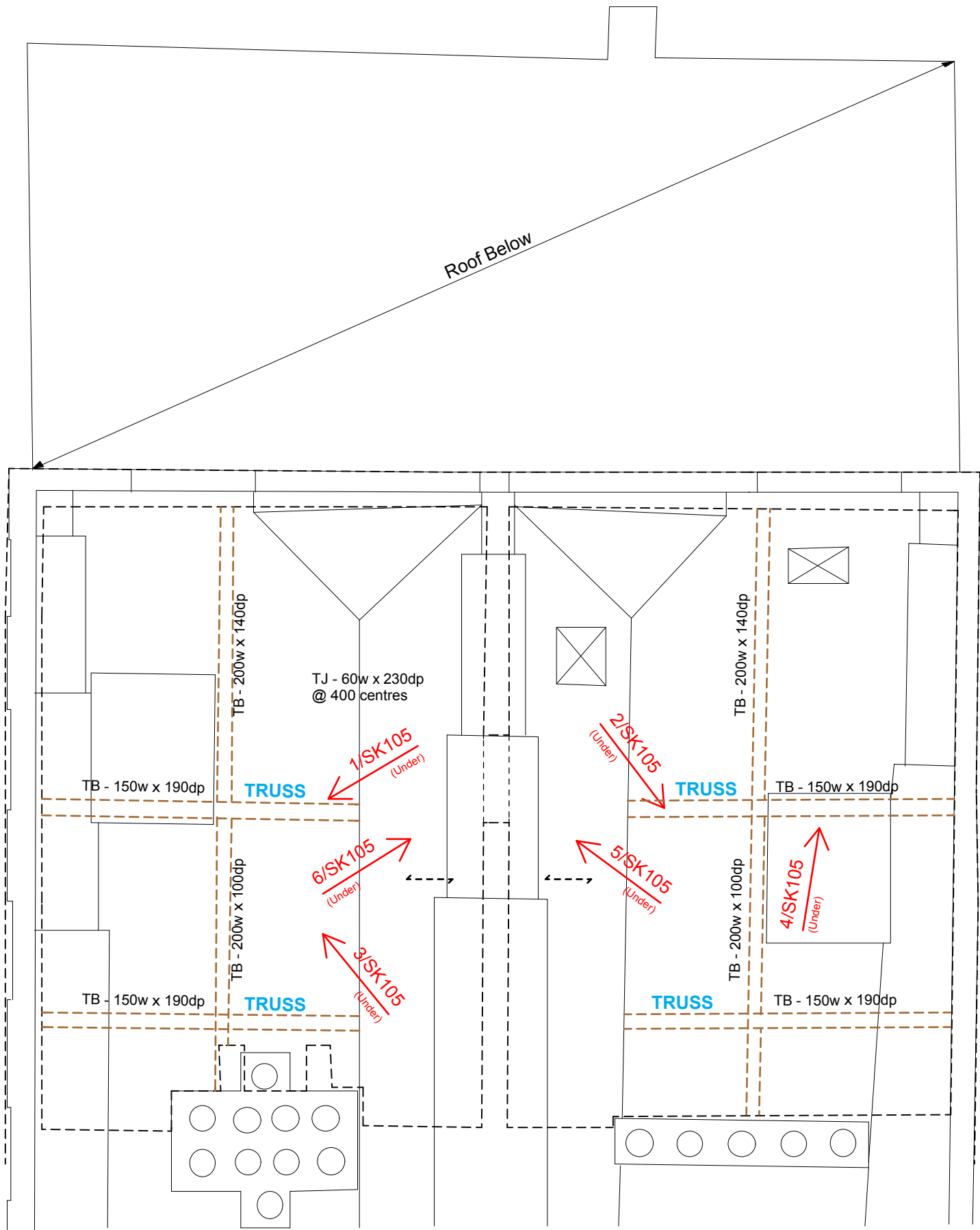




Existing - Roof Level (1:50)



Image 1/SK105



Image 2/SK105



Image 3/SK105



Image 4/SK105



Image 5/SK105



Image 6/SK105

NOTES

1. This drawing is to be read in conjunction with all relevant architect's and engineers drawings and specifications

2. This drawing is only to be scaled from for the purposes of estimating and approximate sizing only. If exact dimensions are relied upon, written dimensions supersede any scaled dimension. Overall setting out is to Architect's details and this drawing therefore should be read in conjunction with their information.

Preliminary

STATUS

P1

REV COMMENTS

15

DATE

CF

CHK

Lyons

O'Neill

Structural Engineers

45 Great Guildford Street

London

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info@lyonsoneill.co.uk

lyonsoneill.co.uk

PROJECT

810/812 Tottenham High Road

SUBJECT

Existing - Roof Level

SCALE @A1

1:50

BY

DON

DATE

Dec 15

CHECKED

CF

DRAWING No.

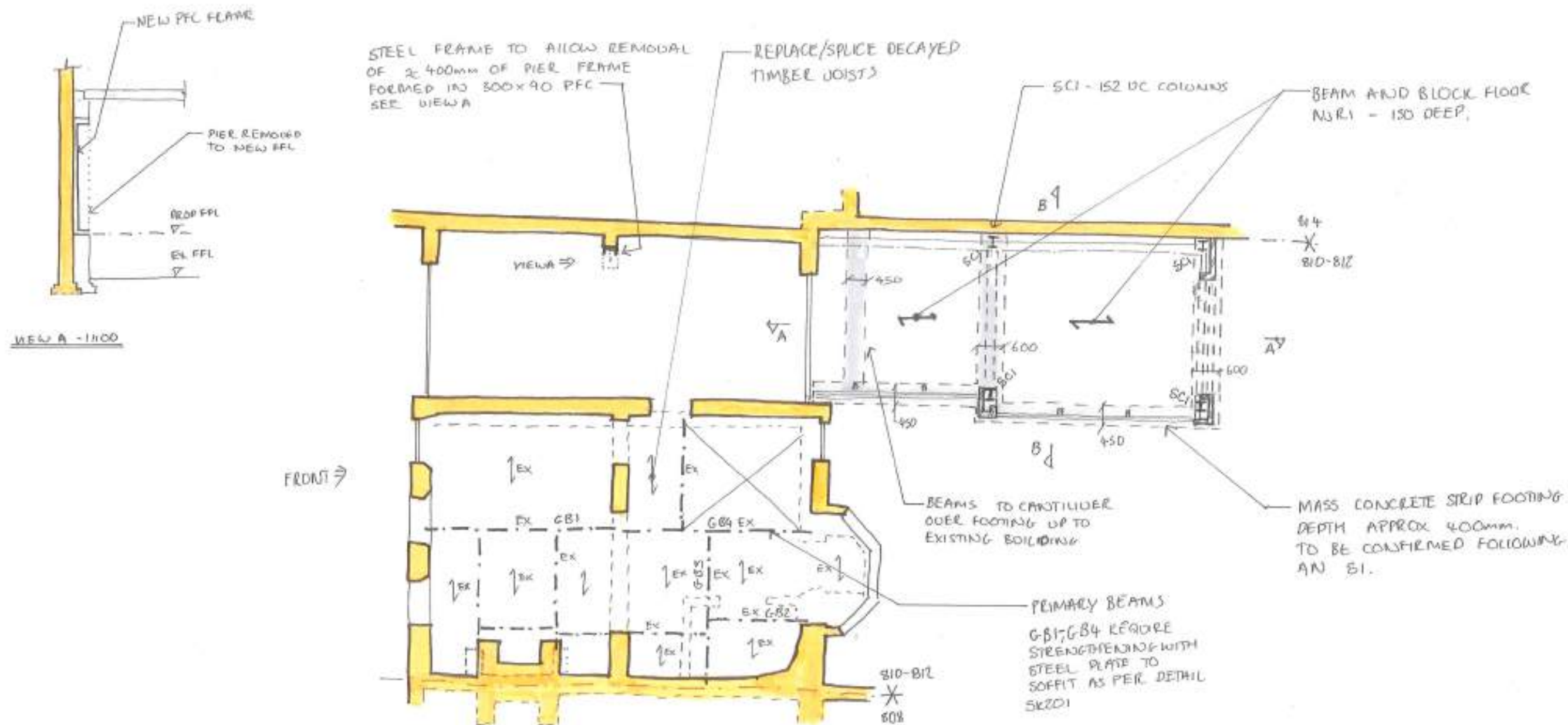
15208/SK105

REV

P1

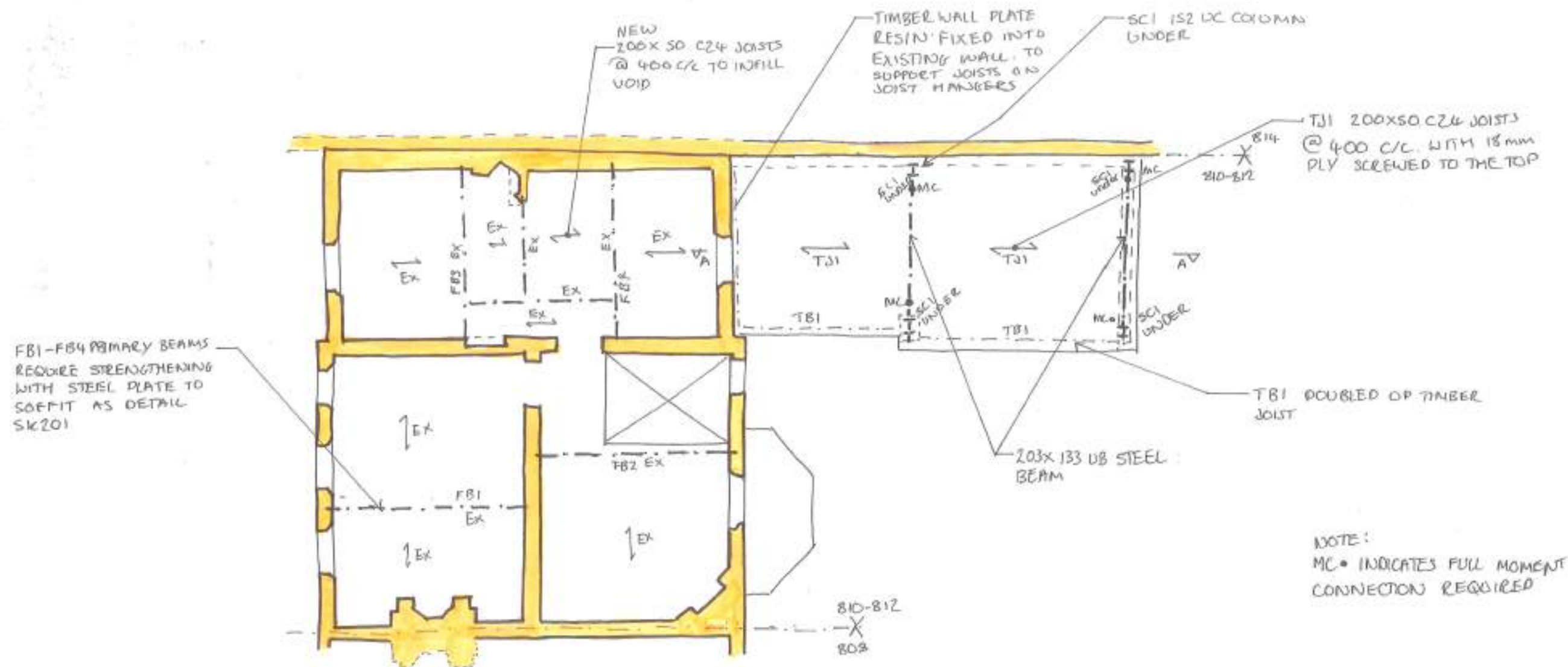
Appendix B

Proposed Structural Drawings



GROUND FLOOR PROPOSED PLAN
1:100 @ A3

			Lyons O'Neill 10 Great Portland Street London W1T 0JG Tel: 020 7321 2200 info@lyonsoneill.co.uk www.lyonsoneill.co.uk 810-812 HIGH ROAD GROUND FLOOR PROPOSED SCALE 1:100 BY CF DATE 12/15 PROJECT KL 15208-SK106 P2
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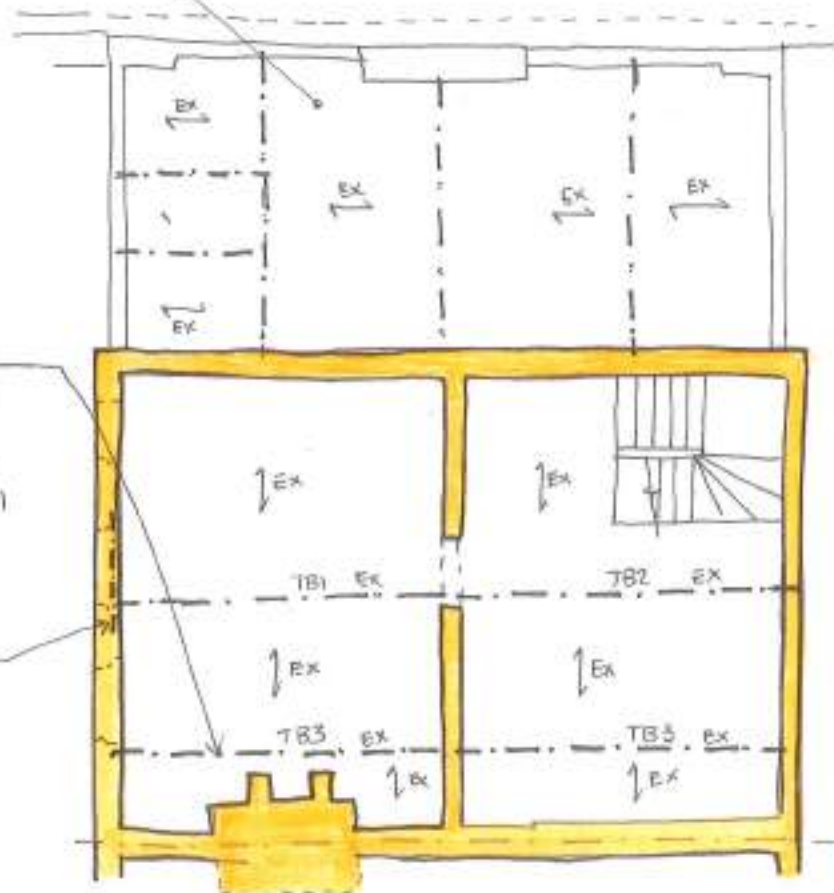
FIRST FLOOR PROPOSED PLAN
1:100 @ A3

			Lyons O'Neill PROJECT: 810-812 HIGH ROAD SUBJECT: FIRST FLOOR PROPOSED 40-5000 000000 0000 0000 0000 1:100 CF 12/15 15208-SK107 P2
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NO CHANGE TO COACH HOUSE LIKELY TO BE REQUIRED

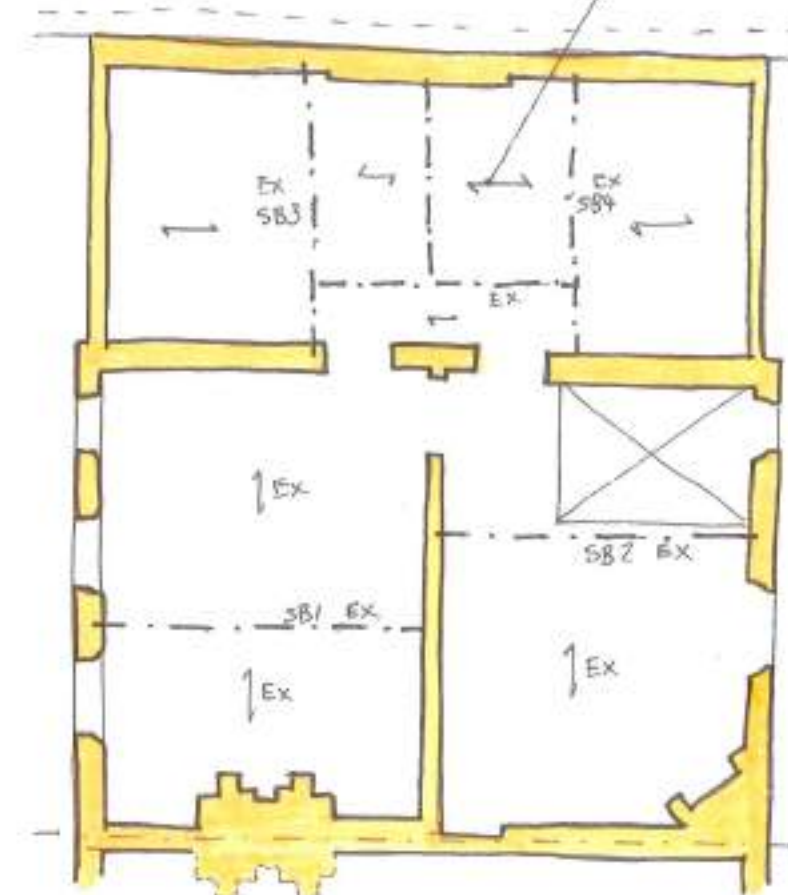
TB2, TB3 PRIMARY BEAMS REQUIRE STRENGTHENING WITH STEEL PLATE TO SOFFIT AS PER DETAIL SK201

NEW PFC 100x50x10



THIRD FLOOR PROPOSED PLAN
1:100 @ A3

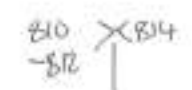
NEW TIMBER INFILL 200x50 C24 JOISTS ON SIMPSON JOIST HANGERS



SB1-SB4 PRIMARY BEAMS REQUIRE STRENGTHENING WITH STEEL PLATE TO SOFFIT AS PER DETAIL SK201

SECOND FLOOR PLAN
1:100 @ A3

			Lyons O'Neill 810-BR HIGH ROAD SECOND+THIRD PROPOSED <table border="1"> <tr> <td>SCALE</td><td>BY</td><td>DATE</td><td>REVISION</td></tr> <tr> <td>1:100</td><td>CF</td><td>12/15</td><td>KL</td></tr> <tr> <td colspan="3">PROJECT</td><td>PI</td></tr> <tr> <td colspan="3">15208-SK108</td><td></td></tr> </table>	SCALE	BY	DATE	REVISION	1:100	CF	12/15	KL	PROJECT			PI	15208-SK108			
SCALE	BY	DATE	REVISION																
1:100	CF	12/15	KL																
PROJECT			PI																
15208-SK108																			



45 Great Suffolk Street LONDON SE1 1LS	+44 (0) 20 7299 7222 info@lyons-o'neill.co.uk lyons-o'neill.co.uk	PROJECT 810-812 HIGH ROAD	SUBJECT SECTIONS PROPOSED	SCALE OF	BY	DATE	CHECKED
				1:100	CF	12/15	EL
ISSUED TO 15208-SK109							REV P2

Job 15205 B10-B12 HIGHROAD

Date 12/15

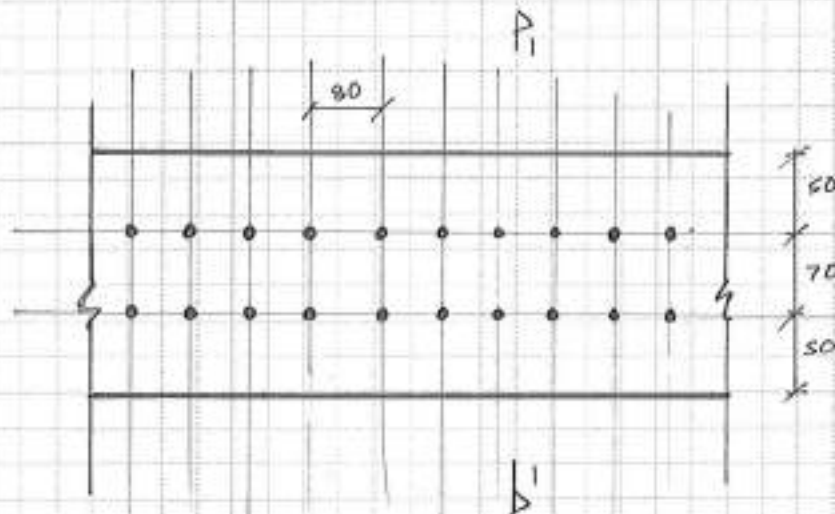
Page

Title TYPICAL BEAM STRENGTHENING DETAIL

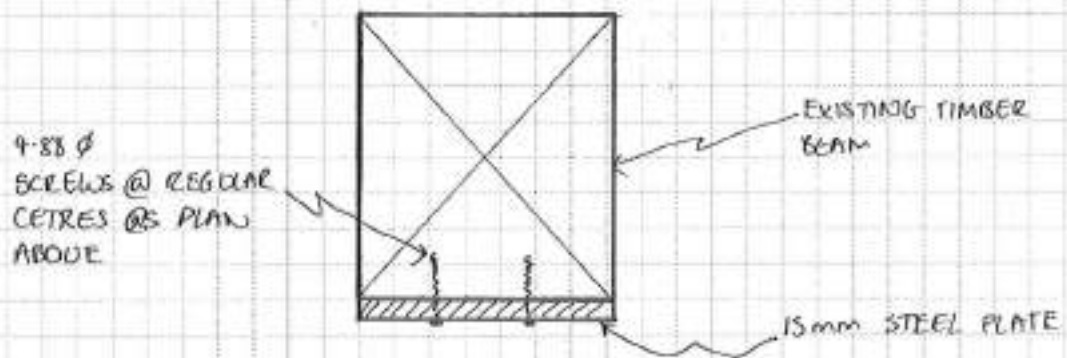
By CF

Chkd

TYPICAL BEAM STRENGTHENING DETAIL SK201



PLAN ON BEAM 30FT



SECTION 1-1

Appendix C

Calculations

15208 - 810-812 High Road

Structural Calculations

Issue Date : Dec-16
Revision : -

Table of Contents

Section	Heading	Page
1	Loads	1.1
2	Existing member checks for proposed loads	2.1 - 2.3
3	Deflection checks - existing and proposed loads	3.1 - 3.6
4	Timber beam strengthening	4.1 - 4.5
5	End bearing checks	5.1

1.0 - Loads

Ground to first - Floor Board finish *

Gk	-	Floor boards (assume 25mm)	=	0.18	kN/m ²
	-	Ceiling & services	=	0.15	kN/m ²
		Gk	=	0.33	kN/m²
Qk (proposed)	-	Office	Qk	=	2.50 kN/m ²
Qk (existing)	-	Residential	QK	=	1.50 kN/m ²

Second to third - Carpeted *

Gk	-	Carpet	=	0.10	kN/m ²
	-	Floor boards (assume 25mm)	=	0.18	kN/m ²
	-	Ceiling & services	=	0.15	kN/m ²
		Gk	=	0.43	kN/m²
Qk (proposed)	-	Office	Qk	=	2.50 kN/m ²
Qk (existing)	-	Residential	QK	=	1.50 kN/m ²

* the dead loads do not include the self weight of the joists, this will be calculated individually for each member check

2.0 - Existing member checks for proposed Loads

.....

Lyons O'Neill

45 Great Guildford Street
London
SE1 0FS

Project

810-812 High Road

Job:

15208

Section:

Member checks - proposed loads

Sheet No:

21

By:

CF

Date:

Dec-15

Chk'd by:

Date:

App'd:

Date:

The timber joists and primary beams were initially checked against the british standards for Shear, bending stress and deflection. The original hardwoods are assumed to be grade D40 and the new timbers are assumed to be C16.

See the following pages for the member checks.

Ground Floor Joists

- G.J.1

Width 100 mm

Depth 130 mm

Centres 400 mm

Span 2.5 m

Self weight 0.23 kN/m²

(Density*width*depth/centres)

Gk 0.55 kN/m²

Gk 0.221 kN/m

Qk 1 kN/m

Grade C16

- G.J.2*

Width 100 mm

Depth 150 mm

Centres 400 mm

Span 3.4 m

Self weight 0.26 kN/m²

(Density*width*depth/centres)

Gk tot 0.59 kN/m²

Gk 0.235 kN/m

Qk 1 kN/m

Grade C16

Ground Floor Beams

- G.B.1

Width 290 mm

Depth 260 mm

Load width 2.4 m

Span 4.1 m

Joist self weight 0.23 kN/m²

Gk 0.55 kN/m²

Gk 1.33 kN/m

Qk 6 kN/m

Grade B40

BEAM HAS BEEN SPECIFIED
FOR DESIGN - 2 COPIES TO BE SUBMITTED
FOR APPROVAL

- G.B.2

Width 150 mm
Depth 150 mm
Load width 1.66 m
Span 2 m
Joist self
weight 0.23 kN/m²
Gk 0.55 kN/m²
Gk 0.91 kN/m
Qk 4.125 kN/m
Grade C16

- G.B.3

Width 175 mm
Depth 140 mm
Span 3.3 m
Grade C16

member supported at 1.6m

Point loads from reactions from 2 GB2 beams @ 2m and 2.3m

Ra and Rb Gk 1 kN
Qk 4.13 kN

- G.B.4

Width 280 mm
Depth 220 mm
Span 3.9 m
Grade C16

Point Load from reaction from GB3 @ 1.9m and Ud1, see over

Job 15208 210-212 HIGH LOAD

Date 12/15

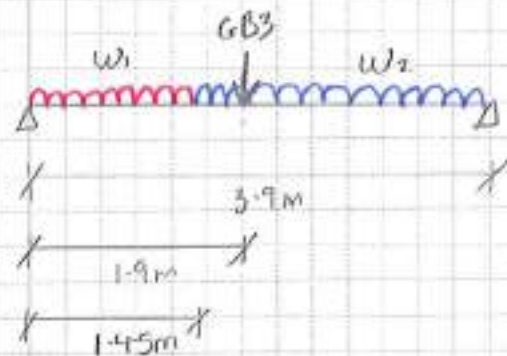
Page 2 of 4

Title EXISTING MEMBER CHECKS

By CF

Chkd

GB4 CONTINUED



-LOADS (GJI JOISTS)

$$w_{1GJ} = \frac{4.6m}{2} \times (0.23kN/m^2 + 0.29kN/m^2) = 1.2 kN/m$$

$$w_{1QE} = \frac{4.6m}{2} \times 2.5kN/m^2 = 5.8 kN/m$$

$$w_{2GJ} = \frac{2.1m}{2} \times (0.23kN/m^2 + 0.29kN/m^2) = 0.55 kN/m$$

$$w_{2QE} = \frac{2.1m}{2} \times 4.5kN/m^2 = 2.6 kN/m$$

$$GB3 = 0 \quad (\text{UPUFT SO IGNORE})$$

 TEK 625		Part no 01-201714 1st issue		Job no. 10026	
Case no 01-201714 1st issue		Original Filed Just QJ: 01-201714 1st issue		Received date 10026	
Case no 01-201714 1st issue		Original Filed Just QJ: 01-201714 1st issue		Received date 10026	

[illegible]

		Model: 2-0-512-400 Road Order: 2-0-512-400 Road Quantity: 2 Description: 2-0-512-400 Road Unit Price: \$100.00 Total Price: \$200.00 Tax: \$0.00 Grand Total: \$200.00	
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[illegible]

Page	810-812 High Road	Value	1527M
05/07/19		Building in blocks	2
Block	Remainder of Block 1033		
CF	1033/1033	1033/1033	1033/1033

cf. 1033 = 0.342

8888 Total outflow in less than primary's section

Lyons O'Neill 46 Great Guildford Street London SE1 0ES		Project: B10-312 High Road		Job: 15208	
		Section: Member properties and loads		Sheet No:	
		By: CF	Date: Dec 15	Chk'd by	Date:

First Floor Joists

- F.J.1

Width: 80 mm
 Depth: 220 mm
 Centres: 400 mm
 Span: 3.7 m
 Self weight: 0.23 kN/m^2 (Density*width*depth/centres)
 Gk: 0.56 kN/m^2
 Gk: 0.22 kN/m
 Qk: 1 kN/m
 Grade: D40

- F.J.2 FJ2 will not be checked as FJ2 is a worse case

Width: 85 mm
 Depth: 230 mm
 Centres: 400 mm
 Span: 3.3 m
 Self weight: 0.26 kN/m^2 (Density*width*depth/centres)
 Grade: D40

- F.J.3

Width: 45 mm (this is assumed as a worst case)
 Depth: 200 mm
 Centres: 410 mm
 Span: 2.5 m
 Self weight: 0.15 kN/m^2 (Density*width*depth/centres)
 Gk: 0.48 kN/m^2
 Gk: 0.20 kN/m
 Qk: 1.03 kN/m
 Grade: D40

First Floor Beams

- F.B.1

Width: 350 mm
 Depth: 220 mm
 Load width: 3 m
 Span: 4.3 m
 Joist self weight: 0.26 kN/m^2
 Gk: 0.58 kN/m^2
 Gk: 1.76 kN/m
 Qk: 7.5 kN/m
 Grade: D40

- F.B.2

Width 300 mm
Depth 220 mm
Span 4.2 m
Grade D40

See over for loads

- F.B.3

Width 200 mm assumed
Depth 200 mm
Load width 3 m
Span 3.7 m
Joist self weight 0.23 kN/m²
Gk 0.56 kN/m²
Gk 1.67 kN/m
Qk 7.5 kN/m
Grade D40

Job 15208 B10-B12 HIGHROAD

Date

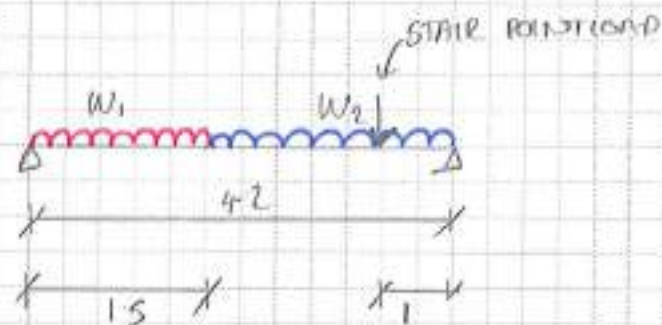
Page 2.13

Title EXISTING STRUCTURE CHECKS

By CF

Chkd

FIRST FLOOR BEAM FB2 CONTINUED



LOADS

STAIR POINT LOAD: CONSERVATIVE

$$G_k = 1 \text{ kN/m}^2 \times 2.7 \text{ m} \times 2 \text{ m} / 4 = 1.35 \text{ kN}$$

$$Q_k = 2.5 \text{ kN/m}^2 \times " \quad " = 3.4 \text{ kN}$$

$$W_{1Gk} = \frac{5.9 \text{ m}}{2} \times (0.23 + 0.33) = 1.65 \text{ kN/m}$$

$$W_{1Qk} = \frac{5.9 \text{ m}}{2} \times 2.5 \text{ kN/m}^2 = 7.4 \text{ kN/m}$$

$$W_{2Gk} = \frac{3.7 \text{ m}}{2} \times (0.23 + 0.33) = 1.04 \text{ kN/m}$$

$$W_{2Qk} = \frac{3.7 \text{ m}}{2} \times 2.5 \text{ kN/m}^2 = 4.6 \text{ kN/m}$$

Project	R-15072-100 R030		Area	10000
Location	R-15072-100 R030		East side of road	
Client	R-15072-100 R030		Client	
Design	R-15072-100 R030		Design	
Drawn	R-15072-100 R030		Drawn	
Checked	R-15072-100 R030		Checked	
Approved	R-15072-100 R030		Approved	

TRUSS BEAM ANALYSIS & DESIGN TO BS5951:2002

Applied loading

Beam loads

Load combinations

Load combinations

Analysis results

Maximum moment

Design moment

Design moment

Design moment

Design moment

Design moment

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Design moment

Design moment

Design moment

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Project	R-15072-100 R030		Area	10000
Location	R-15072-100 R030		East side of road	
Client	R-15072-100 R030		Client	
Design	R-15072-100 R030		Design	
Drawn	R-15072-100 R030		Drawn	
Checked	R-15072-100 R030		Checked	
Approved	R-15072-100 R030		Approved	

Section properties

Overall depth of section

Overall depth of section

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YINGER BEAM ANALYSIS & DESIGN TO BS5951-2:2012

Applied loading

Beam loads

Load combinations

Load combination

Analysis results

Maximum moment

Design moment

Design load

Design load

Design load

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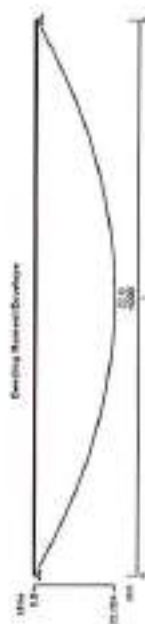
Section properties

Section properties

	Project	810-812 High Road	Job No.	13205
	Case No.	First Floor Joint FB1	Start page no.	1
	Case by	CF	Checked date	07/12/2015
Approved date		Approved by		

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-3:2002

TEKLA calculation version 1.3.17



Applied loading Beam loads

Dead full UDL 1.750 kN/m
Imposed full UDL 7.500 kN/m
Dead self weight of beam = 1

Analysis results

Maximum moment
Design moment
Maximum shear
Design shear
Total load on beam
Reactions at support A
Unfactored dead load reaction at support A
Unfactored imposed load reaction at support A
Reactions at support B
Unfactored dead load reaction at support B
Unfactored imposed load reaction at support B

$M_{max} = 22.624 \text{ kNm}$
 $N = \max(|M_{max}|/L, |M_{min}|/L) = 22.624 \text{ kNm}$
 $F_{max} = 21.045 \text{ kN}$
 $F = \max(|F_{max}|/L, |F_{min}|/L) = 21.045 \text{ kN}$
 $W_{tot} = 42.091 \text{ kN}$
 $R_{A,max} = 21.045 \text{ kN}$
 $R_{A,min} = 4.920 \text{ kN}$
 $R_{B,max} = 21.045 \text{ kN}$
 $R_{B,min} = 4.920 \text{ kN}$
 $R_{A,design} = 16.125 \text{ kN}$
 $R_{B,design} = 16.125 \text{ kN}$



Timber section details

Breadth of sections
Depth of sections
Number of sections in member
Overall breadth of member
Timber strength class
Member details
Service class of timber
Load duration
Length of bearing

$b = 250 \text{ mm}$
 $h = 229 \text{ mm}$
 $N = 1$
 $b_{tot} = N \times b = 250 \text{ mm}$
 040
 1
 Long term
 $L_b = 100 \text{ mm}$

The beam is part of a load-sharing system consisting of four or more members

	Project	810-812 High Road	Job No.	13205
	Case No.	First Floor Joint FB1	Start page no.	2
	Case by	CF	Checked date	07/12/2015
Approved date		Approved by		

Section properties

Cross sectional area of member
Section modulus

$A = N \times b \times h = 77000 \text{ mm}^2$
 $Z_x = N \times b \times h^2 / 6 = 2023333 \text{ mm}^3$
 $Z_y = h \times (N \times b^2 / 6) = 4491667 \text{ mm}^3$
 $I_x = N \times b \times h^3 / 12 = 316666667 \text{ mm}^4$
 $I_y = h \times (N \times b^3 / 12) = 785041667 \text{ mm}^4$
 $I_{xx} = \sqrt{I_x / A} = 63.5 \text{ mm}$
 $I_{yy} = \sqrt{I_y / A} = 101.0 \text{ mm}$

Modification factors

Duration of loading - Table 17
Bearing stress - Table 18
Total depth of member - cl.2.10.6
Load sharing - cl.2.9

$K_0 = 1.00$
 $K_1 = 1.00$
 $K_2 = 1.00$
 $K_3 = 1.00$

Lateral support

No lateral support
Permissible depth-to-breadth ratio - Table 19
Actual depth-to-breadth ratio

$h / (N \times b) = 0.83$
 2.00

Compression perpendicular to grain

Permissible bearing stress (no warping)
Applied bearing stress

$\sigma_{c,perp} = \sigma_{c,90} \times K_0 \times K_1 \times K_2 \times K_3 = 4.250 \text{ N/mm}^2$
 $\sigma_{c,perp} = R_{c,perp} / (N \times b \times L_b) = 0.805 \text{ N/mm}^2$
 $\sigma_{c,perp} / \sigma_{c,perp} = 0.140$

Bending parallel to grain

Permissible bending stress
Applied bending stress

$\sigma_{c,parallel} = \sigma_{c,0} \times K_0 \times K_1 \times K_2 \times K_3 = 14.227 \text{ N/mm}^2$
 $\sigma_{c,parallel} = M / Z_x = 8.013 \text{ N/mm}^2$
 $\sigma_{c,parallel} / \sigma_{c,parallel} = 0.563$

Shear parallel to grain

Permissible shear stress
Applied shear stress

$\tau_{parallel} = \tau \times K_0 \times K_1 = 2.200 \text{ N/mm}^2$
 $\tau_{parallel} = 3 \times F / (2 \times A) = 0.410 \text{ N/mm}^2$
 $\tau_{parallel} / \tau_{parallel} = 0.186$

Deflection

Modulus of elasticity for deflection
Permissible deflection
Bending deflection
Shear deflection
Total deflection

$E = E_{90} = 7500 \text{ N/mm}^2$
 $\delta_{perm} = \min(14 \text{ mm}, 0.002 \times L_b) = 12.950 \text{ mm}$
 $\delta_{b,def} = 18.708 \text{ mm}$
 $\delta_{s,def} = 0.752 \text{ mm}$
 $\delta_{tot} = \delta_{b,def} + \delta_{s,def} = 19.460 \text{ mm}$
 $\delta_{tot} / \delta_{perm} = 1.500$

Applied shear stress

Applied shear stress is less than permissible shear stress

Applied bending stress

Applied bending stress is less than permissible bending stress

Applied shear stress

Applied shear stress is less than permissible shear stress

Applied bending stress

Applied bending stress is less than permissible bending stress

Applied shear stress

Applied shear stress is less than permissible shear stress

Applied bending stress

Applied bending stress is less than permissible bending stress

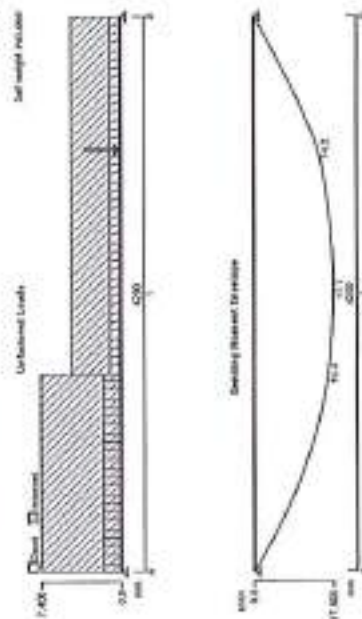
Applied shear stress

Applied shear stress is less than permissible shear stress

	Project	810-812 High Road	Job no.	15208
	Drawn by	First Floor Joint F02	Start page no./Revision	1
	Checked by	03/11/2015	Approved by	Approved date

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEKLA calculation version 1.6.07



Applied loading Beam loads

Dead point load 1.350 kN at 3200 mm
Imposed point load 3.400 kN at 3200 mm
Dead partial UDL 1.650 kN/m from 0 mm to 1500 mm
Imposed partial UDL 7.400 kN/m from 0 mm to 1500 mm
Dead partial UDL 1.000 kN/m from 1500 mm to 4200 mm
Imposed partial UDL 4.800 kN/m from 1500 mm to 4200 mm
Dead self weight of beam = 1

Analysis results

Design moment $M = 17.666$ kNm
Total load on beam $V_{tot} = 34.349$ kN
Reactions at support A $R_{A,tot} = 18.093$ kN
Unfactored dead load reaction at support A $R_{A,dead} = 4.174$ kN
Unfactored imposed load reaction at support A $R_{A,imposed} = 13.920$ kN
Reactions at support B $R_{B,tot} = 17.255$ kN
Unfactored dead load reaction at support B $R_{B,dead} = 4.254$ kN
Unfactored imposed load reaction at support B $R_{B,imposed} = 13.000$ kN



	Project	810-812 High Road	Job no.	15208
	Drawn by	First Floor Joint F02	Start page no./Revision	2
	Checked by	03/11/2015	Approved by	Approved date

Timber section details

Breadth of section

Number of sections

Timber strength class

Member details

Service class of timber

Length of bearing

The beam is part of a load-sharing system consisting of four or more members

Lateral support - cl.2.10.8

Permissible depth-to-breadth ratio 2.00

Actual depth-to-breadth ratio 0.73

PASS - Lateral support is adequate

Check bearing stress

Permissible bearing stress

Applied bearing stress

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

Bending parallel to grain

Permissible bending stress

Applied bending stress

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress

Applied shear stress

PASS - Applied shear stress is less than permissible shear stress

Deflection

Permissible deflection

Total deflection

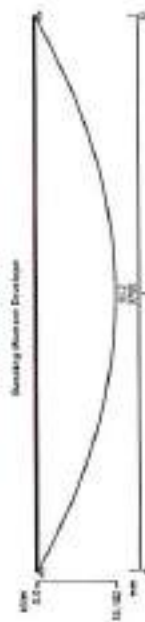
FAIL - Total deflection exceeds permissible deflection

UTILISATION = $\frac{17.355}{12.6} = 1.37$

	Project		Job no.	15208
	810-812 High Road		Start page no. Revision	
	First Floor Joint FBS		Approved by	
Calculated by	Checked by	Drawn by	Approved date	1
Calculated by	Checked by	Drawn by	Approved date	1

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TTC005 calculation version 1.077



Applied loading
Beam loads

Dead full UDL 1.670 kN/m
Imposed full UDL 7.600 kN/m
Dead self weight of beam $\times 1$

Analysis results

Maximum moment $M_{max} = 16.162 \text{ kNm}$
Design moment $M = \max(\text{abs}(M_{max}), \text{abs}(M_{min})) = 16.162 \text{ kNm}$
Maximum shear $F_{max} = 17.472 \text{ kN}$
Design shear $F = \max(\text{abs}(F_{max}), \text{abs}(F_{min})) = 17.472 \text{ kN}$
Total load on beam $V_{load} = 34.345 \text{ kN}$
Reactions at support A $R_{A,max} = 17.472 \text{ kN}$
Unfactored dead load reaction at support A $R_{A,dead} = 3.597 \text{ kN}$
Unfactored imposed load reaction at support A $R_{A,imposed} = 13.875 \text{ kN}$
Reactions at support B $R_{B,max} = 17.472 \text{ kN}$
Unfactored dead load reaction at support B $R_{B,dead} = 3.597 \text{ kN}$
Unfactored imposed load reaction at support B $R_{B,imposed} = 13.875 \text{ kN}$



Timber section details

Breadth of sections $b = 200 \text{ mm}$
Depth of sections $h = 200 \text{ mm}$
Number of sections in member $N = 1$
Overall breadth of member $b_0 = N \times b = 200 \text{ mm}$
Timber strength class **D40**

Member details

Service class of timber **1**
Load duration **Long term**
Length of bearing **$L_b = 106 \text{ mm}$**
The beam is part of a load-sharing system consisting of four or more members

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	810-812 High Road		Start page no. Revision	
	First Floor Joint FBS		Approved by	
Calculated by	Checked by	Drawn by	Approved date	2
Calculated by	Checked by	Drawn by	Approved date	2

Section properties

Cross sectional area of member
Section modulus

$A = N \times b \times h = 40000 \text{ mm}^2$
 $Z_x = N \times b \times h^2 / 6 = 1333333 \text{ mm}^3$
 $Z_y = N \times h \times b^2 / 6 = 1333333 \text{ mm}^3$
 $I_x = N \times b \times h^3 / 12 = 133333333 \text{ mm}^4$
 $I_y = N \times h \times b^3 / 12 = 133333333 \text{ mm}^4$
 $I_{xx} = \sqrt{I_x / A} = 57.7 \text{ mm}$
 $I_{yy} = \sqrt{I_y / A} = 57.7 \text{ mm}$

Second moment of area

Radius of gyration
Modification factors
Duration of loading - Table 17
Bearing stress - Table 18
Total depth of member - cl.2.10.6
Load sharing - cl.2.9
Lateral support - cl.2.10.8
No lateral support

Permissible depth-to-breadth ratio - Table 19
Actual depth-to-breadth ratio
 $h / (N \times b) = 1.00$
 $K_0 = 1.00$
 $K_1 = 1.00$
 $K_2 = (300 \text{ mm} / h)^{1.1} = 1.05$
 $K_3 = 1.10$

Compression perpendicular to grain
Permissible bearing stress (no wane)
Applied bearing stress
 $\sigma_{b,per} = \sigma_{b,0} \times K_0 \times K_1 \times K_2 \times K_3 = 4.200 \text{ N/mm}^2$
 $\sigma_{b,d} = \sigma_{b,per} / (N \times b \times L_{b,d}) = 0.074 \text{ N/mm}^2$
 $\sigma_{b,d} / \sigma_{b,per} = 0.200$

PASS - Lateral support is adequate

Bending parallel to grain

Permissible bending stress
Applied bending stress
 $\sigma_{b,par} = \sigma_{b,0} \times K_0 \times K_1 \times K_2 \times K_3 = 14.377 \text{ N/mm}^2$
 $\sigma_{b,d} = M / Z_x = 12.122 \text{ N/mm}^2$
 $\sigma_{b,d} / \sigma_{b,par} = 0.843$

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

Shear parallel to grain

Permissible shear stress
Applied shear stress
 $\tau_{s,par} = \tau_{s,0} \times K_0 \times K_1 \times K_2 = 2.200 \text{ N/mm}^2$
 $\tau_{s,d} = 3 \times F / (2 \times A) = 0.258 \text{ N/mm}^2$
 $\tau_{s,d} / \tau_{s,par} = 0.238$

PASS - Applied shear stress is less than permissible shear stress

Deflection

Modulus of elasticity for deflection
Permissible deflection
Bending deflection
Shear deflection
Total deflection
 $E = E_{mod} = 7500 \text{ N/mm}^2$
 $\delta_{lim} = \min(14 \text{ mm}, 0.002 \times L_{b,d}) = 14.160 \text{ mm}$
 $\delta_{b,d} = 23.048 \text{ mm}$
 $\delta_{s,d} = 1.034 \text{ mm}$
 $\delta_d = \delta_{b,d} + \delta_{s,d} = 34.082 \text{ mm}$
 $\delta_d / \delta_{lim} = 2.170$

FAIL - Total deflection exceeds permissible deflection

Second Floor Joists

- S.J.1

Width	60 mm	
Depth	230 mm	
Centres	400 mm	
Span	3.7 m	
Self weight	0.24 kN/m ²	(Density*width*depth/centres)
Gk	0.67 kN/m ²	
Gk	0.27 kN/m	
Qk	1 kN/m	
Grade	D40	

- S.J.2 SJ2 will not be checked as SJ2 is a worse case

Width	65 mm	
Depth	210 mm	
Centres	400 mm	
Span	2.2 m	
Self weight	0.24 kN/m ²	(Density*width*depth/centres)
Grade	D40	

Second Floor Beams

- S.B.1

Width	260 mm
Depth	200 mm
Load width	3 m
Span	4.1 m
Joist self weight	0.24 kN/m ²
Gk	0.67 kN/m ²
Gk	2.00 kN/m
Qk	7.5 kN/m
Grade	D40

- S.B.2

Width	290 mm	
Depth	220 mm	
Span	4.2 m	
Grade	D40	See over for loads

- S.B.3

Width	280 mm	
Depth	200 mm	
Span	3.7 m	
Grade	D40	See over for loads

Lyons O'Neill

45 Great Guildford Street
London
SE1 0ES

Project:

810-812 High Road

Job:

15208

Section:

Static Actions

Sheet No.

2.7.0

By:

CF

Date:

Dec-16

Checked by:

Date:

App'd.

Date:

- S.B.4

Width 260 mm

Depth 200 mm

Span 3.7 m

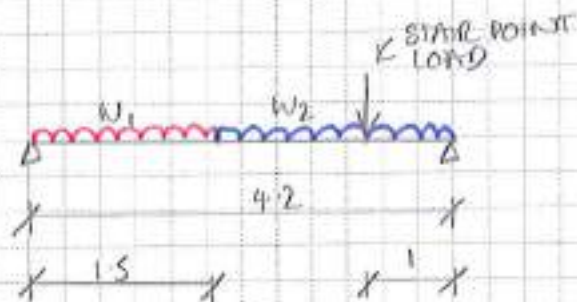
Grade D40

See over for loads

Job 15208 810-812 HIGHROAD
Title EXISTING STRUCTURE CHECKS

Date 12/15 Page 221
By CR Chkd

SECOND FLOOR BEAM - SB2 CONTINUED



LOADS

STAIR POINT LOAD

CONSERVATIVE

$$G_k = 1 \text{ kN/m}^2 \times 2.7 \times 2.0/4 = 1.35 \text{ kN}$$

$$Q_k = 1.5 \text{ " " " } = 3.4 \text{ kN}$$

$$W_{1Gk} = \frac{5.9 \text{ m}}{2} \times (0.24 \text{ kN/m}^2 + 0.43 \text{ kN/m}^2) = 2.08 \text{ kN/m}$$

$$W_{1Qk} = \frac{5.9 \text{ m}}{2} \times 2.5 \text{ kN/m}^2 = 7.4 \text{ kN/m}$$

$$W_{2Gk} = \frac{3.8 \text{ m}}{2} \times (0.24 \text{ kN/m}^2 + 0.43 \text{ kN/m}^2) = 1.27 \text{ kN/m}$$

$$W_{2Qk} = \frac{3.8 \text{ m}}{2} \times 2.5 \text{ kN/m}^2 = 4.75 \text{ kN/m}$$

Job 15205 810-812 HIGH ROAD
Title EXISTING STRUCTURE CHECKS

Date 12/15

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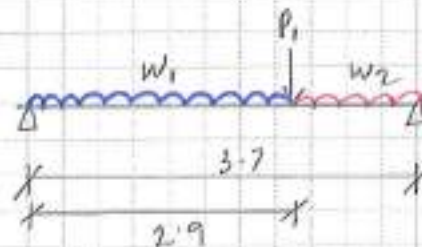
By CF

Chkd

SECOND FLOOR BEAM - SB3 CONTINUED

P₁ LOADED AREA

$$(1.3m + 2m) \times 2.8m / 4 \times \frac{2m}{3.3m} = 1.4m^2$$



LOADS

$$P_{1GK} = 1.4m^2 \times 0.67kN/m^2 = 0.94kN$$

$$P_{1QK} = 1.4m^2 \times 2.5kN/m^2 = 3.5kN$$

$$W_{1GK} = \frac{4m}{2} \times 0.67kN/m^2 = 1.34kN/m$$

$$W_{1QK} = \frac{4m}{2} \times 2.5kN/m^2 = 5kN/m$$

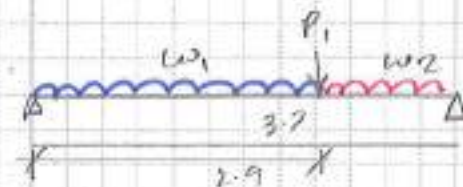
$$W_{2GK} = \frac{6m}{2} \times 0.67kN/m^2 = 2.0kN/m$$

$$W_{2QK} = \frac{6m}{2} \times 2.5kN/m^2 = 7.5kN/m$$

Job 15205 310-812 HIGH ROAD
Title EXISTING STRUCTURE CHECKS

Date 12/15 Page 2-23
By CF Chkd

SECOND FLOOR BEAM - SB4 CONTINUED



$$P_1 \text{ LOADED AREA} = (1.3\text{m} + 2\text{m}) \times 2.8\text{m} / 4 \times \frac{1.3\text{m}}{3.3\text{m}} = 0.91\text{m}^2$$

LOADS

$$P_{1GE} = 0.91\text{m}^2 \times 0.67\text{kN/m}^2 = 0.61\text{kN}$$

$$P_{1QE} = 0.91\text{m}^2 \times 2.5\text{kN/m}^2 = 2.28\text{kN}$$

$$w_{1GR} = \frac{4.2\text{m}}{2} \times 0.67\text{kN/m}^2 = 1.41\text{kN/m}$$

$$w_{1QR} = \frac{4.2\text{m}}{2} \times 2.5\text{kN/m}^2 = 5.25\text{kN/m}$$

$$w_{2GR} = \frac{5.5\text{m}}{2} \times 0.67\text{kN/m}^2 = 1.84\text{kN/m}$$

$$w_{2QR} = \frac{5.5\text{m}}{2} \times 2.5\text{kN/m}^2 = 6.88\text{kN/m}$$

TRUSS BEAM ANALYSIS & DESIGN TO BS 5951-2:2003

Applied loading
Dead loads

Load combinations
Load combination 1

Dead load (DL) = 2.112 kN/m
Imposed load (IL) = 2.112 kN/m

Support A

Support B

Analysis results

Design member

Design member

Design member

Design member

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Section properties

Class 300 DPA 300 C (mm)

Section Modulus

Section Modulus

Section Modulus

Section Modulus

Section Modulus

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	Project		810-812 High Road	Job no	150208
	Calcs for		Second Floor Joist SB1	Start page no/Revision	1
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				03/12/2015	

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEKLA calculation version 1.0.0



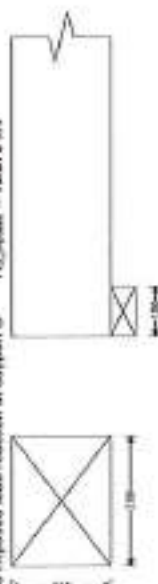
Applied loading

Beam loads

Dead full UDL 2.010 kN/m
Imposed full UDL 7.500 kN/m
Dead self weight of beam $\times 1$

Analysis results

Maximum moment $M_{max} = 20.712 \text{ kNm}$
Design moment $N = \max(M_{max}/M_{allow}, abs(M_{min})) = 20.712 \text{ kNm}$
Maximum shear $F_{max} = 20.207 \text{ kN}$
Design shear $F = \max(abs(F_{max})/F_{allow}, abs(F_{min})) = 20.207 \text{ kN}$
Total load on beam $W_{tot} = 40.414 \text{ kN}$
Reactions at support A $R_{A,dead} = 20.207 \text{ kN}$
Reactions at support B $R_{B,dead} = 20.207 \text{ kN}$
Unfactored dead load reaction at support A $R_{A,dead} = 4.832 \text{ kN}$
Unfactored imposed load reaction at support A $R_{A,imposed} = 15.375 \text{ kN}$
Reactions at support B $R_{B,dead} = 20.207 \text{ kN}$
Unfactored dead load reaction at support B $R_{B,dead} = 4.832 \text{ kN}$
Unfactored imposed load reaction at support B $R_{B,imposed} = 15.375 \text{ kN}$



Timber section details

Breadth of sections $b = 200 \text{ mm}$
Depth of sections $h = 260 \text{ mm}$
Number of sections in member $N = 1$
Overall breadth of member $b_N = N \times b = 200 \text{ mm}$
Timber strength class **D40**
Member details **1**
Service class of timber **Long term**
Load duration **L = 160 mm**
Length of bearing **The beam is part of a load-sharing system consisting of four or more members**

	Project		810-812 High Road	Job no	150208
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Section properties

Cross sectional area of member

Section modulus

Second moment of area

Radius of gyration

Modification factors

Duration of loading - Table 17

Bearing stress - Table 18

Total depth of member - cl.2.10.6

Load sharing - cl.2.9

Lateral support - cl.2.16.8

No lateral support

Permissible depth-to-breadth ratio - Table 19

Actual depth-to-breadth ratio

Compression perpendicular to grain

Permissible bearing stress (no warping)

Applied bearing stress

Bending parallel to grain

Permissible bending stress

Applied bending stress

Shear parallel to grain

Permissible shear stress

Applied shear stress

Deflection

Modulus of elasticity for deflection

Permissible deflection

Bending deflection

Shear deflection

Total deflection

$$A = N \times b \times h = 52020 \text{ mm}^2$$

$$Z_x = N \times b \times h^2 / 6 = 1733333 \text{ mm}^3$$

$$Z_y = h \times (N - b^2 / 6) = 2253333 \text{ mm}^3$$

$$I_x = N \times b \times h^3 / 12 = 173333333 \text{ mm}^4$$

$$I_y = h \times (N \times b^3 / 12 + 2 \times b \times h^3 / 12) = 292933333 \text{ mm}^4$$

$$r_x = \sqrt{I_x / A} = 57.7 \text{ mm}$$

$$r_y = \sqrt{I_y / A} = 75.1 \text{ mm}$$

$$K_0 = 1.00$$

$$K_1 = 1.00$$

$$K_2 = (300 \text{ mm} / h)^{0.11} = 1.05$$

$$K_3 = 1.10$$

$$h / (N \times b) = 0.77$$

$$\sigma_{c,perp} = \sigma_{c,perp} \times K_0 \times K_1 \times K_2 = 4.280 \text{ N/mm}^2$$

$$\sigma_{c,perp} = R_{c,perp} / (N \times b \times L) = 0.777 \text{ N/mm}^2$$

$$\sigma_{c,perp} / \sigma_{c,perp} = 0.181$$

$$\sigma_{c,par} = \sigma_{c,par} \times K_0 \times K_1 \times K_2 = 14.377 \text{ N/mm}^2$$

$$\sigma_{c,par} = M / Z_x = 11.549 \text{ N/mm}^2$$

$$\sigma_{c,par} / \sigma_{c,par} = 0.831$$

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

Bending parallel to grain

Permissible bending stress

Applied bending stress

Shear parallel to grain

Permissible shear stress

Applied shear stress

Deflection

Modulus of elasticity for deflection

Permissible deflection

Bending deflection

Shear deflection

Total deflection

$$E = E_{0.05} = 7500 \text{ N/mm}^2$$

$$\delta_{max} = \min(14 \text{ mm}, 0.005 \times L) = 12.300 \text{ mm}$$

$$\delta_{b,par} = 27.893 \text{ mm}$$

$$\delta_{s,par} = 1.020 \text{ mm}$$

$$\delta_{tot} = \delta_{b,par} + \delta_{s,par} = 28.916 \text{ mm}$$

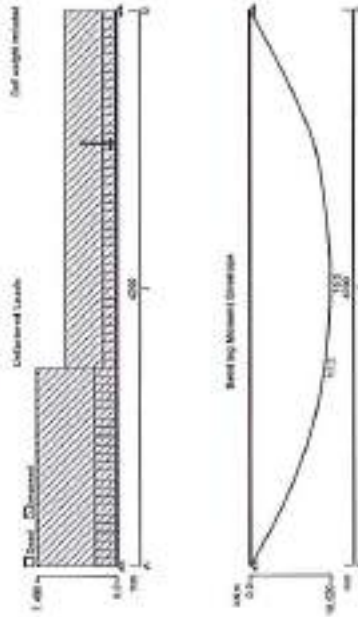
$$\delta_{tot} / \delta_{max} = 2.351$$

FAIL - Total deflection exceeds permissible deflection

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	Client for		Second Floor Joint SB2	Start page no. Revision	
	Client for		CF	Approved date	
Client for		Client for	CF	Approved date	

TIMBER BEAM ANALYSIS & DESIGN TO BS5269-2:2002

TCD05 calculation version 1.5.37



Applied loading Beam loads

Dead point load 1.350 kN at 3200 mm
Imposed point load 3.400 kN at 3200 mm
Dead partial UDL 2.000 kN/m from 0 mm to 1500 mm
Imposed partial UDL 7.400 kN/m from 0 mm to 1500 mm
Dead partial UDL 1.270 kN/m from 1500 mm to 4000 mm
Imposed partial UDL 4.750 kN/m from 1500 mm to 4000 mm
Dead self weight of beam = 1

Analysis results

Design moment $M = 18.857 \text{ kNm}$
Design shear $F = 18.857 \text{ kN}$
Total load on beam $W_{tot} = 36.943 \text{ kN}$
Reactions at support A $R_{A,tot} = 18.857 \text{ kN}$
Reactions at support B $R_{B,tot} = 18.857 \text{ kN}$
Unfactored imposed load reaction at support A $R_{A,imposed} = 4.808 \text{ kN}$
Unfactored imposed load reaction at support B $R_{B,imposed} = 14.866 \text{ kN}$
Unfactored dead load reaction at support A $R_{A,dead} = 14.049 \text{ kN}$
Unfactored dead load reaction at support B $R_{B,dead} = 4.811 \text{ kN}$
Unfactored imposed load reaction at support A $R_{A,imposed} = 13.275 \text{ kN}$
Unfactored imposed load reaction at support B $R_{B,imposed} = 13.275 \text{ kN}$



	Project		810-812 High Road	Job no.	15208
	Client for		Second Floor Joint SB2	Start page no. Revision	
	Client for		CF	Approved date	
Client for		Client for	CF	Approved date	

Timber section details

Breadth of section $b = 250 \text{ mm}$
Depth of section $h = 220 \text{ mm}$
Number of sections $N = 1$
Timber strength class $D40$
Member details $L_d = 100 \text{ mm}$
Service class of timber $L_d = 100 \text{ mm}$
Length of bearing $L_d = 100 \text{ mm}$
The beam is part of a load-sharing system consisting of four or more members
Lateral support - cl.2.10.8
Permissible depth-to-breadth ratio 2.02
Actual depth-to-breadth ratio 0.78
PASS - Lateral support is adequate

Check bearing stress

Permissible bearing stress $\sigma_{b,per} = 4.290 \text{ N/mm}^2$
Applied bearing stress $\sigma_{b,a} = 0.852 \text{ N/mm}^2$
PASS - Applied compressive stress is less than permissible compressive stress at bearing

Bending parallel to grain

Permissible bending stress $\sigma_{b,per} = 14.227 \text{ N/mm}^2$
Applied bending stress $\sigma_{b,a} = 7.917 \text{ N/mm}^2$
PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress $\tau_{shear,per} = 3.206 \text{ N/mm}^2$
Applied shear stress $\tau_{shear,a} = 0.445 \text{ N/mm}^2$
PASS - Applied shear stress is less than permissible shear stress

Deflection

Permissible deflection $\delta_{per} = 12.600 \text{ mm}$
Total deflection $\delta_a = 18.797 \text{ mm}$
FAIL - Total deflection exceeds permissible deflection

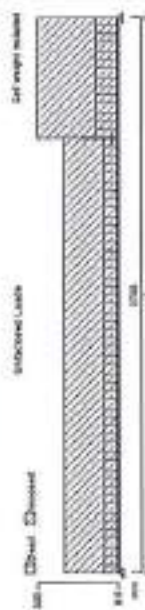
UTILISATION

$$\frac{18.797}{12.6} = 1.47$$

	Project		810-812 High Road		Job no.	15208
	Calculated by		Second Floor Joint SBS		Start date no. Revision	
	Calculated by		CF		Approved date	
Calculated by		Calculated date	Checked by	Checked date	Approved by	Approved date
CF		03/12/2015				

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEC001 calculation version 1.0.07



Applied loading
Beam loads

Dead point load 0.940 kN at 2500 mm
Imposed point load 3.500 kN at 2500 mm
Dead partial UDL 1.340 kN/m from 0 mm to 2500 mm
Imposed partial UDL 5.000 kN/m from 0 mm to 2500 mm
Dead partial UDL 2.000 kN/m from 2500 mm to 3700 mm
Imposed partial UDL 7.500 kN/m from 2500 mm to 3700 mm
Dead self weight of beam $\times$ l

Analysis results

Design moment
Total load on beam
Reactions at support A
Unfactored dead load reaction at support A
Unfactored imposed load reaction at support A
Reactions at support B
Unfactored dead load reaction at support B
Unfactored imposed load reaction at support B



Timber section details
Breadth of section

b = 250 mm

Depth of section

h = 250 mm

	Project		810-812 High Road		Job no.	15208
	Calculated by		Second Floor Joint SBS		Start date no. Revision	
	Calculated by		CF		Approved date	
Calculated by		Calculated date	Checked by	Checked date	Approved by	Approved date
CF		03/12/2015				

Number of sections
Timber strength class
Member details
Service class of timber
Length of bearing
This beam is part of a load-sharing system consisting of four or more members
Lateral support - cl. 2.10.2
Permissible depth-to-breadth ratio 2.00
Actual depth-to-breadth ratio 0.80
PASS - Lateral support is adequate

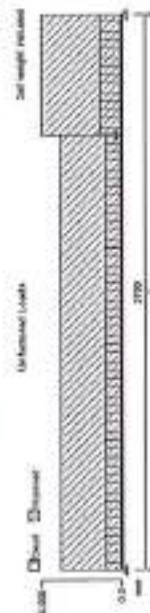
Check bearing stress
Permissible bearing stress
Applied bearing stress
PASS - Applied compressive stress is less than permissible compressive stress at bearing
Bending parallel to grain
Permissible bending stress
Applied bending stress
PASS - Applied bending stress is less than permissible bending stress
Shear parallel to grain
Permissible shear stress
Applied shear stress
PASS - Applied shear stress is less than permissible shear stress
Deflection
Permissible deflection
Total deflection
FAIL - Total deflection exceeds permissible deflection

$$UTILISATION \frac{14.507}{11.1} = 1.31$$

	Project	810-812 High Road	Job no.	15205
	Calcs for	Second Floor Joint S84	Start page no./Revision	1
	Calcs by	CF	Checked date	Approved date
	Calcs date	02/12/2015	Checked by	Approved by

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TE2026 utilisation example 1.5.09



Applied loading Beam loads

Dead point load 0.510 kN at 2900 mm
Imposed point load 2.380 kN at 2900 mm
Dead partial UDL 1.410 kN/m from 0 mm to 2900 mm
Imposed partial UDL 5.250 kN/m from 0 mm to 2900 mm
Dead partial UDL 1.840 kN/m from 2900 mm to 3700 mm
Imposed partial UDL 5.680 kN/m from 2900 mm to 3700 mm
Dead self weight of beam = 1

Analysis results

Design moment	$M = 13.586 \text{ kNm}$	Design shear	$F = 16.767 \text{ kN}$
Total load on beam	$W_{tot} = 30.602 \text{ kN}$		
Reactions at support A	$R_{A,tot} = 13.835 \text{ kN}$		
Unfractured dead load reaction at support A	$R_{A,dead} = 3.489 \text{ kN}$		
Unfractured imposed load reaction at support A	$R_{A,imposed} = 10.346 \text{ kN}$		
Reactions at support B	$R_{B,tot} = 16.767 \text{ kN}$		
Unfractured dead load reaction at support B	$R_{B,dead} = 4.185 \text{ kN}$		
Unfractured imposed load reaction at support B	$R_{B,imposed} = 12.582 \text{ kN}$		



Timber section details
Breadth of section

$b = 200 \text{ mm}$

Depth of section

$h = 200 \text{ mm}$

	Project	810-812 High Road	Job no.	15205
	Calcs for	Second Floor Joint S84	Start page no./Revision	2
	Calcs by	CF	Checked date	Approved date
	Calcs date	02/12/2015	Checked by	Approved by

Number of sections
Timber strength class
D40

Member details
Service class of timber
S1
Length of bearing
 $L_b = 180 \text{ mm}$
The beam is part of a load-sharing system consisting of four or more members
Lateral support - cl.2.10.8
Permissible depth-to-breadth ratio
2.00
Actual depth-to-breadth ratio
0.71
PASS - Lateral support is adequate

Check bearing stress
Permissible bearing stress
 $\sigma_{b,perm} = 4.250 \text{ N/mm}^2$
Applied bearing stress
 $\sigma_{b,app} = 0.584 \text{ N/mm}^2$
PASS - Applied compressive stress is less than permissible compressive stress at bearing

Bending parallel to grain
Permissible bending stress
 $\sigma_{m,perm} = 14.377 \text{ N/mm}^2$
Applied bending stress
 $\sigma_{m,app} = 7.273 \text{ N/mm}^2$
PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain
Permissible shear stress
 $\tau_{perm} = 2.250 \text{ N/mm}^2$
Applied shear stress
 $\tau_{app} = 0.429 \text{ N/mm}^2$
PASS - Applied shear stress is less than permissible shear stress

Deflection
Permissible deflection
 $\delta_{perm} = 11.180 \text{ mm}$
Total deflection
 $\delta_{tot} = 14.819 \text{ mm}$
PASS - Total deflection exceeds permissible deflection

$$UTILISATION \frac{14.6}{11.1} = 1.32$$

Third Floor Joists

- T.J.1

Width 60 mm

Depth 210 mm

Centres 400 mm

Span 2.8 m

Self weight 0.22 kN/m²

(Density*width*depth/centres)

Gk 0.65 kN/m²

Gk 0.26 kN/m

Qk 1 kN/m

Grade D40

Third Floor Beams

- T.B.1

Width 320 mm

Depth 210 mm

Load width 3 m

Span 4.3 m

Joist self weight 0.22 kN/m²

Gk 0.65 kN/m²

Gk 1.94 kN/m

Qk 1.5 kN/m

Grade D40

BEAM HAS BEEN REPLACED
PROPOSED BY COLLECTOR INVESTIGATION
AS NOTED

- T.B.2

Width 280 mm

Depth 200 mm

Span 3.7 m

Grade D40

See over for loads

- T.B.3

Width 170 mm

Depth 200 mm

Load width 1.5 m

Span 4.3 m

Joist self weight 0.22 kN/m²

Gk 0.65 kN/m²

Gk 0.97 kN/m

Qk 3.75 kN/m

Grade D40

Job 15256 810-812 HIGHROAD
Title EXISTING STRUCTURE CHECKS

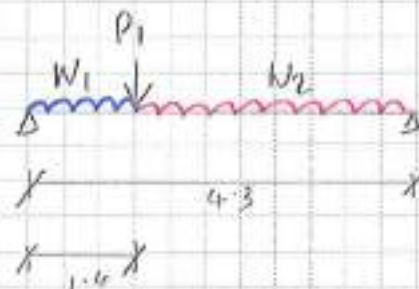
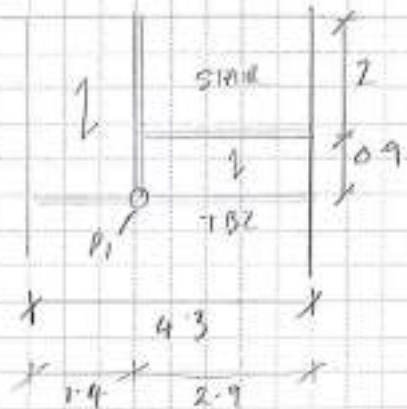
Date 12/15 Page 2-30
By CF Chkd

THIRD FLOOR BEAMS TBL CONSIDERED

P1 AREA

$$\text{STAIR} = \frac{2\text{m} \times 2.9\text{m}}{4} \times \frac{2\text{m}}{2.9\text{m}} = 1\text{m}^2$$

$$\text{FLOOR} = \frac{0.9\text{m} \times 2.9\text{m}}{4} \times \frac{2\text{m}}{2.9\text{m}} = 0.45\text{m}^2$$



LOADS

CONSIDER STAIR LOAD

$$P_{1GR} = 1\text{m}^2 \times 1\text{kN/m}^2 + 0.45\text{m}^2 \times 0.65\text{kN/m}^2 = 1.3\text{kN}$$

$$P_{1AK} = (1\text{m}^2 + 0.45\text{m}^2) \times 2.5\text{kN/m}^2 = 3.63\text{kN}$$

$$W_{1GR} = \frac{5\text{m}}{2} \times 0.65\text{kN/m}^2 = 1.63\text{kN/m}$$

$$W_{1AK} = \frac{5\text{m}}{2} \times 2.5\text{kN/m}^2 = 6.25\text{kN/m}$$

$$W_{2GR} = \frac{3\text{m}}{2} \times 0.65\text{kN/m}^2 = 0.98\text{kN/m}$$

$$W_{2AK} = \frac{3\text{m}}{2} \times 2.5\text{kN/m}^2 = 3.75\text{kN/m}$$

NAME	8" S4S-2 Hg. 9x12	DATE	11/20/19
OWNER	TR-107, 2000, 1000, 1000	DESIGNED BY	DESIGNED BY
DESIGNED BY	DESIGNED BY	CHECKED BY	CHECKED BY
DATE	11/20/19	DATE	11/20/19

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2012

Applied loading

Beam loads

Load combinations

Load combination

Analysis results

Maximum moment

Overall moment

Maximum shear

Design shear

Local load or support

Resistance of support A

Ultimate shear load resistance of support A

Resistance of support E

Ultimate shear load resistance of support E

Ultimate imposed load resistance of support E

Timber section details

Width of section

Depth of section

Number of members

Overall width of member

Timber strength class

Member details

Span to depth of member

Length of member

Timber strength class

Span to depth of member

Length of member

Dead load 10.0 kN/m

Imposed load 10.0 kN/m

Support A

Support E

Support E

Support E

Support E

Support E

Support E

Support E

Support E

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Support E

Dead load 10.0 kN/m

Imposed load 10.0 kN/m

Support A

Support E

Support E

Support E

Support E

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Dead load 10.0 kN/m

Imposed load 10.0 kN/m

Support A

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Dead load 10.0 kN/m

Imposed load 10.0 kN/m

Support A

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Dead load 10.0 kN/m

Imposed load 10.0 kN/m

Support A

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Dead load 10.0 kN/m

Imposed load 10.0 kN/m

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Dead load 10.0 kN/m

Imposed load 10.0 kN/m

Support A

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Dead load 10.0 kN/m

Imposed load 10.0 kN/m

Support A

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Dead load 10.0 kN/m

Imposed load 10.0 kN/m

Support A

Support E

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Support E

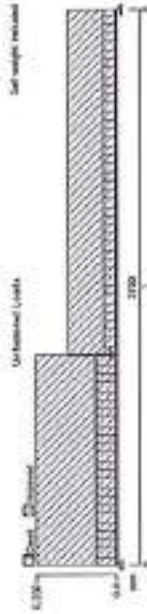
Support E

Support E

TEKLA TAXI	Project 810-812 High Road	Job no. 15203
Drawn by CF	Checked by 03/12/2015	Approved by 1
Calculated by CF	Calculated date 03/12/2015	Approved date

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDOS calculation number 15107



Applied loading
Beam loads

Dead point load 1.500 kN at 1400 mm
Imposed point load 3.630 kN at 1400 mm
Dead partial UDL 1.600 kN/m from 0 mm to 1400 mm
Imposed partial UDL 6.250 kN/m from 0 mm to 1400 mm
Dead partial UDL 0.980 kN/m from 1400 mm to 3700 mm
Imposed partial UDL 3.750 kN/m from 1400 mm to 3700 mm
Dead self weight of beam x 1

Analysis results

Design moment
Total load on beam
Reactions at support A
Reactions at support B
Unfactored imposed load reaction at support A
Reactions at support B
Unfactored dead load reaction at support A
Reactions at support B
Unfactored imposed load reaction at support A
Reactions at support B
Unfactored dead load reaction at support A
Reactions at support B
Unfactored imposed load reaction at support A
Reactions at support B



Timber section details
Breadth of section

b = 200 mm

Depth of section

h = 200 mm

TEKLA TAXI	Project 810-812 High Road	Job no. 15203
Drawn by CF	Checked by 03/12/2015	Approved by 2
Calculated by CF	Calculated date 03/12/2015	Approved date

Number of sections Timber strength class Member details Service class of timber Length of bearing This beam is part of a load-sharing system consisting of four or more members Lateral support - cl.2.10.8 Permissible depth-to-breadth ratio 2.00 Actual depth-to-breadth ratio 0.71 PASS - Lateral support is adequate	N = 1 D40 1 L _b = 100 mm Long term Load duration Applied bearing stress σ _{b,adm} = 4.290 N/mm ² Applied bearing stress σ _{b,app} = 0.575 N/mm ² PASS - Applied compressive stress is less than permissible compressive stress at bearing Applied bending stress σ _{m,adm} = 14.377 N/mm ² Applied bending stress σ _{m,app} = 7.728 N/mm ² PASS - Applied bending stress is less than permissible bending stress Applied shear stress τ _{adm} = 2.290 N/mm ² Applied shear stress τ _{app} = 0.431 N/mm ² PASS - Applied shear stress is less than permissible shear stress	Width of beam b _s = 200 mm Total deflection δ _{tot} = 14.711 mm PASS - Total deflection exceeds permissible deflection
--	---	--

$$\frac{14.711}{1.1} = 1.33$$

	Project		Job no		Approved date
	810-812 High Road		15206		
	Calculated by		Drawn by		
	Third Floor Joint TB3		1		
	Calculated by		Drawn by		
	CF	03/12/2015			

TIMBER BEAM ANALYSIS & DESIGN TO BS5958-2:2012

TECHNICAL DRAWING



Applied loading

Beam loads

Dead self weight UDL 0.970 kN/m
Imposed self weight UDL 3.750 kN/m
Dead self weight of beam = 1

Analysis results

Maximum moment $M_{max} = 11.449 \text{ kNm}$
Design moment $M = \max(|M_{max}|, |M_{min}|) = 11.449 \text{ kNm}$
Maximum shear $F_{max} = 10.650 \text{ kN}$
Design shear $F = \max(|F_{max}|, |F_{min}|) = 10.650 \text{ kN}$
Total load on beam $W_{tot} = 21.190 \text{ kN}$
Reactions at support A $R_{A, tot} = 10.650 \text{ kN}$
Reactions at support B $R_{B, tot} = 10.650 \text{ kN}$
Unfactored dead load reaction at support A $R_{A, dead} = 2.937 \text{ kN}$
Unfactored imposed load reaction at support A $R_{A, imposed} = 8.063 \text{ kN}$
Unfactored dead load reaction at support B $R_{B, dead} = 2.937 \text{ kN}$
Unfactored imposed load reaction at support B $R_{B, imposed} = 8.063 \text{ kN}$



Timber section details

Width of section $b = 170 \text{ mm}$
Depth of section $h = 200 \text{ mm}$
Number of sections in member $N = 1$
Overall breadth of member $b_{tot} = N \times b = 170 \text{ mm}$
Timber strength class $D40$
Member details 1
Service class of timber $Long term$
Load duration $L_d = 180 \text{ min}$
Length of bearing L_b

The beam is part of a load-bearing system consisting of four or more members

 TEKLA Tools	Project		Job no		Approved date
	810-812 High Road		15206		
	Sales ref		Start page no Revision		
	Third Floor Joint TB3		2		
	Calculated by		Checked by	Drawn by	
CF	03/12/2015				

Section properties

Cross sectional area of member

Section modulus

Second moment of area $I_x = N \times b \times h^3 / 12 = 11333333 \text{ mm}^4$
Radius of gyration $r_x = \sqrt{I_x / A} = 87.7 \text{ mm}$

Modification factors

Duration of loading - Table 17

Bearing stress - Table 18

Total depth of member - cl.2.10.8

Load sharing - cl.2.9

Lateral support - cl.2.10.3

No lateral support

Permissible depth-to-breadth ratio - Table 19

Actual depth-to-breadth ratio

Compression perpendicular to grain

Permissible bearing stress (no wave)

Applied bearing stress

Bending parallel to grain

Permissible bending stress

Applied bending stress

Shear parallel to grain

Permissible shear stress

Applied shear stress

Deflection

Modulus of elasticity for deflection

Permissible deflection

Bending deflection

Shear deflection

Total deflection

FAIL - Total deflection exceeds permissible deflection

3.0 - Deflection checks - existing and proposed loads

Project: RIG-B12 High Road				Job: 15208	
Section: Deflection checks				Sheet No: 61	
By: CF	Date: Dec-15	Chk'd by:	Date:	App'd:	Date:

Deflection checks

The joists and primary members all satisfied the british standard requirements for their bending and shear stress

The joists and ground floor primary members (those that were checked) all met the British standard requirements for deflection

The primary members on the first, second and third floors did not meet the deflection requirements of British Standard. The existing and proposed deflections for a sample of the members have been checked based on first principals. To compare the change in deflection and to compare against the typical deflection limits that we currently design to

A summary of their utilisation based on british standards is shown below

	utilisation	deflection
GJ1	<1	
GJ2	<1	
GB1	<1	
GB3	<1	
GB4	<1	
FJ1	<1	
FJ2	<1	
FJ3	<1	
FB1		1.5
FB2		1.3
FB3		2.17
SJ1	<1	
SJ2	<1	
SB1		2.35
SB2		1.49
SB3		1.31
SB4		1.32
TJ1	<1	
TB1		1.912
TB2		1.33
TB3		2.08

see over for the deflection checks based on first principals

Deflection checks

Grade D40 - original timber assumed $E_{min} = 7500 \text{ N/mm}^2$

FB1

$d = 220 \text{ mm}$
 $b = 350 \text{ mm}$
 $I = 310586667 \text{ mm}^4$
 Length = 4300 mm

Existing

$w_{yk} =$	1.76 kN/m	
$w_{yk(3m)} =$	0.54 kN/m	
$w_{yk(dead)} =$	2.30 kN/m	
$w_{yk} =$	4.5 kN/m	(3mx1.5kN/m ²)
$\delta_{dead} =$	4.4 mm	utilisation
$\delta_{live} =$	8.6 mm	0.72
$\delta_{total} =$	13.0 mm	0.76

FB1 - Proposed

$w_{yk(dead)} =$	2.30 kN/m	
$w_{yk} =$	7.5 kN/m	(3mx2.5kN/m ²)
$\delta_{dead} =$	4.4 mm	
$\delta_{live} =$	14.3 mm	1.20
$\delta_{total} =$	18.7 mm	1.08

Live load deflection limits = span/350 = **11.9 mm**

Dead and Live load deflection limits = span/250 = **17.2 mm**

Increase in deflection = **5.7 mm**

Deflection checks

Grade D40 - original timber - assumed

$E_{min} = 7500 \text{ N/mm}^2$

FB3

$d = 200 \text{ mm}$

$b = 200 \text{ mm}$

$I = 133333333 \text{ mm}^4$

Length = 3700 mm

Existing

$w_{sk} = 1.67 \text{ kN/m}$

$w_{sk(swl)} = 0.28 \text{ kN/m}$

$w_{sk(swl)} = 1.95 \text{ kN/m}$

$w_{ck} = 4.5 \text{ kN/m}$ (3mx1.5kN/m²)

$\delta_{dead} = 4.8 \text{ mm}$

$\delta_{live} = 11.0 \text{ mm}$

$\delta_{total} = 15.7 \text{ mm}$

$$\delta = \frac{5 \times w \times l^4}{384 \times E \times I}$$

utilisation

1.07

1.06

FB1 - Proposed

$w_{sk(swl)} = 1.95 \text{ kN/m}$

$w_{ck} = 7.5 \text{ kN/m}$ (3mx2.5kN/m²)

$\delta_{dead} = 4.8 \text{ mm}$

$\delta_{live} = 18.3 \text{ mm}$

$\delta_{total} = 23.1 \text{ mm}$

1.78

1.56

Live load deflection limits = span/360 = 10.3 mm

Dead and Live load deflection limits = span/250 = 14.8 mm

Increase in deflection = 7.3 mm

Deflection checks

Grade D40 - original timber - assumed $E_{tim} = 7500 \text{ N/mm}^2$

SB1

$d = 200 \text{ mm}$
 $b = 260 \text{ mm}$
 $I = 173333333 \text{ mm}^4$
Length = 4100 mm

Existing

$w_{GK} = 2 \text{ kN/m}$
 $w_{GKrel} = 0.36 \text{ kN/m}$
 $w_{GKtotal} = 2.36 \text{ kN/m}$
 $w_{ek} = 4.5 \text{ kN/m}$ (3mx1.5kN/m²)
 $\delta_{dead} = 6.7 \text{ mm}$
 $\delta_{live} = 12.7 \text{ mm}$
 $\delta_{total} = 19.4 \text{ mm}$

$$\delta = \frac{5 \times w \times l^4}{384 \times E \times I}$$

utilisation
1.12
1.18

FB1 - Proposed

$w_{GKtotal} = 2.36 \text{ kN/m}$
 $w_{ek} = 7.5 \text{ kN/m}$ (3mx2.5kN/m²)
 $\delta_{dead} = 6.7 \text{ mm}$
 $\delta_{live} = 21.2 \text{ mm}$
 $\delta_{total} = 27.9 \text{ mm}$

1.88
1.70

Live load deflection limits = span/360 = 11.4 mm
Dead and Live load deflection limits = span/260 = 16.4 mm

Increase in deflection = 8.5 mm

Project: 810-812 High Road				Job: 15208	
Section: Deflection checks				Sheet No: 5	
By: CF	Date: Dec-15	Chk'd by	Date:	App'd:	Date:

Deflection checks

Grade D40 - original timber - assumed $E_{min} = 7500 \text{ N/mm}^2$

TB1

$d = 210 \text{ mm}$
 $b = 320 \text{ mm}$
 $I = 246930000 \text{ mm}^4$
 Length = 4300 mm

Existing

$w_{Gk} = 1.84 \text{ kN/m}$
 $w_{Gk(swl)} = 0.47 \text{ kN/m}$
 $w_{Gk(total)} = 2.41 \text{ kN/m}$
 $w_{qk} = 4.5 \text{ kN/m}$ (3mx1.5kN/m²)
 $\delta_{dead} = 5.8 \text{ mm}$
 $\delta_{live} = 10.8 \text{ mm}$
 $\delta_{total} = 16.6 \text{ mm}$

$$\delta = \frac{5 \times w \times l^4}{384 \times E \times I} \quad \text{utilisation}$$

0.91
0.97

FB1 - Proposed

$w_{Gk(total)} = 2.41 \text{ kN/m}$
 $w_{qk} = 7.5 \text{ kN/m}$ (3mx2.5kN/m²)
 $\delta_{dead} = 5.8 \text{ mm}$
 $\delta_{live} = 18.0 \text{ mm}$
 $\delta_{total} = 23.8 \text{ mm}$

1.51
1.38

Live load deflection limits = span/360 = 11.9 mm
 Dead and Live load deflection limits = span/250 = 17.2 mm

Increase in deflection = 7.2 mm

Deflection checks

Grade: D10 - original timber - assumed Emin = 7500 N/mm²

TB3

d = 200 mm
 b = 170 mm
 I = 113333333 mm⁴
 length = 4300 mm

Existing

w_{gk} = 0.97 kN/m
 w_{gk(su)} = 0.24 kN/m
 w_{gk(total)} = 1.21 kN/m
 w_{qk} = 2.25 kN/m (1.5m x 1.5kN/m²)
 δ_{dead} = 6.3 mm
 δ_{live} = 11.8 mm
 δ_{total} = 18.1 mm

$$\delta = \frac{5 \times w \times l^4}{384 \times E \times I}$$

utilisation
0.99
1.05

FB1 - Proposed

w_{gk(total)} = 1.21 kN/m
 w_{qk} = 3.75 kN/m (1.5m x 2.5kN/m²)
 δ_{dead} = 6.3 mm
 δ_{live} = 19.6 mm
 δ_{total} = 26.0 mm

1.84
1.51

Live load deflection limit = span/360 = 11.9 mm
 Dead and Live load deflection limit = span/250 = 17.2 mm

Increase in deflection = 7.9 mm

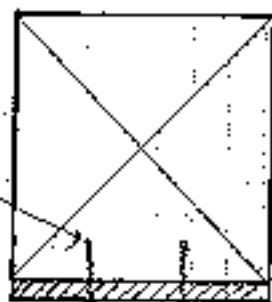
4.0 - Timber beam strengthening

Timber beam strengthening

The Primary beams on the First-Third floors are likely to require strengthening based on the current assumptions of timber grade. It is proposed that this is done by fixing a steel plate to the underside with little and often screws to fix the plate into the timber.

The calculation for a typical detail for this is shown on the following pages.

4-8.8 Ø
SCREWS @ REGULAR
CENTRES OR PLAN
ABOVE



EXISTING TIMBER
BEAM

15mm STEEL PLATE

typical section through timber beam and plate

Job 15205 810-812 HIGH LOAD
Title PROPOSED MEMBER CHECK

Date 12/15 Page 4.2
By CF Chkd

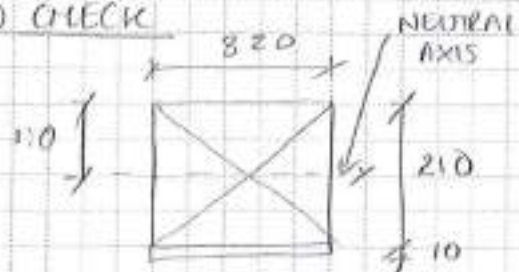
TBI COMPOSITE MEMBER HAND CHECK

LOADS:

$$W_{GR} = 2.41 \text{ kN/m}$$

$$W_{QR} = 7.5 \text{ kN/m}$$

$$\text{SPAN} = 4.3 \text{ m}$$



TIMBER SECTION:

$$d = 210 \text{ mm}$$

$$b = 320 \text{ mm}$$

$$Y_{\text{neutral}} = 110 \text{ mm}$$

$$I_{\text{timber}} = \frac{320 \text{ mm} \times 210 \text{ mm}^3}{12} + 320 \text{ mm} \times 210 \text{ mm} (115 \text{ mm} - 110)^2$$

$$= 2.49 \times 10^8 \text{ mm}^4$$

STEEL SECTION:

$$d = 10 \text{ mm}$$

$$b = 320 \text{ mm}$$

$$Y_{\text{neutral}} = 10 \text{ mm}$$

$$I_{\text{plate}} = \frac{320 \times 10^3}{12} + 320 \times 10 \times (110 - 5)^2$$

$$= 3.53 \times 10^8 \text{ mm}^4$$

$$d_{\text{live}} = \frac{5 \times 7.5 \times 4300^4}{384 \times (205 \times 10^3 \times 3.53 \times 10^8 + 7500 \times 2.49 \times 10^8)} = 3.67 \text{ mm}$$

$$d_{\text{dead+live}} = \frac{5 \times (2.41 + 7.5) \times 4300^4}{384 \times (205 \times 10^3 \times 3.53 \times 10^8 + 7500 \times 2.49 \times 10^8)} = 4.85 \text{ mm}$$

Project: 810-812 High Road				Job: 15208	
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TB1 composite design

$d = 210 \text{ mm}$
 $b = 320 \text{ mm}$
 $I = 248840000 \text{ mm}^4$
 $\text{Length} = 4300 \text{ mm}$

$w_{dead} = 2.41 \text{ kN/m}$
 $w_{ok} = 7.5 \text{ kN/m} \quad (3\text{mx}2.5\text{kN/m}^2)$

composite section:

depth to neutral axis = 110 mm

Timber beam

$d = 210 \text{ mm}$
 $b = 320 \text{ mm}$
 $\text{centre} = 115 \text{ mm}$

Steel Plate:

$d = 10 \text{ mm}$
 $b = 320 \text{ mm}$
 $\text{centre} = 5 \text{ mm}$

$I_{timber} = 248840000 \text{ mm}^4$
 $I_{plate} = 35306886.7 \text{ mm}^4$

$E = 7500 \text{ N/mm}^2$
 $E = 205000 \text{ N/mm}^2$

$\delta_{dead} = 1.18 \text{ mm}$
 $\delta_{live} = 3.67 \text{ mm}$
 $\delta_{total} = 4.85 \text{ mm}$

→ SLAB IS WITHIN ALLOW

TB3 composite beam

d = 200 mm

b = 170 mm

I = 113333333 mm⁴

Length = 4300 mm

W_{g, total} = 1.21 kN/m

W_{gc} = 3.75 kN/m (1.5m x 2.5 kN/m²)

depth to neutral axis = 105 mm

Timber beam:

d = 200 mm

b = 170 mm

centre = 110 mm

Steel Plate:

d = 10 mm

b = 170 mm

y = 5 mm

I_{timber} = 114183333 mm⁴

I_{plate} = 170141667 mm⁴

E = 7500 N/mm²

E = 205000 N/mm²

δ_{dead} = 1.24 mm

δ_{live} = 3.84 mm

δ_{total} = 5.08 mm

Slip plane shear Stress

S = 10664 kN

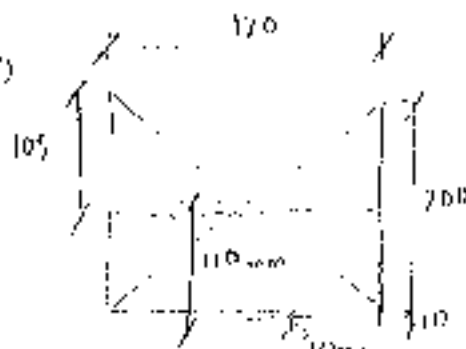
A = 34000 mm²

Y = 5 mm

I = 131197500 mm⁴

I = 170 mm

f_q = 0.08 N/mm²



$$\delta = \frac{W_{gc} \cdot L^4}{8 \cdot E \cdot I} + \frac{W_{g, total} \cdot L^4}{8 \cdot E \cdot I}$$

$$f_q = \frac{SAY}{It}$$

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Chkd

TBS PLATE SCREW FIXING DESIGN

$$f_q = 0.08 \text{ N/mm}^2 \Rightarrow 80 \text{ kN/m}^2$$

Vcap 1NO AN10 4.88 mm ϕ 35mm Penetration = 0.64 kN

NO SCREWS required /m² =

$$\frac{80 \text{ kN/m}^2}{0.64 \text{ kN}} = 125 \text{ NO}$$

WIDTH = 170mm

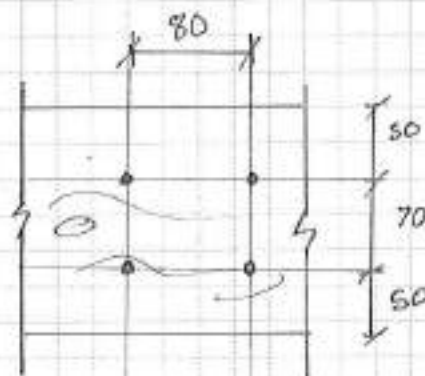
2 NO Across Width

$$\therefore \frac{1\text{m}}{0.17\text{m}} \div \frac{125\text{NO}}{2} = 0.094\text{m}$$

$\therefore$ 2 SCREWS REQUIRED @ max 0.094m

$\Rightarrow$ 80mm CENTRES

max spacing = $10d = 48.8 \Rightarrow 94\text{mm} \checkmark \text{OK}$



PLAN OF SOFAT OF BEAM

5.0 - End bearing checks

Concentrated end bearing stress checks

The bearing stress for the primary beams has been calculated. The bearing length is assumed to be 100mm, however further investigation will be required to determine this

The concentrated bearing stress capacity is assumed to be 0.63N/mm^2

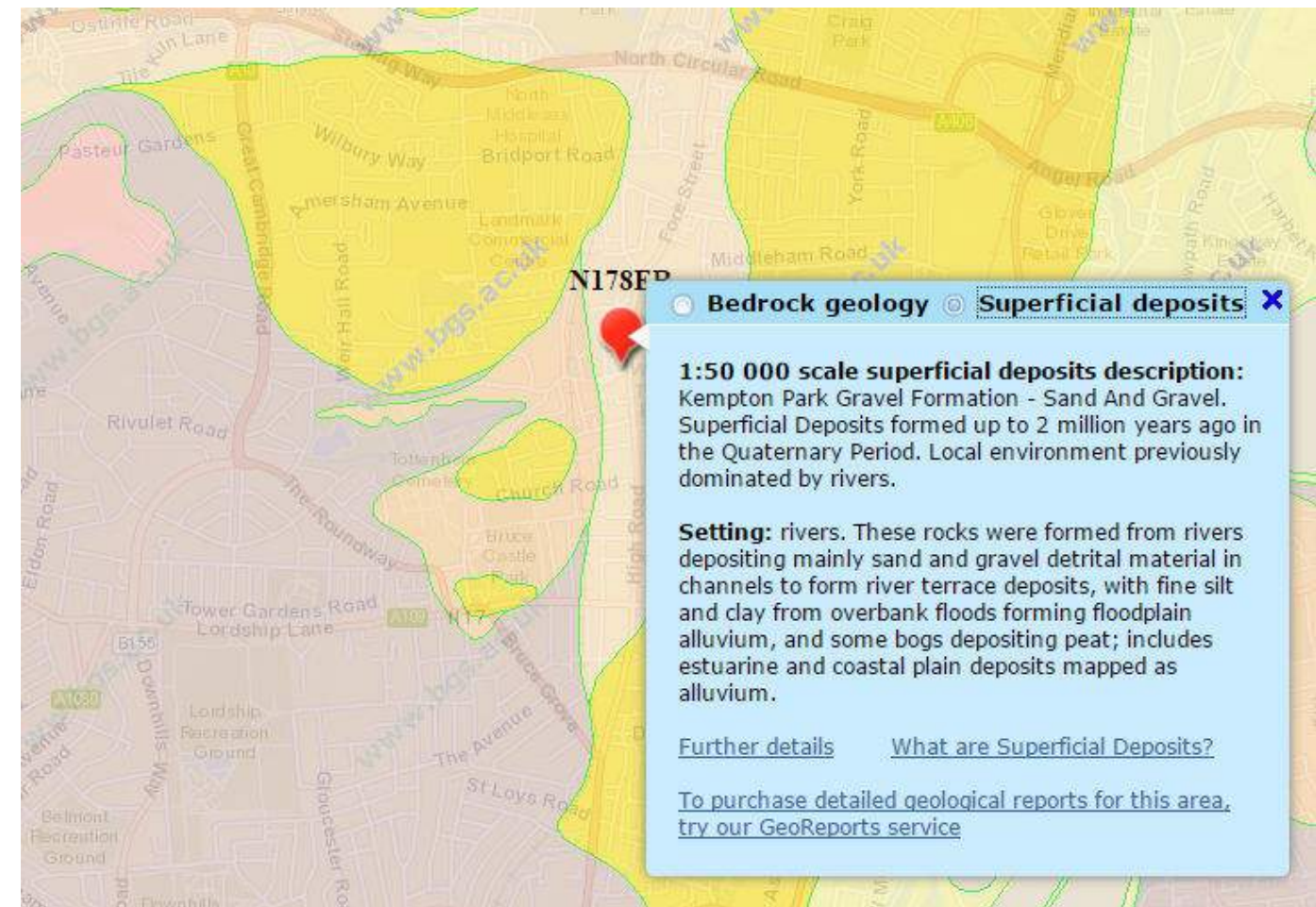
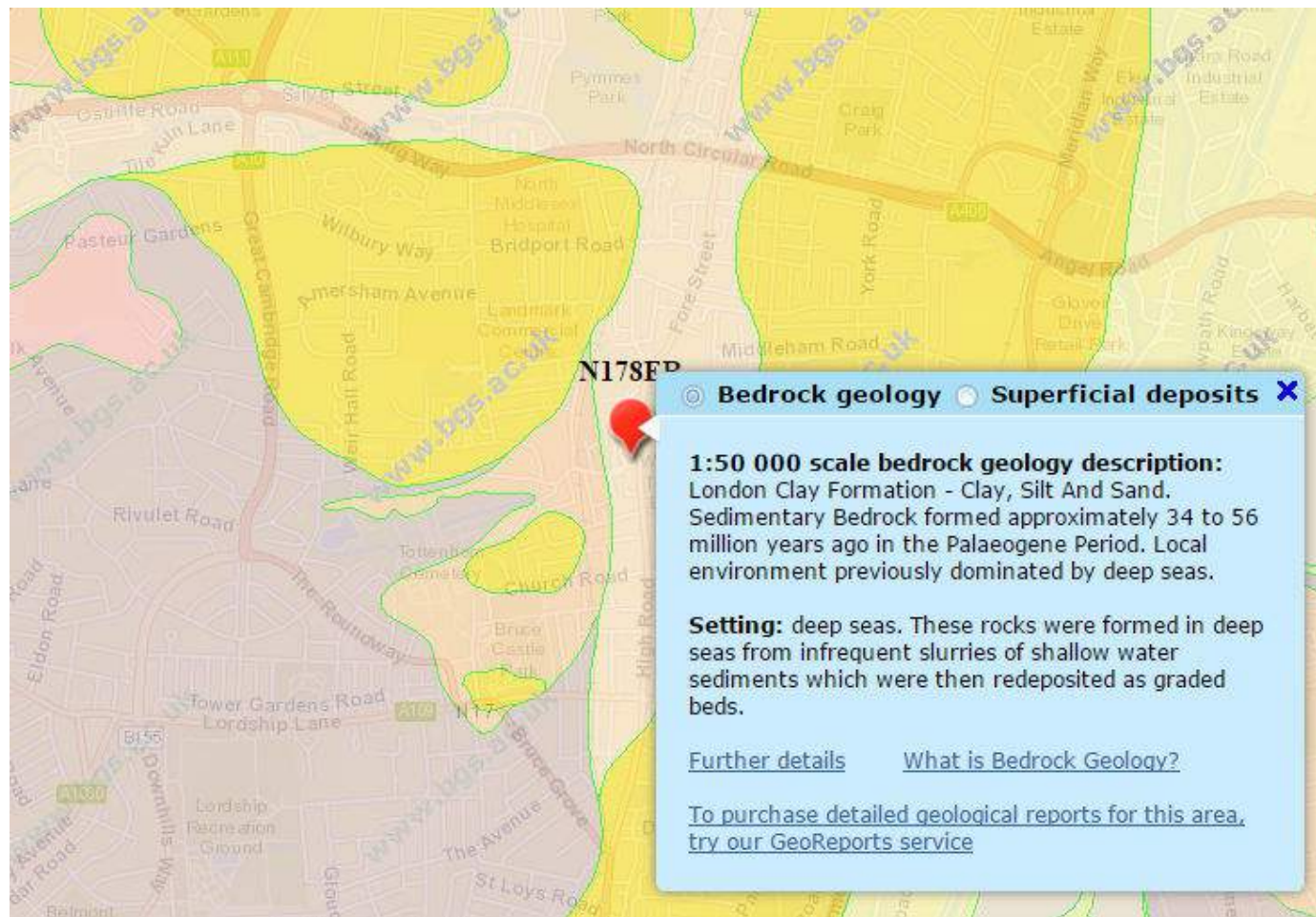
$$GB1 = 16.1\text{kN} \times 10^3 / (290\text{mm} \times 100\text{mm}) = 0.56\text{N/mm}^2$$

	End Force kN	width mm	stress N/mm ²	
GB1	16.1	290	0.56	
GB2	5.0	150	0.33	
GB3	9.0	175	0.51	
GB4	12.1	280	0.43	
FB1	21.0	350	0.60	
FB2	18.0	300	0.60	
FB3	17.5	200	0.88	>0.63N/mm ²
SB1	20.2	260	0.78	>0.63N/mm ²
SB2	18.9	290	0.65	>0.63N/mm ²
SB3	13.7	260	0.53	
SB4	16.7	280	0.60	
IB1	21.3	320	0.67	>0.63N/mm ²
IB2	18.1	280	0.65	
IB3	10.6	170	0.62	

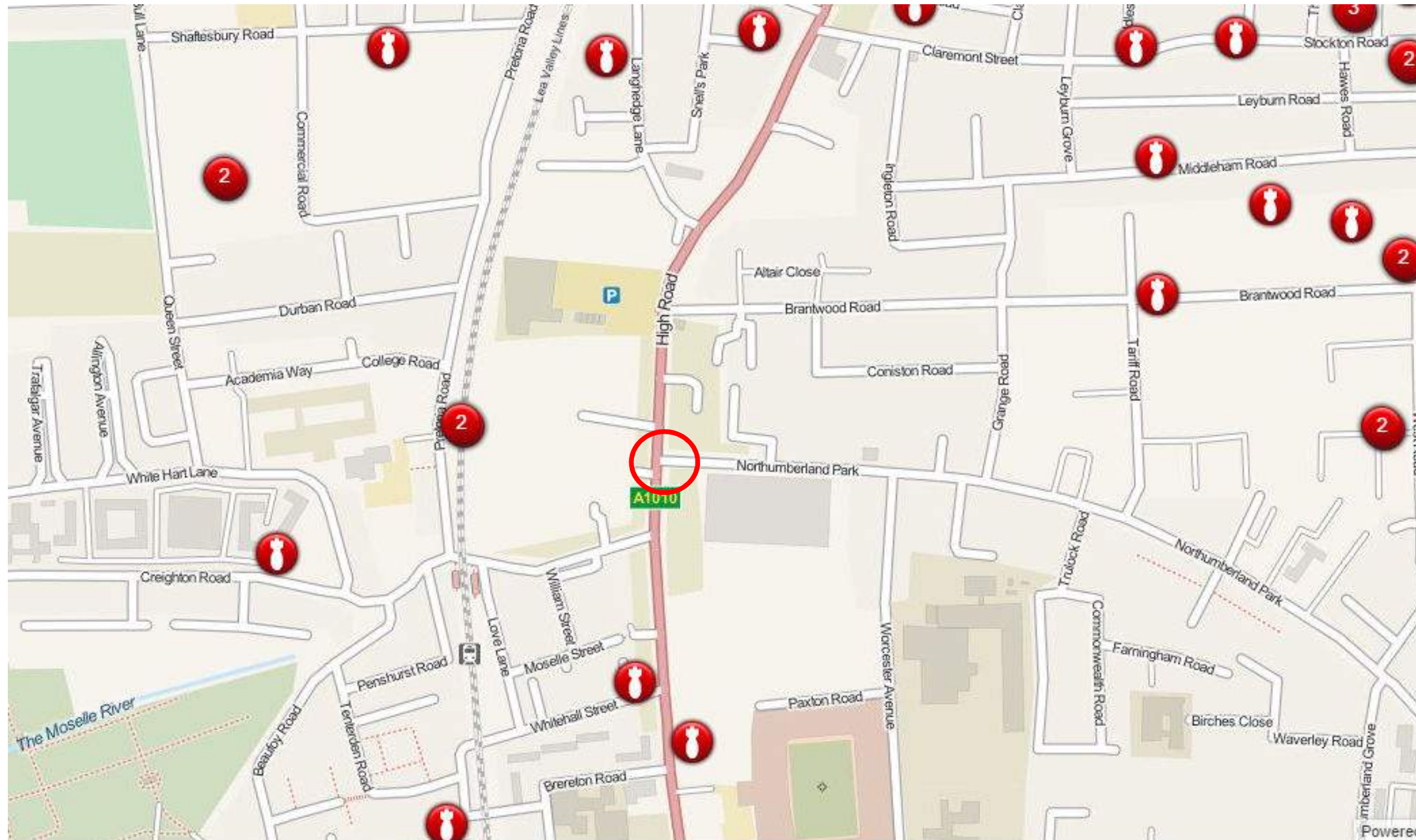
The bearing stresses of FB3, SB1, SB2 have a bearing stress of more than 0.63N/mm^2 , assuming the bearing length is 100mm

Appendix D

Historical and Geological Maps



Geological Survey



World War 2 Bomb Damage Map

810-812 High Road, Tottenham N17 8ER

December 2015