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LONDON NW1 9AG

12.568 October 2014

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$\begin{array}{c} \begin{array}{c} (Retaining marked marke$	RETAINING WALLS W/L Porty wall: P(No bokk (S. [W/Lime 4.9m]) + (7.8 W/Lime 3.0m) 48.4 No cool: 0.75 W/Lime 2.0m x 2 3.0 No port 0.75 W/Lime 2.0m x 2 3.0 VL Abor: 0.50 /Lime 2.0m x 2 5.0 VL Abor: 0.50 /Lime 2.0m x 2 + 3 6.0 VL Abor: 1.50 /Lime 2.0m x 2 + 3 9.0 Start Stud: (S. 1W/Lime 3.4m) + (7.8 W/Lime 5.0m) 40.8 Start Stud: (S. 1W/Lime 3.4m) + (7.8 W/Lime 5.0m) 40.8 Start Stud: (S. 1W/Lime 3.4m) + (7.8 W/Lime 5.0m) 40.8 VL Place: 1.9 W/Lime 1.55m MAX LOADING VL Place: 1.9 W/Lime 1.55m 1.2 VL Place: 1.9 W/Lime 1.55m 2.4 VL Place: 1.9 W/Lime 1.55m 2.4 VL Place: 1.9 W/Lime 1.55m 35.6 MIN LOADING 45.9 Start Start 1.55m 35.6	Martin Redston Associates Consulting Civil & Structural Engineers 3 Edward Square, London N1 0SP Tel: 020 7837 5377 Fax: 020 7837 3211 6 Hale Lane, London NW7 3NX Tel: 020 8959 1666 Fax: 020 8906 8503 Email: martin@redston.org	Date 01/10/14 Eng. JC Job No. 12, 568 102 CAMDEN N LONDON NWI 9AG	Sheet No. 1 1eいら
Front and rear well: s/w b/wh: (5 1 White 3 4) + (7.86 White 50m) 40.8 s/w stud: [.06 White 1.55m s/w roof: 0.75 When 1.55m W root: 0.75 When 1.55m s/w hoor: 0.56 When 1.55m 3 VL ploot: 1 2 White 1.55m 3 S/w b/wh: (5.16 When 2.7m) + (7.86 When 2.8m) s/w b/wh: (5.16 When 2.7m) + (7.86 When 2.8m) MIN LOADING Worst case	Front and rear wall: 3/6 b/wh: (5 1 Winter 3.4) + (7.86 Wint 50m) 3/6 stud: [.0 Winter 1.5m 3/6 root: 0.756 Wint 1.55m M. root: 0.756 Winter 1.55m 3/6 door: 0.560 /mar 1.55m 3 VL Ador: 1.20 /mar 1.55m 3 3/6 b/wh: (5.160 /mar 2.7m) + (7.860 /mar 2.8m) 35.6 MIN LOADING Workt case	RETAINING WALLS Party wall: 3/4 5/4k=(5.144)=*** 4.9m) + (7.86 3/4 5/4k=(5.144)=*** 4.9m) + (7.86 3/4 5/4k=(5.144)=*** 4.9m) + (7.86 3/4 5/4k=(5.144)=*** 4.9m) + (7.86 3/4 5/4k=(5.144)=***********************************	V/~~ « 3.0~) 49 3 5	21 VL 8.4 3.0 5.0 7.4 21.0
expiration see		Front and rear wall: s/w b/wh: (5 1 Winta 3.4.) + (7.86) s/w stud: 1.060/1.4. 1.55 s/w roof: 0.7560/2.1.55 V. roof: 0.7560/2.1.55 S/w door: 0.560/2.25 VL floor: 1.20/2.25 S/w b/wh: (5.160/2.27) + (7.86)	VILLE S.O.) 40 MAX LOADING 1 45 VILLE 2.8.) MIN LOADING 35.	.8 .5 .2 .4 .9 .7 .6
			worst case	

Tedds	Project 102	Camden Mews,	London, NW1 S	ØAG	Job no. 12.	568
Martin Redston Associates 6 Hale Lane	Calcs for	Party Wall R	etaining Wall		Start page no./Re	vision 2
London NW7 3NX	Calcs by J	Calcs date 01/10/2014	Checked by	Checked date	Approved by	Approved date

RETAINING WALL ANALYSIS

In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1

Tedds calculation version 2.4.08

Retaining wall details			
Stem type	Cantilever		
Stem height	h _{stem} = 2400 mm		
Prop height	h _{prop} = 0 mm		
Stem thickness	t _{stem} = 330 mm		
Angle to rear face of stem	α = 90 deg		
Stem density	$\gamma_{\text{stem}} = 25 \text{ kN/m}^3$		
Toe length	l _{toe} = 1200 mm		
Heel length	I _{heel} = 100 mm		
Base thickness	t _{base} = 350 mm		
Base density	$\gamma_{\text{base}} = 25 \text{ kN/m}^3$		
Height of retained soil	h _{ret} = 2400 mm	Angle of soil surface	$\beta = 0 \deg$
Depth of cover	d _{cover} = 0 mm		
Height of water	h _{water} = 1600 mm		
Water density	γ _w = 9.8 kN/m ³		
Retained soil properties			
Soil type	Soft clay		
Moist density	γ _{mr} = 17 kN/m ³		
Saturated density	$\gamma_{sr} = 17 \text{ kN/m}^3$		
Characteristic effective shear r	esistance angle	φ' _{r.k} = 18 deg	
Characteristic wall friction angl	e	$\delta_{r.k} = 9 \text{ deg}$	
Base soil properties			
Soil type	Firm clay		
Moist density	γ _{mb} = 18 kN/m ³		
Characteristic effective shear r	esistance angle	φ' _{b.k} = 18 deg	
Characteristic wall friction angl	е	$\delta_{b.k} = 9 \text{ deg}$	
Characteristic base friction and	gle	$\delta_{bb.k} = 12 \text{ deg}$	
Presumed bearing capacity	P _{bearing} = 100 kN/m ²		
Loading details			
Variable surcharge load	Surcharge _Q = 3 kN/m ²		
Vertical line load at 1365 mm	P _{G1} = 57.4 kN/m		
	P _{Q1} = 21 kN/m		



Todda	Project 102 Camde	n Mews	s, London, NW	1 9AG	Job no. 12	.568
Martin Redston Associates	Calcs for				Start page no./F	Revision
6 Hale Lane	Party	/ Wall F	Retaining Wall			4
London NW7 3NX	Calcs by Calcs da J 01/10	^{te})/2014	Checked by	Checked date	Approved by	Approved date
Horizontal forces on wall						
Total	F _{total_h} = F _{sat_h} + F _{moist_h} +	- F _{water_} h	h + F _{sur_h} = 44.4	kN/m		
Moments on wall						
Total	$M_{total} = M_{stem} + M_{base} + N$	l _{sat} + M _n	noist + M _{water} + M	1 _{sur} + M _P = 112.7	kNm/m	
Check bearing pressure						
Propping force	$F_{prop_base} = 44.4 \text{ kN/m}$					
Bearing pressure at toe Factor of safety	q _{toe} = 0 kN/m ² FoS _{bo} = 1.139		Bearing press	sure at heel	q _{heel} = 87.8 kl	N/m ²
	PASS - Allowable	bearin	ng pressure ex	ceeds maximu	m applied bea	ring pressure
RETAINING WALL DESIGN						
In accordance with EN1992-	1-1:2004 incorporating C	corrige	ndum dated J	anuary 2008 and	d the UK Natio	nal Annex
incorporating National Ame	ndment No.1				Tedds calcula	ation version 2.4.0
Concrete details - Table 3.1	- Strength and deformati	on cha	racteristics fo	or concrete		
Concrete strength class	C32/40					
Char.comp.cylinder strength	f _{ck} = 32 N/mm ²		Mean axial ter	nsile strength	f _{ctm} = 3.0 N/m	1m ²
Secant modulus of elasticity	E _{cm} = 33346 N/mm ²		Maximum ago	gregate size	h _{agg} = 20 mm	
Design comp.concrete strengt	h		f _{cd} = 18.1 N/m	im ²	Partial factor	γc = 1.50
Reinforcement details						
Characteristic yield strength	f _{yk} = 500 N/mm ²		Modulus of ela	asticity	E _s = 200000	N/mm²
Design yield strength	f _{yd} = 435 N/mm ²		Partial factor		γs = 1.15	
Cover to reinforcement						
Front face of stem	c _{sf} = 20 mm		Rear face of s	stem	c _{sr} = 75 mm	
Top face of base	c _{bt} = 20 mm		Bottom face of	of base	c _{bb} = 75 mm	
Check stem design at base	of stem					
Depth of section	h = 330 mm					
Rectangular section in flexu	re - Section 6.1					
Design bending moment	M = 36.1 kNm/m		K = 0.019		K' = 0.207	
			K' > K -	No compressio	on reinforceme	nt is required
Tens.reinforcement required	A _{sr.req} = 354 mm ² /m					
Tens.reinforcement provided	16 dia.bars @ 200 c/c		Tens.reinforce	ement provided	A _{sr.prov} = 1005	5 mm²/m
Min.area of reinforcement	$A_{\text{sr.min}} = 388 \text{ mm}^2/\text{m}$		Max.area of re		$A_{sr.max} = 1320$	0 mm²/m
	PASS - Area of reinfor	cemen	t provided is g	greater than are	a of reinforcer	nent required
Crack control - Section 7.3						
Limiting crack width	$w_{max} = 0.3 \text{ mm}$		Maximum cra	ck width	w _k = 0.165 m	m
PASS - Maximum crack wide	th is less than limiting cr	ack wi	dthRectangul	ar section in sh	ear - Section 6	.2
Design shear force	V = 45.6 kN/m	-	Design shear	resistance	V _{Rd.c} = 128.1	kN/m
		PAS	os - Design sh	ear resistance	exceeas desig	n snear force
Horizontal reinforcement pa	rallel to face of stem - So	ection 9	9.6			
Min.area of reinforcement	$A_{sx.req} = 330 \text{ mm}^2/\text{m}$		Max.spacing o	of reinforcement	S _{sx_max} = 400	mm
i rans.reinforcement provided	TU dia.bars @ 200 c/c	comor	rans.reinford	ement provided	$A_{sx.prov} = 393$	mm²/m nont roquirer
.	FASS - Area Of reinitor	cemen	i provided is (ji ealer thân are	a UI TEIIIIOFCEI	nem required
Check base design at toe						
Depth of section	h = 350 mm					



Tedds	Project 102	Camden Mews,	London, NW1 9	9AG	Job no. 12.	568
Martin Redston Associates 6 Hale Lane	Calcs for	Front Wall R	etaining Wall		Start page no./Re	vision 6
London NW7 3NX	Calcs by J	Calcs date 01/10/2014	Checked by	Checked date	Approved by	Approved date

RETAINING WALL ANALYSIS

In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1

Tedds calculation version 2.4.08

Retaining wall details			
Stem type	Cantilever		
Stem height	h _{stem} = 2400 mm		
Prop height	$h_{prop} = 0 mm$		
Stem thickness	t _{stem} = 330 mm		
Angle to rear face of stem	α = 90 deg		
Stem density	γ _{stem} = 25 kN/m ³		
Toe length	I _{toe} = 1200 mm		
Heel length	I _{heel} = 100 mm		
Base thickness	t _{base} = 350 mm		
Base density	$\gamma_{\text{base}} = 25 \text{ kN/m}^3$		
Height of retained soil	h _{ret} = 2400 mm	Angle of soil surface	$\beta = 0 \deg$
Depth of cover	$d_{cover} = 0 mm$		
Height of water	h _{water} = 1600 mm		
Water density	γ _w = 9.8 kN/m ³		
Retained soil properties			
Soil type	Soft clay		
Moist density	$\gamma_{mr} = 17 \text{ kN/m}^3$		
Saturated density	$\gamma_{sr} = 17 \text{ kN/m}^3$		
Characteristic effective shear r	esistance angle	φ' _{r.k} = 18 deg	
Characteristic wall friction angle		$\delta_{r.k} = 9 \text{ deg}$	
Base soil properties			
Soil type	Firm clay		
Moist density	γ _{mb} = 18 kN/m ³		
Characteristic effective shear r	esistance angle	φ' _{b.k} = 18 deg	
Characteristic wall friction angle	e	$\delta_{b.k} = 9 \text{ deg}$	
Characteristic base friction ang	le	$\delta_{bb.k} = 12 \text{ deg}$	
Presumed bearing capacity	$P_{\text{bearing}} = 100 \text{ kN/m}^2$		
Loading details			
Variable surcharge load	Surcharge _Q = 10 kN/m ²		
Vertical line load at 1365 mm	P _{G1} = 35.6 kN/m		



	Project				Job no.	
Tedds	102 (Camden Mews	s, London, NW1	9AG	12.	568
Martin Redston Associates	Calcs for				Start page no./Re	evision
6 Hale Lane		Front Wall R	Retaining Wall			8
London NW7 3NX	Calcs by J	Calcs date 01/10/2014	Checked by	Checked date	Approved by	Approved date
Horizontal forces on wall						
Total	$F_{total_h} = F_{sat_h} + F$	moist_h + Fwater_h	+ F _{sur_h} = 53.5 k	:N/m		
Moments on wall						
Total	M _{total} = M _{stem} + M _b	ase + Msat + Mm	noist + M _{water} + M _{su}	ır + MP = 42.8 k	:Nm/m	
Check bearing pressure						
Propping force	F _{prop_base} = 53.5 k	N/m				
Bearing pressure at toe	$q_{toe} = 65.3 \text{ kN/m}^2$		Bearing pressu	e at heel	$q_{heel} = 0 \text{ kN/m}^2$	2
Factor of safety	$FoS_{bp} = 1.531$	weble beerin		a a da manduar	m annlind haar	
	PASS - Allo		ig pressure exc	eeus maximur	n applied bear	ng pressure
RETAINING WALL DESIGN						
In accordance with EN1992-1	I-1:2004 incorpora	ating Corriger	ndum dated Jar	uary 2008 and	d the UK Natior	al Annex
incorporating National Amen	dment No.1			•		
					Tedds calculat	on version 2.4.0
Concrete details - Table 3.1 -	Strength and def	ormation cha	racteristics for	concrete		
Concrete strength class	C32/40					
Char.comp.cylinder strength	f _{ck} = 32 N/mm ²		Mean axial tens	ile strength	f _{ctm} = 3.0 N/mr	n²
Secant modulus of elasticity	E _{cm} = 33346 N/m	m²	Maximum aggre	gate size	h _{agg} = 20 mm	
Design comp.concrete strength	า		f _{cd} = 18.1 N/mm	12	Partial factor	γc = 1.50
Reinforcement details						
Characteristic yield strength	f _{yk} = 500 N/mm ²		Modulus of elas	ticity	Es = 200000 N	l/mm²
Design yield strength	f _{yd} = 435 N/mm ²		Partial factor		γs = 1.15	
Cover to reinforcement						
Front face of stem	c _{sf} = 20 mm		Rear face of ste	m	c _{sr} = 75 mm	
Top face of base	c _{bt} = 20 mm		Bottom face of I	oase	c _{bb} = 75 mm	
Check stem design at base o	of stem					
Depth of section	h = 330 mm					
Rectangular section in flexu	ro - Soction 6 1					
Rectangular section in nexu	e - Section 0.1					
Design bending moment	M = 50.6 kNm/m		K = 0.026		K' = 0.207	
Design bending moment	M = 50.6 kNm/m		K = 0.026 <i>K' > K - N</i>	o compressio	K' = 0.207 n reinforcemer	nt is require
Tens.reinforcement required	M = 50.6 kNm/m	m	K = 0.026 K' > K - N	o compressio	K' = 0.207 n reinforcemer	nt is require
Tens.reinforcement provided	M = 50.6 kNm/m A _{sr.req} = 496 mm ² / 16 dia.bars @ 20	m 0 c/c	K = 0.026 <i>K' > K - N</i> Tens.reinforcen	o compression	K' = 0.207 n reinforcemer A _{sr.prov} = 1005	nt is require
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement	$M = 50.6 \text{ kNm/m}$ $A_{sr.req} = 496 \text{ mm}^2/$ 16 dia.bars @ 20 $A_{sr.min} = 388 \text{ mm}^2/$	'm 0 c/c 'm	K = 0.026 <i>K' > K - N</i> Tens.reinforcen Max.area of reir	o compression	K' = 0.207 <i>n reinforcemer</i> A _{sr.prov} = 1005 A _{sr.max} = 13200	nt is required mm²/m) mm²/m
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement	M = 50.6 kNm/m A _{sr.req} = 496 mm ² / 16 dia.bars @ 20 A _{sr.min} = 388 mm ² / <i>PASS - Area of r</i>	'm 0 c/c 'm einforcement	K = 0.026 K' > K - N Tens.reinforcen Max.area of rein t provided is gro	o compression nent provided nforcement eater than area	K' = 0.207 n reinforcemer A _{sr.prov} = 1005 A _{sr.max} = 13200 a of reinforcem	nt is required mm²/m) mm²/m ent required
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3	M = 50.6 kNm/m A _{sr.req} = 496 mm ² / 16 dia.bars @ 20 A _{sr.min} = 388 mm ² / <i>PASS - Area of r</i>	'm 0 c/c 'm einforcement	K = 0.026 K' > K - N Tens.reinforcen Max.area of reir t provided is gro	o compression nent provided nforcement eater than area	K' = 0.207 n reinforcemer A _{sr.prov} = 1005 A _{sr.max} = 13200 a of reinforcem	nt is required mm²/m) mm²/m ent required
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width	M = 50.6 kNm/m A _{sr.req} = 496 mm ² / 16 dia.bars @ 20 A _{sr.min} = 388 mm ² / <i>PASS - Area of r</i> W _{max} = 0.3 mm	ˈm 0 c/c ˈm æ inforcement	K = 0.026 K' > K - N Tens.reinforcen Max.area of rein t provided is gro Maximum crack	o compression nent provided nforcement eater than area width	K' = 0.207 n reinforcemer A _{sr.prov} = 1005 A _{sr.max} = 13200 a of reinforcem W _k = 0.203 mr	nt is required mm²/m) mm²/m ent required
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt	M = 50.6 kNm/m A _{sr.req} = 496 mm ² / 16 dia.bars @ 20 A _{sr.min} = 388 mm ² / <i>PASS - Area of r</i> W _{max} = 0.3 mm <i>h is less than limi</i>	'm 0 c/c 'm einforcement t ing crack wic	K = 0.026 K' > K - N Tens.reinforcen Max.area of reir t provided is gro Maximum crack	o compression nent provided nforcement eater than area width section in she	K' = 0.207 n reinforcemen $A_{sr.prov} = 1005$ $A_{sr.max} = 13200$ a of reinforcem $w_k = 0.203 \text{ mm}$ ear - Section 6.	nt is required mm²/m) mm²/m ent required n 2
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force	M = 50.6 kNm/m A _{sr.req} = 496 mm ² / 16 dia.bars @ 20 A _{sr.min} = 388 mm ² / PASS - Area of r W _{max} = 0.3 mm h is less than limi V = 57.6 kN/m	ʻm 0 c/c ʻm einforcement t ing crack wic	K = 0.026 K' > K - N Tens.reinforcen Max.area of rein t provided is gro Maximum crack dth Rectangular Design shear re	o compression nent provided nforcement eater than area width section in she	K' = 0.207 <i>n reinforcemer</i> $A_{sr.prov} = 1005$ $A_{sr.max} = 13200$ <i>a of reinforcem</i> $w_k = 0.203$ mm <i>ear - Section 6.</i> $V_{Rd.c} = 128.1 \text{ k}$	nt is required mm²/m 0 mm²/m ent required n 2 :N/m
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force	$M = 50.6 \text{ kNm/m}$ $A_{sr.req} = 496 \text{ mm}^2/$ 16 dia.bars @ 20 $A_{sr.min} = 388 \text{ mm}^2/$ <i>PASS - Area of r</i> $w_{max} = 0.3 \text{ mm}$ <i>h is less than limi</i> $V = 57.6 \text{ kN/m}$	'm 0 c/c /m reinforcement ting crack wid PAS	K = 0.026 K' > K - N Tens.reinforcen Max.area of reir t provided is gro Maximum crack dth Rectangular Design shear re	<i>to compression</i> nent provided nforcement eater than area width section in she isistance ar resistance e	K' = 0.207 n reinforcemer $A_{sr.prov} = 1005$ $A_{sr.max} = 13200$ a of reinforcem $w_k = 0.203 \text{ mm}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ H}$ exceeds design	nt is required mm²/m 0 mm²/m ent required n 1 2 :N/m 5 shear force
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement par	$M = 50.6 \text{ kNm/m}$ $A_{sr.req} = 496 \text{ mm}^2/$ 16 dia.bars @ 20 $A_{sr.min} = 388 \text{ mm}^2/$ $PASS - Area of r$ $w_{max} = 0.3 \text{ mm}$ $h \text{ is less than limi}$ $V = 57.6 \text{ kN/m}$ rallel to face of stermal	'm 0 c/c 'm reinforcement ting crack wid PAS :m - Section 9	K = 0.026 K' > K - N Tens.reinforcen Max.area of rein t provided is gro Maximum crack dthRectangular Design shear re S - Design shear	to compression nent provided nforcement eater than area width section in she sistance ar resistance e	K' = 0.207 n reinforcemen $A_{sr.prov} = 1005$ $A_{sr.max} = 13200$ a of reinforcem $w_k = 0.203 \text{ mm}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ H}$ exceeds design	nt is required mm²/m o mm²/m ent required n 2 :N/m o shear force
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack width Design shear force Horizontal reinforcement par Min.area of reinforcement	$M = 50.6 \text{ kNm/m}$ $A_{sr.req} = 496 \text{ mm}^2/$ 16 dia.bars @ 20 $A_{sr.min} = 388 \text{ mm}^2/$ $PASS - Area of r$ $w_{max} = 0.3 \text{ mm}$ $h \text{ is less than limit}$ $V = 57.6 \text{ kN/m}$ rallel to face of stere $A_{sx.req} = 330 \text{ mm}^2/$	ʻm 0 c/c ⁄m r einforcement t ing crack wid PAS • m - Section 9 ʻm	K = 0.026 K' > K - N Tens.reinforcen Max.area of reir t provided is gra Maximum crack dth Rectangular Design shear re S - Design shear 0.6 Max.spacing of	o compression nent provided nforcement eater than area width section in she sistance ar resistance e reinforcement	K' = 0.207 n reinforcemen $A_{sr.prov} = 1005$ $A_{sr.max} = 13200$ a of reinforcem $w_k = 0.203 \text{ mm}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ H}$ exceeds design $s_{sx_max} = 400 \text{ m}$	nt is required mm²/m 0 mm²/m ent required n 2 :N/m 5 shear force
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement par Min.area of reinforcement Trans.reinforcement provided	$M = 50.6 \text{ kNm/m}$ $A_{\text{sr.req}} = 496 \text{ mm}^2/16 \text{ dia.bars} @ 20$ $A_{\text{sr.min}} = 388 \text{ mm}^2/26$ $PASS - Area of r$ $w_{\text{max}} = 0.3 \text{ mm}$ $h \text{ is less than limi}$ $V = 57.6 \text{ kN/m}$ $rallel to face of steres$ $A_{\text{sx.req}} = 330 \text{ mm}^2/20$ $T = 0.2 \text{ mm}^2/20$	'm 0 c/c 'm reinforcement ting crack wid PAS rm - Section 9 'm 0 c/c	K = 0.026 K' > K - N Tens.reinforcen Max.area of rein t provided is gro Maximum crack dthRectangular Design shear re S - Design shear Design shear re S - Design shear Data S - Design shear Data S - Design S -	o compression nent provided nforcement eater than area width section in she sistance ar resistance of reinforcement nent provided	K' = 0.207 n reinforcemen $A_{sr.prov} = 1005$ $A_{sr.max} = 13200$ a of reinforcem $w_k = 0.203 \text{ mm}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ H}$ exceeds design $S_{sx_max} = 400 \text{ m}$ $A_{sx.prov} = 393 \text{ m}$	nt is required mm²/m 0 mm²/m ent required n 2 :N/m a shear force nm nm²/m
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement par Min.area of reinforcement Trans.reinforcement provided	$M = 50.6 \text{ kNm/m}$ $A_{sr.req} = 496 \text{ mm}^2/16 \text{ dia.bars} @ 20$ $A_{sr.min} = 388 \text{ mm}^2/PASS - Area of r$ $W_{max} = 0.3 \text{ mm}$ $h \text{ is less than limi}$ $V = 57.6 \text{ kN/m}$ $rallel to face of ster A_{sx.req} = 330 \text{ mm}^2/10 \text{ dia.bars} @ 20 PASS - Area of r$	/m 0 c/c /m reinforcement ting crack wid PAS PAS m - Section 9 /m 0 c/c einforcement	K = 0.026 K' > K - N Tens.reinforcen Max.area of rein t provided is gra Maximum crack dth Rectangular Design shear re S - Design shear Max.spacing of Trans.reinforcen t provided is gra	o compression nent provided nforcement eater than area width section in she sistance ar resistance of reinforcement nent provided sater than area	K' = 0.207 n reinforcement $A_{sr.prov} = 1005$ $A_{sr.max} = 13200$ a of reinforcement $w_k = 0.203 \text{ mm}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ Here}$ exceeds design $S_{sx_max} = 400 \text{ m}$ $A_{sx.prov} = 393 \text{ m}$ a of reinforcement	nt is required mm²/m) mm²/m ent required n 2 SN/m o shear force nm nm²/m ent required
Design bending moment Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement par Min.area of reinforcement Trans.reinforcement provided Check base design at toe	M = 50.6 kNm/m A _{sr.req} = 496 mm ² / 16 dia.bars @ 20 A _{sr.min} = 388 mm ² / PASS - Area of r w _{max} = 0.3 mm h is less than limi V = 57.6 kN/m rallel to face of ster A _{sx.req} = 330 mm ² / 10 dia.bars @ 20 PASS - Area of r	/m 0 c/c /m reinforcement ting crack wid PAS rm - Section 9 /m 0 c/c einforcement	K = 0.026 K' > K - N Tens.reinforcen Max.area of reir t provided is gro Maximum crack dthRectangular Design shear re S - Design shear S - Design shear Max.spacing of Trans.reinforcen t provided is gro	o compression nent provided nforcement eater than area width section in she sistance ar resistance of reinforcement ment provided eater than area	K' = 0.207 n reinforcement $A_{sr.prov} = 1005$ $A_{sr.max} = 13200$ a of reinforcement $W_k = 0.203 \text{ mm}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ Here}$ exceeds design $S_{SX_max} = 400 \text{ m}$ $A_{sx.prov} = 393 \text{ m}$ a of reinforcement	nt is required mm²/m 0 mm²/m ent required n 2 :N/m a shear force nm nm²/m ent required

2	Project	2 Camden Mews	s London NW/1	946	Job no.	568
Tedds	10			37.0	12	.500
Martin Redston Associates	Calcs for	Front Wall F	Retaining Wall		Start page no./R	evision 9
6 Hale Lane						.
NW7 3NX	Calcs by J	Calcs date 01/10/2014	Checked by	Checked date	Approved by	Approved date
	•					
Rectangular section in flexur	e - Section 6.1	~	1/ 0.026		K' 0 207	
Design bending moment	IVI = 36.3 KINIII/	m	K' > K - I	No compression	n = 0.207 n reinforceme	nt is required
Tens.reinforcement required	Abb.reg = 535 mi	m²/m				ne lo requireu
Tens reinforcement provided	20 dia bars @	200 c/c	Tens.reinforce	ment provided	Abb prov = 1571	mm²/m
Min.area of reinforcement	$A_{bb,min} = 417 \text{ m}$	m²/m	Max.area of re	inforcement	$A_{bb,max} = 1400$	0 mm²/m
	PASS - Area c	f reinforcemen	t provided is g	reater than area	of reinforcen	nent required
Crack control - Section 7.3						
Limiting crack width	w _{max} = 0.3 mm		Maximum crac	k width	w _k = 0.153 mr	m
PASS - Maximum crack width	n is less than li	miting crack wi	dthRectangula	r section in she	ear - Section 6	.2
Design shear force	V = 79.6 kN/m		Design shear r	esistance	V _{Rd.c} = 158.5	kN/m
		PAS	SS - Design she	ear resistance e	xceeds desig	n shear force
Rectangular section in flexure	e - Section 6.1					
Design bending moment	M = 0.4 kNm/m	ı	K = 0.000		K' = 0.207	
			K' > K - I	No compression	n reinforceme	nt is required
Tens.reinforcement required	$A_{bt.req} = 3 \text{ mm}^2/$	m				
Tens.reinforcement provided	12 dia.bars @	200 c/c	Tens.reinforce	ment provided	$A_{bt.prov} = 565 r$	nm²/m
Min.area of reinforcement	Abt.min = 509 mr	n²/m of reinforcemen	Max.area of rei t provided is a	inforcement reater than area	A _{bt.max} = 1400 of reinforcen	0 mm²/m nent required
Crock control Section 7.2	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		, provided io g			ionicioquilou
Limiting crack width	Wmov – 0 3 mm		Maximum crac	k width	w _k – 0 001 mr	m
DASS Maximum arack width		miting areak wi	dth Dector gulo	r costion in cha	ar Section 6	
Design shear force	V = 7.7 kN/m		Design shear r	esistance	$V_{\text{Rdo}} = 153.1$.∠ kN/m
Design chical lotes		PAS	SS - Design she	ear resistance e	exceeds design	n shear force
Secondary transverse reinfor	cement to has	- Section 9.3	Ū		· · ·	
Min.area of reinforcement	Abx.reg = 314 mi	m^2/m	Max.spacing of	f reinforcement	Sbx max = 450 I	mm
Trans.reinforcement provided	10 dia.bars @	200 c/c	Trans.reinforce	ement provided	A _{bx.prov} = 393	mm²/m
	PASS - Area c	of reinforcemen	t provided is g	reater than area	of reinforcen	nent required



Tedds	Project 102	Camden Mews,	London, NW1 S	9AG	Job no. 12.	568
Martin Redston Associates 6 Hale Lane	Calcs for	Rear Wall Re	etaining Wall		Start page no./Re 1	vision 1
London NW7 3NX	Calcs by J	Calcs date 01/10/2014	Checked by	Checked date	Approved by	Approved date

RETAINING WALL ANALYSIS

In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1

Tedds calculation version 2.4.08

Retaining wall details			
Stem type	Cantilever		
Stem height	h _{stem} = 2400 mm		
Prop height	h _{prop} = 0 mm		
Stem thickness	t _{stem} = 330 mm		
Angle to rear face of stem	α = 90 deg		
Stem density	$\gamma_{\text{stem}} = 25 \text{ kN/m}^3$		
Toe length	I _{toe} = 1200 mm		
Heel length	I _{heel} = 100 mm		
Base thickness	t _{base} = 350 mm		
Base density	$\gamma_{\text{base}} = 25 \text{ kN/m}^3$		
Height of retained soil	h _{ret} = 2400 mm	Angle of soil surface	$\beta = 0 \deg$
Depth of cover	d _{cover} = 0 mm		
Height of water	h _{water} = 1600 mm		
Water density	γ _w = 9.8 kN/m ³		
Retained soil properties			
Soil type	Soft clay		
Moist density	$\gamma_{mr} = 17 \text{ kN/m}^3$		
Saturated density	$\gamma_{sr} = 17 \text{ kN/m}^3$		
Characteristic effective shear r	esistance angle	φ' _{r.k} = 18 deg	
Characteristic wall friction angle		$\delta_{r.k} = 9 \text{ deg}$	
Base soil properties			
Soil type	Firm clay		
Moist density	γ _{mb} = 18 kN/m ³		
Characteristic effective shear r	esistance angle	φ' _{b.k} = 18 deg	
Characteristic wall friction angl	e	$\delta_{b.k} = 9 \text{ deg}$	
Characteristic base friction and	gle	$\delta_{bb.k} = 12 \text{ deg}$	
Presumed bearing capacity	P _{bearing} = 100 kN/m ²	·	
Loading details			
Variable surcharge load	Surcharge _Q = 3 kN/m ²		
Vertical line load at 1365 mm	P _{G1} = 35.6 kN/m		



Tedds	102	Camden Mews	s, London, NW	1 9AG	12.	568
Martin Redston Associates	Calcs for				Start page no./R	evision
6 Hale Lane		Rear Wall F	Retaining Wall			13
London NW7 3NX	Calcs by J	Calcs date 01/10/2014	Checked by	Checked date	Approved by	Approved d
Horizontal forces on wall						
Total	$F_{total_h} = F_{sat_h} + F_{sat_h}$	Fmoist_h + Fwater_h	h + F _{sur_h} = 44.4	kN/m		
Moments on wall						
Total	$M_{total} = M_{stem} + M_{stem}$	_{base} + M _{sat} + M _n	noist + M _{water} + N	1 _{sur} + M _P = 54.3 k	«Nm/m	
Check bearing pressure						
Propping force	Fprop_base = 44.4 k	kN/m				
Bearing pressure at toe	$q_{toe} = 50.5 \text{ kN/m}^2$	2	Bearing press	ure at heel	$q_{heel} = 0 \text{ kN/m}$	2
Factor of safety	FoS _{bp} = 1.981					
	PASS - All		ig pressure ex		ili applied bear	ing press
RETAINING WALL DESIGN						
In accordance with EN1992-	1-1:2004 incorpor	ating Corrige	ndum dated Ja	anuary 2008 and	d the UK Natior	nal Annex
incorporating National Amer	ndment No.1			,		
					Tedds calculat	ion version 2
Concrete details - Table 3.1 ·	Strength and de	formation cha	racteristics fo	or concrete		
Concrete strength class	C32/40					
Char.comp.cylinder strength	f _{ck} = 32 N/mm ²		Mean axial ter	nsile strength	f _{ctm} = 3.0 N/m	m²
Secant modulus of elasticity	E _{cm} = 33346 N/m	1m ²	Maximum agg	regate size	h _{agg} = 20 mm	
Design comp.concrete strengt	h		f _{cd} = 18.1 N/m	m ²	Partial factor	γc = 1.
Reinforcement details						
Characteristic yield strength	f _{yk} = 500 N/mm ²		Modulus of ela	asticity	Es = 200000 N	√mm²
Design yield strength	f _{yd} = 435 N/mm ²		Partial factor		γs = 1.15	
Cover to reinforcement						
Front face of stem	c _{sf} = 20 mm		Rear face of s	stem	c _{sr} = 75 mm	
Top face of base	c _{bt} = 20 mm		Bottom face o	f base	c _{bb} = 75 mm	
Check stem design at base of	of stem					
Depth of section	h = 330 mm					
Rectangular section in flexu	re - Section 6.1					
Design bending moment	M = 36.1 kNm/m		K = 0.019		K' = 0.207	
			K' > K -	No compressio	n reinforcemer	nt is requi
.	A _{sr.req} = 354 mm ²	²/m				
lens.reinforcement required		0.c/c	Tens.reinforce	ement provided	A _{sr.prov} = 1005	mm²/m
Tens.reinforcement required	16 dia.bars @ 20					a 21
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement	16 dia.bars @ 20 A _{sr.min} = 388 mm ²	²/m	Max.area of re	einforcement	A _{sr.max} = 1320	u mm²/m
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement	16 dia.bars @ 20 A _{sr.min} = 388 mm ² PASS - Area of	²/m reinforcemen t	Max.area of re t provided is g	einforcement greater than are	A _{sr.max} = 1320 a of reinforcem	o mm²/m nent requi
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3	16 dia.bars @ 20 A _{sr.min} = 388 mm ² PASS - Area of	²/m reinforcemen	Max.area of re t provided is g	einforcement greater than are	A _{sr.max} = 1320 a of reinforcen	o mm²/m nent requi
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width	16 dia.bars @ 20 A _{sr.min} = 388 mm ² PASS - Area of W _{max} = 0.3 mm	²/m reinforcemen	Max.area of re t provided is g Maximum crae	einforcement greater than are	A _{sr.max} = 1320 a of reinforcem w _k = 0.165 mr	o mm²/m nent requi n
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt	16 dia.bars @ 20 A _{sr.min} = 388 mm ² PASS - Area of W _{max} = 0.3 mm	iting crack wi	Max.area of re t provided is g Maximum crad dthRectangula	einforcement greater than are ck width ar section in sh	A _{sr.max} = 13200 a of reinforcem w _k = 0.165 mr ear - Section 6.	o mm²/m nent requi n 2
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force	16 dia.bars @ 20 A _{sr.min} = 388 mm ² PASS - Area of w _{max} = 0.3 mm h is less than lim V = 45.6 kN/m	iting crack wi	Max.area of re t provided is g Maximum crac dthRectangula Design shear	einforcement greater than are ck width ar section in sh resistance	$A_{sr.max} = 13200$ a of reinforcem $w_k = 0.165 mr$ ear - Section 6. $V_{Rd.c} = 128.14$	o mm²/m ne <i>nt requi</i> n 2 <n m<="" td=""></n>
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force	16 dia.bars @ 20 A _{sr.min} = 388 mm ² PASS - Area of w _{max} = 0.3 mm th is less than lim V = 45.6 kN/m	iting crack wie PAS	Max.area of re t provided is g Maximum crad dthRectangula Design shear SS - Design sh	einforcement greater than are ck width ar section in sh resistance eear resistance	$A_{sr.max} = 13200$ a of reinforcem $w_k = 0.165 \text{ mr}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ H}$ exceeds design	n mm²/m nent requi n 2 <n m<br="">n shear fo</n>
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement par	16 dia.bars @ 20 A _{sr.min} = 388 mm ² <i>PASS - Area of</i> w _{max} = 0.3 mm <i>th is less than lim.</i> V = 45.6 kN/m rallel to face of st	² /m reinforcement iting crack with PAS em - Section S	Max.area of re t provided is g Maximum crace dthRectangula Design shear SS - Design sh 9.6	einforcement greater than are ck width ar section in sh resistance gear resistance	$A_{sr.max} = 13200$ a of reinforcem $w_k = 0.165 \text{ mm}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ M}$ exceeds design	n n 2 xN/m n shear fo
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement par Min.area of reinforcement	16 dia.bars @ 20 A _{sr.min} = 388 mm ² <i>PASS - Area of</i> w _{max} = 0.3 mm <i>th is less than lime</i> V = 45.6 kN/m rallel to face of st A _{sx.req} = 330 mm ²	² /m reinforcemen iting crack wi PAS em - Section S ² /m	Max.area of re t provided is g Maximum crac dthRectangula Design shear SS - Design sh 9.6 Max.spacing o	einforcement greater than are ck width ar section in sh resistance gear resistance of freinforcement	$A_{sr.max} = 13200$ a of reinforcem $w_k = 0.165 \text{ mr}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ H}$ exceeds design $S_{sx_max} = 400 \text{ r}$	n mm²/m n n 2 KN/m n shear fo
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement pa Min.area of reinforcement Trans.reinforcement provided	16 dia.bars @ 20 $A_{sr.min} = 388 \text{ mm}^2$ PASS - Area of $w_{max} = 0.3 \text{ mm}$ th is less than lim. V = 45.6 kN/m rallel to face of st $A_{sx.req} = 330 \text{ mm}^2$ 10 dia.bars @ 20	iting crack wie PAS em - Section S 2/m 00 c/c	Max.area of re t provided is g Maximum crad dthRectangula Design shear SS - Design sh 2.6 Max.spacing of Trans.reinforc	einforcement greater than are ck width ar section in sh resistance dear resistance of reinforcement ement provided	$A_{sr.max} = 13200$ a of reinforcem $w_k = 0.165 \text{ mr}$ ear - Section 6. $V_{Rd.c} = 128.1 \text{ H}$ exceeds design $s_{sx_max} = 400 \text{ r}$ $A_{sx.prov} = 393 \text{ r}$	n n 2 kN/m n shear fo nm nm ² /m
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement par Min.area of reinforcement Trans.reinforcement provided	16 dia.bars @ 20 $A_{sr.min} = 388 mm^2$ PASS - Area of $w_{max} = 0.3 mm$ h is less than lim. V = 45.6 kN/m rallel to face of st $A_{sx.req} = 330 mm^2$ 10 dia.bars @ 20 PASS - Area of	² /m reinforcemen iting crack wid PAS em - Section S ² /m 00 c/c reinforcemen	Max.area of re t provided is g Maximum crace dthRectangula Design shear SS - Design sh Design sh D	einforcement greater than are ck width ar section in sh resistance ear resistance of reinforcement ement provided greater than are	$A_{sr.max} = 13200$ a of reinforcem $w_k = 0.165 \text{ mr}$ ear - Section 6. $V_{Rd.c} = 128.14$ exceeds design $S_{sx_max} = 400 \text{ r}$ $A_{sx.prov} = 393 \text{ r}$ a of reinforcem	n n 2 KN/m n shear fo nm nm ² /m nent requi
Tens.reinforcement required Tens.reinforcement provided Min.area of reinforcement Crack control - Section 7.3 Limiting crack width PASS - Maximum crack widt Design shear force Horizontal reinforcement par Min.area of reinforcement Trans.reinforcement provided Check base design at toe	16 dia.bars @ 20 A _{sr.min} = 388 mm ² <i>PASS - Area of</i> w _{max} = 0.3 mm <i>h is less than lim</i> V = 45.6 kN/m rallel to face of st A _{sx.req} = 330 mm ² 10 dia.bars @ 20 <i>PASS - Area of</i>	iting crack with reinforcement iting crack with PAS em - Section S 2/m 20 c/c reinforcement	Max.area of re t provided is g Maximum crad dth Rectangula Design shear SS - Design sh 9.6 Max.spacing of Trans.reinforc t provided is g	einforcement greater than are ck width ar section in sh resistance ear resistance of reinforcement ement provided greater than are	$A_{sr.max} = 13200$ a of reinforcem $w_k = 0.165 \text{ mr}$ ear - Section 6. $V_{Rd.c} = 128.14$ exceeds design $s_{sx_max} = 400 \text{ r}$ $A_{sx.prov} = 393 \text{ r}$ a of reinforcem	n n 2 KN/m n shear fo nm nm ² /m nent requi

	Project	Comdon Mour	London NIM/1	0.4.0	Job no.	F69
Tedds	102	2 Camden Mews	s, London, NVV 1	9AG	12	.568
Martin Redston Associates	Calcs for	Rear Wall F	Retaining Wall		Start page no./R	evision 14
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NW7 3NX	Calcs by J	Calcs date 01/10/2014	Checked by	Checked date	Approved by	Approved date
Rectangular section in flexure	e - Section 6.1	~	V 0.010		K' 0 207	
Design bending moment	101 = 43.1 KINI11/1	11	K = 0.019	lo compression	n = 0.207	nt is required
Tens reinforcement required	$A_{bb reg} = 391 \text{ mr}$	m²/m	$K \ge K - K$	0 compression	i reinioi ceinei	it is required
Tens reinforcement provided	16 dia bars @ 3	200 c/c	Tens reinforcer	ment provided	Abb prov = 1005	mm²/m
Min area of reinforcement	$A_{bb min} = 420 mi$	<u>-00 0,0</u> m²/m	Max area of rei	nforcement	$A_{bb} = 1400$	0 mm²/m
	PASS - Area o	f reinforcemen	t provided is gr	reater than area	of reinforcen	nent required
Crack control - Section 7.3						-
Limiting crack width	w _{max} = 0.3 mm		Maximum cracl	k width	w _k = 0.2 mm	
PASS - Maximum crack width	is loss than li	niting crack wi	dthRectangula	r section in she	ar - Section 6	2
Design shear force	V = 65.8 kN/m		Design shear r	esistance	$V_{\rm Pdo} = 137 \rm kN$	l/m
Boolgh chour force		PAS	SS - Design she	ear resistance e	exceeds desig	n shear force
Rectangular section in flexur	a - Section 6 1		U			
Design bending moment	M = 0.2 kNm/m		K – 0 000		K' – 0 207	
Doolgh bonding momon	- 0.2 ((11)/11		K' > K - N	lo compressio	n reinforceme	nt is required
Tens.reinforcement required	$A_{bt,reg} = 1 \text{ mm}^2/1$	m		•		
Tens.reinforcement provided	12 dia.bars @ 2	200 c/c	Tens.reinforcer	ment provided	A _{bt.prov} = 565 r	nm²/m
Min.area of reinforcement	A _{bt.min} = 509 mm	n²/m	Max.area of rei	nforcement	A _{bt.max} = 1400	0 mm²/m
	PASS - Area o	f reinforcemen	t provided is gr	reater than area	of reinforcen	nent required
Crack control - Section 7.3						
Limiting crack width	w _{max} = 0.3 mm		Maximum cracl	k width	w _k = 0 mm	
PASS - Maximum crack width	ı is less than lir	niting crack wi	dthRectangula	r section in she	ear - Section 6	.2
Design shear force	V = 3.3 kN/m		Design shear r	esistance	V _{Rd.c} = 153.1	kN/m
		PAS	SS - Design she	ear resistance e	xceeds desig	n shear force
Secondary transverse reinfor	cement to base	e - Section 9.3				
Min.area of reinforcement	A _{bx.req} = 201 mr	n²/m	Max.spacing of	reinforcement	Sbx_max = 450 I	nm
Trans.reinforcement provided	10 dia.bars @ 2	200 c/c	Trans.reinforce	ment provided	Abx.prov = 393	mm²/m
	PASS - Area o	f reinforcemen	t provided is gr	reater than area	of reinforcen	nent required

