Site: Job: \$	43 Fairfax Close, Biddulph. Superstructure umber: MAB/17/28		Made by MAB Page 1 File copy
ProStee	5.41g 532231	FAIRFAX CLOSE PS5	Printed 21 Apr 2017 16:21
Projec Site ad Job: S Job nu ITEMS	t started 20 Apr 2017 MAB ddress: 43 Fairfax Close, Biddulph. uperstructure imber: MAB/17/28		
1:	Beam: New Floor Beam 1 Over Kitchen/Dining Span: 6.2 m. Reactions (unfactored/factored): R1: 18.73/26.74 Use 254 x 146 x 37 UB S275 Bearing R1: 175 x 100 mm padstone SEE BEAM 2 FOR PADSTONE DETAIL Bearing R2: 147 x 100 mm padstone SEE BEAM 2 FOR PASTONE DETAIL	kN R2: 18.73/26.74 kN	
2:	Beam: New Floor Beam 2 Over Kitchen/Dining Span: 6.2 m. Reactions (unfactored/factored): R1: 31.69/46.69 Use 254 x 146 x 43 UB S275 Bearing R1: 275 x 100 mm padstone FOR DETAIL USE WIDTH OF WALL X 300 X 22 PIER LOCATION Bearing R2: 300 x 100 mm padstone FOR DETAIL USE 'L' SHAPED COMBINED PAD AND 1 AT PARTY WALL SUPPORT WITH NEW BONDED TO EXISTING	kn R2: 32.63/48.12 kn 5 DEEP COMBINED PADST STONE 300 EACH LEG X 10 BLOCKWORK TO INNER LI	ONE TO BEAMS 2 AND 1 AT 0 X 225 DEEP TO BEAMS 2 EAF OF EXTENSION FULLY

Site: Job: Job	43 Fairfax Clo Superstructure number: MAB/1	Made Page File c	Made by MAB Page 2 File copy				
ProSte	el 5.41g 532231		F/	AIRFAX CLUSE.PS3	Printed	a 21 Apr 2017 16:	21
Bear	n: New Floor B	eam 1 Over Kitchen/D	ining			Sp	an: 6.2 m.
	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
υL	roof	0.6 x 1.4	0	Ū	L	2.60	2.60
υD	roof	0.9 x 1.4	0		L	3.91	3.91
υD	wall	2.2 x 2.3 x 0.7	0		L	10.98	10.98
υD	beam	0.4	0		L	1.24	1.24
			Unfact	tored reactions (	kN) Total:	18.73	18.73
					Dead:	16.13	16.13
					Live:	2.60	2.60
Tota	load: 37.46/53	.49 kN Unfactored/Fact	tored	Factored	l reactions:	26.74	26.74
		Load types: U:UD	DL D: Dead; L:	Live (positions i	in m. from R1)		
Maxi	mum B.M. (facto	ored) = 41.5 kNm at 3.10	) m. from R1				

Maximum S.F. (factored) = 26.7 kN at R1

Live load deflection = 16.2 x 10<sup>8</sup>/EI at 3.10 m. from R1 (*E in N/mm<sup>2</sup>*, *I in cm<sup>4</sup>*)

Total deflection = 116.2 x 10<sup>8</sup>/EI at 3.10 m. from R1





Shear force and bending moment

Beam calculation to BS5950-1:2000 using S275 steel

#### SECTION SIZE : 254 x 146 x 37 UB S275

D=256.0 mm B=146.4 mm t=6.3 mm T=10.9 mm  $I_x$ =5,540 cm<sup>4</sup>  $r_y$ =3.48 cm  $S_x$ =483 cm<sup>3</sup> Section classification: T = 10.9mm  $p_y = 275 \text{ N/mm}^2 \epsilon = 1.00$ (Table 11) Flange: b/T = 73.2/10.9 = 6.72 (<=9 $\epsilon$ : Class 1 plastic) Web: d/t = 219.0/6.3 = 34.8 (<=80ɛ: Class 1 plastic) For design purposes section classification is Class 2, compact Shear capacity = 0.6 p<sub>v</sub>.t.D = 0.6 x 275 x 6.3 x 256.0/1000 = 266 kN (>=26.7) OK Maximum moment = 41.45 kNm at 3.10 m. from R1 Moment capacity,  $M_c = p_v.S_x = 275 \times 483/1000 = 132.8 \text{ kNm OK}$ Beam is laterally restrained at supports only: effective length = 1.0L Effective length ( $L_E$ ) = 6.20m Slenderness,  $\lambda (L_E/r_v) = 6.20 \times 100/3.48 = 178.2$ Slenderness factor (v) = 0.723 (x = 24.4;  $\lambda$ /x = 7.30) Buckling parameter (u) = 0.889  $\beta_w = 1.000$  (Class 1/2 compact) Equivalent slenderness  $(\lambda_{LT}) = u.v.\lambda_{.}\sqrt{\beta_{w}} = 114.5$ Bending strength,  $p_b = 102.7 \text{ N/mm}^2$ Maximum moment within segment,  $M_x = 41.45$  kNm Equivalent uniform moment factor,  $m_{LT} = 0.925$  (M<sub>2</sub>=31.1, M<sub>3</sub>=41.5, M<sub>4</sub>=31.1) Equivalent uniform moment =  $0.925 \times 41.45 = 38.34 \text{ kNm}$ Buckling resistance moment,  $M_b = p_b S_x = 102.7 \times 483/1000 = 49.62 \text{ kNm OK}$ 

Site: 43 Fairfax Close, Biddulph.		Made by MAB
Job: Superstructure		Page 3
Job number: MAB/17/28		File copy
ProSteel 5.41g 532231	FAIRFAX CLOSE.PS5	Printed 21 Apr 2017 16:21
Check unstiffened web capacity with load of 26.74 kN C1 = 64.1 kN; C2 = 1.73 kN/mm; C4 = 196; K = r (for derivation of C factors see Steelwork Design Gu Bearing capacity, $P_w = C1+b_1C2$ ( $b_e$ taken as zero With $b_1=0$ , unstiffened web buckling capacity, $P_x =$	nin{0.5+( $a_e$ /1.4d),1.0}; $p_{yw} = 27$ uide to BS5950-1:2000 6th ed.) b) Buckling capacity, $P_x = K \sqrt{2}$ 56.1 kN: no minimum stiff bearing	75N/mm² (C4.P <sub>w</sub> ) ng length required
LL deflection = 16.16 x 1e8/205,000 x 5540.000 = 1.4 TL deflection = 116.2 x 1e8/205,000 x 5540 = 10.2 mm	mm (L/4357) OK າ (L/606)	
Bearing details		
254x146x37 UB stiff bearing length, $b_1 = t + 1.6r + 2T$	= 40.3 mm	
Local design strength of masonry (factored) = 2.80 N/n	nm <sup>2</sup> (User-entered value)	
R1: 175 x 100 mm padstone		
Factored reaction = 16.13 x 1.4 + 2.60 x 1.6 = 26.74 k	N	
Factored stress under padstone = 26.74 x 1000/175 x	100 = 1.53 N/mm <sup>2</sup>	
SEE BEAM2 FOR PADSTONE DETAIL		
R2: 147 x 100 mm padstone		
Factored reaction = 16.13 x 1.4 + 2.60 x 1.6 = 26.74 k	N	
Factored stress under padstone = 26.74 x 1000/147 x	100 = 1.82 N/mm <sup>2</sup>	
SEE BEAM2 FOR PASTONE DETAIL		

Site: 43 Fairfax Close, Biddulph.						y MAB		
Job	Superstructure				Page 4			
Job	number: MAB/17/28				File co	ру		
ProSteel 5.41g 532231			FAIRFAX	FAIRFAX CLOSEPS5		Printed 21 Apr 2017 16:21		
Bea	m: New Floor Beam 2	Over Kitchen/Dining				Spa	an: 6.2 m.	
	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp	
υL	roof & ceiling	0.85 x 3.4	0	-	L	8.96	8.96	
υD	roof & ceiling	1.15 x 3.4	0		L	12.12	12.12	
υD	wall	1.0 x 2.3 x 0.7	0		L	4.99	4.99	
υD	beam	0.4	0		L	1.24	1.24	
ΡL	ex beam floor	1.5 x 3.3 x 1.2	3.4			2.68	3.26	
ΡD	ex beam floor	0.6 x 3.3 x 1.2	3.4			1.07	1.30	
ΡD	ex beam stud wall	0.5 x 2.3 x 1.2	3.4			0.62	0.76	
			Unfactor	ed reactions (k	N) Total:	31.69	32.63	
					Dead:	20.05	20.41	
					Live:	11.64	12.22	
Tota	l load: 64.32/94.82 kN	Unfactored/Factored		Factored	reactions:	46.69	48.12	
	Loa	d types: U:UDL P:PL	D: Dead; L: Liv	e (positions ir	n m. from R1)			

Maximum B.M. (factored) = 84.1 kNm at 3.40 m. from R1

Maximum S.F. (factored) = -48.1 kN at R2

Live load deflection = 84.7 x 10<sup>8</sup>/EI at 3.15 m. from R1 (*E in N/mm<sup>2</sup>*, *I in cm<sup>4</sup>*)

Total deflection = 217.0 x 10<sup>8</sup>/EI at 3.10 m. from R1





Shear force and bending moment

Beam calculation to BS5950-1:2000 using S275 steel

#### SECTION SIZE : 254 x 146 x 43 UB S275

Maximum moment = 84.13 kNm at 3.40 m. from R1

Moment capacity,  $M_c = p_y \cdot S_x = 275 \times 566/1000 = 155.7 \text{ kNm OK}$ 

Beam is laterally restrained at 3.40m from R1

Segment	Mx	u	V	λ	$\beta_{W}$	λιτ	р <sub>ь</sub>	Mb	m <sub>IT</sub>	M <sub>b</sub> /m <sub>l T</sub>	
0.00-3.40	84.13	0.89	0.84	96.59	1.00	71.95	183.7	103.97	0.76	136.66	OK
3.40-6.20	84.13	0.89	0.88	79.55	1.00	61.96	208.3	117.90	0.71	166.29	OK
Critical segment for buckling lies between 0.00m and 3.40m											
Effective law		0.40						(1 /)	101		00 50

Effective length (L<sub>E</sub>) = 3.40m Buckling parameter (u) = 0.890  $\beta_w$  = 1.000 (Class 1/2 compact) Slenderness,  $\lambda (L_E/r_y) = 3.40 \times 100/3.52 = 96.59$ Slenderness factor (v) = 0.837 (x = 21.2;  $\lambda/x = 4.56$ ) Equivalent slenderness ( $\lambda_{LT}$ ) = u.v. $\lambda_{-}/\beta_w = 71.95$ 

Site: 43 Fairfax Close, Biddulph.		Made by MAB		
Job: Superstructure	Page 5			
Job number: MAB/17/28		File copy		
ProSteel 5.41g 532231	FAIRFAX CLOSEPS5	Printed 21 Apr 2017 16:21		
Bending strength, p <sub>b</sub> = 183.7 N/mm <sup>2</sup>				
Maximum moment within segment, $M_x = 84.13$ kM Equivalent uniform moment factor, $m_{LT} = 0.761$ (M Equivalent uniform moment = 0.761 x 84.13 = 64.00 Buckling resistance moment, $M_b = p_b.S_x = 183.7$ x	Nm 4 <sub>2</sub> =35.0, M <sub>3</sub> =60.7, M <sub>4</sub> =77.1) 0 kNm < 566/1000 = 104.0 kNm OK			
Check unstiffened web capacities with loads of 46.6 C1 = 80.4 kN; C2 = 1.98 kN/mm; C4 = 293; K (for derivation of C factors see Steelwork Design Bearing capacity, $P_w = C1+b_1C2$ (be taken as 2 R1: With $b_1=0$ , unstiffened web buckling capacity R2: With $b_1=0$ , unstiffened web buckling capacity	59 kN and 48.12 kN = min{0.5+( $a_e$ /1.4d),1.0}; $p_{yw} = 2$ <i>a Guide to BS5950-1:2000 6th ed.</i> ) zero) Buckling capacity, $P_x = K_y$ y, $P_x = 76.7$ kN: no minimum stiff y, $P_x = 76.7$ kN: no minimum stiff	275N/mm <sup>2</sup> /(C4.P <sub>w</sub> ) bearing length required bearing length required		
LL deflection = 84.70 x 1e8/205,000 x 6540.000 = 6 TL deflection = 217.0 x 1e8/205,000 x 6540 = 16.2	6.3 mm (L/981) OK mm (L/383)			
Bearing details				
254x146x43 UB stiff bearing length, $b_1 = t + 1.6r +$	2T = 44.8 mm			
Local design strength of masonry (factored) = $1.70$	N/mm <sup>2</sup> (User-entered value)			
R1: 275 x 100 mm padstone				
Factored reaction = 20.05 x 1.4 + 11.64 x 1.6 = 46.	.69 kN			
Factored stress under padstone = 46.69 x 1000/27	5 x 100 = 1.70 N/mm²			
FOR DETAIL USE WIDTH OF WALL X 300 X 225 LOCATION	DEEP COMBINED PADSTONE	TO BEAMS 2 AND 1 AT PIER		

#### R2: 300 x 100 mm padstone

Factored reaction = 20.41 x 1.4 + 12.22 x 1.6 = 48.12 kN

Factored stress under padstone =  $48.12 \times 1000/300 \times 100 = 1.60 \text{ N/mm}^2$ 

FOR DETAIL USE 'L' SHAPED COMBINED PADSTONE 300 EACH LEG X 100 X 225 DEEP TO BEAMS 2 AND 1 AT PARTY WALL SUPPORT WITH NEW BLOCKWORK TO INNER LEAF OF EXTENSION FULLY BONDED TO EXISTING