight of beam $\times 1$

Load combinations

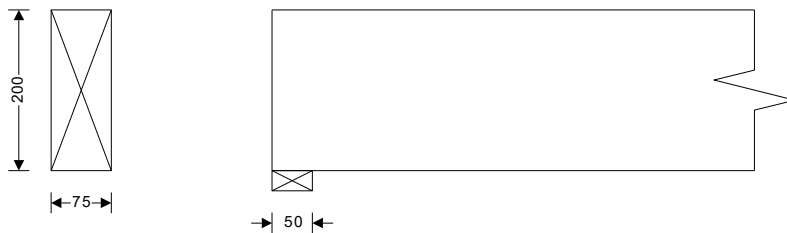
Load combination 1	Support A	Dead $\times 1.00$ Imposed $\times 1.00$
	Span 1	Dead $\times 1.00$ Imposed $\times 1.00$
	Support B	Dead $\times 1.00$ Imposed $\times 1.00$

Analysis results

Maximum moment	$M_{\max} = 2.937 \text{ kNm}$	$M_{\min} = 0.000 \text{ kNm}$
Design moment	$M = \max(\text{abs}(M_{\max}), \text{abs}(M_{\min})) = 2.937 \text{ kNm}$	
Maximum shear	$F_{\max} = 2.554 \text{ kN}$	$F_{\min} = -2.554 \text{ kN}$

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Design shear	$F = \max(\text{abs}(F_{\max}), \text{abs}(F_{\min})) = 2.554 \text{ kN}$	
Total load on beam	$W_{\text{tot}} = 5.107 \text{ kN}$	
Reactions at support A	$R_{A_{\max}} = 2.554 \text{ kN}$	$R_{A_{\min}} = 2.554 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_{\text{Dead}}} = 0.645 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_{\text{Imposed}}} = 1.909 \text{ kN}$	
Reactions at support B	$R_{B_{\max}} = 2.554 \text{ kN}$	$R_{B_{\min}} = 2.554 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_{\text{Dead}}} = 0.645 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_{\text{Imposed}}} = 1.909 \text{ kN}$	



Timber section details

Breadth of sections	$b = 75 \text{ mm}$
Depth of sections	$h = 200 \text{ mm}$
Number of sections in member	$N = 1$
Overall breadth of member	$b_b = N \times b = 75 \text{ mm}$
Inclination of section	$\theta = 10.0 \text{ deg}$
Timber strength class	C22

Member details

Service class of timber	2
Load duration	Medium term
Length of bearing	$L_b = 50 \text{ mm}$

Section properties

Cross sectional area of member	$A = N \times b \times h = 15000 \text{ mm}^2$
Section modulus	$Z_x = N \times b \times h^2 / 6 = 500000 \text{ mm}^3$ $Z_y = h \times (N \times b)^2 / 6 = 187500 \text{ mm}^3$
Second moment of area	$I_x = N \times b \times h^3 / 12 = 50000000 \text{ mm}^4$ $I_y = h \times (N \times b)^3 / 12 = 7031250 \text{ mm}^4$
Radius of gyration	$i_x = \sqrt{I_x / A} = 57.7 \text{ mm}$ $i_y = \sqrt{I_y / A} = 21.7 \text{ mm}$
Second moment of area of rotated section	$I_\theta = (I_x + I_y) / 2 + (I_x - I_y) \times \cos(2 \times \theta) / 2 = 48704334 \text{ mm}^4$

Modification factors

Duration of loading - Table 17	$K_3 = 1.25$
Bearing stress - Table 18	$K_4 = 1.00$
Total depth of member - cl.2.10.6	$K_7 = (300 \text{ mm} / h)^{0.11} = 1.05$
Load sharing - cl.2.9	$K_8 = 1.00$

Lateral support - cl.2.10.8

Ends held in position and members held in line, as by direct connection of sheathing, deck or joists	
Permissible depth-to-breadth ratio - Table 19	5.00
Actual depth-to-breadth ratio	$h / (N \times b) = 2.67$

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PASS - Lateral support is adequate

Compression perpendicular to grain

Permissible bearing stress (with wane)

$$\sigma_{c_adm} = \sigma_{cp2} \times K_3 \times K_4 \times K_8 = \mathbf{2.125 \text{ N/mm}^2}$$

Applied bearing stress

$$\sigma_{c_a} = R_{B_max} / (N \times b \times L_b) = \mathbf{0.681 \text{ N/mm}^2}$$

$$\sigma_{c_a} / \sigma_{c_adm} = \mathbf{0.320}$$

PASS - Applied compressive stress is less than permissible compressive stress at bearing

Bending parallel to grain

Permissible bending stress

$$\sigma_{m_adm} = \sigma_m \times K_3 \times K_7 \times K_8 = \mathbf{8.888 \text{ N/mm}^2}$$

Applied bending stress

$$\sigma_{m_a} = M \times \cos(\theta) / Z_x + M \times \sin(\theta) / Z_y = \mathbf{8.504 \text{ N/mm}^2}$$

$$\sigma_{m_a} / \sigma_{m_adm} = \mathbf{0.957}$$

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress

$$\tau_{adm} = \tau \times K_3 \times K_8 = \mathbf{0.888 \text{ N/mm}^2}$$

Applied shear stress

$$\tau_a = 3 \times F / (2 \times A) = \mathbf{0.255 \text{ N/mm}^2}$$

$$\tau_a / \tau_{adm} = \mathbf{0.288}$$

PASS - Applied shear stress is less than permissible shear stress

Deflection

Modulus of elasticity for deflection

$$E = E_{min} = \mathbf{6500 \text{ N/mm}^2}$$

Permissible deflection

$$\delta_{adm} = \min(23 \text{ mm}, 0.005 \times L_{s1}) = \mathbf{23.000 \text{ mm}}$$

Bending deflection

$$\delta_{b_s1} = \mathbf{20.447 \text{ mm}}$$

Shear deflection

$$\delta_{v_s1} = \mathbf{0.578 \text{ mm}}$$

Total deflection

$$\delta_a = \delta_{b_s1} + \delta_{v_s1} = \mathbf{21.026 \text{ mm}}$$

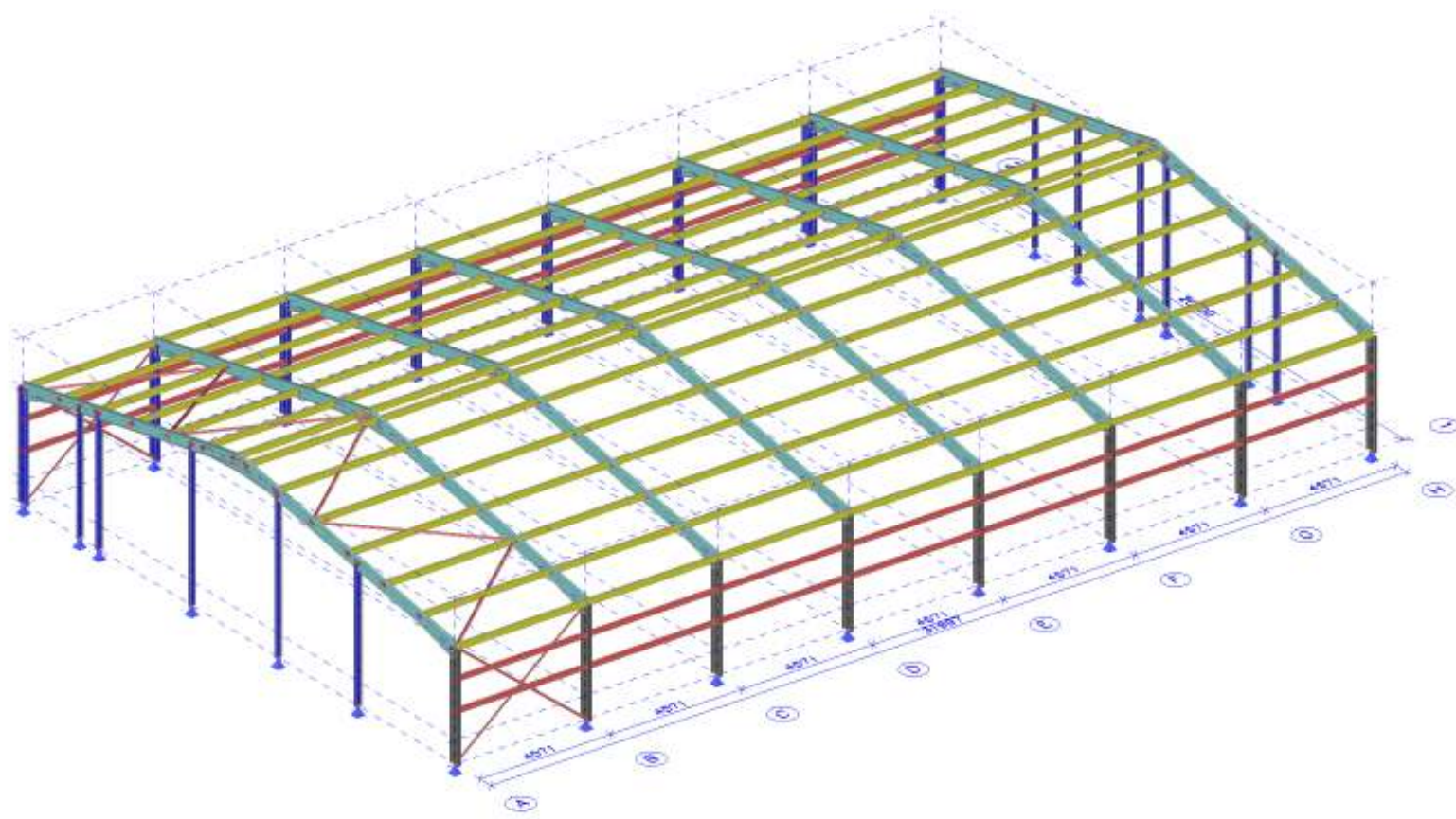
$$\delta_a / \delta_{adm} = \mathbf{0.914}$$

PASS - Total deflection is less than permissible deflection

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2. Structure



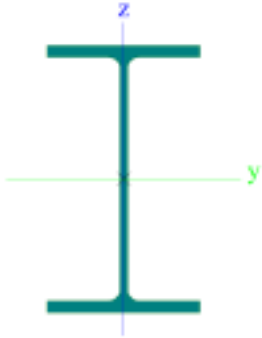
3. Project

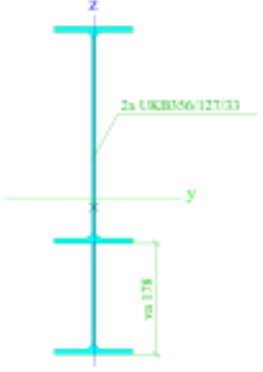
Licence user	admin@quick-calcs.net
Project	Manor Farm
Part	Portal framed structure
Description	-
Author	KS
Date	Mar 24
Structure	Frame XYZ
No. of nodes :	177
No. of beams :	173
No. of slabs :	0
No. of solids :	0
No. of used profiles :	5
No. of load cases :	51
No. of used materials :	3
Acceleration of gravity [m/s²]	9.810
National code	EC - EN

4. Cross-sections

CS5	
Type	UB178/102/19

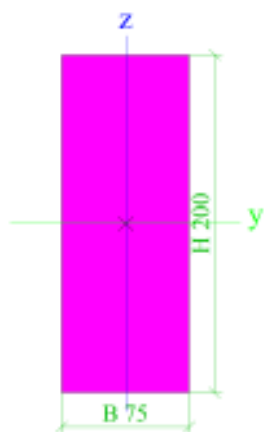
Formcode	1 - I section
Shape type	Thin-walled

Item material	S 275	
Fabrication	rolled	
Colour		
Flexural buckling y-y,	a	b
Flexural buckling z-z		
A [m ²]	2.4300e-03	
A _y [m ²], A _z [m ²]	1.5267e-03	8.6654e-04
A _L [m ² /m], A _D [m ² /m]	7.3800e-01	7.3769e-01
c _{y,UCS} [mm], c _{z,UCS} [mm]	51	89
α [deg]	0.00	
I _y [m ⁴], I _z [m ⁴]	1.3565e-05	1.3671e-06
i _y [mm], i _z [mm]	75	24
W _{el,y} [m ³], W _{el,z} [m ³]	1.5300e-04	2.7000e-05
W _{pl,y} [m ³], W _{pl,z} [m ³]	1.7126e-04	4.1590e-05
M _{pl,y,+} [Nm], M _{pl,y,-} [Nm]	47115.30	47115.30
M _{pl,z,+} [Nm], M _{pl,z,-} [Nm]	11438.55	11438.55
d _y [mm], d _z [mm]	0	0
I _t [m ⁴], I _w [m ⁶]	4.4100e-08	9.8479e-09
β _y [mm], β _z [mm]	0	0
Picture		
CS4		
Type	UB356/127/33	
Formcode	1 - I section	
Shape type	Thin-walled	
Item material	S 275	
Fabrication	rolled	
Colour		
Flexural buckling y-y,	a	b
Flexural buckling z-z		
A [m ²]	4.2100e-03	
A _y [m ²], A _z [m ²]	2.0767e-03	2.0818e-03
A _L [m ² /m], A _D [m ² /m]	1.1700e+00	1.1700e+00
c _{y,UCS} [mm], c _{z,UCS} [mm]	63	175
α [deg]	0.00	
I _y [m ⁴], I _z [m ⁴]	8.2538e-05	2.8025e-06
i _y [mm], i _z [mm]	140	26
W _{el,y} [m ³], W _{el,z} [m ³]	4.7300e-04	4.4700e-05
W _{pl,y} [m ³], W _{pl,z} [m ³]	5.4290e-04	7.0291e-05
M _{pl,y,+} [Nm], M _{pl,y,-} [Nm]	149370.54	149370.54
M _{pl,z,+} [Nm], M _{pl,z,-} [Nm]	19333.18	19333.18
d _y [mm], d _z [mm]	0	0
I _t [m ⁴], I _w [m ⁶]	8.7900e-08	8.0972e-08
β _y [mm], β _z [mm]	0	0

Picture		
CS6		
Type	I + I var	
Detailed	UKB356/127/33; 178	
Shape type	Thin-walled	
Item material	S 275	
Fabrication	welded	
Colour		
Flexural buckling y-y,	b	c
Flexural buckling z-z		
A [m ²]	6.3431e-03	
A _y [m ²], A _z [m ²]	3.1153e-03	3.2701e-03
A _L [m ² /m], A _D [m ² /m]	1.7560e+00	1.7560e+00
c _{y,UCS} [mm], c _{z,UCS} [mm]	63	250
α [deg]	0.00	
I _y [m ⁴], I _z [m ⁴]	2.2122e-04	4.2037e-06
i _y [mm], i _z [mm]	187	26
W _{el,y} [m ³], W _{el,z} [m ³]	7.9854e-04	6.7045e-05
W _{pl,y} [m ³], W _{pl,z} [m ³]	1.0058e-03	1.0549e-04
M _{pl,y,+} [Nm], M _{pl,y,-} [Nm]	276593.33	276593.33
M _{pl,z,+} [Nm], M _{pl,z,-} [Nm]	29008.43	29008.43
d _y [mm], d _z [mm]	0	-13
I _t [m ⁴], I _w [m ⁶]	1.1434e-07	1.9391e-07
β _y [mm], β _z [mm]	65	0
Picture		
CS7		
Type	RECT	
Detailed	75; 200	
Shape type	Thick-walled	
Item material	C24 (EN 338)	
Fabrication	timber	
Colour		
A [m ²]	1.5000e-02	
A _y [m ²], A _z [m ²]	1.2512e-02	1.2502e-02
A _L [m ² /m], A _D [m ² /m]	5.5000e-01	5.5000e-01
c _{y,UCS} [mm], c _{z,UCS} [mm]	38	100
α [deg]	0.00	

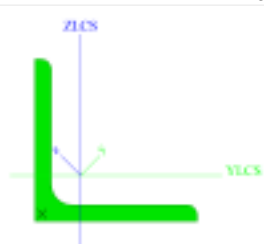
I_y [m ⁴], I_z [m ⁴]	5.0000e-05	7.0313e-06
i_y [mm], i_z [mm]	58	22
$W_{el,y}$ [m ³], $W_{el,z}$ [m ³]	5.0000e-04	1.8750e-04
$W_{pl,y}$ [m ³], $W_{pl,z}$ [m ³]	6.1268e-04	2.2975e-04
$M_{pl,y,+}$ [Nm], $M_{pl,y,-}$ [Nm]	12866.20	12866.20
$M_{pl,z,+}$ [Nm], $M_{pl,z,-}$ [Nm]	4824.82	4824.82
d_y [mm], d_z [mm]	0	0
I_t [m ⁴], I_w [m ⁶]	2.1487e-05	1.3273e-08
β_y [mm], β_z [mm]	0	0

Picture

**CS8**

Type	HFLeq70x70x7	
Formcode	4 - L section	
Shape type	Thin-walled	
Item material	S 275	
Fabrication	rolled	
Colour		
Flexural buckling y-y, Flexural buckling z-z	b	b
A [m ²]	9.3970e-04	
A_y [m ²], A_z [m ²]	7.8961e-04	7.9525e-04
A_L [m ² /m], A_D [m ² /m]	2.7200e-01	2.7224e-01
$C_{y,UCS}$ [mm], $C_{z,UCS}$ [mm]	20	20
$I_{y,LCS}$ [m ⁴], $I_{z,LCS}$ [m ⁴]	4.2290e-07	4.2290e-07
$I_{yz,LCS}$ [m ⁴]	-2.4779e-07	
α [deg]	45.00	
I_y [m ⁴], I_z [m ⁴]	6.7090e-07	1.7500e-07
i_y [mm], i_z [mm]	27	14
$W_{el,y}$ [m ³], $W_{el,z}$ [m ³]	1.3548e-05	6.2796e-06
$W_{pl,y}$ [m ³], $W_{pl,z}$ [m ³]	2.1545e-05	1.1097e-05
$M_{pl,y,+}$ [Nm], $M_{pl,y,-}$ [Nm]	5924.99	5924.99
$M_{pl,z,+}$ [Nm], $M_{pl,z,-}$ [Nm]	3051.69	3051.69
d_y [mm], d_z [mm]	-24	0
I_t [m ⁴], I_w [m ⁶]	1.6000e-08	1.1673e-40
β_y [mm], β_z [mm]	0	92

Picture

**Explanations of symbols**

Formcode	h - Height
	b - Flange width
	t - Flange thickness
	s - Web thickness

Explanations of symbols

	r - Radius at flange root
	r1 - Radius at flange toe
	a - Flange slope
	W - Internal bolt distance

Explanations of symbols	
	w _m - Unit warping at flange toe
A	Area
A _y	Shear Area in principal y-direction
A _z	Shear Area in principal z-direction
A _L	Circumference per unit length
A _D	Drying surface per unit length
C _{Y,UCS}	Centroid coordinate in Y-direction of Input axis system
C _{Z,UCS}	Centroid coordinate in Z-direction of Input axis system
I _{Y,LCS}	Second moment of area about the YLCS axis
I _{Z,LCS}	Second moment of area about the ZLCS axis
I _{YZ,LCS}	Product moment of area in the LCS system
α	Rotation angle of the principal axis system
I _y	Second moment of area about the principal y-axis
I _z	Second moment of area about the principal z-axis
i _y	Radius of gyration about the principal y-axis

Explanations of symbols	
i _z	Radius of gyration about the principal z-axis
W _{el,y}	Elastic section modulus about the principal y-axis
W _{el,z}	Elastic section modulus about the principal z-axis
W _{pl,y}	Plastic section modulus about the principal y-axis
W _{pl,z}	Plastic section modulus about the principal z-axis
M _{pl,y,+}	Plastic moment about the principal y-axis for a positive M _y moment
M _{pl,y,-}	Plastic moment about the principal y-axis for a negative M _y moment
M _{pl,z,+}	Plastic moment about the principal z-axis for a positive M _z moment
M _{pl,z,-}	Plastic moment about the principal z-axis for a negative M _z moment
d _y	Shear center coordinate in principal y-direction measured from the centroid
d _z	Shear center coordinate in principal z-direction measured from the centroid
I _t	Torsional constant
I _w	Warping constant
β _y	Mono-symmetry constant about the principal y-axis
β _z	Mono-symmetry constant about the principal z-axis

5. Materials

Steel EC3

Name	ρ [kg/m ³]	E _{mod} [MPa] G _{mod} [MPa]	μ α [m/mK]	Lower limit [mm]	Upper limit [mm]	F _y [MPa]	F _u [MPa]	Colour
S 235	7850.00	2.1000e+05 8.0769e+04	0.3 0.01e-003	0 40	40 80	235.0 215.0	360.0 360.0	■
S 275	7850.00	2.1000e+05 8.0769e+04	0.3 0.01e-003	0 40	40 80	275.0 255.0	430.0 410.0	■

Timber EC5

Name	Type of timber	μ α [m/mK]	E _{mod} [MPa] G _{mod} [MPa]	f _{m,k} [MPa]	f _{t,0,k} [MPa]	f _{t,90,k} [MPa]	f _{c,0,k} [MPa]	f _{c,90,k} [MPa]	f _{v,k} [MPa]	Colour
C24 (EN 338)	Solid 420.00	0 5.00e-06	1.1000e+04 6.9000e+02	24.0	14.5	0.4	21.0	2.5	4.0	■

6. Load cases

Name	Description	Action type	Load group	Direction	Duration	Master load case
	Spec	Load type				
LC1	Self weight	Permanent Self weight	LG1	-Z		
LC2	Permanent	Permanent Standard	LG1			
LC3	Variable Standard	Variable Static	LG2		Short	None
3DWind1	0, + CPE, + CPI Static wind	Variable Static	LG3			None
3DWind2	0, + CPE, - CPI Static wind	Variable Static	LG3			None

Name	Description	Action type	Load group	Direction	Duration	Master load case
	Spec	Load type				
3DWind3	0, - CPE, + CPI Static wind	Variable Static	LG3			None
3DWind4	0, - CPE, - CPI Static wind	Variable Static	LG3			None
3DWind5	90, + CPE, + CPI Static wind	Variable Static	LG3			None
3DWind6	90, + CPE, - CPI Static wind	Variable Static	LG3			None
3DWind7	90, - CPE, + CPI Static wind	Variable Static	LG3			None
3DWind8	90, - CPE, - CPI Static wind	Variable Static	LG3			None
3DWind9	180, + CPE, + CPI Static wind	Variable Static	LG3			None
3DWind10	180, + CPE, - CPI Static wind	Variable Static	LG3			None
3DWind11	180, - CPE, + CPI Static wind	Variable Static	LG3			None
3DWind12	180, - CPE, - CPI Static wind	Variable Static	LG3			None
3DWind13	270, + CPE, + CPI Static wind	Variable Static	LG3			None
3DWind14	270, + CPE, - CPI Static wind	Variable Static	LG3			None
3DWind15	270, - CPE, + CPI Static wind	Variable Static	LG3			None
3DWind16	270, - CPE, - CPI Static wind	Variable Static	LG3			None
3DWind17	0, +/- Cpe, + CPE, + CPI Static wind	Variable Static	LG3			None
3DWind18	0, -/+ Cpe, + CPE, + CPI Static wind	Variable Static	LG3			None
3DWind19	0, +/- Cpe, + CPE, - CPI Static wind	Variable Static	LG3			None
3DWind20	0, -/+ Cpe, + CPE, - CPI Static wind	Variable Static	LG3			None
3DWind21	0, +/- Cpe, - CPE, + CPI Static wind	Variable Static	LG3			None
3DWind22	0, -/+ Cpe, - CPE, + CPI Static wind	Variable Static	LG3			None
3DWind23	0, +/- Cpe, - CPE, - CPI Static wind	Variable Static	LG3			None
3DWind24	0, -/+ Cpe, - CPE, - CPI Static wind	Variable Static	LG3			None
3DWind25	90, +/- Cpe, + CPE, + CPI Static wind	Variable Static	LG3			None
3DWind26	90, -/+ Cpe, + CPE, + CPI Static wind	Variable Static	LG3			None
3DWind27	90, +/- Cpe, + CPE, - CPI Static wind	Variable Static	LG3			None
3DWind28	90, -/+ Cpe, + CPE, - CPI Static wind	Variable Static	LG3			None
3DWind29	90, +/- Cpe, - CPE, + CPI	Variable	LG3			None

Name	Description	Action type	Load group	Direction	Duration	Master load case
	Spec	Load type				
	CPI					
	Static wind	Static				
3DWind30	90, -/+ Cpe, - CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind31	90, +/- Cpe, - CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind32	90, -/+ Cpe, - CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind33	180, +/- Cpe, + CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind34	180, -/+ Cpe, + CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind35	180, +/- Cpe, + CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind36	180, -/+ Cpe, + CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind37	180, +/- Cpe, - CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind38	180, -/+ Cpe, - CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind39	180, +/- Cpe, - CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind40	180, -/+ Cpe, - CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind41	270, +/- Cpe, + CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind42	270, -/+ Cpe, + CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind43	270, +/- Cpe, + CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind44	270, -/+ Cpe, + CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind45	270, +/- Cpe, - CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind46	270, -/+ Cpe, - CPE, + CPI	Variable	LG3			None
	Static wind	Static				
3DWind47	270, +/- Cpe, - CPE, - CPI	Variable	LG3			None
	Static wind	Static				
3DWind48	270, -/+ Cpe, - CPE, - CPI	Variable	LG3			None
	Static wind	Static				

7. Combinations

Name	Description	Type	Load cases	Coeff. [-]
ULS-Set B (auto)		EN-ULS (STR/GEO) Set B	LC1 - Self weight	1.000
			LC2 - Permanent	1.000
			LC3 - Variable	1.000
			3DWind1 - 0, + CPE, + CPI	1.000
			3DWind2 - 0, + CPE, - CPI	1.000
			3DWind3 - 0, - CPE, + CPI	1.000
			3DWind4 - 0, - CPE, - CPI	1.000
			3DWind5 - 90, + CPE, + CPI	1.000
			3DWind6 - 90, + CPE, - CPI	1.000
			3DWind7 - 90, - CPE, + CPI	1.000
			3DWind8 - 90, - CPE, - CPI	1.000
			3DWind9 - 180, + CPE, + CPI	1.000
			3DWind10 - 180, + CPE, - CPI	1.000
			3DWind11 - 180, - CPE, + CPI	1.000
			3DWind12 - 180, - CPE, - CPI	1.000
			3DWind13 - 270, + CPE, + CPI	1.000
			3DWind14 - 270, + CPE, - CPI	1.000
			3DWind15 - 270, - CPE, + CPI	1.000
			3DWind16 - 270, - CPE, - CPI	1.000
			3DWind17 - 0, +/- Cpe, + CPE, + CPI	1.000
			3DWind18 - 0, -/+ Cpe, + CPE, + CPI	1.000
			3DWind19 - 0, +/- Cpe, + CPE, - CPI	1.000
			3DWind20 - 0, -/+ Cpe, + CPE, - CPI	1.000
			3DWind21 - 0, +/- Cpe, - CPE, + CPI	1.000
			3DWind22 - 0, -/+ Cpe, - CPE, + CPI	1.000
			3DWind23 - 0, +/- Cpe, - CPE, - CPI	1.000
			3DWind24 - 0, -/+ Cpe, - CPE, - CPI	1.000
			3DWind25 - 90, +/- Cpe, + CPE, + CPI	1.000
			3DWind26 - 90, -/+ Cpe, + CPE, + CPI	1.000
			3DWind27 - 90, +/- Cpe, + CPE, - CPI	1.000
			3DWind28 - 90, -/+ Cpe, + CPE, - CPI	1.000
			3DWind29 - 90, +/- Cpe, - CPE, + CPI	1.000
			3DWind30 - 90, -/+ Cpe, - CPE, + CPI	1.000
			3DWind31 - 90, +/- Cpe, - CPE, - CPI	1.000
			3DWind32 - 90, -/+ Cpe, - CPE, - CPI	1.000
			3DWind33 - 180, +/- Cpe, + CPE, + CPI	1.000
			3DWind34 - 180, -/+ Cpe, + CPE, + CPI	1.000
			3DWind35 - 180, +/- Cpe, + CPE, - CPI	1.000
			3DWind36 - 180, -/+ Cpe, + CPE, - CPI	1.000
			3DWind37 - 180, +/- Cpe, - CPE, + CPI	1.000
			3DWind38 - 180, -/+ Cpe, - CPE, + CPI	1.000

Name	Description	Type	Load cases	Coeff. [-]
			3DWind39 - 180, +/- Cpe, - CPE, - CPI	1.000
			3DWind40 - 180, -/+ Cpe, - CPE, - CPI	1.000
			3DWind41 - 270, +/- Cpe, + CPE, + CPI	1.000
			3DWind42 - 270, -/+ Cpe, + CPE, + CPI	1.000
			3DWind43 - 270, +/- Cpe, + CPE, - CPI	1.000
			3DWind44 - 270, -/+ Cpe, + CPE, - CPI	1.000
			3DWind45 - 270, +/- Cpe, - CPE, + CPI	1.000
			3DWind46 - 270, -/+ Cpe, - CPE, + CPI	1.000
			3DWind47 - 270, +/- Cpe, - CPE, - CPI	1.000
			3DWind48 - 270, -/+ Cpe, - CPE, - CPI	1.000
SLS-Char (auto)		EN-SLS Characteristic	LC1 - Self weight	1.000
			LC2 - Permanent	1.000
			LC3 - Variable	1.000
			3DWind1 - 0, + CPE, + CPI	1.000
			3DWind2 - 0, + CPE, - CPI	1.000
			3DWind3 - 0, - CPE, + CPI	1.000
			3DWind4 - 0, - CPE, - CPI	1.000
			3DWind5 - 90, + CPE, + CPI	1.000
			3DWind6 - 90, + CPE, - CPI	1.000
			3DWind7 - 90, - CPE, + CPI	1.000
			3DWind8 - 90, - CPE, - CPI	1.000
			3DWind9 - 180, + CPE, + CPI	1.000
			3DWind10 - 180, + CPE, - CPI	1.000
			3DWind11 - 180, - CPE, + CPI	1.000
			3DWind12 - 180, - CPE, - CPI	1.000
			3DWind13 - 270, + CPE, + CPI	1.000
			3DWind14 - 270, + CPE, - CPI	1.000
			3DWind15 - 270, - CPE, + CPI	1.000
			3DWind16 - 270, - CPE, - CPI	1.000
			3DWind17 - 0, +/- Cpe, + CPE, + CPI	1.000
			3DWind18 - 0, -/+ Cpe, + CPE, + CPI	1.000
			3DWind19 - 0, +/- Cpe, + CPE, - CPI	1.000
			3DWind20 - 0, -/+ Cpe, + CPE, - CPI	1.000
			3DWind21 - 0, +/- Cpe, - CPE, + CPI	1.000
			3DWind22 - 0, -/+ Cpe, - CPE, + CPI	1.000
			3DWind23 - 0, +/- Cpe, - CPE, - CPI	1.000
			3DWind24 - 0, -/+ Cpe, - CPE, - CPI	1.000
			3DWind25 - 90, +/- Cpe, + CPE, + CPI	1.000
			3DWind26 - 90, -/+ Cpe, + CPE, + CPI	1.000
			3DWind27 - 90, +/- Cpe, + CPE, - CPI	1.000
			3DWind28 - 90, -/+ Cpe, + CPE, - CPI	1.000
			3DWind29 - 90, +/- Cpe, - CPE, + CPI	1.000

Name	Description	Type	Load cases	Coeff. [-]
			3DWind30 - 90, -/+ Cpe, - CPE, + CPI	1.000
			3DWind31 - 90, +/- Cpe, - CPE, - CPI	1.000
			3DWind32 - 90, -/+ Cpe, - CPE, - CPI	1.000
			3DWind33 - 180, +/- Cpe, + CPE, + CPI	1.000
			3DWind34 - 180, -/+ Cpe, + CPE, + CPI	1.000
			3DWind35 - 180, +/- Cpe, + CPE, - CPI	1.000
			3DWind36 - 180, -/+ Cpe, + CPE, - CPI	1.000
			3DWind37 - 180, +/- Cpe, - CPE, + CPI	1.000
			3DWind38 - 180, -/+ Cpe, - CPE, + CPI	1.000
			3DWind39 - 180, +/- Cpe, - CPE, - CPI	1.000
			3DWind40 - 180, -/+ Cpe, - CPE, - CPI	1.000
			3DWind41 - 270, +/- Cpe, + CPE, + CPI	1.000
			3DWind42 - 270, -/+ Cpe, + CPE, + CPI	1.000
			3DWind43 - 270, +/- Cpe, + CPE, - CPI	1.000
			3DWind44 - 270, -/+ Cpe, + CPE, - CPI	1.000
			3DWind45 - 270, +/- Cpe, - CPE, + CPI	1.000
			3DWind46 - 270, -/+ Cpe, - CPE, + CPI	1.000
			3DWind47 - 270, +/- Cpe, - CPE, - CPI	1.000
			3DWind48 - 270, -/+ Cpe, - CPE, - CPI	1.000
SLS-Quasi (auto)		EN-SLS Quasi-permanent	LC1 - Self weight	1.000
			LC2 - Permanent	1.000
			LC3 - Variable	1.000
			3DWind1 - 0, + CPE, + CPI	1.000
			3DWind2 - 0, + CPE, - CPI	1.000
			3DWind3 - 0, - CPE, + CPI	1.000
			3DWind4 - 0, - CPE, - CPI	1.000
			3DWind5 - 90, + CPE, + CPI	1.000
			3DWind6 - 90, + CPE, - CPI	1.000
			3DWind7 - 90, - CPE, + CPI	1.000
			3DWind8 - 90, - CPE, - CPI	1.000
			3DWind9 - 180, + CPE, + CPI	1.000
			3DWind10 - 180, + CPE, - CPI	1.000
			3DWind11 - 180, - CPE, + CPI	1.000
			3DWind12 - 180, - CPE, - CPI	1.000
			3DWind13 - 270, + CPE, + CPI	1.000
			3DWind14 - 270, + CPE, - CPI	1.000
			3DWind15 - 270, - CPE, + CPI	1.000
			3DWind16 - 270, - CPE, - CPI	1.000
			3DWind17 - 0, +/- Cpe, + CPE, + CPI	1.000
			3DWind18 - 0, -/+ Cpe, + CPE, + CPI	1.000
			3DWind19 - 0, +/- Cpe, + CPE, - CPI	1.000
			3DWind20 - 0, -/+ Cpe, + CPE, - CPI	1.000

Name	Description	Type	Load cases	Coeff. [-]
			3DWind21 - 0, +/- Cpe, - CPE, + CPI	1.000
			3DWind22 - 0, -/+ Cpe, - CPE, + CPI	1.000
			3DWind23 - 0, +/- Cpe, - CPE, - CPI	1.000
			3DWind24 - 0, -/+ Cpe, - CPE, - CPI	1.000
			3DWind25 - 90, +/- Cpe, + CPE, + CPI	1.000
			3DWind26 - 90, -/+ Cpe, + CPE, + CPI	1.000
			3DWind27 - 90, +/- Cpe, + CPE, - CPI	1.000
			3DWind28 - 90, -/+ Cpe, + CPE, - CPI	1.000
			3DWind29 - 90, +/- Cpe, - CPE, + CPI	1.000
			3DWind30 - 90, -/+ Cpe, - CPE, + CPI	1.000
			3DWind31 - 90, +/- Cpe, - CPE, - CPI	1.000
			3DWind32 - 90, -/+ Cpe, - CPE, - CPI	1.000
			3DWind33 - 180, +/- Cpe, + CPE, + CPI	1.000
			3DWind34 - 180, -/+ Cpe, + CPE, + CPI	1.000
			3DWind35 - 180, +/- Cpe, + CPE, - CPI	1.000
			3DWind36 - 180, -/+ Cpe, + CPE, - CPI	1.000
			3DWind37 - 180, +/- Cpe, - CPE, + CPI	1.000
			3DWind38 - 180, -/+ Cpe, - CPE, + CPI	1.000
			3DWind39 - 180, +/- Cpe, - CPE, - CPI	1.000
			3DWind40 - 180, -/+ Cpe, - CPE, - CPI	1.000
			3DWind41 - 270, +/- Cpe, + CPE, + CPI	1.000
			3DWind42 - 270, -/+ Cpe, + CPE, + CPI	1.000
			3DWind43 - 270, +/- Cpe, + CPE, - CPI	1.000
			3DWind44 - 270, -/+ Cpe, + CPE, - CPI	1.000
			3DWind45 - 270, +/- Cpe, - CPE, + CPI	1.000
			3DWind46 - 270, -/+ Cpe, - CPE, + CPI	1.000
			3DWind47 - 270, +/- Cpe, - CPE, - CPI	1.000
			3DWind48 - 270, -/+ Cpe, - CPE, - CPI	1.000

8. Wind data

Name	Type	Roof type	Roof overhangs	Swap outer surface	Load direction
WD1	Wall			X	0
					90
					180
					270
WD2	Wall			X	0

Name	Type	Roof type	Roof overhangs	Swap outer surface	Load direction
					90
					180
					270
WD3	Wall			X	0
					90
					180
					270
WD4	Wall			X	0
					90
					180
					270
WD5	Wall			X	0
					90
					180
					270
WD6	Wall			X	0
					90
					180
					270
WD7	Wall			X	0
					90
					180
					270
WD8	Wall			X	0
					90
					180
					270
WD9	Wall			X	0
					90
					180
					270
WD10	Wall			X	0
					90
					180
					270
WD11	Wall			X	0
					90
					180
					270
WD12	Wall			X	0
					90
					180
					270
WD13	Wall			X	0
					90
					180
					270
WD14	Wall			X	0
					90
					180
					270
WD15	Roof	Monopitch	X	X	0
					90
					180
					270
WD16	Roof	Monopitch	X	X	0
					90
					180
					270
WD17	Roof	Monopitch	X	X	0
					90
					180
					270
WD18	Roof	Monopitch	X	X	0
					90
					180
					270

Name	Type	Roof type	Roof overhangs	Swap outer surface	Load direction
WD19	Roof	Monopitch	X	X	0
					90
					180
					270
WD20	Roof	Monopitch	X	X	0
					90
					180
					270
WD21	Roof	Monopitch	X	X	0
					90
					180
					270
WD22	Roof	Monopitch	X	X	0
					90
					180
					270
WD23	Roof	Monopitch	X	X	0
					90
					180
					270
WD24	Roof	Monopitch	X	X	0
					90
					180
					270
WD25	Roof	Monopitch	X	X	0
					90
					180
					270
WD26	Wall			X	0
					90
					180
					270
WD27	Wall			X	0
					90
					180
					270
WD28	Wall			X	0
					90
					180
					270
WD29	Wall			X	0
					90
					180
					270
WD30	Wall			X	0
					90
					180
					270
WD31	Wall			X	0
					90
					180
					270
WD32	Wall			X	0
					90
					180
					270
WD33	Wall			X	0
					90
					180
					270
WD34	Wall			X	0
					90
					180
					270
WD35	Wall			X	0
					90
					180

Name	Type	Roof type	Roof overhangs	Swap outer surface	Load direction
					270
WD36	Wall			X	0
					90
					180
					270
WD37	Wall			X	0
					90
					180
					270
WD38	Wall			X	0
					90
					180
					270

9. Mesh setup

Name	MeshSetup1
Generation of variable eccentricities on members instead of constant ones	X
Generation of nodes in connections of beam elements	X
Elastic mesh	✓
Use automatic mesh refinement	X
Connect members/nodes	✓
Division on haunches and arbitrary members	5
Division for integration strip and 2D-1D upgrade	50
Average number of 1D mesh elements on straight 1D members	1
Average size of 2D mesh element [m]	0.500
Average size of 1D mesh element on curved 1D members [m]	0.200
Minimal length of beam element [m]	0.100
Maximal length of beam element [m]	1000.000
Average size of tendons, elements on subsoil, nonlinear soil spring [m]	1.000
Minimal distance between definition point and line [m]	0.001
Average size of panel element [m]	1.000
Mesh refinement following the beam type	None
Definition of mesh element size for panels	Manual

10. Solver setup

Name	SolverSetup1
Neglect shear force deformation (Ay, Az >> A)	X
Initial stress	X
Maximum soil interaction iterations	10
Maximum iterations	20
Number of increments	1
Number of buckling modes	2
Minimal number of sections on member	10
Step for soil/water pressure [m]	0.500
C1x [MN/m ³]	1.0000e-01
C1y [MN/m ³]	1.0000e-01
C1z [MN/m ³]	1.0000e+01
C2x [MN/m]	5.0000e+00
C2y [MN/m]	5.0000e+00
Coefficient for reinforcement	1
Warning when maximal translation is greater than [mm]	1000.0
Warning when maximal rotation is greater than [mrad]	100.0
Solver precision ratio	1
Soil combination	None
Type of solver	Direct
Type of eigen value solver	Lanczos
Method of calculation	Picard

11. Nodes

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N1	-0.100	20.084	0.000
N2	-0.100	20.084	3.650

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N3	-0.100	0.084	0.000
N4	-0.100	0.084	3.650

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N7	-0.100	10.084	5.450
N8	4.471	20.084	0.000

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N9	4.471	20.084	3.650
N10	4.471	0.084	0.000
N11	4.471	0.084	3.650
N12	4.471	10.084	5.450
N13	9.042	20.084	0.000
N14	9.042	20.084	3.650
N15	9.042	0.084	0.000
N16	9.042	0.084	3.650
N17	13.613	20.084	0.000
N18	13.613	20.084	3.650
N19	13.613	0.084	0.000
N20	13.613	0.084	3.650
N21	18.184	20.084	0.000
N22	18.184	20.084	3.650
N23	18.184	0.084	0.000
N24	18.184	0.084	3.650
N25	22.755	20.084	0.000
N26	22.755	20.084	3.650
N27	22.755	0.084	0.000
N28	22.755	0.084	3.650
N29	27.326	20.084	0.000
N30	27.326	20.084	3.650
N31	27.326	0.084	0.000
N32	27.326	0.084	3.650
N33	31.897	20.084	0.000
N34	31.897	20.084	3.650
N35	31.897	0.084	0.000
N36	31.897	0.084	3.650
N37	9.042	10.084	5.450
N38	13.613	10.084	5.450
N39	18.184	10.084	5.450
N40	22.755	10.084	5.450
N41	27.326	10.084	5.450
N42	31.897	10.084	5.450
N43	-0.100	8.417	5.150
N44	4.471	8.417	5.150
N45	-0.100	6.751	4.850
N46	4.471	6.751	4.850
N47	-0.100	5.084	4.550
N48	4.471	5.084	4.550
N49	-0.100	3.417	4.250
N50	4.471	3.417	4.250
N51	-0.100	1.751	3.950
N52	4.471	1.751	3.950
N53	9.042	1.751	3.950
N54	9.042	3.417	4.250
N55	9.042	5.084	4.550
N56	9.042	6.751	4.850
N57	9.042	8.417	5.150
N58	13.613	1.751	3.950
N59	13.613	3.417	4.250
N60	13.613	5.084	4.550
N61	13.613	6.751	4.850
N62	13.613	8.417	5.150
N63	18.184	1.751	3.950
N64	18.184	3.417	4.250
N65	18.184	5.084	4.550

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N66	18.184	6.751	4.850
N67	18.184	8.417	5.150
N68	22.755	1.751	3.950
N69	22.755	3.417	4.250
N70	22.755	5.084	4.550
N71	22.755	6.751	4.850
N72	22.755	8.417	5.150
N73	27.326	1.751	3.950
N74	27.326	3.417	4.250
N75	27.326	5.084	4.550
N76	27.326	6.751	4.850
N77	27.326	8.417	5.150
N78	31.897	1.751	3.950
N79	31.897	3.417	4.250
N80	31.897	5.084	4.550
N81	31.897	6.751	4.850
N82	31.897	8.417	5.150
N83	31.897	18.417	3.950
N84	27.326	18.417	3.950
N85	31.897	16.751	4.250
N86	27.326	16.751	4.250
N87	31.897	15.084	4.550
N88	27.326	15.084	4.550
N89	31.897	13.417	4.850
N90	27.326	13.417	4.850
N91	31.897	11.751	5.150
N92	27.326	11.751	5.150
N93	22.755	18.417	3.950
N94	22.755	16.751	4.250
N95	22.755	15.084	4.550
N96	22.755	13.417	4.850
N97	22.755	11.751	5.150
N98	18.184	18.417	3.950
N99	18.184	16.751	4.250
N100	18.184	15.084	4.550
N101	18.184	13.417	4.850
N102	18.184	11.751	5.150
N103	13.613	18.417	3.950
N104	13.613	16.751	4.250
N105	13.613	15.084	4.550
N106	13.613	13.417	4.850
N107	13.613	11.751	5.150
N108	9.042	18.417	3.950
N109	9.042	16.751	4.250
N110	9.042	15.084	4.550
N111	9.042	13.417	4.850
N112	9.042	11.751	5.150
N113	4.471	18.417	3.950
N114	4.471	16.751	4.250
N115	4.471	15.084	4.550
N116	4.471	13.417	4.850
N117	4.471	11.751	5.150
N118	-0.100	18.417	3.950
N119	-0.100	16.751	4.250
N120	-0.100	15.084	4.550
N121	-0.100	13.417	4.850
N122	-0.100	11.751	5.150

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N123	31.897	4.484	0.000
N124	31.897	4.484	4.442
N125	31.897	5.784	0.000
N126	31.897	5.784	4.676
N131	31.897	9.584	0.000
N132	31.897	9.584	5.360
N133	31.897	10.784	0.000
N134	31.897	10.784	5.324
N135	31.897	15.684	0.000
N136	31.897	15.684	4.442
N137	31.897	13.684	0.000
N138	31.897	13.684	4.802
N139	31.897	10.784	5.450
N140	-0.100	8.284	0.000
N141	-0.100	8.284	5.126
N142	-0.100	4.584	0.000
N143	-0.100	4.584	4.460
N144	-0.100	12.284	0.000
N145	-0.100	12.284	5.054
N146	-0.100	17.484	0.000
N147	-0.100	17.484	4.118
N148	-0.100	16.584	0.000
N149	-0.100	16.584	4.280
N150	4.471	20.084	3.500
N151	-0.100	20.084	3.500
N152	-0.100	0.084	2.650
N153	4.471	0.084	2.650
N154	-0.100	0.084	1.650
N155	4.471	0.084	1.650
N156	9.042	0.084	1.650
N157	9.042	0.084	2.650
N158	13.613	0.084	1.650
N159	13.613	0.084	2.650
N160	18.184	0.084	1.650
N161	18.184	0.084	2.650
N162	22.755	0.084	1.650
N163	22.755	0.084	2.650
N164	27.326	0.084	1.650
N165	27.326	0.084	2.650
N166	31.897	0.084	1.650
N167	31.897	0.084	2.650
N168	27.326	20.084	1.650
N169	31.897	20.084	1.650
N170	27.326	20.084	2.650
N171	31.897	20.084	2.650
N172	22.755	20.084	1.650
N173	22.755	20.084	2.650
N174	18.184	20.084	1.650
N175	18.184	20.084	2.650
N176	13.613	20.084	1.650
N177	13.613	20.084	2.650
N178	9.042	20.084	1.650
N179	9.042	20.084	2.650
N180	4.471	20.084	1.650
N181	4.471	20.084	2.650
N182	-0.100	20.084	1.650
N183	-0.100	20.084	2.650

12. Members

Name	Cross-section	Material	Length [m]	Beg. node	End node	Type
B1	CS4 - UB356/127/33	S 275	3.650	N1	N2	column (100)
B2	CS4 - UB356/127/33	S 275	3.650	N3	N4	general (0)
B5	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N2	N7	rafter (90)
B6	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N7	N4	rafter (90)
B7	CS4 - UB356/127/33	S 275	3.650	N8	N9	column (100)
B8	CS4 - UB356/127/33	S 275	3.650	N10	N11	general (0)
B9	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N9	N12	rafter (90)
B10	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N12	N11	rafter (90)
B11	CS4 - UB356/127/33	S 275	3.650	N13	N14	column (100)
B12	CS4 - UB356/127/33	S 275	3.650	N15	N16	general (0)
B13	CS4 - UB356/127/33	S 275	3.650	N17	N18	column (100)
B14	CS4 - UB356/127/33	S 275	3.650	N19	N20	general (0)
B15	CS4 - UB356/127/33	S 275	3.650	N21	N22	column (100)
B16	CS4 - UB356/127/33	S 275	3.650	N23	N24	general (0)
B17	CS4 - UB356/127/33	S 275	3.650	N25	N26	column (100)
B18	CS4 - UB356/127/33	S 275	3.650	N27	N28	general (0)
B19	CS6 - I + I var (UKB356/127/33; 178)	S 275	3.650	N29	N30	column (100)
B20	CS4 - UB356/127/33	S 275	3.650	N31	N32	general (0)
B21	CS4 - UB356/127/33	S 275	3.650	N33	N34	column (100)
B22	CS4 - UB356/127/33	S 275	3.650	N35	N36	general (0)
B23	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N14	N37	rafter (90)
B24	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N18	N38	rafter (90)
B25	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N22	N39	rafter (90)
B26	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N26	N40	rafter (90)
B27	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N30	N41	rafter (90)
B28	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N34	N42	rafter (90)
B29	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N37	N16	rafter (90)
B30	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N38	N20	rafter (90)
B31	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N39	N24	rafter (90)
B32	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N40	N28	rafter (90)
B33	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N41	N32	rafter (90)
B34	CS6 - I + I var (UKB356/127/33; 178)	S 275	10.161	N42	N36	rafter (90)
B42	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N4	N11	purlin (0)
B35	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N7	N12	purlin (0)
B43	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N43	N44	purlin (0)
B44	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N45	N46	purlin (0)
B45	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N47	N48	purlin (0)
B46	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N49	N50	purlin (0)
B47	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N51	N52	purlin (0)
B48	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N11	N16	purlin (0)
B49	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N52	N53	purlin (0)
B50	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N50	N54	purlin (0)
B51	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N48	N55	purlin (0)
B52	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N46	N56	purlin (0)
B53	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N44	N57	purlin (0)
B54	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N12	N37	purlin (0)
B55	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N16	N20	purlin (0)
B56	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N53	N58	purlin (0)
B57	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N54	N59	purlin (0)
B58	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N55	N60	purlin (0)
B59	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N56	N61	purlin (0)
B60	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N57	N62	purlin (0)
B61	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N37	N38	purlin (0)
B62	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N20	N24	purlin (0)
B63	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N58	N63	purlin (0)
B64	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N59	N64	purlin (0)
B65	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N60	N65	purlin (0)
B66	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N61	N66	purlin (0)
B67	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N62	N67	purlin (0)
B68	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N38	N39	purlin (0)
B69	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N24	N28	purlin (0)
B70	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N63	N68	purlin (0)
B71	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N64	N69	purlin (0)
B72	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N65	N70	purlin (0)

Name	Cross-section	Material	Length [m]	Beg. node	End node	Type
B73	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N66	N71	purlin (0)
B74	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N67	N72	purlin (0)
B75	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N39	N40	purlin (0)
B76	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N28	N32	purlin (0)
B77	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N68	N73	purlin (0)
B78	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N69	N74	purlin (0)
B79	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N70	N75	purlin (0)
B80	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N71	N76	purlin (0)
B81	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N72	N77	purlin (0)
B82	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N40	N41	purlin (0)
B83	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N32	N36	purlin (0)
B84	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N73	N78	purlin (0)
B85	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N74	N79	purlin (0)
B86	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N75	N80	purlin (0)
B87	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N76	N81	purlin (0)
B88	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N77	N82	purlin (0)
B89	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N41	N42	purlin (0)
B90	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N34	N30	purlin (0)
B91	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N83	N84	purlin (0)
B92	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N85	N86	purlin (0)
B93	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N87	N88	purlin (0)
B94	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N89	N90	purlin (0)
B95	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N91	N92	purlin (0)
B96	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N42	N41	purlin (0)
B97	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N30	N26	purlin (0)
B98	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N84	N93	purlin (0)
B99	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N86	N94	purlin (0)
B100	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N88	N95	purlin (0)
B101	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N90	N96	purlin (0)
B102	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N92	N97	purlin (0)
B103	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N26	N22	purlin (0)
B104	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N93	N98	purlin (0)
B105	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N94	N99	purlin (0)
B106	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N95	N100	purlin (0)
B107	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N96	N101	purlin (0)
B108	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N97	N102	purlin (0)
B109	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N22	N18	purlin (0)
B110	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N98	N103	purlin (0)
B111	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N99	N104	purlin (0)
B112	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N100	N105	purlin (0)
B113	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N101	N106	purlin (0)
B114	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N102	N107	purlin (0)
B115	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N18	N14	purlin (0)
B116	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N103	N108	purlin (0)
B117	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N104	N109	purlin (0)
B118	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N105	N110	purlin (0)
B119	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N106	N111	purlin (0)
B120	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N107	N112	purlin (0)
B121	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N14	N9	purlin (0)
B122	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N108	N113	purlin (0)
B123	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N109	N114	purlin (0)
B124	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N110	N115	purlin (0)
B125	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N111	N116	purlin (0)
B126	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N112	N117	purlin (0)
B127	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N9	N2	purlin (0)
B128	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N113	N118	purlin (0)
B129	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N114	N119	purlin (0)
B130	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N115	N120	purlin (0)
B131	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N116	N121	purlin (0)
B132	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N117	N122	purlin (0)
B134	CS5 - UB178/102/19	S 275	4.442	N123	N124	column (100)
B135	CS5 - UB178/102/19	S 275	4.676	N125	N126	column (100)
B138	CS5 - UB178/102/19	S 275	5.360	N131	N132	column (100)
B139	CS5 - UB178/102/19	S 275	5.324	N133	N134	column (100)
B140	CS5 - UB178/102/19	S 275	4.442	N135	N136	column (100)
B141	CS5 - UB178/102/19	S 275	4.802	N137	N138	column (100)

Name	Cross-section	Material	Length [m]	Beg. node	End node	Type
B146	CS5 - UB178/102/19	S 275	5.126	N140	N141	column (100)
B147	CS5 - UB178/102/19	S 275	4.460	N142	N143	column (100)
B148	CS5 - UB178/102/19	S 275	5.054	N144	N145	column (100)
B149	CS5 - UB178/102/19	S 275	4.118	N146	N147	column (100)
B150	CS5 - UB178/102/19	S 275	4.280	N148	N149	column (100)
B151	CS8 - HFLeq70x70x7	S 275	5.849	N8	N2	beam (80)
B152	CS8 - HFLeq70x70x7	S 275	5.757	N1	N150	beam (80)
B153	CS8 - HFLeq70x70x7	S 275	5.849	N3	N11	beam (80)
B154	CS8 - HFLeq70x70x7	S 275	5.849	N10	N4	beam (80)
B155	CS8 - HFLeq70x70x7	S 275	5.707	N151	N114	beam (80)
B156	CS8 - HFLeq70x70x7	S 275	5.689	N114	N121	beam (80)
B157	CS8 - HFLeq70x70x7	S 275	5.689	N121	N12	beam (80)
B158	CS8 - HFLeq70x70x7	S 275	5.689	N12	N45	beam (80)
B159	CS8 - HFLeq70x70x7	S 275	5.689	N45	N50	beam (80)
B160	CS8 - HFLeq70x70x7	S 275	5.689	N50	N4	beam (80)
B161	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N152	N153	beam (80)
B162	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N154	N155	beam (80)
B163	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N155	N156	beam (80)
B164	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N153	N157	beam (80)
B165	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N156	N158	beam (80)
B166	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N157	N159	beam (80)
B167	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N158	N160	beam (80)
B168	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N159	N161	beam (80)
B169	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N160	N162	beam (80)
B170	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N161	N163	beam (80)
B171	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N162	N164	beam (80)
B172	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N163	N165	beam (80)
B173	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N164	N166	beam (80)
B174	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N165	N167	beam (80)
B175	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N168	N169	beam (80)
B176	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N170	N171	beam (80)
B177	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N172	N168	beam (80)
B178	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N173	N170	beam (80)
B179	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N174	N172	beam (80)
B180	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N175	N173	beam (80)
B181	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N176	N174	beam (80)
B182	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N177	N175	beam (80)
B183	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N178	N176	beam (80)
B184	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N179	N177	beam (80)
B185	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N180	N178	beam (80)
B186	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N181	N179	beam (80)
B187	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N182	N180	beam (80)
B188	CS7 - RECT (75; 200)	C24 (EN 338)	4.571	N183	N181	beam (80)

13. Load panels

Name	Panel type	Load transfer direction	Selection of entities
LP1	To panel edges and beams	X (LCS panel)	Auto selection
LP2	To panel edges and beams	X (LCS panel)	Auto selection
LP3	To panel edges and beams	X (LCS panel)	Auto selection
LP4	To panel edges and beams	X (LCS panel)	Auto selection
LP5	To panel edges and beams	X (LCS panel)	Auto selection
LP6	To panel edges and beams	X (LCS panel)	Auto selection
LP7	To panel edges and beams	X (LCS panel)	Auto selection
LP8	To panel edges and beams	X (LCS panel)	Auto selection
LP9	To panel edges and beams	X (LCS panel)	Auto selection
LP10	To panel edges and beams	X (LCS panel)	Auto selection
LP11	To panel edges and beams	X (LCS panel)	Auto selection
LP12	To panel edges and beams	X (LCS panel)	Auto selection
LP13	To panel edges and beams	X (LCS panel)	Auto selection
LP14	To panel edges and beams	X (LCS panel)	Auto selection
LP15	To panel edges and beams	X (LCS panel)	Auto selection
LP16	To panel edges and beams	X (LCS panel)	Auto selection
LP17	To panel edges and beams	X (LCS panel)	Auto selection
LP18	To panel edges and beams	X (LCS panel)	Auto selection

Name	Panel type	Load transfer direction	Selection of entities
LP19	To panel edges and beams	X (LCS panel)	Auto selection
LP20	To panel edges and beams	X (LCS panel)	Auto selection
LP21	To panel edges and beams	X (LCS panel)	Auto selection
LP22	To panel edges and beams	X (LCS panel)	Auto selection
LP23	To panel edges and beams	X (LCS panel)	Auto selection
LP24	To panel edges and beams	X (LCS panel)	Auto selection
LP25	To panel edges and beams	X (LCS panel)	Auto selection
LP26	To panel edges and beams	X (LCS panel)	Auto selection
LP27	To panel edges and beams	X (LCS panel)	Auto selection
LP28	To panel edges and beams	X (LCS panel)	Auto selection
LP29	To panel edges and beams	X (LCS panel)	Auto selection
LP30	To panel edges and beams	X (LCS panel)	Auto selection
LP31	To panel edges and beams	X (LCS panel)	Auto selection
LP32	To panel edges and beams	X (LCS panel)	Auto selection
LP33	To panel edges and beams	X (LCS panel)	Auto selection
LP34	To panel edges and beams	X (LCS panel)	Auto selection
LP35	To panel edges and beams	X (LCS panel)	Auto selection
LP36	To panel edges and beams	X (LCS panel)	Auto selection
LP37	To panel edges and beams	X (LCS panel)	Auto selection
LP38	To panel edges and beams	X (LCS panel)	Auto selection
LP39	To panel edges and beams	X (LCS panel)	Auto selection
LP40	To panel edges and beams	X (LCS panel)	Auto selection
LP41	To panel edges and beams	X (LCS panel)	Auto selection

Explanations of symbols

Selection of entities	All: selects all edges and beams that support the panel at the same place. Auto selection: in the cases where two or more supporting elements overlap, the selection omits edges that belong to 2D members that lie in the same plane as the panel. User selection: requires a manual selection of supporting edges and beams (by means of using an Action button). By type: only beam members of the types selected in the list are considered as supporting elements.
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14. Haunches

Name	Member	Cross-section	Position	Length x	Coor
H1	B5	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H2	B6	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H3	B9	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H4	B10	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H5	B23	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H6	B24	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H7	B25	CS6 - I + I var (UKB356/127/33; 178)	Both	0.150	Rela
H8	B26	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H9	B27	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H10	B28	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H11	B29	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H12	B30	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H13	B31	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H14	B32	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H15	B33	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela
H16	B34	CS6 - I + I var (UKB356/127/33; 178)	Both	0.130	Rela

15. Surface load

Name	Dir	Type	Value [kN/m ²]	Load case	System	Loc
SF1	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF2	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF3	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF4	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF5	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF6	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF7	Z	Force	-0.60	LC3 - Variable	LCS	Length
SF8	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF9	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF10	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF11	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF12	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF13	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF14	Z	Force	-0.60	LC3 - Variable	GCS	Length
SF15	Z	Force	-0.60	LC3 - Variable	GCS	Length

16. 3D wind generator data

Code references

National annex	Standard EN
Base code	EN 1991-1-4:2005-04
Correction sheets / Addenda	EN 1991-1-4:2005/AC:2010-01

Wind pressure according to EC1

V _{b,0} - basic wind velocity [m/s]	24.100
ρ _o - air density [kg/m ³]	1.25
c _{dir} - directional factor	1
c _{season} - season factor	1
c _o - orography factor	1
1/p - life period of the building [year]	50.00
c _{prob} - probability factor	1
K - shape factor	0.2
n - exponent	0.5
terrain category	0
K _r - terrain factor	0.15603
z ₀ - roughness length [m]	0.003
z _{min} - minimal height [m]	1.000
k _l - turbulence factor	1
Type of the structure	Vertical walls or rectangular buildings (EC1-1-4, 7.2.2)
Reference level of terrain [m]	130.000
Correlation between zones D and E	✓

Wind data

Name	Type	Roof type	Roof overhangs	Swap outer surface
WD1	Wall			X
WD2	Wall			X
WD3	Wall			X
WD4	Wall			X
WD5	Wall			X
WD6	Wall			X
WD7	Wall			X
WD8	Wall			X
WD9	Wall			X
WD10	Wall			X
WD11	Wall			X
WD12	Wall			X
WD13	Wall			X
WD14	Wall			X
WD15	Roof	Monopitch	No	X
WD16	Roof	Monopitch	No	X
WD17	Roof	Monopitch	No	X
WD18	Roof	Monopitch	No	X
WD19	Roof	Monopitch	No	X

Name	Type	Roof type	Roof overhangs	Swap outer surface
WD20	Roof	Monopitch	No	X
WD21	Roof	Monopitch	No	X
WD22	Roof	Monopitch	No	X
WD23	Roof	Monopitch	No	X
WD24	Roof	Monopitch	No	X
WD25	Roof	Monopitch	No	X
WD26	Wall			X
WD27	Wall			X
WD28	Wall			X
WD29	Wall			X
WD30	Wall			X
WD31	Wall			X
WD32	Wall			X
WD33	Wall			X
WD34	Wall			X
WD35	Wall			X
WD36	Wall			X
WD37	Wall			X
WD38	Wall			X

Name	Load direction
WD1	0 90 180 270
WD2	0 90 180 270
WD3	0 90 180 270
WD4	0 90 180 270
WD5	0 90 180 270
WD6	0 90 180 270
WD7	0 90 180 270
WD8	0 90 180 270
WD9	0 90 180 270
WD10	0 90 180 270
WD11	0 90 180 270
WD12	0 90

Name	Load direction
	180
	270
WD13	0
	90
	180
	270
WD14	0
	90
	180
	270
WD15	0
	90
	180
	270
WD16	0
	90
	180
	270
WD17	0
	90
	180
	270
WD18	0
	90
	180
	270
WD19	0
	90
	180
	270
WD20	0
	90
	180
	270
WD21	0
	90
	180
	270
WD22	0
	90
	180
	270
WD23	0
	90
	180
	270
WD24	0
	90
	180
	270
WD25	0
	90
	180
	270
WD26	0
	90
	180
	270
WD27	0
	90
	180
	270
WD28	0
	90
	180
	270
WD29	0

Name	Load direction
WD30	90
	180
	270
	0
WD31	90
	180
	270
	0
WD32	90
	180
	270
	0
WD33	90
	180
	270
	0
WD34	90
	180
	270
	0
WD35	90
	180
	270
	0
WD36	90
	180
	270
	0
WD37	90
	180
	270
	0
WD38	90
	180
	270
	0

17. Displacement of nodes

Linear calculation

Combination: SLS-Char (auto)

Extreme: Global

Selection: All

Name	Case	U _x [mm]	U _y [mm]	U _z [mm]	Φ _x [mrad]	Φ _y [mrad]	Φ _z [mrad]	U _{total} [mm]
N151	SLS-Char (auto)/1	0.0	0.1	0.0	0.0	0.1	1.0	0.1
N12	SLS-Char (auto)/2	24.1	-2.2	-62.5	-0.2	14.6	0.0	67.0
N32	SLS-Char (auto)/2	0.3	-15.9	-0.2	-2.5	0.1	-1.8	15.9
N179	SLS-Char (auto)/2	0.1	14.3	-0.1	-1.2	0.0	0.2	14.3
N37	SLS-Char (auto)/2	23.3	-0.5	-77.1	-0.1	4.7	0.0	80.5
N1	SLS-Char (auto)/1	0.0	0.0	0.0	-0.1	0.0	0.8	0.0
N54	SLS-Char (auto)/2	7.9	-8.9	-28.8	-11.8	0.2	-2.3	31.1
N109	SLS-Char (auto)/2	8.4	7.8	-29.3	11.9	-0.1	2.4	31.4
N184	SLS-Char (auto)/2	22.7	-2.0	-0.3	0.0	16.2	-0.7	22.8

Name	Case	U _x [mm]	U _y [mm]	U _z [mm]	Φ _x [mrad]	Φ _y [mrad]	Φ _z [mrad]	U _{total} [mm]
N82	SLS-Char (auto)/2	20.2	-0.7	-0.2	0.1	-14.3	-4.8	20.2
N91	SLS-Char (auto)/2	20.3	-0.7	-0.1	0.0	-14.0	4.8	20.3

Name	Combination key
SLS-Char (auto)/1	LC1 + LC2
SLS-Char (auto)/2	LC1 + LC2 + LC3

18. 3D displacement

Linear calculation

Combination: SLS-Char (auto)

Selection: All

Location: In nodes avg. on macro. System: LCS mesh element

Results on 1D member:

Extreme 1D: Global

Name	dx [m]	Fibre	Case	u _x [mm]	u _y [mm]	u _z [mm]	Φ _x [mrad]	Φ _y [mrad]	Φ _z [mrad]	U _{total} [mm]
B151	0.000	1	SLS-Char (auto)/1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B23	10.161	13	SLS-Char (auto)/2	-13.2	24.1	-76.3	-4.7	-0.1	0.8	81.1

Name	Combination key
SLS-Char (auto)/1	LC1 + LC2
SLS-Char (auto)/2	LC1 + LC2 + LC3

19. 3D stress

Linear calculation

Combination: ULS-Set B (auto)

Selection: All

Location: In nodes avg. on macro. System: LCS mesh element

Basic magnitudes

Results on 1D member

Extreme 1D: Global

Name	dx [m]	Fibre	Case	σ _x [MPa]	T _{xy} [MPa]	T _{xz} [MPa]	T _{tor} [MPa]
B12	3.650	1	ULS-Set B (auto)/1	-352.0	0.0	0.0	2.2
B12	3.650	13	ULS-Set B (auto)/1	323.1	0.0	0.0	2.2

Name	Combination key
ULS-Set B (auto)/1	1.35*LC1 + 1.35*LC2 + 1.50*LC3

20. Reactions

Linear calculation

Combination: SLS-Char (auto)

System: Global

Extreme: Global

Selection: All

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn9/N35	SLS-Char (auto)/1	-0.78	1.13	11.93	0.00	0.00	0.00	0.0	0.0
Sn2/N3	SLS-Char (auto)/1	1.02	1.92	8.65	0.00	0.00	0.00	0.0	0.0
Sn11/N13	SLS-Char (auto)/1	0.00	-29.82	43.74	0.00	0.00	0.00	0.0	0.0
Sn4/N15	SLS-Char (auto)/1	-0.01	30.10	43.72	0.00	0.00	0.00	0.0	0.0
Sn18/N146	SLS-Char (auto)/2	0.01	0.00	1.79	0.00	0.00	0.00	0.0	0.0
Sn8/N31	SLS-Char (auto)/1	0.76	26.11	44.62	0.00	0.00	0.00	0.0	0.0

Name	Combination key
SLS-Char (auto)/1	LC1 + LC2 + LC3
SLS-Char (auto)/2	LC1 + LC2

21. 1D internal forces

Linear calculation

Combination: ULS-Set B (auto)

Coordinate system: Principal

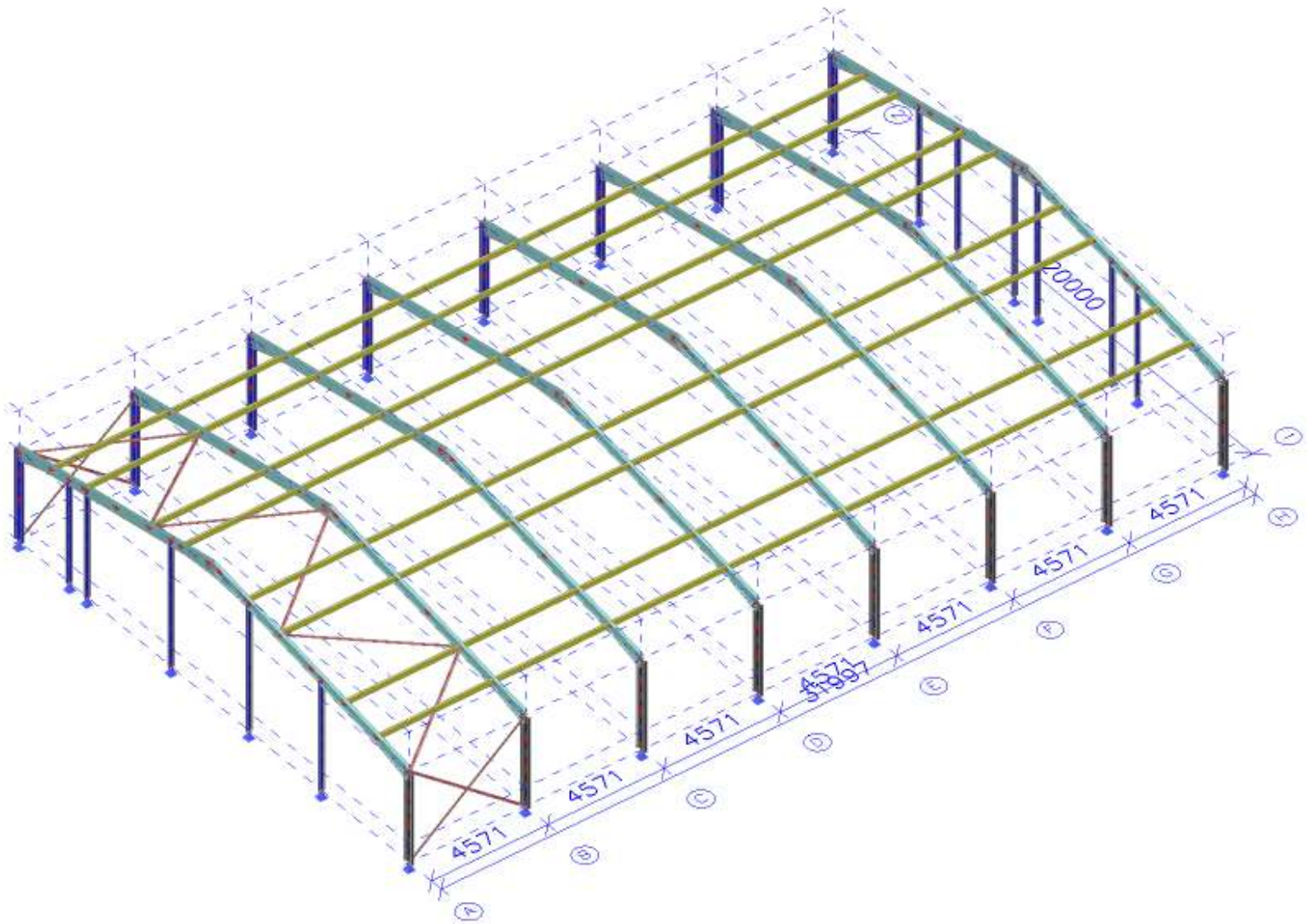
Extreme 1D: Global

Selection: All

Name	dx [m]	Case	N [kN]	V _y [kN]	V _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]
B20	0.000	ULS-Set B (auto)/1	-64.84	-1.14	-37.91	0.00	0.00	0.00
B5	7.925-	ULS-Set B (auto)/1	8.82	-0.27	-8.03	-0.10	-5.85	-0.30
B9	9.861+	ULS-Set B (auto)/1	-43.49	-5.36	-7.01	0.24	57.12	1.50
B29	10.161	ULS-Set B (auto)/1	-53.56	0.52	-51.93	-0.03	-154.31	0.62
B23	0.000	ULS-Set B (auto)/1	-53.34	-0.47	51.99	0.02	-153.02	0.54
B6	1.693+	ULS-Set B (auto)/1	5.03	0.11	-8.68	-0.81	-3.44	-0.29
B34	0.508-	ULS-Set B (auto)/1	0.04	2.87	-4.13	1.00	-3.90	-2.94
B12	3.650	ULS-Set B (auto)/1	-60.95	-0.05	-43.50	0.02	-159.25	-0.04
B11	3.650	ULS-Set B (auto)/1	-60.98	0.07	43.24	-0.02	157.94	0.02
B28	9.861-	ULS-Set B (auto)/1	0.79	-2.92	0.76	-0.50	-2.36	-3.60
B10	0.300-	ULS-Set B (auto)/1	-43.29	5.42	6.19	-0.23	56.85	1.53

Name	Combination key
ULS-Set B (auto)/1	1.35*LC1 + 1.35*LC2 + 1.50*LC3

22. Rafter restraints



23. EC-EN 1993 Steel check ULS

Values: **UC_{Overall}**

Linear calculation

Combination: ULS-Set B (auto)

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Overall Unity Check

Name	dx [m]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B12	3.650	ULS-Set B (auto)/1	CS4 - UB356/127/33	S 275	1.14	1.14	1.08

Name	Combination key
ULS-Set B (auto)/1	1.35*LC1 + 1.35*LC2 + 1.50*LC3

24. EC-EN 1993 Steel Check SLS

Linear calculation

Combination: SLS-Char (auto)

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Overall Unity Check

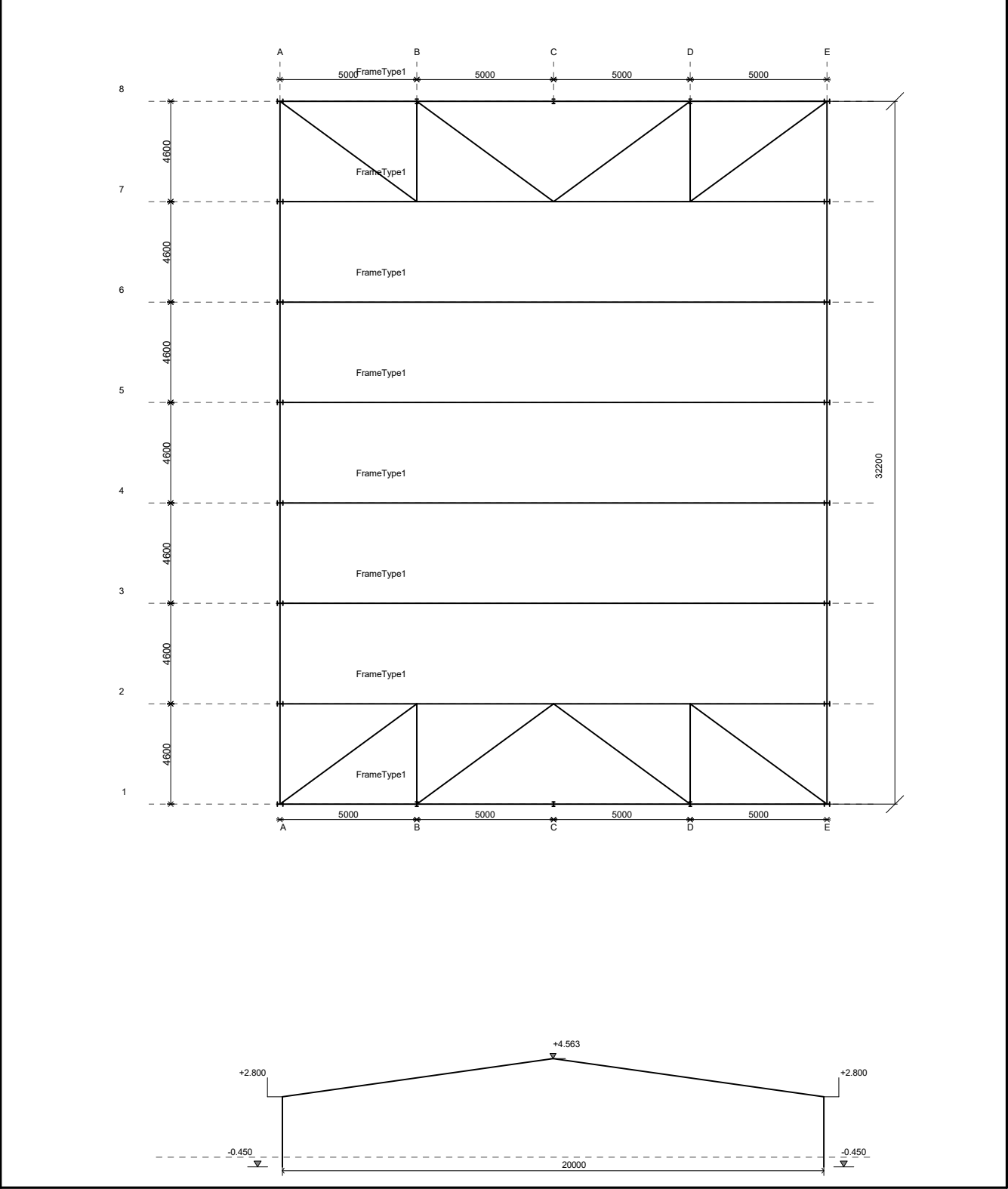
Name	dx [m]	Case	u _{y,max} [mm] u _{z,max} [mm]	u _{y,var} [mm] u _{z,var} [mm]	Lim. u _{y,max} [mm] Lim. u _{z,max} [mm]	Lim. u _{y,var} [mm] Lim. u _{z,var} [mm]	Check u _{y,max} [-] Check u _{z,max} [-]	Check u _{y,var} [-] Check u _{z,var} [-]	Camber dx u _z [mm] Camber [mm]	Check Overall [-]
B23	10.055	SLS-Char (auto)/1	0.2 -78.1	0.2 -53.1	3.0 101.6	1.7 56.4	0.08 0.77	0.09 0.94	- -	0.94

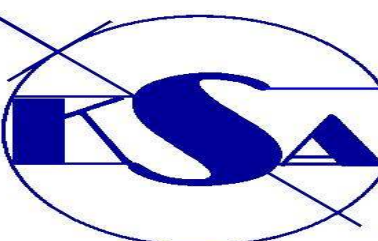
Name	Combination key
SLS-Char (auto)/1	LC1 + LC2 + LC3

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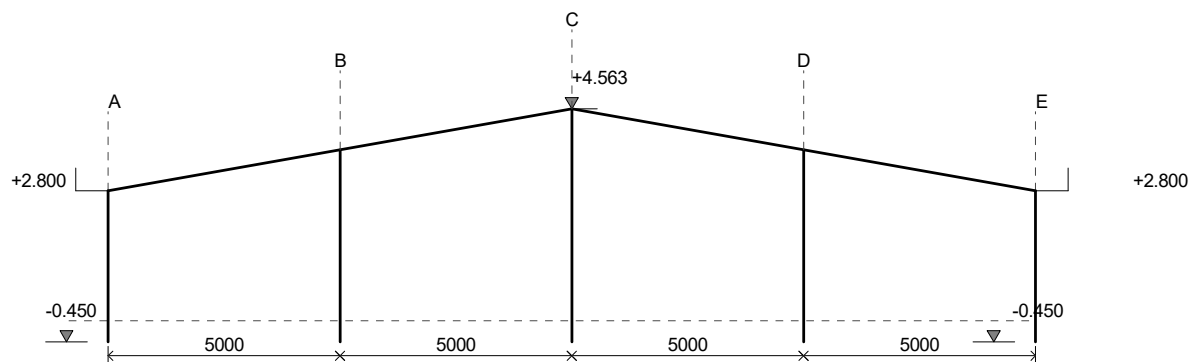
General Layout Diagram :



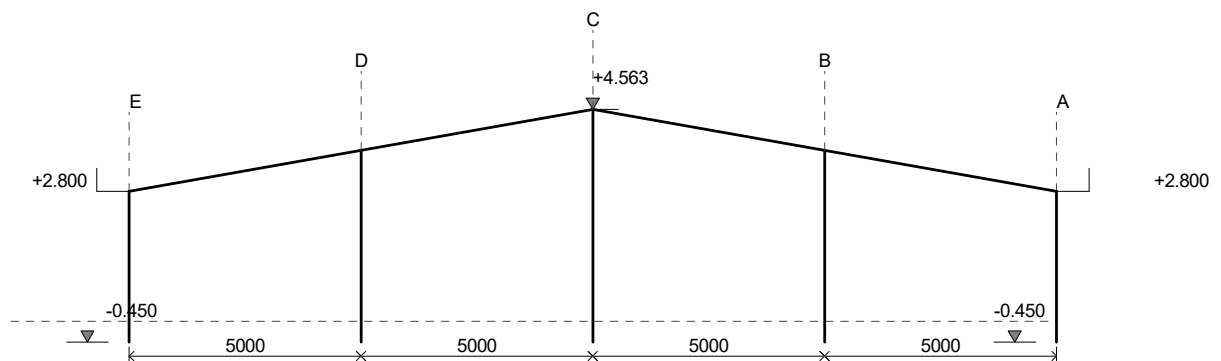
	Manor Farm	Job No	23M01/23
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End Frame Diagram :

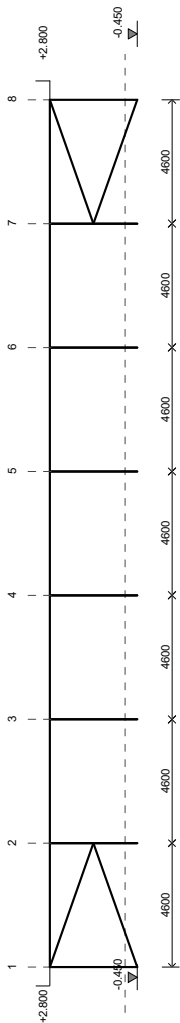


Near End Frame Details

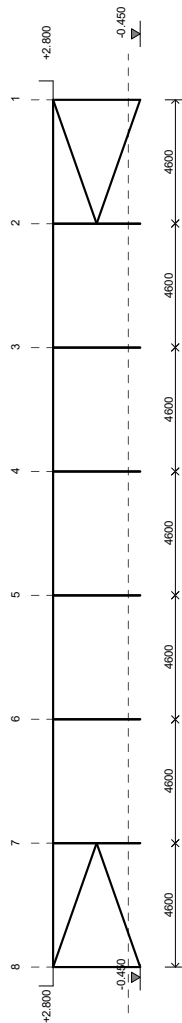


Far End Frame Details

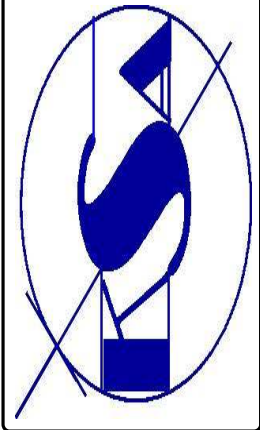
Side Wall Details :

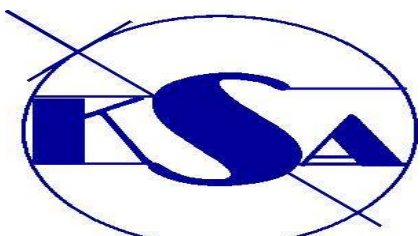


Right side wall details



Left side wall details

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Building and location data

Site location	Manor Farm	Building length	32.200 m
Site grid reference	-	Building Width	20.000 m
Left wall faces	270 degrees	Site altitude (AOD)	130.000 m
Wind load code	BS 6399-2	Snow load code	BS 6399-3

Geometry

Dimensions in metres relative to datum and centre line intersection points

No	Span length	Roof shape	Left						Right			
			Base level	Eaves level	Slope (°)	Horiz. length	Rise	Ridge level	Fall	Slope (°)	Eaves level	Base level
1	20.000	Duopitch	-0.450	2.800	10.000	10.000	1.763	4.563	1.763	10.000	2.800	-0.450

Support details

Numerical values in kN/mm Proportional values in % terms

No	Span	L/R	Type	Vertical stiffness	Horizontal stiffness	SLS rotational stiffness			ULS rotational stiffness			ULS % column plastic moment
						Type	% column	% rigid	Type	% column	% rigid	
0	1	Left	Foundation	Rigid	Rigid	Partial	10.00	16.67	Partial	10.00	16.67	10.00
1	1	Right	Foundation	Rigid	Rigid	Partial	10.00	16.67	Partial	10.00	16.67	10.00

Dead and imposed loads for all spans

Area unit loads excluding member self weight and casings

Type	Category	Applied to	Applied on	kN/m ²
Roof cladding	Dead	Rafters	Slope	0.160
Eaves cladding	Dead	Eaves cantilevers	Slope	0.150
Canopy cladding	Dead	Canopy cantilevers	Slope	0.150
Wall cladding	Dead	Columns	Elevation	0.160
Parapet cladding	Dead	Parapet posts	Elevation	0.160
Services	Dead	Rafters	Plan	0.100
Ceiling	Dead	Rafters	Plan	0.000
Roof imposed	Imposed	Rafters	Plan	0.600
Roof imposed	Imposed	Eaves cantilevers	Plan	0.600
Roof imposed	Imposed	Canopy cantilevers	Plan	0.600
Ceiling imposed	Imposed	Rafters	Plan	0.000

Wind load parameters

Loading code BS 6399-2 (condensed data)

Wind blowing from	Left	Right	Near	Far	Units
Effective wind speed	32.000	32.000	32.000	32.000	m/s
Dynamic pressure	0.628	0.628	0.628	0.628	kN/m ²
Internal pressures(+) and suction(-)					
Internal pressure	0.097	0.097	0.097	0.097	kN/m ²

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Wind load parameters (continued)

<i>Wind blowing from</i>	<i>Left</i>	<i>Right</i>	<i>Near</i>	<i>Far</i>	<i>Units</i>
Internal suction	-0.146	-0.146	-0.146	-0.146	kN/m ²
Frictional Drag Coefficient					
Frictional Drag Coefficient	0.020	0.020	0.020	0.020	-

Snow load parameters to BS 6399 pt 3

Snow loads - uniform loads including transverse drifts

<i>Span</i>	<i>Side</i>	<i>Uniform snow (kN/m²)</i>	<i>Asymmetric snow</i>	<i>Transverse snow (kN/m)</i>
1	Left	0.516	-	-
	Right	0.516	-	-

Combination reference abbreviations

<i>Abbreviation</i>	<i>Expansion</i>
ASI	Asymmetrical snow loads on left slopes
ASr	Asymmetrical snow loads on right slopes
D	Dead loads
Dead	Dead loads
DeadP	Permanent dead loads
I	Imposed loads (I _o + I _e)
I _e	Imposed loads on even spans
Imp.even	Imposed loads on even spans
Imp.odd	Imposed loads on odd spans
Imposed	Imposed loads (Imp.odd + Imp.even)
I _o	Imposed loads on odd spans
ML	Minimum horizontal load acting left to right
MR	Minimum horizontal load acting right to left
NL	Notional load acting left to right
NR	Notional load acting right to left
SDP	Snow drift that forms along spans
SDT	Snow drift that forms transverse to spans
US	Uniform snow loads
Use	Uniform snow loads on even spans
USo	Uniform snow loads on odd spans
WFIP	Wind blowing from far with internal pressure
WFIS	Wind blowing from far with internal suction
WLIP	Wind blowing from left with internal pressure
WLIS	Wind blowing from left with internal suction
WNIP	Wind blowing from near with internal pressure
WNIS	Wind blowing from near with internal suction
WRIP	Wind blowing from right with internal pressure
WRIS	Wind blowing from right with internal suction

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ULS load combinations 1 to 6

Load category			Partial safety factors					
No	Name	Type	1	2	3	4	5	6
	Combination reference		D+I+NL	D+I+NR	D+I+WLIS	D+I+ML	D+I+WRIS	D+I+MR
	Elastic analysis		P'Delta	P'Delta	P'Delta	P'Delta	P'Delta	P'Delta
	Plastic analysis		Yes	Yes	Yes	Yes	Yes	Yes
	Base design		Non_wind	Non_wind	Wind	Wind	Wind	Wind
1	Permanent Dead	Dead	1.400	1.400	1.200	1.200	1.200	1.200
2	Removable Dead	Dead	1.400	1.400	1.200	1.200	1.200	1.200
3	Roof Imposed (odd)	Imposed	1.600	1.600	1.200	1.200	1.200	1.200
4	Roof Imposed (even)	Imposed	1.600	1.600	1.200	1.200	1.200	1.200
5	Ceiling Imposed (odd)	Imposed	1.600	1.600	1.200	1.200	1.200	1.200
6	Ceiling Imposed (even)	Imposed	1.600	1.600	1.200	1.200	1.200	1.200
7	Notional horiz.dead	Dead	1.400	-1.400	0.000	0.000	0.000	0.000
8	Notional horiz.imposed	Imposed	1.600	-1.600	0.000	0.000	0.000	0.000
9	Minimum horiz.	Wind	0.000	0.000	0.000	1.200	0.000	-1.200
10	Wind lft ext. pressure	Wind	0.000	0.000	1.200	0.000	0.000	0.000
11	Wind lft int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
12	Wind lft int. suction	Wind	0.000	0.000	1.200	0.000	0.000	0.000
13	Wind rgt ext. pressure	Wind	0.000	0.000	0.000	0.000	1.200	0.000
14	Wind rgt int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
15	Wind rgt int. suction	Wind	0.000	0.000	0.000	0.000	1.200	0.000
16	Wind near ext. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
17	Wind near int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
18	Wind near int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
19	Wind far ext. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
20	Wind far int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
21	Wind far int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
22	Snow-drift-parallel	Snow	0.000	0.000	0.000	0.000	0.000	0.000
23	Snow-uniform-odd	Snow	0.000	0.000	0.000	0.000	0.000	0.000
24	Snow-uniform-even	Snow	0.000	0.000	0.000	0.000	0.000	0.000

ULS load combinations 7 to 12

Load category			Partial safety factors					
No	Name	Type	7	8	9	10	11	12
	Combination reference		D+I+WNIS	D+I+WFIS	D + WLIP	D + ML	D + WRIP	D + MR
	Elastic analysis		P'Delta	P'Delta	P'Delta	P'Delta	P'Delta	P'Delta
	Plastic analysis		Yes	Yes	Yes	Yes	Yes	Yes
	Base design		Wind	Wind	Wind	Wind	Wind	Wind
1	Permanent Dead	Dead	1.200	1.200	1.000	1.000	1.000	1.000
2	Removable Dead	Dead	1.200	1.200	0.000	0.000	0.000	0.000
3	Roof Imposed (odd)	Imposed	1.200	1.200	0.000	0.000	0.000	0.000
4	Roof Imposed (even)	Imposed	1.200	1.200	0.000	0.000	0.000	0.000
5	Ceiling Imposed (odd)	Imposed	1.200	1.200	0.000	0.000	0.000	0.000
6	Ceiling Imposed (even)	Imposed	1.200	1.200	0.000	0.000	0.000	0.000

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ULS load combinations 7 to 12 (continued)

Load category			Partial safety factors					
No	Name	Type	7	8	9	10	11	12
7	Notional horiz.dead	Dead	0.000	0.000	0.000	0.000	0.000	0.000
8	Notional horiz.imposed	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
9	Minimum horiz.	Wind	0.000	0.000	0.000	1.400	0.000	-1.400
10	Wind lft ext. pressure	Wind	0.000	0.000	1.400	0.000	0.000	0.000
11	Wind lft int. pressure	Wind	0.000	0.000	1.400	0.000	0.000	0.000
12	Wind lft int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
13	Wind rgt ext. pressure	Wind	0.000	0.000	0.000	0.000	1.400	0.000
14	Wind rgt int. pressure	Wind	0.000	0.000	0.000	0.000	1.400	0.000
15	Wind rgt int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
16	Wind near ext. pressure	Wind	1.200	0.000	0.000	0.000	0.000	0.000
17	Wind near int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
18	Wind near int. suction	Wind	1.200	0.000	0.000	0.000	0.000	0.000
19	Wind far ext. pressure	Wind	0.000	1.200	0.000	0.000	0.000	0.000
20	Wind far int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
21	Wind far int. suction	Wind	0.000	1.200	0.000	0.000	0.000	0.000
22	Snow-drift-parallel	Snow	0.000	0.000	0.000	0.000	0.000	0.000
23	Snow-uniform-odd	Snow	0.000	0.000	0.000	0.000	0.000	0.000
24	Snow-uniform-even	Snow	0.000	0.000	0.000	0.000	0.000	0.000

ULS load combinations 13 to 18

Load category			Partial safety factors					
No	Name	Type	13	14	15	16	17	18
	Combination reference		D + WNIP	D + WFIP	D+CI+SDP	D+CI+US	D+CI+US+WLIS	D+CI+US+WRIS
	Elastic analysis		P'Delta	P'Delta	P'Delta	P'Delta	P'Delta	P'Delta
	Plastic analysis		Yes	Yes	Yes	Yes	Yes	Yes
	Base design		Wind	Wind	Non_wind	Non_wind	Wind	Wind
1	Permanent Dead	Dead	1.000	1.000	1.400	1.400	1.200	1.200
2	Removable Dead	Dead	0.000	0.000	1.400	1.400	1.200	1.200
3	Roof Imposed (odd)	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
4	Roof Imposed (even)	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
5	Ceiling Imposed (odd)	Imposed	0.000	0.000	1.600	1.600	1.200	1.200
6	Ceiling Imposed (even)	Imposed	0.000	0.000	1.600	1.600	1.200	1.200
7	Notional horiz.dead	Dead	0.000	0.000	0.000	0.000	0.000	0.000
8	Notional horiz.imposed	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
9	Minimum horiz.	Wind	0.000	0.000	0.000	0.000	0.000	0.000
10	Wind lft ext. pressure	Wind	0.000	0.000	0.000	0.000	1.200	0.000
11	Wind lft int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
12	Wind lft int. suction	Wind	0.000	0.000	0.000	0.000	1.200	0.000
13	Wind rgt ext. pressure	Wind	0.000	0.000	0.000	0.000	0.000	1.200
14	Wind rgt int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
15	Wind rgt int. suction	Wind	0.000	0.000	0.000	0.000	0.000	1.200
16	Wind near ext. pressure	Wind	1.400	0.000	0.000	0.000	0.000	0.000

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ULS load combinations 13 to 18 (continued)

Load category			Partial safety factors					
No	Name	Type	13	14	15	16	17	18
17	Wind near int. pressure	Wind	1.400	0.000	0.000	0.000	0.000	0.000
18	Wind near int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
19	Wind far ext. pressure	Wind	0.000	1.400	0.000	0.000	0.000	0.000
20	Wind far int. pressure	Wind	0.000	1.400	0.000	0.000	0.000	0.000
21	Wind far int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
22	Snow-drift-parallel	Snow	0.000	0.000	1.050	0.000	0.000	0.000
23	Snow-uniform-odd	Snow	0.000	0.000	0.000	1.600	1.200	1.200
24	Snow-uniform-even	Snow	0.000	0.000	0.000	1.600	1.200	1.200

SLS load combinations 1 to 6

Load category			Partial safety factors					
No	Name	Type	1	2	3	4	5	6
	Combination reference		DeadP	Dead	Imposed	WLIS	WRIS	WNIS
	Elastic analysis		Linear	Linear	Linear	Linear	Linear	Linear
	Plastic analysis		No	No	No	No	No	No
1	Permanent Dead	Dead	1.000	1.000	0.000	0.000	0.000	0.000
2	Removable Dead	Dead	0.000	1.000	0.000	0.000	0.000	0.000
3	Roof Imposed (odd)	Imposed	0.000	0.000	1.000	0.000	0.000	0.000
4	Roof Imposed (even)	Imposed	0.000	0.000	1.000	0.000	0.000	0.000
5	Ceiling Imposed (odd)	Imposed	0.000	0.000	1.000	0.000	0.000	0.000
6	Ceiling Imposed (even)	Imposed	0.000	0.000	1.000	0.000	0.000	0.000
7	Notional horiz.dead	Dead	0.000	0.000	0.000	0.000	0.000	0.000
8	Notional horiz.imposed	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
9	Minimum horiz.	Wind	0.000	0.000	0.000	0.000	0.000	0.000
10	Wind lft ext. pressure	Wind	0.000	0.000	0.000	1.000	0.000	0.000
11	Wind lft int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
12	Wind lft int. suction	Wind	0.000	0.000	0.000	1.000	0.000	0.000
13	Wind rgt ext. pressure	Wind	0.000	0.000	0.000	0.000	1.000	0.000
14	Wind rgt int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
15	Wind rgt int. suction	Wind	0.000	0.000	0.000	0.000	1.000	0.000
16	Wind near ext. pressure	Wind	0.000	0.000	0.000	0.000	0.000	1.000
17	Wind near int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
18	Wind near int. suction	Wind	0.000	0.000	0.000	0.000	0.000	1.000
19	Wind far ext. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
20	Wind far int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
21	Wind far int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
22	Snow-drift-parallel	Snow	0.000	0.000	0.000	0.000	0.000	0.000
23	Snow-uniform-odd	Snow	0.000	0.000	0.000	0.000	0.000	0.000
24	Snow-uniform-even	Snow	0.000	0.000	0.000	0.000	0.000	0.000

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SLS load combinations 7 to 12

Load category			Partial safety factors					
No	Name	Type	7	8	9	10	11	12
	Combination reference		WFIS	WLIP	WRIP	WNIP	WFIP	US
	Elastic analysis		Linear	Linear	Linear	Linear	Linear	Linear
	Plastic analysis		No	No	No	No	No	No
1	Permanent Dead	Dead	0.000	0.000	0.000	0.000	0.000	0.000
2	Removable Dead	Dead	0.000	0.000	0.000	0.000	0.000	0.000
3	Roof Imposed (odd)	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
4	Roof Imposed (even)	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
5	Ceiling Imposed (odd)	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
6	Ceiling Imposed (even)	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
7	Notional horiz.dead	Dead	0.000	0.000	0.000	0.000	0.000	0.000
8	Notional horiz.imposed	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
9	Minimum horiz.	Wind	0.000	0.000	0.000	0.000	0.000	0.000
10	Wind lft ext. pressure	Wind	0.000	1.000	0.000	0.000	0.000	0.000
11	Wind lft int. pressure	Wind	0.000	1.000	0.000	0.000	0.000	0.000
12	Wind lft int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
13	Wind rgt ext. pressure	Wind	0.000	0.000	1.000	0.000	0.000	0.000
14	Wind rgt int. pressure	Wind	0.000	0.000	1.000	0.000	0.000	0.000
15	Wind rgt int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
16	Wind near ext. pressure	Wind	0.000	0.000	0.000	1.000	0.000	0.000
17	Wind near int. pressure	Wind	0.000	0.000	0.000	1.000	0.000	0.000
18	Wind near int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
19	Wind far ext. pressure	Wind	1.000	0.000	0.000	0.000	1.000	0.000
20	Wind far int. pressure	Wind	0.000	0.000	0.000	0.000	1.000	0.000
21	Wind far int. suction	Wind	1.000	0.000	0.000	0.000	0.000	0.000
22	Snow-drift-parallel	Snow	0.000	0.000	0.000	0.000	0.000	0.000
23	Snow-uniform-odd	Snow	0.000	0.000	0.000	0.000	0.000	1.000
24	Snow-uniform-even	Snow	0.000	0.000	0.000	0.000	0.000	1.000

SLS Base load combinations 1 to 6

Load category			Partial safety factors					
No	Name	Type	1	2	3	4	5	6
	Combination reference		D+I	D+I+WLIS	D+I+WRIS	D+I+WNIS	D+I+WFIS	D+WLIP
	Elastic analysis		Linear	Linear	Linear	Linear	Linear	Linear
	Plastic analysis		No	No	No	No	No	No
	Base design		Non_wind	Wind	Wind	Wind	Wind	Wind
1	Permanent Dead	Dead	1.000	1.000	1.000	1.000	1.000	1.000
2	Removable Dead	Dead	1.000	1.000	1.000	1.000	1.000	0.000
3	Roof Imposed (odd)	Imposed	1.000	1.000	1.000	1.000	1.000	0.000
4	Roof Imposed (even)	Imposed	1.000	1.000	1.000	1.000	1.000	0.000
5	Ceiling Imposed (odd)	Imposed	1.000	1.000	1.000	1.000	1.000	0.000
6	Ceiling Imposed (even)	Imposed	1.000	1.000	1.000	1.000	1.000	0.000
7	Notional horiz.dead	Dead	0.000	0.000	0.000	0.000	0.000	0.000

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SLS Base load combinations 1 to 6 (continued)

Load category			Partial safety factors					
No	Name	Type	1	2	3	4	5	6
8	Notional horiz.imposed	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
9	Minimum horiz.	Wind	0.000	0.000	0.000	0.000	0.000	0.000
10	Wind lft ext. pressure	Wind	0.000	1.000	0.000	0.000	0.000	1.000
11	Wind lft int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	1.000
12	Wind lft int. suction	Wind	0.000	1.000	0.000	0.000	0.000	0.000
13	Wind rgt ext. pressure	Wind	0.000	0.000	1.000	0.000	0.000	0.000
14	Wind rgt int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
15	Wind rgt int. suction	Wind	0.000	0.000	1.000	0.000	0.000	0.000
16	Wind near ext. pressure	Wind	0.000	0.000	0.000	1.000	0.000	0.000
17	Wind near int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
18	Wind near int. suction	Wind	0.000	0.000	0.000	1.000	0.000	0.000
19	Wind far ext. pressure	Wind	0.000	0.000	0.000	0.000	1.000	0.000
20	Wind far int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
21	Wind far int. suction	Wind	0.000	0.000	0.000	0.000	1.000	0.000
22	Snow-drift-parallel	Snow	0.000	0.000	0.000	0.000	0.000	0.000
23	Snow-uniform-odd	Snow	0.000	0.000	0.000	0.000	0.000	0.000
24	Snow-uniform-even	Snow	0.000	0.000	0.000	0.000	0.000	0.000

SLS Base load combinations 7 to 12

Load category			Partial safety factors					
No	Name	Type	7	8	9	10	11	12
	Combination reference		D+WRIP	D+WNIP	D+WFIP	D+CI+US	D+CI+US+WLIS	D+CI+US+WRIS
	Elastic analysis		Linear	Linear	Linear	Linear	Linear	Linear
	Plastic analysis		No	No	No	No	No	No
	Base design		Wind	Wind	Wind	Non_wind	Wind	Wind
1	Permanent Dead	Dead	1.000	1.000	1.000	1.000	1.000	1.000
2	Removable Dead	Dead	0.000	0.000	0.000	1.000	1.000	1.000
3	Roof Imposed (odd)	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
4	Roof Imposed (even)	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
5	Ceiling Imposed (odd)	Imposed	0.000	0.000	0.000	1.000	1.000	1.000
6	Ceiling Imposed (even)	Imposed	0.000	0.000	0.000	1.000	1.000	1.000
7	Notional horiz.dead	Dead	0.000	0.000	0.000	0.000	0.000	0.000
8	Notional horiz.imposed	Imposed	0.000	0.000	0.000	0.000	0.000	0.000
9	Minimum horiz.	Wind	0.000	0.000	0.000	0.000	0.000	0.000
10	Wind lft ext. pressure	Wind	0.000	0.000	0.000	0.000	1.000	0.000
11	Wind lft int. pressure	Wind	0.000	0.000	0.000	0.000	0.000	0.000
12	Wind lft int. suction	Wind	0.000	0.000	0.000	0.000	1.000	0.000
13	Wind rgt ext. pressure	Wind	1.000	0.000	0.000	0.000	0.000	1.000
14	Wind rgt int. pressure	Wind	1.000	0.000	0.000	0.000	0.000	0.000
15	Wind rgt int. suction	Wind	0.000	0.000	0.000	0.000	0.000	1.000
16	Wind near ext. pressure	Wind	0.000	1.000	0.000	0.000	0.000	0.000
17	Wind near int. pressure	Wind	0.000	1.000	0.000	0.000	0.000	0.000

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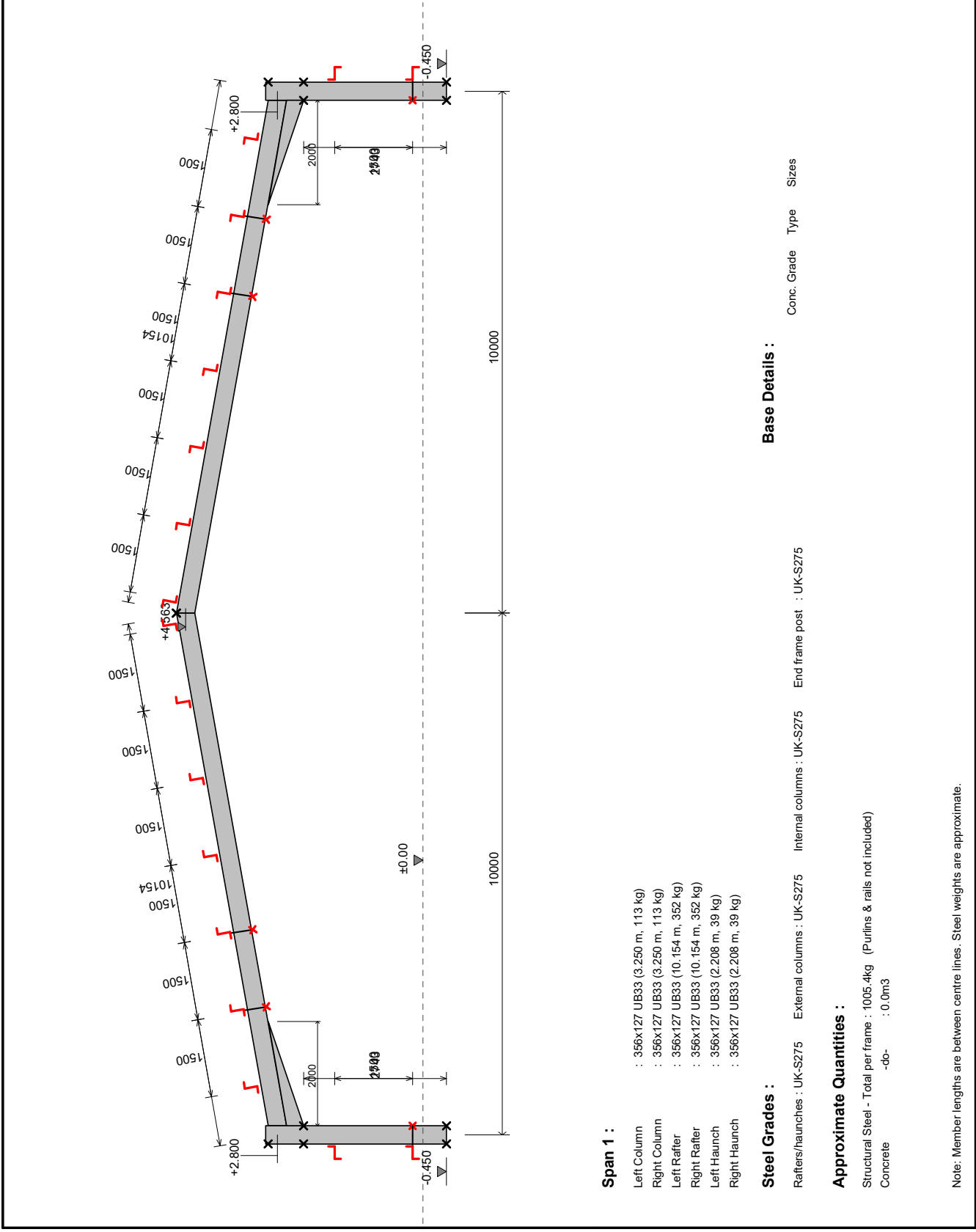
SLS Base load combinations 7 to 12 (continued)

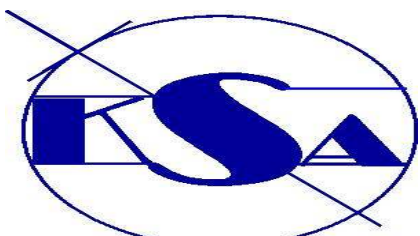
Load category			Partial safety factors					
No	Name	Type	7	8	9	10	11	12
18	Wind near int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
19	Wind far ext. pressure	Wind	0.000	0.000	1.000	0.000	0.000	0.000
20	Wind far int. pressure	Wind	0.000	0.000	1.000	0.000	0.000	0.000
21	Wind far int. suction	Wind	0.000	0.000	0.000	0.000	0.000	0.000
22	Snow-drift-parallel	Snow	0.000	0.000	0.000	0.000	0.000	0.000
23	Snow-uniform-odd	Snow	0.000	0.000	0.000	1.000	1.000	1.000
24	Snow-uniform-even	Snow	0.000	0.000	0.000	1.000	1.000	1.000

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FrameType1 : Portal geometry and sections :



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FrameType1 : Building and location data

Site location	Manor Farm	Building length	32.200 m	Near end roof shape	Plain
Site grid reference	-	Frame distance to near end	4.600 m	Far end roof shape	Plain
Left wall faces	270 degrees	Site altitude (AOD)	130.000 m	Left eaves shape	Plain
Wind load code	BS 6399-2	Snow load code	BS 6399-3	Right eaves shape	Plain

FrameType1 : Member sections

Note that the load for haunch steel and casings is the maximum at the column and reduces to zero. Member lengths are taken between centre line intersection points. Resultant steel weights are approximate only for purpose of comparing alternative designs.

Location	Design group	Steel section	Grade	Self load	Casing type	Load (kN/m)	Overall length	Approx. steel wt
Rafters and columns								
Span 1 - Left Column	1	356x127 UB33	UK-S275	0.347	None	0.000	3.250	112.6
Left rafter	2	356x127 UB33	UK-S275	0.347	None	0.000	10.154	351.8
Left haunch	2	356x127 UB33	UK-S275	0.347	None	0.000	2.208	38.2
Right rafter	2	356x127 UB33	UK-S275	0.347	None	0.000	10.154	351.8
Right haunch	2	356x127 UB33	UK-S275	0.347	None	0.000	2.208	38.2
Right column	3	356x127 UB33	UK-S275	0.347	None	0.000	3.250	112.6
Total weight per frame (kg)								1005.4

FrameType1 : Haunch details

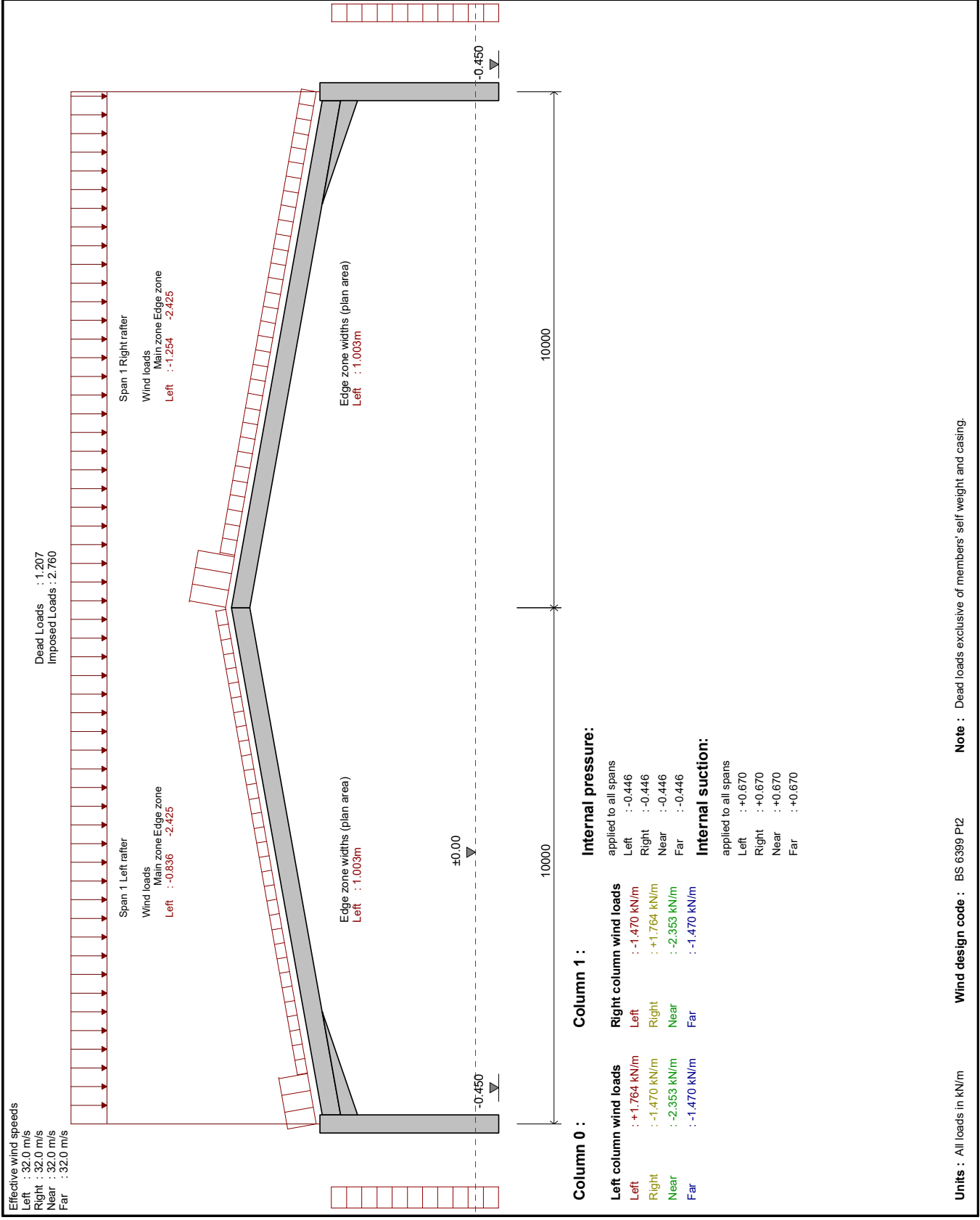
Numerical values in metres Proportional values in % terms

Span No.	Left type	% span	Horizontal length to		Depth below centre rafter	Right type	% span	Horizontal length to		Depth below centre rafter
			Column face	Centre				Column face	Centre	
1	Eaves	10.00	2.000	2.174	0.507	Eaves	10.00	2.000	2.174	0.507

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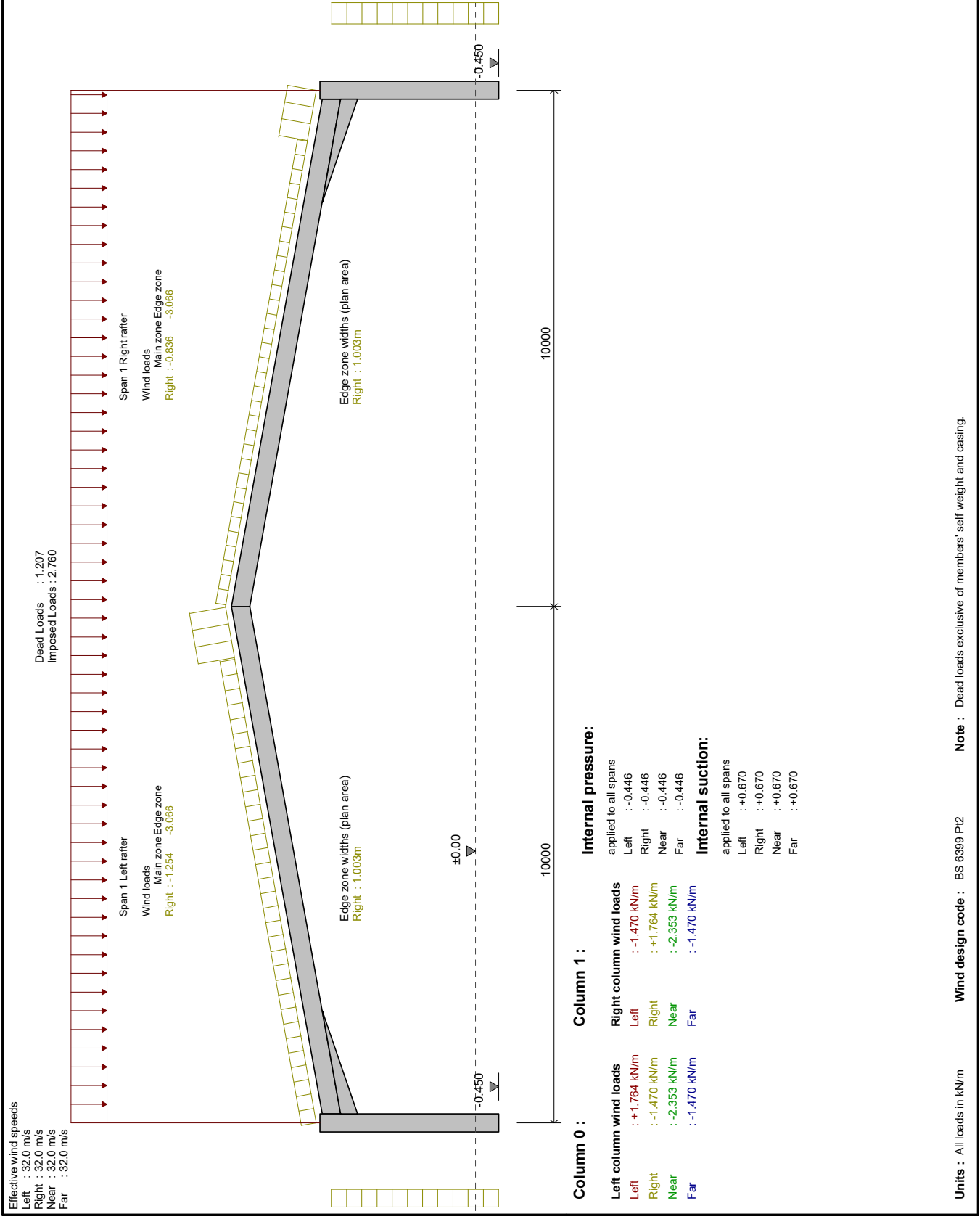
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FrameType1 : Portal loads (Wind direction - LEFT) :

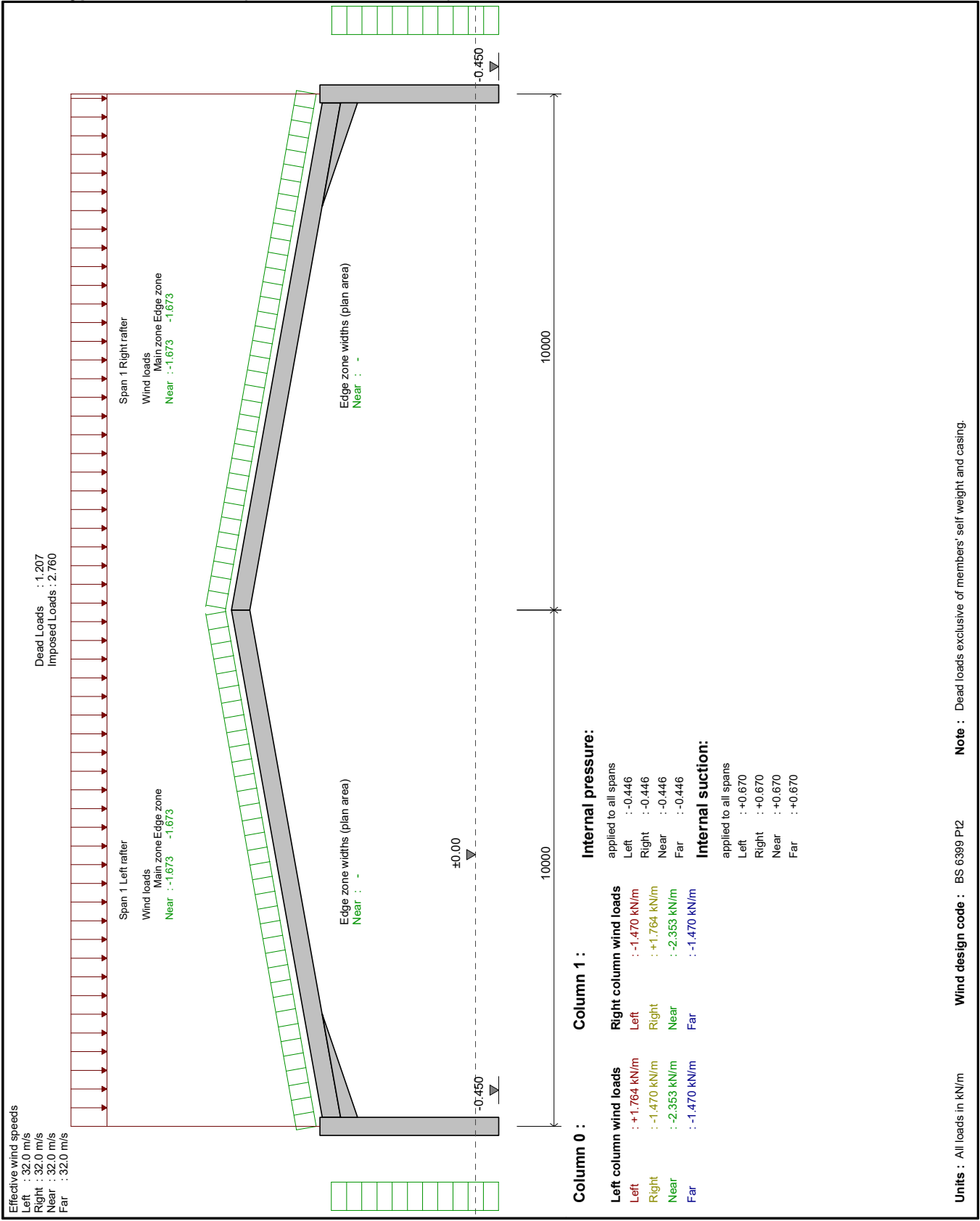


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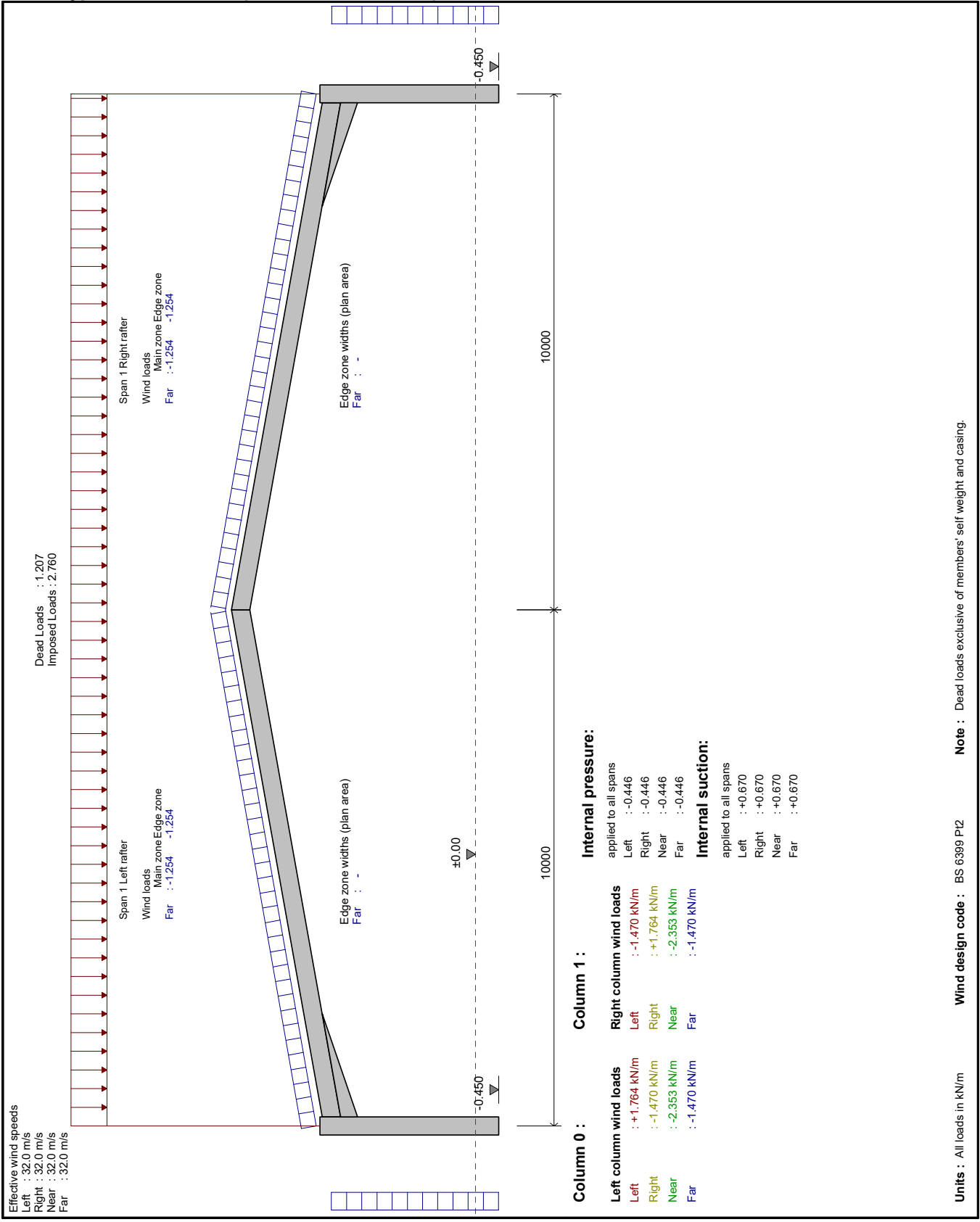
FrameType1 : Portal loads (Wind direction - RIGHT) :



FrameType1 : Portal loads (Wind direction - NEAR) :



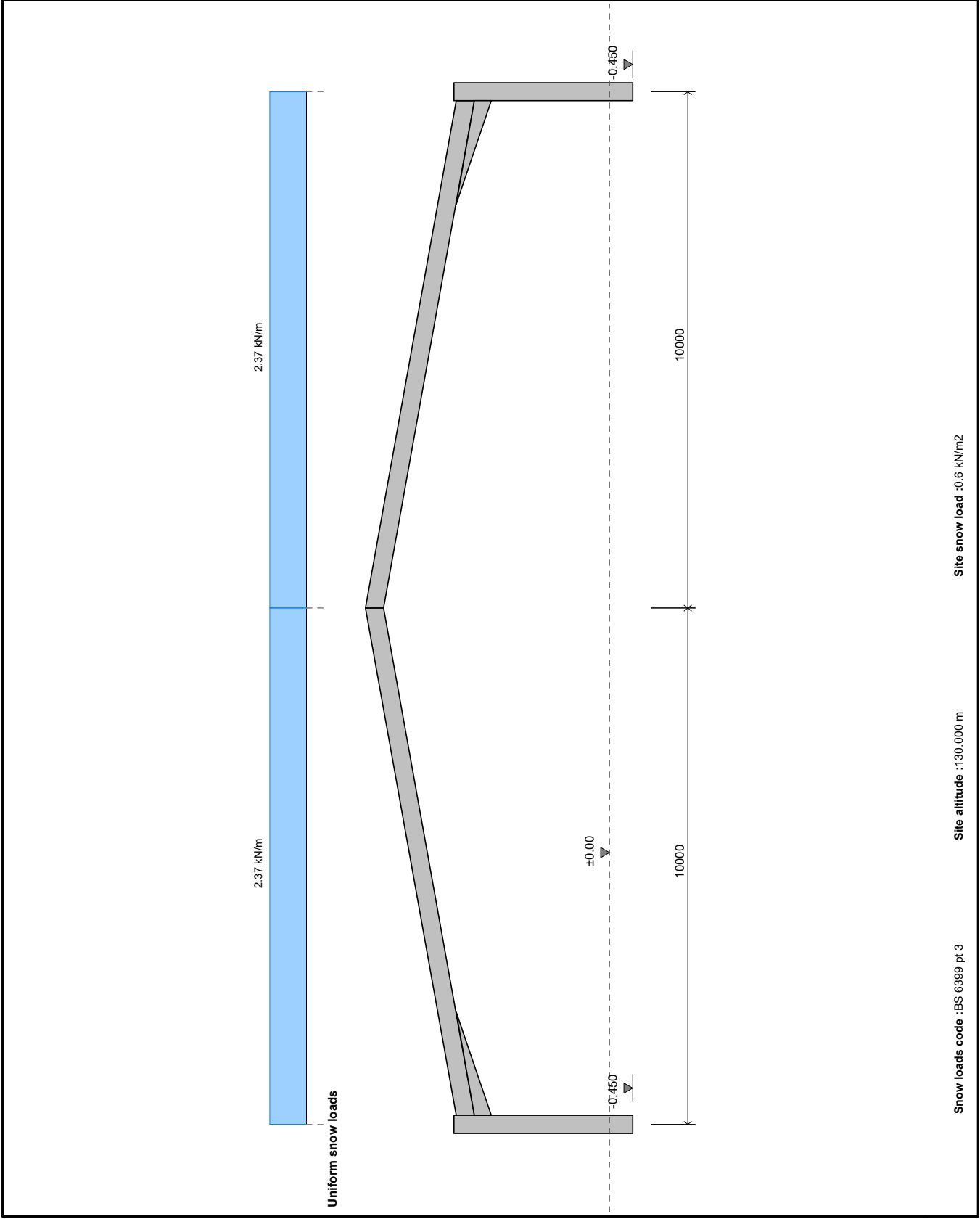
FrameType1 : Portal loads (Wind direction - FAR) :



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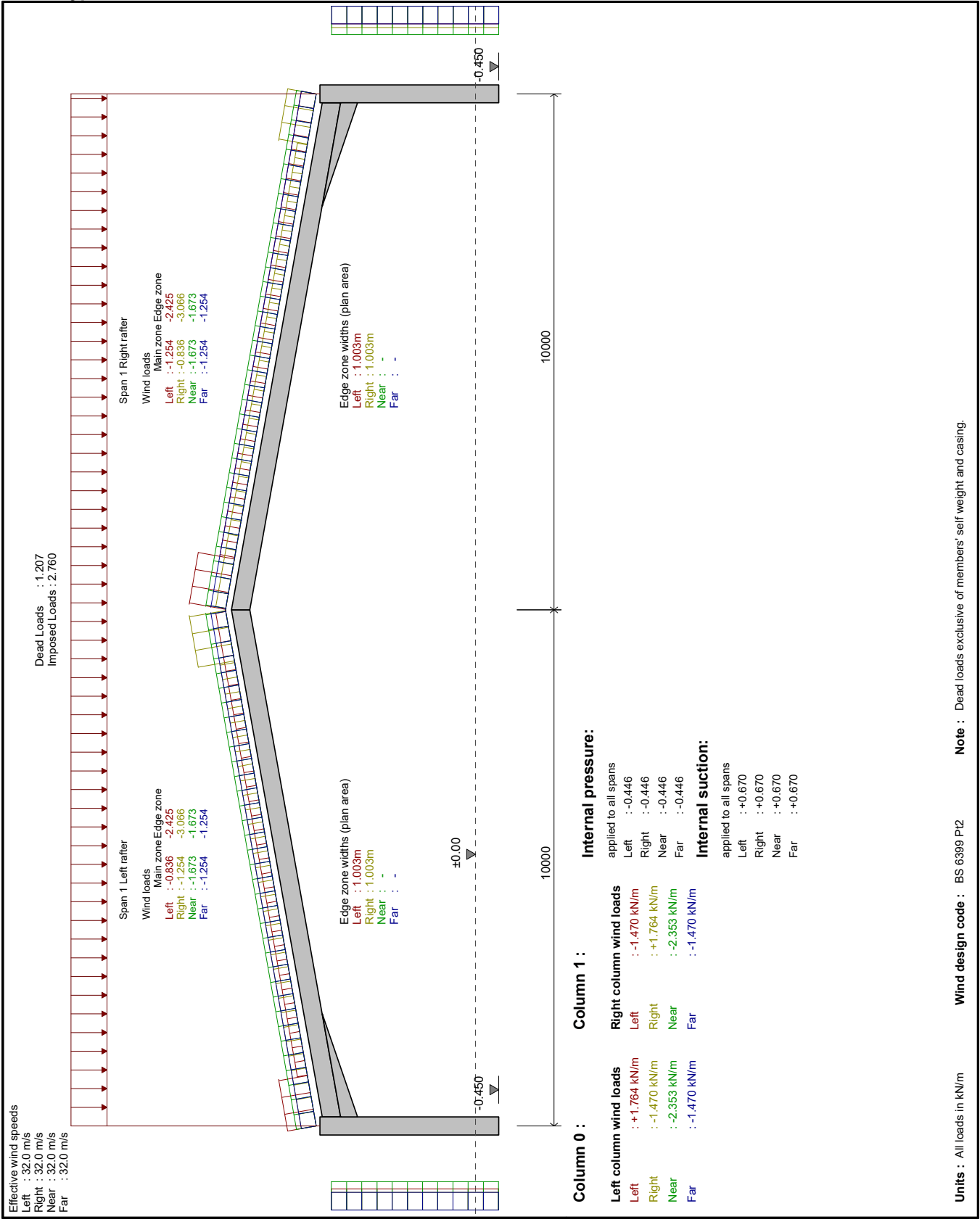
FrameType1 : Portal snow loads :



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FrameType1 : Portal loads :



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FrameType1 : Wind load parameters

Loading code BS 6399-2 (condensed data)

Loaded width : 4.600

<i>Wind blowing from</i>	<i>Left</i>	<i>Right</i>	<i>Near</i>	<i>Far</i>	<i>Units</i>
Effective wind speed	32.000	32.000	32.000	32.000	m/s
Dynamic pressure	0.628	0.628	0.628	0.628	kN/m ²
Internal pressures(+) and suction(-)					
Internal pressure	0.097	0.097	0.097	0.097	kN/m ²
Internal suction	-0.146	-0.146	-0.146	-0.146	kN/m ²
Span 1 external pressures (+) and suctions (-)					
Left wall/column	0.384	-0.320	-0.511	-0.320	kN/m ²
Left roof/rafter	-0.216	-0.312	-0.364	-0.273	kN/m ²
Right roof/rafter	-0.312	-0.216	-0.364	-0.273	kN/m ²
Right wall/column	-0.320	0.384	-0.511	-0.320	kN/m ²

FrameType1 : Minimum and notional horizontal loads

Unfactored loads in kN applied to eaves nodes

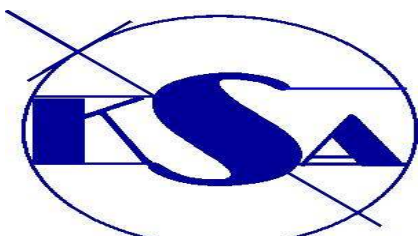
<i>BS 5950-1:2000 clause Derived from dead/imposed</i>	<i>Minimum</i>	<i>Notional</i>	
	<i>2.4.2.4 Dead</i>	<i>2.4.2.4 Dead</i>	<i>2.4.2.4 Imposed</i>
% applied	1.000	0.500	0.500
Span 1 - left	0.195	0.097	0.138
- right	0.195	0.097	0.138

FrameType1 : Ultimate limit state analysis

First hinge analysis	
Lowest first hinge formation load factor	0.726
Combination producing lowest first hinge load factor	D+I+NR
Combination number	2
Member containing the first hinge	Left column span 1
Position of the hinge	0 mm
Collapse analysis	
Lowest collapse load factor	1.196
Combination producing lowest collapse load factor	D+I+NL
Combination number	1
Results	
Utilisation ratio	0.836
Collapse status	Pass

FrameType1 : SLS deflection analysis

<i>Item</i>	<i>Vertical direction</i>	<i>Horizontal direction</i>	<i>Units</i>
Critical load combination	21	27	-
Critical combination name	Imposed	WRIP	-
Critical deflection position	Span 1 apex	Span 1 right haunch	-
Span / height	20.000	-2.743	m

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SLS deflection analysis (continued)

Item	Vertical direction	Horizontal direction	Units
Deflection - actual	-41.6	-9.4	mm
Limit (maximum)	100.0	-13.7	mm
Deflection ratio - actual	481	292	-
Deflection ratio limit (minimum)	200	200	-
Results			
Utilisation ratio	0.416	0.684	-
Status	Pass	Pass	-

FrameType1 : Member check results

Span	Local capacity			Lateral buckling			Torsional buckling			Status
	U-Ratio	Comb.	Pos.	U-Ratio	Comb.	Pos.	U-Ratio	Comb.	Pos.	
Rafters	0.476	n/a	-	0.669	n/a	-	0.987	n/a	-	Passed
Left rafter span 1	0.476	D+I+NR	2208	0.669	D+I+NR	2208	0.987	D+I+NR	2208	Passed
Right rafter span 1	0.475	D+I+NL	7946	0.668	D+I+NL	7946	0.984	D+I+NL	7946	Passed
External columns	1.000	n/a	-	0.964	n/a	-	1.000	n/a	-	Passed
Left column span 1	1.000	D+I+NR	2743	0.963	D+I+NR	2743	1.000	D+I+NR	2743	Passed
Right column span 1	1.000	D+I+NL	2743	0.964	D+I+NL	2743	1.000	D+I+NL	2743	Passed

Nearest sheeting rail on column N is > D/2 from underside of haunch. Additional lateral restraints required between 2917 and 2569.

FrameType1 : ULS Base reactions

Units : Forces in kN and moment in kNm

Load Combination	Support 0					Support 1				
	N	Hx	Hy	Mx	My	N	Hx	Hy	Mx	My
D+I+NL	71.2	57.5	0.0	0.0	-14.3	71.7	-58.2	0.0	0.0	14.7
D+I+NR	71.6	58.2	0.0	0.0	-14.7	71.3	-57.5	0.0	0.0	14.3
D+I+WLIS	43.0	32.5	0.0	0.0	-8.3	47.1	-46.0	0.0	0.0	14.8
D+I+ML	56.4	46.9	0.0	0.0	-14.8	56.6	-47.3	0.0	0.0	14.8
D+I+WRIS	46.9	45.9	0.0	0.0	-14.8	43.0	-32.4	0.0	0.0	8.2
D+I+MR	56.6	47.3	0.0	0.0	-14.8	56.5	-46.9	0.0	0.0	14.8
D+I+WNIS	55.3	40.6	0.0	0.0	-12.9	55.3	-40.6	0.0	0.0	12.9
D+I+WFIS	45.1	43.0	0.0	0.0	-13.9	45.2	-43.0	0.0	0.0	13.9
D + WLIP	-21.4	-17.4	0.0	0.0	8.5	-17.1	1.6	0.0	0.0	1.8
D + ML	14.8	9.8	0.0	0.0	-3.1	15.0	-10.3	0.0	0.0	3.6
D + WRIP	-17.2	-1.7	0.0	0.0	-1.8	-21.6	17.5	0.0	0.0	-8.6
D + MR	15.0	10.3	0.0	0.0	-3.6	14.8	-9.8	0.0	0.0	3.1
D + WNIP	-7.3	-8.2	0.0	0.0	3.9	-7.3	8.2	0.0	0.0	-3.9
D + WFIP	-19.1	-5.7	0.0	0.0	2.8	-19.1	5.7	0.0	0.0	-2.8
D+CI+SDP	27.3	19.9	0.0	0.0	-6.6	27.3	-19.9	0.0	0.0	6.6
D+CI+US	65.3	53.8	0.0	0.0	-14.8	65.3	-53.8	0.0	0.0	14.8
D+CI+US+WLIS	38.4	28.5	0.0	0.0	-7.1	42.4	-42.0	0.0	0.0	14.8
D+CI+US+WRIS	42.2	41.9	0.0	0.0	-14.8	38.4	-28.3	0.0	0.0	7.1

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FrameType1 : SLS Base reactions

Units : Forces in kN and moment in kNm

Load Combination	Support 0					Support 1				
	N	Hx	Hy	Mx	My	N	Hx	Hy	Mx	My
D + I	47.1	39.2	0.0	0.0	-12.9	47.1	-39.2	0.0	0.0	12.9
D + I + WLIS	36.0	27.3	0.0	0.0	-7.3	39.1	-38.5	0.0	0.0	14.8
D + I + WRIS	39.0	38.5	0.0	0.0	-14.8	35.9	-27.2	0.0	0.0	7.3
D + I + WNIS	46.1	33.8	0.0	0.0	-10.6	46.1	-33.8	0.0	0.0	10.6
D + I + WFIS	37.6	35.6	0.0	0.0	-11.4	37.6	-35.6	0.0	0.0	11.4
D + WLIP	-11.1	-9.5	0.0	0.0	5.2	-7.9	-1.7	0.0	0.0	2.3
D + WRIP	-8.0	1.7	0.0	0.0	-2.3	-11.1	9.6	0.0	0.0	-5.2
D + WNIP	-1.0	-3.1	0.0	0.0	1.9	-1.0	3.1	0.0	0.0	-1.9
D + WFIP	-9.4	-1.2	0.0	0.0	1.0	-9.4	1.2	0.0	0.0	-1.0
D + US	43.2	35.7	0.0	0.0	-11.7	43.2	-35.7	0.0	0.0	11.7
D + US + WLIS	3.8	-1.9	0.0	0.0	2.3	6.9	-9.4	0.0	0.0	5.2
D + US + WRIS	6.8	9.3	0.0	0.0	-5.2	3.7	2.0	0.0	0.0	-2.3

FrameType1 : Load categories reactions

Units : Forces in kN and moment in kNm

Load Category	Support 0					Support 1				
	N	Hx	Hy	Mx	My	N	Hx	Hy	Mx	My
DeadP	14.9	10.0	0.0	0.0	-3.3	14.9	-10.0	0.0	0.0	3.3
Dead	19.5	14.2	0.0	0.0	-4.7	19.5	-14.2	0.0	0.0	4.7
Imposed	27.6	25.0	0.0	0.0	-8.2	27.6	-25.0	0.0	0.0	8.2
WLIS	-11.1	-11.9	0.0	0.0	5.6	-8.0	0.6	0.0	0.0	1.9
WRIS	-8.1	-0.7	0.0	0.0	-1.9	-11.2	12.0	0.0	0.0	-5.6
WNIS	-1.0	-5.4	0.0	0.0	2.3	-1.0	5.4	0.0	0.0	-2.3
WFIS	-9.5	-3.6	0.0	0.0	1.5	-9.5	3.6	0.0	0.0	-1.5
WLIP	-26.0	-19.6	0.0	0.0	8.5	-22.9	8.3	0.0	0.0	-1.0
WRIP	-22.9	-8.4	0.0	0.0	1.0	-26.1	19.7	0.0	0.0	-8.5
WNIP	-15.9	-13.1	0.0	0.0	5.2	-15.9	13.1	0.0	0.0	-5.2
WFIP	-24.3	-11.2	0.0	0.0	4.3	-24.3	11.2	0.0	0.0	-4.3
US	23.7	21.5	0.0	0.0	-7.1	23.7	-21.5	0.0	0.0	7.1

FrameType1 : Joint forces (ULS) at left eaves of span 1

Units : Forces in kN and moment in kNm

Sign Convention : Sagging moments - Positive ; Hogging moments - Negative

ULS Comb.	Left rafter			Lower column		
	Axial	Shear	Mom.	Axial	Shear	Mom.
D+I+NL	68.49	55.27	-173.07	66.32	-57.49	-173.07
D+I+NR	68.55	55.63	-176.83	66.69	-58.21	-176.83
D+I+WLIS	49.23	37.27	-112.97	45.25	-42.01	-112.97
D+I+ML	55.44	43.24	-138.24	52.21	-46.85	-138.24
D+I+WRIS	50.19	38.10	-130.34	46.24	-42.81	-130.34
D+I+MR	55.47	43.39	-139.82	52.37	-47.32	-139.82
D+I+WNIS	40.48	33.79	-108.89	40.30	-33.99	-108.89

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Joint forces (ULS) at left eaves of span 1 (continued)

ULS Comb.	Left rafter			Lower column		
	Axial	Shear	Mom.	Axial	Shear	Mom.
D+I+WFIS	47.12	37.64	-121.24	45.25	-39.87	-121.24
D + WLIP	-13.32	-10.08	37.97	-12.24	11.37	37.97
D + ML	11.86	9.41	-28.75	11.33	-9.77	-28.75
D + WRIP	-12.26	-9.45	21.61	-11.43	10.43	21.61
D + MR	11.88	9.54	-30.02	11.45	-10.32	-30.02
D + WNIP	-23.80	-14.37	43.47	-18.28	20.95	43.47
D + WFIP	-16.33	-9.72	29.78	-12.41	14.39	29.78
D+CI+SDP	23.51	18.58	-58.34	22.39	-19.93	-58.34
D+CI+US	63.46	50.08	-161.15	60.34	-53.81	-161.15
D+CI+US+WLI	44.46	33.47	-100.95	40.68	-37.97	-100.95
D+CI+US+WRI	45.40	34.18	-117.05	41.54	-38.78	-117.05

FrameType1 : Joint forces (ULS) at apex of span 1

Units : Forces in kN and moment in kNm

ULS Comb.	Right rafter			Left rafter		
	Axial	Shear	Mom.	Axial	Shear	Mom.
D+I+NL	57.01	9.82	59.52	56.93	-10.27	59.52
D+I+NR	56.95	10.18	59.51	57.00	-9.91	59.51
D+I+WLIS	41.24	4.07	33.82	40.14	-10.28	33.82
D+I+ML	46.39	8.08	40.84	46.35	-8.28	40.84
D+I+WRIS	40.01	10.26	33.65	41.11	-4.04	33.65
D+I+MR	46.36	8.23	40.84	46.38	-8.12	40.84
D+I+WNIS	31.38	5.56	33.84	31.39	-5.51	33.84
D+I+WFIS	38.05	6.67	36.66	38.04	-6.75	36.66
D + WLIP	-14.10	-5.99	-8.63	-15.30	-0.80	-8.63
D + ML	9.91	1.68	8.37	9.88	-1.81	8.37
D + WRIP	-15.47	0.90	-8.82	-14.23	6.13	-8.82
D + MR	9.88	1.81	8.37	9.91	-1.68	8.37
D + WNIP	-25.78	-4.56	-7.42	-25.78	4.54	-7.42
D + WFIP	-18.31	-3.22	-4.75	-18.31	3.24	-4.75
D+CI+SDP	19.63	3.46	16.76	19.63	-3.46	16.76
D+CI+US	52.99	9.31	47.93	52.98	-9.37	47.93
D+CI+US+WLI	37.25	3.44	29.90	36.18	-9.51	29.90
D+CI+US+WRI	36.05	9.50	29.72	37.12	-3.40	29.72

FrameType1 : Joint forces (ULS) at right eaves of span 1

Units : Forces in kN and moment in kNm

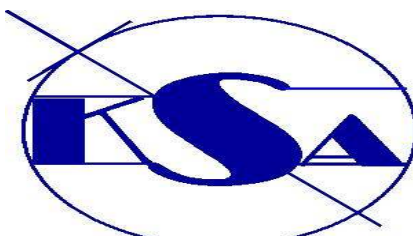
ULS Comb.	Right rafter			Lower column		
	Axial	Shear	Mom.	Axial	Shear	Mom.
D+I+NL	68.57	-55.72	-176.83	66.78	-58.21	-176.83
D+I+NR	68.50	-55.35	-173.08	66.41	-57.49	-173.08
D+I+WLIS	50.32	-38.24	-130.68	46.40	-42.92	-130.68

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Joint forces (ULS) at right eaves of span 1 (continued)

ULS Comb.	Right rafter			Lower column		
	Axial	Shear	Mom.	Axial	Shear	Mom.
D+I+ML	55.47	-43.44	-139.82	52.41	-47.32	-139.82
D+I+WRIS	49.09	-37.29	-112.61	45.25	-41.87	-112.61
D+I+MR	55.45	-43.29	-138.24	52.26	-46.85	-138.24
D+I+WNIS	40.47	-33.73	-108.88	40.25	-33.99	-108.88
D+I+WFIS	47.14	-37.72	-121.26	45.33	-39.87	-121.26
D + WLIP	-12.12	9.39	21.24	-11.35	10.31	21.24
D + ML	11.88	-9.54	-30.02	11.46	-10.32	-30.02
D + WRIP	-13.50	10.17	38.40	-12.36	11.52	38.40
D + MR	11.86	-9.41	-28.75	11.33	-9.77	-28.75
D + WNIP	-23.80	14.35	43.47	-18.26	20.95	43.47
D + WFIP	-16.33	9.74	29.79	-12.43	14.39	29.79
D+CI+SDP	23.52	-18.59	-58.34	22.39	-19.93	-58.34
D+CI+US	63.48	-50.14	-161.14	60.40	-53.81	-161.14
D+CI+US+WLI	45.53	-34.31	-117.39	41.70	-38.88	-117.39
D+CI+US+WRI	44.32	-33.48	-100.59	40.67	-37.84	-100.59

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Purlin and sheeting rail details

Location	Manufacturer	Purlin/rail system	Section reference	Self Wt (kg/m)
Purlin - end bay	Metsec	Zed purlin sleeved : 1 sag rods	142 Z 13	2.94
Purlin - Int. bay	Metsec	Zed purlin sleeved : 1 sag rods	142 Z 13	2.94
Rails - End wall	Metsec	Zed Sleeved - Side rail	142 Z 13	2.94
Rails - Side wall	Metsec	Zed Sleeved - Side rail	142 Z 13	2.94

Purlin and sheeting rail load capacities (kN)

Location	Span length (m)		Ultimate pressure		Ultimate suction		Serviceability		
	Critical	Select	Reqd.	Prov.	Reqd.	Prov.	Defl.Limit	Reqd.	Prov.
Purlin - End bay	4.60	5.00	8.88	12.95	5.37	12.95	L/180	6.34	7.79
Purlin - Int. bay	4.60	5.00	8.88	12.95	5.37	12.95	L/180	5.77	7.79
Rails - End wall	5.00	5.00	6.32	12.10	8.26	12.10	L/150	5.90	8.64
Rails - side wall	4.60	5.00	4.39	12.10	6.35	12.10	L/150	4.54	8.64

Note :Purlins and Rails load calculations are provided to give an approximation of sizes for the project, and should be verified with the manufacturer.

Member forces - End frame post

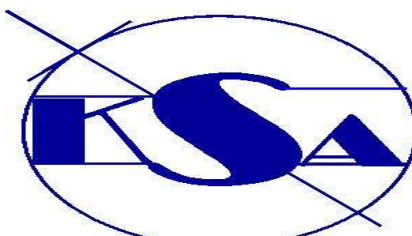
Location	Section		Axial load (kN)	Shear Force (kN)	Bending moment (kNm)	Comb.
Near End Span 1	127x76 UB13	Force	18.2	8.1	10.6	D+Wind
		Capacity	462.0	88.0	23.4	
Far End Span 1	127x76 UB13	Force	19.8	8.1	10.6	D+Wind
		Capacity	462.0	88.0	23.4	

Design Result - End frame post

Span	Local capacity			Lateral buckling			Torsional buckling		
	U-Ratio	Comb.	Pos.	U-Ratio	Comb.	Pos.	U-Ratio	Comb.	Pos.
Near End Span 1	0.453	D+Wind	2592	0.640	D+Wind	2592	0.825	D+Wind	2429
Far End Span 1	0.453	D+Wind	2592	0.646	D+Wind	2592	0.825	D+Wind	2429

Design Result - End frame post (continued)

Span	Deflection			Status
	U-Ratio	Comb.	Pos.	
Near End Span 1	0.951	D+Win	2534	Passed
Far End Span 1	0.951	D+Win	2534	Passed

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Member forces - Transverse roof bracing

Location	Section		Axial load (kN)	Shear Force (kN)	Bending moment (kNm)	Comb.
Grid 1-2 : Span 1	100x100x15 RSEA	Force	-20.2	1.1	1.9	D+Wind
		Capacity	770.0	222.8	19.5	
Grid 7-8 : Span 1	100x100x15 RSEA	Force	-20.2	1.1	1.9	D+Wind
		Capacity	770.0	222.8	19.5	

Design Result - Tranverse roof bracing

Location	Local capacity			Lateral buckling			Torsional buckling		
	U-Ratio	Comb.	Pos.	U-Ratio	Comb.	Pos.	U-Ratio	Comb.	Pos.
Grid 1-2 : Span 1	0.117	D+Wind	3397	0.656	D+Wind	3397	N/A	D+Wind	0
Grid 7-8 : Span 1	0.117	D+Wind	3397	0.656	D+Wind	3397	N/A	D+Wind	0

Design Result - Transverse roof bracing (continued)

Location	Deflection			Status
	U-Ratio	Comb.	Pos.	
Grid 1-2 : Span 1	0.366	D+Win	3397	Passed
Grid 7-8 : Span 1	0.366	D+Win	3397	Passed

Member forces - Longitudinal wall bracing

Location	Section	Local Capacity		Status
		Force	Capacity	
Along A Grid 1-2	80x80x10 RSEA	19.5	415.3	Passed
Along A Grid 7-8	80x80x10 RSEA	19.5	415.3	Passed
Along E Grid 1-2	80x80x10 RSEA	19.5	415.3	Passed
Along E Grid 7-8	80x80x10 RSEA	19.5	415.3	Passed

Member forces - Longitudinal wall bracing

Location	Section	Lateral Buckling		Status
		Force	Capacity	
Along A Grid 1-2	80x80x10 RSEA	19.5	27.3	Passed
Along A Grid 7-8	80x80x10 RSEA	19.5	27.3	Passed
Along E Grid 1-2	80x80x10 RSEA	19.5	27.3	Passed

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Member forces - Longitudinal wall bracing (continued)

Location	Section	Lateral Buckling		Status
		Force	Capacity	
Along E Grid 7-8	80x80x10 RSEA	19.5	27.3	Passed

Longitudinal wall bracing details

Location	Bracing type	No of panels	Panel height
Along A Grid 1-2	Mirror K	2	1.625
			1.625
Along A Grid 7-8	K	2	1.625
			1.625
Along E Grid 1-2	Mirror K	2	1.625
			1.625
Along E Grid 7-8	K	2	1.625
			1.625

Member forces - Roof tie

Location	Section	Axial load		Status
		Force	Capacity	
Longitudinal ties	60.3x3.2 CHS	18.4	157.9	Passed
Ridge ties	48.3x4.0 CHS	-	-	N/A

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Bill of approximate quantities

Reference	Location	No	Length (m)	Section	Weight (kg)	Total Wt(kg)
Frame Design Groups						
FrameType1	Span 1 - Left column	8	3.250	356x127 UB33	112.6	900.9
	Span 1 - Left rafter	8	10.154	356x127 UB33	351.8	2814.8
	Span 1 - Left haunch	8	2.208	356x127 UB33	38.2	306.0
	Span 1 - Right rafter	8	10.154	356x127 UB33	351.8	2814.8
	Span 1 - Right haunch	8	2.208	356x127 UB33	38.2	306.0
	Span 1 - Right column	8	3.250	356x127 UB33	112.6	900.9
					Total	8043.3
End Frame Post						
Near end	Grid B	1	4.132	127x76 UB13	53.71	53.7
	Grid C	1	5.013	127x76 UB13	65.17	65.2
	Grid D	1	4.132	127x76 UB13	53.71	53.7
Far end	Grid B	1	4.132	127x76 UB13	53.71	53.7
	Grid C	1	5.013	127x76 UB13	65.17	65.2
	Grid D	1	4.132	127x76 UB13	53.71	53.7
Transverse roof bracing						
Grid 1-2	Span 1	1	36.604	100x100x15 RSEA	801.63	801.6
Grid 7-8	Span 1	1	36.604	100x100x15 RSEA	801.63	801.6
Longitudinal wall bracings						
Left wall	Grid 1-2	1	9.757	80x80x10 RSEA	116.11	116.1
	Grid 7-8	1	9.757	80x80x10 RSEA	116.11	116.1
Right wall	Grid 1-2	1	9.757	80x80x10 RSEA	116.11	116.1
	Grid 7-8	1	9.757	80x80x10 RSEA	116.11	116.1
Longitudinal ties						
Longitudinal ties	-	2	32.200	60.3x3.2 CHS	145.22	290.4
Grand total						10746.7