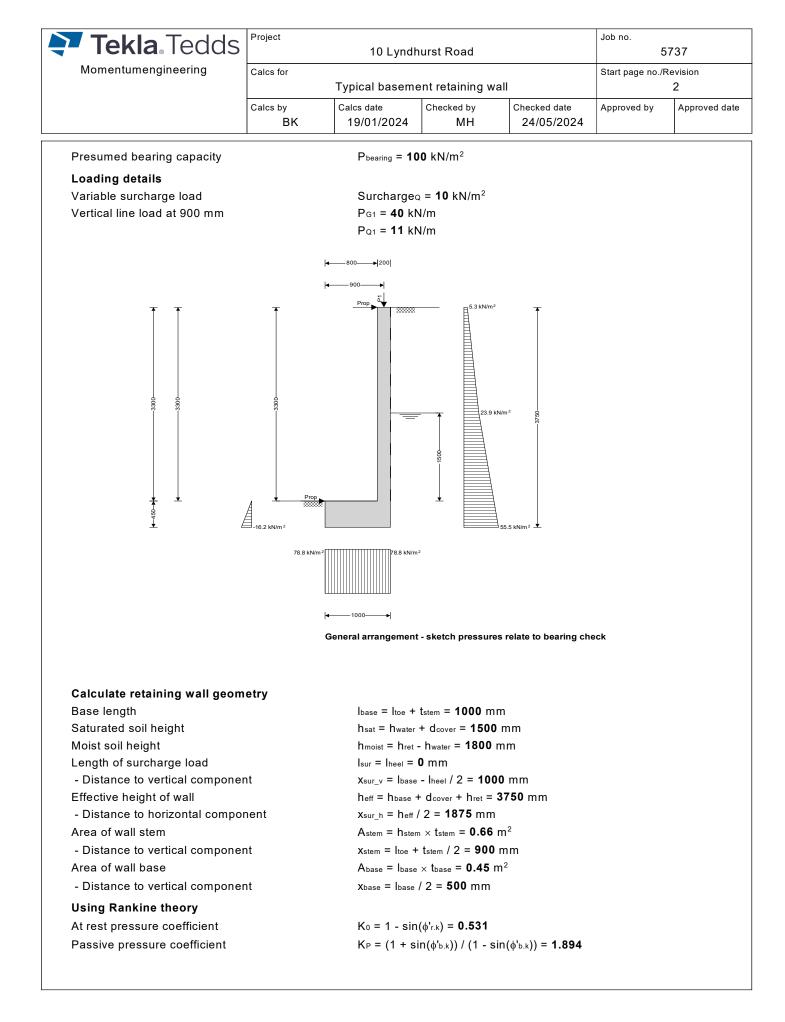
<b>Tekla</b> Tedds	Project		10 Lyndh	urst Road		Job no.	5737	
Momentumengineering	Calcs for Typical basement retaining wall					Start page no./Revision 1		
	Calcs by BK	Calcs 19/	<sup>date</sup> 01/2024	Checked by MH	Checked date 24/05/2024	Approved by	Approved	
RETAINING WALL ANALYSIS In accordance with EN1997-1: incorporating Corrigendum N	-	orating (	Corrigend	um dated Feb	ruary 2009 and			
Analysis summary						Tedds calcul	ation version	
<b>Design summary</b> Overall design utilisation Overall design status			.991 'ass					
						Decult		
Description Bearing pressure		Unit kN/m <sup>2</sup>	Capacit 100	y Applied 78.8	F o S 1.270	PASS		
		[XIN/11]	100	10.0	1.210			
Design summary		110:4	Duardat	d Damitur I		Becult		
Description Shear resistance		Unit kN/m	Provide 74.2	d Required	Utilisation 0.459	Result PASS		
Stem p0 - Shear resistance		kN/m	103.9	85.7	0.825	PASS		
Stem p1 front face - Flexural re	inforcement	mm <sup>2</sup> /m	754.0	216.9	0.288	PASS		
Stem p1 - Shear resistance		kN/m	86.6	25.5	0.294	PASS		
Base top face - Flexural reinford		mm²/m	754.0	593.4	0.787	PASS		
Base bottom face - Flexural rein	torcement	mm <sup>2</sup> /m	754.0	555.8	0.737	PASS		
Base - Shear resistance		kN/m	161.8	74.2	0.459	PASS		
Retaining wall details		_		4:1				
Stem type			ropped ca					
Stem height			stem = 3300					
Prop height			prop = <b>3300</b>					
Stem thickness			<sub>tem</sub> = <b>200</b> r	nm				
Angle to rear face of stem		α	= <b>90</b> deg					
Stem density		γ	<sub>stem</sub> = <b>25</b> kl	N/m <sup>3</sup>				
Toe length		Ite	<sub>be</sub> = <b>800</b> m	m				
Base thickness		tı	<sub>ase</sub> = <b>450</b> r	nm				
Base density		γ	<sub>base</sub> = <b>25</b> kl	N/m <sup>3</sup>				
Height of retained soil		h	ret = <b>3300</b>	mm				
Angle of soil surface			= <b>0</b> deg					
Depth of cover			<sub>cover</sub> = <b>0</b> m	m				
Height of water			water = $150$					
Water density			$\gamma_{\rm w} = 9.8 \ \rm kN/m^3$					
-		Ŷ						
Retained soil properties			_					
Soil type				graded sand a	nd gravel			
Moist density		γ	mr = <b>19.5</b> k	N/m³				
Saturated density		γ	<sub>sr</sub> = <b>21.9</b> kl	N/m <sup>3</sup>				
Characteristic effective shear re	sistance ang	le ø	' <sub>r.k</sub> = <b>28</b> de	g				
Characteristic wall friction angle		δ	r.k = <b>14</b> deg	9				
Base soil properties			·					
		<u> </u>	tiff close					
Soil type			tiff clay	3				
		γ	5 = <b>19</b> kN/r					
Soil density								
Soil density Characteristic effective shear re	sistance ang	le ø	' <sub>b.k</sub> = <b>18</b> de	g				
-			' <sub>b.k</sub> = <b>18</b> de <sub>b.k</sub> = <b>9</b> deg	-				



Tekla. Tedds	Project	10 Lyndh	urst Road		Job no. 5	737
Momentumengineering	Calcs for	Typical baseme	ent retaining wal	I	Start page no./R	evision 3
	Calcs by BK	Calcs date 19/01/2024	Checked by MH	Checked date 24/05/2024	Approved by	Approved date

Bearing pressure check	
Vertical forces on wall	
Wall stem	F <sub>stem</sub> = A <sub>stem</sub> × γ <sub>stem</sub> = <b>16.5</b> kN/m
Wall base	$F_{base}$ = $A_{base} \times \gamma_{base}$ = 11.3 kN/m
Line loads	$F_{P_v} = P_{G1} + P_{Q1} = 51 \text{ kN/m}$
Total	F <sub>total_v</sub> = F <sub>stem</sub> + F <sub>base</sub> + F <sub>P_v</sub> + F <sub>water_v</sub> = <b>78.8</b> kN/m
Horizontal forces on wall	
Surcharge load	F <sub>sur_h</sub> = K <sub>0</sub> × Surcharge <sub>Q</sub> × h <sub>eff</sub> = <b>19.9</b> kN/m
Saturated retained soil	$F_{sat_h} = K_0 \times (\gamma_{sr} - \gamma_w) \times (h_{sat} + h_{base})^2 / 2 = 12.2 \text{ kN/m}$
Water	$F_{water_h} = \gamma_w \times (h_{water} + d_{cover} + h_{base})^2 / 2 = 18.7 \text{ kN/m}$
Moist retained soil	$F_{moist_h}$ = K <sub>0</sub> × $\gamma_{mr}$ × ((heff - hsat - hbase) <sup>2</sup> / 2 + (heff - hsat - hbase) × (hsat +
	h <sub>base</sub> )) = <b>53.1</b> kN/m
Base soil	$F_{pass_h} = -K_P \times \gamma_b \times (d_{cover} + h_{base})^2 / 2 = -3.6 \text{ kN/m}$
Total	F <sub>total_h</sub> = F <sub>sur_h</sub> + F <sub>sat_h</sub> + F <sub>water_h</sub> + F <sub>moist_h</sub> + F <sub>pass_h</sub> = <b>100.1</b> kN/m
Moments on wall	
Wall stem	M <sub>stem</sub> = F <sub>stem</sub> × x <sub>stem</sub> = <b>14.9</b> kNm/m
Wall base	M <sub>base</sub> = F <sub>base</sub> × x <sub>base</sub> = <b>5.6</b> kNm/m
Surcharge load	$M_{sur} = -F_{sur_h} \times x_{sur_h} = -37.3 \text{ kNm/m}$
Line loads	Mp = (P <sub>G1</sub> + P <sub>Q1</sub> ) × p <sub>1</sub> = <b>45.9</b> kNm/m
Saturated retained soil	$M_{sat} = -F_{sat_h} \times x_{sat_h} = -7.9 \text{ kNm/m}$
Water	M <sub>water</sub> = -F <sub>water_h</sub> × x <sub>water_h</sub> = <b>-12.1</b> kNm/m
Moist retained soil	Mmoist = -Fmoist_h × xmoist_h = -78.1 kNm/m
Total	Mtotal = Mstem + Mbase + Msur + MP + Msat + Mwater + Mmoist = -69.1 kNm/m
Check bearing pressure	
Propping force to stem	Fprop_stem = (Ftotal_v × Ibase / 2 - Mtotal) / (hprop + tbase) = <b>28.9</b> kN/m
Propping force to base	Fprop_base = Ftotal_h - Fprop_stem = <b>71.2</b> kN/m
Moment from propping force	$M_{prop} = F_{prop_stem} \times (h_{prop} + t_{base}) = 108.5 \text{ kNm/m}$
Distance to reaction	$\overline{\mathbf{x}}$ = (M <sub>total</sub> + M <sub>prop</sub> ) / F <sub>total_v</sub> = <b>500</b> mm
Eccentricity of reaction	$e = \bar{x} - I_{base} / 2 = 0 mm$
Loaded length of base	I <sub>load</sub> = I <sub>base</sub> = <b>1000</b> mm
Bearing pressure at toe	$q_{toe} = F_{total_v} / I_{base} \times (1 - 6 \times e / I_{base}) = 78.8 \text{ kN/m}^2$
Bearing pressure at heel	$q_{\text{heel}} = F_{\text{total_v}} / I_{\text{base}} \times (1 + 6 \times e / I_{\text{base}}) = 78.8 \text{ kN/m}^2$
Factor of safety	FoS <sub>bp</sub> = P <sub>bearing</sub> / max(q <sub>toe</sub> , q <sub>heel</sub> ) = <b>1.27</b>
PA	ASS - Allowable bearing pressure exceeds maximum applied bearing pressure

## RETAINING WALL DESIGN

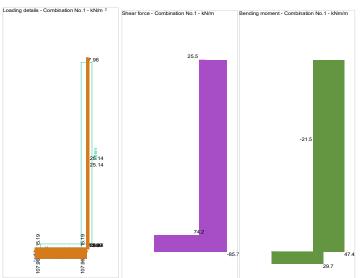
In accordance with EN1992-1-1:2004 incorporating Corrigendum dated January 2008 and the UK National Annex incorporating National Amendment No.1

Tedds calculation version 2.9.17

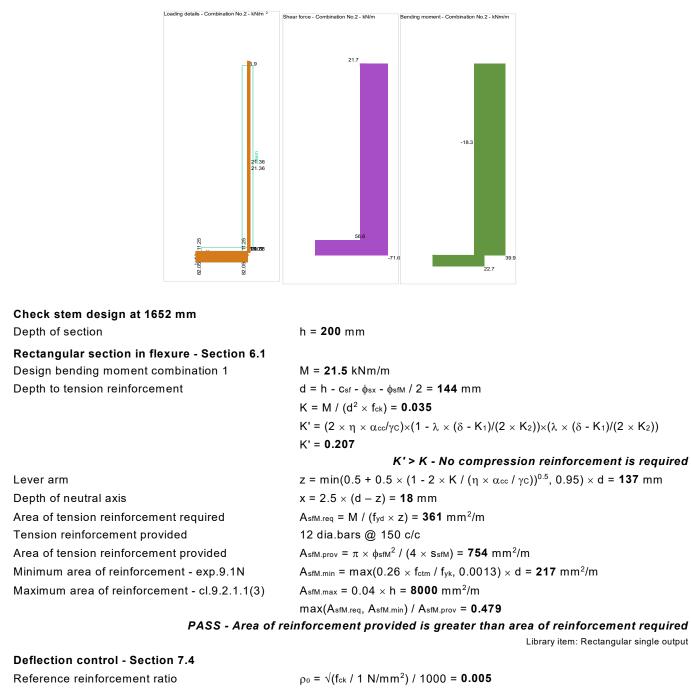
## Concrete details - Table 3.1 - Strength and deformation characteristics for concrete

Concrete strength class	C30/37
Characteristic compressive cylinder strength	f <sub>ck</sub> = <b>30</b> N/mm <sup>2</sup>
Characteristic compressive cube strength	f <sub>ck,cube</sub> = <b>37</b> N/mm <sup>2</sup>
Mean value of compressive cylinder strength	f <sub>cm</sub> = f <sub>ck</sub> + 8 N/mm <sup>2</sup> = <b>38</b> N/mm <sup>2</sup>
Mean value of axial tensile strength	$f_{ctm} = 0.3 \ N/mm^2 \times (f_{ck} \ / \ 1 \ N/mm^2)^{2/3} = \textbf{2.9} \ N/mm^2$

<b>Tekla</b> Tedds	Project	10 Lyndh	urst Road		Job no. 5	737
Momentumengineering	Calcs for				Start page no./F	Revision
		Typical baseme	ent retaining w	all		4
	Calcs by BK	Calcs date 19/01/2024	Checked by MH	Checked date 24/05/2024	Approved by	Approved d
5% fractile of axial tensile streng	ıth	f <sub>ctk,0.05</sub> = 0.7	× fctm = 2.0 N/	′mm²		
Secant modulus of elasticity of c	oncrete	E <sub>cm</sub> = 22 kN	$1/mm^2 \times (f_{cm} / T)$	10 N/mm <sup>2</sup> ) <sup>0.3</sup> = <b>32</b>	<b>837</b> N/mm²	
Partial factor for concrete - Table	e 2.1N	γc = <b>1.50</b>				
Compressive strength coefficien	t - cl.3.1.6(1)	αcc = <b>0.85</b>				
Design compressive concrete st	rength - exp.3.1	$\bar{b}$ $f_{cd} = \alpha_{cc} \times f_{cd}$	ck / γc = <b>17.0</b> N	/mm²		
Maximum aggregate size		h <sub>agg</sub> = <b>20</b> m	m			
Ultimate strain - Table 3.1		εcu2 = <b>0.003</b>	5			
Shortening strain - Table 3.1		εcu3 = <b>0.003</b>	5			
Effective compression zone heig	pht factor	$\lambda = 0.80$				
Effective strength factor		η = <b>1.00</b>				
Bending coefficient k1		K <sub>1</sub> = <b>0.40</b>				
Bending coefficient k <sub>2</sub>		K <sub>2</sub> = 1.00 ×	(0.6 + 0.0014	/ <sub>8cu2</sub> ) = <b>1.00</b>		
Bending coefficient k <sub>3</sub>		K3 = <b>0.40</b>				
Bending coefficient k₄		$K_4 = 1.00 \times$	(0.6 + 0.0014	/ɛcu2) <b>=1.00</b>		
Reinforcement details						
Characteristic yield strength of r	einforcement	f <sub>yk</sub> = <b>500</b> N/	mm²			
Modulus of elasticity of reinforce	ment	Es = <b>20000</b>	<b>0</b> N/mm <sup>2</sup>			
Partial factor for reinforcing stee	I - Table 2.1N	γs <b>= 1.15</b>				
Design yield strength of reinforce	ement	$f_{yd} = f_{yk} / \gamma s$	= <b>435</b> N/mm <sup>2</sup>			
Cover to reinforcement						
Front face of stem		c <sub>sf</sub> = <b>40</b> mm	ı			
Rear face of stem		c <sub>sr</sub> = <b>50</b> mm	ı			
Top face of base		c <sub>bt</sub> = <b>50</b> mm	-			
Bottom face of base		c <sub>bb</sub> = <b>75</b> mr	n			



Tekla. Tedds	Project	10 Lyndh	urst Road		Job no. 5	737
Momentumengineering	Calcs for	Typical baseme	ent retaining w	all	Start page no./R	tevision 5
	Calcs by BK	Calcs date 19/01/2024	Checked by MH	Checked date 24/05/2024	Approved by	Approved date



Reference reinforcement ratio	$\rho_0 = \sqrt{(f_{ck} / 1 N/mm^2) / 1000} = 0.005$
Required tension reinforcement ratio	$\rho = A_{sfM.req} / d = 0.003$
Required compression reinforcement ratio	ρ' = A <sub>sfM.2.req</sub> / d <sub>2</sub> = <b>0.000</b>
Structural system factor - Table 7.4N	K <sub>b</sub> = 1
Reinforcement factor - exp.7.17	$K_s = min(500 \text{ N/mm}^2 / (f_{yk} \times A_{sfM.req} / A_{sfM.prov}), 1.5) = 1.5$
Limiting span to depth ratio - exp.7.16.a	$min(K_s \times K_b \times [11 + 1.5 \times \sqrt{(f_{ck} / 1 N/mm^2)} \times \rho_0 / \rho + 3.2 \times \sqrt{(f_{ck} / 1 N/mm^2)})$
	$N/mm^2$ ) × ( $\rho_0 / \rho - 1$ ) <sup>3/2</sup> ], 40 × K <sub>b</sub> ) = <b>40</b>
Actual span to depth ratio	h <sub>prop</sub> / d = <b>22.9</b>
	PASS - Span to depth ratio is less than deflection control limit

Tekla Tedds		10 Lyndh	urst Road		5	5737
Momentumengineering Cal	cs for	Typical baseme	ent retaining w	vall	Start page no./I	Revision 6
Cal	cs by BK	Calcs date 19/01/2024	Checked by MH	Checked date 24/05/2024	Approved by	Approved
Crack control - Section 7.3						
Limiting crack width		w <sub>max</sub> = <b>0.3</b> (	mm			
Variable load factor - EN1990 - Tat	ble A1 1	$\psi_2 = 0.6$				
Serviceability bending moment		Ψ <sup>2</sup> 010 M <sub>sls</sub> = <b>13.9</b>	kNm/m			
Tensile stress in reinforcement			$A_{sfM.prov} \times z) = 1$	<b>134.7</b> N/mm <sup>2</sup>		
Load duration		Long term	(3)(0)(0) (2)			
Load duration factor		kt = <b>0.4</b>				
Effective area of concrete in tension	ı		2.5 × (h - d). (	h - x) / 3, h / 2)		
		Ac.eff = 6060	. , .	, , ,		
Mean value of concrete tensile stre	ngth	f <sub>ct.eff</sub> = f <sub>ctm</sub> =	<b>2.9</b> N/mm <sup>2</sup>			
Reinforcement ratio		$\rho_{p.eff} = A_{sfM,p}$	orov / Ac.eff = <b>0.0</b>	)12		
Modular ratio		$\alpha_{e} = E_{s} / E_{c}$	m = <b>6.091</b>			
Bond property coefficient		k <sub>1</sub> = <b>0.8</b>				
Strain distribution coefficient		k <sub>2</sub> = <b>0.5</b>				
		k3 = <b>3.4</b>				
		k4 = <b>0.425</b>				
Maximum crack spacing - exp.7.11		$s_{r.max} = k_3 \times$	$c_{\text{sf}} \textbf{+} \textbf{k}_1 \times \textbf{k}_2 \times \\$	$k_4$ $\times$ $\varphi_{sfM}$ / $\rho_{p.eff}$ = 3	300 mm	
Maximum crack width - exp.7.8		Wk = Sr.max >	a max(σs – kt ×	$(f_{ct.eff} / \rho_{p.eff}) \times (1 +$	+ αe × ρp.eff), 0	.6 × σs) / E
		w <sub>k</sub> = <b>0.121</b>	mm			
		$w_k / w_{max} =$	0.404			
		PASS	- Maximum c	rack width is les	s than limitir	ng crack
Check stem design at base of ste	em					
Depth of section		h = <b>200</b> mn	n			
Rectangular section in flexure - S						
Design bending moment combination	on 1	M = <b>47.4</b> kl				
Depth to tension reinforcement			φ <sub>sr</sub> / 2 = <b>142</b> n	nm		
			× fck) = <b>0.078</b>			
		K' = (2 × η K' = <b>0.207</b>	× αcc/γc)×(1 - λ	$1 \times (\delta - K_1)/(2 \times K_2)$	))×(λ × (δ - Κ1	)/(2 × K2))
			K' > K -	No compression	n reinforceme	ent is req
Lever arm		z = min(0.5	+ 0.5 × (1 - 2	$\times$ K / ( $\eta \times \alpha_{cc}$ / $\gamma c$ )	) <sup>0.5</sup> , 0.95) × d	= <b>131</b> mn
Depth of neutral axis		x = 2.5 × (d	– z) = <b>27</b> mm	I		
Area of tension reinforcement requi	red	$A_{sr.req} = M /$	(f <sub>yd</sub> × z) = 829	mm²/m		
Tension reinforcement provided		16 dia.bars	@ 150 c/c			
Area of tension reinforcement provi	ded	$A_{sr.prov} = \pi >$	$\phi_{sr^2}$ / (4 $\times$ s <sub>sr</sub> )	<b>= 1340</b> mm²/m		
Minimum area of reinforcement - ex	(p.9.1N	A <sub>sr.min</sub> = ma	$x(0.26 \times f_{ctm} / f_{ctm})$	f <sub>yk</sub> , 0.0013) × d = 2	<b>214</b> mm²/m	
Maximum area of reinforcement - cl	1.9.2.1.1(3)	$A_{sr.max} = 0.0$	04 × h = 8000	mm²/m		
		max(A <sub>sr.req</sub> ,	Asr.min) / Asr.prov	v = <b>0.619</b>		
PA	SS - Area o	f reinforcement	provided is g	greater than area	<b>of reinforce</b> ibrary item: Recta	-
Deflection control - Section 7.4				L	ierary item. Neola	ngular single
Reference reinforcement ratio		$ ho_0$ = $\sqrt{f_{ck}}$ / 1	N/mm²) / 100	00 = <b>0.005</b>		
Required tension reinforcement rati	o	$\rho = A_{sr.req} / $	-			
Required compression reinforceme		•	/ d2 = <b>0.000</b>			
Structural system factor - Table 7.4		K <sub>b</sub> = <b>1</b>				
Poinforcement factor over 7 17				$\times \Lambda / \Lambda $		

 $K_s = min(500 \text{ N/mm}^2 / (f_{yk} \times A_{sr.req} / A_{sr.prov}), 1.5) = 1.5$ 

Reinforcement factor - exp.7.17

<b>Tekla</b> Tedds	Project	10 Lyndl	nurst Road		Job no. 5	5737		
Momentumengineering	Calcs for				Start page no./F			
		Typical basem	ent retaining w	rall		7		
	Calcs by BK	Calcs date 19/01/2024	Checked by MH	Checked date 24/05/2024	Approved by	Approved of		
Limiting span to depth ratio - ex	p.7.16.b	 min(K₅ x K	ь × [11 + 1.5 ×	√(fck / 1 N/mm²) ×	00/(0 - 0') +	√(fck / 1		
			-	40 × K <sub>b</sub> ) = <b>28.1</b>	F T F F F			
Actual span to depth ratio		$h_{prop} / d = 2$		,				
		PASS	- Span to dep	oth ratio is less th	han deflectio	n control l		
Crack control - Section 7.3								
Limiting crack width		w <sub>max</sub> = 0.3	mm					
Variable load factor - EN1990 -	Table A1.1	ψ2 <b>= 0.6</b>						
Serviceability bending moment		Msls = <b>31.4</b>	kNm/m					
Tensile stress in reinforcement		$\sigma_s$ = M <sub>sls</sub> / (	Asr.prov × z) = 1	<b>78.3</b> N/mm <sup>2</sup>				
Load duration		Long term						
Load duration factor		kt = <b>0.4</b>						
Effective area of concrete in ten	sion	A <sub>c.eff</sub> = min	(2.5 × (h - d), (	h - x) / 3, h / 2)				
		A <sub>c.eff</sub> = 578	<b>31</b> mm²/m					
Mean value of concrete tensile s	strength	$f_{ct.eff} = f_{ctm} =$	<b>2.9</b> N/mm <sup>2</sup>					
Reinforcement ratio		$\rho_{p.eff} = A_{sr.p}$	rov / Ac.eff = 0.02	23				
Modular ratio		$\alpha_{e} = E_{s} / E_{s}$	cm = 6.091					
Bond property coefficient		k1 = <b>0.8</b>						
Strain distribution coefficient		k <sub>2</sub> = <b>0.5</b>						
		k <sub>3</sub> = <b>3.4</b>						
		k <sub>4</sub> = <b>0.425</b>						
Maximum crack spacing - exp.7	.11	sr.max = k3 >	$c_{sr} + k_1 \times k_2 \times k_2$	$k_4 \times \phi_{sr} / \rho_{p.eff}$ = 28	<b>37</b> mm			
Maximum crack width - exp.7.8		$w_{k} = s_{r.max} \times max(\sigma_{s} - k_{t} \times (f_{ct.eff} / \rho_{p.eff}) \times (1 + \alpha_{e} \times \rho_{p.eff}), 0.6 \times \sigma_{s}) / E_{s}$						
		w <sub>k</sub> = <b>0.174</b>	mm					
		$W_k / W_{max} =$						
		PASS	- Maximum c	rack width is les	s than limitin	ig crack w		
Rectangular section in shear	Section 6.2							
Design shear force		V = <b>85.7</b> k	N/m					
			B / γc = <b>0.120</b>					
		k = min(1 -	⊦ √(200 mm / c	i), 2) = <b>2.000</b>				
Longitudinal reinforcement ratio			r.prov / d, 0.02)					
		$v_{min} = 0.03$	$5 \text{ N}^{1/2}/\text{mm} \times \text{k}^3$	$^{/2} \times f_{ck}^{0.5} = 0.542 N$	l/mm²			
Design shear resistance - exp.6	.2a & 6.2b	V <sub>Rd.c</sub> = max	$(C_{Rd.c} \times k \times (1))$	00 N <sup>2</sup> /mm <sup>4</sup> × $\rho$ I × f	ck) <sup>1/3</sup> , Vmin) $\times$ d			
		V <sub>Rd.c</sub> = 103	<b>.9</b> kN/m					
		$V / V_{Rd.c} =$						
		PAS	SS - Design sl	near resistance e	xceeds desig	yn shear fo		
Check stem design at prop								
Depth of section		h = <b>200</b> mi	n					
Rectangular section in shear	- Section 6.2							
Design shear force		V = <b>25.5</b> k	N/m					
		$C_{Rd,c} = 0.13$	8 / γc = <b>0.120</b>					
		k = min(1 -	⊦ √(200 mm / c	i), 2) = <b>2.000</b>				
Longitudinal reinforcement ratio		p⊨= min(A₅	r1.prov / d, 0.02)	= 0.005				
		v <sub>min</sub> = 0.03	$5 \text{ N}^{1/2}/\text{mm} \times \text{k}^3$	$^{/2} \times f_{ck}^{0.5}$ = <b>0.542</b> N	l/mm²			
Design shear resistance - exp.6	.2a & 6.2b	V <sub>Rd.c</sub> = max	$(C_{Rd.c} \times k \times (1))$	00 N <sup>2</sup> /mm <sup>4</sup> × $\rho$ I × f	ck) <sup>1/3</sup> , Vmin) × d			

<b>Tekla</b> Tedds	Project	10 Lyndh	urst Road		Job no. 5	737			
Momentumengineering	Calcs for				Start page no./F				
		Typical baseme	-	all		8			
	Calcs by BK	Calcs date 19/01/2024	Checked by MH	Checked date 24/05/2024	Approved by	Approved d			
		V / V <sub>Rd.c</sub> = (	).297						
			-	ear resistance e	xceeds desig	n shear fo			
Horizontal reinforcement para					2/				
Minimum area of reinforcement			-	$(, 0.001 \times t_{stem}) = 3$	335 mm²/m				
Maximum spacing of reinforcem Transverse reinforcement provid		s <sub>sx_max</sub> = <b>40</b> 10 dia.bars							
Area of transverse reinforcemer			× φsx <sup>2</sup> / (4 × Ssx)	= <b>393</b> mm <sup>2</sup> /m					
	•			reater than area	of reinforce	ment requi			
Check base design at toe						-			
Depth of section		h = <b>450</b> mn	n						
Rectangular section in flexure	- Section 6.1								
Design bending moment combin		M = <b>29.7</b> kl	Nm/m						
Depth to tension reinforcement		d = h - сы -	φ <sub>bb</sub> / 2 = <b>369</b> r	nm					
		$K = M / (d^2)$	× fck) = <b>0.007</b>						
		K' = (2 $\times \eta$	× αcc/γc)×(1 - λ	$\times$ ( $\delta$ - K <sub>1</sub> )/(2 $\times$ K <sub>2</sub>	))×(λ × (δ - K <sub>1</sub> )	/(2 × K <sub>2</sub> ))			
		K' = <b>0.207</b>							
				No compression		-			
Lever arm		-	$z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_c))^{0.5}, 0.95) \times d = 351 \text{ mm}$						
Depth of neutral axis		-	l – z) = <b>46</b> mm	<u>,</u>					
Area of tension reinforcement re	quired		(f <sub>yd</sub> × z) = <b>195</b>	mm²/m					
Tension reinforcement provided			@ 150 c/c	21					
Area of tension reinforcement p				) = <b>754</b> mm <sup>2</sup> /m					
Minimum area of reinforcement	•		$04 \times h = 18000$	$f_{yk}$ , 0.0013) × d =	550 mm²/m				
Maximum area of reinforcement	- 01.9.2.1.1(3)		, Abb.min) / Abb.pro						
	PASS - Area of	-	-	reater than area	of reinforce	ment requi			
					brary item: Rectar				
Crack control - Section 7.3									
Limiting crack width		Wmax = 0.3 I	mm						
Variable load factor - EN1990 -	Table A1.1	$\psi_2 = 0.6$							
Serviceability bending moment		Msls = <b>21.6</b>		<b>4 7</b> NH 2					
Tensile stress in reinforcement Load duration			$A_{bb.prov} \times z) = 8$	<b>1.7</b> N/mm²					
Load duration		Long term kt = <b>0.4</b>							
Effective area of concrete in ten	sion		2.5 × (h - d), (ł	1 - x) / 3. h / 2)					
		Ac.eff = 1340		···,· •, ···, <b>-</b> )					
Mean value of concrete tensile s	strength	$f_{ct.eff} = f_{ctm} =$	<b>2.9</b> N/mm <sup>2</sup>						
Reinforcement ratio		$\rho_{p,eff} = A_{bb,p}$	rov / A <sub>c.eff</sub> = <b>0.00</b>	)6					
Modular ratio		$\alpha_{e} = E_{s} / E_{c}$	m = <b>6.091</b>						
Bond property coefficient		k1 = <b>0.8</b>							
Strain distribution coefficient		k <sub>2</sub> = 0.5							
		k <sub>3</sub> = 3.4							
Movimum grock oncoing	11	k4 = <b>0.425</b>		key du la	19 mm				
Maximum crack spacing - exp.7				$k_4 \times \phi_{bb} / \rho_{p,eff} = 6$		6 v = ) / F			
Maximum crack width - exp.7.8		Wk = Sr.max > Wk = <b>0.152</b>	-	$(f_{ct.eff} / \rho_{p.eff}) \times (1 +$	- αe × ρp.eff), 0.	υ×σs)/Es			

MomentumengineeringStart page no./RevisionCalcs forStart page no./RevisionCalcs by BKCalcs date 19/01/2024Checked by MHChecked date 24/05/2024Approved byApproved dateApproved dateWk / Wmax = 0.506PASS - Maximum crack width is less than limiting crack width Rectangular section in shear - Section 6.2Design shear forceV = 74.2 kN/m CRd.c = 0.18 / $\gamma$ c = 0.120 k = min(1 + $\sqrt{(200 mm / d)}, 2)$ = 1.736Longitudinal reinforcement ratio $\rho$ I = min(Abb.prov / d, 0.02) = 0.002 Vmin = 0.035 N $^{1/2}$ /mm × k $^{3/2}$ × fkc $^{0.5}$ = 0.439 N/mm <sup>2</sup> Design shear resistance - exp.6.2a & 6.2bVRd.c = max(CRd.c × k × (100 N <sup>2</sup> /mm <sup>4</sup> × \rhoI × fck)^{1/3}, Vmin) × d VRd.c = 0.459PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement to base - Section 9.3Minimum area of reinforcement - cl.9.3.1.1(2)Maximum spacing of reinforcement providedAbs.req = 0.2 × Abb.prov = 151 mm <sup>2</sup> /m Maximum spacing of reinforcement provided	<b>Tekla</b> Tedds	Project	10 Lvnd	hurst Road		Job no. 5	737	
Typical basement relaining wall     9       Calcs by BK     Claics date BK     Checked by Checked by BK     Checked by Checked by BASS - Maximum creck width is less than limiting crack with Checked by Checked by		Calcs for	, <b>,</b>					
BK19/01/2024MH24/05/2024Wir / Wmax = 0.506PASS - Maximum crack width is less than limiting crack widthRectangular section in shear - Section 6.2Design shear force $V = 74.2 \text{ kN/m}$ $Cmax = 0.18 / yo = 0.120K = min(1 + \sqrt{(200 mm / d)}, 2) = 1.736p = min(Abab grav / d, 0.02) = 0.002vmm = 0.035 N^{12}mm \times R^{100} \times fa^{105} = 0.439 \text{ N/mm}^2Design shear resistance - exp.6.2a & 6.2bV = racc = max(Cata x K \times (100 N^2/mm^4 \times pi \times fax)^{1/3}, Vmm) \times dV race = 161.8 \text{ kN/m}V / Vrate = 0.459Bescondary transverse reinforcement to base - Section 9.3Minimum area of reinforcement - cl.9.3.1.1(2)Abaseq = 0.2 × Abaseq = 151 mm²/mMaximum spacing of reinforcement - cl.9.3.1.1(3)Box_max = 450 mmTransverse reinforcement providedArea of transverse reinforcement providedAbaseq = 0.2 × Abaseq 200 c/cArea of transverse reinforcement providedAbaseq = 100 c/cArea of reinforcement providedAbaseq = 100 c/cArea of transverse reinforcement providedAbaseq = 100 c/cArea of 100 c/c$			Typical basem	ent retaining w	vall	57 Start page no./Ro Approved by s than limiting /mm <sup>2</sup> :k) <sup>1/3</sup> , Vmin) × d		
wk / Wimax = 0.506         PASS - Maximum crack width is less than limiting crack wi         Rectangular section in shear - Section 6.2         Design shear force       V = 74.2 kN/m Crade = 0.18 / rp = 0.120 k = min(Absprov / d, 0.02) = 1.736         Longitudinal reinforcement ratio       pi = min(Absprov / d, 0.02) = 0.002 Vmm = 0.035 N <sup>1/2</sup> /mm × k <sup>3/2</sup> × fa <sup>0.5</sup> = 0.439 N/mm <sup>2</sup> Design shear resistance - exp.6.2a & 6.2b       Vrade = max(Crade × k × (100 N <sup>2</sup> /mm <sup>4</sup> × pi × fax) <sup>1/3</sup> , Vmm) × d Vrade = 161.8 kN/m V / Vrade = 0.459 Design shear resistance exceeds design shear for Secondary transverse reinforcement or base - Section 9.3         Minimum area of reinforcement - cl.9.3.1.1(2)       Absernat = 450 mm Transverse reinforcement - cl.9.3.1.1(2)         Maximum spacing of reinforcement - cl.9.3.1.1(2)       Absernat = 450 mm Transverse reinforcement provided         Absernat = A fab mm       Transverse reinforcement provided         Absernat = 0.05 V/d absers g 100 c/c       Absernat = 450 mm         Area of transverse reinforcement provided       Absernat = 450 mm         Transverse reinforcement provided       Absernat = 100 min <sup>2</sup> /m         PASS - Area of reinforcement provided       Absernat = 100 min <sup>2</sup> /m         PASS - Area of reinforcement provided is greater than area of reinforcement requi         10 dia.bars g 100 cr       10 dia.bars g 100 cr         12 mbms g 100 cr       12 mbms g 100 cr         12 mbms g 10 cr       10 cr							Approved da	
PASS - Maximum crack width is less than limiting crack wi         Rectangular section in shear - Section 6.2         Design shear force       V = 74.2 kN/m CRac = 0.18 / yc = 0.120 k = min(1 + √(200 mm / d), 2) = 1.736 pri = min(Abb prov / d, 0.02) = 0.002 Vmm = 0.035 N <sup>12</sup> /mm × k <sup>32</sup> × fa <sup>0.6</sup> = 0.439 N/mm <sup>2</sup> Longitudinal reinforcement ratio       pri = min(Abb prov / d, 0.02) = 0.002 Vmm = 0.035 N <sup>12</sup> /mm × k <sup>32</sup> × fa <sup>0.6</sup> = 0.439 N/mm <sup>2</sup> Design shear resistance - exp.6.2a & 6.2b       Vrad = max(Crad × k × (100 N <sup>2</sup> /mm <sup>4</sup> × pi × fa) <sup>13</sup> , Vmm) × d Vf vad = 0.459         PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement - cl.9.3.1.1(2)       Abxreg = 0.2 × Absprov = 151 mm <sup>2</sup> /m         Maximum spacing of reinforcement - cl.9.3.1.1(3)       six_max = 450 mm         Transverse reinforcement provided       10 dia.bars @ 200 c/c         Area of transverse reinforcement provided       Abx.prov = π × φax <sup>2</sup> / (4 × sbac) = 393 mm <sup>2</sup> /m         PASS - Area of reinforcement provided is greater than area of reinforcement require         Vietabare @ 100 cic         Vietabare @ 100		BK	19/01/2024	MH	24/05/2024			
PASS - Maximum crack width is less than limiting crack wiRectangular section in shear - Section 6.2Design shear force $V = 74.2$ kN/m $Grade = 0.18 / yc = 0.120$ $k = min(1 + \sqrt{200} \text{ mm } / d), 2) = 1.736Longitudinal reinforcement ratiopi = min(Aaba prov / d, 0.02) = 0.002Vmin = 0.035 N12/mm \times k^{4/2} \times f_{16}^{6.5} = 0.439 N/mm²Design shear resistance - exp.6.2a & 6.2bVrade = max(Crade x k \times (100 \text{ N}^2/\text{mm}^4 \times pi \times fak)^{13}, Vmin) \times dVrade = 0.459Bescondary transverse reinforcement – cl.9.3.1.1(2)Abscrep = 0.2 × Aabaprov = 151 mm²/mMaximum spacing of reinforcement – cl.9.3.1.1(2)Abscrep = 0.2 × Aabaprov = 151 mm²/mMaximus spacing of reinforcement – cl.9.3.1.1(3)sbc_max = 450 mmTransverse reinforcement provided10 dia.bars @ 2000 c/cArea of transverse reinforcement providedAbscrep = \pi \times \phi_{0.2}^2 / (4 \times sbas) = 393 \text{ mm}^2/mPASS - Area of reinforcement provided is greater than area of reinforcement requinePASS - Area of reinforcement provided is greater than area of reinforcement requine10 determe 0.000 v/v or 0 (10 determe 0.000$			Wk / Wmax =	0 506				
Design shear force $V = 74.2 \text{ kN/m}$ $C_{Rd,c} = 0.18 / y_{C} = 0.120$ $K = min(1 + \sqrt{(200 mm / d)}, 2) = 1.736$ Longitudinal reinforcement ratio $p_{1} = min(Ab_{prov} / d, 0.02) = 0.002$ $v_{min} = 0.035 \text{ N}^{12}/\text{mm} \times \text{k}^{32} \times f_{0}^{0.5} = 0.439 \text{ N/mm}^{2}$ Design shear resistance - exp.6.2a & 6.2b $V_{Rd,c} = max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times p_{1} \times f_{0k})^{10}, v_{min}) \times d$ $V_{Rd,c} = 161.8 \text{ kN/m}$ $V / V_{Rd,c} = 0.559$ <b>PASS - Design shear resistance exceeds design shear for</b> <b>Secondary transverse reinforcement</b> - cl.9.3.1.1(2) As $v_{Rma} = 4.50 \text{ mm}$ Transverse reinforcement - cl.9.3.1.1(3) Sb $v_{Rmax} = 450 \text{ mm}$ Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided Abx.prov = $\pi \times \phi_{0}k^2 / (4 \times s_{DN}) = 393 \text{ mm}^2/\text{m}$ <b>PASS - Area of reinforcement provided</b> Abx.prov = $\pi \times \phi_{0}k^2 / (4 \times s_{DN}) = 393 \text{ mm}^2/\text{m}$ <b>PASS - Area of reinforcement provided</b> $V_{Td, Rd, Rd, Rd, Rd, Rd, Rd, Rd, Rd, Rd, R$					rack width is les	s than limitin	g crack wi	
Design shear force $V = 74.2 \text{ kN/m}$ $C_{Rd,c} = 0.18 / y_{C} = 0.120$ $K = min(1 + \sqrt{(200 mm / d)}, 2) = 1.736$ Longitudinal reinforcement ratio $\rho := min(Abc prov / d, 0.02) = 0.002$ $v_{min} = 0.035 \text{ N}^{1/2}(\text{mm } \times k^{3/2} \times f_{a}^{0.5} = 0.439 \text{ N/mm}^2$ Design shear resistance - exp.6.2a & 6.2b $V_{Rd,c} = max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_1 \times f_{a})^{1/3}, v_{min}) \times d$ $V_{Rd,c} = 161.8 \text{ kN/m}$ $V / V_{Rd,c} = 0.459$ <b>PASS - Design shear resistance exceeds design shear for</b> <b>Secondary transverse reinforcement - c</b> !9.3.1.1(2) As $v_{Rd,c} = 0.2 \times \text{Abc prov} = 151 \text{ mm}^2/\text{m}$ Maximum spacing of reinforcement - c!.9.3.1.1(3) So $v_{max} = 450 \text{ mm}$ Transverse reinforcement provided 10 dia bars @ 200 c/c Area of transverse reinforcement provided As $v_{RV} = r \times \phi_{RS}^2 / (4 \times s_{RS}) = 333 \text{ mm}^2/\text{m}$ <b>PASS - Area of reinforcement provided is greater than area of reinforcement requiness and the start of th</b>	ectangular section in shear	- Section 6.2					-	
$k = \min(1 + \sqrt{(200 \text{ mm } / \text{ d})}, 2) = 1.736$ $p_1 = \min(A_{bb, prov} / \text{ d}, 0.02) = 0.002$ $\forall_{min} = 0.035 \text{ N}^{12}/\text{mm} \times k^{3/2} \times f_{ak}^{0.5} = 0.439 \text{ N/mm}^2$ Design shear resistance - exp.6.2a & 6.2b $\forall_{Nd,c} = \max(C_{Nd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times p_1 \times f_{ak})^{1/3}, \forall_{Nmin}) \times d$ $\forall_{Nd,c} = 161.8 \text{ kN/m}$ $\forall / \forall_{Nd,c} = 0.459$ $PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement - cl.9.3.1.1(2) A_{bx,req} = 0.2 \times A_{bb, prov} = 151 \text{ mm}^2/\text{m} Maximum spacing of reinforcement - cl.9.3.1.1(3) b_{x,max} = 450 \text{ mm} Transverse reinforcement provided A_{bx,prov} = \pi \times \phi_{bx}^2 / (4 \times s_{bx}) = 393 \text{ mm}^2/\text{m} PASS - Area of reinforcement provided is greater than area of reinforcement requil PASS - Area of reinforcement provided = 190 \text{ cc} \frac{12 \text{ desaws } 0.100 \text{ cc}}{12 \text{ desaws } 0.100 \text{ cc}} \frac{12 \text{ desaws } 0.100 \text{ cc}}{12 \text{ desaws } 0.100 \text{ cc}}$	-		V = <b>74.2</b> k	N/m				
Longitudinal reinforcement ratio p = min(Aub.prov / d, 0.02) = 0.002 vmin = 0.035 N <sup>1/2</sup> /mm × k <sup>3/2</sup> × fav <sup>0.5</sup> = 0.439 N/mm <sup>2</sup> Design shear resistance - exp.6.2a & 6.2b Vrd.c = max(Crd.c × k × (100 N <sup>2</sup> /mm <sup>4</sup> × pi × fav) <sup>1/3</sup> , vmin) × d Vrd.c = 161.8 KN/m V / Vrd.c = 0.459 PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement to base - Section 9.3 Minimum area of reinforcement - cl.9.3.1.1(2) Abx.req = 0.2 × Abb.prov = 151 mm <sup>2</sup> /m Maximum spacing of reinforcement - cl.9.3.1.1(3) Secondary transverse reinforcement provided Area of transverse reinforcement provided Area of transverse reinforcement provided Area of transverse reinforcement provided PASS - Area of reinforcement provided is greater than area of reinforcement requine 10 dia.bars @ 200 c/c Area of transverse reinforcement provided Abx.prov = $\pi \times \phi bx^2 / (4 \times sbx) = 393$ mm <sup>2</sup> /m PASS - Area of reinforcement provided is greater than area of reinforcement requine 12 dealars @ 100 cl 12 dealars @ 100 cl 13 dealars @ 100 cl 14 dealars @ 100 cl 15 dealars @ 100 cl 15 dealars @ 100 cl 15 dealars @ 100 cl 15 dealars @ 100 cl 16 dealars @ 100 cl 17 dealars @ 100 cl 18 dealars @ 100 cl 19 dealars @ 100 cl 19 dealars @ 100 cl 19 dealars @ 100 cl 10 dealars @ 100 cl 1			$C_{Rd,c} = 0.1$	8 / γc = <b>0.120</b>				
$v_{min} = 0.035 \text{ N}^{12}/\text{mm} \times k^{32} \times fe^{0.5} = 0.439 \text{ N/mm}^2$ Design shear resistance - exp.6.2a & 6.2b $V_{Rd,c} = \max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_1 \times fek)^{1/3}, v_{min}) \times d$ $V_{Rd,c} = 161.8 \text{ kN/m}$ $V / V_{Rd,c} = 0.459$ $PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement to base - Section 9.3 Minimum area of reinforcement - cl.9.3.1.1(2) Abx.req = 0.2 \times Abb.prov = 151 \text{ mm}^2/\text{m} Maximum spacing of reinforcement - cl.9.3.1.1(3) Sbx_max = 450 mm Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided Abx.prov = \pi \times \phi_{kx}^2 / (4 \times s_{kx}) = 393 \text{ mm}^2/\text{m} PASS - Area of reinforcement provided is greater than area of reinforcement requi $			k = min(1 ·	+ √(200 mm / d	l), 2) = <b>1.736</b>			
Design shear resistance - exp.6.2a & 6.2b $V_{Rd,c} = max(C_{Rd,c} \times k \times (100 N^2/mm^4 \times \rho \times fex)^{1/3}, v_{min}) \times d V_{Rd,c} = 161.8 kN/m V / V_{Rd,c} = 0.459 PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement to base - Section 9.3 Minimum area of reinforcement - cl.9.3.1.1(2) Abxreq = 0.2 × Abb.prov = 151 mm^2/m Maximum spacing of reinforcement - cl.9.3.1.1(3) Sox_max = 450 mm Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided Abx prov = \pi \times \phi bx^2 / (4 \times Sbx) = 393 mm^2/mPASS - Area of reinforcement provided is greater than area of reinforcement requines the order of the second seco$	ongitudinal reinforcement ratio		ρι = min(A	ob.prov / d, 0.02)	= 0.002			
Vird.c = 161.8 kN/m V / Vird.c = 0.459 PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement to base - Section 9.3 Minimum area of reinforcement – cl.9.3.1.1(2) Abx.reg = 0.2 × Abb.prov = 151 mm²/m Maximum spacing of reinforcement – cl.9.3.1.1(3) Sbx_max = 450 mm Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided Abx.prov = $\pi \times \phi bx^2 / (4 \times bbx) = 393 \text{ mm}^2/m$ PASS - Area of reinforcement provided is greater than area of reinforcement requines the of th			v <sub>min</sub> = 0.03	$5 \text{ N}^{1/2}/\text{mm} \times \text{k}^{3/2}$	$^{/2} \times f_{ck}^{0.5} = 0.439 N$	l/mm²		
$V / V_{Rd,c} = 0.459$ PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement to base - Section 9.3 Minimum area of reinforcement - cl.9.3.1.1(2) A <sub>bx,leq</sub> = 0.2 × A <sub>bbb,prov</sub> = 151 mm <sup>2</sup> /m Maximum spacing of reinforcement - cl.9.3.1.1(3) Sb <sub>x</sub> max = 450 mm Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided A <sub>bx prov</sub> = $\pi \times \phi_{bx}^2 / (4 \times s_{bx}) = 393 \text{ mm}^2/m$ PASS - Area of reinforcement provided Is greater than area of reinforcement requines PASS - Area of reinforcement provided Is greater than area of reinforcement requines $V / V_{Rd,c} = 0.2 \times A_{bx} = 0.2 \times$	esign shear resistance - exp.6	.2a & 6.2b	V <sub>Rd.c</sub> = ma	$x(C_{Rd.c} \times k \times (1))$	00 N <sup>2</sup> /mm <sup>4</sup> × $\rho$ I × f	$(c_k)^{1/3}$ , Vmin) × d		
PASS - Design shear resistance exceeds design shear for Secondary transverse reinforcement to base - Section 9.3 Minimum area of reinforcement - cl.9.3.1.1(2) Abx.req = 0.2 × Abb.prov = 151 mm²/m Maximum spacing of reinforcement - cl.9.3.1.1(3) sbx_max = 450 mm Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided Abx.prov = $\pi \times \phi bx^2 / (4 \times sbx) = 393 \text{ mm²/m}$ PASS - Area of reinforcement provided is greater than area of reinforcement requined is greater than area of reinforcement requined to be of the state of the s			V <sub>Rd.c</sub> = <b>161</b>	<b>.8</b> kN/m				
Secondary transverse reinforcement to base - Section 9.3 Minimum area of reinforcement - cl.9.3.1.1(2) Abx.req = 0.2 × Abb.prov = 151 mm <sup>2</sup> /m Maximum spacing of reinforcement - cl.9.3.1.1(3) Sbx_max = 450 mm Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided Abx.prov = $\pi \times \phi_{bx}^2 / (4 \times s_{bx}) = 393 mm^2/m$ PASS - Area of reinforcement provided is greater than area of reinforcement requined to the second state of the second s			V / $V_{Rd.c}$ =	0.459				
Minimum area of reinforcement - cl.9.3.1.1(2) A <sub>bx.req</sub> = 0.2 × A <sub>bb.prov</sub> = <b>151</b> mm <sup>2</sup> /m Maximum spacing of reinforcement - cl.9.3.1.1(3) s <sub>bx_max</sub> = <b>450</b> mm Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided A <sub>bx.prov</sub> = π × ψ <sub>bx</sub> <sup>2</sup> / (4 × s <sub>bx</sub> ) = <b>393</b> mm <sup>2</sup> /m <i>PASS - Area of reinforcement provided is greater than area of reinforcement requi</i> <sup>10</sup> dia.bars @ 10 c/c <sup>10</sup> dia.bars @ 10 c/c <sup>10</sup> dia.bars @ 10 c/c <sup>10</sup> dia.bars @ 10 c/c <sup>12</sup> dia.bars @ 10 c/c <sup>12</sup> dia.bars @ 150 c/c <sup>13</sup> dia.bars @ 150 c/c <sup>14</sup> dia.bars @ 150 c/c <sup>15</sup> dia.bars @ 150 c/c <sup>15</sup> dia.bars @ 150 c/c <sup>16</sup> dia.bars @ 150 c/c <sup>17</sup> dia.bars @ 150 c/c <sup>10</sup> dia.bars @ 150				SS - Design sh	near resistance e	xceeds desig	n shear fo	
Maximum spacing of reinforcement – cl.9.3.1.1(3) $s_{bx_max} = 450 \text{ mm}$ Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided $A_{bx,prov} = \pi \times \phi_{bx}^2 / (4 \times s_{bx}) = 393 \text{ mm}^2/\text{m}$ PASS - Area of reinforcement provided is greater than area of reinforcement requines the second s	-							
Transverse reinforcement provided 10 dia.bars @ 200 c/c Area of transverse reinforcement provided Abx.prov = π × φbx <sup>2</sup> / (4 × sbx) = 393 mm <sup>2</sup> /m PASS - Area of reinforcement provided is greater than area of reinforcement requi					<b>1</b> mm²/m			
Area of transverse reinforcement provided $A_{bx,prov} = \pi \times \phi_{bx}^2 / (4 \times s_{bx}) = 393 \text{ mm}^2/\text{m}$ PASS - Area of reinforcement provided is greater than area of reinforcement requines the transmission of transmis			-					
PASS - Area of reinforcement provided is greater than area of reinforcement requi				-				
10 dia bars @ 200 d/s 0 → i ← i ← 50 paralel to face of stem 12 dia bars @ 150 c/c 12 dia bars @ 150 c/c		•			-			
		parallel to 12 dia.ba 12 dia.ba 12 dia.ba	face of stem ars @ 150 c/c 1 ars @ 150 c/c 1 ars @ 150 c/c 1 ars @ 150 c/c 1 ars @ 150 c/c 1	2 dia.bars @ 150 c/c				
12 dia.bars @ 150 c/c <sup>75</sup> 10 dia.bars @ 200 c/c transverse reinforcement in base Reinforcement details		150						