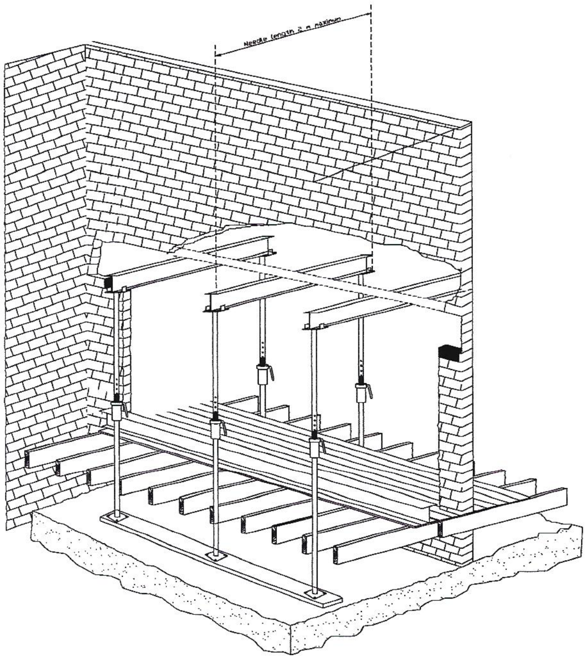
MILNES ASSOCIATES Structural Engineers
The Maples, Station Road, Blackminster.WR11 7TF
07778 033623 darren@milnes-associates.com

Job No.9714 – Weston Turville Village Hall – Bi-folds – May'24

Loadings Sheet	Kg/m sq.	Service KN/m sq.
ROOF / CEILING		
DL		
		LL 0.75
	125	DL 1.25
CAVITY WALL		
DL		
	350	DL 3.50

1) Provide 25mm sharp sand/cement dry pack between new steels and existing masonry.
2) These calculations are to be approved by Building Control, suggest building notice.
3) Openings in cement based mortar walls formed with a disc cutter, refer to engineer where lime based.
4) Pad-stones to be precast concrete or engineering brick as specified with min 150mm bearings.
5) Condition of existing masonry to be inspected by engineer where forming pad stones at bearing points if soft or lime based brickwork, partial rebuilding or rebuilding of piers may be necessary.
6) All new steels to be supplied with two coats zinc phosphate.
7) Steels supporting floors encased for half hour fire resistance (2 layer plaster board or intumescent paint).
8) Temporary needle propping requirements @ 1.0m cts set 500mm from each side of wall onto solid base.



9) All works to be carried out in accordance with the CDM regulations with the appointment of a CDM co-ordinator if required and preparation of pre-tender health & safety plan with risk assessment:-

BRIEF DESCRIPTION OF WORK Domestic alterations.
MAIN HAZARDS
- Danger of falling masonry during demolition
- Temporary works for new openings.

MILNES ASSOCIATES

structural calculations

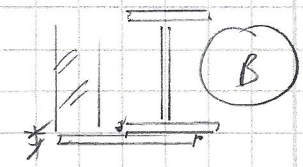
WT VILLAGE HALL

JOB 9714

MAY '24

				kN/m DL	LL
BS5950	BI - FOLDS	6400		DL	LL
	GABLE	3.5 x 1.8		6.5	
	ROOF / CEILING (IF PURLINS)	1.25 x 2.5 x 2 x 3 / 8		2.5	[1] 2

(B) → SHEETS 3.5 USE 305 x 165 UB54



BS5628 PADSTONES CDS 1.0 N/mm²

$38 \times 10^3 / 100 \times 1.0 = 380$ mm

SEE PAGE 6

By: DMM

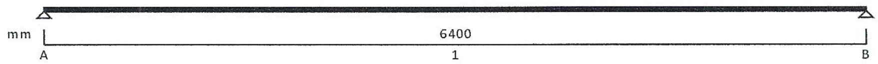
Ck: /

Milnes Associates Structural Engineers	Project Weston Turville Village Hall				Job no. 9714	
	Calcs for bi-folds				Start page no./Revision 3	
	Calcs by D	Calcs date May'24	Checked by	Checked date	Approved by	Approved date

STEEL BEAM ANALYSIS & DESIGN (BS5950)

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

TEDDS calculation version 3.0.08



Support conditions		
Support A	Vertically restrained	
	Rotationally free	
Support B	Vertically restrained	
	Rotationally free	
Applied loading		
Beam loads	Dead full UDL 2.5 kN/m	
	Dead trapezoidal load 6.5 kN/m from 3250 mm to 3250 mm	
	Imposed full UDL 2 kN/m	
	Dead self weight of beam × 1	
Analysis results		
Maximum moment	M_{max} = **69.2** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **38.3** kN	V_{min} = **-38.4** kN
Deflection	δ_{max} = **8.4** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **38.3** kN	R_{A_min} = **38.3** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **20** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **6.4** kN	
Maximum reaction at support B	R_{B_max} = **38.4** kN	R_{B_min} = **38.4** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **20.1** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **6.4** kN	
Section details		
Section type	**UKB 305x165x54 (Tata Steel Advance)**	
Steel grade	**S275**	
From table 9: Design strength p_y		
Thickness of element	max(T, t) = **13.7** mm	
Design strength	p_y = **275** N/mm^2	
Modulus of elasticity	E = **205000** N/mm^2	
Lateral restraint		
	Span 1 has lateral restraint at supports only	
Effective length factors		
Effective length factor in major axis	K_x = **1.00**	
Effective length factor in minor axis	K_y = **1.00**	
Effective length factor for lateral-torsional buckling	$K_{LT.A}$ = **1.20** + 2 × D	
	$K_{LT.B}$ = **1.20** + 2 × D	

Classification of cross sections - Section 3.5

$\varepsilon = \sqrt{[275 \text{ N/mm}^2 / p_y]} = \mathbf{1.00}$

Internal compression parts - Table 11

Depth of section — d = **265.2** mm

$d / t = 33.6 \times \varepsilon <= 80 \times \varepsilon$ — Class 1 plastic

Outstand flanges - Table 11

Width of section — b = B / 2 = **83.5** mm

$b / T = 6.1 \times \varepsilon <= 9 \times \varepsilon$ — Class 1 plastic

Section is class 1 plastic

Shear capacity - Section 4.2.3

Design shear force — $F_v = \max(\text{abs}(V_{max}), \text{abs}(V_{min})) = \mathbf{38.4}$ kN

$d / t < 70 \times \varepsilon$

Web does not need to be checked for shear buckling

Shear area — $A_v = t \times D = \mathbf{2452}$ mm^2

Design shear resistance — $P_v = 0.6 \times p_y \times A_v = \mathbf{404.6}$ kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment — $M = \max(\text{abs}(M_{s1\_max}), \text{abs}(M_{s1\_min})) = \mathbf{69.2}$ kNm

Moment capacity low shear - cl.4.2.5.2 — $M_c = \min(p_y \times S_{xx}, 1.2 \times p_y \times Z_{xx}) = \mathbf{232.7}$ kNm

Effective length for lateral-torsional buckling - Section 4.3.5

Effective length for lateral torsional buckling — $L_E = 1.2 \times L_{s1} + 2 \times D = \mathbf{8301}$ mm

Slenderness ratio — $\lambda = L_E / r_{yy} = \mathbf{211.131}$

Equivalent slenderness - Section 4.3.6.7

Buckling parameter — u = **0.889**

Torsional index — x = **23.612**

Slenderness factor — $v = 1 / [1 + 0.05 \times (\lambda / x)^2]^{0.25} = \mathbf{0.669}$

Ratio - cl.4.3.6.9 — $\beta_W = \mathbf{1.000}$

Equivalent slenderness - cl.4.3.6.7 — $\lambda_{LT} = u \times v \times \lambda \times \sqrt{[\beta_W]} = \mathbf{125.569}$

Limiting slenderness - Annex B.2.2 — $\lambda_{L0} = 0.4 \times (\pi^2 \times E / p_y)^{0.5} = \mathbf{34.310}$

$\lambda_{LT} > \lambda_{L0}$ - Allowance should be made for lateral-torsional buckling

Bending strength - Section 4.3.6.5

Robertson constant — $\alpha_{LT} = \mathbf{7.0}$

Perry factor — $\eta_{LT} = \max(\alpha_{LT} \times (\lambda_{LT} - \lambda_{L0}) / 1000, 0) = \mathbf{0.639}$

Euler stress — $p_E = \pi^2 \times E / \lambda_{LT}^2 = \mathbf{128.3}$ N/mm^2

$\phi_{LT} = (p_y + (\eta_{LT} + 1) \times p_E) / 2 = \mathbf{242.6}$ N/mm^2

Bending strength - Annex B.2.1 — $p_b = p_E \times p_y / (\phi_{LT} + (\phi_{LT}^2 - p_E \times p_y)^{0.5}) = \mathbf{89.1}$ N/mm^2

Equivalent uniform moment factor - Section 4.3.6.6

Moment at quarter point of segment — $M_2 = \mathbf{49.8}$ kNm

Moment at centre-line of segment — $M_3 = \mathbf{69.2}$ kNm

Moment at three quarter point of segment — $M_4 = \mathbf{50}$ kNm

Maximum moment in segment — $M_{abs} = \mathbf{69.2}$ kNm

Maximum moment governing buckling resistance — $M_{LT} = M_{abs} = \mathbf{69.2}$ kNm

Equivalent uniform moment factor for lateral-torsional buckling

$m_{LT} = \max(0.2 + (0.15 \times M_2 + 0.5 \times M_3 + 0.15 \times M_4) / M_{abs}, 0.44) = \mathbf{0.917}$

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment $M_b = p_b \times S_{xx}$ = **75.3** kNm

M_b / m_{LT} = **82.2** kNm

PASS - Buckling resistance moment exceeds design bending moment

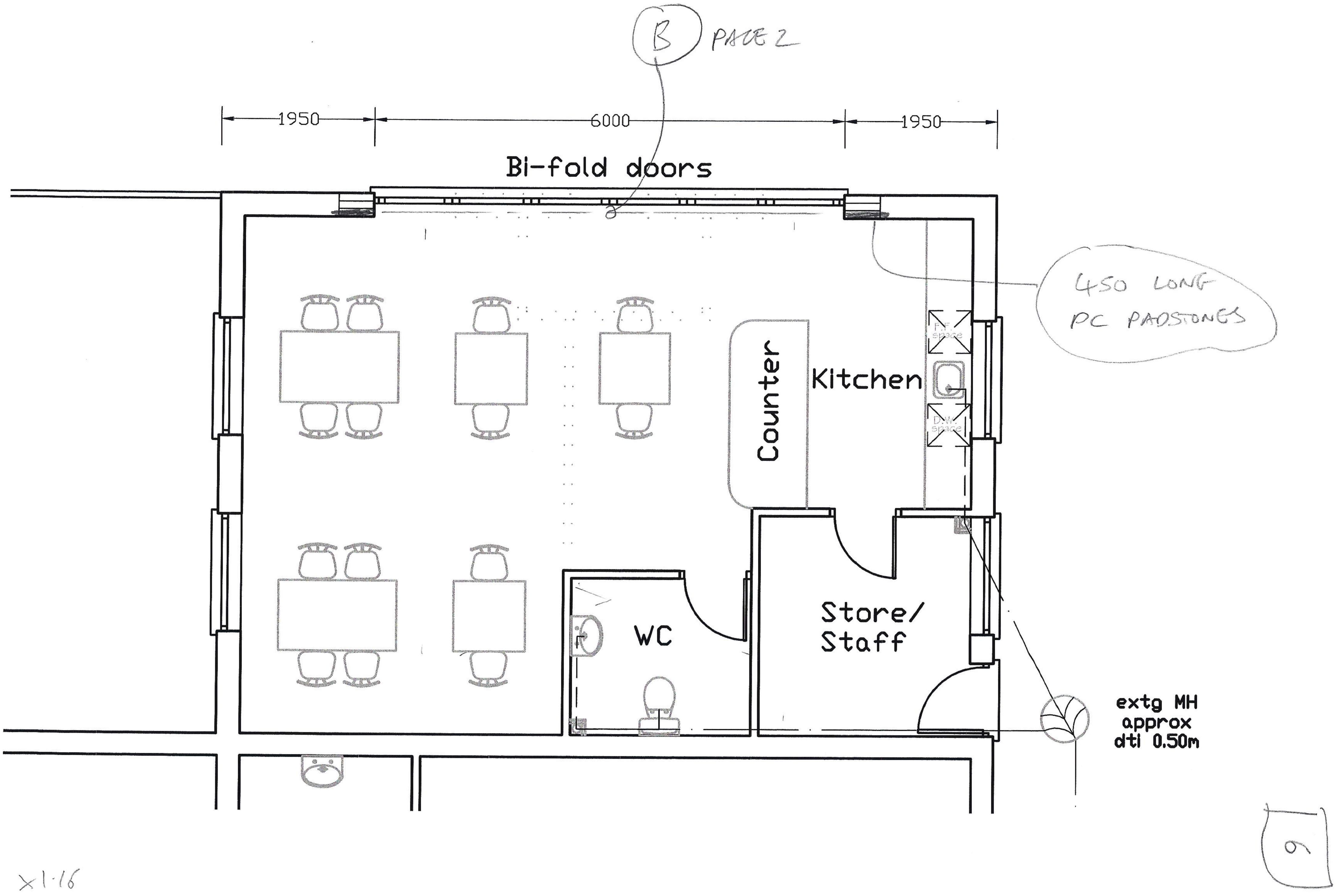
Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection $\delta_{lim} = L_{s1} / 360$ = **17.778** mm

Maximum deflection span 1 $\delta = \max(\text{abs}(\delta_{max}), \text{abs}(\delta_{min}))$ = **8.372** mm

PASS - Maximum deflection does not exceed deflection limit


B
PAGE 2
1950
6000
1950
Bi-fold doors
450 LONG
PC PADSTONES
F.F. space
D.W. space
Counter
Kitchen
WC
Store/
Staff
extg MH
approx
dtl 0.50m

x1·16