Learning Tool for Reinforced Concrete Design	Project				Job Ref.	
	Section				Sheet no./rev. 1	
	Calc.by	Date	Chk'd by	Date	App'd by	Date

SHEAR CAPACITY AND SHEAR REINFORCEMENT CALCULATION (BS8110:PART1:1997)

STEP 1

Find the v_c referring Table 3.8

Table 3.8 — Values of v_c design concrete shear stress

$\frac{100A_s}{b_v d}$	Effective depth mm							
	125	150	175	200	225	250	300	≥ 400
	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2
≤ 0.15	0.45	0.43	0.41	0.40	0.39	0.38	0.36	0.34
0.25	0.53	0.51	0.49	0.47	0.46	0.45	0.43	0.40
0.50	0.67	0.64	0.62	0.60	0.58	0.56	0.54	0.50
0.75	0.77	0.73	0.71	0.68	0.66	0.65	0.62	0.57
1.00	0.84	0.81	0.78	0.75	0.73	0.71	0.68	0.63
1.50	0.97	0.92	0.89	0.86	0.83	0.81	0.78	0.72
2.00	1.06	1.02	0.98	0.95	0.92	0.89	0.86	0.80
≥ 3.00	1.22	1.16	1.12	1.08	1.05	1.02	0.98	0.91

NOTE 1 Allowance has been made in these figures for a γ_m of 1.25.

NOTE 2 The values in the table are derived from the expression:

$0.79\{100A_s/(b_v d)\}^{1/3}\ (400/d)^{1/4}/\gamma_m$

where

$\frac{100A_s}{b_v d}$ should not be taken as greater than 3;

$\frac{400}{d}$ should not be taken as less than 1.

For characteristic concrete strengths greater than 25 N/mm^2, the values in this table may be multiplied by $(f_{cu}/25)^{1/3}$. The value of f_{cu} should not be taken as greater than 40.

$$\frac{100A_S}{bd} =$$

$$v_c =$$

STEP 2

Find the shear capacity;

$$\boldsymbol{v = \frac{V}{bd} =}$$

NOTE

Table 3.7 — Form and area of shear reinforcement in beams

Value of v N/mm^2	Form of shear reinforcement to be provided	Area of shear reinforcement to be provided
Less than $0.5v_c$ throughout the beam	See NOTE 1	—
$0.5v_c < v < (v_c + 0.4)$	Minimum links for whole length of beam	$A_{sv} \geq 0.4b_v s_v/0.95f_{yv}$ (see NOTE 2)
$(v_c + 0.4) < v < 0.8\sqrt{f_{cu}}$ or 5 N/mm^2	Links or links combined with bent-up bars. Not more than 50 % of the shear resistance provided by the steel may be in the form of bent-up bars (see NOTE 3)	Where links only provided: $A_{sv} \geq b_v s_v(v - v_c)/0.95f_{yv}$ Where links and bent-up bars provided: see **3.4.5.6**
NOTE 1 While minimum links should be provided in all beams of structural importance, it will be satisfactory to omit them in members of minor structural importance such as lintels or where the maximum design shear stress is less than half v_c. NOTE 2 Minimum links provide a design shear resistance of 0.4 N/mm^2. NOTE 3 See **3.4.5.5** for guidance on spacing of links and bent-up bars.		

STEP 3

Find the S_v by using Table 3.7;

$S_v \leq$

- The spacing not exceed 0.75d.($0.75d =$)
- The spacing more than 150mm.

Therefore, shear reinforce spacing is ……………mm.

SHEAR CAPACITY AND SHEAR REINFORCEMENT CALCULATION (EC2)

Shear check at Support;

Maximum Shear force at the face of the support,

$$V_{Ef} = \frac{wl}{2} =$$

Crushing strength of the diagonal strut(concrete),

$$V_{Rd,max} = \frac{\alpha_{cw} b_w Z V_1 f_{cd}}{\cot\theta + \tan\theta}$$

$$V_1 = 0.6\left(1 - \frac{f_{CK}}{250}\right)$$

$f_{cd} = \frac{\alpha_{CC} f_{CK}}{\gamma_C}$; $\alpha_{CW} = 1 \; for \; non \; prestressed \; members.$

Assume ϴ=22^0 for uniformly distributed loads.

$V_{Rd,max} =$

$V_{Rd,max} = V_{Ef}$

$\theta = 0.5 \sin^{-1}\left(\frac{2V_{Ef}}{\alpha_{cw} b_w Z V_1 f_{cd}}\right)$

$\theta =$

Find the shear capacity. $V_{Ed} =$

Design value of shear resistance of the concrete beam without links.

$V_{Rd,max} = \left[C_{Rd,C} K (100 \rho_1 f_{CK})^{1/3} + K_1 \sigma_{CP}\right] b_w d$

$V_{Rd,max} = V_{Rd,C} =$

$V_{min} = 0.035 K^{3/2} f_{CK}^{\frac{1}{2}} =$

$(V_{min} + K_1 \sigma_{CP}) b_w d =$

If , $V_{Ed} > \{maximum \; of \; [(V_{min} + K_1 \sigma_{CP}) b_w d] \; or \; V_{Rd,C} \}$

Shear reinforcement is necessary.

$V_{Rd,max} = V_{Ed} = \frac{A_{sw}}{S} Z f_{ywd} \cot \theta$

$\frac{A_{sw}}{S} =$

It is assumed links are of T10 diameter bars with two upright arms.($A_{sw} = 157 mm^2$)

$S \leq$

So provided T10 @..............mm spacing.

<u>Check</u>

Maximum longitudinal spacing between links.

$S_{I,max} = 0.75 d (1 + \cot \alpha)$ α=90^0 (Vertical shear links provided)

$S_{I,max} =$

Therefore links T10 @ ……..mm.