JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	001		
CALCULATION:	CALCULATION BY:	DATE:	CHECKED BY:	
Preliminary calculations -350mm garden front slab	Rob M	Jan. 24		

CALCULATIONS:

REF

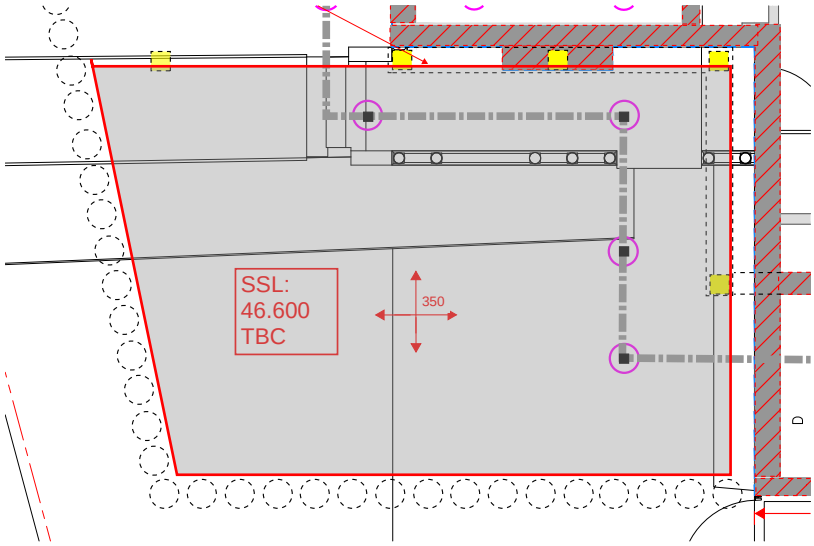
OUTPUT

Design check on 350mm slab over basement to front garden area.

Slab will be designed to support minimum 1.0m of soil @ 19kN/M^3

Finishes allowance of 2.5kN/M^2

Imposed allowance of 5.0kN/M^2.



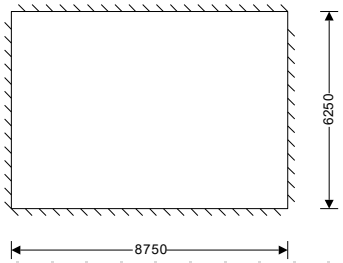
RC SLAB DESIGN

In accordance with EN1992-1-1:2004 incorporating corrigendum January 2008 and the UK national annex

Tedds calculation version 1.0.22

Design summary

Description	Unit	Provided	Required	Utilisation	Result
Short span					
Reinf. at midspan	mm^2/m	1340	1134	0.846	PASS
Bar spacing at midspan	mm	150	209	0.716	PASS
Shear at discont. supp	kN/m	160.2	116.3	0.726	PASS
Deflection ratio		20.36	36.61	0.556	PASS
Long span					
Reinf. at midspan	mm^2/m	1340	617	0.460	PASS
Bar spacing at midspan	mm	150	300	0.500	PASS
Shear at discont. supp	kN/m	156.5	116.3	0.743	PASS
Cover					
Min cover bottom	mm	35	21	0.600	PASS



JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	002		
CALCULATION:	CALCULATION BY:	DATE:	CHECKED BY:	
Preliminary calculations -350mm garden front slab	Rob M	Jan. 24		

CALCULATIONS:

REF

Slab definition

Slab reference name	**garden slab**		
Type of slab	**Two way unrestrained edges**	Overall slab depth	h = **350** mm
Shorter effective span of panel	l_x = **6250** mm	Longer effective span of panel	l_y = **8750** mm
Support conditions	**Four edges simply supported**		
		Bottom outer layer of reinft	**Short span direction**

Loading

Charac. permanent action	G_k = **22.0** kN/m^2	Charac variable action	Q_k = **5.0** kN/m^2
Partial factor for perm. action	γ_G = **1.35**	Partial factor for var. action	γ_Q = **1.50**
Quasi-perm. value of var.action		ψ_2 = **0.30**	

Concrete properties

Concrete strength class	C32/40	Partial factor	γ_C = **1.50**
Compressive strength factor	α_{cc} = **0.85**	Maximum aggregate size	d_g = **20** mm

Reinforcement properties

Characteristic yield strength	f_{yk} = **500** N/mm^2	Partial factor	γ_S = **1.15**

Concrete cover to reinforcement

Nom cover to btm reinft	c_{nom_b} = **35** mm	Fire resistance to btm of slab	R_{btm} = **60** min
Reinforcement fabrication	**Subject to QA system**	Min reqd nom cover btm reinft	$c_{nom\_b\_min}$ = **21.0** mm

PASS - There is sufficient cover to the bottom reinforcement

Slab definition

Slab reference name	**garden slab**		
Type of slab	**Two way unrestrained edges**	Overall slab depth	h = **350** mm
Shorter effective span of panel	l_x = **6250** mm	Longer effective span of panel	l_y = **8750** mm
Support conditions	**Four edges simply supported**		
		Bottom outer layer of reinft	**Short span direction**

Loading

Charac. permanent action	G_k = **22.0** kN/m^2	Charac variable action	Q_k = **5.0** kN/m^2
Partial factor for perm. action	γ_G = **1.35**	Partial factor for var. action	γ_Q = **1.50**
Quasi-perm. value of var.action		ψ_2 = **0.30**	

Concrete properties

Concrete strength class	C32/40	Partial factor	γ_C = **1.50**
Compressive strength factor	α_{cc} = **0.85**	Maximum aggregate size	d_g = **20** mm

Reinforcement properties

Characteristic yield strength	f_{yk} = **500** N/mm^2	Partial factor	γ_S = **1.15**

Concrete cover to reinforcement

Nom cover to btm reinft	c_{nom_b} = **35** mm	Fire resistance to btm of slab	R_{btm} = **60** min
Reinforcement fabrication	**Subject to QA system**	Min reqd nom cover btm reinft	$c_{nom\_b\_min}$ = **21.0** mm

PASS - There is sufficient cover to the bottom reinforcement

Reinforcement design at midspan in short span direction

Design bending moment M_{x_p} = **143.9** kNm/m

Reinforcement provided **16 mm dia. bars at 150 mm centres (1340 mm^2/m)**

K < K' - Compression reinforcement is not required

Area of reinft reqd for bending	$A_{sx\_p\_m}$ = **1134** mm^2/m	Minimum area required	$A_{sx\_p\_min}$ = **483** mm^2/m

PASS - Area of tension reinforcement provided is adequate (0.846)

Check reinforcement spacing

Max allowable spacing	$s_{max\_x\_p}$ = **209** mm	Actual bar spacing	s_{x_p} = **150** mm

PASS - Reinforcement spacing is acceptable (0.716)

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	003		
CALCULATION:	CALCULATION BY:	DATE:	CHECKED BY:	
Preliminary calculations -350mm garden front slab	Rob M	Jan. 24		

CALCULATIONS:

REF | OUTPUT

Shear check at short span discontinuous support

Shear force V_{x_d} = **116.3** kN/m Shear resistance V_{Rd,c_x_d} = **160.2** kN/m

PASS - Shear capacity is adequate (0.726)

Shear check at long span discontinuous support

Shear force V_{y_d} = **116.3** kN/m Shear resistance V_{Rd,c_y_d} = **156.5** kN/m

PASS - Shear capacity is adequate (0.743)

Basic span-to-depth deflection ratio check

Limit span-to-depth ratio $ratio_{lim\_x}$ = **36.61** Actual span-to-depth ratio $ratio_{act\_x}$ = **20.36**

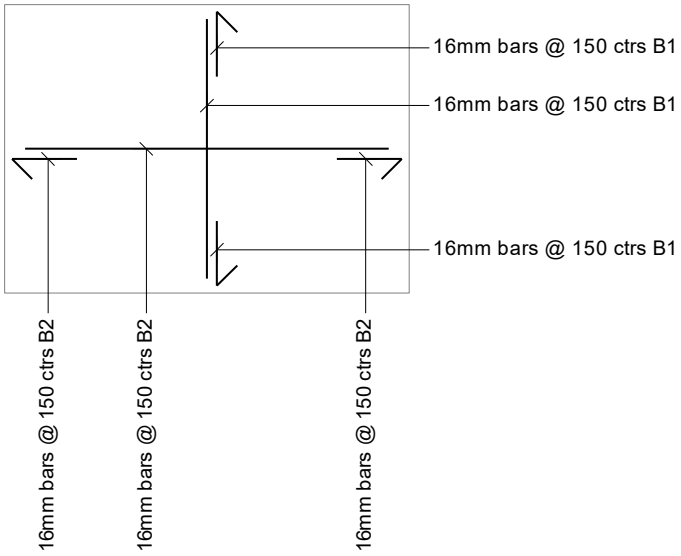
PASS - Actual span-to-effective depth ratio is acceptable (0.556)

Reinforcement summary

Midspan in short span direction	**16 mm dia. bars at 150 mm centres B1**
Midspan in long span direction	**16 mm dia. bars at 150 mm centres B2**
Discontinuous support in short span direction	**16 mm dia. bars at 150 mm centres B1**
Discontinuous support in long span direction	**16 mm dia. bars at 150 mm centres B2**

Reinforcement sketch

The following sketch is indicative only. Note that additional reinforcement may be required in accordance with clauses 9.2.1.2, 9.2.1.4 and 9.2.1.5 of EN 1992-1-1:2004 to meet detailing rules.



JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	004		
CALCULATION: Preliminary calculations - 350mm rear slab at ground floor	CALCULATION BY:	DATE:	CHECKED BY:	
	Rob M	Jan. 24		

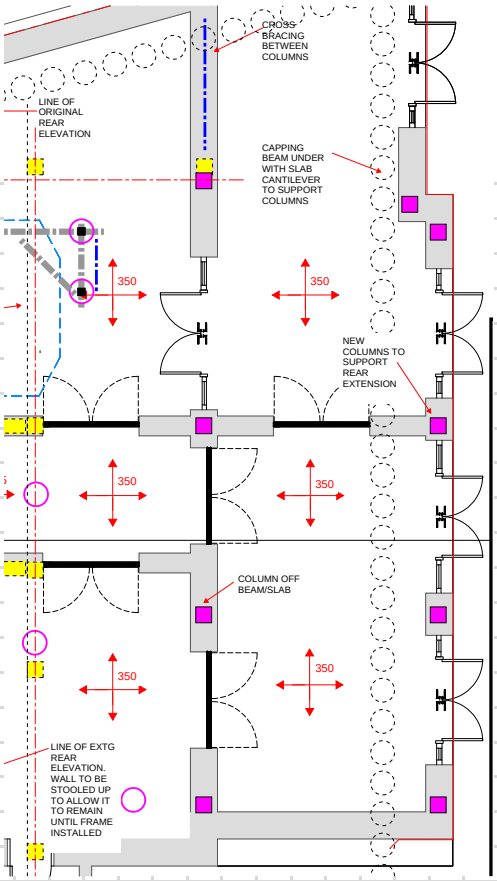
CALCULATIONS:

REF

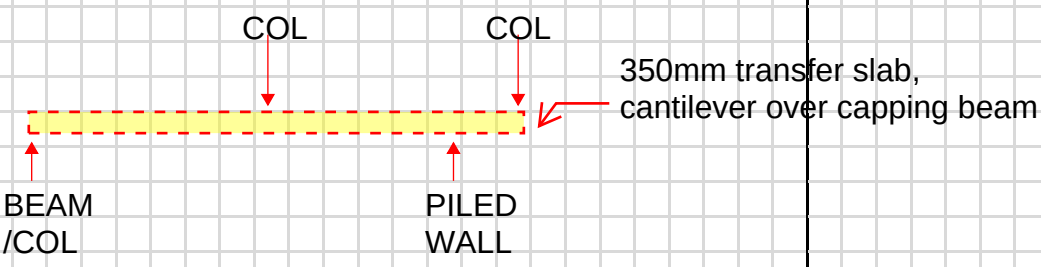
OUTPUT

Design check on 350mm transfer slab over basement to rear garden area.

Slab will be designed as a transfer slab supporting rear extension framing.



Proposed plan on slab at ground floor rear, plan extract.



Proposed cross section showing 350mm TRANSFER slab

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	005		
CALCULATION: Preliminary calculations - 350mm rear slab at ground floor	CALCULATION BY:	DATE:	CHECKED BY:	
	Rob M	Jan. 24		

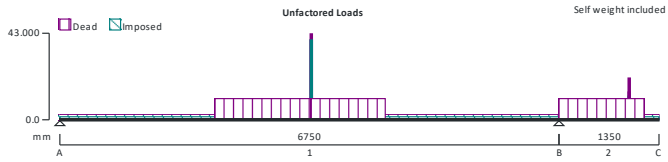
CALCULATIONS:

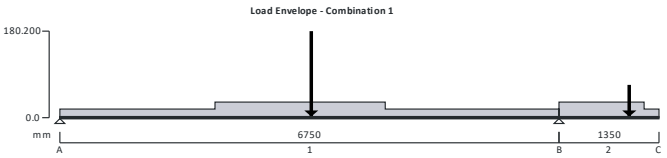
REF

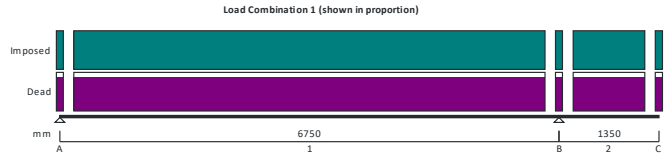
OUTPUT

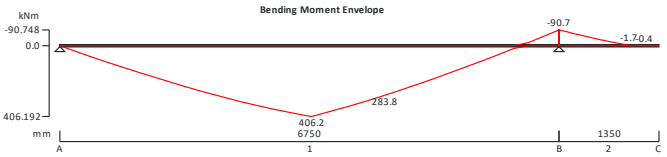
RC BEAM ANALYSIS & DESIGN BS8110

TEDDS calculation version 2.1.1







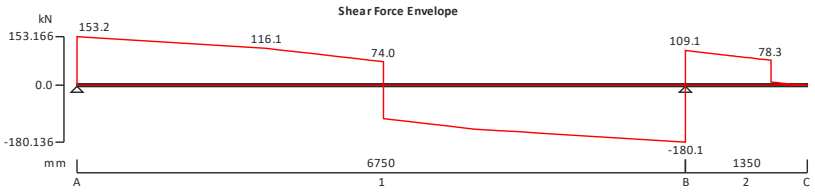


Force Diagrams for Cantilever 350mm Slab

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	006		
CALCULATION: Preliminary calculations - 350mm rear slab at ground floor	CALCULATION BY:	DATE:	CHECKED BY:	
	Rob M	Jan. 24		

CALCULATIONS:

REF | OUTPUT



Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free
Support C	Vertically free
	Rotationally free

Applied loading

	Dead self weight of beam × 1
finisihes	Dead full UDL 2.5 kN/m
imposed	Imposed full UDL 1.5 kN/m
PL cavity wall	Dead point load 43 kN at 3400 mm
PL col 1 gk	Dead point load 40 kN at 3400 mm
PL col 1 qk	Imposed point load 40 kN at 3400 mm
PL col 2 gk	Dead point load 14.1 kN at 7700 mm
PL 2 col 2 qk	Imposed point load 12 kN at 7700 mm
PL3 cav wall	Dead point load 21 kN at 7700 mm
PARTIAL WALL	Dead partial UDL 10.5 kN/m from 2100 mm to 3400 mm
PARTIAL CAV WALL	Dead partial UDL 10.5 kN/m from 3400 mm to 4400 mm
PARTIAL CAV WALL	Dead partial UDL 10.5 kN/m from 6750 mm to 7900 mm

Load combinations

Load combination 1	Support A	Dead × 1.40
		Imposed × 1.60
	Span 1	Dead × 1.40
		Imposed × 1.60
	Support B	Dead × 1.40
		Imposed × 1.60
	Span 2	Dead × 1.40
		Imposed × 1.60
	Support C	Dead × 1.40
		Imposed × 1.60

Analysis results

Maximum moment support A	M_{A_max} = **0** kNm	M_{A_red} = **0** kNm
Maximum moment span 1 at 3400 mm	M_{s1_max} = **406** kNm	M_{s1_red} = **406** kNm
Maximum moment support B	M_{B_max} = **-91** kNm	M_{B_red} = **-91** kNm
Maximum moment span 2 at support	M_{s2_max} = **0** kNm	M_{s2_red} = **0** kNm
Maximum moment support C	M_{C_max} = **0** kNm	M_{C_red} = **0** kNm

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	007		
CALCULATION: Preliminary calculations - 350mm rear slab at ground floor	CALCULATION BY: Rob M	DATE: Jan. 24	CHECKED BY:	

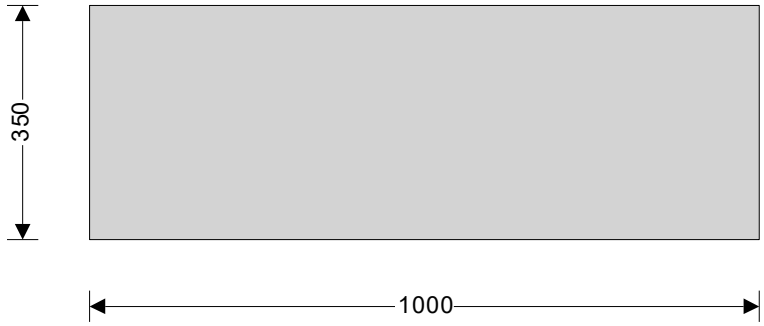
CALCULATIONS:

REF | OUTPUT

Maximum shear support A	V_{A_max} = **153** kN	V_{A_red} = **153** kN
Maximum shear support A span 1 at 295 mm	$V_{A\_s1\_max}$ = **148** kN	$V_{A\_s1\_red}$ = **148** kN
Maximum shear support B	V_{B_max} = **-180** kN	V_{B_red} = **-180** kN
Maximum shear support B span 1 at 6455 mm	$V_{B\_s1\_max}$ = **-175** kN	$V_{B\_s1\_red}$ = **-175** kN
Maximum shear support B span 2 at 295 mm	$V_{B\_s2\_max}$ = **100** kN	$V_{B\_s2\_red}$ = **100** kN
Maximum shear support C	V_{C_max} = **0** kN	V_{C_red} = **0** kN
Maximum shear support C span 2 at 1050 mm	$V_{C\_s2\_max}$ = **7** kN	$V_{C\_s2\_red}$ = **7** kN
Maximum reaction at support A	R_A = **153** kN	
Maximum reaction at support B	R_B = **289** kN	
Maximum reaction at support C	R_C = **0** kN	

Rectangular section details

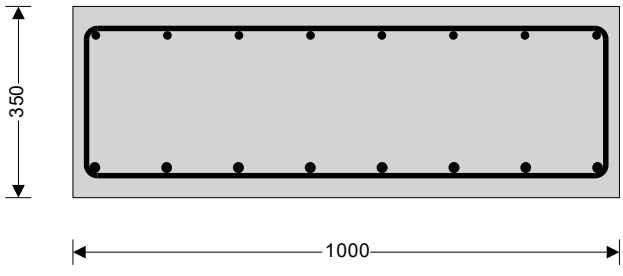
Section width b = **1000** mm Section depth h = **350** mm



Material details

Concrete strength class	**C32/40**	Char comp cube strength	f_{cu} = **40** N/mm²
Modulus of elasticity of conc	E_c = **28000** N/mm²	Maximum aggregate size	h_{agg} = **20** mm
Char yield strength of reinf	f_y = **500** N/mm²	Char yield str of shear reinf	f_{yv} = **500** N/mm²
Nominal cover to top reinf	c_{nom_t} = **35** mm	Nominal cover to bottom reinf	c_{nom_b} = **35** mm
Nominal cover to side reinf	c_{nom_s} = **20** mm		

Support A



8 x 16ϕ bars

2 x 10ϕ shear legs at 150 c/c

8 x 20ϕ bars

Rectangular section in shear

Shear - span 1 at 295 mm V = **148** kN Shear stress v = **0.502** N/mm²

Allowable design shear stress v_{max} = **5.000** N/mm²

PASS - Design shear stress is less than maximum allowable

Value of v from Table 3.7 $0.5 \times v_c < v < (v_c + 0.4$ N/mm²)

Design shear resistance req'd	v_s = **0.400** N/mm²	Area of shear reinf req'd	$A_{sv,req}$ = **920** mm²/m
Shear reinforcement provided	2 × 10ϕ legs at 150 c/c	Area of shear reinf. prov	$A_{sv,prov}$ = **1047** mm²/m

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	008		
CALCULATION: Preliminary calculations - 350mm rear slab at ground floor	CALCULATION BY: Rob M	DATE: Jan. 24	CHECKED BY:	

CALCULATIONS:

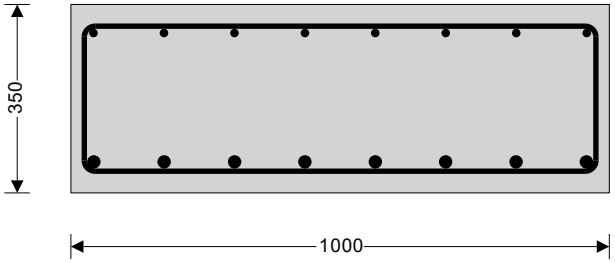
REF | OUTPUT

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **221** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Mid span 1



Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment	M = **406** kNm	Depth to tension reinf.	d = **292** mm
	K = **0.119**		K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm	z = **247** mm	Depth of neutral axis	x = **102** mm
Area of tension reinf req'd	$A_{s,req}$ = **3784** mm^2	Tension reinf provided	8 × 25ϕ bars
Area of tension reinf prov	$A_{s,prov}$ = **3927** mm^2	Minimum area of reinf	$A_{s,min}$ = **455** mm^2
Maximum area of reinf	$A_{s,max}$ = **14000** mm^2		

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Shear reinforcement provided	2 × 10ϕ legs at 150 c/c		
Area of shear reinf provided	$A_{sv,prov}$ = **1047** mm^2/m	Minimum area of shear reinf	$A_{sv,min}$ = **920** mm^2/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **219** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars	s = **106** mm	Min dist between bars	s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress	f_s = **321.2** N/mm^2	Max distance between bars	s_{max} = **146** mm

PASS - Satisfies the maximum spacing criteria

Span to depth ratio (cl. 3.4.6)

Span to depth ratio (T.3.9)	$span\_to\_depth_{basic}$ = **26.0**	Service stress in tension rein	f_s = **321.2** N/mm^2
Modification for tension reinf	f_{tens} = **0.780**	Modification for comp reinf	f_{comp} = **1.155**
Modification for span > 10m	f_{long} = **1.000**	Allowable span to depth ratio	$span\_to\_depth_{allow}$ = **23.4**
Actual span to depth ratio	$span\_to\_depth_{actual}$ = **23.1**		

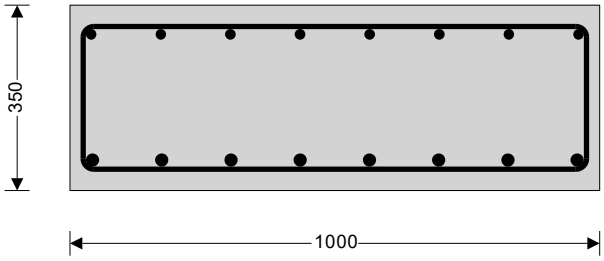
PASS - Actual span to depth ratio is within the allowable limit

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	009		
CALCULATION: Preliminary calculations - 350mm rear slab at ground floor	CALCULATION BY:	DATE:	CHECKED BY:	
	Rob M	Jan. 24		

CALCULATIONS:

REF | OUTPUT

Support B



8 x 20ϕ bars

2 x 10ϕ shear legs at 150 c/c

8 x 25ϕ bars

Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment	M = **91** kNm	Depth to tension reinf.	d = **295** mm
	K = **0.026**		K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm	z = **280** mm	Depth of neutral axis	x = **33** mm
Area of tension reinf req'd	$A_{s,req}$ = **744** mm^2	Tension reinf provided	8 $\times$ 20ϕ bars
Area of tension reinf prov	$A_{s,prov}$ = **2513** mm^2	Minimum area of reinf	$A_{s,min}$ = **455** mm^2
Maximum area of reinf	$A_{s,max}$ = **14000** mm^2		

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Shear - span 1 at 6455 mm	V = **175** kN	Shear stress	v = **0.593** N/mm^2
Allowable design shear stress	v_{max} = **5.000** N/mm^2		

PASS - Design shear stress is less than maximum allowable

Value of v from Table 3.7	0.5 $\times$ v_c < v < (v_c + 0.4 N/mm^2)		
Design shear resistance req'd	v_s = **0.400** N/mm^2	Area of shear reinf req'd	$A_{sv,req}$ = **920** mm^2/m
Shear reinforcement provided	2 $\times$ 10ϕ legs at 150 c/c	Area of shear reinf. prov	$A_{sv,prov}$ = **1047** mm^2/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing	$s_{vl,max}$ = **221** mm		

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Shear - span 2 at 295 mm	V = **100** kN	Shear stress	v = **0.337** N/mm^2
Allowable design shear stress	v_{max} = **5.000** N/mm^2		

PASS - Design shear stress is less than maximum allowable

Value of v from Table 3.7	v < 0.5v_c		
Design shear resistance req'd	v_s = **0.400** N/mm^2	Area of shear reinf req'd	$A_{sv,req}$ = **920** mm^2/m
Shear reinforcement provided	2 $\times$ 10ϕ legs at 150 c/c	Area of shear reinf. prov	$A_{sv,prov}$ = **1047** mm^2/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing	$s_{vl,max}$ = **221** mm		

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars	s = **111** mm	Min dist between bars	s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress	f_s = **98.7** N/mm^2	Max distance between bars	s_{max} = **300** mm

PASS - Satisfies the maximum spacing criteria

Span to depth ratio (cl. 3.4.6)

Span to depth ratio (T.3.9)	$span\_to\_depth_{basic}$ = **7.0**	Service stress in tension rein	f_s = **98.7** N/mm^2
Modification for tension reinf	f_{tens} = **2.000**	Modification for comp reinf	f_{comp} = **1.307**

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	010		
CALCULATION: Preliminary calculations - 350mm rear slab at ground floor	CALCULATION BY: Rob M	DATE: Jan. 24	CHECKED BY:	

CALCULATIONS:

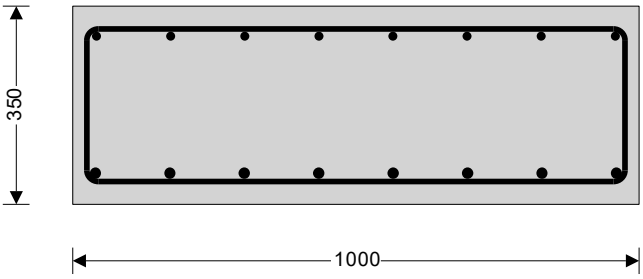
REF | OUTPUT

Modification for span > 10m f_{long} = **1.000** Allowable span to depth ratio span_to_depth$_{allow}$ = **18.3**

Actual span to depth ratio span_to_depth$_{actual}$ = **4.6**

PASS - Actual span to depth ratio is within the allowable limit

Mid span 2



Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment M = **56** kNm Depth to tension reinf. d = **297** mm

K = **0.016** K' = **0.156**

K' > K - No compression reinforcement is required

Lever arm z = **282** mm Depth of neutral axis x = **33** mm

Area of tension reinf req'd $A_{s,req}$ = **454** mm^2 Tension reinf provided 8 × 16ϕ bars

Area of tension reinf prov $A_{s,prov}$ = **1608** mm^2 Minimum area of reinf $A_{s,min}$ = **455** mm^2

Maximum area of reinf $A_{s,max}$ = **14000** mm^2

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Shear reinforcement provided 2 × 10ϕ legs at 150 c/c

Area of shear reinf provided $A_{sv,prov}$ = **1047** mm^2/m Minimum area of shear reinf $A_{sv,min}$ = **920** mm^2/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max longitudinal spacing $s_{vl,max}$ = **223** mm

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars s = **116** mm Min dist between bars s_{min} = **25** mm

PASS - Satisfies the minimum spacing criteria

Design service stress f_s = **94.2** N/mm^2 Max distance between bars s_{max} = **300** mm

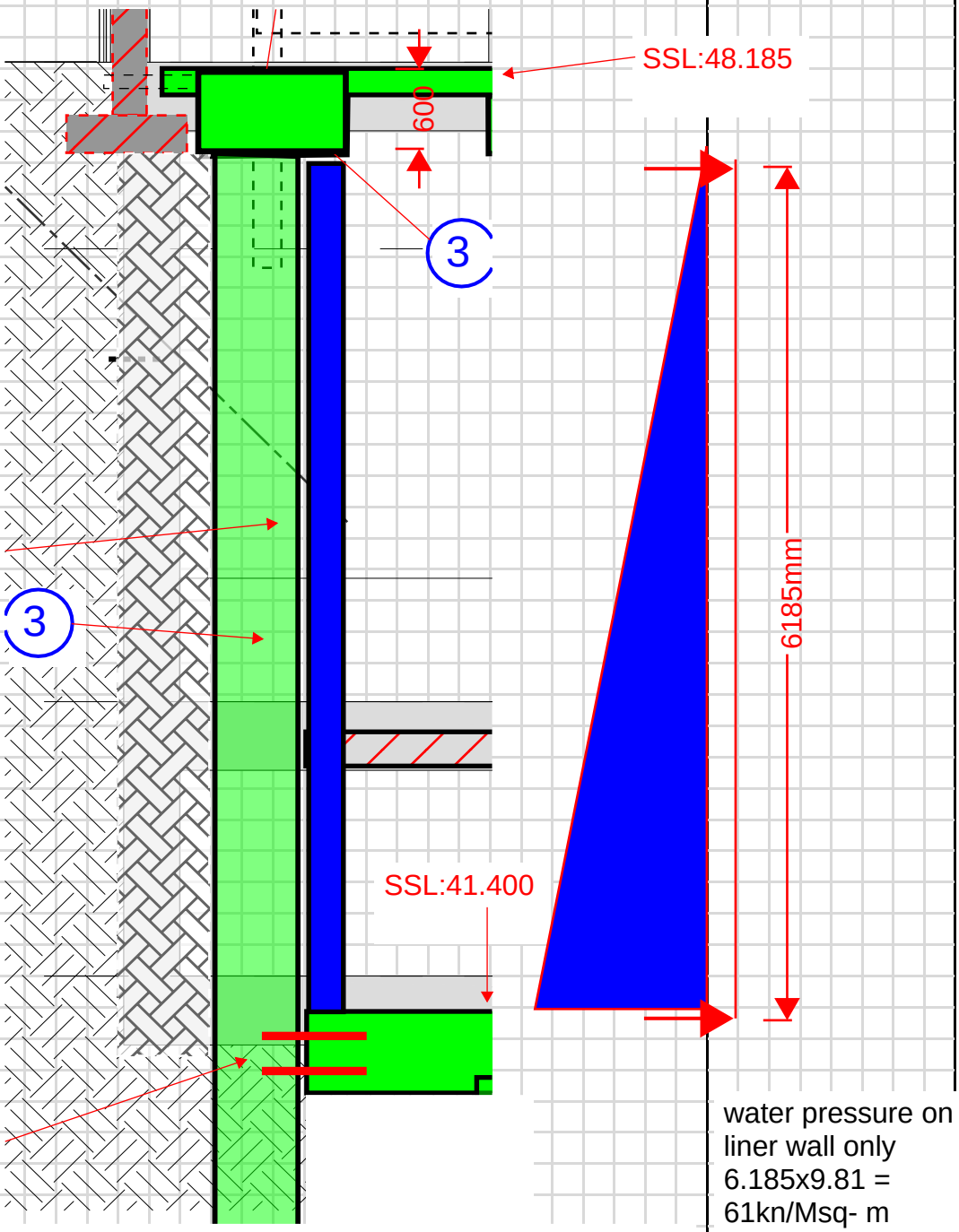
PASS - Satisfies the maximum spacing criteria

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	011		
CALCULATION: Preliminary calculations - RC liner wall to deeper basement area, 300mm thick.	CALCULATION BY:	DATE:	CHECKED BY:	
	Rob M	Jan. 24		

CALCULATIONS:

REF

OUTPUT



water pressure on liner wall only
6.185x9.81 = 61kn/Msq- m

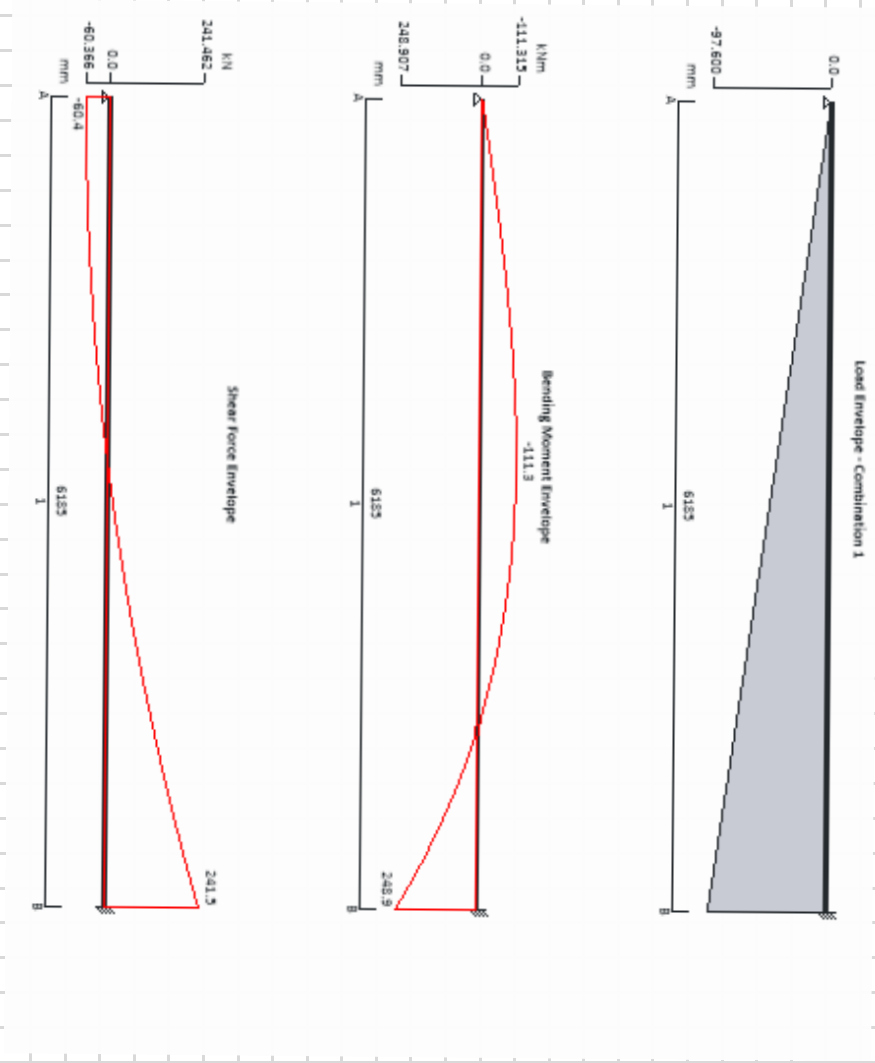
Proposed cross section showing 300mm liner wall to deeper basement area in pool

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUMBER:		Form
68 Elsworthy Road NW3 3BP	233950	012		
CALCULATION: Preliminary calculations - RC liner wall to deeper basement area, 300mm thick.	CALCULATION BY:	DATE:	CHECKED BY:	
	Rob M	Jan. 24		

CALCULATIONS:

REF

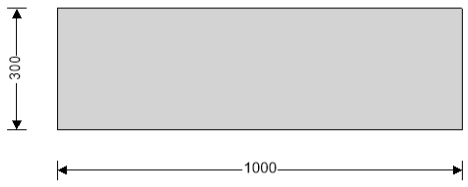
OUTPUT

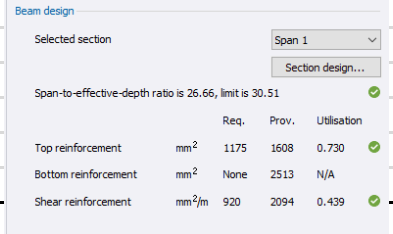


Maximum moment support B	M_{B_max} = **249** kNm	M_{B_red} = **249** kNm
Maximum shear support A	V_{A_max} = **-60** kN	V_{A_red} = **-60** kN
Maximum shear support A span 1 at 232 mm	$V_{A\_s1\_max}$ = **-60** kN	$V_{A\_s1\_red}$ = **-60** kN
Maximum shear support B	V_{B_max} = **241** kN	V_{B_red} = **241** kN
Maximum shear support B span 1 at 5958 mm	$V_{B\_s1\_max}$ = **220** kN	$V_{B\_s1\_red}$ = **220** kN
Maximum reaction at support A	R_A = **-60** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **-38** kN	
Maximum reaction at support B	R_B = **-241** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **-151** kN	

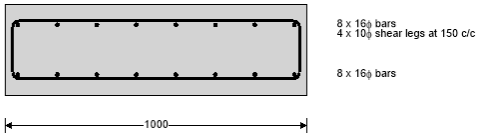
Rectangular section details

Section width	b = **1000** mm
Section depth	h = **300** mm

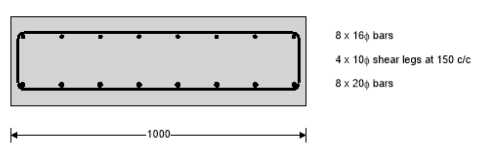




Support A



Mid span 1



Support B