Structural Calculations

Date 12/08/2022

Job Number 29 Bedford Row

Progress Work Place Solutions

The Structural Engineers

Project Information

Description :	Structural calculations
Design codes :	
	Eurocode 3
	BS 5628 : Part 1 : 1992
	TR34
Additional Notes	Calculations carried out using client dimension and span input. It is imperative these are correct.
	All construction should conform with the requirement of Building Regulations Approved Document A and the NHBC
	All work to be carried out by a competent contractor and works agreed by the local authority building inspector
	Inform engineer of any discrepancies between Architect's drawings, this document and on site works
	Ground Conditions have not been checked. Building control should advise on site.
	The building should be adequately supported During construction.
	Unless specifically noted, horizontal stability of the structure is not considered
	Calculations to be read in full prior to work commencing. Any assumptions to be confirmed on site prior to works.

Material Properties

New Normal Brickwork- To have a crushing strength of at least 20 N/mm2, a density of between 1800 and 2200 kg/m3 and absorption may be over 12%. It should be laid in a mortar no weaker than mortar designation (iii) according to BS EN 1996-1-1:2005 with its UK national Annex

New Engineering Brickwork- To be minimum class B. a density of between 1800 and 2200 kg/m3 and absorption may be over 12%. It should be laid in a mortar no weaker than mortar designation (iii) according to BS EN 1996-1-1:2005 with its UK national Annex

New Blockwork- Blockwork to have a crushing strength of at least 7.2 N/mm2 . It should have a density of no less than 600 kg/m3 and no more than 1400 kg/m3 and be laid in a mortar no weaker than mortar designation (iii) according to BS EN 1996-1-1:2005 with its UK national Annex

The ends of every wall should be bonded or otherwise securely tied throughout their full height to a buttressing wall. Any damaged wall should be removed and rebuilt.

Steelwork- to be grade S275 JR when used internal. SHS, RHS and CHS columns to be grade S355J0. Padstones to be used beneath all steel beams when supported off masonry

All steelwork shall be designed and fabricated in accordance with b.s 5950 part 1 current edition. All steelwork is to be thoroughly cleaned of all mill scale, rust, dirt and grease by shot blasting to Swedish standard as 2.5, prior to the application of a high build zinc phosphate primer (shop coat) to give a d.f.t. of 75 microns u.n.o.) All steelwork within cavity walls and below d.p.c. is to be given two coats of bituminous paint to give a minimum d.f.t of 100 microns by the general contractor and be compatible with fabrication paint.

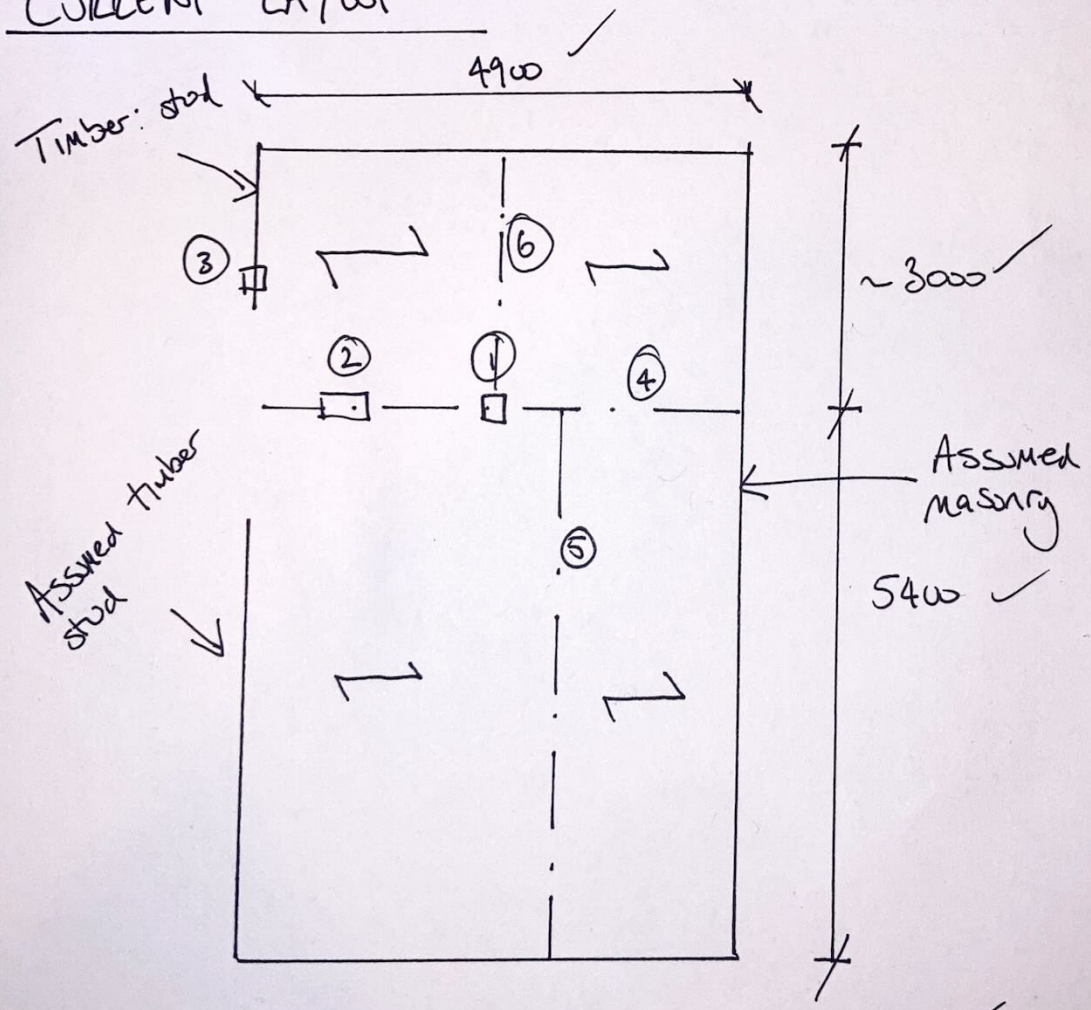
Steel beams should have minimum of 100mm bearing length. They should not bear onto lintels or openings. They are to be supported on load bearing walls with an area of at least $0.1m^2$ (i.e 1m length) They should not be inserted into a chimney or chimney breast.

Approved document A should be read in conjunction with any work proposed and carried out. In particular the requirements set out in diagram 5,13 and 14. Note these listed diagrams are not exhaustive and the building works should comply with the full document.

The Structural Engineers	Calculation Sheet	Job no.	Sheet Number	Date
		1038	1	08/22
		REVISION B		
Job Title: PROGRESS WORK PLACE.				

Calculations to cover office amendments to 29 Bedford Rowe.

CURRENT LAYOUT



1= 100x100 steel post - To be removed
2= Timber colum - removed
3= Steel colum - Retained if possible
4= Timber beam. ~~Replaced~~. Remain.
5= Timber beam. Remain - Capacity not checked
6. "
7. Timber joists Remain. capacity not checked

The Structural Engineers	Calculation Sheet	Job no.	Sheet Number	Date
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Job Title: PROGRESS WORK PLACE

Loading

Beams to support floor loading only.

No masonry walls are above to ground floor

⇒ DL = Timber floor + partitions = 1.1 KN/m² ✓

Office live load * = 2.5 KN/m² ✓

* BS6399 Table 1. offices for general use.

Loading to beam 5.

$\frac{4.9m}{2}$ × 1.1 = 2.7 KN/m
× 2.5 = 6.1 KN/m

⇒ PL to new steel
= 5.4 × 2.7/2 = 7.3 kN DL ✓
= 11 × 6.1/2 = 16.5 KN LL. ✓

Loading to beam 6.

4.9 × 1.1 = 2.7
× 2.5 = 6.1

⇒ PL = 3 × 2.7/2 = 4.1 ✓
3 × 6.1/2 = 9.2 ✓

The Structural Engineers	Calculation Sheet	Job no.	Sheet Number	Date
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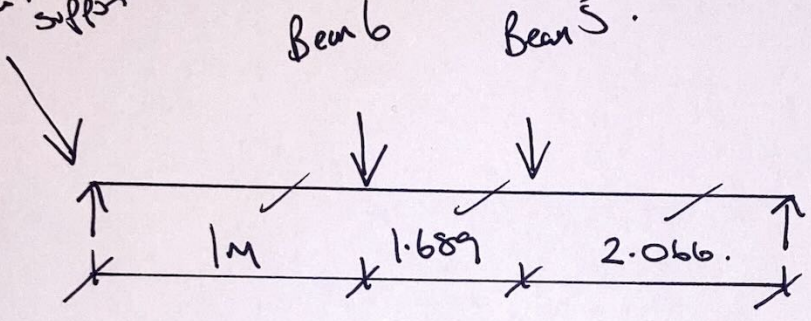
Job Title
PROGRESS WORK PLACE.

New Steel Design

See calculations overleaf for column support



See overleaf. specify 254 x 146 x 31 UB. ✓

Limiting δ to 4900/360 = 14mm Calculated = 11mm ⇒ OK ✓

Pad stone to RHS. Reaction = 33kN ✓

⇒ $33 \times 10^3 / 1.5 \times 100$ = 220mm MINIMUM ✓

⇒ specify 440 x 100 x 215deep padstone ✓

	29 Bedford Rowe	Revision	**A**
	Job No: **1038**	Page:	**01**
Member: **New Steel**	Prepared By: **LD**	Date:	**14/08/2022**

GENERAL DATA	
Steel Grade:	**S275**
p_y *[MPa]* =	275
E *[GPa]* =	205

SELECTED SECTION	
UC	**203x203x46**
Classification: compact	

SPAN *[m]* =	**4.90**

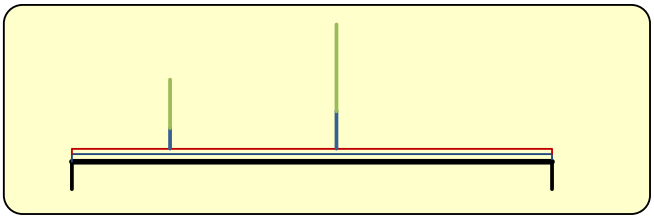
INCLUDE S/W	☑

EFFECTIVE LENGTH *[m]* =	**2.10**
Destabilizing load:	☑

SAFETY FACTORS	
γ_{LL} =	**1.60**
γ_{DL} =	**1.40**

SECTION PROPERTIES					
D =	203.2	*mm*	r_x =	8.8	*cm*
B =	203.6	*mm*	r_y =	5.1	*cm*
t =	7.2	*mm*	I_{xx} =	4570	cm^4
T =	11.0	*mm*	I_{yy} =	1550	cm^4
r =	10.2	*mm*	Z_x =	450.0	cm^3
d =	160.8	*mm*	Z_y =	152.0	cm^3
A =	58.7	cm^2	S_x =	497.0	cm^3
weight =	46.1	*kg/m*	S_y =	231.0	cm^3

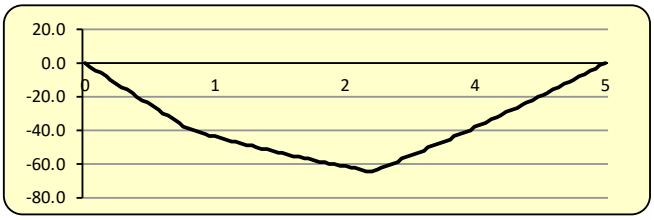
LOADING	*Dead*	*Imposed*		*position from left*		*length*
UDL =	**1.00**	**1.00**	*kN/m*			
Partial UDL 'a' =			*kN/m*	*m*		*m*
Partial UDL 'b' =			*kN/m*	*m*		*m*
Point Load 1 =	**4.10**	**9.20**	*kN*	**1.00**	*m*	~~~~
Point Load 2 =	**7.30**	**16.50**	*kN*	**2.70**	*m*	~~~~
Point Load 3 =			*kN*		*m*	~~~~
Point Load 4 =			*kN*		*m*	~~~~
Point Load 5 =			*kN*		*m*	~~~~
Point Load 6 =			*kN*		*m*	~~~~
Point Load 7 =			*kN*		*m*	~~~~



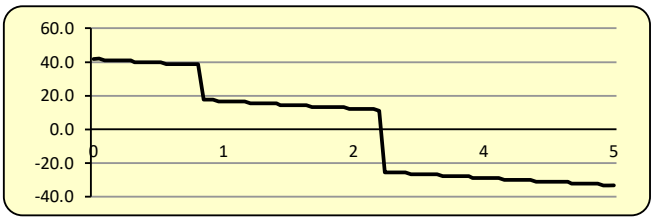
SUMMARY OF RESULTS			
Max Applied Moment =	64.35 kNm	< 136.68 kNm	**OK**
Max Applied Shear =	41.66 kN	< 241.4 kN	**OK**
Max Deflection LL =	6.44 mm	< 13.61 mm	**OK**
Max Deflection LL + DL=	10.12 mm	< 19.6 mm	**OK**

REACTIONS	*Dead*	*Imposed*	*Total*		
Left Reaction =	10.12	17.18	27.30	*kN*	*unfactored*
Right Reaction =	8.44	13.42	21.86	*kN*	
Left Reaction =	14.17	27.49	41.66	*kN*	*factored*
Right Reaction =	11.81	21.47	33.29	*kN*	

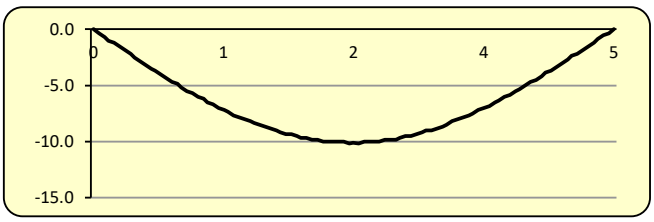
DETAILED RESULTS: **MOMENT (ULS)**		
Maximum applied moment M_{max} =	64.35	*kNm*
Moment capacity M_c =	136.68	*kNm*
-- LTB not considered as λLT < λ0 --		
Buckling resistance moment M_b =	N/A	
Allowable moment =	136.68	*kNm*
Usage factor =	**0.47**	



DETAILED RESULTS: **SHEAR (ULS)**		
Maximum applied shear force F_v =	41.66	*kN*
Shear capacity P_v =	241.40	*kN*
-- Low shear present --		
Usage factor =	**0.17**	



DETAILED RESULTS: **DEFLECTION (SLS)**			
Actual deflection LL =	6.44	*mm*	*(L/761)*
Allowable deflection LL =	13.61	*mm*	*(L/360)*
Usage factor =	**0.47**		



DETAILED RESULTS: **DEFLECTION (SLS)**			
Actual deflection LL+DL=	10.12	*mm*	*(L/484)*
Allowable deflection LL+DL =	19.60	*mm*	***(L/250) or 25***
Usage factor =	**0.52**		

show **LL+DL** deflection diagram

The Structural Engineers	Calculation Sheet	Job no.	Sheet Number	Date
		1038	4	08/22

Job Title: PROGRESS WORK PLACE.

COLUMN TO LHS

Reaction factored = 42kN. ✓

Column = standalone length = 2.53m (floor to floor) ✓

As cantilever ⇒ 2Le = 5m effective length ✓

from blue book 100 x 100 x 6.3 Le = 5m

Axial capacity = 241 kN ✓

Moment resistance = 23 kNm ✓

Assume bending of $\frac{100}{2}$ + 50mm x 42 = 4.2kNm ✓

⇒ $\frac{4.2}{23} + \frac{42}{241} = 35\%$ ⇒ OK. ✓

Footing required to column. In the absence of any ground investigation assume sbp = 100kN/m²

⇒ $\sqrt{27kN/100} = 0.52 \times 0.52$ ✓

⇒ specify 0.6m x 0.6m x 0.3m footing ✓

* 2 No. 100mm x 60mm wide holes based on the following rules
1- Minimum 500mm from end of beam 4- 750mm from any incoming beam
2- Minimum 250mm between holes.
3- Holes centred on web of beam.

The Structural Engineers | Calculation Sheet

Job no. 1038 | Sheet Number 5 | Date 08/22

Job Title Ploaless work plate

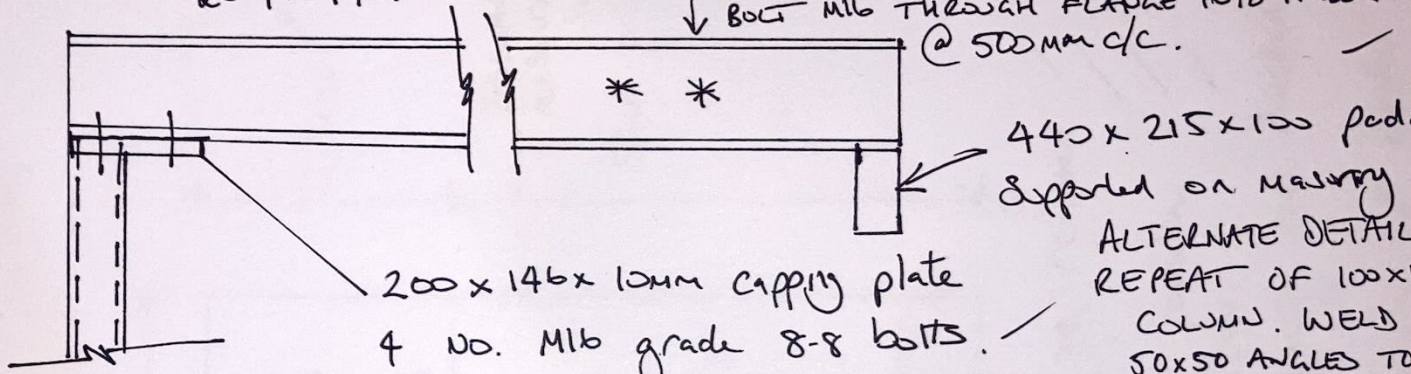
REVISION A.

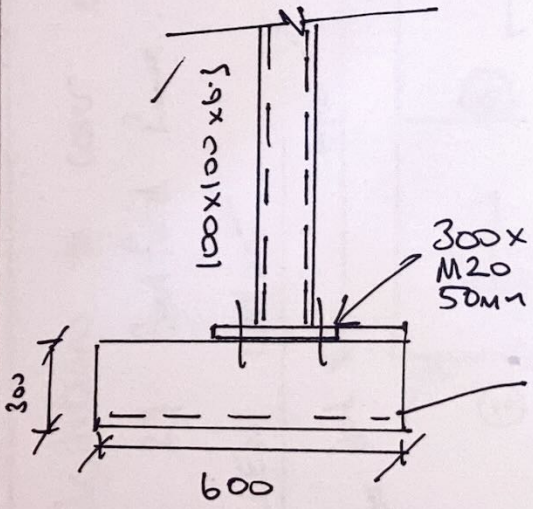
REVISION B.

DETAILS.

All steel grade S355.

203 x 203 x 46 UC or
254 x 146 x 31 UB





No. Fix timber stud wall to new column for stability