SHEAR
Chartered Structural Engineers

STRUCTURAL INVESTIGATION REPORT AT HOULKERS FARM, WHINS LANE, READ, BB12 7RB.

Document Number	Revision	Description	Issue Date
8305	P1	-	26/09/24

Survey Date:	20th September 2024 9:30am. Weather bright and dry.
Survey/ Report By:	Richard Lomax MIStructe BEng (Hons)
Client Name & Address:	Miles Pollard

Telephone: [redacted] **Email:** Richard@Shearltd.co.uk **Web:** www.shearltd.co.uk

Office: High Valley Stables, Conway Road, Rawtenstall, Rossendale, BB4 7ST
Registered in England. Number 5777126

INTRODUCTION

Shear Limited was instructed by the building owner Miles Pollard on the 9th September 2024 to carry out a structural investigation to detached barn at Houlkers Farm, Whins Lane, Read, BB12 7RB with a view to its conversion for residential purposes.

This report specifically addresses any significant structural short comings (apparent during the visit) and items of disrepair which we would consider likely to affect the building's suitability in regards to its proposed redevelopment.

The report is written by Richard Lomax MIStructe BEng (Hons).

The report should not be construed as a valuation report and is not an inventory of every single defect, some of which would not significantly affect the use of the structure. If the report does refer to some minor defects; this does not imply that the structure is free from other such defects.

The report does not appraise the condition of dpc, possible damp penetration, condensation or the condition of the timber components with regard to rot and infestation from a visual perspective. These issues may be highlighted as potential problems but specialist advice needs to be sought on these non-structural matters.

No building services (gas, electricity, water, heating), manholes and drainage systems, garages and other outbuildings, the boundary structures, retaining walls, paths and drives, windows, doors and other joinery items, internal and external décor / plaster / ceiling finishes, rainwater goods, kitchens and bathrooms will be inspected unless noted otherwise in the report.

No other part of the structure will be exposed that is covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect.

The investigation was carried out internally from within the building and at ground level externally. Further defects may be encountered upon following more extensive investigation, involving exposure of structural elements for example that may be recommended in the report.

The report does not include any calculation assessment to ascertain the structural capacity/ adequacy of the structure apart from the roof steelwork as requested. The Author knows of no reason why the structural calculations should not be of a standard designed in accordance with British Standards and subject to Local Authority approval at the time of its design and construction.

The Author has no knowledge of the structure's construction or condition prior to the investigation only that noted in the clients brief and marketing document.

This report is intended for use only by the building owner Miles Pollard in relation to its renovation. No other third party may use this report without the written consent of Shear Ltd.

STRUCTURE DESCRIPTION

The structure is basically a detached traditional farm building built circa early 1900 located south of Whins Lane, Read on a sloping site overlooking open fields and valley beyond. Refer photograph P1 below.

P1 – Front (East) Elevation

The structure is basically a typical agricultural barn building with single storey annexes built to the front and rear elevations over its past. The building has been used for typical farm use as a shippon and the storage of hay and agricultural equipment.

The walls are generally of random stone construction although there are additions of brick constructed walls evident internally in places.

The roof is traditional stone slates off timber rafters supported off steel roof structure to main barn and timber purlins/ trusses to the single storey structures.

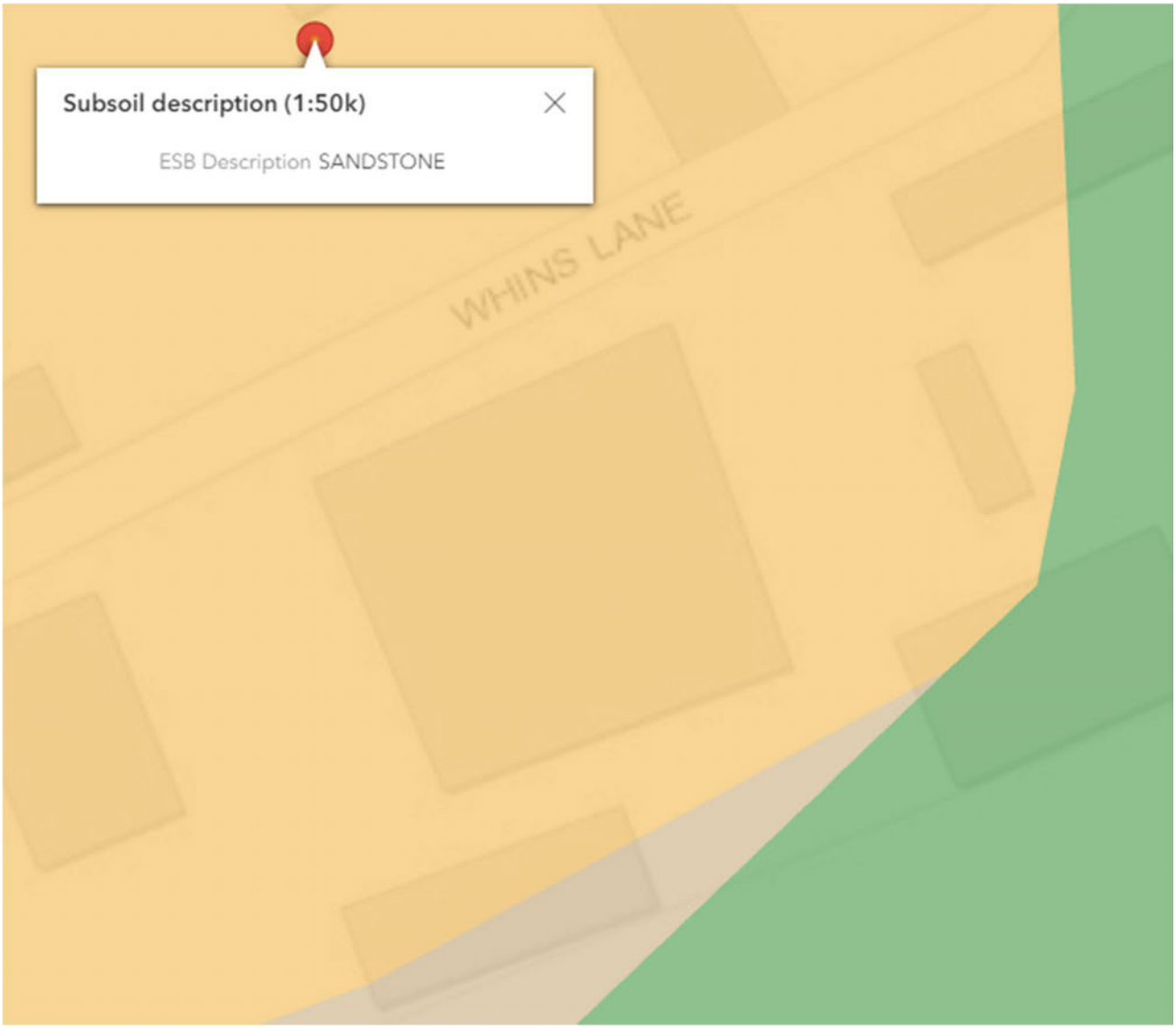
Some suspended timber first floor evident towards South elevation assumed for hay storage.

Internally, there are large buttressing piers supporting the main steel roof structure.

The ground floor is a combination of earth and concrete ground bearing constructions.

Overall stability of the structure appears to be provided by the external solid wall construction and the buttressing piers.

Geological survey maps indicate the majority of the building is founded on Sandstone with interfaces with Mudstone/ Sandstone and Glacial Till immediately to the South of the building, refer extract below.



FRONT (EAST) ELEVATION INSPECTION FINDINGS

Inspection of the front elevation revealed the wall construction to be fairly plumb and aligned with no significant cracking indicative of structural movement, refer photograph P1 on previous page.

Some stone units loose at eaves level.

Steel corrosion evident to lintels over main barn entrance evident.

External ground level to underside of 19" wide stone wall footing measured circa 500mm off clay strata with some water evident to trial hole (to right hand side of main barn entrance) – refer photograph P2 below

P2

External ground level to top of concrete footing (150mm thick) measured circa 300mm off clay strata with some water evident to trial hole (corner to South elevation). Footing outstand circa 125-150mm wide, refer photograph P3 below

P3

SIDE (SOUTH) ELEVATION INSPECTION FINDINGS

Inspection of the South elevation revealed the wall construction to be fairly plumb and aligned with no significant cracking indicative of structural movement. Some outward lateral movement evident to top of pike, refer photograph P4 and P5 below.

Some stone units loose at eaves level.

P4

P5

External ground level to top of concrete footing (150mm thick) measured circa 300mm off dry clay strata to trial hole. Footing outstand circa 150mm wide, refer photograph P6 below

P6

REAR (WEST) ELEVATION INSPECTION FINDINGS

Inspection of the West elevation revealed the wall construction to be fairly plumb and aligned with no significant cracking indicative of structural movement. Refer photograph P7 below.

Some stone units loose at eaves level.

P7

The external ground level slopes from Whins Road level down along the elevation towards the South elevation, refer photograph P8 below.

P8

External ground level to top of stone corbel footing (circa 300mm thick) measured circa 550mm off clay strata with water to trial hole towards South elevation. Stone footing outstand circa 100-150mm wide refer photograph P9 below

P9

External ground level to underside of 500mm wide stone wall footing measured circa 1000mm off dry clay strata (trial hole adjacent Whins Road) – refer photograph P10 below

P10

SIDE (NORTH-WHINS ROAD) ELEVATION INSPECTION FINDINGS

Inspection of the North elevation revealed the wall construction to undulate across its length but fairly plumb, refer photograph P11 below. Outward bulge of wall highlighted below.

P11

Roof ridge line relatively level but undulation across entire roof evident with typical sagging below the gable lines.

MAIN BARN INTERNAL INSPECTION FINDINGS

Main barn roof structure off corroded grillage of steel beams, refer photograph P12 below

P12

Purlin steel beams on 2 lines (upper and lower slopes) measured 9x4" with tapered flanges spanning from external walls to internal beam/ post supports. At steel supports the beams are bolted together with web plates – simple bearing supports.

The 3 number primary beams spanning the width of the barn measured 10x5" with tapered flanges. At bearings the beams are built into stone buttressing walls with immediate purlin steel over bolted down to the top flange.

Steel vertical posts not measured due to accessibility but are deemed none significant in structural terms given short height.

North elevation wall to Whins Road supported off a circa 650mm deep chamfered concrete beam off clay. Some water evident to trial hole – refer photograph P13 below.

P13

No significant cracking indicative of structural movement to North elevation wall to Whins Road.

Extent of retained wall condition to be confirmed following topographical survey.

Trial holes to 2' thick internal barn walls are built directly off the clay at internal ground floor level or 500mm below. Refer photograph P14 below (this photograph adjacent buttressing pier shows stone wall footing at internal ground floor level.

P14

Final trial hole footing (500mm below) photograph too dark to include.

Monopitch trusses to shippon painted and part covered by ceiling construction hindered inspection but no signs of significant cracking/ fissures or sagging indicative of structural movement, refer photograph P15 below. Inspect on removal of ceiling construction.

P15

Vertical cracking evident to internal wall within shippon towards the South elevation, refer photograph P16 below. Not evident to opposite side of wall.

P16

BARN CONCLUSION/ RECOMMENDATIONS

Old farm buildings like this are notoriously built off shallow footings off variable soil stratum following the slope of the land. This is the case with this structure using various footing constructions, either wide solid stone wall construction or concrete footings to the extensions. Unlike old farm buildings, there is very little significant cracking to walls indicative of structural movement. This is likely due to the building being founded off sandstone although the trial holes indicate a Glacial Till at shallow depths. If the Glacial Till is a shallow layer over the Sandstone, this may explain its uniform stiffness and why there are little signs of structural cracking to walls.

The addition of a first floor timber construction is insignificant in weight compared to the thick stone wall self-weight so its inclusion does not require a foundation strengthening technique such as underpinning.

A topographical survey will aid the Architect in determining the ground floor construction specification. Treatment of the external walls adjacent the higher Whins Road level needs some consideration in relation to damp proofing/ tanking.

Any cracking evident in the report can be fixed using modern crack stitching techniques using stainless steel helical bars or replacing small stone units with longer units by competent stone mason – both techniques to span across cracks to provide a stronger and better bond.

Any new floor structure (and roof) should be effectively tied to the wall structure in accordance with modern Building Regulations to restrain any lateral movement. The addition of internal buttressing walls (toothed in) off concrete footings will also strengthen long elevation walls if possible.

Masonry returns to ends of main load-bearing walls in relation to the proposed plans will need careful consideration given the flat open countryside exposure.

Appoint timber specialist to inspect at high level and intrusively investigate the timber truss/ purlin/ rafter/ lintel elements and check for rot infestation where applicable – locally repair/ strengthen, where required.

Make good to the external fabric to prevent water penetrating by re-pointing sympathetically and replace missing stone units ensuring all rain and surface water is directed to drainage systems and away from the building and footings.
Replace internal window/ door timber lintels with more modern robust materials such as steelwork or precast concrete.

The roof steelwork has been assessed (see calculation appended to rear of this report) for strength in accordance with BS 449 (with oak cladding addition) and requires no additional strengthening although the corrosion protection system needs to be replaced. Internal steelwork should be thoroughly cleaned and treated with a zinc sulphate epoxy primer of 80 micron thickness. Steelwork external to the building insulation shall need to be galvanized – specific treatment subject to exact location within the structure.

Overall, in the Authors opinion, there are no structural reasons to preclude satisfactory refurbishment of the building without major reconstruction (i.e. demolition/ rebuilding) leading to the enhancement of the building for its proposed residential purpose.

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Calculation Sheet

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Email: richard@shearltd.co.uk
[redacted]

Customer	Miles Pollard	**Proj No**	8305
Project Title	Houlkers Farm, Whins Lane, Read, BB12 7RB.	**Calc No**	1
Calculation Title	Barn Conversion	**Phase/CTR**	N/A
Elec File Location			
Project File Location		**Page**	1 **of 4** pages

INTRODUCTION

The following calculations have been prepared on behalf of Miles Pollard for the proposed barn conversion at Houlkers Farm, Whins Lane, Read, BB12 7RB.

The calculations have been prepared by Richard Lomax BEng (Hons) CEng MIStructE.

The works involve the conversion of an existing farm building.

The layout of the building and load-bearing elements has not been substantially altered with respect to building regulation A3 - disproportionate collapse.

All design carried out in accordnace with current British codes of practice:

SCOPE OF CALCULATIONS

The calculations will assess the existing roof steelwork design

APPENDIX

Roof steel frame analysis

ASSUMPTIONS

Refer calculations.

Rev	Date	Description	By	Checked	Approved
P1	20-Sep-24	Preliminary Issue	RAL	RAL	RAL

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Rev	Date	By	Checked	Rev	Date	By	Checked	Rev	Date	By	Checked
P1	20-Sep-24	RAL	RAL								

LOADINGS

Proposed Roof Load

Random sized stone flags 25 - 40mm thick:	1.5	kN/m^2	(conservative)
Batten & felt:	0.05	kN/m^2	
Rafters:	0.065	kN/m^2	
Insulation:	0.05	kN/m^2	
Plasterboard, skim & services:	0.18	kN/m^2	
Total dead:	1.85	kN/m^2	
Imposed:	0.75	kN/m^2	

First Floor

Typical residential timber floor construction:	0.6	kN/m^2	
Residential imposed floor loading:	1.50	kN/m^2	

Random stone wall: (N/A)

450 random stone wall:	9.32	kN/m^2	(10% allowance for air pockets in rubble fill)
Total dead:	9.32	kN/m^2	

Inner leaf: (N/A)

100 dense block:	1.86	kN/m^2	
50 insulation say:	0.05	kN/m^2	
Plasterboard and skim:	0.18	kN/m^2	
Total dead:	2.09	kN/m^2	

Oak cladding:

0.15 kN/m

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Project File Location

Rev	Date	By	Checked	Rev	Date	By	Checked	Rev	Date	By	Checked
P1	20-Sep-24	RAL	RAL								

PURLIN BEAM LOADINGS - UPPER PURLIN

Purlin cts. = 2.025 m Design span = m

Dead Load:

Roof dead: 1.85 kN/m^2 x 2.03 x 1 = 3.74 kN/m

Imposed Load:

Roof imposed 0.75 kN/m^2 x 2.03 x 1 = 1.52 kN/m

PURLIN BEAM LOADINGS - LOWER PURLIN

Purlin cts. = 1.35 m Design span = m

Dead Load:

Roof dead: 1.85 kN/m^2 x 1.35 x 1 = 2.49 kN/m

Imposed Load:

Roof imposed 0.75 kN/m^2 x 1.35 x 1 = 1.01 kN/m

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Calculation Sheet

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[redacted]

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Project Title	Houlkers Farm, Whins Lane, Read, BB12 7RB.	**Calc No**	1
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Project File Location

Rev	Date	By	Checked	Rev	Date	By	Checked	Rev	Date	By	Checked
P1	20-Sep-24	RAL	RAL								

PURLIN ASSESSMENT TO BS 449 - EXISTING 9x4" JOIST

Maximum moment from analysis = 15.50 kN.m (safe working loads) Refer appendix for analysis

Effective length, L = 4789.00 mm = 188.54 in r_y = 0.82 in

L/r_y = 188.54 / 0.82 = 229.93

D/T = 9.00 / 0.46 = 19.69

From Table 3a of BS449-2, allowable stress, p_{bc} = 74.00 N/mm^2

Section modulus, Z_x = 18.03 in^3 = 295459 mm^3

Maximum stress = M/Z = 15.50 / 295459 = 52.46 N/mm^2

Applied maximum stress < allowable stress therefore ok.

PURLIN STEEL SUPPORT ASSESSMENT TO BS 449 - EXISTING 10x5" JOIST

Maximum moment from analysis = 49.30 kN.m (safe working loads) Refer appendix for analysis

Effective length, L = 3745.00 mm = 147.44 in r_y = 1.05 in
(ends built into supporting piers, effective span = 0.7L, posts over ignored)

L/r_y = 147.44 / 1.05 = 140.42

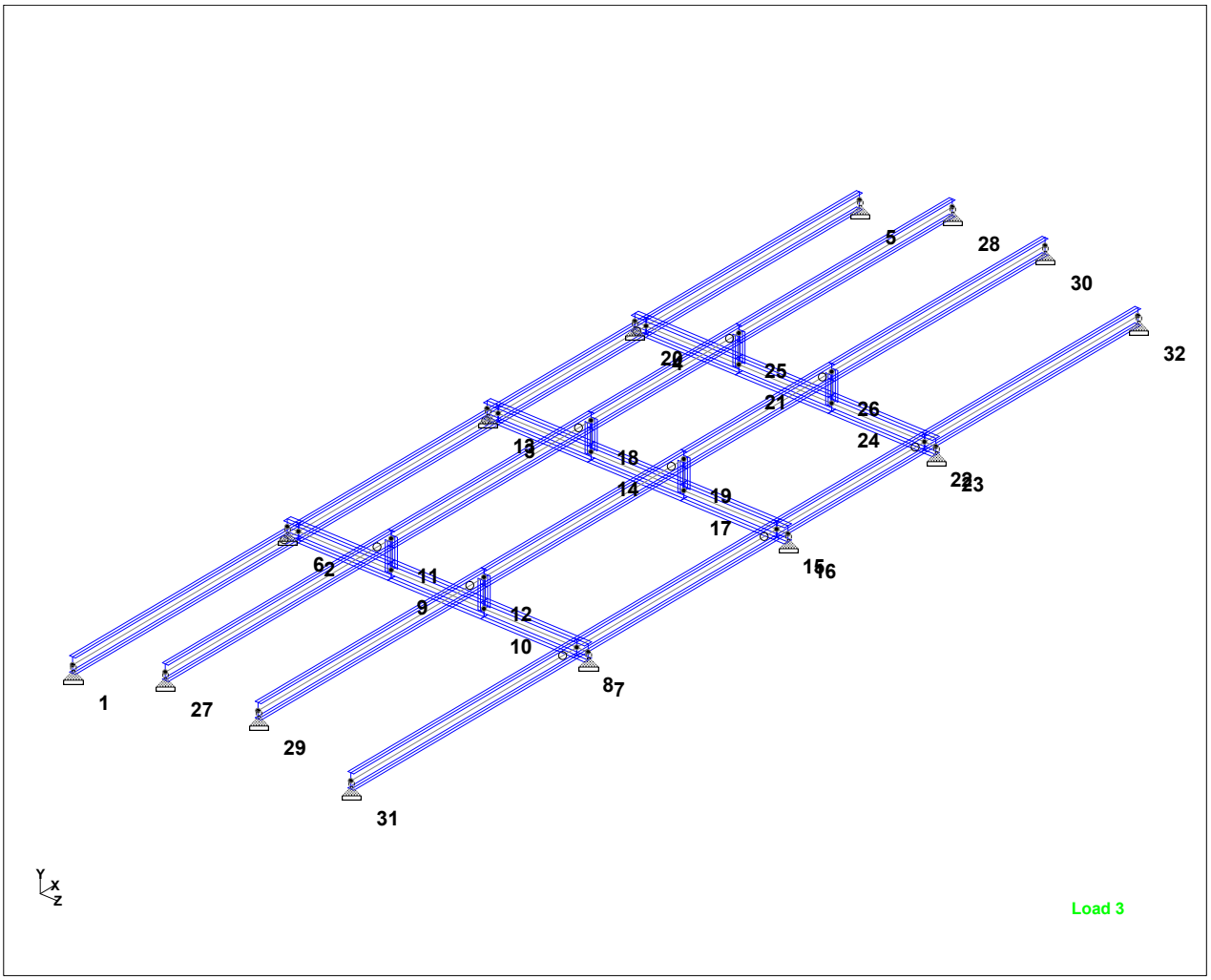
D/T = 10.00 / 0.55 = 18.12

From Table 3a of BS449-2, allowable stress, p_{bc} = 112.00 N/mm^2

Section modulus, Z_x = 29.25 in^3 = 479323 mm^3

Maximum stress = M/Z = 49.30 / 479323 = 102.85 N/mm^2

Applied maximum stress < allowable stress therefore ok.



Roof Structure (Input data was modified after picture taken)

Nodes

Node	X (m)	Y (m)	Z (m)
1	0.000	0.000	0.000
2	4.789	0.000	0.000
3	9.024	0.000	0.000
4	12.156	0.000	0.000
5	16.675	0.000	0.000
6	4.789	0.000	-0.200
7	4.789	0.000	5.150
8	4.789	0.000	4.950
9	4.789	0.000	1.650
10	4.789	0.000	3.300
11	4.789	0.500	1.650
12	4.789	0.500	3.300
13	9.024	0.000	-0.200
14	9.024	0.000	1.650
15	9.024	0.000	4.950
16	9.024	0.000	5.150
17	9.024	0.000	3.300
18	9.024	0.500	1.650
19	9.024	0.500	3.300
20	12.156	0.000	-0.200
21	12.156	0.000	1.650
22	12.156	0.000	4.950
23	12.156	0.000	5.150
24	12.156	0.000	3.300

Nodes Cont...

Node	X (m)	Y (m)	Z (m)
25	12.156	0.500	1.650
26	12.156	0.500	3.300
27	0.000	0.500	1.650
28	16.675	0.500	1.650
29	0.000	0.500	3.300
30	16.675	0.500	3.300
31	0.000	0.000	4.950
32	16.675	0.000	4.950

Beams

Beam	Node A	Node B	Length (m)	Property	β (degrees)
1	1	2	4.789	1	0
2	2	3	4.235	1	0
3	3	4	3.132	1	0
4	4	5	4.519	1	0
5	6	2	0.200	2	0
6	2	9	1.650	2	0
7	8	7	0.200	2	0
8	9	10	1.650	2	0
9	10	8	1.650	2	0
10	9	11	0.500	3	0
11	10	12	0.500	3	0
12	13	3	0.200	2	0
13	3	14	1.650	2	0
14	15	16	0.200	2	0
15	14	17	1.650	2	0
16	17	15	1.650	2	0
17	14	18	0.500	3	0
18	17	19	0.500	3	0
19	20	4	0.200	2	0
20	4	21	1.650	2	0
21	22	23	0.200	2	0
22	21	24	1.650	2	0
23	24	22	1.650	2	0
24	21	25	0.500	3	0
25	24	26	0.500	3	0
26	8	15	4.235	1	0
27	15	22	3.132	1	0
28	27	11	4.789	1	0
29	11	18	4.235	1	0
30	18	25	3.132	1	0
31	25	28	4.519	1	0
32	29	12	4.789	1	0
33	12	19	4.235	1	0
34	19	26	3.132	1	0
35	26	30	4.519	1	0
36	31	8	4.789	1	0
37	22	32	4.519	1	0

Section Properties

Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	UB254X102X28	36.100	179.000	4E+3	9.571	STEEL
2	UB254X146X37	47.200	571.000	5.54E+3	15.332	STEEL
3	UB152X89X16	20.300	89.800	834.000	3.561	STEEL

Materials

Mat	Name	E (kN/mm^2)	ν	Density (kg/m^3)	α (/°C)
1	STEEL	205.000	0.300	7.83E+3	12E -6
2	STAINLESSSTEEL	197.930	0.300	7.83E+3	18E -6
3	ALUMINUM	68.948	0.330	2.71E+3	23E -6
4	CONCRETE	21.718	0.170	2.4E+3	10E -6

Supports

Node	X (kN/mm)	Y (kN/mm)	Z (kN/mm)	rX (kN^-m/deg)	rY (kN^-m/deg)	rZ (kN^-m/deg)
1	Fixed	Fixed	Fixed	-	-	-
5	Fixed	Fixed	Fixed	-	-	-
6	Fixed	Fixed	Fixed	-	-	-
7	Fixed	Fixed	Fixed	-	-	-
13	Fixed	Fixed	Fixed	-	-	-
16	Fixed	Fixed	Fixed	-	-	-
20	Fixed	Fixed	Fixed	-	-	-
23	Fixed	Fixed	Fixed	-	-	-
27	Fixed	Fixed	Fixed	-	-	-
28	Fixed	Fixed	Fixed	-	-	-
29	Fixed	Fixed	Fixed	-	-	-
30	Fixed	Fixed	Fixed	-	-	-
31	Fixed	Fixed	Fixed	-	-	-
32	Fixed	Fixed	Fixed	-	-	-

Releases

Beam ends not shown in this table are fixed in all directions.

Beam	Node	x	y	z	rx	ry	rz
1	2	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
2	3	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
3	4	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
26	15	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
27	22	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
28	11	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
29	18	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
30	25	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
32	12	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
33	19	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
34	26	Fixed	Fixed	Fixed	Fixed	Fixed	Pin
36	8	Fixed	Fixed	Fixed	Fixed	Fixed	Pin

Primary Load Cases

Number	Name	Type
1	LOAD CASE 1 - DEAD	None
2	LOAD CASE 2 - IMPOSED	None

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
3	COMBINATION LOAD CASE 3 - D+I (SLS	1	LOAD CASE 1 - DEAD	1.00
		2	LOAD CASE 2 - IMPOSED	1.00

1 LOAD CASE 1 - DEAD : Beam Loads

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
1	UNI kN/m	GY	-2.490	-	-	-	-
	UNI kN/m	GY	-0.150	-	-	-	-
2	UNI kN/m	GY	-2.490	-	-	-	-
	UNI kN/m	GY	-0.150	-	-	-	-
3	UNI kN/m	GY	-0.150	-	-	-	-
	UNI kN/m	GY	-2.490	-	-	-	-
4	UNI kN/m	GY	-0.150	-	-	-	-
	UNI kN/m	GY	-2.490	-	-	-	-
5	UNI kN/m	GY	-0.150	-	-	-	-
6	UNI kN/m	GY	-0.150	-	-	-	-
7	UNI kN/m	GY	-0.150	-	-	-	-
8	UNI kN/m	GY	-0.150	-	-	-	-
9	UNI kN/m	GY	-0.150	-	-	-	-
10	UNI kN/m	GY	-0.150	-	-	-	-
11	UNI kN/m	GY	-0.150	-	-	-	-
12	UNI kN/m	GY	-0.150	-	-	-	-
13	UNI kN/m	GY	-0.150	-	-	-	-
14	UNI kN/m	GY	-0.150	-	-	-	-
15	UNI kN/m	GY	-0.150	-	-	-	-
16	UNI kN/m	GY	-0.150	-	-	-	-
17	UNI kN/m	GY	-0.150	-	-	-	-
18	UNI kN/m	GY	-0.150	-	-	-	-
19	UNI kN/m	GY	-0.150	-	-	-	-
20	UNI kN/m	GY	-0.150	-	-	-	-
21	UNI kN/m	GY	-0.150	-	-	-	-
22	UNI kN/m	GY	-0.150	-	-	-	-
23	UNI kN/m	GY	-0.150	-	-	-	-
24	UNI kN/m	GY	-0.150	-	-	-	-
25	UNI kN/m	GY	-0.150	-	-	-	-
26	UNI kN/m	GY	-2.490	-	-	-	-
	UNI kN/m	GY	-0.150	-	-	-	-
27	UNI kN/m	GY	-0.150	-	-	-	-
	UNI kN/m	GY	-2.490	-	-	-	-
28	UNI kN/m	GY	-0.150	-	-	-	-
	UNI kN/m	GY	-3.740	-	-	-	-
29	UNI kN/m	GY	-0.150	-	-	-	-
	UNI kN/m	GY	-3.740	-	-	-	-
30	UNI kN/m	GY	-3.740	-	-	-	-
	UNI kN/m	GY	-0.150	-	-	-	-
31	UNI kN/m	GY	-3.740	-	-	-	-
	UNI kN/m	GY	-0.150	-	-	-	-
32	UNI kN/m	GY	-3.740	-	-	-	-
	UNI kN/m	GY	-0.150	-	-	-	-
33	UNI kN/m	GY	-3.740	-	-	-	-
	UNI kN/m	GY	-0.150	-	-	-	-
34	UNI kN/m	GY	-3.740	-	-	-	-
	UNI kN/m	GY	-0.150	-	-	-	-
35	UNI kN/m	GY	-0.150	-	-	-	-
	UNI kN/m	GY	-3.740	-	-	-	-
36	UNI kN/m	GY	-0.150	-	-	-	-

1 LOAD CASE 1 - DEAD : Beam Loads Cont...

Beam	Type		Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
36	UNI	kN/m	GY	-2.490	-	-	-	-
37	UNI	kN/m	GY	-0.150	-	-	-	-
	UNI	kN/m	GY	-2.490	-	-	-	-

2 LOAD CASE 2 - IMPOSED : Beam Loads

Beam	Type		Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
1	UNI	kN/m	GY	-1.010	-	-	-	-
2	UNI	kN/m	GY	-1.010	-	-	-	-
3	UNI	kN/m	GY	-1.010	-	-	-	-
4	UNI	kN/m	GY	-1.010	-	-	-	-
26	UNI	kN/m	GY	-1.010	-	-	-	-
27	UNI	kN/m	GY	-1.010	-	-	-	-
28	UNI	kN/m	GY	-1.520	-	-	-	-
29	UNI	kN/m	GY	-1.520	-	-	-	-
30	UNI	kN/m	GY	-1.520	-	-	-	-
31	UNI	kN/m	GY	-1.520	-	-	-	-
32	UNI	kN/m	GY	-1.520	-	-	-	-
33	UNI	kN/m	GY	-1.520	-	-	-	-
34	UNI	kN/m	GY	-1.520	-	-	-	-
35	UNI	kN/m	GY	-1.520	-	-	-	-
36	UNI	kN/m	GY	-1.010	-	-	-	-
37	UNI	kN/m	GY	-1.010	-	-	-	-

Beam Maximum Moments

Distances to maxima are given from beam end A.

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
1	1	4.789	1:LOAD CASE	Max +ve	4.789	0.028	4.789	-0.000
				Max -ve	0.000	-0.000	2.395	-7.568
			2:LOAD CASE	Max +ve	4.789	0.011	4.789	-0.000
				Max -ve	0.000	-0.000	2.395	-2.895
			3:COMBINATIC	Max +ve	4.789	0.039	4.789	-0.000
				Max -ve	0.000	-0.000	2.395	-10.464
2	2	4.235	1:LOAD CASE	Max +ve	4.235	0.053	4.235	-0.000
				Max -ve	0.000	-0.059	2.118	-5.919
			2:LOAD CASE	Max +ve	4.235	0.021	4.235	-0.000
				Max -ve	0.000	-0.023	2.118	-2.264
			3:COMBINATIC	Max +ve	4.235	0.074	4.235	-0.000
				Max -ve	0.000	-0.082	2.118	-8.183
3	3	3.132	1:LOAD CASE	Max +ve	3.132	0.042	3.132	-0.000
				Max -ve	0.000	-0.053	1.566	-3.238
			2:LOAD CASE	Max +ve	3.132	0.017	3.132	-0.000
				Max -ve	0.000	-0.021	1.566	-1.239
			3:COMBINATIC	Max +ve	3.132	0.059	3.132	-0.000
				Max -ve	0.000	-0.075	1.566	-4.477
4	4	4.519	1:LOAD CASE	Max +ve	4.519	-0.000	0.000	0.006
				Max -ve	0.000	-0.011	2.259	-6.736
			2:LOAD CASE	Max +ve			0.000	0.002
				Max -ve	0.000	-0.004	2.259	-2.577
			3:COMBINATIC	Max +ve			0.000	0.008
				Max -ve	0.000	-0.015	2.259	-9.313
5	6	0.200	1:LOAD CASE	Max +ve	0.200	0.471		
				Max -ve			0.200	-5.998
			2:LOAD CASE	Max +ve	0.200	0.184		

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve			0.200	-2.288
			3:COMBINATIC	Max +ve	0.200	0.654		
				Max -ve			0.200	-8.286
6	2	1.650	1:LOAD CASE	Max +ve	0.000	0.557		
				Max -ve	1.650	-0.366	1.650	-35.598
			2:LOAD CASE	Max +ve	0.000	0.218		
				Max -ve	1.650	-0.143	1.650	-13.646
			3:COMBINATIC	Max +ve	0.000	0.775		
				Max -ve	1.650	-0.509	1.650	-49.244
7	8	0.200	1:LOAD CASE	Max +ve	0.000	0.471		
				Max -ve	0.200	-0.000	0.000	-5.998
			2:LOAD CASE	Max +ve	0.000	0.184		
				Max -ve			0.000	-2.288
			3:COMBINATIC	Max +ve	0.000	0.654		
				Max -ve	0.200	-0.000	0.000	-8.286
8	9	1.650	1:LOAD CASE	Max +ve				
				Max -ve	0.000	-0.365	0.825	-35.634
			2:LOAD CASE	Max +ve				
				Max -ve	0.000	-0.143	0.000	-13.641
			3:COMBINATIC	Max +ve				
				Max -ve	0.000	-0.508	0.825	-49.275
9	10	1.650	1:LOAD CASE	Max +ve	1.650	0.557		
				Max -ve	0.000	-0.366	0.000	-35.598
			2:LOAD CASE	Max +ve	1.650	0.218		
				Max -ve	0.000	-0.143	0.000	-13.646
			3:COMBINATIC	Max +ve	1.650	0.775		
				Max -ve	0.000	-0.509	0.000	-49.244
10	9	0.500	1:LOAD CASE	Max +ve			0.500	0.280
				Max -ve	0.000	-0.015		
			2:LOAD CASE	Max +ve			0.500	0.110
				Max -ve	0.000	-0.006		
			3:COMBINATIC	Max +ve			0.500	0.390
				Max -ve	0.000	-0.020		
11	10	0.500	1:LOAD CASE	Max +ve	0.000	0.015	0.500	0.280
				Max -ve				
			2:LOAD CASE	Max +ve	0.000	0.006	0.500	0.110
				Max -ve				
			3:COMBINATIC	Max +ve	0.000	0.020	0.500	0.390
				Max -ve				
12	13	0.200	1:LOAD CASE	Max +ve	0.200	0.192	0.000	0.000
				Max -ve			0.200	-4.900
			2:LOAD CASE	Max +ve	0.200	0.074	0.000	0.000
				Max -ve	0.000	-0.000	0.200	-1.863
			3:COMBINATIC	Max +ve	0.200	0.266	0.000	0.000
				Max -ve			0.200	-6.762
13	3	1.650	1:LOAD CASE	Max +ve	0.000	0.299		
				Max -ve	1.650	-0.216	1.650	-29.050
			2:LOAD CASE	Max +ve	0.000	0.116		
				Max -ve	1.650	-0.084	1.650	-11.091
			3:COMBINATIC	Max +ve	0.000	0.415		
				Max -ve	1.650	-0.300	1.650	-40.142
14	15	0.200	1:LOAD CASE	Max +ve	0.000	0.192		
				Max -ve	0.200	-0.000	0.000	-4.900
			2:LOAD CASE	Max +ve	0.000	0.074	0.200	0.000
				Max -ve	0.200	-0.000	0.000	-1.863
			3:COMBINATIC	Max +ve	0.000	0.266		
				Max -ve	0.200	-0.000	0.000	-6.762
15	14	1.650	1:LOAD CASE	Max +ve				

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve	0.000	-0.215	0.825	-29.123
			2:LOAD CASE	Max +ve				
				Max -ve	0.000	-0.084	0.000	-11.100
			3:COMBINATIC	Max +ve				
				Max -ve	0.000	-0.299	0.825	-40.222
16	17	1.650	1:LOAD CASE	Max +ve	1.650	0.299		
				Max -ve	0.000	-0.216	0.000	-29.050
			2:LOAD CASE	Max +ve	1.650	0.116		
				Max -ve	0.000	-0.084	0.000	-11.091
			3:COMBINATIC	Max +ve	1.650	0.415		
				Max -ve	0.000	-0.300	0.000	-40.142
17	14	0.500	1:LOAD CASE	Max +ve	0.000	0.021	0.500	0.158
				Max -ve				
			2:LOAD CASE	Max +ve	0.000	0.008	0.500	0.061
				Max -ve				
			3:COMBINATIC	Max +ve	0.000	0.030	0.500	0.219
				Max -ve				
18	17	0.500	1:LOAD CASE	Max +ve			0.500	0.158
				Max -ve	0.000	-0.021		
			2:LOAD CASE	Max +ve			0.500	0.061
				Max -ve	0.000	-0.008		
			3:COMBINATIC	Max +ve			0.500	0.219
				Max -ve	0.000	-0.030		
19	20	0.200	1:LOAD CASE	Max +ve				
				Max -ve	0.200	-0.024	0.200	-5.079
			2:LOAD CASE	Max +ve			0.000	0.000
				Max -ve	0.200	-0.002	0.200	-1.932
			3:COMBINATIC	Max +ve				
				Max -ve	0.200	-0.026	0.200	-7.012
20	4	1.650	1:LOAD CASE	Max +ve	0.000	0.029		
				Max -ve	1.650	-0.045	1.650	-30.088
			2:LOAD CASE	Max +ve	0.000	0.019		
				Max -ve	1.650	-0.023	1.650	-11.498
			3:COMBINATIC	Max +ve	0.000	0.048		
				Max -ve	1.650	-0.068	1.650	-41.586
21	22	0.200	1:LOAD CASE	Max +ve	0.200	-0.000	0.200	-0.000
				Max -ve	0.000	-0.024	0.000	-5.079
			2:LOAD CASE	Max +ve				
				Max -ve	0.000	-0.002	0.000	-1.932
			3:COMBINATIC	Max +ve				
				Max -ve	0.000	-0.026	0.000	-7.012
22	21	1.650	1:LOAD CASE	Max +ve				
				Max -ve	1.650	-0.045	0.825	-30.123
			2:LOAD CASE	Max +ve				
				Max -ve	1.650	-0.022	0.000	-11.492
			3:COMBINATIC	Max +ve				
				Max -ve	1.650	-0.067	0.825	-41.615
23	24	1.650	1:LOAD CASE	Max +ve	1.650	0.029		
				Max -ve	0.000	-0.045	0.000	-30.088
			2:LOAD CASE	Max +ve	1.650	0.019		
				Max -ve	0.000	-0.023	0.000	-11.498
			3:COMBINATIC	Max +ve	1.650	0.048		
				Max -ve	0.000	-0.068	0.000	-41.586
24	21	0.500	1:LOAD CASE	Max +ve			0.500	0.016
				Max -ve	0.000	-0.016	0.000	-0.006
			2:LOAD CASE	Max +ve			0.500	0.011
				Max -ve	0.000	-0.006	0.000	-0.002
			3:COMBINATIC	Max +ve			0.500	0.027

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve	0.000	-0.022	0.000	-0.008
25	24	0.500	1:LOAD CASE	Max +ve	0.000	0.016	0.500	0.016
				Max -ve			0.000	-0.006
			2:LOAD CASE	Max +ve	0.000	0.006	0.500	0.011
				Max -ve			0.000	-0.002
			3:COMBINATIC	Max +ve	0.000	0.022	0.500	0.027
				Max -ve			0.000	-0.008
26	8	4.235	1:LOAD CASE	Max +ve	0.000	0.059	4.235	-0.000
				Max -ve	4.235	-0.053	2.118	-5.919
			2:LOAD CASE	Max +ve	0.000	0.023	4.235	-0.000
				Max -ve	4.235	-0.021	2.118	-2.264
			3:COMBINATIC	Max +ve	0.000	0.082	4.235	-0.000
				Max -ve	4.235	-0.074	2.118	-8.183
27	15	3.132	1:LOAD CASE	Max +ve	0.000	0.053	3.132	-0.000
				Max -ve	3.132	-0.042	1.566	-3.238
			2:LOAD CASE	Max +ve	0.000	0.021	3.132	-0.000
				Max -ve	3.132	-0.017	1.566	-1.239
			3:COMBINATIC	Max +ve	0.000	0.075	3.132	-0.000
				Max -ve	3.132	-0.059	1.566	-4.477
28	27	4.789	1:LOAD CASE	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	4.789	-0.046	2.395	-11.152
			2:LOAD CASE	Max +ve	0.000	0.000	4.789	-0.000
				Max -ve	4.789	-0.018	2.395	-4.358
			3:COMBINATIC	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	4.789	-0.064	2.395	-15.509
29	11	4.235	1:LOAD CASE	Max +ve	4.235	0.031	0.000	0.280
				Max -ve	0.000	-0.047	2.118	-8.581
			2:LOAD CASE	Max +ve	4.235	0.012	0.000	0.110
				Max -ve	0.000	-0.018	2.118	-3.353
			3:COMBINATIC	Max +ve	4.235	0.043	0.000	0.390
				Max -ve	0.000	-0.065	2.118	-11.934
30	18	3.132	1:LOAD CASE	Max +ve	0.000	0.030	0.000	0.158
				Max -ve	3.132	-0.041	1.566	-4.691
			2:LOAD CASE	Max +ve	0.000	0.012	0.000	0.061
				Max -ve	3.132	-0.016	1.566	-1.833
			3:COMBINATIC	Max +ve	0.000	0.042	0.000	0.219
				Max -ve	3.132	-0.057	1.566	-6.524
31	25	4.519	1:LOAD CASE	Max +ve	4.519	0.000	0.000	0.016
				Max -ve	0.000	-0.042	2.259	-9.922
			2:LOAD CASE	Max +ve	4.519	0.000	0.000	0.011
				Max -ve	0.000	-0.016	2.259	-3.875
			3:COMBINATIC	Max +ve	4.519	0.000	0.000	0.027
				Max -ve	0.000	-0.058	2.259	-13.797
32	29	4.789	1:LOAD CASE	Max +ve	4.789	0.046	0.000	0.000
				Max -ve	0.000	0.000	2.395	-11.152
			2:LOAD CASE	Max +ve	4.789	0.018	0.000	0.000
				Max -ve	0.000	-0.000	2.395	-4.358
			3:COMBINATIC	Max +ve	4.789	0.064	0.000	0.000
				Max -ve	0.000	-0.000	2.395	-15.509
33	12	4.235	1:LOAD CASE	Max +ve	0.000	0.047	0.000	0.280
				Max -ve	4.235	-0.031	2.118	-8.581
			2:LOAD CASE	Max +ve	0.000	0.018	0.000	0.110
				Max -ve	4.235	-0.012	2.118	-3.353
			3:COMBINATIC	Max +ve	0.000	0.065	0.000	0.390
				Max -ve	4.235	-0.043	2.118	-11.934
34	19	3.132	1:LOAD CASE	Max +ve	3.132	0.041	0.000	0.158
				Max -ve	0.000	-0.030	1.566	-4.691
			2:LOAD CASE	Max +ve	3.132	0.016	0.000	0.061

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve	0.000	-0.012	1.566	-1.833
			3:COMBINATIC	Max +ve	3.132	0.057	0.000	0.219
				Max -ve	0.000	-0.042	1.566	-6.524
35	26	4.519	1:LOAD CASE	Max +ve	0.000	0.042	0.000	0.016
				Max -ve	4.519	-0.000	2.259	-9.922
			2:LOAD CASE	Max +ve	0.000	0.016	0.000	0.011
				Max -ve			2.259	-3.875
			3:COMBINATIC	Max +ve	0.000	0.058	0.000	0.027
				Max -ve			2.259	-13.797
36	31	4.789	1:LOAD CASE	Max +ve	0.000	0.000	4.789	-0.000
				Max -ve	4.789	-0.028	2.395	-7.568
			2:LOAD CASE	Max +ve	0.000	0.000	4.789	-0.000
				Max -ve	4.789	-0.011	2.395	-2.895
			3:COMBINATIC	Max +ve	0.000	0.000	4.789	-0.000
				Max -ve	4.789	-0.039	2.395	-10.464
37	22	4.519	1:LOAD CASE	Max +ve	0.000	0.011	0.000	0.006
				Max -ve	4.519	-0.000	2.259	-6.736
			2:LOAD CASE	Max +ve	0.000	0.004	0.000	0.002
				Max -ve			2.259	-2.577
			3:COMBINATIC	Max +ve	0.000	0.015	0.000	0.008
				Max -ve	4.519	-0.000	2.259	-9.313