STRUCTURAL ENGINEER'S REPORT

1st Floor at 26 Mornington Terrace London NW1 7RS

REF:20124

ads consultancy

The Institution of StructuralEngineers

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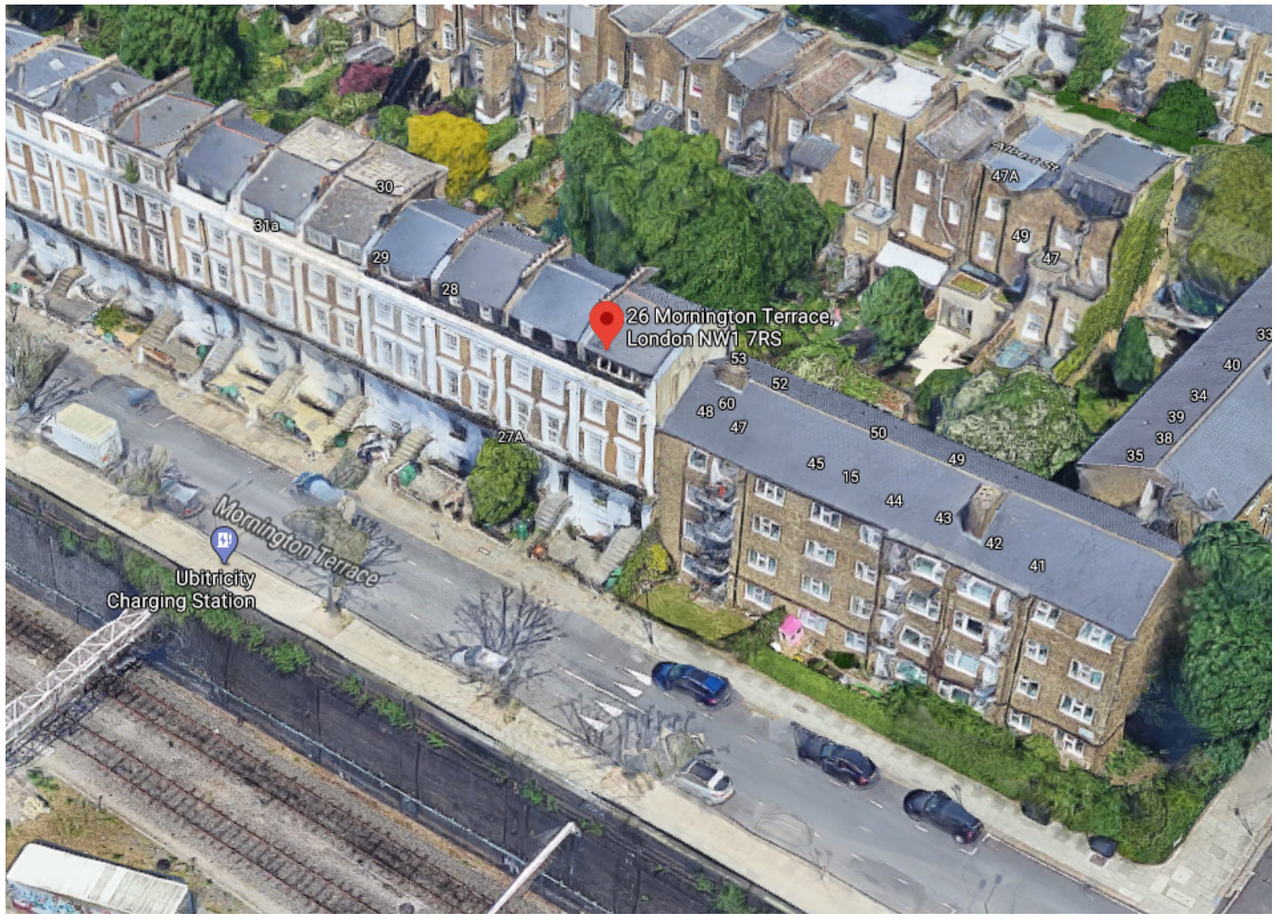
INTRODUCTION



Introduction

The property is an existing five storey terrace, at 26 Mornington Terrace. It lies circa 450m South of Camden Town Underground station and circa 300m West-North West of Mornington Crescent Underground Station. Each floor is currently a separate residential dwelling, and the strucure seems to be of traditional construction, i.e. load bearing masonry with timber floors and a timber roof.

We were called to visit site by Shoreditch UK, as they were worried about the condition and structural integrity of an existing timber stud, during redecorating / refurbishing the first floor flat. The existing timber stud in question was in line with the internal spine wall, running along the middle of the property and parallel to the street/Mornington Terrace. The stud was supporting existing timber trusses. Please refer to relevant photos on page 3 of this report and existing elevation of the spine wall and trusses in Appendix A, also indicating the existing timber stud.

Stephanos Nicolaou, Associate Director of the practice, visited the site 21st July 2020. It should be noted that ADS Consultancy had access only to the first floor.

Calculations

Following our site visit, calculations have been carried out and the existing timber stud could not be proved structurally adequate (i.e. it failed in our calculations). Hence, it was proposed to introduce steel structure to support the relevant load. This was in the form of 2No. steel parallel flange channels (PFCs) on either side of the existing top cord timber plate of the trusses and timber stud spine wall. Please refer to relevant calculations in this report, as well as the proposed elevation and details in Appendix A.

INTRODUCTION

Site: 26 Mornington Terrace | **Made by SN**
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SuperBeam 4.60d 440380 | **20124_Current.SBW** | **Printed 29 Dec 2020 17:23**

Calculations for timber post/stud to BS5268 Part 2: 2002 using C16 timber

Location: Existing 90x90mm Timber Stud

Pos	Load	Dead kN	Live kN	Total kN
A	2nd and Loft	11.84	17.75	29.59
A	Partitions	5.70	0.00	5.70
A	Roof	8.76	0.00	8.76
A	Timber Stud wall over	9.10	0.00	9.10
Total load		35.40	17.75	53.15

Member length = 2.8m. Effective lengths: L_{Ex} = 1.0L = 2.8 m. L_{Ey} = 1.0L = 2.8 m.

Use: **90 x 90 C16**

Cross sectional area = 8,100 mm^2 Z_{xx} = 121.5 cm^3

K_3 (loading duration factor) = 1.00 K_8 (load sharing factor) = 1.0

Slenderness is critical about the yy axis r_{yy} = 90/√12 = 26.0 mm

Slenderness ratio, λ_{yy} = 2.8 x 1000/26 = 108

Grade permissible compressive stress, $\sigma_{c,g}$ = 6.8 N/mm^2

Compressive stress used to determine K_{12}, $\sigma_{c,g}.K_3$ = 6.8 x 1.00 = 6.80 N/mm^2

E value used to determine K_{12} = 5,800 N/mm^2 (E_{min})

K_{12} (compression modification factor) = 0.346

Permissible compressive stress, $\sigma_{c,adm}$ = 6.80 x 0.346 = 2.35 N/mm^2

Applied compressive stress, $\sigma_{c,a}$ = 53.15 x 1000/8,100 = 6.56 N/mm^2 **FAIL**

Member fails in compression

Above: structural calculations relating to the exiting 90x90mm timber stud

Right hand side: Structural calculations for the steel PFCs to provide the required structural support

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Beam: **Beam #1** **Span: 5.2 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	D	o.w.	1.1	0		L	2.86	2.86
V	D	2nd&Loft Floor sw	1*7.8*0.5*2	0	1*7.8*0.5*2	3.15	17.13	7.44
V	L	2nd&Loft Floor Occ	1.5*7.8*0.5*2	0	1.5*7.8*0.5*2	3.15	25.69	11.16
V	D	2ndst&Loft Partitions	0.5*7.5*0.5*2	0	0.5*7.5*0.5*2	3.15	8.23	3.58
V	D	Roof	1.5*7.7*0.5	0	1.5*7.7*0.5	3.15	12.68	5.51
V	D	Timber stud wall over	1*3*2	0	1*3*2	3.15	13.18	5.72
					Total load: 116.05 kN		**79.77**	**36.28**
						Dead:	*54.08*	*25.11*
						Live:	*25.69*	*11.16*

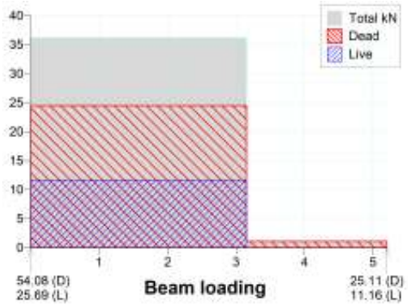
Load types: U:UDL V:Variable load D: Dead; L: Live (positions in m. from R1)

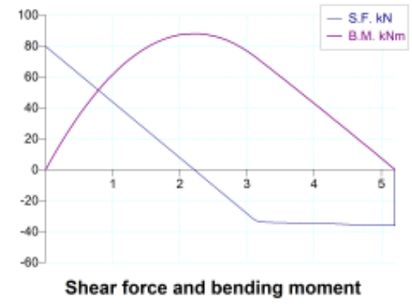
Maximum B.M. = 88.1 kNm at 2.21 m. from R1

Maximum S.F. = 79.8 kN at 0.00 m. from R1

Live load deflection = 74.4 x 10^8/EI at 2.47 m. from R1 *(E in N/mm^2, I in cm^4)*

Total deflection = 233.1 x 10^8/EI at 2.47 m. from R1





Steel calculation to BS449 Part 2 using S355 steel

SECTION SIZE : **2No 300 x 100 x 46 PFC S355**

D=300.0 mm B=100.0 mm t=9.0 mm T=16.5 mm I_x=8,230 cm^4 r_y=3.13 cm Z_x=549 cm^3 *(per section)*

L_E/r_y = 5.20 x 100/3.13 = 166 D/T = 18.2

Permissible bending stress, p_{bc} = 114.7 N/mm^2 (Table 3b)

Actual bending stress, f_{bc} = 88.1 x 1000/(2 x 549.0) = 80.2 N/mm^2 OK

Maximum shear in web, f_s = 79.8 x 1000/(2 x 9.0 x 300.0) = 14.8 N/mm^2 OK

Web buckling and crushing have not been checked

Live load deflection = 74.4 x 1e8/(2 x 205,000 x 8,230) = 2.2 mm (L/2359) OK

Total deflection = 233 x 1e8/(2 x 205,000 x 8,230) = 6.9 mm (L/753)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2$ = 0.489 at 2.18 m. (<=1.25 OK)

Bearings *(bearing plate sizing to BS5950-1:2000)*

300 x 100 x 46 PFC stiff bearing length, b_1 = t + 0.8r + T = 37.5 mm; O/A b_1 taken as 75 mm

Masonry: 10N/mm^2 brick, class (iii) mortar, normal const/normal mfr, Class 1 bearing
Local design strength (factored) = 3.4 x 1.25/3.5 = 1.21N/mm^2 (BS5628-1:2005 Table 2a)

R1: 1000 x 100 mm bearing plate

Factored reaction = 54.08 x 1.4 + 25.69 x 1.6 = 116.82 kN

55 mm m.s. bearing plate, size 1000 x 100 mm
Bearing plate projection beyond stiff bearing length = (1000-75)/2 = 462.5mm
Factored stress under plate = 116.82 x 1000/1000 x 100 = 1.17 N/mm^2
Required plate thickness = √(3x1.17x463x463/255) = 54.2 mm: use 55mm
Factored bending stress in plate = 1.17x463x(463/2)/(55x55/6) = 247.8 N/mm^2 (p_y=255 N/mm^2)

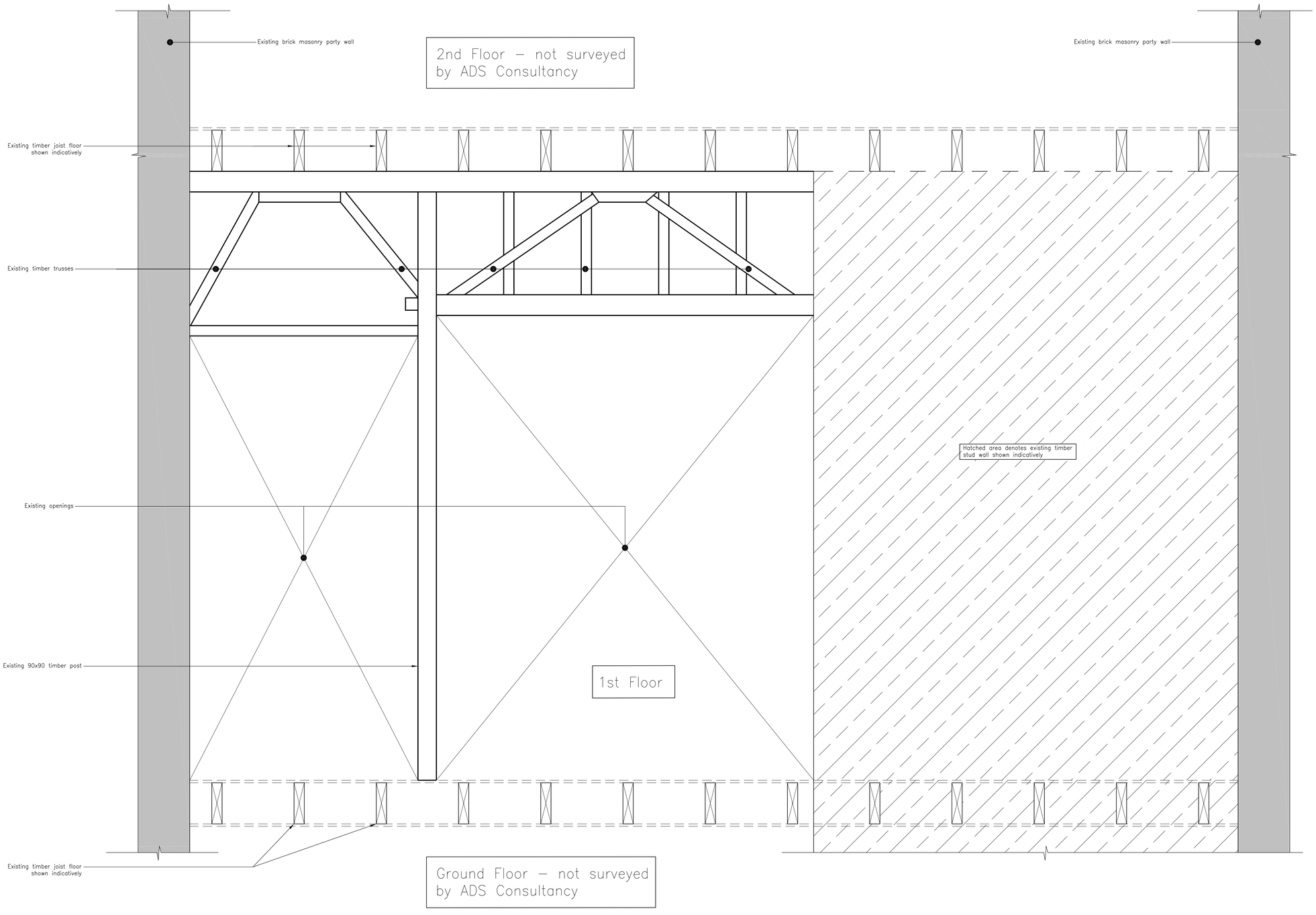
R2: 450 x 100 x 200h mm padstone

Factored reaction = 25.11 x 1.4 + 11.16 x 1.6 = 53.02 kN

Factored stress under padstone = 53.02 x 1000/450 x 100 = 1.18 N/mm^2

Sections to be bolted together with tube spacers or suitable alternative connection at max 1.5m c/s

Appendix A - Drawings



SECTION 01/1-1: EXISTING TIMBER SPINE WALL/TRUSSES

SCALE 1:10 @ A1

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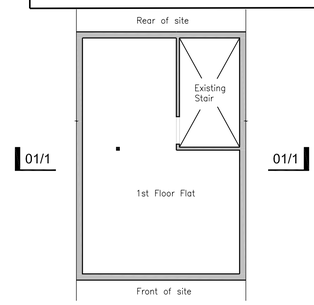

KEY PLAN

SCALE 1:100 @ A1

NOT FOR CONSTRUCTION

Revision	Description	By	Appd	Date
E1	ISSUED FOR INFORMATION	SN	AS	29.12.20

Drawing Status: INFORMATION

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Architect:

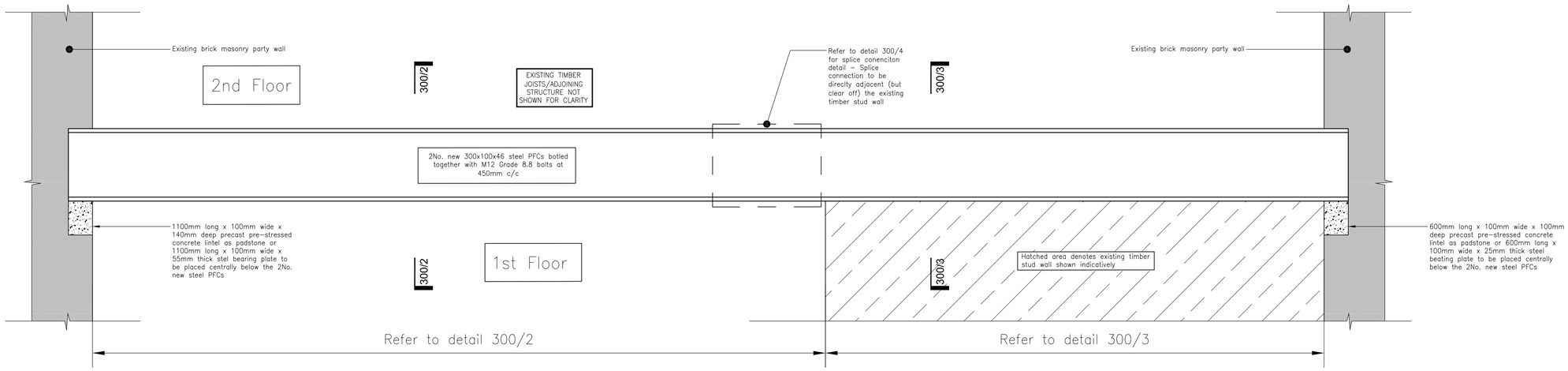
Project: 1st Floor Flat, 26 Mornington Terrace NW1 7RS

Title: EXISTING SPINE WALL ELEVATION

Drawn	Chkd/Appd	Date
SN	AS	DEC '20

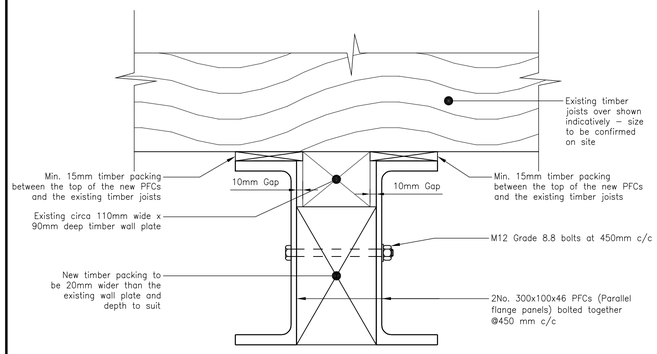
Cad File	Scale
20124_Current.dwg	1:50 @ A1

Drawing Number	Revision
20124/10	E1



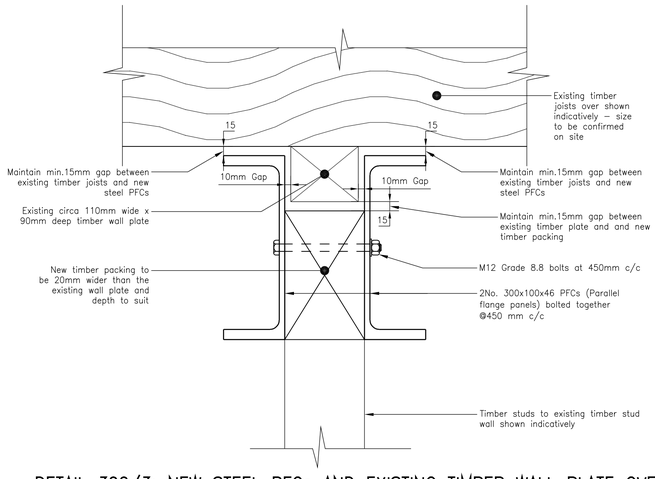
SECTION 300/1-1: NEW STEEL PFCs

SCALE 1:10 @ A1



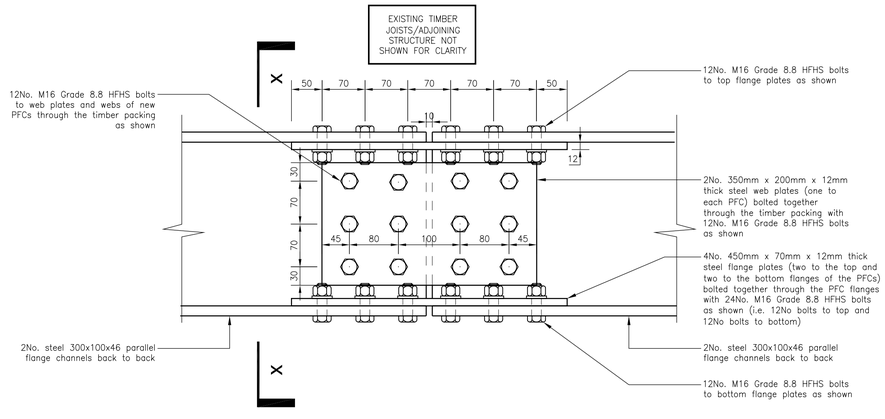
DETAIL 300/2: NEW STEEL PFCs AND EXISTING TIMBER WALL PLATE OVER OPENING (TYPICAL)

SCALE 1:5 @ A1



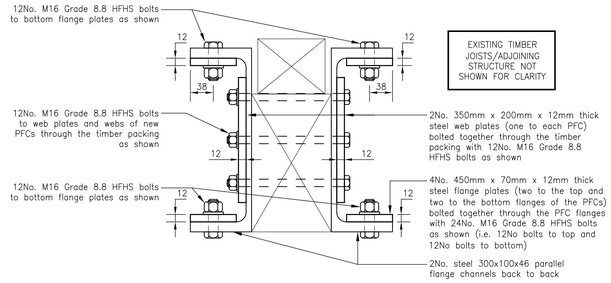
DETAIL 300/3: NEW STEEL PFCs AND EXISTING TIMBER WALL PLATE OVER OPENING (TYPICAL)

SCALE 1:5 @ A1



DETAIL 300/4: SPLICE CONNECTION TO NEW STEEL PFCs (TYPICAL)

SCALE 1:5 @ A1



SECTION X-X: SPLICE CONNECTION TO NEW STEEL PFCs (TYPICAL)

SCALE 1:5 @ A1

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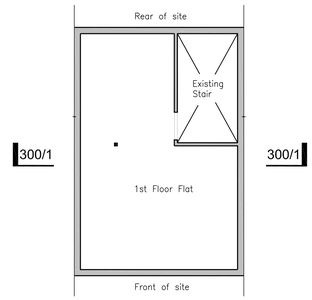

KEY PLAN

SCALE 1:100 @ A1

Revision	Description	By	Appd.	Date
P2	Issued to include with report	SN	ASa	29.12.20
P1	Preliminary Issue for Review	SN	ASa	22.07.20

Drawing Status: PRELIMINARY

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Architect:

Project: 1st Floor Flat, 26 Mornington Terrace NW1 7RS

Title: PROPOSED DETAILS SHEET 1 OF 1

Drawn: SN	Chkd/Appd: ASa	Date: July 2020
Cad File: 20124_Current.dwg		Scale: AS SHOWN
Drawing Number: 20124/300		Revision: P2