info@structurehaus.com . www.structurehaus.com

PROJECT: Airport Tractor Shed - IOS

REF: 06349E

DATE: April 2024

CALCULATIONS

CALCULATIONS	PROJECT: Airport Tractor Shed	PROJECT No:	06349E
		DATE:	April '24
		CALCULATIONS BY:	MDH

STRUCTURAL SUMMARY

The following is to be read alongside the overall remedial works package being completed by Currie & Brown, these are for the remedial detail for the 150mm square timber post base plate detail only.

The existing base plates have corroded and the timber posts have rotten.

The proposal is to cut the existing posts short to ensure all rot and moisture tracking is removed and to have the timber stop well before the damp ground. This can be achieved via acrow propping at the eaves position.

The works are to be sequenced such that only one post per frame is worked on at any time and that no adjacent posts are worked on either. At least 24hr should be left before the temporary propping is removed and the remedial works considered to be complete to allow for works on opposite or adjacent posts.

STRUCTURAL STABILITY

To be maintained during the works by sequencing the works. The contractor is responsible for maintaining the stability during the works.

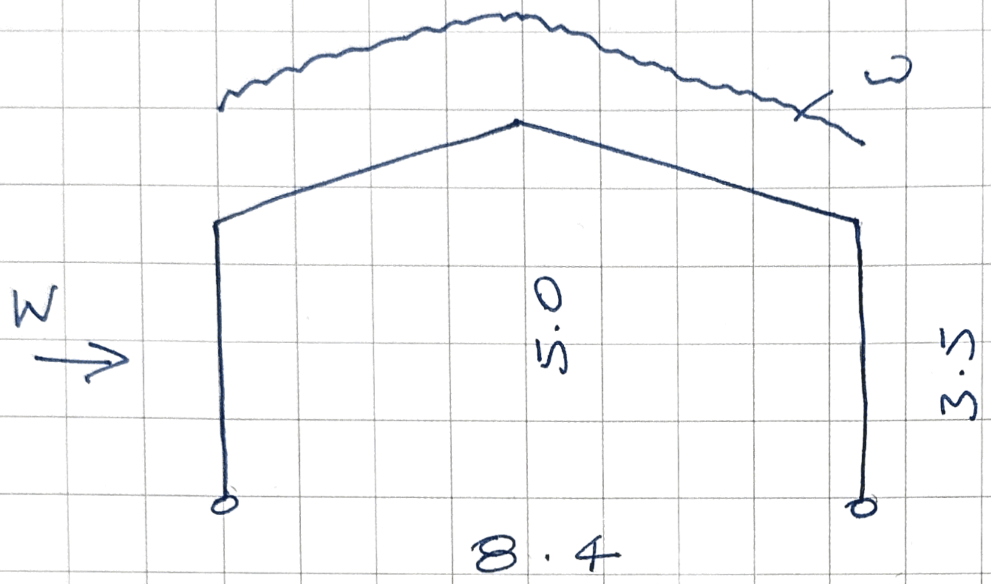
ASSUMPTIONS

A competent and experienced contractor is used.

DESIGN REFERENCES

Eurocode 1: Actions on structures (EN 1991)
Eurocode 2: Design of concrete structures (EN 1992)
~~Eurocode 3: Design of steel structures (EN 1993)~~
~~Eurocode 4: Design of composite steel and concrete structures (EN 1994)~~
Eurocode 5: Design of timber structures (EN 1995)
~~Eurocode 6: Design of masonry structures (EN 1996)~~
~~Eurocode 7: Geotechnical design (EN 1997)~~
~~Eurocode 8: Design of structures for earthquake resistance (EN 1998)~~
~~Eurocode 9: Design of aluminium structures (EN 1999~~)

structureHaus		Ref 06349E
		Date April '24
Calculation	Contract Airport Tractor Shed	Sheet 1
		By MDH



w: 1.0 × 3.4/2 × 2   3.4
0.6   2.0
kN/m

W : 0.77 × 3.4   2.6 kN/m

From TEDDS :-

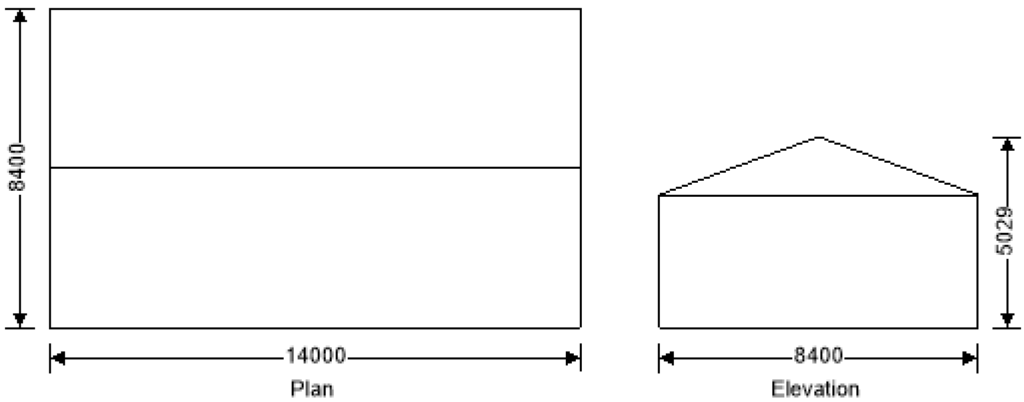
Shear : 1.7 kN

Axial : 35.2 kN

WIND LOADING

In accordance with EN1991-1-4:2005+A1:2010 and the UK national annex

Tedds calculation version 3.0.28



Building data

Type of roof	Duopitch
Length of building	L = **14000** mm
Width of building	W = **8400** mm
Height to eaves	H = **3500** mm
Pitch of roof	α_0 = **20.0** deg
Total height	h = **5029** mm

Basic values

Location	St Marys
Wind speed velocity (FigureNA.1)	$v_{b,map}$ = **23.5** m/s
Distance to shore	L_{shore} = **1.00** km
Altitude above sea level	A_{alt} = **30.0**m
Altitude factor	$c_{alt} = A_{alt}/1m \times 0.001 + 1$ = **1.030**
Fundamental basic wind velocity	$v_{b,0} = v_{b,map} \times c_{alt}$ = **24.2** 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**
Air density	ρ = **1.226** kg/m^3
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)	$v_b = c_{dir} \times c_{season} \times v_{b,0} \times c_{prob}$ = **24.2** m/s
Reference mean velocity pressure	$q_b = 0.5 \times \rho \times v_b^2$ = **0.359** kN/m^2

Orography

Orography factor not significant	c_o = 1.0
Terrain category	Sea
Displacement height (sheltering effect excluded)	h_{dis} = 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.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 = **3500**mm

Displacement height (sheltering effects excluded) — h_{dis} = **0** mm

Exposure factor (Figure NA.7) — c_e = **2.01**

Peak velocity pressure — $q_p = c_e \times q_b$ = **0.72** kN/m^2

Structural factor

Structural damping — δ_s = **0.050**

Height of element — h_{part} = **3500** mm

Size factor (Table NA.3) — c_s = **0.918**

Dynamic factor (Figure NA.9) — c_d = **1.026**

Structural factor — $c_sc_d = c_s \times c_d$ = **0.941**

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

Reference height (at which q is sought) — z = **5029**mm

Displacement height (sheltering effects excluded) — h_{dis} = **0** mm

Exposure factor (Figure NA.7) — c_e = **2.25**

Peak velocity pressure — $q_p = c_e \times q_b$ = **0.81** kN/m^2

Structural factor

Structural damping — δ_s = **0.050**

Height of element — h_{part} = **5029** mm

Size factor (Table NA.3) — c_s = **0.930**

Dynamic factor (Figure NA.9) — c_d = **1.039**

Structural factor — $c_sc_d = c_s \times c_d$ = **0.966**

Structural factor - roof 0 deg

Structural damping — δ_s = **0.050**

Height of element — h_{part} = **5029** mm

Size factor (Table NA.3) — c_s = **0.913**

Dynamic factor (Figure NA.9) — c_d = **1.026**

Structural factor — $c_sc_d = c_s \times c_d$ = **0.936**

Peak velocity pressure for internal pressure

Peak velocity pressure – internal (as roof press.) — $q_{p,i}$ = **0.81** kN/m^2

Pressures and forces

Net pressure — $p = c_sc_d \times q_p \times c_{pe} - q_{p,i} \times c_{pi}$

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, (kN/m^2)	Net pressure p (kN/m^2)	Area A_{ref} (m^2)	Net force F_w (kN)
F (-ve)	-0.90	0.81	-0.84	5.38	-4.53
G (-ve)	-0.70	0.81	-0.69	9.60	-6.63
H (-ve)	-0.33	0.81	-0.41	47.59	-19.67
I (-ve)	-0.50	0.81	-0.54	47.59	-25.66
J (-ve)	-1.17	0.81	-1.04	14.98	-15.63

Total vertical net force — $F_{w,v}$ = **-67.76** kN

Total horizontal net force — $F_{w,h}$ = **3.58** kN

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	0.81	-1.07	7.78	-8.34
B	-0.80	0.81	-0.77	28.04	-21.56
D	0.75	0.72	0.34	49.00	16.89
E	-0.39	0.72	-0.43	49.00	-20.96

Overall loading

Equiv leeward net force for overall section — $F_l = F_{w,wE}$ = **-21.0** kN

Net windward force for overall section — $F_w = F_{w,wD}$ = **16.9** kN

Lack of correlation (cl.7.2.2(3) – Note) — f_{corr} = **0.85** as h/W is 0.599

Overall loading overall section — $F_{w,D} = f_{corr} \times (F_w - F_l + F_{w,h})$ = **35.2** 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)	0.40	0.81	0.54	5.38	2.93
G (+ve)	0.30	0.81	0.47	9.60	4.50
H (+ve)	0.27	0.81	0.44	47.59	21.11
I (+ve)	-0.50	0.81	-0.14	47.59	-6.46
J (+ve)	-1.17	0.81	-0.64	14.98	-9.58

Total vertical net force — $F_{w,v}$ = **11.75** kN

Total horizontal net force — $F_{w,h}$ = **15.25** 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	0.81	-0.67	7.78	-5.20
B	-0.80	0.81	-0.37	28.04	-10.25
D	0.75	0.72	0.75	49.00	36.66
E	-0.39	0.72	-0.02	49.00	-1.19

Overall loading

Equiv leeward net force for overall section — $F_l = F_{w,wE}$ = **-1.2** kN

Net windward force for overall section — $F_w = F_{w,wD}$ = **36.7** kN

Lack of correlation (cl.7.2.2(3) – Note) — f_{corr} = **0.85** as h/W is 0.599

Overall loading overall section — $F_{w,D} = f_{corr} \times (F_w - F_l + F_{w,h})$ = **45.1** 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/m²)	Net pressure p (kN/m²)	Area A_{ref} (m²)	Net force F_w (kN)
F (-ve)	-1.47	0.81	-1.30	3.75	-4.90
G (-ve)	-1.37	0.81	-1.23	3.75	-4.61
H (-ve)	-0.60	0.81	-0.63	30.04	-18.89
I (-ve)	-0.43	0.81	-0.50	87.60	-43.73

Total vertical net force $F_{w,v}$ = **-67.78** 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/m²)	Net pressure p (kN/m²)	Area A_{ref} (m²)	Net force F_w (kN)
A	-1.20	0.72	-1.00	5.88	-5.86
B	-0.80	0.72	-0.72	23.52	-16.89
C	-0.50	0.72	-0.51	19.60	-9.98
D	0.71	0.81	0.40	35.82	14.17
E	-0.33	0.81	-0.42	35.82	-14.97

Overall loading

Equiv leeward net force for overall section $F_l = F_{w,wE}$ = **-15.0** kN

Net windward force for overall section $F_w = F_{w,wD}$ = **14.2** kN

Lack of correlation (cl.7.2.2(3) – Note) f_{corr} = **0.85** as h/L is 0.359

Overall loading overall section $F_{w,D} = f_{corr} \times (F_w - F_l + F_{w,h})$ = **24.8** 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/m²)	Net pressure p (kN/m²)	Area A_{ref} (m²)	Net force F_w (kN)
F (+ve)	0.30	0.81	0.48	3.75	1.79
G (+ve)	0.27	0.81	0.45	3.75	1.69
H (+ve)	0.23	0.81	0.42	30.04	12.73
I (+ve)	0.20	0.81	0.40	87.60	34.87

Total vertical net force $F_{w,v}$ = **48.00** 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/m²)	Net pressure p (kN/m²)	Area A_{ref} (m²)	Net force F_w (kN)
A	-1.20	0.72	-0.59	5.88	-3.49
B	-0.80	0.72	-0.31	23.52	-7.40
C	-0.50	0.72	-0.11	19.60	-2.07
D	0.71	0.81	0.80	35.82	28.62
E	-0.33	0.81	-0.01	35.82	-0.52

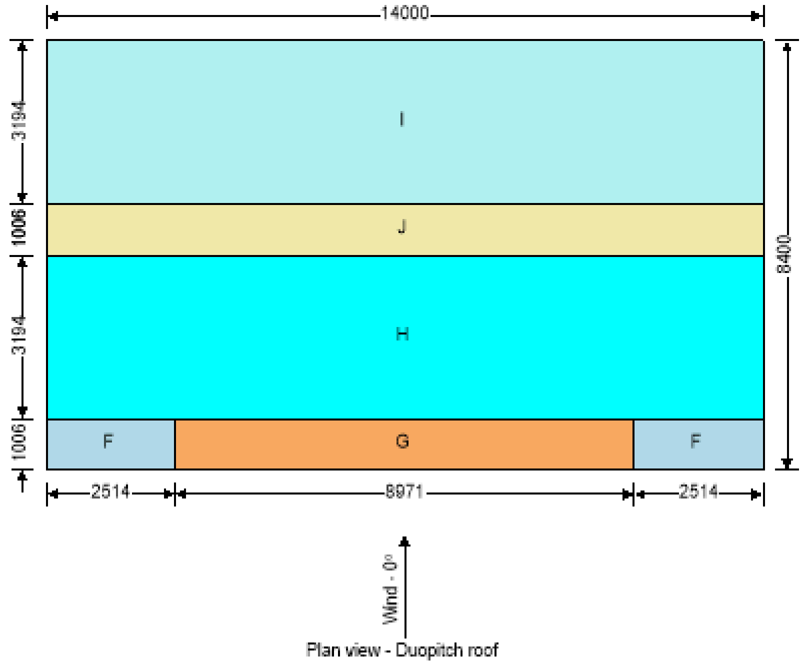
Overall loading

Equiv leeward net force for overall section $F_l = F_{w,wE}$ = **-0.5** kN

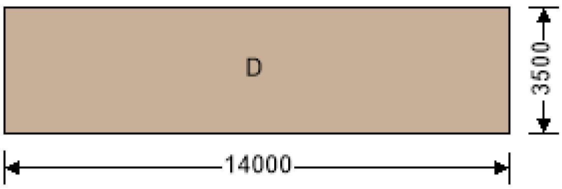
Net windward force for overall section $F_w = F_{w,wD} =$ **28.6** kN

Lack of correlation (cl.7.2.2(3) – Note) $f_{corr} =$ **0.85** as h/L is 0.359

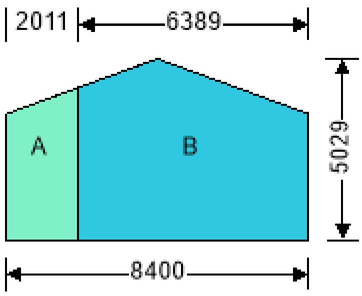
Overall loading overall section $F_{w,D} = f_{corr} \times (F_w - F_l + F_{w,h}) =$ **24.8** kN



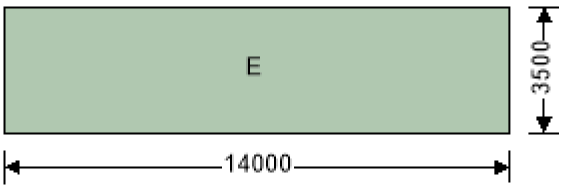
Plan view - Duopitch roof



Windward face

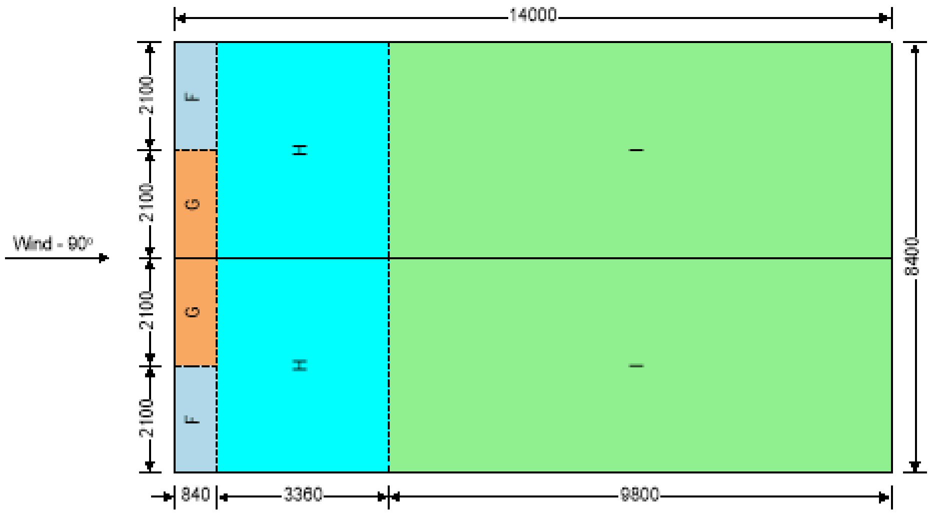


Side face

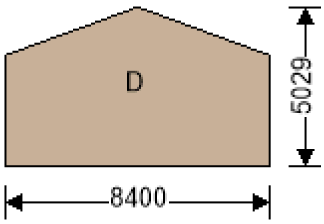


Leeward face

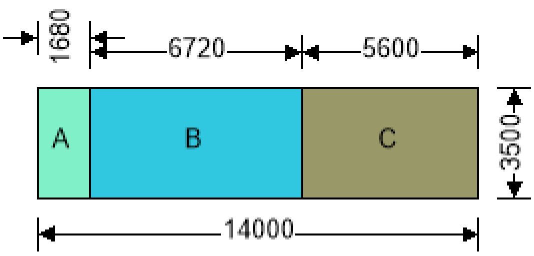
	Project				Job no.	
	Airport Tractor Shed				06349E	
	Calcs for				Start page no./Revision	
	Wind Loading				7	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	MDH	24/04/2024				



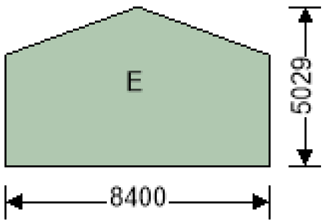
Plan view - Duopitch roof



Windward face



Side face



Leeward face

TIMBER MEMBER ANALYSIS & DESIGN (EN1995-1-1:2004)

In accordance with EN1995-1-1:2004 + A2:2014 incorporating corrigendum June 2006 and the UK national annex

Tedds calculation version 2.2.20

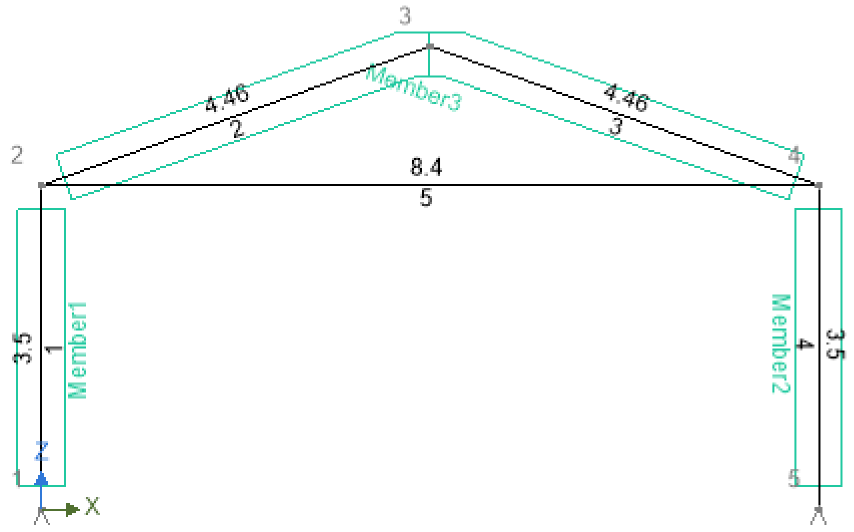
Member1 results summary	Unit	Capacity	Maximum	Utilisation	Result
Compressive stress	N/mm²	11.3	1.6	0.139	PASS
Bearing stress	N/mm²	1.3	0.1	0.069	PASS
Bending stress	N/mm²	12.9	11.2	0.870	PASS
Shear stress	N/mm²	2.2	0.2	0.083	PASS
Bending and axial force				0.889	PASS
Column stability check				1.132	FAIL
Beam stability check				0.886	PASS
Deflection	mm	14	10.8	0.768	PASS
Member2 results summary	**Unit**	**Capacity**	**Maximum**	**Utilisation**	**Result**
Compressive stress	N/mm²	11.3	1.6	0.139	PASS
Bearing stress	N/mm²	2.0	0.1	0.050	PASS
Bending stress	N/mm²	12.9	12.3	0.949	PASS
Shear stress	N/mm²	2.2	0.2	0.091	PASS
Bending and axial force				0.968	PASS
Column stability check				1.211	FAIL
Beam stability check				1.030	FAIL
Deflection	mm	14	14.1	1.008	FAIL

ANALYSIS

Tedds calculation version 1.0.37

Geometry

Geometry (m) - 150x150



Materials

Name	Density (kg/m³)	Youngs Modulus kN/mm²	Shear Modulus kN/mm²	Thermal Coefficient °C⁻¹
C16 (EC5)	370	8	0.5	0
C24 (EC5)	420	11	0.69	0

Sections

Name	Area	Moment of inertia		Shear area parallel to	
		Major	Minor	Minor	Major
	(cm²)	(cm⁴)	(cm⁴)	(cm²)	(cm²)
150x150	225	4218.8	4218.8	187.5	187.5

Nodes

Node	Co-ordinates		Freedom			Coordinate system		Spring		
	X (m)	Z (m)	X	Z	Rot.	Name	Angle (°)	X (kN/m)	Z (kN/m)	Rot. kNm/°
1	0	0	Fixed	Fixed	Free		0	0	0	0
2	0	3.5	Free	Free	Free		0	0	0	0
3	4.2	5	Free	Free	Free		0	0	0	0
4	8.4	3.5	Free	Free	Free		0	0	0	0
5	8.4	0	Fixed	Fixed	Free		0	0	0	0

Elements

Element	Length (m)	Nodes		Section	Material	Releases			Rotated
		Start	End			Start moment	End moment	Axial	
1	3.5	1	2	150x150	C24 (EC5)	Fixed	Fixed	Fixed	
2	4.46	2	3	150x150	C16 (EC5)	Fixed	Fixed	Fixed	
3	4.46	3	4	150x150	C16 (EC5)	Fixed	Fixed	Fixed	
4	3.5	4	5	150x150	C24 (EC5)	Fixed	Fixed	Fixed	
5	8.4	2	4	150x150	C16 (EC5)	Fixed	Fixed	Fixed	

Members

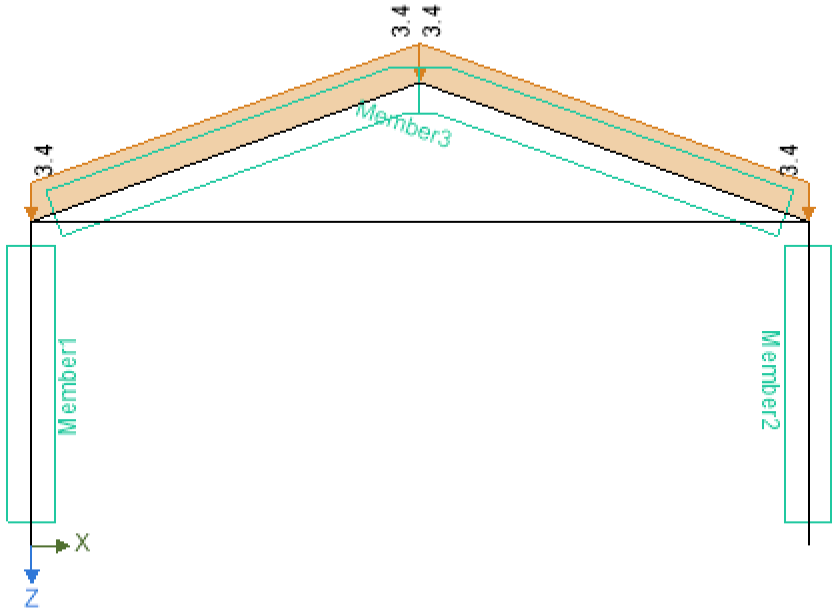
Name	Elements	
	Start	End
Member1	1	1
Member2	4	4
Member3	2	3

Loading

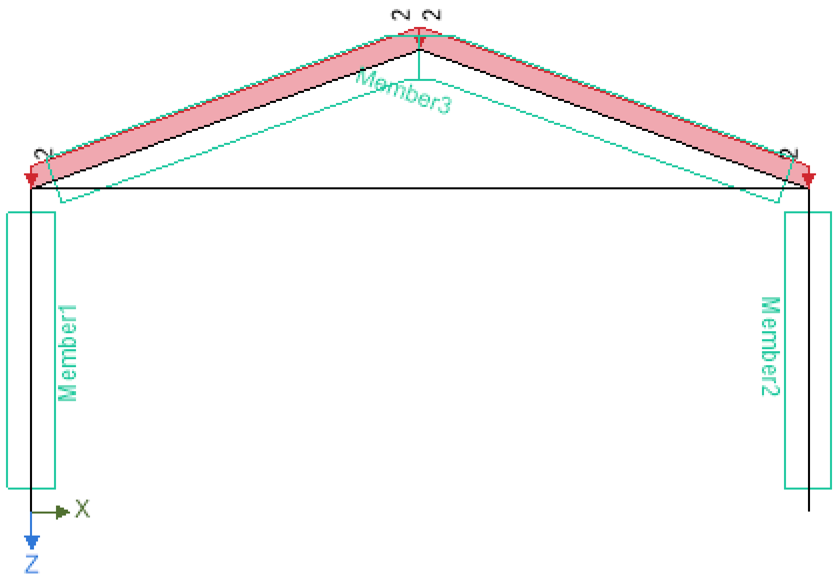
Self weight included

Project Airport Tractor Shed					Job no. 06349E	
Calcs for Frame Loading					Start page no./Revision 10	
Calcs by MDH	Calcs date 24/04/2024	Checked by	Checked date		Approved by	Approved date

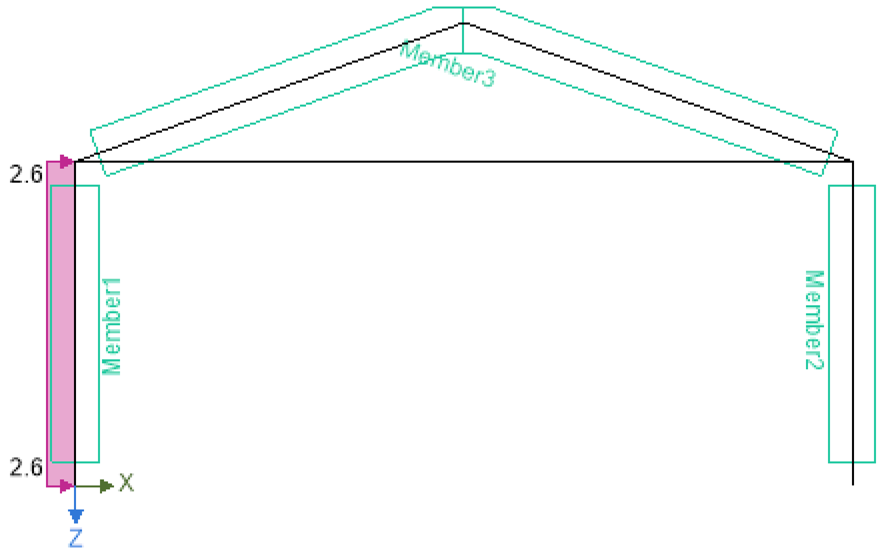
Permanent - Loading (kN/m)



Imposed - Loading (kN/m)



Wind - Loading (kN/m)



Load combination factors

Load combination	Self Weight	Permanent	Imposed	Wind
1.35G + 1.5Q + 1.5RQ (Strength)	1.35	1.35	1.50	
1.0G + 1.0Q + 1.0RQ (Service)	1.00	1.00	1.00	
1.35G + 1.5Q + 1.5ψ_0S + 1.5ψ_0W (Strength)	1.35	1.35	1.50	
1.0G + 1.0Q + 0.5S + 0.5W (Service)	1.00	1.00	1.00	

Member Loads

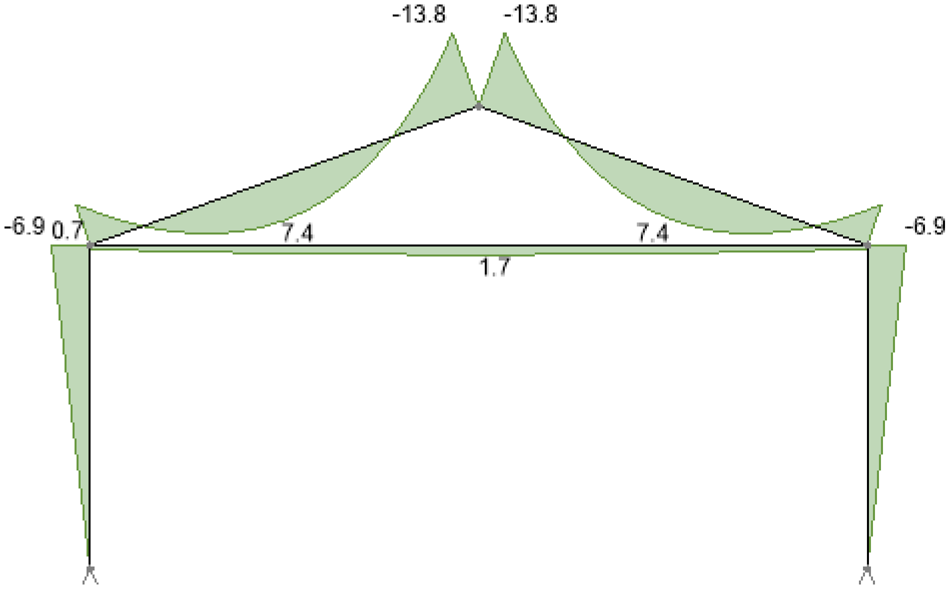
Member	Load case	Load Type	Orientation	Description
Member3	Permanent	UDL	GlobalZ	3.4 kN/m
Member3	Imposed	UDL	GlobalZ	2 kN/m
Member1	Wind	UDL	GlobalX	2.6 kN/m

Project Airport Tractor Shed				Job no. 06349E	
Calcs for Frame Loading				Start page no./Revision 12	
Calcs by MDH	Calcs date 24/04/2024	Checked by	Checked date	Approved by	Approved date

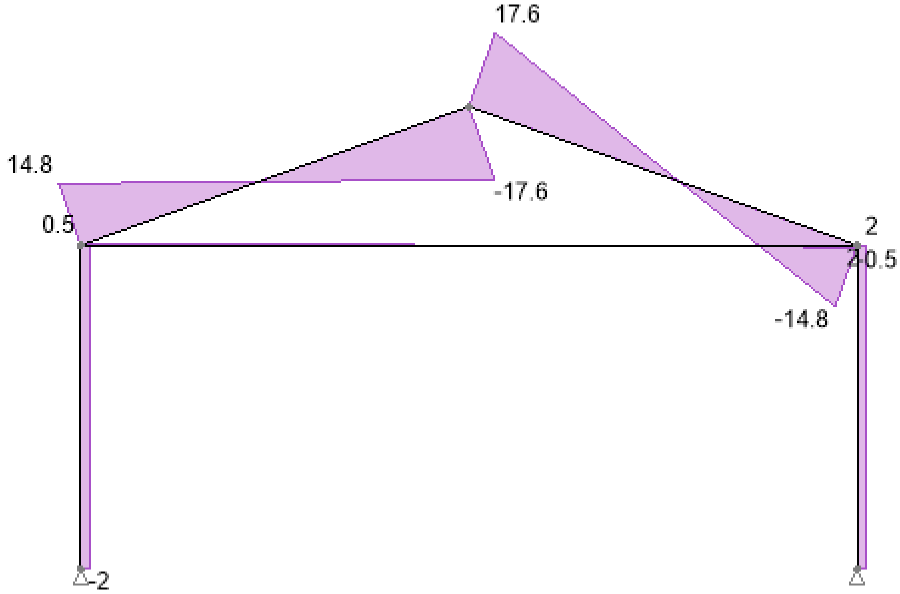
Results

Forces

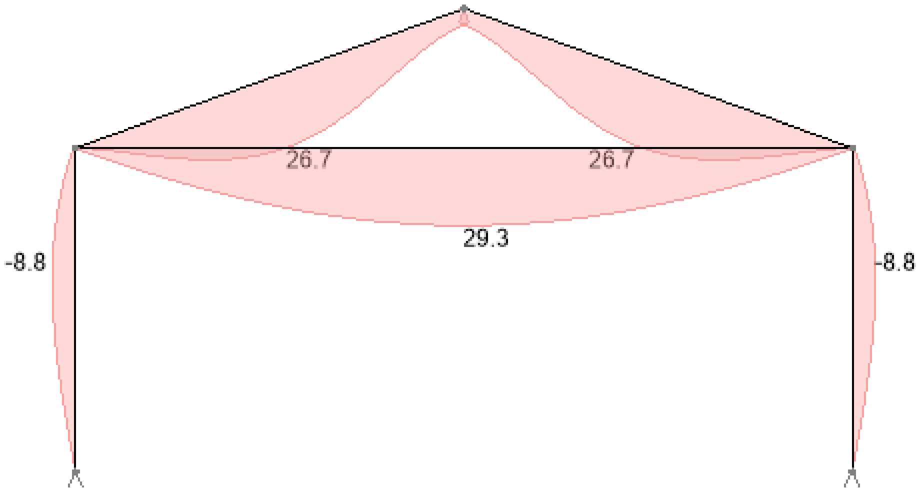
Strength combinations - Moment envelope (kNm)



Strength combinations - Shear envelope (kN)



Service combinations - Deflection envelope (mm)



Member1 - Span 1

Partial factor for material properties and resistances

Partial factor for material properties - Table 2.3 γ_M = **1.300**

Member details

Load duration - cl.2.3.1.2 Long-term

Service class - cl.2.3.1.3 1

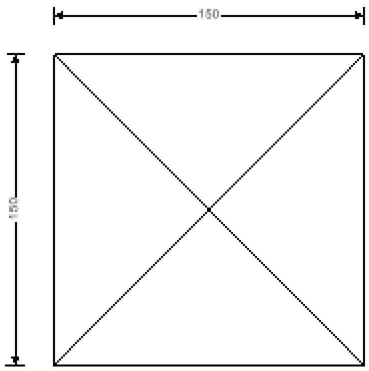
Timber section details

Number of timber sections in member N = **1**

Breadth of sections b = **150** mm

Depth of sections h = **150** mm

Timber strength class - EN 338:2016 Table 1 **C24**



150x150 timber section
Cross-sectional area, A, 22500 mm^2
Section modulus, W_y, 562500 mm^3
Section modulus, W_z, 562500 mm^3
Second moment of area, I_y, 42187500 mm^4
Second moment of area, I_z, 42187500 mm^4
Radius of gyration, i_y, 43.3 mm
Radius of gyration, i_z, 43.3 mm
Timber strength class C24
Characteristic bending strength, $f_{m,k}$, 24 N/mm^2
Characteristic shear strength, $f_{v,k}$, 4 N/mm^2
Characteristic compression strength parallel to grain, $f_{c,0,k}$, 21 N/mm^2
Characteristic compression strength perpendicular to grain, $f_{c,90,k}$, 2.5 N/mm^2
Characteristic tension strength parallel to grain, $f_{t,0,k}$, 14.5 N/mm^2
Mean modulus of elasticity, $E_{0,mean}$, 11000 N/mm^2
Fifth percentile modulus of elasticity, $E_{0.05}$, 7400 N/mm^2
Shear modulus of elasticity, G_{mean}, 690 N/mm^2
Characteristic density, ρ_k, 350 kg/m^3
Mean density, ρ_{mean}, 420 kg/m^3

Span details

Bearing length L_b = **100** mm

Consider Combination 3 - 1.35G + 1.5Q + 1.5ψ_0S + 1.5ψ_0W (Strength)

Modification factors

Duration of load and moisture content - Table 3.1 k_{mod} = **0.7**

Deformation factor - Table 3.2 k_{def} = **0.6**

Bending stress re-distribution factor - cl.6.1.6(2) k_m = **0.7**

Crack factor for shear resistance - cl.6.1.7(2) k_{cr} = **0.67**

Check compression parallel to the grain - cl.6.1.4

Design axial compression P_d = **35.242** kN

Design compressive stress $\sigma_{c,0,d} = P_d / A$ = **1.566** N/mm^2

Design compressive strength $f_{c,0,d} = k_{mod} \times f_{c.0.k} / \gamma_M$ = **11.308** N/mm^2

$\sigma_{c,0,d} / f_{c,0,d}$ = **0.139**

PASS - Design parallel compression strength exceeds design parallel compression stress

Check design at end of span

Check shear force - Section 6.1.7

Design shear force $F_{y,d}$ = **1.807** kN

Design shear stress - exp.6.60 $\tau_{y,d} = 1.5 \times F_{y,d} / (k_{cr} \times b \times h)$ = **0.180** N/mm^2

Design shear strength $f_{v,y,d} = k_{mod} \times f_{v.k} / \gamma_M$ = **2.154** N/mm^2

$\tau_{y,d} / f_{v,y,d}$ = **0.083**

PASS - Design shear strength exceeds design shear stress

Check bending moment - Section 6.1.6

Design bending moment $M_{y,d}$ = **6.325** kNm

Design bending stress $\sigma_{m,y,d} = M_{y,d} / W_y$ = **11.244** N/mm^2

Design bending strength $f_{m,y,d} = k_{mod} \times f_{m.k} / \gamma_M$ = **12.923** N/mm^2

$\sigma_{m,y,d} / f_{m,y,d}$ = **0.87**

PASS - Design bending strength exceeds design bending stress

Check combined bending and axial compression - Section 6.2.4

Combined loading checks - exp.6.19 & 6.20 $(\sigma_{c,0,d} / f_{c,0,d})^2 + \sigma_{m,y,d} / f_{m,y,d}$ = **0.889**

$(\sigma_{c,0,d} / f_{c,0,d})^2 + k_m \times \sigma_{m,y,d} / f_{m,y,d}$ = **0.628**

PASS - Combined bending and axial compression utilisation is acceptable

Check columns subjected to either compression or combined compression and bending - cl.6.3.2

Effective length for y-axis bending $L_{e,y} = 0.9 \times 3500$ mm = **3150** mm

Slenderness ratio $\lambda_y = L_{e,y} / i_y$ = **72.746**

Relative slenderness ratio - exp. 6.21 $\lambda_{rel,y} = \lambda_y / \pi \times \sqrt{(f_{c.0.k} / E_{0.05})}$ = **1.234**

Effective length for z-axis bending $L_{e,z}$ = **0** mm

Slenderness ratio $\lambda_z = L_{e,z} / i_z$ = **0**

Relative slenderness ratio - exp. 6.22 $\lambda_{rel,z} = \lambda_z / \pi \times \sqrt{(f_{c.0.k} / E_{0.05})}$ = **0**

$\lambda_{rel,y}$ > 0.3 column stability check is required

Straightness factor β_c = **0.2**

Instability factors - exp.6.25, 6.26, 6.27 & 6.28 $k_y = 0.5 \times (1 + \beta_c \times (\lambda_{rel,y} - 0.3) + \lambda_{rel,y}^2)$ = **1.354**

$k_z = 0.5 \times (1 + \beta_c \times (\lambda_{rel,z} - 0.3) + \lambda_{rel,z}^2)$ = **0.470**

$k_{c,y} = 1 / (k_y + \sqrt{(k_y^2 - \lambda_{rel,y}^2)})$ = **0.523**

$k_{c,z} = 1 / (k_z + \sqrt{(k_z^2 - \lambda_{rel,z}^2)})$ = **1.064**

Column stability checks - exp.6.23 & 6.24 $\sigma_{c,0,d} / (k_{c,y} \times f_{c,0,d}) + \sigma_{m,y,d} / f_{m,y,d}$ = **1.135**

$\sigma_{c,0,d} / (k_{c,z} \times f_{c,0,d}) + k_m \times \sigma_{m,y,d} / f_{m,y,d}$ = **0.739**

FAIL - Column stability is not acceptable

Check beams subjected to either bending or combined bending and compression - cl.6.3.3

Lateral buckling factor - exp.6.34 k_{crit} = **1.000**

Beam stability check - exp.6.35 $(\sigma_{m,y,d} / (k_{crit} \times f_{m,y,d}))^2 + \sigma_{c,0,d} / (k_{c,z} \times f_{c,0,d})$ = **0.887**

PASS - Beam stability is acceptable

Consider Combination 4 - 1.0G + 1.0Q + 0.5S + 0.5W (Service)

Check design at end of span

Check y-y axis deflection - Section 7.2

Instantaneous deflection δ_y = **6.7** mm

Quasi-permanent variable load factor ψ_2 = **0.3**

Final deflection with creep $\delta_{y,Final} = \delta_y \times (1 + k_{def})$ = **10.8** mm

Allowable deflection $\delta_{y,Allowable} = L_{m1\_s1} / 250$ = **14** mm

$\delta_{y,Final} / \delta_{y,Allowable}$ = **0.768**

PASS - Allowable deflection exceeds final deflection

Member2 - Span 1

Partial factor for material properties and resistances

Partial factor for material properties - Table 2.3 γ_M = **1.300**

Member details

Load duration - cl.2.3.1.2 Long-term

Service class - cl.2.3.1.3 1

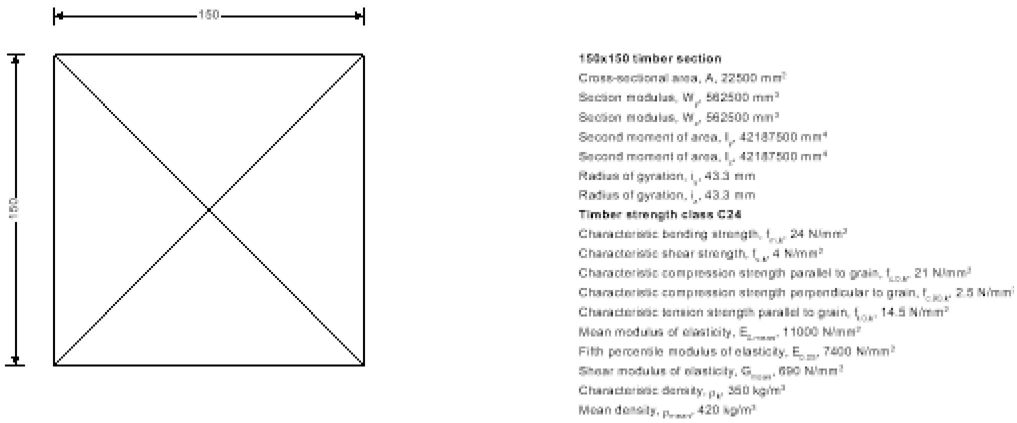
Timber section details

Number of timber sections in member N = **1**

Breadth of sections b = **150** mm

Depth of sections h = **150** mm

Timber strength class - EN 338:2016 Table 1 **C24**



Span details

Bearing length L_b = **100** mm

Consider Combination 3 - 1.35G + 1.5Q + 1.5ψ_0S + 1.5ψ_0W (Strength)

Modification factors

Duration of load and moisture content - Table 3.1 k_{mod} = **0.7**

Deformation factor - Table 3.2 k_{def} = **0.6**

Bending stress re-distribution factor - cl.6.1.6(2) k_m = **0.7**

Crack factor for shear resistance - cl.6.1.7(2) k_{cr} = **0.67**

Check compression parallel to the grain - cl.6.1.4

Design axial compression — P_d = **34.804** kN

Design compressive stress — $\sigma_{c,0,d} = P_d / A =$ **1.547** N/mm²

Design compressive strength — $f_{c,0,d} = k_{mod} \times f_{c.0.k} / \gamma_M =$ **11.308** N/mm²

$\sigma_{c,0,d} / f_{c,0,d} =$ **0.137**

PASS - Design parallel compression strength exceeds design parallel compression stress

Check design at start of span

Check shear force - Section 6.1.7

Design shear force — $F_{y,d}$ = **1.972** kN

Design shear stress - exp.6.60 — $\tau_{y,d} = 1.5 \times F_{y,d} / (k_{cr} \times b \times h) =$ **0.196** N/mm²

Design shear strength — $f_{v,y,d} = k_{mod} \times f_{v.k} / \gamma_M =$ **2.154** N/mm²

$\tau_{y,d} / f_{v,y,d} =$ **0.091**

PASS - Design shear strength exceeds design shear stress

Check bending moment - Section 6.1.6

Design bending moment — $M_{y,d}$ = **6.901** kNm

Design bending stress — $\sigma_{m,y,d} = M_{y,d} / W_y =$ **12.269** N/mm²

Design bending strength — $f_{m,y,d} = k_{mod} \times f_{m.k} / \gamma_M =$ **12.923** N/mm²

$\sigma_{m,y,d} / f_{m,y,d} =$ **0.949**

PASS - Design bending strength exceeds design bending stress

Check combined bending and axial compression - Section 6.2.4

Combined loading checks - exp.6.19 & 6.20 — $(\sigma_{c,0,d} / f_{c,0,d})^2 + \sigma_{m,y,d} / f_{m,y,d} =$ **0.968**

$(\sigma_{c,0,d} / f_{c,0,d})^2 + k_m \times \sigma_{m,y,d} / f_{m,y,d} =$ **0.683**

PASS - Combined bending and axial compression utilisation is acceptable

Check columns subjected to either compression or combined compression and bending - cl.6.3.2

Effective length for y-axis bending — $L_{e,y} = 0.9 \times 3500$ mm = **3150** mm

Slenderness ratio — $\lambda_y = L_{e,y} / i_y =$ **72.746**

Relative slenderness ratio - exp. 6.21 — $\lambda_{rel,y} = \lambda_y / \pi \times \sqrt{(f_{c.0.k} / E_{0.05})} =$ **1.234**

Effective length for z-axis bending — $L_{e,z}$ = **0** mm

Slenderness ratio — $\lambda_z = L_{e,z} / i_z =$ **0**

Relative slenderness ratio - exp. 6.22 — $\lambda_{rel,z} = \lambda_z / \pi \times \sqrt{(f_{c.0.k} / E_{0.05})} =$ **0**

$\lambda_{rel,y}$ > 0.3 column stability check is required

Straightness factor — β_c = **0.2**

Instability factors - exp.6.25, 6.26, 6.27 & 6.28 — $k_y = 0.5 \times (1 + \beta_c \times (\lambda_{rel,y} - 0.3) + \lambda_{rel,y}^2) =$ **1.354**

$k_z = 0.5 \times (1 + \beta_c \times (\lambda_{rel,z} - 0.3) + \lambda_{rel,z}^2) =$ **0.470**

$k_{c,y} = 1 / (k_y + \sqrt{(k_y^2 - \lambda_{rel,y}^2)}) =$ **0.523**

$k_{c,z} = 1 / (k_z + \sqrt{(k_z^2 - \lambda_{rel,z}^2)}) =$ **1.064**

Column stability checks - exp.6.23 & 6.24 — $\sigma_{c,0,d} / (k_{c,y} \times f_{c,0,d}) + \sigma_{m,y,d} / f_{m,y,d} =$ **1.211**

$\sigma_{c,0,d} / (k_{c,z} \times f_{c,0,d}) + k_m \times \sigma_{m,y,d} / f_{m,y,d} =$ **0.793**

FAIL - Column stability is not acceptable

Check beams subjected to either bending or combined bending and compression - cl.6.3.3

Lateral buckling factor - exp.6.34 — k_{crit} = **1.000**

Beam stability check - exp.6.35 — $(\sigma_{m,y,d} / (k_{crit} \times f_{m,y,d}))^2 + \sigma_{c,0,d} / (k_{c,z} \times f_{c,0,d}) =$ **1.03**

FAIL - Beam stability is not acceptable

Consider Combination 4 - 1.0G + 1.0Q + 0.5S + 0.5W (Service)

Check design 1441 mm along span

Check y-y axis deflection - Section 7.2

Instantaneous deflection δ_y = **8.8** mm

Quasi-permanent variable load factor ψ_2 = **0.3**

Final deflection with creep $\delta_{y,Final} = \delta_y \times (1 + k_{def})$ = **14.1** mm

Allowable deflection $\delta_{y,Allowable} = L_{m2\_s1} / 250$ = **14** mm

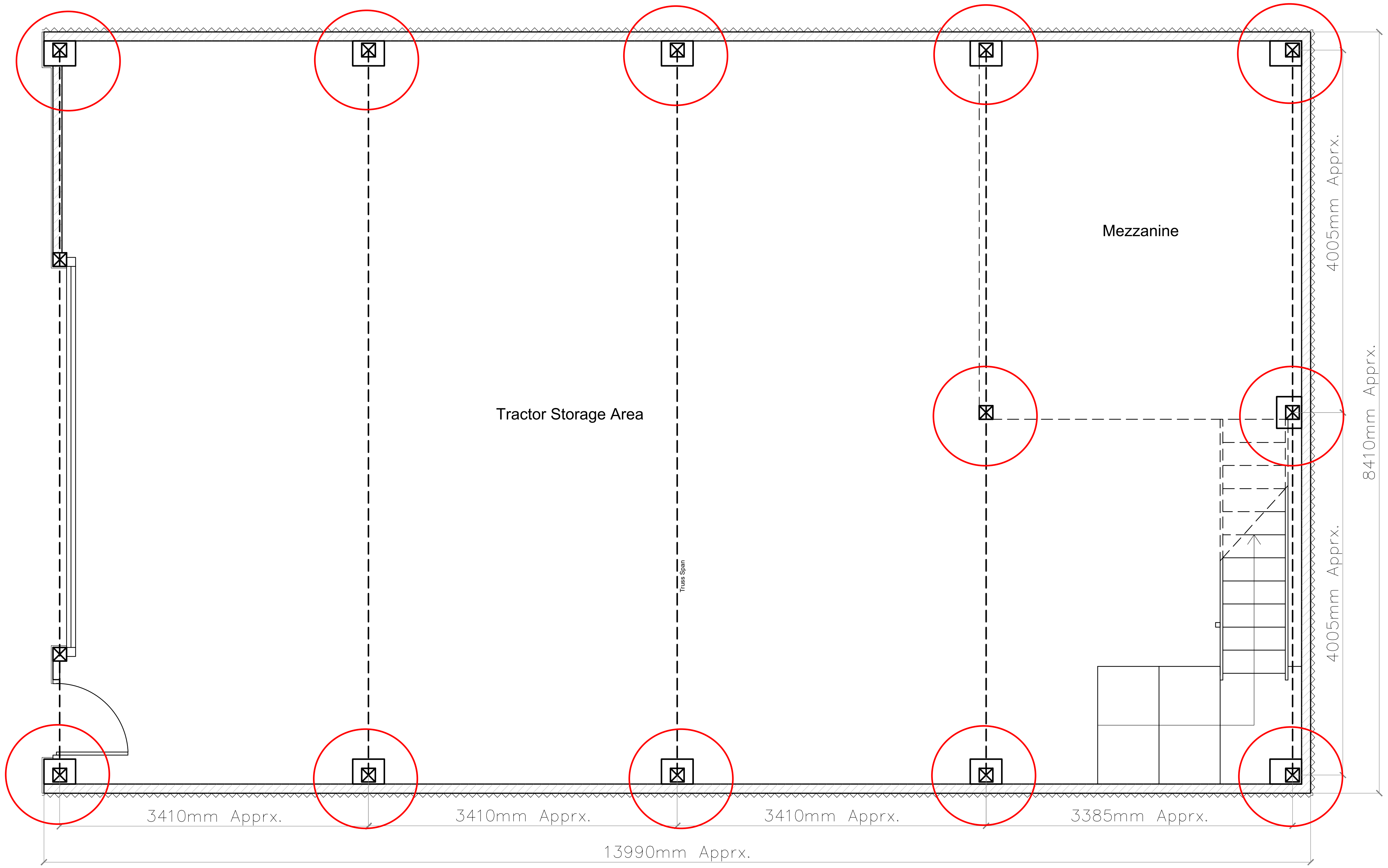
$\delta_{y,Final} / \delta_{y,Allowable}$ = **1.008**

FAIL - Final deflection exceeds allowable deflection

Scale 1:50

0 1 2 3 4 5

Remedial Post Base Required



Check all dimensions on site prior to project commencement. This drawing must be read in conjunction with all other drawings, details and specifications issues. Discrepancies between this and other drawings, details and/or specifications must be referred to the issuer.

Project Number: *06349E*

Project Title: *Airport Tractor shed*

Drawing Number: *06128L_SK01*

Drawing Title: *Locations of Post Base*

Initials: *MDH* Date: *25/04/2024*

Revision:

Purpose of Issue: *For Construction*

Rev	Date	Description

Currie & Brown

Unit 6, Mills Bakery, Royal William Yard,
Plymouth, Devon PL1 3GE
Tel: 01752 278 100 Web: www.curriebrown.com

Project
Tractor Shed Roof Replacement and Repair Works

Title
Existing Floor Plans

Client
Council of the Isles of Scilly

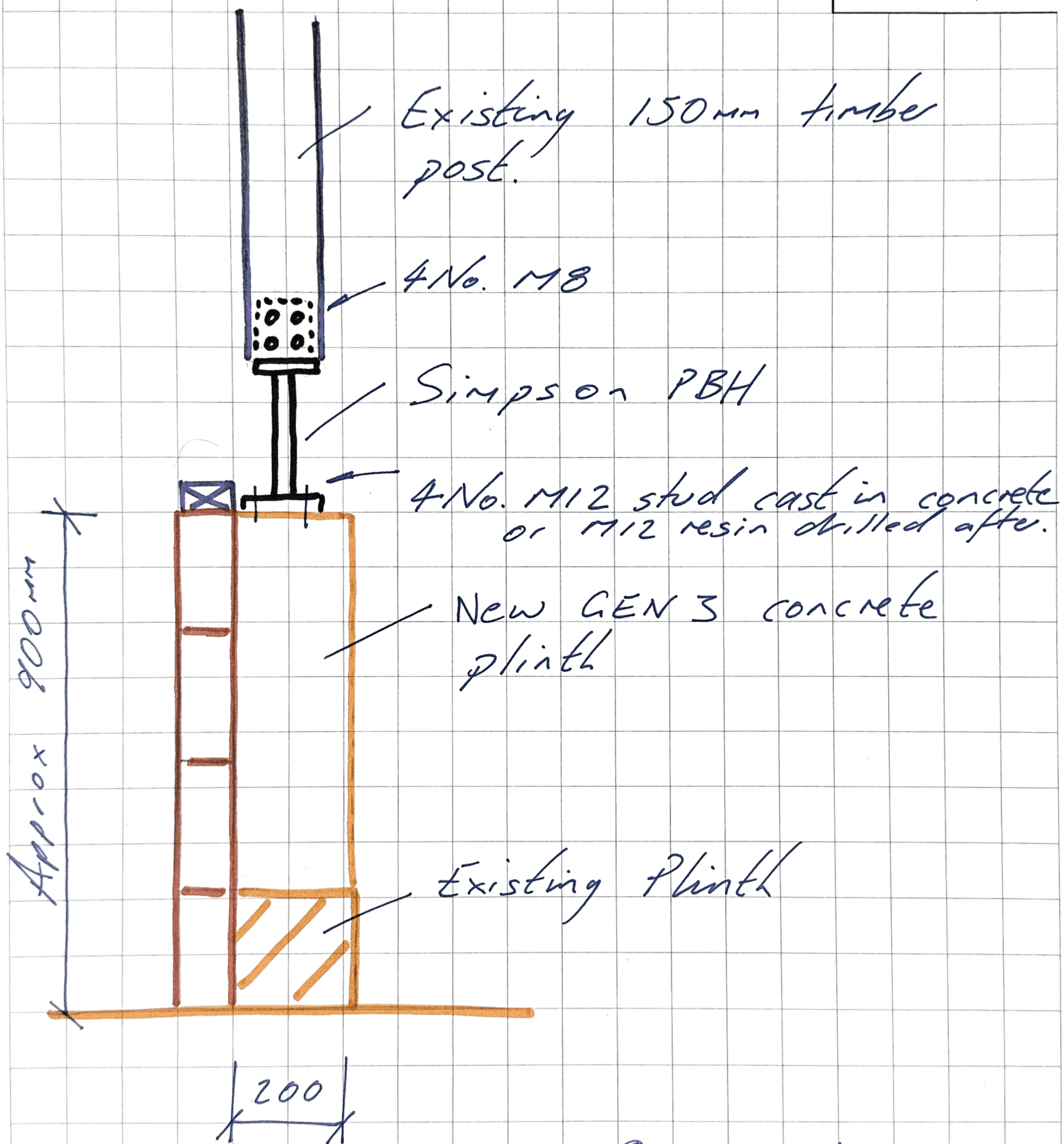
Date	14.03.2024	Drawn	AH
Scale	1:50@A3	Checked	KC
Drwg No.	PL4101565_TS_00_01	Rev	

structureHaus

Ref	06349E
Date	APRIL '24
Sheet	SK02
By	MOH

Sketch

Contract Airport Tractor Shed



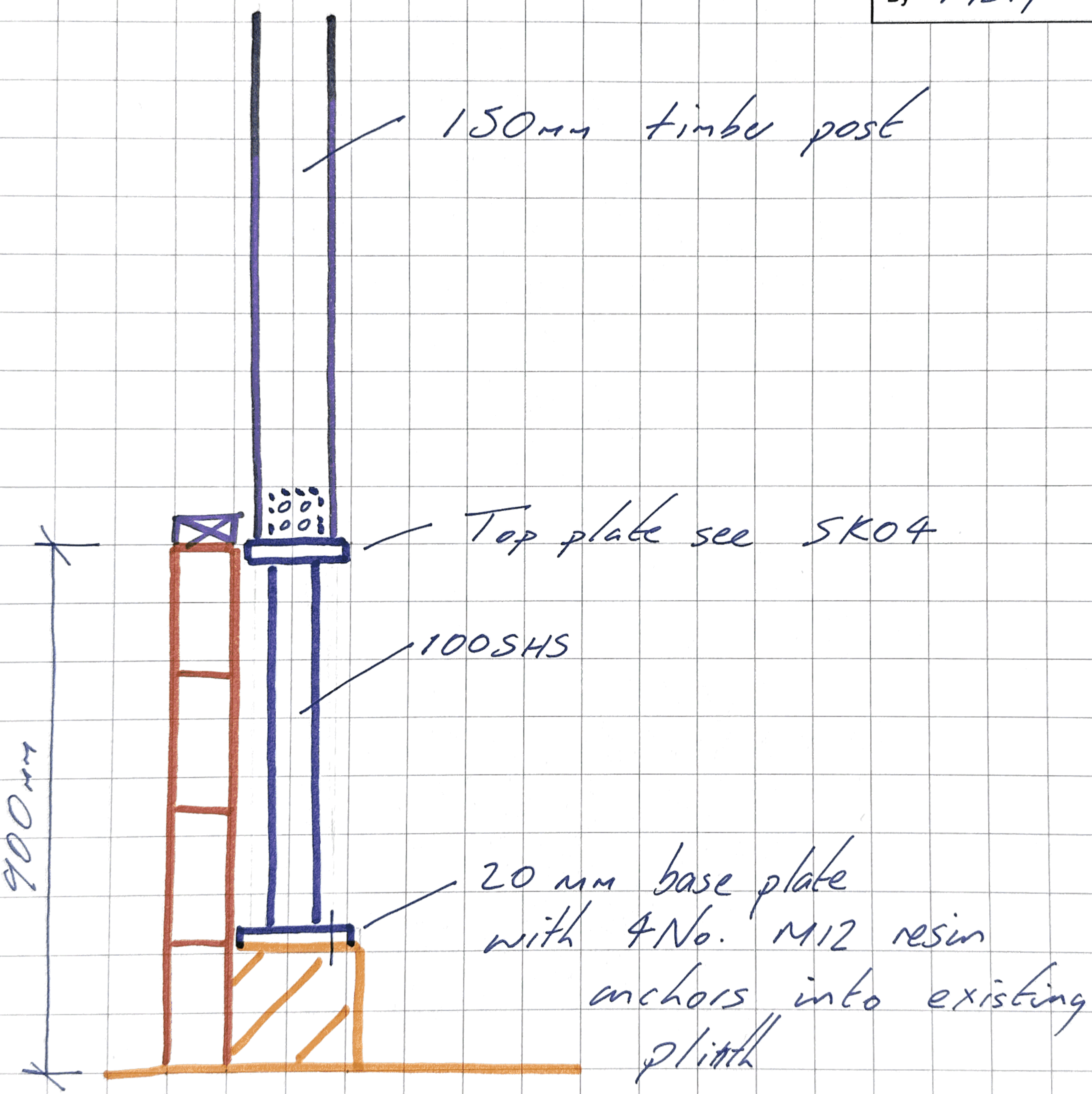
OPTION A

structureHaus

Ref	06349E
Date	April '24
Sheet	SK03
By	MDH

Sketch

Contract: Airport Tractor Shed

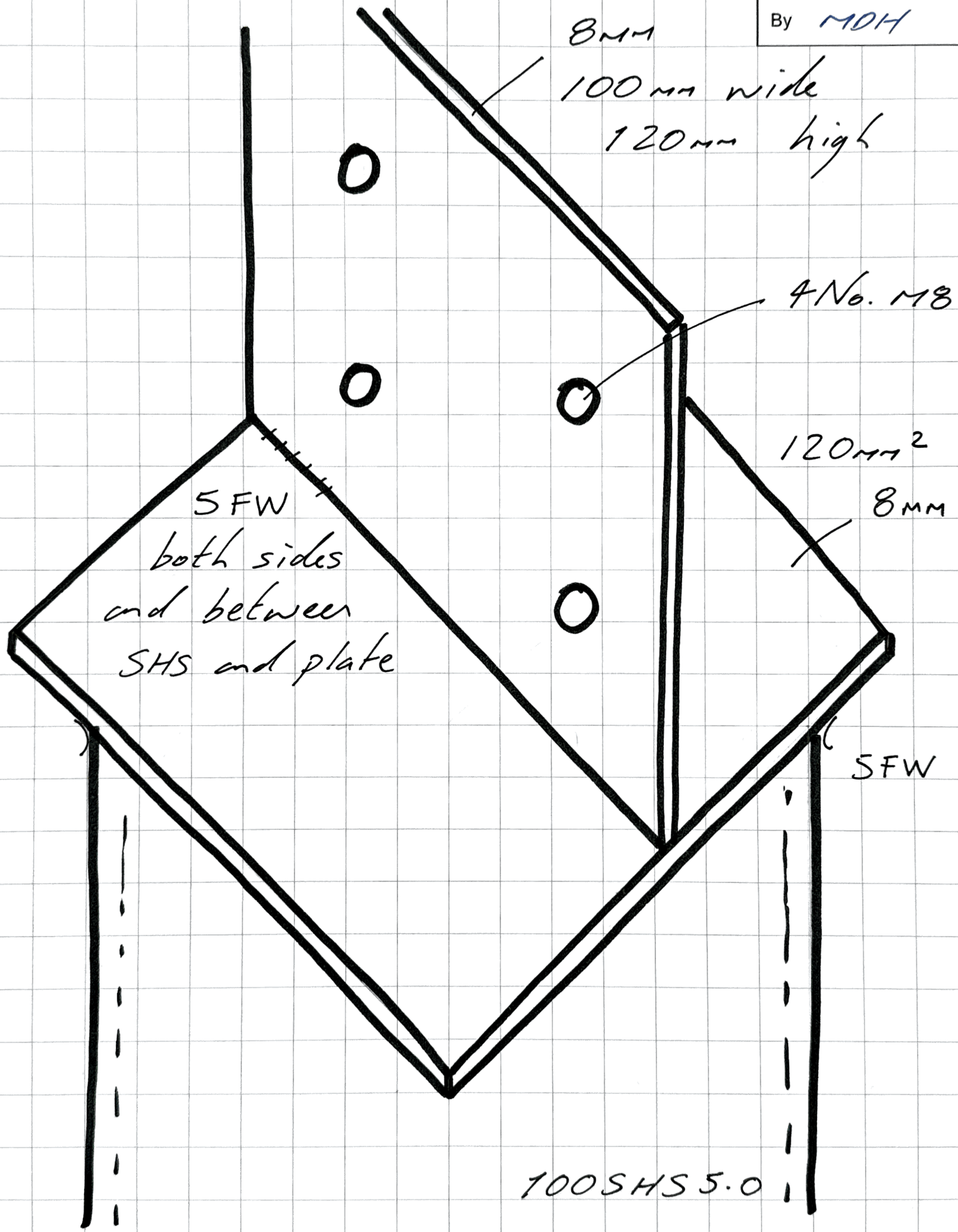


OPTION B

structureHaus

Ref	06349E
Date	APRIL '24
Sheet	SK04
By	MDH

Sketch   Contract Airport Tractor Shed

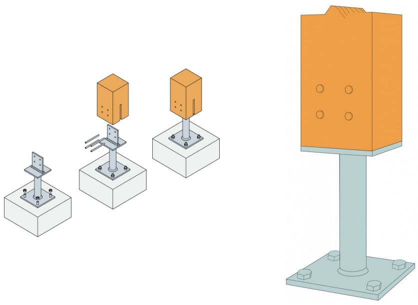


Technical data sheet

PBH
Heavy Duty Elevated Post Base

The PBH is suitable for heavy duty post support applications including Glulam timber posts,with a standoff height of 216mm. Dowels included.

PBH75 suitable for posts 75 x 75mm to 120 x 120mm
PBH120 suitable for posts 120 x 120mm to 200 x 200mm



Features

Material

- Hot-dip galvanised mild steel plate

Benefits

-

Applications

Suitable On

-

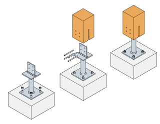
When to Use

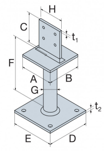
-

Technical data sheet

PBH
Heavy Duty Elevated Post Base

Technical Data





Product Dimensions

References	Timber Post Size [mm]	Product Dimensions [mm]										Top plate holes	Bottom plate holes
		A	B	C	D	E	F	G	H	t_1	t_2	Ø8,5	Ø14
PBH75	75x75 - 120x120	75	75	110	160	100	216	42.4	45	8	8	2	2
PBH120	120x120 - 200x200	120	120	110	155	155	216	42.4	90	8	8	4	4

Product characteristic capacities - Simplified values

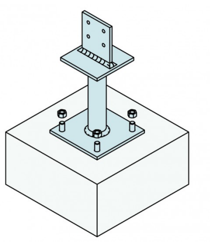
References	Simplified product capacities - Timber to Concrete													
	Number of Fasteners				Simplified characteristic capacities - Timber C24 [kN]									
	On post		On concrete		$R_{1.k}$*	$R_{2.k}$			$R_{3.k}=R_{4.k}$			$R_{5.k}=R_{6.k}$		
						Width of the post [mm]			Width of the post [mm]			Width of the post [mm]		
	Qty	Type	Qty	Type		80	100	120	80	100	120	80	100	120
PBH75	4	STD Ø8	2	Ø12**	105.5	8.1	9.5	10.4	5.5	6.5	7.1	5.8	6.6	7.3
PBH120	4	STD Ø8	4	Ø12**	156.4	20.7	20.7	20.7	7.7	7.7	7.7	7.3	7.9	8.5

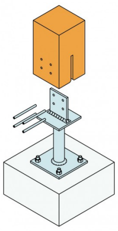
*The published characteristic capacity is based on medium term load duration and service class 3 according to EC5 (EN 1995) (k_{mod} = 0.7). For other load duration and service class, please refer to the ETA to get more accurate capacities.
**Refer to the Simpson Strong-Tie anchor product range for suitable anchors. Typical anchor solutions depend on the concrete type, spacing and edge distances.

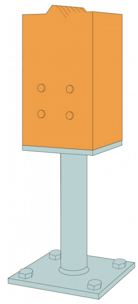
Installation

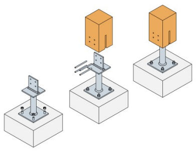
Installation

- Use the flitch plate to mark and drill the 8mm diameter holes for the dowels
- Cut a 9mm slot in the side adjacent to the drilled holes, for the flitch plate
- Fix to the foundation with M12 anchors
- Lower the post onto the flitch plate, align the holes and fit the dowels
- Not recommended when the top of post/column is not restrained (e.g. fence post)
- Stainless steel option available to order









Winchester Road Cardinal Point Tamworth Staffordshire
B78 3HG
tel: +44 1827 255600
fax: +44 1827 255616