

STRUCTURAL CALCULATIONS

For

476 Garstang Road Broughton PR3 5JB

PROPOSED ALTERATIONS AND EXTENSION

STRUCTURAL ENGINEERS

ROBERT E. FRY & ASSOCIATES LTD.

45 Bridgeman Terrace Wigan WN1 1TT Tel: (01942) 826020 Fax: (01942) 230816

PROJECT NO: 19192

Revision 0 – March 2020

By: Paul M. Bithell I.Eng AMI.Struct.E AaPS

	Project				Job Ref.	
KEFA		476 Garstang r	oad, Broughto	n	191	192
Robert E Fry Associates Ltd	Section		Sheet no./rev.			
		ALTERATIONS	6 & EXTENSION	N	2	2
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

<u>BRIEF</u>

To provide designs as requested for the proposed alterations and extension at the above property; no other structural aspects have been considered as it is assumed that these comply with Document A/Building Regulations:

The calculations are based on our interpretation of the drawings submitted and a number of assumptions have been made; these assumptions will need to be checked and confirmed on site and any variation which may affect the design should be brought to the attention of the Engineer for comment.

In line with the CDM Regulations 2015, we are obliged to inform the Client of the risks that may be encountered in the works and, wherever possible, risks have been eliminated from the design however it is not possible to remove all risks. The Client must take all reasonable steps to ensure that only competent contractors who are experienced and familiar with this type of work are employed; in addition, suitable arrangements must be in place to manage the works. Further information can be found at: www.hse.gov.uk/pubns/indg411.htm.

Your appointed Contractor must plan, manage and monitor the construction work under their control so that it is carried out without risks to health and safety and shall co-ordinate their activities with others involved with the project; they are required to prepare a construction phase plan.

Any work that is carried out prior to approval of the calculations/details shall be at the risk of the Client and their Contractor. The Engineer cannot be held responsible for any additional work that may be deemed necessary by the Local Authority or other statutory body after work has commenced prior to approval. The Client and/or Contractor must bear all the costs associated with any additional work.

RFFA	Project	470 Constants		h 4a a	Job Ref.		
	Section	476 Garstang r	19192 Sheet no /rev				
Robert E Fry Associates Ltd	Geolon						
45 Bridgeman Terrace Wigan WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by Date		
Tel: 01942-826020	P.Bithell	March 2020					
LOADINGS							
MAIN ROOF	tiles	0.55					
	felt/battens rafters, etc	0.05 <u>0.15</u> 0.75					
	<u>0.75</u> = cos 30º	0.87					
	framing, etc. insulation ceiling	0.15 0.05 <u>0.15</u> 1.22	kN/m²	DEAD	say, 1.25 kN/m²		
	roof/snow	0.75	kN/m²	IMPOSED			
DORMER ROOF	tiles felt/battens rafters, etc	0.55 0.05 <u>0.15</u> 0.75					
	$\frac{0.75}{\cos 20^{\circ}} =$	0.80					
	insulation ceiling	0.05 <u>0.15</u> 1.00	kN/m²	DEAD			
	roof/snow	0.75	kN/m²	IMPOSED			
GRD. FLOOR	finishes screed insulation pc floor	0.15 1.80 0.05 <u>3.00</u> 5.00	kN/m²	DEAD			

E.

	Project				Job Ref.	
KEFA		476 Garstang	road, Broug	hton		19192
Pohort E En/ Apponiator I td	Section				Sheet no./rev	
45 Bridgeman Terrace		ALTERATION	S & EXTENS	SION		4
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				
		• •		• •		• •
EXT. WALL	103 brick insulation 100 block 1-plaster	2.18 0.05 1.39 <u>0.15</u> 3.77	kN/m ²	DEAD		
DORMER WALL	render+board insulation framing 1-plaster	0.55 0.05 0.25 <u>0.15</u> 1.00	kN/m ²	DEAD		

	Project				Job Ref.	
KEFA	And Period 476 Garstang road, Broughton Associates Ltd Section ALTERATIONS & EXTENSION In Terrace In Terrace Calc. by Date Chk'd by Date	19192				
Robert E Fry Associates Ltd 45 Bridgeman Terrace Wigan, WN1 1TT	Section		Sheet no./rev.			
		ALTERATION	S & EXTENSIO	N	4	5
	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

LAYOUT

	Project				Job Ref.	
KEFA		476 Garstang ı	road, Broughto	n	19 [,]	192
Robert E Fry Associates Ltd 45 Bridgeman Terrace Wigan, WN1 1TT	Section	Sheet no./rev.				
		ALTERATION	S & EXTENSIO	N	(6
	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

RAFTERS

Adopt C16 timber rafters at 600mm centres; max. span = 3.25m (on plan) with a roof pitch of 30°

Loading, roof (d) = 1.25kN/m² and (i) = 0.75kN/m²

→ provide 47x200mm C16 rafters at 600mm centres throughout

TIMBER RAFTER DESIGN (BS5268-2:2002)

30 degrees



Rafter details

Breadth of timber sections;	b = 47 mm;	Depth of timber sections;	h = 200 mm
Rafter spacing;	s = 600 mm;	Rafter span;	Single span
Clear length of span on slope;	L _{cl} = 3753 mm;	Rafter slope;	α = 30.0 deg
Timber strength class;	C16		
Section properties			
Cross sectional area of rafter;	A = 9400 mm²;	Section modulus;	Z = 313333 mm ³
Radius of gyration;	r = 58 mm;	Second moment of area;	l = 31333333 mm ⁴
Loading details			
Rafter self weight;	F _j = 0.03 kN/m;	Dead load on slope;	F _d = 1.04 kN/m ²
Imposed snow load on plan;	F _u = 0.75 kN/m ² ;	Imposed point load;	F _p = 0.90 kN
Modification factors			
Section depth factor;	K ₇ = 1.05 ;	Load sharing factor;	K ₈ = 1.10

	Project				Job Ref.	
REFA		476 Garstang	road, Broughto	n	19	192
Pohort E En Accoristos Ltd	Section				Sheet no./rev.	
45 Bridgeman Terrace		ALTERATION	S & EXTENSIO	N		7
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				
.						
Consider long term load con	idition			4 6 4		
Load duration factor;	$K_3 = 1.00;$		Effective apon:	b. to ratter;	F = 0.565 KIN/I	m
Notional bearing length,	Lb – 9 mm,		Ellective spart,			11
Check bending stress						
Permissible bending stress;	σ _{m adm} = 6.096 !	N/mm²;	Applied bendin	g stress;	σ _{m max} = 3.19 1	I N/mm ²
	_		PASS - Applie	d bending stres	s within perm	issible limits
Chack compressive stress n	arallol to grain					
Permissible comp. stress:	$a_{\rm range} = 4.636$	l/mm ² ·	Applied compre	acciva etrace:	σ	N/mm ²
		PAS	SS - Applied compression	npressive stres	s within perm	issible limits
.						
Check combined bending an	id compressive s	stress parallel	to grain			
Complined loading check;	0.623 < 1 PASS - Combined compre		ssive and here	lina strossos ar	o within norm	issible limits
	FA33 - COII		essive and bene	ing suesses a	e within perm	
Check shear stress						
Permissible shear stress;	τ _{adm} = 0.737 N/r	nm²;	Applied shear s	stress;	τ _{max} = 0.170 N	l/mm ²
	vaun ener of the tarter,		PASS - App	lied shear stres	s within perm	issible limits
Check deflection						
Permissible deflection;	δ_{adm} = 11.286 m	ım;	Total deflection	1;	δ _{max} = 5.578 m	nm
			PASS	- Total deflectio	n within perm	issible limits
Consider medium term load	<u>condition</u>			to roftor		2
Notional bearing length:	$n_3 = 1.23$, $l_{h} = 15 \text{ mm}^2$		Effective span:	. to failer,	$\Gamma = 0.303 \text{ km/l}$	n
notional bearing iongui,			Encouve span,			
Check bending stress						
Permissible bending stress;	σ _{m_adm} = 7.620 Ι	N/mm²;	Applied bendin	g stress;	σm_max = 5.112	2 N/mm ²
			PASS - Applie	d bending stres	ss within permissible limits	
Check compressive stress p	arallel to grain					
Permissible comp. stress:	$\sigma_{c,adm} = 5.420$ N	J/mm ² :	Applied compre	essive stress:	σ _{c max} = 0.627	′ N/mm²
· •·····		PAS	SS - Applied cor	npressive stres	s within perm	issible limits
					-	
Chook combined bendling	d compressive	troop norall-1	to arein			
Combined loading check:	0 815 < 1	stress parallel	to grain			
Jonnon loading bicor,	PASS - Con	bined compre	essive and bend	ling stresses ar	e within perm	issible limits
				.g = ccboo ui		
Check shear stress						
Permissible shear stress;	τ _{adm} = 0.921 N/r	nm²;	Applied shear s	stress;	τ _{max} = 0.271 N	l/mm ²
			PASS - App	lied shear stres	s within perm	issible limits

Check deflection Permissible deflection; δi Consider short term load condit Load duration factor; K Notional bearing length; L	Section Calc. by P.Bithell adm = 11.303 m ition 3 = 1.50 ;	476 Garstang ALTERATION Date March 2020	Total deflectior	n N Date	19 Sheet no./rev. App'd by	8 Date
Robert E Fry Associates Ltd 45 Bridgeman Terrace Wigan, WN1 1TT 0 Tel: 01942-826020 0 Check deflection 6 Permissible deflection; δ. Consider short term load condit Load duration factor; K Notional bearing length; L	Section Calc. by P.Bithell Madm = 11.303 m <u>ition</u> K3 = 1.50 ;	ALTERATION Date March 2020	S & EXTENSIO	N Date	Sheet no./rev.	8 Date
45 Bridgeman Terrace Wigan, WN1 1TT Tel: 01942-826020 Check deflection Permissible deflection; Ø. Consider short term load condit Load duration factor; K Notional bearing length; L	Calc. by P.Bithell Jadm = 11.303 m <u>ition</u> K ₃ = 1.50 ;	ALTERATION Date March 2020	S & EXTENSION Chk'd by Total deflection PASS	N Date	App'd by	8 Date
Wigan, WN1 1TT (Tel: 01942-826020 (Check deflection (Permissible deflection; δ. Consider short term load condit Load duration factor; K Notional bearing length; L	Calc. by P.Bithell adm = 11.303 m i <u>tion</u> K3 = 1.50 ;	Date March 2020 m;	Chk'd by Total deflection PASS	Date .	App'd by	Date
Tel: 01942-826020 Check deflection Permissible deflection; δ. Consider short term load condit Load duration factor; K Notional bearing length; L	P.Bithell iadm = 11.303 m <u>ition</u> K ₃ = 1.50 ;	March 2020	Total deflectior			
Check deflection Permissible deflection; δ. Consider short term load condit Load duration factor; K Notional bearing length; L	a _{dm} = 11.303 m <u>ition</u> (3 = 1.50;	m;	Total deflectior			
Check deflection Permissible deflection; δ. Consider short term load condit Load duration factor; K Notional bearing length; L	a _{dm} = 11.303 m <u>ition</u> ∕₃ = 1.50;	m;	Total deflectior PASS			
Check deflection Permissible deflection; δ. Consider short term load condit Load duration factor; K Notional bearing length; L Check bending stress	a _{dm} = 11.303 m i <u>tion</u> K3 = 1.50;	m;	Total deflection PASS			
Permissible deflection; δ Consider short term load condit Load duration factor; K Notional bearing length; L Check bending stress L	_{iadm} = 11.303 m <u>ition</u> ⊲ = 1.50;	m;	Total deflectior PASS	•		
Consider short term load condi Load duration factor; K Notional bearing length; L	<u>ition</u> ⊲ = 1.50 ;		PASS	,	δ _{max} = 8.962 n	nm
Consider short term load condition factor; K Notional bearing length; L	<u>ition</u> ⟨₃ = 1.50;			Total deflection	n within perm	issible limits
Consider short term load condiLoad duration factor;KNotional bearing length;LCheck bending stress	<u>ition</u> ∖₃ = 1.50;					
Load duration factor; K Notional bearing length; L	K₃ = 1.50 ;					
Notional bearing length; L			Total UDL perp	o. to rafter;	F = 0.565 kN/	m
Chook handing stress	_{-b} = 13 mm;		Effective span;		L _{eff} = 3766 mr	n
Chook handling stress						
check behaing stress						
Permissible bending stress; σ	⊽m_adm = 9.144 №	N/mm²;	Applied bendin	g stress;	σ _{m_max} = 5.539	9 N/mm²
			PASS - Applie	d bending stres	s within perm	nissible limits
Check compressive stress par	allel to grain					
Permissible completes:	$r_{\rm r} = 6.072$ N	l/mm ² ·	Applied compre	acciva etrace:	σ	N/mm ²
		<i>Ρ</i> Δς	Applied comple	nnressive stres	s within norm	nissihle limite
					o	
Check combined bending and o	compressive s	stress parallel	to grain			
Combined loading check; 0	.695 < 1					
	PASS - Com	bined compre	essive and bend	ling stresses ar	e within perm	issible limits
Check shear stress						
Permissible shear stress; τ_i	_{adm} = 1.106 N/n	nm²;	Applied shear s	stress;	τ _{max} = 0.294 Ν	√mm²
			PASS - App	lied shear stres	s within perm	issible limits
. . .						
Check deflection						
Permissible deflection; δ_i	_{adm} = 11.297 m	m;	Total deflectior	l;	δ _{max} = 8.913 n	nm
			PASS - Total deflect		tion within permissible limits	

REFA	Project				Job Ref.	
		476 Garstang	road, Brought	on	19	192
	Section				Sheet no./rev.	
45 Bridgeman Terrace		ALTERATION	S & EXTENSIO	ON		9
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				
	•			•	•	-

DORMER PURLIN

Adopt C16 timber, max. span = 1.80m (on plan), loading as follows

roof (d)	=	1.00 [#] x (2.05 / 2)	=	1.03	
roof (d)	=	1.25 [#] x (1.20 / 2)	=	0.75	
roof (i)	=	0.75 [#] x [(2.05+1.20) / 2)]	=		1.22

(for detail) provide 47x200mm C16 \rightarrow purlin

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.02



DEEA	Project				Job Ref.	
KEFA		476 Garstang	road, Broughto	n	19	192
	Section				Sheet no./rev.	
Robert E Fry Associates Ltd		ALTERATION	S & EXTENSIO	N		10
45 Bridgeman Terrace Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				
Applied loading						
Roam loads						
Dealli Ioaus		Dood colf	woight of boom	- 1		
		Dead sell		I		
		Dead full (JDL 1.030 KN/M			
dormer		Dead full (
r+d		Imposed fu	UII UDL 1.220 KN	I/m		
Load combinations						
Load combination 1		Support A		Dead	1.00	
				Impose	d [´] 1 00	
		Span 1		Dood	1 00	
		Spann		Deau	1.00	
				Impose	u 1.00	
		Support B		Dead	1.00	
				Impose	d 1.00	
Analysis results						
Design moment;	M = 1.229 kNm;		Design shear;		F = 2.731 kN	
Total load on beam;	W _{tot} = 5.461 kN					
Reactions at support A;	RA max = 2.731 k	kN;	R _{A min} = 2.731	kN		
Unfactored dead load reaction a	at support A;	$R_{A_{Dead}} = 1$	I. 633 kN			
Unfactored imposed load reaction	on at support A;	R _{A_Imposed} =	= 1.098 kN			
Reactions at support B;	R _{B_max} = 2.731 k	N;	R _{B_min} = 2.731	kN		
Unfactored dead load reaction a	at support B;	$R_{B_{Dead}} = 1$	I .633 kN			
Unfactored imposed load reacti	on at support B;	R _{B_Imposed} =	= 1.098 kN			
Timber section details						
Breadth of section:	b = 47 mm:		Depth of sectio	n:	h = 200 mm	
Number of sections:	N = 1:		Breadth of bea	m:	b₀ = 47 mm	
Timber strength class;	C16					
Mombor dotails						
Service class of timber	1·		Load duration.		Medium term	1
Length of span:	-, _{s1} = 1800 mm					
Length of bearing:	$L_{\rm b} = 50 \text{ mm}$					
_ogar or souring,	_µ vv mm					
Lateral support - cl.2.10.8						
Permiss.depth-to-breadth ratio;	5.00 ;		Actual depth-to	-breadth ratio;	4.26	
				PASS - L	ateral suppor	t is adequa
Check bearing stress						
-	σc adm = 2.125 Ν	l/mm²;	Applied bearing	g stress;	σ _{c_a} = 1.162 Ν	l/mm²
Permissible bearing stress:				- '		

	Project				Job Ref.	
KEFA		476 Garstang	road, Broughte	on	1	9192
	Section				Sheet no./rev.	
AS Bridgeman Terrace		ALTERATION	ERATIONS & EXTENSION			11
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				
Bending parallel to grain						N/ 2
Permissible bending stress;	σm_adm = 6.927	N/mm²; PASS - Applie	Applied bendli d bending stre	ng stress; ss is less than	σ _{m_a} = 3.922 permissible b	N/mm ² Dending stress
Shear parallel to grain						
Permissible shear stress;	τ _{adm} = 0.838 N	/mm²;	Applied shear	stress;	τa = 0.436 N/	/mm²
		PASS - A	pplied shear s	tress is less the	an permissibl	e shear stress
Deflection						
Permissible deflection;	δ _{adm} = 5.400 m	ım;	Total deflectio	n;	δa = 2.715 m	m
		P	ASS - Total de	flection is less	than permiss	ible deflection

	Project				Job Ref.	
KEFA		19192				
	Section				Sheet no./rev.	
45 Bridgeman Terrace		ALTERATION	S & EXTENSIO	N	1	2
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

DORMER 'TRIMMERS'

Adopt C16 timber, max. span = 3.25m (on plan); supports nominal loading from the main roof, reaction from purlin plus weight of dormer wall

roof (d)	=	1.25 [#] x (0.60 / 2)	=	0.38
roof (d)	=	0.75 [#] x (0.62 / 2)	=	0.23
purlin (d)	=	from design	=	1.63kN
purlin (i)	=	from design	=	1.10kN
dormer (d)	=	1.00 [#] x 1.33(2.35 / 2)	=	1.56kN/m partial

→ provide 3-No. 47x200mm C16 rafters
 screwed together to form trimmers
 either side of dormer

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.02



	Project		Job Ref.			
KEFA		19192				
Robert E Fry Associates Ltd	Section				Sheet no./rev.	
		ALTERATION	13			
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

Applied loading			
Beam loads			
		Dead self weight of beam $ eq$ 1	
roof lower		Dead partial UDL 0.380 kN/m fro	om 0 mm to 2050 mm
roof lower		Imposed partial UDL 0.230 kN/n	n from 0 mm to 2050 mm
roof upper		Dead partial UDL 0.750 kN/m fro	om 2050 mm to 3250 mm
roof upper		Imposed partial UDL 0.450 kN/n	n from 2050 mm to 3250 mm
purlin		Dead point load 1.630 kN at 205	50 mm
purlin		Imposed point load 1.100 kN at	2050 mm
dormer wall		Dead partial UDL 1.560 kN/m fro	om 0 mm to 2050 mm
Load combinations			
Load combination 1		Support A	Dead [´] 1.00
			Imposed 1.00
		Span 1	Dead
			Imposed (1.00)
		Support B	$Dead \stackrel{\frown}{=} 1.00$
		Support D	
			imposea 1.00
Analysis results			
Design moment;	M = 4.427 kNm;	Design shear;	F = 4.486 kN
Total load on beam;	W _{tot} = 8.951 kN		
Reactions at support A;	R _{A_max} = 4.486 kN;	R _{A_min} = 4.486 kN	
Unfactored dead load react	ion at support A;	R _{A_Dead} = 3.657 kN	
Unfactored imposed load re	eaction at support A;	RA_Imposed = 0.829 kN	
Reactions at support B;	R _{B_max} = 4.465 kN;	R _{B_min} = 4.465 kN	
Unfactored dead load react	ion at support B;	R _{B_Dead} = 3.183 kN	
Unfactored imposed load re	eaction at support B;	R _{B_Imposed} = 1.283 kN	
\uparrow Λ /			
X X X 30 - 28			\leq
/ / / /			
 ≪──141── >	∙ → 50 ←		
Timber section details			
Breadth of section;	b = 47 mm;	Depth of section;	h = 200 mm
Number of sections;	N = 3;	Breadth of beam;	b _b = 141 mm
Timber strength class;	C16		
Member details			

Service class of timber;

1;

Load duration;

Medium term

DEEA	Project				Job Ref.	
KEFA		476 Garstang	road, Broughto	on	1	9192
Pohort E Env Associatos I td	Section				Sheet no./rev.	
45 Bridgeman Terrace		ALTERATION	S & EXTENSIO	N		14
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				
Length of span;	L _{s1} = 3250 mm					
Length of bearing;	L _b = 50 mm					
Lateral support - cl.2.10.8						
Permiss.depth-to-breadth ratio;	5.00 ;		Actual depth-to	o-breadth ratio;	1.42	
				PASS - L	ateral suppo	rt is adequate
Check bearing stress						
Permissible bearing stress;	σc_adm = 2.338 I	N/mm²;	Applied bearing	g stress;	σ_{c_a} = 0.636	N/mm²
PAS	S - Applied con	pressive stres	ss is less than p	permissible con	npressive str	ess at bearing
Bending parallel to grain						
Permissible bending stress;	σm_adm = 7.620	N/mm ² ;	Applied bendir	ig stress;	σ _{m_a} = 4.710	N/mm ²
		PASS - Applie	d bending stre	ss is less than _l	permissible b	ending stress
Shear parallel to grain						
Permissible shear stress:	Tadm = 0.921 N/	mm²:	Applied shear	stress:	τa = 0.239 N/	/mm ²
		PASS - A	pplied shear st	tress is less tha	n permissible	e shear stress
Deflection						
Permissible deflection;	δ _{adm} = 9.750 mr	n;	Total deflection	ו;	δa = 7.493 m	m
		P	ASS - Total dei	flection is less t	than permiss	ible deflection

	Project				Job Ref.	
KEFA	476 Garstang road, Broughton				19192	
Robert E Fry Associates Ltd	Section				Sheet no./rev.	
		ALTERATIONS	S & EXTENSION	N	1	5
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

RIDGE BEAM

<u>/!</u>`

Beam supports new roof construction and reaction from dormer trimmers only, no other loads considered; assume beam be restrained over its 6.00m span and limit deflection, under total dead & imposed, to 15mm (approx. span/360)

Loading:	roof (d)	= 1.25 [#] x (6.50	(2) / 2) = 4.06
	roof (i)	= 0.75 [#] x (6.50	(2) / 2) = 2.44
	reaction (d) reaction (i)	= 3.18 kN = 1.28 kN	applied at 3.6m & 5.4m from R_A applied at 3.6m & 5.4m from R_A
Reactions	R _A =	33.20 kN ult. (d =	14.6kN & i = 8.0kN)
	R _B =	39.70 kN ult. (d =	17.8kN & i = 9.2kN)

\rightarrow adopt 305 x 102 x 28 UB (S275)

beam weight approx. 170kgs; contractor/builder to consider handling issues during installation; ensure adequate propping of gable wall until beam – and roof – can be constructed the execution of the works

STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.07







Support conditions

Support A

Support B

Applied loading

Beam loads

Vertically restrained Rotationally free Vertically restrained Rotationally free

Dead self weight of beam 1 roof - Dead full UDL 4.06 kN/m roof - Imposed full UDL 2.44 kN/m dormer - Dead point load 3.18 kN at 3600 mm Imposed point load 1.28 kN at 3600 mm dormer - Dead point load 3.18 kN at 5400 mm Imposed point load 1.28 kN at 5400 mm

 δ_{min} = 0 mm

Load combinations

Deflection;

Load combination 1 - gravity	Support A	Dead
		Imposed
		Dead
		Imposed 1.60
	Support B	Dead
		Imposed 1.60
Analysis results		
Maximum moment;	M _{max} = 55.2 kNm;	M _{min} = 0 kNm
Maximum shear;	V _{max} = 33.2 kN;	V _{min} = -39.7 kN

δ_{max} = **12.7** mm;

		Project				Job Ref.	
KEFA			476 Garstan	g road, Brough	19	19192	
Robert E Env Associat	as I ta	Section				Sheet no./rev.	
45 Bridgeman Terrac	es Liu		ALTERATIO	NS & EXTENSI	NC		17
Wigan, WN1 1TT	•	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020		P.Bithell	March 2020)			
Maximum reaction at	cupport A		P	22 2 KNI-	D	- 33 3 KNI	
	support A	, at support Δ·	RA_max -	- 14 6 kN	INA_min -	- 33.2 KIN	
Unfactored imposed	load reacti	on at support A.	RA Impage	a = 8 kN			
Maximum reaction at	support B	:	R _{B max} =	39.7 kN:	R _B min =	= 39.7 kN	
Unfactored dead load	d reaction a	, at support B:	RB Dead =	= 17.8 kN			
Unfactored imposed	load reacti	on at support B:	R _B Impose	a = 9.2 kN			
		, ii ,	5beed	-			
Section details							
Section type;		UB 305x102x2	8 (BS4-1);	Steel grade;		S275	
			_				
Classification of cro	oss sectio	ns - Section 3.5			: 6 :	Disstis	
rensile strain coeffici	ent;	ε = 1.00;		Section class	incation;	Plastic	
Shoar capacity So	ction 4 2 2	2					
Design shear force:	cuon 4.2.3	, F., = 39 7 kN [.]		Design shear	resistance:	P. = 305 6 kN	I
Design shear lorde,		1 v – 33 .7 kN,	P	ASS - Design shear	hear resistance e	xceeds desig	n shear force
			•			Access acong	
Moment capacity - S	Section 4.2	2.5					
Design bending mor	ient;	M = 55.2 kNm;		Moment capa	icity low shear;	Mc = 110.8 kN	Im
				PASS - Momen	capacity exceed	ls design ben	ding moment
Check vertical defle	ction - Se	ction 2.5.2					
Consider deflection d	ue to dead	d and imposed lo	bads				
Limiting deflection		δ _{lim} = 15 mm;		Maximum dei	flection;	δ = 12.661 mr	n
			P	ASS - Maximum	deflection does	not exceed de	eflection limit
check beam bea	rings:						
Reactions	RA	= 33.20	kN ult	d = 14.6	i = 8.0		
	R _B	= 39.70	kN ult	d = 17.8	i = 9.2		
	2		*				
Worse case is R	_B onto h	lock wall/dah	le: adont 1	00mm thick	$3.6N/mm^2$ bloc	kwork laid i	in M4
mortar throughou	t with no	rmal manufac	cture and c	onstruction			
			\rightarrow	provide	300mm long	y x 100mm	wide
				(C8/10)	concrete na	dstone 15	0mm
				doon	at hearings:	hoam to	havo
				deep,			
				100mm	seating' onto	padstone/	wall

	Project				Job Ref.	
KEFA	476 Garstang road, Broughton				19192	
Robert E Fry Associates Ltd	Section	Sheet no./rev.				
		ALTERATION	S & EXTENSIO	N	1	8
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

MASONRY BEARING DESIGN TO BS5628-1:2005

TEDDS calculation version 1.0.07

Masonry details			
Masonry type;	Aggregate concrete blocks (25% or less formed voids)	
Compressive strength;	p _{unit} = 3.6 N/mm ² ;	Mortar designation;	iii
Least horiz dim of units;	l _{unit} = 100 mm;	Height of units;	h _{unit} = 215 mm
Masonry units;	Category II;	Construction control;	Normal
Partial safety factor;	γm = 3.5 ;	Characteristic strength;	f _k = 3.5 N/mm ²
Leaf thickness;	t = 100 mm;	Effective wall thickness;	t _{ef} = 135 mm
Wall height;	h = 3000 mm;	Effective height of wall;	h _{ef} = 3000 mm
Bearing details			
Beam spanning out of plane of	wall		
Width of bearing;	B = 102 mm;	Length of bearing;	l _b = 100 mm
Edge distance;	x _{edge} = 350 mm		
Loading details			
Concentrated dead load;	G _k = 18 kN;	Concentrated imposed load;	Q _k = 9 kN
Design concentrated load;	F = 39.6 kN		
Masonry bearing type			
Bearing type;	Туре 2 ;	Bearing safety factor;	γ _{bear} = 1.50
Check design bearing without	ut a spreader		
Design bearing stress;	f _{ca} = 3.886 N/mm ² ;	Allowable bearing stress;	f _{cp} = 1.500 N/mm ²
	FAIL - Design bearing	stress exceeds allowable bea	nring stress, use a spreader
Spreader details			
Length of spreader;	l _s = 300 mm;	Depth of spreader;	hs = 150 mm
Edge distance;	s _{edge} = 251 mm		
Spreader bearing type			
Bearing type;	Туре 2 ;	Bearing safety factor;	γ _{bear} = 1.50
Check design bearing with a	spreader		
Loading acts at midpoint of spi	reader		
Design bearing stress;	f _{ca} = 1.321 N/mm ² ;	Allowable bearing stress;	f _{cp} = 1.500 N/mm ²
	PASS -	Allowable bearing stress exc	eeds design bearing stress
Check design bearing at 0.4	imes h below the bearing level		
Design bearing stress;	f _{ca} = 0.240 N/mm²;	Allowable bearing stress;	f _{cp} = 0.680 N/mm ²
PASS -	Allowable bearing stress at 0.	4 ´ h below bearing level exc	eeds design bearing stress

	Project		Job Ref.			
KEFA	476 Garstang road, Broughton				19192	
Robert E Fry Associates Ltd	Section		Sheet no./rev.			
		ALTERATIONS	3 & EXTENSION	N	1	9
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

BEAM/LINTEL

Beam/lintel supports new roof construction, reaction from dormer trimmers and masonry over, no other loads considered; assume beam be unrestrained over its 3.95m span and limit deflection, under total dead & imposed, to 10mm (approx. span/360)

roof (d) roof (i)	= =	1.25 [#] x (6.50 / 0.75 [#] x (6.50 /	4) 4)	= =	2.03	1.22
brick (d)	=	2.18 [#] x (0.45m	ו)	=	0.98	
block (d)	=	1.59 [#] x (0.45m	ו)	=	0.72	
dormer (d)	=	1.00 [#] x (2.35m	ו)	=	2.35ki	N/m partial
reaction (d) reaction (i)	= =	3.66 kN 0.83 kN	applied applied	l at 2.4 l at 2.4	5m fror 5m fror	$n R_A$ $n R_A$
R _A = R _B =	20.30 24.90) kN ult. (d = 11) kN ult. (d = 14	1.4kN & 1.5kN &	i = 2.7 i = 2.9	kN) kN)	
		÷	adopt (S355) plate	200 x comp	a 100 x lete wi	x 8.0mm thk RHS th 6mm thk ledger
weight approx lation; ensure a ructed the exe	k. 170kg adequat cution o	gs; contractor/bu te propping of ga f the works	uilder to able wa	consid II until	der han beam –	dling issues during - and roof – can be
	roof (d) roof (i) brick (d) block (d) dormer (d) reaction (d) reaction (i) $R_A = R_B =$	roof (d)=roof (i)=brick (d)=block (d)=dormer (d)=reaction (d)=reaction (i)= R_A = 20.30 R_B =24.90weight approx. 170kgvalue of the execution of the ex	roof (d) = $1.25^{\#} \times (6.50 / 700 \text{ roof (i)})$ = $0.75^{\#} \times (6.50 / 700 \text{ brick (d)})$ = $2.18^{\#} \times (0.45 \text{ mrs})$ block (d) = $1.59^{\#} \times (0.45 \text{ mrs})$ dormer (d) = $1.00^{\#} \times (2.35 \text{ mrs})$ reaction (d) = 3.66 kN reaction (i) = 0.83 kN $R_A = 20.30 \text{ kN ult.}$ (d = 147 R_B) = 24.90 kN ult. (d = 147 reaction) $R_B = 24.90 \text{ kN ult.}$ (d = 147 reaction) \Rightarrow weight approx. 170kgs; contractor/but lation; ensure adequate propping of gas ructed the execution of the works	roof (d) = $1.25^{\#} \times (6.50 / 4)$ roof (i) = $0.75^{\#} \times (6.50 / 4)$ brick (d) = $2.18^{\#} \times (0.45m)$ block (d) = $1.59^{\#} \times (0.45m)$ dormer (d) = $1.00^{\#} \times (2.35m)$ reaction (d) = 3.66 kN applied reaction (i) = 0.83 kN applied R_A = 20.30 kN ult. (d = $11.4 \text{ kN} \& R_B$ = 24.90 kN ult. (d = $14.5 \text{ kN} \& R_B$) \Rightarrow adopt (S355) plate weight approx. 170kgs; contractor/builder to lation; ensure adequate propping of gable was ructed the execution of the works	roof (d) = $1.25^{\#} \times (6.50 / 4)$ = roof (i) = $0.75^{\#} \times (6.50 / 4)$ = brick (d) = $2.18^{\#} \times (0.45m)$ = block (d) = $1.59^{\#} \times (0.45m)$ = dormer (d) = $1.00^{\#} \times (2.35m)$ = reaction (d) = 3.66 kN applied at 2.4 reaction (i) = 0.83 kN applied at 2.4 R_A = 20.30 kN ult. (d = $11.4 \text{ kN} \& i = 2.7$ R_B = 24.90 kN ult. (d = $14.5 \text{ kN} \& i = 2.9$ \rightarrow adopt 200 \times (S355) comp plate weight approx. 170kgs; contractor/builder to consid lation; ensure adequate propping of gable wall until tructed the execution of the works	roof (d) = $1.25^{\#} \times (6.50 / 4)$ = 2.03 roof (i) = $0.75^{\#} \times (6.50 / 4)$ = brick (d) = $2.18^{\#} \times (0.45m)$ = 0.98 block (d) = $1.59^{\#} \times (0.45m)$ = 0.72 dormer (d) = $1.00^{\#} \times (2.35m)$ = $2.35k1$ reaction (d) = 3.66 kN applied at $2.45m$ from reaction (i) = 0.83 kN applied at $2.45m$ from R_A = 20.30 kN ult. (d = $11.4\text{ kN} \& i = 2.7\text{ kN}$) R_B = 24.90 kN ult. (d = $14.5\text{ kN} \& i = 2.9\text{ kN}$) \Rightarrow adopt 200 x 100 x (S355) complete wight plate weight approx. 170kgs; contractor/builder to consider han lation; ensure adequate propping of gable wall until beam - ructed the execution of the works

					TEDDS	calculation version
an length &	partial factors for	r loading				
Span	Factor	s for moments &	forces	Factors for deflection		
(mm)	γfd	γfi	γfw	γdd	γdi	γdw
3950	1.40	1.60	0.00	1.00	1.00	1.00

	Project		Job Ref.			
KEFA		476 Garstang r	oad, Broughton	n	191	92
	Section		Sheet no./rev.			
45 Bridgeman Terrace		ALTERATIONS	& EXTENSION	4	2	0
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

Load descriptions

Loads are applied normal to the major principal axis (x-axis) of the member.

Ref.	Category	Description
1	"Dead"	"self-wt"
2	"Dead"	"roof"
3	"Imposed"	"roof"
4	"Dead"	"blk"
5	"Dead"	"bwk"
6	"Dead"	"dormer walls"
7	"Imposed"	"dormer walls"
8	"Dead"	"dormer front"

Loading data

Ref. #	Category	Туре	Load	Position	Load	Position	Eccentricity
			kN/m	mm	kN/m	mm	mm
1	"Dead"	UDL	1.0	0	-	3950	0
2	"Dead"	UDL	2.0	0	-	3950	0
3	"Imposed"	UDL	1.2	0	-	3950	0
4	"Dead"	UDL	1.0	0	-	3950	0
5	"Dead"	UDL	0.7	0	-	3950	200
6	"Dead"	Point load	3.7 kN	2450	-	-	0
7	"Imposed"	Point load	0.8 kN	2450	-	-	0
8	"Dead"	UDL	2.4	2450	-	3950	0

Analysis results - entire span

Ra	R₀	F _{vy}	M _x		Tq	Deflecti	on: δEl _x
kN (fac)	kN (fac)	kN (fac)	kNm (fac) Sense		kNm (fac)	kNm ³	Direction
20.3	24.9	24.9	24.1	"Sagging"	0.80	26.51	"Down"

Unfactored support reactions

Support A;	Dead load; -11.4 kN;	Live load; -2.7 kN;	Wind load; 0.0 kN;
Support B;	Dead load; -14.5 kN;	Live load; -2.9 kN;	Wind load; 0.0 kN;

LTB segment results

Seg.	x₅	x _e	L _{LT}	M∟⊤	M _{mLT2}	M _{mLT3}	M _{mLT4}
	mm	mm	mm	kNm (fac)	kNm (fac)	kNm (fac)	kNm (fac)
1	0	3950	3950	24.1	15.9	23.4	18.8



	Project		Job Ref.			
KEFA		476 Garstang r	oad, Broughto	n	19 [.]	192
	Section		Sheet no./rev.			
45 Bridgeman Terrace		ALTERATION	S & EXTENSION	N	2	2
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				

Check;	Load;	Capacity;	Notes;	Result;
Deflection;	δ _{y_max} = 5.8 mm;	δ _{lim} = 10.0 mm;	Span / 360 or 10.0 mm;	Pass
Twist angle	φ _{sls} = 0.01 deg	φ _{lim} = 2.00 deg	T _{qu} = 0.57 kNm	Pass
Shear;	F _{vy} = 24.9 kN;	P _{vy} = 635.5 kN;	Low shear;	Pass;
Moment;	M _x = 24.1 kNm;	M _{cx} = 95.2 kNm;	Serviceability governs;	Pass
LTB;	λ = 126 ;	λ _{lim} = 263 ;	LTB check not req'd; L _{E_LT} = 5140 mm;	Pass
Overall buckling	Index; i _b = 0.229	Limit = 1.0	σ _{byt} = 0 N/mm ²	Pass
Local capacity	σ _{bx} + σ _{byt} = 108 N/mm ²	p _y = 355 N/mm ²	$ σ_{bx} = 108 \text{ N/mm}^2 $ $ σ_{byt} = 0 \text{ N/mm}^2 $	Pass
Combined shear stresses	τ = 12 N/mm ²	p _v = 213 N/mm ²	τ _{bw} = 10 N/mm ² τ _{vt} = 2 N/mm ²	Pass

check flange plate & welds:

Moment applied to plate	Μ	= = =	1.40 [(0.98 x 0.225) 1.40 [0.22] 0.31 kNm/m	brickwork only
Plate thickness required	t _p	=	(6M / bp _y) ^{1/2}	where $b = 1000mm \& p_y = 275N/mm^2$
		= =	[(6 x 0.31 x 10 ⁶) / (10 2.60mm minimum	00 x 275)] ^½

→ provide 6mm 'flange' plate for detail

Assume (conservatively) 70mm minimum lever-arm between welds, thus

Force in welds	=	(0.31 x 10³) / 70mm
	=	4.43 kN/m

Adopting 4mm fillet welds with a capacity of 0.62kN/mm, thus

REFA		Project	Job Ref.	Job Ref.				
				19192				
Robert E Frv Associate	s Ltd	Section	Sheet no./rev					
45 Bridgeman Terrace			ALTERA	TIONS	& EXTENSIO	N		23
Wigan, WN1 1TT		Calc. by	Date		Chk'd by	Date	App'd by	Date
Tel: 01942-826020		P.Bithell	March 2	2020				
Weld length require	ed	=	4.43 /	0.62				
		=	7.14m	m/m	nominal			
				\rightarrow	adopt 4r	nm FW's at	50mm hit/:	300mm
					miss alo	ng plate ler	ngth	
check beam bear	ings:							
Reactions	R₄	= 20.30	0 kN ult		d = 11 4	i = 27	,	
	D_	- 24.90			d = 1/5	i – 2.0	1	
	ΓB	- 24.50			u – 14.5	1 - 2.9)	
Worse case is R _B mortar throughout	onto bl with nc	lock wall/rh-fr ormal manufa	ont; adop acture and	ot 100 d cons →	mm thick, 3 struction provide	.6N/mm², bl 300mm lor	lockwork lain ng x 100mr	d in M4 n wide
Worse case is R _B mortar throughout	onto bl with nc	lock wall/rh-fr ormal manufa	ont; adop acture and	ot 100 d cons →	mm thick, 3 struction provide (C8/10) deep, at	.6N/mm², bl 300mm lor concrete p bearings; b	lockwork lain ng x 100mr padstone, f peam/lintel t	d in M4 m wide 150mm to have
Worse case is R _B mortar throughout	onto bl with nc	lock wall/rh-fr ormal manufa	ont; adop acture and	ot 100 d cons →	mm thick, 3 struction provide (C8/10) deep, at 225mm '	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on	lockwork lain ng x 100mr padstone, peam/lintel t	d in M4 m wide 150mm to have e/wall
Worse case is R _B mortar throughout	onto bl with nc	lock wall/rh-fr ormal manufa	ront; adop icture and	ot 100 d cons →	mm thick, 3 struction provide (C8/10) deep, at 225mm f	.6N/mm², bl 300mm lor concrete p bearings; b seating' on	lockwork lai ng x 100mr badstone, beam/lintel t ito padston	d in M4 n wide 150mm to have e/wall
Worse case is R _B mortar throughout	onto bl with nc	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u>	ont; adop icture and	ot 100 d cons →	mm thick, 3 struction provide (C8/10) deep, at 225mm '	.6N/mm², bl 300mm lor concrete p bearings; b seating' on	lockwork lai ng x 100mr badstone, beam/lintel t nto padston	d in M4 m wide 150mm to have e/wall
Worse case is R _B mortar throughout	onto bl with nc	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u>	ont; ador icture and	ot 100 d cons →	mm thick, 3 struction provide (C8/10) deep, at 225mm '	.6N/mm², bl 300mm lor concrete p bearings; b seating' on	lockwork lain ng x 100mr badstone, f beam/lintel t ato padston	d in M4 m wide 150mm to have e/wall
Worse case is R _B mortar throughout <u>MASONRY BEARING</u> Masonry details	onto bl with nc	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u>	ront; adop icture and :2005	ot 100 d cons →	mm thick, 3 struction provide (C8/10) deep, at 225mm *	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on	lockwork laid ng x 100mr padstone, f peam/lintel t nto padston	d in M4 m wide 150mm to have e/wall
Worse case is R _B mortar throughout <u>MASONRY BEARING</u> Masonry details Masonry type;	onto bl with nc	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u> Aggregate co	ront; adop icture and <u>:2005</u> ncrete blo	ot 100 d cons →	mm thick, 3 struction provide (C8/10) deep, at 225mm '	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on seating' on	lockwork lain ng x 100mr badstone, f beam/lintel t ato padston TEDDS calcu	d in M4 m wide 150mm to have e/wall
Worse case is R _B mortar throughout <u>MASONRY BEARING</u> Masonry details Masonry type; Compressive strength; Least horiz dim of units	onto bl with nc	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u> Aggregate co p _{unit} = 3.6 N/mr	ront; adop icture and <u>:2005</u> ncrete bloo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm f 3% or less for Mortar designa	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on seating' on med voids)	lockwork laid ng x 100mr badstone, f beam/lintel f nto padston TEDDS calcu iii hun = 215 r	d in M4 m wide 150mm to have e/wall Jation version 1
Worse case is R _B mortar throughout <u>MASONRY BEARING</u> Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units:	onto bl with nc DESIGN	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u> Aggregate co p _{unit} = 3.6 N/mr l _{unit} = 100 mm; Category II:	ront; adop icture and <u>:2005</u> ncrete blo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm '	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on seating' on med voids)	lockwork lain ng x 100mr badstone, f beam/lintel f nto padston TEDDS calcu iii hunit = 215 r Normal	d in M4 m wide 150mm to have e/wall
Worse case is R _B mortar throughout <u>MASONRY BEARING</u> Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial sofaty factor;	onto bl with nc	lock wall/rh-fr ormal manufa N TO BS5628-1 Aggregate co punit = 3.6 N/mr lunit = 100 mm; Category II;	ront; adop icture and <u>:2005</u> ncrete blo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm ' 3% or less for Mortar designa Height of units Construction c	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on seating' on med voids) tion;	lockwork lain ng x 100mr badstone, fo beam/lintel to beam/lintel to to padston TEDDS calcu iii hunit = 215 r Normal f. = 2.5 N/m	d in M4 m wide 150mm to have e/wall ulation version 1 nm
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor;	onto bl with nc	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u> Aggregate co p _{unit} = 3.6 N/mr l _{unit} = 100 mm; Category II; γ _m = 3.5; t = 100 mm;	ront; adop icture and <u>:2005</u> ncrete bloo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm f 225mm f wortar designate Height of units Construction construction constructi construction co	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on seating' on med voids) tion; tion; strength;	lockwork laid ng x 100mr badstone, f beam/lintel f nto padston TEDDS calcu iii h _{unit} = 215 r Normal f _k = 3.5 N/m	d in M4 m wide 150mm to have e/wall ulation version 1 nm
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor; Leaf thickness;	onto bl with nc	lock wall/rh-fr prmal manufa <u>N TO BS5628-1</u> Aggregate co p _{unit} = 3.6 N/mr l _{unit} = 100 mm; Category II ; γ _m = 3.5; t = 100 mm;	ront; adop icture and :2005 ncrete blo m²;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm 4 8% or less for Mortar designate Height of units Construction of Characteristic states	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on med voids) tion; tion; tion; strength; hickness;	lockwork laid ng x 100mr badstone, f beam/lintel t nto padston TEDDS calcu iii h _{unit} = 215 r Normal f _k = 3.5 N/m t _{ef} = 135 mr	d in M4 m wide 150mm to have e/wall ulation version 1 nm nm
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor; Leaf thickness; Wall height;	onto bl with nc	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u> Aggregate co p _{unit} = 3.6 N/mr l _{unit} = 100 mm; Category II; γ _m = 3.5; t = 100 mm; h = 3000 mm;	ront; adop icture and <u>:2005</u> ncrete bloo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm 4 3% or less for Mortar designate Height of units Construction can Characteristic state Effective wall the Effective height	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on seating' on med voids) tion; tion; strength; hickness; t of wall;	lockwork laid ng x 100mr badstone, f beam/lintel f nto padston TEDDS calcu iii h _{unit} = 215 r Normal f _k = 3.5 N/m t _{ef} = 135 mr h _{ef} = 3000 r	d in M4 m wide 150mm to have e/wall ulation version 1 nm nm nm ² m
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor; Leaf thickness; Wall height; Bearing details	onto bl with nc	lock wall/rh-fr ormal manufa <u>N TO BS5628-1</u> Aggregate co p _{unit} = 3.6 N/mr l _{unit} = 100 mm; Category II; γ _m = 3.5; t = 100 mm; h = 3000 mm;	ront; adop acture and <u>:2005</u> ncrete blo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm 4 3% or less for Mortar designate Height of units Construction construction constr	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on seating' on med voids) tion; tion; strength; hickness; t of wall;	lockwork laid ng x 100mr badstone, fo beam/lintel fo to padston TEDDS calcu iii h _{unit} = 215 r Normal f _k = 3.5 N/m t _{ef} = 135 mr h _{ef} = 3000 r	d in M4 m wide 150mm to have e/wall ulation version 1 nm nm ² m
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor; Leaf thickness; Wall height; Bearing details Beam spanning in plan	onto bl with nc	lock wall/rh-fr prmal manufa N TO BS5628-1 Aggregate co punit = 3.6 N/mr lunit = 100 mm; Category II; γ_m = 3.5; t = 100 mm; h = 3000 mm;	ront; adop icture and :2005 ncrete blo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm 4 3% or less for Mortar designate Height of units Construction of Characteristic state Effective wall the Effective height	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on seating' on med voids) tion; tion; strength; hickness; t of wall;	lockwork laid ng x 100mr badstone, f beam/lintel f nto padston TEDDS calcu iii h _{unit} = 215 r Normal f _k = 3.5 N/m t _{ef} = 135 mr h _{ef} = 3000 r	d in M4 m wide 150mm to have e/wall ulation version 1 nm nm
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor; Leaf thickness; Wall height; Bearing details Beam spanning in plan Width of bearing;	onto bl with nc DESIGN	lock wall/rh-fr prmal manufa <u>N TO BS5628-1</u> Aggregate co p _{unit} = 3.6 N/mr l _{unit} = 100 mm; Category II; γ _m = 3.5; t = 100 mm; h = 3000 mm;	ront; adop acture and <u>:2005</u> ncrete blo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm 4 3% or less for Mortar designate Height of units Construction construction constr	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on med voids) ition; tion; strength; hickness; t of wall;	lockwork laid ng x 100mr badstone, fo beam/lintel fo to padston TEDDS calcu iii h _{unit} = 215 rr Normal f _k = 3.5 N/m t _{ef} = 135 mr h _{ef} = 3000 r	d in M4 m wide 150mm to have e/wall ulation version 1 nm nm ² m mm
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor; Leaf thickness; Wall height; Bearing details Beam spanning in plan Width of bearing;	onto bl with nc DESIGN	lock wall/rh-fr formal manufa N TO BS5628-1 Aggregate compunit = 3.6 N/mr lunit = 100 mm; Category II; γ_m = 3.5; t = 100 mm; h = 3000 mm; B = 100 mm;	ront; adop icture and :2005 ncrete blo m²;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm 4 % or less for Mortar designa Height of units Construction ca Characteristic s Effective wall the Effective heigh	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on med voids) tion; tion; strength; hickness; t of wall;	lockwork laid ng x 100mr badstone, f beam/lintel f nto padston TEDDS calcu iii h _{unit} = 215 r Normal f _k = 3.5 N/m t _{ef} = 135 mr h _{ef} = 3000 r	d in M4 m wide 150mm to have e/wall ulation version 1 nm nm ² m mm
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor; Leaf thickness; Wall height; Bearing details Beam spanning in plan Width of bearing; Loading details	onto bl with nc DESIGN	lock wall/rh-fr brmal manufa N TO BS5628-1 Aggregate col punit = 3.6 N/mr lunit = 100 mm; Category II; γ_m = 3.5; t = 100 mm; h = 3000 mm; B = 100 mm;	ront; adop acture and <u>:2005</u> ncrete blo m ² ;	ot 100 d cons → cks (25	mm thick, 3 struction provide (C8/10) deep, at 225mm 4 6% or less for Mortar designate Height of units Construction of Characteristic state Effective wall the Effective height	.6N/mm², bl 300mm lor concrete p bearings; b seating' on med voids) tion; tion; strength; hickness; t of wall;	lockwork laid ng x 100mr badstone, foeam/lintel f bto padston TEDDS calcu iii $h_{unit} = 215 rr$ Normal $f_k = 3.5 N/rr$ $t_{ef} = 135 mr$ $h_{ef} = 3000 rr$ $l_b = 225 mr$	d in M4 m wide 150mm to have e/wall ulation version 1 mm mm
Worse case is R _B mortar throughout MASONRY BEARING Masonry details Masonry type; Compressive strength; Least horiz dim of units Masonry units; Partial safety factor; Leaf thickness; Wall height; Bearing details Beam spanning in plan Width of bearing; Loading details Concentrated dead loa	onto bl with nc DESIGI	lock wall/rh-fr prmal manufa N TO BS5628-1 Aggregate co punit = 3.6 N/mr lunit = 100 mm; Category II ; $\gamma_m = 3.5$; t = 100 mm; h = 3000 mm; B = 100 mm; $G_k = 15 kN;$	ront; adop icture and :2005 ncrete blo m ² ;	ot 100 d cons →	mm thick, 3 struction provide (C8/10) deep, at 225mm 4 % or less for Mortar designa Height of units Construction of Characteristic = Effective wall the Effective height Length of bear	.6N/mm ² , bl 300mm lor concrete p bearings; b seating' on med voids) tion; tion; strength; hickness; t of wall; ing; mposed load;	lockwork laid ng x 100mr badstone, f beam/lintel f nto padston TEDDS calcu iii hunit = 215 r Normal fk = 3.5 N/m tef = 135 mr hef = 3000 r lb = 225 mn Qk = 3 kN	d in M4 m wide 150mm to have e/wall ulation version 1 nm nm nm ² m nm

DEEA	Project	Job Ref.				
KEFA		19192				
Robert E Frv Associates Ltd	Section				Sheet no./rev.	
45 Bridgeman Terrace		ALTERATION	S & EXTENSIO	N	24	
Wigan, WN1 1TT	Calc. by	Date	Chk'd by	Date	App'd by	Date
Tel: 01942-826020	P.Bithell	March 2020				
Masonry boaring type						
Bearing type:			Bearing safety	factor	Mars - 1 25	
beamig type,	турет,		bearing salety		γbear - 1.25	
Check design bearing witho	ut a spreader					
Design bearing stress;	Design bearing stress: $f_{ca} = 1.108 \text{ N/mm}^{2}$			ng stress;	f _{cp} = 1.250 N/mm ²	
		PASS -	Allowable bearing stress exc		eeds design bearing stre	
				-	-	-
Check design bearing at 0.4	× h below the b	earing level				
Design bearing stress;	f _{ca} = 0.175 N/m	.175 N/mm ² ; Allowable bearing stress;			f _{cp} = 0.680 N/mm ²	
PASS -	Allowable beari	ing stress at 0.4	f ´ h below be	aring level exce	eeds design be	earing stre