BTA
STRUCTURAL DESIGN
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THE HOLDING

UPPER MINETY

SN16 9PS



STRUCTURAL REPORT

ON

AGRICULTURAL BUILDING

Date of inspection

7th August 2023

HEAD OFFICE BTA Structural Design Ltd, Street Farmhouse, Shipton Moyne, Tetbury GL8 8PN
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JGB Birdwood MA CEng MICE MIStructE

Registered in England – number: 4605547 address: as Head Office

1. Introduction

We were appointed by Mr. Rex Goodings of The Holding, Flisteridge Road, Upper Minety to report on the structural condition of an agricultural building at the property and its suitability for conversion to residential use.

Our report is concerned only with this structural issue, all other aspects of the property are outside our report.

Our report is prepared for the use of the above named client in connection with a planning submission only and is not to be relied upon by third parties without our specific written authorisation.

No exposing work was carried out. Our report is based on a visual inspection.

A site visit was carried out in the afternoon of 7th August 2023. Weather conditions were dry.

Our report contains photographs of the buildings taken on the day of inspection, and calculations to justify the roof framing.

2. General Description

The building is a small barn approximately 9.8m x 5.0m in plan. There is a monopitch roof covered with corrugated sheets rising from about 3m on the north side to 3.75m on the south.

The external walls are of concrete block at low level, with corrugated metal sheeting above.

The main structure consists of timber frames spanning N-S at intervals of up to 3.6m. These carry timber purlins and sheeting rails which support the corrugated sheet cladding to the roof and walls.

There is a concrete floor.

The barn is a little overgrown by trees and shrubs on the north side, but is generally in a usable condition and weathertight.

3. Observations

Externally the metal roof cladding is intact and appears not to be leaking. There is an incomplete gutter on the north side filling a water butt.

The upper parts of the walls and most of the western side (which contains large steel framed doors) are clad in similar corrugated sheet to the roof. On the north side this is not set vertical, but this seems to be as-built rather than the result of any movement.

The lower parts of the walls are in 100mm concrete blockwork to a height of about 1.8m. This is in good condition without significant cracking.

The main structural framing is in timber with two internal cross frames running N-S and consisting of:

- 150 x 150mm posts
- 220 x 50mm principal rafters
- 150 x 50mm knee braces bolted between posts and principal rafters.

The frames support 5No. 145 x 45mm purlins equally spaced, in bays of 3.6m, 3.5m and 1.75m respectively (starting at the east end).

There is a similar frame at the east end.

At the west end (which contains the doors) there are 203 x 102mm steel stanchions at the corners to which the 220 x 50mm principal rafter is bolted.

The frames, rafters and purlins are in good condition apart from some surface rust to the steel stanchions. There is no evidence of significant movement in the frames.

Calculations are attached to this report justifying the frames as they stand, and allowing for additional loading from insulation and finishes.

The barn has a concrete floor in good condition where visible.

4. Comments & Conclusions

Existing Structure

This is a simply built agricultural barn, and remains in satisfactory usable condition, with no signs of significant movement.

The roof and wall cladding are intact, and the interior of the building is dry.

To maintain the barn in usable condition, no structural repairs are needed at the present time.

Proposed Conversion

To convert and upgrade the barn to provide habitable accommodation the following works will be included:

- Provision of insulation and ceiling finishes to the roof covering. This can be done below the existing sheets, or by replacement with twin wall insulated roof panels. The attached calculations demonstrate that the existing structure will be adequate for either option.

- New and adjusted openings in external walls. These can be achieved without affecting the main structure of the building.

- Provision of new exterior cladding to the building. This can sit outside the existing blockwork walls.

- Provision of insulation and internal linings to the external walls. These can sit inside the existing blockwork walls.

- Provision of damp proof membrane, insulation and finishes to the floor. These can be laid above the existing floor slab.

- New non loadbearing internal partitions built off the existing slab.

- Provision of electrical and mechanical services. These will not impact the existing structure.

We therefore conclude that conversion of this building can be carried out without significant reconstruction of its structural elements.

We will be pleased to answer any questions on this report.



James Birdwood MA CEng MICE MIStructE
1043/ JGBB

Photographs 7th August 2023



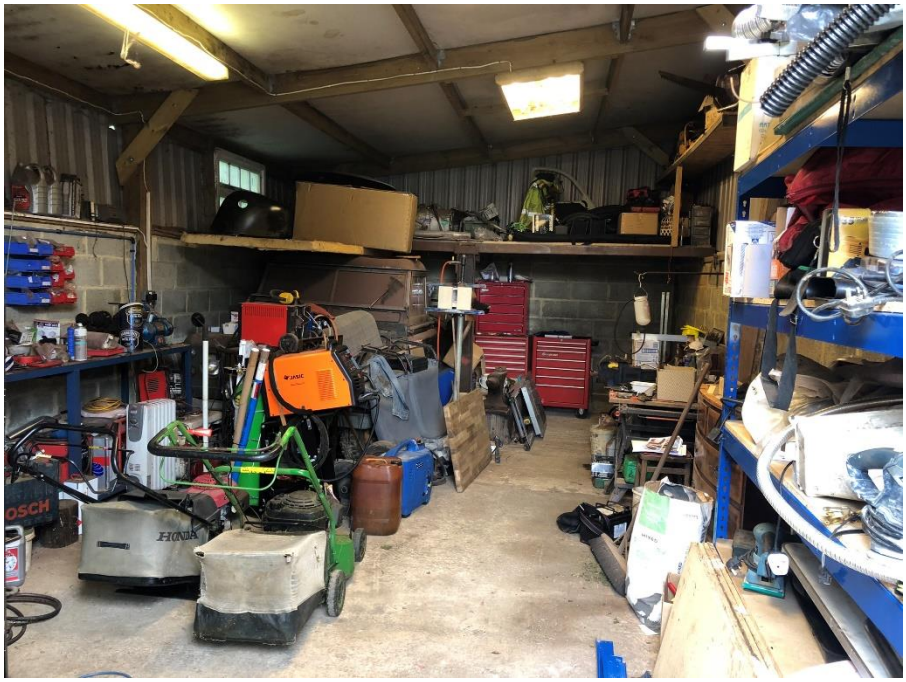
View from South West



East Elevation



Interior Looking West



Interior Looking East

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Appendix A

Structural Calculations

for

Barn Roof

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Barn Roof Structure

Structural Calculations

These calculations analyze the timber frame and purlins, to check that it is adequately designed and capable of carrying insulation, roof finishes and lighting services in addition to the existing roof sheeting, or replacement cladding.

These calculations are issued for the purposes of a planning submission. They are not intended for construction.

Design Criteria

Loading	Dead	Live	Total
Roof	0.40	0.60	1.00 kN/m²
Wind		0.60	0.60 kN/m²

The calculations show that the structures can safely carry the additional loads referred to above, and that the frames are stable under wind loading. The deflections in a building of this type can be a little higher than in a normal residential building and could cause cosmetic cracking in brittle finishes such as plasterboard. We therefore recommend that a more flexible finish is used for all ceilings, such as timber boarding, or self-finished double skin roof panels.

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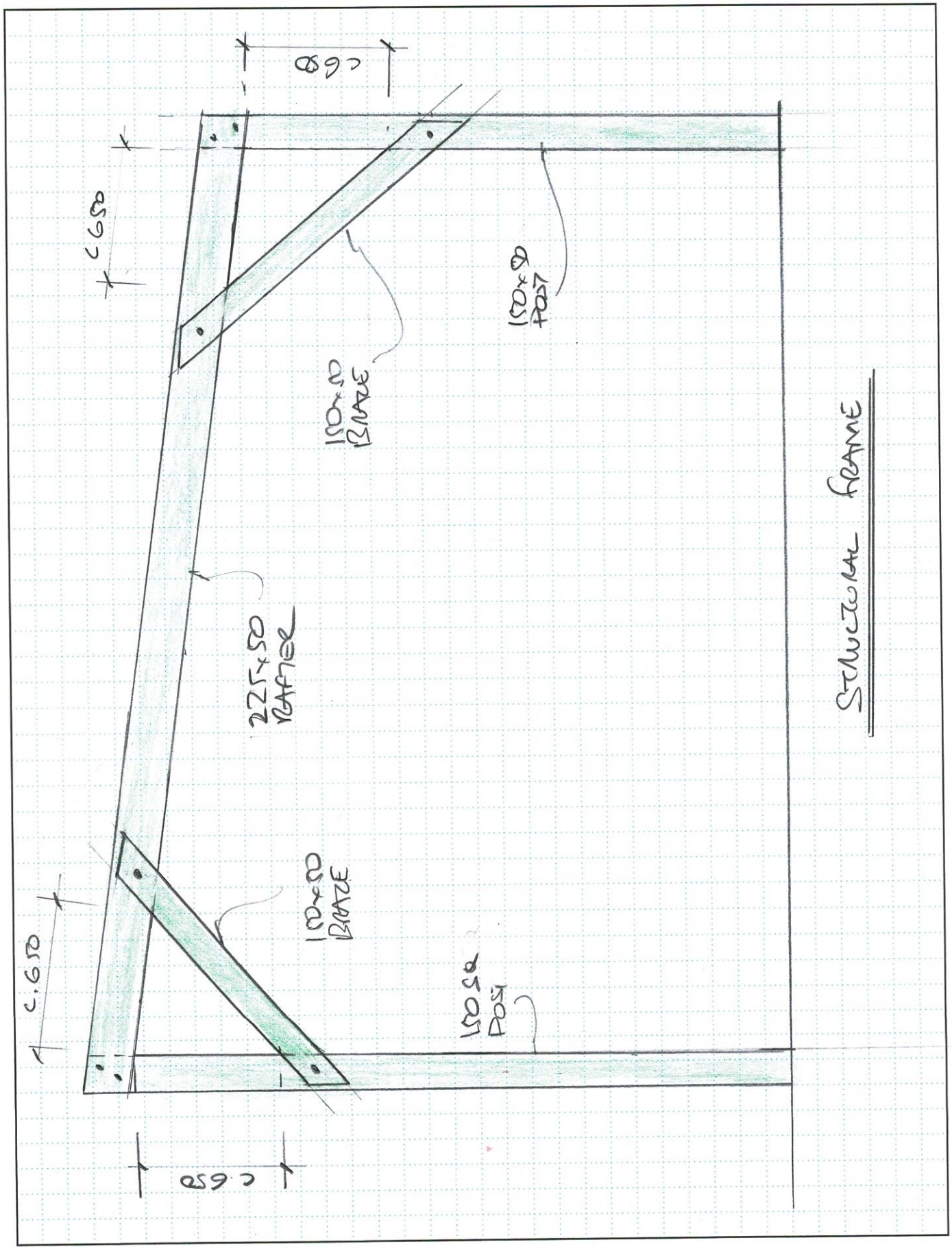
JOB NO 1043		
SHEET NO H/01		REV
DRG REF	MADE BY DP	CHD

PROJECT THE HOLDING	LOCATION Roof STRUCTURE	DATE 8/23



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JOB NO	1043	
SHEET NO	H102	REV
DRG REF	MADE BY	CHD

PROJECT	LOCATION	DATE
THE MOULDING	Roof Structure	8/23

Purlins

Spacing = 1.2m

UDL = 1.2 kN/m

Span = 3.5m

M = $1.2 \times 3.5^2/8$ = 1.84kNm

100x50 Z = 188 & 9.77 N/mm²

CM $1.1 \times 1.25 \times 7.5$ = 10.3 OK

E = 1406

$\Delta = 5 \times 1.2 \times 3.5^4 \times 10^5 / 384 \times 9.9 \times 1406$

Δ = 17mm (Span/206) OK

Acceptable but recommend using non-brittle ceiling finishes. Possibly timber boarding or double skinned roof panels (not plasterboard)

EXISTING PURLINS OK

(Avoid plasterboard ceilings)

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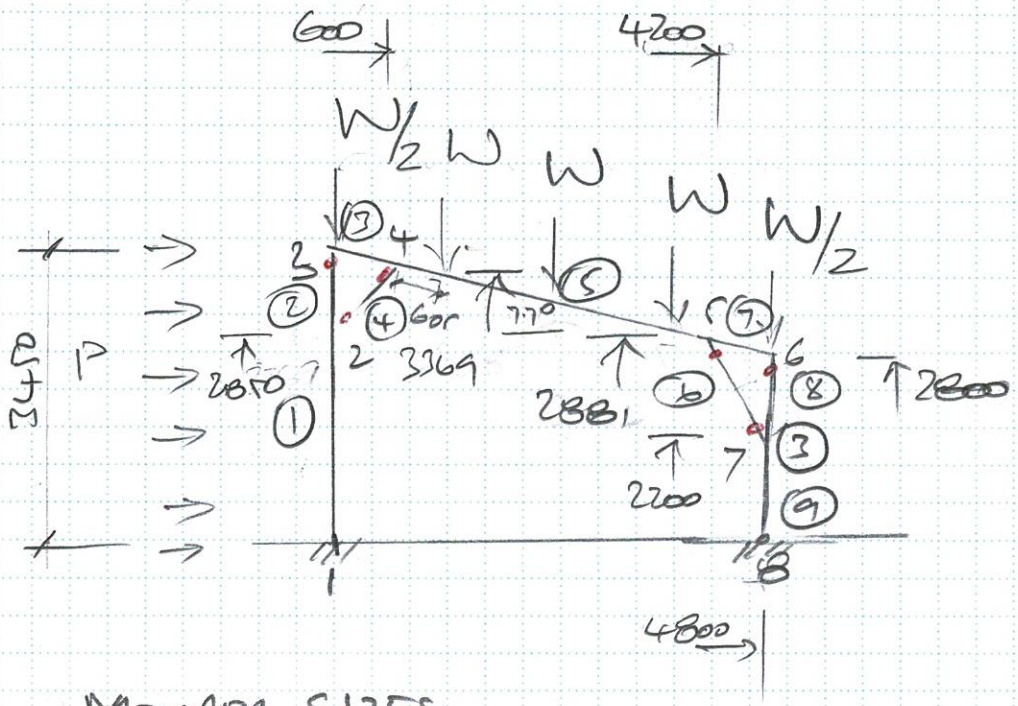
JOB NO	1043	
SHEET NO	H/03	REV
DRG REF	MADE BY OB	CHD

PROJECT	LOCATION	DATE
THE HOLDING	ROOF STRUCTURE	8/23

FRAME MODEL



• PIN JOINT

MEMBER SIZES

①, ②, ⑧, ⑨	150 × 150 MM
③, ⑤, ⑦	225 × 50 MM
④, ⑥	150 × 50 MM

LOADING

Roof @ 1.0 kN/m² (0.4D + 0.6L)

$W = 3.5 \text{ m} \times 1.2 \text{ m} \times 1.0 \text{ kN/m}^2 = 4.2 \text{ kN}$.

WIND @ 0.6 kN/m² (Sheltered)

$p = 3.5 \times 0.6 = 2.1 \text{ kN/m}$

SEE NL-STRESS ANALYSIS

```
TABULATE ALL
PRINT DATA RESULTS FROM 1
TYPE PLANE FRAME
NUMBER OF JOINTS 8
NUMBER OF MEMBERS 9
NUMBER OF SUPPORTS 2
NUMBER OF LOADINGS 1
JOINT COORDINATES
1 0 0 SUPPORT
2 0 2.85
3 0 3.45
4 0.6 3.369
5 4.2 2.881
6 4.8 2.8
7 4.8 2.2
8 4.8 0 SUPPORT
MEMBER INCIDENCES
1 1 2
2 2 3
3 3 4
4 2 4
5 4 5
6 5 7
7 5 6
8 6 7
9 7 8
MEMBER RELEASES
2 END MOMENT Z
4 START MOMENT Z
4 END MOMENT Z
6 START MOMENT Z
6 END MOMENT Z
8 START MOMENT Z
CONSTANTS E 10.8E6 ALL G 0.68E6 ALL DENSITY 4.2 ALL
MEMBER PROPERTIES
1 THRU 2 RECTANGLE D 0.15
3 RECTANGLE DY 0.225 DZ 0.05
4 RECTANGLE DY 0.15 DZ 0.05
5 AS 3
6 AS 4
7 AS 3
8 THRU 9 AS 1
LOADING Dead + Live
JOINT LOADS
3 FORCE Y -2.1
6 FORCE Y -2.1
MEMBER LOADS
1 THRU 2 FORCE X PROJECTED UNIFORM W 2.1
5 FORCE Y GLOBAL CONCENTRATED P -4.2 L 0.605
5 FORCE Y GLOBAL CONCENTRATED P -4.2 L 1.815
5 FORCE Y GLOBAL CONCENTRATED P -4.2 L 3.025
MEMBER SELF WEIGHTS
1 THRU 9 1
SOLVE
```

LOADING Dead + Live
JOINT DISPLACEMENTS

JOINT	X DISPLACEMENT	Y DISPLACEMENT	Z ROTATION
1	0.000000000	0.000000000	0.000000000
2	0.005160786	-0.000088531	-0.004398742
3	0.008622371	-0.000089645	-0.006101282
4	0.008150797	-0.003703590	-0.006866461
5	0.008257543	-0.001887809	0.005229423
6	0.008546806	-0.000078192	0.003236922
7	0.009975128	-0.000089503	-0.000393524
8	0.000000000	0.000000000	0.000000000

10mm

LOADING Dead + Live
MEMBER FORCES

MEMBER	JOINT	AXIAL FORCE	SHEAR FORCE	BENDING MOMENT
1	1	7.6831	2.7441	1.7706
	2	-7.4138	3.2409	-2.4787
2	2	0.4795	4.7611	2.4787
	3	-0.4228	-3.5011	0.0000
3	3	-3.2453	-2.1305	0.0000
	4	3.2415	2.1589	-1.2985
4	2	10.5886	0.0095	0.0000
	4	-10.5722	0.0095	0.0000
5	4	3.7612	5.7609	1.2985
	5	-5.4768	6.8950	-3.3766
6	5	19.0746	0.0095	0.0000
	7	-19.0961	0.0095	0.0000
7	5	-8.9443	5.5913	3.3766
	6	8.9405	-5.5630	0.0000
8	6	-4.6091	-8.1159	0.0000
	7	4.5524	8.1159	-4.8695
9	7	9.7820	4.5009	4.8695
	8	-9.9899	-4.5009	5.0325

4.87 kNm

LOADING Dead + Live
ELASTIC STRESSES: POSITIVE≡COMPRESSION FOR AXIAL AND Y POSITIVE BENDING

MEMBER	JOINT	AXIAL STRESS	AV.SHEAR STRESS	BENDING STRESS
1	1	341.4726	146.3498	-3147.7845
	2	329.5026	172.8502	-4406.5531
2	2	21.3115	253.9277	-4406.5531
	3	18.7915	-186.7277	0.0000
3	3	-288.4697	-227.2552	0.0000
	4	-288.1295	230.2792	-3077.8996
4	2	1411.8090	1.5120	0.0000
	4	1409.6292	1.5120	0.0000
5	4	334.3269	614.5013	-3077.8996
	5	486.8227	735.4621	-8003.8653
6	5	2543.2810	1.5120	0.0000
	7	2546.1412	1.5120	0.0000
7	5	-795.0525	596.4054	-8003.8653
	6	-794.7123	-593.3814	0.0000
8	6	-204.8471	-432.8476	0.0000
	7	-202.3271	432.8476	-8656.9523

8N/mm²

MEMBER	JOINT	AXIAL STRESS	AV.SHEAR STRESS	BENDING STRESS
9	7	434.7574	240.0502	-8656.9523
	8	443.9974	-240.0502	8946.7287

LOADING Dead + Live
SUPPORT REACTIONS

JOINT	X FORCE	Y FORCE	Z MOMENT
1	-2.7441	7.6831	1.7706
8	-4.5009	9.9899	5.0325

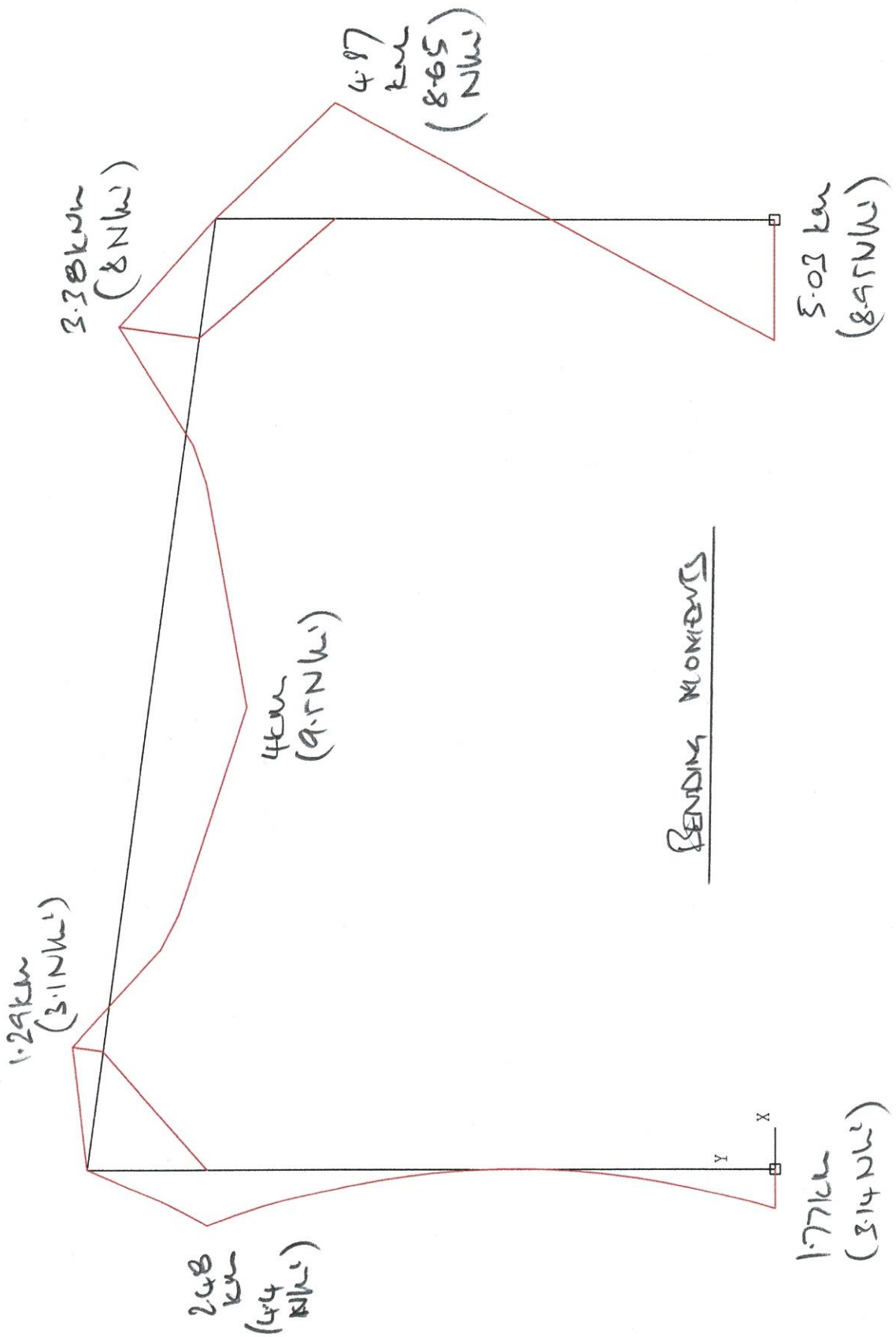
EQUILIBRIUM CHECK	SUM OF FORCES	REACTION
FORCES IN DIRECTION X	7.2450	-7.2450
FORCES IN DIRECTION Y	-17.6731	17.6731
MOMENTS ABOUT AXIS Z	-54.8989	54.7549

BTA Structural Design
Tetbury GL8 8PN
he Holding, Upper Minety
Timber frame

Made by: JB
Date: 26/8/22
Ref No: 1043

Structure scale 1 cm = 0.300 □ = supports

Moment Z scale 1 cm = 2.50 LOADING Dead + Live



Structure scale 1 cm = 0.300 □ = supports

Deflectn scale 1 cm = 0.01000 LOADING Dead + Live

