

Pad	footing	details
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Length of pad footing Width of pad footing Area of pad footing Depth of pad footing Depth of soil over pad footing Density of concrete

Column details

Column base length Column base width Column eccentricity in x Column eccentricity in y

Soil details

Cohesive soil

Density of soil $\rho_{soil} = 18.0 \text{ kN/m}^3$ Design shear strength $\phi' = 25.0 \text{ deg}$ Design base friction $\delta = 19.3 \text{ deg}$ Allowable bearing pressure $P_{bearing} = 250 \text{ kN/m}^2$ Axial loading on column $P_{GA} = 500.0 \text{ kN}$

V

Imposed axial load on column

$$\begin{split} & L = 2000 \text{ mm} \\ & B = 2000 \text{ mm} \\ & A = L \times B = 4.000 \text{ m}^2 \\ & h = 600 \text{ mm} \\ & h_{\text{soil}} = 750 \text{ mm} \\ & \rho_{\text{conc}} = 24.0 \text{ kN/m}^3 \end{split}$$

2000

850-

V

►

la = **300** mm ba = **300** mm ePxA = **0** mm ePyA = **0** mm

P_{GA} = **500.0** kN P_{QA} = **300.0** kN

Tekla	Project				Job Ref.	
LEMARG ENGINEERING	Section				Sheet no./rev. 2	
	Calc. by U	Date 7/26/2021	Chk'd by	Date	App'd by	Date
Wind axial load on column Total axial load on column		Pwa = 0.0 kN Pa = 800.0 kN	۷			
Foundation loads Dead surcharge load Imposed surcharge load Pad footing self weight Soil self weight Total foundation load		$F_{Gsur} = 0.000$ $F_{Qsur} = 0.000$ $F_{swt} = h \times \rho_{con}$ $F_{soil} = h_{soil} \times \rho$ $F = A \times (F_{Gsur})$	kN/m ² kN/m ² c = 14.400 kN/ soil = 13.500 kN + FQsur + Fswt 1	m² I/m² + Fsoil) = 111.6 kN		
Calculate pad base reaction Total base reaction Eccentricity of base reaction in x Eccentricity of base reaction in y	Control and the same tensionT = F + PA = 911.6 kNControl base reactionT = F + PA = 911.6 kNControl tricity of base reaction in x $e_{Tx} = (PA \times e_{PxA} + M_{xA} + H_{xA} \times h) / T = 0 mm$ Control tricity of base reaction in y $e_{Ty} = (PA \times e_{PyA} + M_{yA} + H_{yA} \times h) / T = 0 mm$					
Check pad base reaction eccent	ricity	abs(eтx) / L +	abs(e _{Ty}) / B =	0.000		
Calculate pad base pressures Minimum base pressure Maximum base pressure	Base reaction acts within middle third of base $q_1 = T/A - 6 \times T \times e_{Tx} / (L \times A) - 6 \times T \times e_{Ty} / (B \times A) = 227.900 \text{ kN/m}^2$ $q_2 = T/A - 6 \times T \times e_{Tx} / (L \times A) + 6 \times T \times e_{Ty} / (B \times A) = 227.900 \text{ kN/m}^2$ $q_3 = T/A + 6 \times T \times e_{Tx} / (L \times A) + 6 \times T \times e_{Ty} / (B \times A) = 227.900 \text{ kN/m}^2$ $q_4 = T/A + 6 \times T \times e_{Tx} / (L \times A) + 6 \times T \times e_{Ty} / (B \times A) = 227.900 \text{ kN/m}^2$ $q_{min} = \min(q_1, q_2, q_3, q_4) = 227.900 \text{ kN/m}^2$ $q_{max} = \max(q_1, q_2, q_3, q_4) = 227.900 \text{ kN/m}^2$ PASS - Maximum base pressure is less than allowable bearing pressure 227.9 kN/m^2 227.9 kN/m^2					
	227.9 kN/m ²		22	27.9 kN/m ²		



	Project				Job Ref.		
LEMARG ENGINEERING	Section			Sheet no./rev. 3			
	Calc. by U	Date 7/26/2021	Chk'd by	Date	App'd by	Date	
Partial safety factors for loads							
Partial safety factor for dead loads		γfG = 1.40					
Partial safety factor for imposed loa	ids	γfQ = 1.60					
Partial safety factor for wind loads		$\gamma fW = 0.00$					
Ultimate axial loading on column	I						
Ultimate axial load on column		$P_{uA} = P_{GA} \times \gamma_{fG}$	G + PQA $\times \gamma$ fQ +	Pwa × γfw = 118	80.0 kN		
Ultimate foundation loads							
Ultimate foundation load		$F_u = A \times [(F_{Gsu})$	ur + Fswt + Fsoil)	$\times \gamma _{ m fG}$ + FQsur $ imes \gamma$	/fq] = 156.2 kN		
Ultimate horizontal loading on co	olumn						
Ultimate horizontal load in x direction	on	$H_{xuA} = H_{GxA} \times I_{u}$	γfG + H QxA × γfC	α + Hwxa × γfw =	0.0 kN		
Ultimate horizontal load in y direction	on	$H_{yuA} = H_{GyA} \times H_{yuA}$	γfG + H QyA × γfC	$a + HwyA \times \gamma fw =$	0.0 kN		
Ultimate moment on column							
Ultimate moment on column in x di	rection	$M_{xuA} = M_{GxA} \times$	γfG + $M_{QxA} \times \gamma f$	$fQ + MWxA \times \gamma fW =$	= 0.000 kNm		
Ultimate moment on column in y di	rection	$M_{yuA} = M_{GyA} imes$	γfG + MQyA × γf	α + M wyA × γfw =	= 0.000 kNm		
Calculate ultimate pad base reac	tion						
Ultimate base reaction		$T_u = F_u + P_{uA}$	= 1336.2 kN				
Eccentricity of ultimate base reaction	on in x	$e_{Txu} = (P_{uA} \times e_{tau})$	PxA + MxuA + H	$I_{xuA} \times h$) / $T_u = 0$	mm		
Eccentricity of ultimate base reaction	on in y	$e_{Tyu} = (P_{uA} \times e$	PyA + MyuA + H	$I_{yuA} \times h) / T_u = 0$	mm		
Calculate ultimate pad base pres	sures						
		q1u = Tu/A - 6>	≺Tu×e⊤xu/(L×A)	- 6×Tu×етуи/(В×	(A) = 334.060 kN	l/m²	
		$q_{2u} = T_u/A - 6$	≺Tu×e⊤xu/(L×A)	+ 6×Tu× етуи/(В	8×A) = 334.060 k	N/m²	
		qзu = Tu/A + 6	×Tu×етxu/(L×A)) - 6×Tu×етуu/(Вз	×A) = 334.060 kM	N/m ²	
•••		$q_{4u} = T_u/A + 6$	×Tu×e⊤xu/(L×A)) + 6×Ти×етуи/(В	8×A) = 334.060 k	N/m²	
Minimum ultimate base pressure		$q_{minu} = min(q_1)$	u, Q2u, Q3u, Q4u) 1 Q2u, Q2u, Q4u) = 334.060 KN/r .) - 334.060 kN	m² /m²		
Coloulate rate of charge of hose			1u, q 2u, q 3u, q 4u	1) – 334.000 KN	/111		
Left hand hase reaction	pressure in	ful = $(a_{10} + a_{20})$) × B / 2 – 669	8 120 kN/m			
Right hand base reaction		$f_{\rm UR} = (q_{\rm SU} + q_{\rm ZU})$	u) × B / 2 = 66	8.120 kN/m			
Length of base reaction		$L_x = L = 2000$	mm				
Rate of change of base pressure		$C_x = (f_{uR} - f_{uL})$	/ L _x = 0.000 kl	N/m/m			
Calculate pad lengths in x direct	on						
Left hand length		LL = L / 2 + eF	exA = 1000 mm	1			
Right hand length		LR = L / 2 - eP	xA = 1000 mm				
Calculate ultimate moments in x	direction						
Ultimate moment in x direction		$M_x = f_{uL} \times L_L^2$	$/2 + C_x \times L_{L^3} /$	$^{\prime}6 - F_u \times LL^2 / (2)$	× L) = 295.000	<nm< td=""></nm<>	
Calculate rate of change of base	pressure in	y direction					
Top edge base reaction		fu⊤ = (q 2u + q4u	u) × L / 2 = 668	3.120 kN/m			
Bottom edge base reaction		fuв = (q1u + q3u	u) × L / 2 = 668	8.120 kN/m			
Length of base reaction		L _y = B = 2000	mm				
Rate of change of base pressure		Су = (fuв - fuт)	/ Ly = 0.000 ki	N/m/m			

Tekla	Project Job Ref.							
LEMARG ENGINEERING	Section		Sheet no./rev.					
	Calc. by U	Date 7/26/2021	Chk'd by	Date	App'd by	Date		
Calculate pad lengths in y dire	ection							
Top length		LT = B / 2 - ePy	a = 1000 mm					
Bottom length		L _B = B / 2 + e _P	_{yA} = 1000 mm					
Calculate ultimate moments in	y direction							
Ultimate moment in y direction		$M_y = f_{uT} \times L_T^2 / $	$2 + C_y \times L_T^3 / 6$	$-$ F _u × L τ^2 / (2 × E	3) = 295.000 ki	٨m		
Material details								
Characteristic strength of concre	te	fcu = 30 N/mm ²	2					
Characteristic strength of reinfor	cement	fy = 500 N/mm	2					
Characteristic strength of shear	reinforcement	f _{yv} = 250 N/mm	n ²					
Nominal cover to reinforcement		Cnom = 50 mm						
Moment design in x direction								
Diameter of tension reinforceme	nt	ф _{хв} = 16 mm						
Depth of tension reinforcement		$d_x = h - C_{nom} - d_{xB} / 2 = 542 \text{ mm}$						
Design formula for rectangula	r beams (cl 3.4.	4 4)	•					
Design formula for rectangula	i beallis (cl 5.4.	+.+) K ₂ – M₂ / (B ⊻)	dv ² × fau) – 0 017					
		$K_{x}' = 0.156$						
			K _x < K _x ' c	ompression re	inforcement is	s not require		
Lever arm		$z_x = d_x \times min(f)$	0.5 + √(0.25 - K×	/ 0.9)], 0.95) = \$	515 mm			
Area of tension reinforcement re	auired	As $x reg = Mx / 0$	$(0.87 \times f_v \times z_x) =$	1317 mm ²				
Minimum area of tension reinfor	cement	$A_{s \times min} = 0.00$	13 × B × h = 156	0 mm ²				
Tension reinforcement provided		12 No. 16 dia. bars bottom (175 centres)						
Area of tension reinforcement provided		$A_{s_xB_prov} = N_{xB} \times \pi \times \phi_{xB}^2 / 4 = 2413 \text{ mm}^2$						
Area or tension reinforcement pr	ovided							
Area of tension reinforcement pr	ovided PASS -	Tension reinford	ement provide	d exceeds tens	ion reinforce	nent require		
Moment design in y direction	PASS -	Tension reinford	cement provide	d exceeds tens	ion reinforcei	nent require		
Moment design in y direction Diameter of tension reinforceme	oviaea <i>PASS -</i> nt	Tension reinford φ _{yB} = 16 mm	cement provide	d exceeds tens	ion reinforcei	ment require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement	ovided <i>PASS -</i> nt	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - 6$	cement provide	d exceeds tens	ion reinforcer	ment require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula	nt r beams (cl 3.4.	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d_{4.4}$	cement provide фхв - фув / 2 = 526	d exceeds tens	ion reinforcei	nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula	PASS - nt r beams (cl 3.4.4	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - c$ 4.4) $K_y = M_y / (L \times c)$	cement provide $\phi_{xB} - \phi_{yB} / 2 = 526$ $d_y^2 \times f_{cu}) = 0.018$	d exceeds tens	ion reinforcei	nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula	PASS - nt r beams (cl 3.4.4	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - dy$ 4.4) $K_y = M_y / (L \times dy)$ $K_y' = 0.156$	cement provide $\phi_{xB} - \phi_{yB} / 2 = 526$ $d_{y^2} \times f_{cu}) = 0.018$	d exceeds tens	ion reinforcei	nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula	PASS - nt r beams (cl 3.4.4	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - 0$ 4.4) $K_y = M_y / (L \times 0)$ $K_{y'} = 0.156$	cement provide $\phi_{XB} - \phi_{YB} / 2 = 526$ $d_{y^2} \times f_{cu}) = 0.018$ $K_y < K_y' c$	d exceeds tens 5 mm ompression rea	ion reinforcei	nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula	PASS - nt r beams (cl 3.4.4	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d_y$ 4.4) $K_y = M_y / (L \times d_y)^2$ $K_{y'} = 0.156$ $z_y = d_y \times \min([10])^2$	cement provide $\phi_{xB} - \phi_{yB} / 2 = 526$ $d_{y}^{2} \times f_{cu}) = 0.018$ $K_{y} < K_{y}' c$ $0.5 + \sqrt{(0.25 - K_{y})}$	d exceeds tens 5 mm ompression ret / 0.9)], 0.95) = 5	ion reinforce inforcement is 500 mm	nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re	oviaed PASS - nt r beams (cl 3.4.4 quired	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d$ 4.4) $K_y = M_y / (L \times d$ $K_y' = 0.156$ $z_y = d_y \times \min([d_{A_s_y} - d_y]) / (d_{A_s_y} - d_y) / $	cement provide $\phi_{xB} - \phi_{yB} / 2 = 526$ $d_{y}^{2} \times f_{cu}) = 0.018$ $K_{y} < K_{y}' c$ $0.5 + \sqrt{(0.25 - K_{y})}$ $(0.87 \times f_{y} \times z_{y}) = 1$	d exceeds tens 5 mm ompression rea / 0.9)], 0.95) = 5 1357 mm ²	ion reinforcer inforcement is 500 mm	nent require s not require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re Minimum area of tension reinforcement reinforcement	PASS - nt r beams (cl 3.4. quired cement	Tension reinford $\varphi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d_y$ 4.4) $K_y = M_y / (L \times d_y)$ $K_y' = 0.156$ $z_y = d_y \times \min([I_x + I_y] + I_y] + I_y$ $A_{s_y req} = M_y / (I_y + I_y] + I_y$	cement provide $\phi_{xB} - \phi_{yB} / 2 = 526$ $d_y^2 \times f_{cu}) = 0.018$ $K_y < K_y' c$ $0.5 + \sqrt{(0.25 - K_y)}$ $(0.87 \times f_y \times z_y) = 1$ $13 \times L \times h = 156$	d exceeds tens 5 mm ompression rea / 0.9)], 0.95) = \$ 1357 mm ² 0 mm ²	ion reinforcer inforcement is 500 mm	nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re Minimum area of tension reinforcement provided	PASS - nt r beams (cl 3.4.4 quired	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d$ 4.4) $K_y = M_y / (L \times d$ $K_{y'} = 0.156$ $z_y = d_y \times \min([M_{A_{S_y}} - m_y] / (L_{A_{S_y}} - m_y) / (L_{A_{S_y}} - m_y] / (L_{A_{S_y}} - m_y) / ($	cement provide $\phi_{xB} - \phi_{yB} / 2 = 526$ $d_{y^2} \times f_{cu}) = 0.018$ $K_y < K_y' c$ $0.5 + \sqrt{(0.25 - K_y)}$ $(0.87 \times f_y \times z_y) = 13 \times L \times h = 1566$ bars bottom (2)	d exceeds tens 5 mm ompression rea / 0.9)], 0.95) = 5 1357 mm ² 0 mm ² 200 centres)	ion reinforcer inforcement is 500 mm	nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re Minimum area of tension reinforcement provided Area of tension reinforcement provided	PASS - nt r beams (cl 3.4.4 quired cement ovided	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d_y$ 4.4) $K_y = M_y / (L \times d_y)$ $K_y' = 0.156$ $z_y = d_y \times \min([I_x] A_{s_y_req} = M_y / (I_y) A_{s_y_r$	cement provides $\phi_{xB} - \phi_{yB} / 2 = 526$ $d_{y}^{2} \times f_{cu}) = 0.018$ $K_{y} < K_{y}' c$ $0.5 + \sqrt{(0.25 - K_{y})}$ $(0.87 \times f_{y} \times z_{y}) = 13 \times L \times h = 1566$ bars bottom (2 $\times \pi \times \phi_{yB}^{2} / 4 = 2$	d exceeds tens 5 mm ompression rea / 0.9)], 0.95) = \$ 1357 mm ² 0 mm ² 200 centres) 2011 mm ²	ion reinforcer inforcement is 500 mm	nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re Minimum area of tension reinforcement provided Area of tension reinforcement provided	PASS - nt r beams (cl 3.4.4 quired cement ovided PASS -	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d$ 4.4) $K_y = M_y / (L \times d$ $K_y' = 0.156$ $z_y = d_y \times \min([I + A_{s_y} - I + G_y] + (I + A_{s_y} - I + G_y] + (I + A_{s_y} - I + G_y] + (I + A_{s_y} - I + G_y) + (I + A_{s_y} - I + (I +$	cement provide $\phi_{XB} - \phi_{YB} / 2 = 526$ $dy^2 \times f_{cu}) = 0.018$ $K_y < K_y ' c$ $0.5 + \sqrt{(0.25 - K_y)}$ $0.87 \times f_y \times z_y) = 13 \times L \times h = 1566$ $bars bottom (2 \times \pi \times \phi_{YB}^2 / 4 = 2)$ $cement provide$	d exceeds tens 5 mm (0.9)], 0.95) = 5 1357 mm ² 0 mm ² 200 centres) 2011 mm ² d exceeds tens	ion reinforcer inforcement is 500 mm	nent require 5 not require nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re Minimum area of tension reinforcement provided Area of tension reinforcement provided Area of tension reinforcement provided	PASS - nt r beams (cl 3.4.4 quired cement ovided PASS - at d from top fa	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - 0$ 4.4) $K_y = M_y / (L \times 0)$ $K_y' = 0.156$ $z_y = d_y \times \min([1 + A_{s_y_req} = M_y / 0]$ $A_{s_y_req} = M_y / 0$ $A_{s_y_min} = 0.00$ 10 No. 16 dial $A_{s_yB_prov} = N_yB$ Tension reinford according to column	cement provides $\phi_{XB} - \phi_{YB} / 2 = 526$ $K_y < K_y ' c$ $K_y < K_y ' c$ $K_y < K_y ' c$ $0.5 + \sqrt{(0.25 - K_y)}$ $0.87 \times f_y \times Z_y) = 13 \times L \times h = 156$ $bars bottom (2 \times \pi \times \phi_{YB}^2 / 4 = 2)$ $cement provides$	d exceeds tens 5 mm (0.9)], 0.95) = 5 1357 mm ² 0 mm ² 200 centres) 2011 mm ² d exceeds tens	ion reinforcer inforcement is 500 mm	nent require 5 not require ment require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re Minimum area of tension reinforcement provided Area of tension reinforcement provided Area of tension reinforcement provided Ultimate pressure for shear	PASS - nt r beams (cl 3.4.4 quired cement ovided PASS - at d from top fa	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d$ 4.4) $K_y = M_y / (L \times d$ $K_y' = 0.156$ $Z_y = d_y \times \min([I + A_{s_y} - I + G_y] + (I + A_{s_y} - I + G_y]$ $A_{s_y} - I = 0.00^\circ$ 10 No. 16 dia. $A_{s_y} - I = N_y B_y$ Tension reinford $A_{s_y} = (I + I - G_y]$	cement provides $φ_{xB} - φ_{yB} / 2 = 526$ $dy^2 \times f_{cu}) = 0.018$ $K_y < K_y' c$ $0.5 + \sqrt{(0.25 - K_y)}$ $13 \times L \times h = 156$ bars bottom (2 $\times \pi \times φ_{yB}^2 / 4 = 2$ cement provides $\times (B / 2 + e_{PA} + b_{yA})$	d exceeds tens 5 mm ompression rea / 0.9)], 0.95) = 5 1357 mm ² 0 mm ² 200 centres) 2011 mm ² d exceeds tens ba / 2 + dy) / L +	ion reinforcer inforcement is 500 mm ion reinforcer	nent require 5 not require nent require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re Minimum area of tension reinforc Tension reinforcement provided Area of tension reinforcement pr Calculate ultimate shear force Ultimate pressure for shear	PASS - nt r beams (cl 3.4.4 quired cement ovided PASS - at d from top fa	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - 0$ 4.4) $K_y = M_y / (L \times 0$ $K_y' = 0.156$ $z_y = d_y \times \min([1 - A_{s_y_req} = M_y / (1 - A_{s_y_req} + M_y / (1 - A_{s_y_req} $	cement provides $\phi_{XB} - \phi_{YB} / 2 = 526$ $d_{Y}^2 \times f_{cu}) = 0.018$ $K_y < K_y' c$ $0.5 + \sqrt{(0.25 - K_y)}$ $0.87 \times f_Y \times z_y) = 13 \times L \times h = 1564$ $bars bottom (2 \times \pi \times \phi_{YB}^2 / 4 = 2)$ cement provides $\times (B / 2 + e_{PYA} + KN/m^2)$	d exceeds tens 5 mm ompression rea / 0.9)], 0.95) = 5 1357 mm ² 0 mm ² 200 centres) 2011 mm ² d exceeds tens ba / 2 + dy) / L +	ion reinforcer inforcement is 500 mm tion reinforcer q4u) / 2	nent require 5 not require ment require		
Moment design in y direction Diameter of tension reinforcement Depth of tension reinforcement Design formula for rectangula Lever arm Area of tension reinforcement re Minimum area of tension reinforcement provided Area of tension reinforcement provided	PASS - nt r beams (cl 3.4.4 quired cement ovided PASS - at d from top fa	Tension reinford $\phi_{yB} = 16 \text{ mm}$ $d_y = h - C_{nom} - d$ 4.4) $K_y = M_y / (L \times d$ $K_y' = 0.156$ $z_y = d_y \times \min([I + A_{s_y,req} = M_y / (I + A_{s_y,req} = M_$	$ement \ provides$ $\phi_{XB} - \phi_{YB} / 2 = 526$ $dy^{2} \times f_{cu}) = 0.018$ $K_{y} < K_{y}' c$ $0.5 + \sqrt{(0.25 - K_{y})} = 13 \times L \times h = 156$ $bars \ bottom (2 \times \pi \times \phi_{YB}^{2} / 4 = 2 \times ment \ provides$ $\times (B / 2 + e_{PyA} + K_{y})$ $e_{PyA} - b_{A} / 2 - d$	d exceeds tens 5 mm ompression rea / 0.9)], 0.95) = 5 1357 mm ² 0 mm ² 200 centres) 2011 mm ² d exceeds tens bA / 2 + dy) / L +	iion reinforcer inforcement is 500 mm iion reinforcer q4u) / 2	nent require s not require ment require		

Tekla Tedds	Project Job Ref.									
LEMARG ENGINEERING	Section		Sheet no./rev. 5							
	Calc. by U	Date 7/26/2021	Chk'd by	Date	App'd by	Date				
Shear stresses at d from top fa	ace of column	ı (cl 3.5.5.2)								
Design shear stress		v _{su} = V _{su} / (L	\times d _y) = 0.182 N	/mm²						
From BS 8110:Part 1:1997 - Ta	ble 3.8									
Design concrete shear stress	Design concrete shear stress		$v_c = 0.79 \text{ N/mm}^2 \times \text{min}(3, [100 \times A_{s_yB_prov} / (L \times d_y)]^{1/3}) \times \text{max}((400 \text{ mm / } 100 \text{ mm }))$							
		$(d_y)^{1/4}$, 0.67) × (min(f _{cu} / 1 N/mm ² , 40) / 25) ^{1/3} / 1.25 = 0.361 N/mm ²								
Allowable design shear stress		v _{max} = min(0.	.8 N/mm ² × $\sqrt{(f_{ct})}$. / 1 N/mm²),	5 N/mm ²) = 4.382	N/mm ²				
			PAS	S - V _{su} < V _c - I	No shear reinford	ement required				
Calculate ultimate punching sl	near force at f	ace of column								
Ultimate pressure for punching s	hear	$q_{puA} = q_{1u}+[(l$	_/2+epxa-la/2)+(l	а)/2]×Cx/B-[(Е	3/2+е _{РуА} -bа/2)+(ba)/2]×Cy/L =				
		334.060 kN/i	m²							
Average effective depth of reinfo	rcement	$d = (d_x + d_y) / 2 = 534 \text{ mm}$								
Area loaded for punching shear a	Area loaded for punching shear at column		A _{pA} = (I _A)×(b _A) = 0.090 m ²							
Length of punching shear perime	eter	$u_{pA} = 2 \times (I_A) + 2 \times (b_A) = 1200 \text{ mm}$								
Ultimate shear force at shear per	Ultimate shear force at shear perimeter		$V_{puA} = P_{uA} + (F_u / A - q_{puA}) \times A_{pA} = 1153.450 \text{ kN}$							
Effective shear force at shear pe	Effective shear force at shear perimeter		V _{puAeff} = V _{puA} = 1153.450 kN							
Punching shear stresses at fac	ce of column	(cl 3.7.7.2)								
Design shear stress		$v_{\text{puA}} = V_{\text{puAeff}}$	/ (u _{pA} × d) = 1.8	00 N/mm ²						
Allowable design shear stress	Allowable design shear stress		$v_{max} = min(0.8N/mm^2 \times \sqrt{(f_{cu} / 1 N/mm^2)}, 5 N/mm^2) = 4.382 N/mm^2$							
		PASS - Desig	gn shear stres	s is less tha	n allowable desig	gn shear stress				
Calculate ultimate punching sl	near force at p	perimeter of 1.5 d	I from face of o	olumn						
Ultimate pressure for punching s	hear	$q_{puA1.5d} = q_{1u}$	+[L/2]×Cx/B-[(B/	'2 +е руа - bа/2-1	I.5×d)+(b _≜ +2×1.5×	$(d)/2] \times C_y/L =$				
		334.060 kN/m ²								
Average effective depth of reinfo	Average effective depth of reinforcement		$d = (d_x + d_y) / 2 = 534 \text{ mm}$							
Area loaded for punching shear at column		$A_{pA1.5d} = L \times (b_A + 2 \times 1.5 \times d) = 3.804 \text{ m}^2$								
Length of punching shear perimeter		u _{pA1.5d} = 2×L = 4000 mm								
Ultimate shear force at shear per	Ultimate shear force at shear perimeter		$V_{puA1.5d} = P_{uA} + (F_u / A - q_{puA1.5d}) \times A_{pA1.5d} = 57.820 \text{ kN}$							
Effective shear force at shear pe	rimeter	VpuA1.5deff = VpuA1.5d × 1.25 = 72.275 kN								
Punching shear stresses at pe	rimeter of 1.5	d from face of co	olumn (cl 3.7.3	7.2)						
Design shear stress		$v_{puA1.5d} = V_{puA1.5d}$	A1.5deff / (U pA1.5d ×	d) = 0.034 N	l/mm²					
From BS 8110:Part 1:1997 - Ta	ble 3.8									
Design concrete shear stress	Design concrete shear stress		$v_{c} = 0.79 \text{ N/mm}^{2} \times \text{min}(3, \text{ [}100 \times (A_{s_xB_prov} / (B \times d_{x}) + A_{s_yB_prov} / (L \times d_{y})) \text{ / }$							
		2] ^{1/3}) × max(1.25 = 0.370	(800 mm / (d _x +) N/mm ²	dy)) ^{1/4} , 0.67)	× (min(fcu / 1 N/mr	m ² , 40) / 25) ^{1/3} /				
Allowable design shear stress		v _{max} = min(0.	.8N/mm ² × $\sqrt{(f_{cu})}$	/ 1 N/mm²), క	5 N/mm²) = 4.382	N/mm²				
		PASS - v _{puA1.5d} < v _c - No shear reinforcement required								





---- Shear at d from column face

 $-\cdot$ - Punching shear perimeter at 1.5 × d from column face