

Project Title: Most Roof Repairs - Timber Sillce.		Project No: 11796R	Page No: 1	Rev:
Calculations	Notes	Meeting Minutes	Sketch Sheet	Made by: JH
				Checked by:
				Date: Sept '24
				Scanned:

① 4.6m Valley Beam: 100 x 275mm - C24

$M_{im} = 5.8 \text{ kNm}$, $V_{im} = 10.5 \text{ kN}$, $N_c = 29 \text{ kN}$ (JLS FACTORED)
for SLS, CONSERVATION DIVIDED BY 1.35: $V_{sLS} = 7.8 \text{ kN}$, $N_{sLS} = 21.5 \text{ kN}$, $M_{sLS} = 4.3 \text{ kNm}$.
CONSIDER REPAIR DESIGN IN ACCORDANCE WITH BS 5268-2.

BH 25.09.24

PROPOSED ARRANGEMENT:

FROM T.81, FOR M16 BOLT:

EDGE DIST = $4 \times \phi = 64 \text{ mm}$

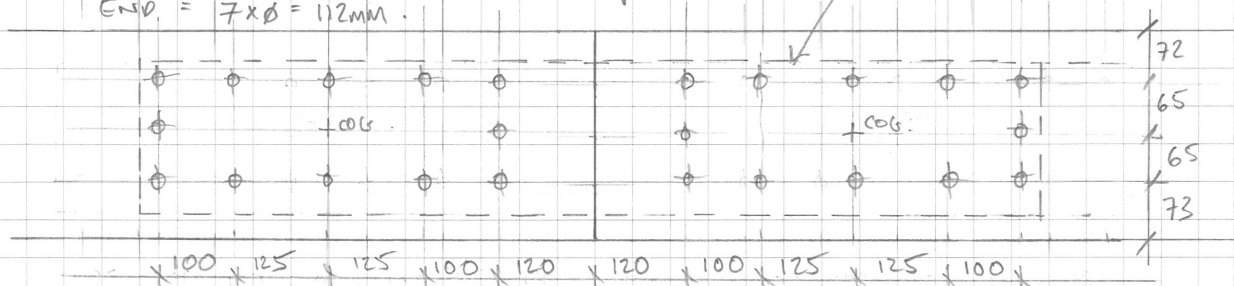
PITCH = " = 64 mm

END = $7 \times \phi = 112 \text{ mm}$

2x12 NO. M16 (4.6) BOLTS E.S.
w/ 50 x 4mm WASHERS

$M = 4.3 \text{ kNm}$
 $N_c = 21.5 \text{ kN}$
 $V = 7.8 \text{ kN}$

200 x 5mm CENTRAL PLATE (S275)



REAL MOMENT OF INERTIA : $2 \times 3 \times 0.225^2 + 2 \times 2 \times 0.125^2$
EACH SIDE ABOUT BOLT CGS + $2 \times 5 \times 0.065^2 = 0.409 \text{ m}^2$

DISTANCE FROM CG TO SILLCE = $0.12 + 0.1 + 0.125 = 0.345 \text{ m}$

M ADD DUE TO OFFSET = $7.8 \times 0.345 = 2.69 \text{ kNm}$

TOTAL M ON GROUP = $4.3 + 2.69 = 6.99 \text{ kNm}$

FORCE IN EXTREME BOLT DUE TO MOMENT = $6.99 \times 0.225 / 0.409 = 3.85 \text{ kN}$ (VERT)

HORIZ. F " " = $6.99 \times 0.065 / 0.409 = 1.11 \text{ kN}$ (HORIZ)

VERT. F DUE TO SHEAR/BOLT = $7.8 / 12 = 0.65 \text{ kN}$

HORIZ. F DUE TO TVE/BOLT = $21.5 / 12 = 1.79 \text{ kN}$

TOTAL F VERT = $3.85 + 0.65 = 4.5 \text{ kN}$

TOTAL F HORIZ = $1.11 + 1.79 = 2.9 \text{ kN}$

VECTOR FORCE = $\sqrt{4.5^2 + 2.9^2} = 5.36 \text{ kN}$
4 from VERT = $90 - \tan^{-1}(2.9/4.5) = 57.17^\circ$

FORCE IN TIMBER EACH SIDE OF FLITCH PLATE = $5.36 / 2 = 2.68 \text{ kN}$

FOR M16 (4.6) BOLT IN C24 TIMBER, $(100 - 6) / 2 = 47 \text{ mm}$ EACH SIDE OF PLATE:

MEDIUM-TERM LOADING.

$F_{||} = 3.29 \text{ kN}$, $F_{\perp} = 2.74 \text{ kN}$ (TABLE 71)

$F = (3.29 \times 2.74) / (3.29 \times \sin^2 57.2 + 2.74 \times \cos^2 57.2) = 2.88 \text{ kN}$

6.6.4.1

$K_{46} = 1.0$, $K_{56} = 1.0$, $K_{57} = 1.0 \therefore F_{ADM} = 1 \times 1 \times 1 \times 2.88 \text{ kN} = 2.88 \text{ kN}$

6.6.6.

$F_{DES} = 2.68 < 2.88 @ 93\% \text{ OK}$

PROVIDE M16 (4.6) BOLTS w/ WASHERS $\phi = 48 \text{ mm}$, $t = 4 \text{ mm}$.
ARRANGEMENT AS ABOVE.

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Calculation for PLATE: (PLUGS)

$$\text{Min. } t = 0.3 \times 16 = 4.8 \therefore \text{by } 5.0 \text{mm. S275}$$

$$\text{For GR4.6 BOLT IN } 5.0 \text{mm PL, BEARING CAPACITY} = 36.8 \text{ kN, SHEAR CAP. DBL} = 50.2$$

$$> 5.36 \times 1.35 = 7.3 \text{ kN} \therefore \text{OK.}$$

$$\text{MIN EDGE DIST. IN STEEL} = 35 \text{mm, TRY } 200 \text{mm d/p PLATE.}$$

$$Z = 5 \times 200^2 / 6 = 33333 \text{ mm}^3$$

$$\sigma_m = 5.8 \times 10^6 / 33333 = 174 \text{ N/mm}^2$$

$$\sigma_v = (3 \times 10.5 \times 10^3) / (2 \times 200 \times 5) = 15.75 \text{ N/mm}^2 \text{ (LOW SHEAR)}$$

$$\sigma_c = (29 \times 10^3) / (200 \times 5) = 29 \text{ N/mm}^2$$

$$\text{COMBINED } \sigma_{M \& C} = 174 + 29 = 203 \text{ N/mm}^2 < 275 \text{ N/mm}^2 \therefore \text{OK.}$$

PROVIDE 200 x 5mm S275 PLATE.

CHECK CAPACITY OF RESIDUAL SECTION IN BENDING: @ END OF CONNECTION.

(BS5268-2 - PERMISSIBLE STRESS DESIGN).

$$M = 4.3 + 7.8 \times 0.605 = 9.0 \text{ kNm}$$

$$\sigma_m = 6 \times 9.0 \times 10^6 / 94 \times 275^2 = 7.6 \text{ N/mm}^2$$

(C24) k_2 k_3 k_4 k_5

$$\sigma_{ADM} = 7.5 \times 1 \times 1 \times 1 \times 1.25 = 9.375 \text{ N/mm}^2 > 7.6 \text{ N/mm}^2 \therefore \text{OK. T.8}$$

$$\sigma_N = 21.5 \times 10^3 / 94 \times 275 = 0.83 \text{ N/mm}^2, \sigma_{ADM} = 7.9 \times 1.25 \times 1 \times 1 \times 0.81 = 8.0 \text{ N/mm}^2 \therefore \text{OK. 2.1}$$

NOTE: CALCULATION ASSUMES TIMBER IS C24. IF GRADE IS

LESSER THEN DESIGN MUST BE REVISITED.

MAY REQUIRE PAIR OF PLATES EITHER SIDE OF MEMBER