



Project		16 Oakleaze, Minety, Malmesbury, SN16 9RD		Job Ref.	
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ANX BUILDS LTD

Project Title: 16 Oakleaze, Minety, Malmesbury, SN16 9RD
Project reference: Structural Calculation Package
Issue: **Initial issue**
Date: 12/10/26
By: **D.Holster BSc (Hons), MSc, CEng, MStructE**
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App: **D.Holster BSc (Hons), MSc, CEng, MStructE**

Revision:

Initial Issue



Project 16 Oakleaze, Minety, Malmesbury, SN16 9RD				Job Ref.	
Section Lifting Calculations				Sheet no./rev. 3	
Calc. by ANX	Date 12/10/26	Chk'd by KM	Date 12/10/26	App'd by ANX	Date 12/10/26

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1.0 Introduction

This calculation report relates to the design of a standard LGS lifting detail (see Figure 1.1 below). The following report relates to the feasibility of being able to lift and move the proposed mobile home as a single unit. The proposal is to install lifting points in the positions shown on pages over. The lifting points will be positioned on panel joints. The frames are designed to be robust enough to transfer load to the lifting points.

The detail comprises a proprietary lifting eye which is bolted to a Simpson HTT5 bracket which in turn connects to a 2No lifting studs via 8No TC25 tek screws.

The LGS members which form the detail (top track and lifting studs) are assumed to be standard LGS 100mm x 65mm x 1.5mm C-sections.

The lifting detail has been designed for a safe lifting force of 15kN.

The connection has been designed in accordance with;

- BS EN 1991-1-1:2002; General Actions – Densities, Self-weight, Imposed Loads for Buildings
- BS EN 1993-1-1:2005: Design of Steel Structures

LIFTING DETAIL

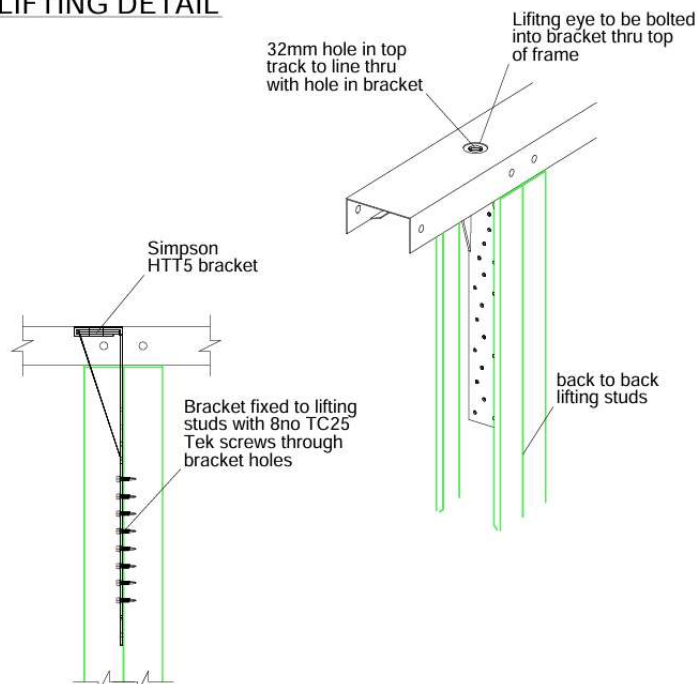


Figure 1.1: Bracket Detail



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FRONT ELEVATION



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2.0 Design Philosophy

The connection has been modelled and analysed using Oasys GSA Building 10.2 software; refer to Figure 2.1. GSA's in design functionality facilitates design checks and production of calculations within the software.

Using design forces derived from the GSA model, the steel framing members have been checked in accordance with BS EN 1993-1-1:2005: Design of Steel Structures and the associated UK National Annex.

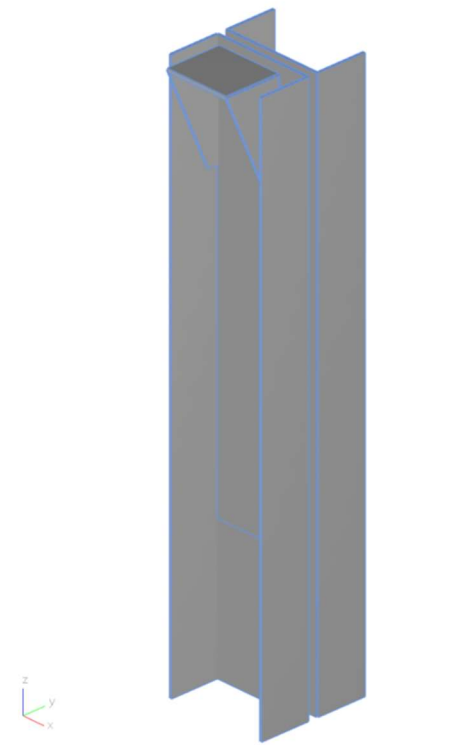


Figure 2.1: GSA Model

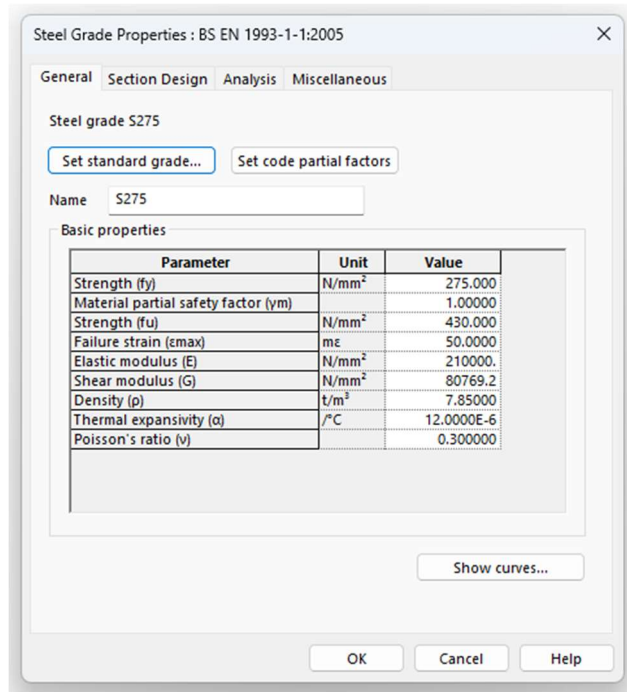
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3.0 TSD Model Input

3.1 Material Properties

Grade S390GD+Z steelwork has been assumed in the design of the LGS members.

Grade S275 steelwork has been assumed in the design of the bracket connection.



Parameter	Unit	Value
Strength (fy)	N/mm ²	275.000
Material partial safety factor (γm)		1.00000
Strength (fu)	N/mm ²	430.000
Failure strain (εmax)	mε	50.0000
Elastic modulus (E)	N/mm ²	210000.
Shear modulus (G)	N/mm ²	80769.2
Density (ρ)	t/m ³	7.85000
Thermal expansivity (α)	/°C	12.0000E-6
Poisson's ratio (ν)		0.300000

Figure 3.1: GSA Model Input



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3.2 Loading

Dead Load

Steel Bracket / LGS members As calculated

Lifting Load

Lifting allowance 15kN

3.3 Load Combinations

The GSA model has been analysed for both serviceability state limit (SLS) and ultimate state limit (ULS). Several combinations have been assigned to both to capture critical downwards and upwards loading scenarios.

Safe Lifting Load Combinations

SL: 3.00 DL + 3.00W

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4.0 Analysis Results

The GSA model was used to assess Von Mises stresses for the lift condition.

4.1 Von Mises Stress Check

The maximum von Mises stress developed within the straps was reviewed within the GSA model. It was found that the maximum stress developed in the LGS members was 350N/mm² (peak locations). The maximum allowable stress is 390N/mm² for S390GD+Z grade steel. Therefore, passes by inspection.

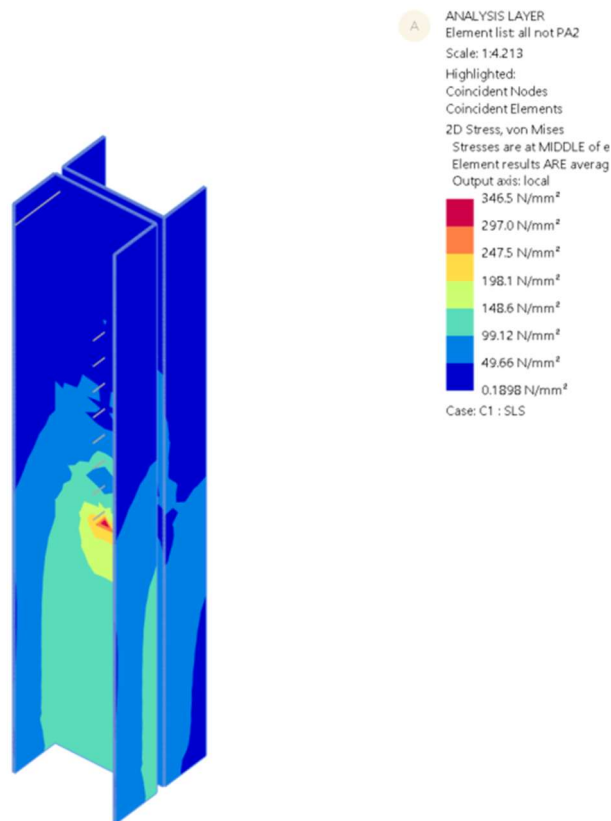


Figure 4.1: Analysis Results – Maximum Von Mises stress = 350N/mm².



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Appendix A: Typical Member Design Checks

Technical data sheet

SIMPSON

Strong-Tie

HTT Hold Down

Ideal for existing or new construction, HTT Tension ties provide a high strength timber to concrete, or timber to masonry, tension connection

The long vertical leg makes it possible to add the required number of fasteners (CNA Nails and CSA Screws) in a vertical post and still comply to relevant standards with regards to fastener spacing requirements.

The unique design of the HTT - a multi ply seat formed from a single piece of steel - gives the tension tie extra strength at the concrete / masonry anchorage point

Features

Material

Z275 Pre-galvanised mild steel.

Benefits

- Enables a connection to concrete structure.

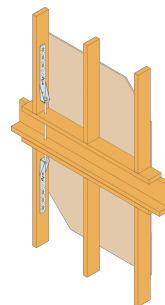
Applications

Connections

Timber Members

When to Use

- Timber structures which exerted to high uplift forces can be connected to concrete structures with the HTT Hold Down.
- Tension force connection between timber floor joists and masonry walls



HTT4 & HTT5



HTT22E & HTT31

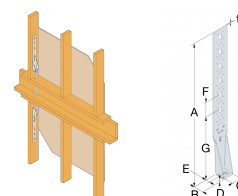
HTT
Hold Down

Technical Data

Product Dimensions



References	DB nr.	NOBB nr.	Product Dimensions [mm]						Flange A				Flange B			Box Quantity
			A	B	C	D	E	t	Ø4,7	Ø5	Slots Ø5x12	Ø21	Ø17,5	Ø21	Ø25	
HTT4	1388657	42922721	314	60	64	11.4	35	2.8	18	-	-	-	1	-	-	16
HTT5	1388655	42922755	403	56	64	11.4	35	2.8	26	-	-	-	1	-	-	10
HTT22E	2049836	-	558	60	63	12	33	3	-	31	3	3	-	-	-	10
HTT31	2151752	-	790	60	90	12	33	3	-	41	4	6	-	-	1	5



Product capacities - simplified values

References	Product capacities - Timber to Concrete												
	Number of Fasteners						Characteristic capacities - Timber C24 to concrete [kN]						
	Flange A				Flange B		R _{1,k} (without US50/50/8 washer)				R _{1,k} (With US50/50/8 washer)		
	Qty	Type	Qty	Type	Qty	Type	CNA4.0x50	CNA4.0x60	CSA5.0x50	CSA5.0x80	CNA4.0x40	CNA4.0x50	CNA4.0x60
HTT4	18	CNA	-	-	1	M16	24.7	31	-	-	23.9	31.7	34.2
HTT5	18	CNA	-	-	1	M16	24.7	31	-	-	23.9	31.7	34.2
HTT22E	26	CNA/CSA	-	-	1	M16	42.3	52.3	52.3	52.3	-	-	-
HTT31	39	CNA/CSA	-	-	1	M24	77.4	77.4	77.4	77.4	-	-	-

Simplified numerical characteristic capacities values are based on load duration and service class assumption (Instantaneous, Service class 2, $k_{mod} = 1.1$). For other load duration, service class and fasteners, please refer to ETA-07/0285.

For HTT31, 4 CSA5.0x50 must always be installed on the bottom extremity of the oblong holes to reach the capacities given in the table. For other fasteners in these holes, the calculation shall be calculated according to ETA.

Technical data sheet



HTT Hold Down

LGS Performance Values - 1.2mm Thick - Single Stud

References	Fasteners			Characteristic Capacities [kN]		Safe Working Loads [kN]	
	Flange A	Flange B		R _{2,K}	Deflection at Load [mm]	R _{2,SWL,ST}	Deflection at Load [mm]
	Stud (X34B1016)	Anchor Bolt					
	Qty	Qty	Ø [mm]				
HTT4	18	1	16	21.2	4.7	14.1	2.6
HTT5	26	1	16	28.9	6.4	18.9	3.2
HTT22E	-	-	-	-	-	-	-
HTT31	-	-	-	-	-	-	-

1. Performance Values are based upon tests completed by Simpson strong Tie U.S I accordance to ICC-ES AC261 - acceptance criteria for connectors used with Cold Formed Steel Structural Members
2. Deflection at Load is the deflection of the hold down measured between the anchor bolt and the strap portion of the hold down when loaded to the stated tension load
3. The engineer or designer shall be responsible for specifying suitable anchor type, embedment & configuration

LGS Performance Values - 1.6mm Thick - Single Stud

References	Fasteners			Safe Working Loads [kN]		Characteristic Capacities [kN]	
	Flange A	Flange B		R _{2,SWL,ST}	Deflection at Load [mm]	R _{2,K}	Deflection at Load [mm]
	Stud (X34B1016)	Anchor Bolt					
	Qty	Qty	Ø [mm]				
HTT5	26	1	16	18.5	3.2	28.6	6.4

1. Performance Values are based upon tests completed by Simpson strong Tie U.S I accordance to ICC-ES AC261 - acceptance criteria for connectors used with Cold Formed Steel Structural Members
2. Deflection at Load is the deflection of the hold down measured between the anchor bolt and the strap portion of the hold down when loaded to the stated tension load
3. The engineer or designer shall be responsible for specifying suitable anchor type, embedment & configuration

LGS Performance Values - 1.2mm Thick - Back to Back

References	Fasteners			Safe Working Loads [kN]		Characteristic Capacities [kN]	
	Flange A	Flange B		R _{2,SWL,ST}	Deflection at Load [mm]	R _{2,K}	Deflection at Load [mm]
	Stud (X34B1016)	Anchor Bolt					
	Qty	Qty	Ø [mm]				
HTT4	18	1	16	19.5	3.2	29.7	6.4
HTT5	26	1	16	20.8	3.2	31	6.4

Safe working load > 15kN. Therefore HTT5 bracket suitable.

1. Performance Values are based upon tests completed by Simpson strong Tie U.S I accordance to ICC-ES AC261 - acceptance criteria for connectors used with Cold Formed Steel Structural Members
2. Deflection at Load is the deflection of the hold down measured between the anchor bolt and the strap portion of the hold down when loaded to the stated tension load
3. The engineer or designer shall be responsible for specifying suitable anchor type, embedment & configuration

HTT Hold Down

Installation

Fixing

Fastening into Timber Stud:

- 4mm CNA Nails
- 5mm CSA Screws

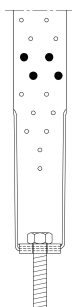
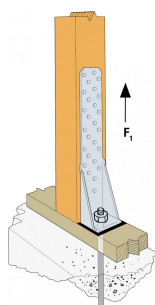
for fastener & capacity options see 'Product Capacities - Simplified Values' table

Fastening to the concrete:

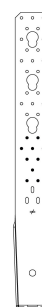
- Mechanical anchors: M16 WA Anchor or BOAX-II
- Chemical anchors: injection mortar SET-XP or AT-HP + M16 threaded rod LMAS

Installation

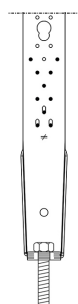
- The connector is mounted with a suitable M16 bolt to the concrete or masonry wall, and the vertical leg is fastened with 4mm CNA Nails, or 5.0mm CSA Screws, to the timber.



For HTT5 these holes must always be filled.



For HTT22E these holes must always be filled



HTT22E Nail pattern



Typical Tek Screw Fixing Check

Design Forces

Parameter	Symbol	value	Units	Notes
Moment (ULS)	M_{Moment}	0.00	kNm	
Tension (ULS)	F_{Tension}	0.00	kN	
Shear Major - Y Direction (ULS)	$F_{Z\text{Shear}}$	22.50	kN	
Shear Minor - X Direction (ULS)	$F_{Y\text{Shear}}$	0.00	kN	

Fixing Check

In accordance with BS EN 1993-1-1:2005

Parameter	Symbol	value	Units	Notes
Safety Factors				
Partial factor M0	γ_{M0}	1.00		UK National Annex to EC3 Part 1-1,
Partial factor M1	γ_{M1}	1.00		UK National Annex to EC3 Part 1-1,
Partial factor M2	γ_{M2}	1.25		UK National Annex to EC3 Part 1-1,
Fixing plate Parameters				
Fixing plate grade		S390		
Fixing plate thickness	t_{BP}	1.5	mm	1.5mm gauge LGS studs
Fixing plate packing thickness	t_{packing}	0	mm	
Fixing plate yield strength	F_y	390	N/mm ²	
Fixing plate ultimate tensile strength	F_u	460	N/mm ²	
Fixing Parameters				
Fixing Yield strength	F_{yb}	240	N/mm ²	IStructE EC3 Manual - Table 10.5 - Grade 4.6
Fixing Ultimate Yield strength	F_{ub}	400	N/mm ²	IStructE EC3 Manual - Table 10.5 - Grade 4.6
Characteristic Shear Strength	$F_{v,k}$	9.4	kN	5.5mm Tek Screw
Characteristic Tensile Strength	$F_{t,k}$	14.9	kN	5.5mm Tek Screw
Characteristic Pull Out Strength	$F_{p,k}$	5.1	kN	5.5mm Tek Screw
No. of Bolts	N	8		
Bolt type				5.5mm Tek Screw
Bolt diameter	D_{Bolt}	5.5		
Hole diameter	d_0	6	mm	
Critical bolt edge distance	e	25	mm	
Critical bolt pitch	ρ	25	mm	
1. Shear resistance per shear plane	$F_{v,Rd}$	7.5	kN	
K1, edge bolts	$K_{1,\text{edge}}$	2.5		
ad, edge bolts	$\alpha_{d,\text{edge}}$	1.39		
ab, edge bolts	$\alpha_{b,\text{edge}}$	0.52		
K1, inner bolts	$K_{1,\text{inner}}$	2.5		
ad, inner bolts	$\alpha_{d,\text{inner}}$	1.14		
ab, inner bolts	$\alpha_{b,\text{inner}}$	0.87		
2. Bearing resistance	$F_{b,Rd}$	4	kN	
K2	K_2	0.9		
3. Tension resistance	$F_{t,Rd}$	11.9	kN	
4. Pull out resistance	$B_{p,Rd}$	4.1	kN	
Reduction factor	β_p	1		
Shear force per bolt	$F_{v,Ed}$	2.8	kN	
Utilisation		71%		Sufficient bolt shear capacity
Tension force per bolt	$F_{t,Ed}$	0	kN	
Utilisation		0%		Sufficient bolt tension capacity
Combined shear and tension check		71%		Sufficient combined bolt shear and tension capacity