

DAILY SITE RECORD

SITE / JOB No.	FORMER MANOX SITE MANCHESTER	DAY / DATE	MONDAY 11TH MAY 2020	DRILLER	R BENNETT
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BH	DEPTH		CASING	FORMATION	GROUTING			
	FROM	TO			PFA	CEMENT	SAND	OTHER
				<u>PROBE DRILLING FOR</u> <u>MINE SHAFT</u>				
				10 HOLES AT 1 METER CENTRES				
	GL	25m		DRIFT WITH BOULDERS AND GRAVELS				
	25m	26m		HARD DRILLING				
				TOTAL = 260 METERS				
				DRILLING HOLES USING 70mm				
				BUTTON BIT AND WATER FLUSH				

REMARKS:	GAS MONITORING		
	CH_4 : 0 % LEL	H_2S : 0 PPM	
	CO : 0 PPM	O_2 : 20.9 %	
	NOTES:		
	 R.E./SUPERVISOR		

[illegible]

DAILY SITE RECORD

SITE / JOB NO.	FORMER MANOX SITE MANCHESTER	DAY / DATE	TUESDAY 12TH MAY 2020	DRILLER	R BENNETT
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BH	DEPTH		CASING	FORMATION	GROUTING			
	FROM	TO			PFA	CEMENT	SAND	OTHER
				<u>PROBE DRILLING FOR</u> <u>MINE SHAFT</u>				
				25 HOLES AT 1 METER CENTRES				
	GL	25m		DRIFT WITH BOULDERS AND GRAVELS				
	25m	26m		HARD DRILLING				
				TOTAL = 650 MTRS				
				DRILLING HOLES USING 70MM				
				BUTTON BIT AND WATER FLUSH				

REMARKS:	GAS MONITORING	
	CH ₄ : 0 % LEL	H ₂ S : 0 PPM
	CO : 0 PPM	O ₂ : 20.9 %
	NOTES:	
	 R.E./SUPERVISOR	

[illegible]

SITE / JOB NO.	FORMER MANOX SITE MANCHESTER	DAY / DATE	WEDNESDAY 13 TH MAY 2020	DRILLER	R BENNETT
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[illegible]

REMARKS:	GAS MONITORING	
	CH ₄ : 0 % LEL	H ₂ S : 0 PPM
	CO : 0 PPM	O ₂ : 21.1 %
	NOTES:	
..... R.E./SUPERVISOR		

[illegible]

REMARKS:	GAS MONITORING	
	CH ₄ : 1 % LEL	H ₂ S : 0 PPM
	CO : 0 PPM	O ₂ : 20.9 %
	NOTES:	
	 R.E./SUPERVISOR	

[illegible]

[illegible][illegible][illegible]

BH	DEPTH		CASING	FORMATION	GROUTING			
	FROM	TO			PFA	CEMENT	SAND	OTHER
				<u>PROBE DRILLING FOR</u> <u>MINE SHAFT</u>				
	GL	25m		DRIFT, WITH BOULDERS AND GRAVELS				
	25m	26m		HARD DRILLING				
				25 HOLES AT 1 METER CENTRES TO LOCATE MINE SHAFT				
				HOLES DRILLED USING 70MM BUTTON BIT AND WATER FLUSH				
				TOTAL = 650 METRES				

REMARKS:	GAS MONITORING			
	CH ₄ :	0 % LEL	H ₂ S :	0 PPM
	CO :	0 PPM	O ₂ :	20.9 %
	NOTES:			
	 R.E./SUPERVISOR			

[illegible]

BH	DEPTH		CASING	FORMATION	GROUTING			
	FROM	TO			PFA	CEMENT	SAND	OTHER
				<u>PROBE DRILLING FOR</u> <u>MINE SHAFT</u>				
				12 HOLES AT 1 METER CENTRES TO LOCATE SHAFT				
	GL	25m		DRIFT WITH BOULDERS AND GRAVELS				
	25m	26m		HARD DRILLING				
				6 HOLES INTO SHAFT				
	GL	20m		SOFT DRILLING				
	20m	26m		SOFT WITH FIRM BANDS				
	26m	31m		HARD DRILLING				
				TOTAL = 498m ²				

REMARKS:	GAS MONITORING			
	CH ₄ :	% LEL	H ₂ S :	PPM
	CO :	PPM	O ₂ :	%
	NOTES:			
..... R.E./SUPERVISOR				

[illegible]

5CM

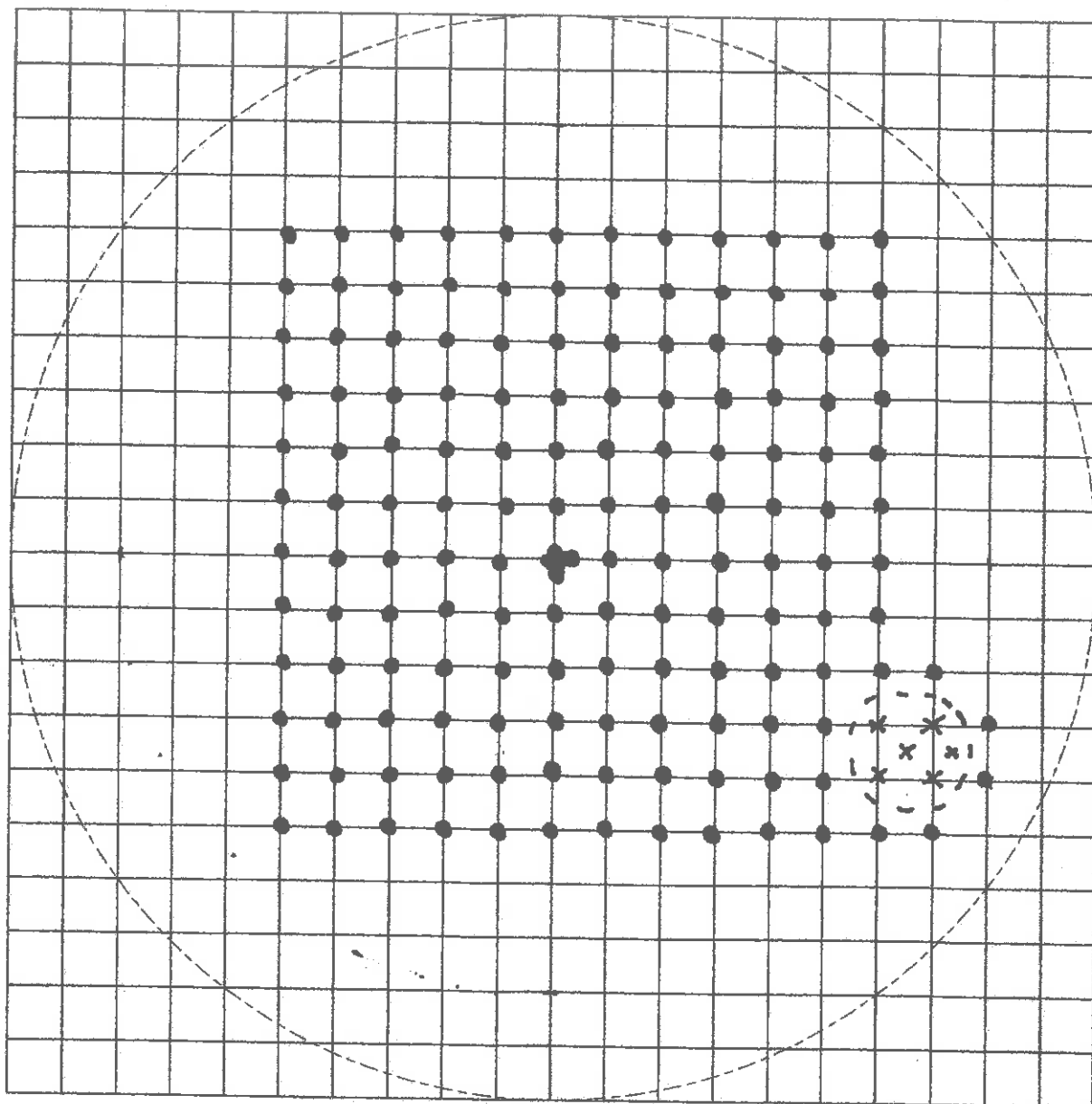
SCALE WITH CAUTION AS DISTORTION CAN OCCUR

DRG FRAME REF QC 1.1/5A

5CM

IRON STREET

COLESHILL STREET



M & J Drilling Services Ltd - Probing Record

Job No.

Drilled By

Scale

Job Title

FORMER MANOX SITE
MANCHESTER

Date

R BENNETT

1:125

19TH MAY 2020

BH	DEPTH		CASING	FORMATION	GROUTING			
	FROM	TO			PFA	CEMENT	SAND	OTHER
				<u>PROBE DRILLING FOR</u> <u>MINE SHAFT</u>				
				12 HOLES AT 1 METER CENTRES TO LOCATE SHAFT				
	GL	25m		DRIFT WITH BOULDERS AND GRAVELS				
	25m	26m		HARD DRILLING				
				6 HOLES INTO SHAFT				
	GL	20m		SOFT DRILLING				
	20m	26m		SOFT WITH FIRM BANDS				
	26m	31m		HARD DRILLING				
				TOTAL = 498m ²				

[illegible][illegible]

5CM

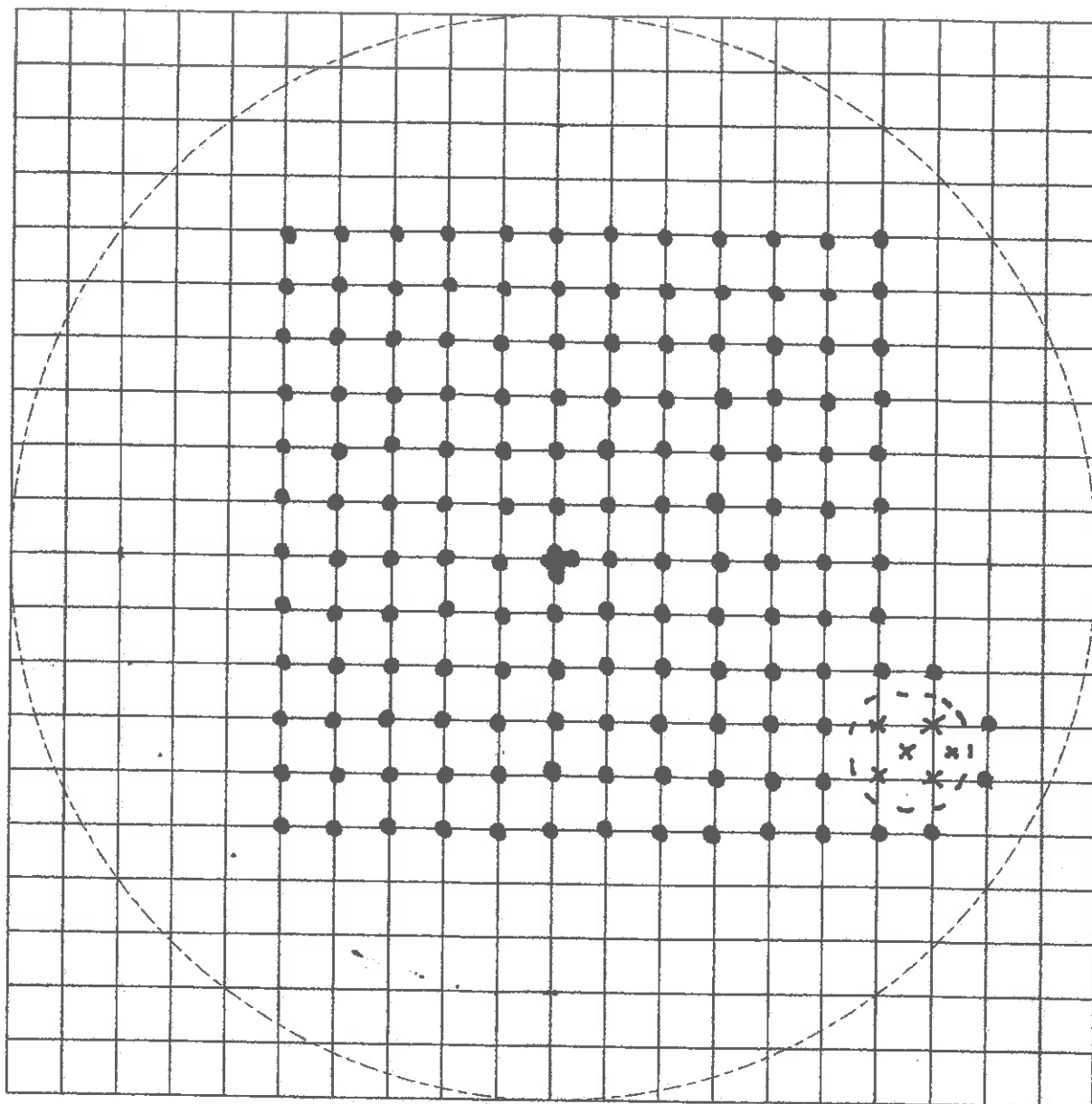
SCALE WITH CAUTION AS DISTORTION CAN OCCUR

DRG FRAME REF QC 1.1/5A

5CM

IRON STREET

COLESHILL STREET



M & J Drilling Services Ltd - Probing Record

Job No.

Drilled By

Scale

Job Title

FORMER MANOX SITE
MANCHESTER

Date

R BENNETT

1:125

19TH MAY 2020



The Coal
Authority

Permit to Enter or Disturb Coal Authority Interests

Permit 19640

Name and Address of Permit Holder:

Engie
14 The Quays
Salford
Manchester
M50 3BF

Site Location:

Former Manox Site
Flat 1 Sycamore Court
Sandal Street
Manchester
M40 7BS

This certificate hereby grants the above named Permit Holder a Permit to carry out:-

A ground investigation comprising 16 boreholes to 50m to determine presence of shallow mine workings and drilling in a spiral pattern to locate 1 recorded mine entry (Coal Authority Ref. 386399-007) all within the Authority's interests at the identified site location above as shown on the Grant Permit Boundary (overleaf) for the period of 12 months from the granted date shown below. The granting of this Permit does not constitute advice given by the Authority in relation to the proposed operations. It is the Permit Holder's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.

Conditions:

- *Water flush drilling exclusively.*
- *Gas Monitoring CO, CH₄, CO₂, O₂, H₂S at borehole and rig*
- *Operators undertaking the work must be in possession of this certificate and the Permit boundary plan at the time of works*

Signed: Leigh Sharpe Granted Date: 11/02/2020

For and on behalf of The Coal Authority

Nominated Representative: Leigh Sharpe, Permitting Manager;

The Coal Authority, Permitting Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG

Tel: 01623 637450; E-Mail: permissions@coal.gov.uk

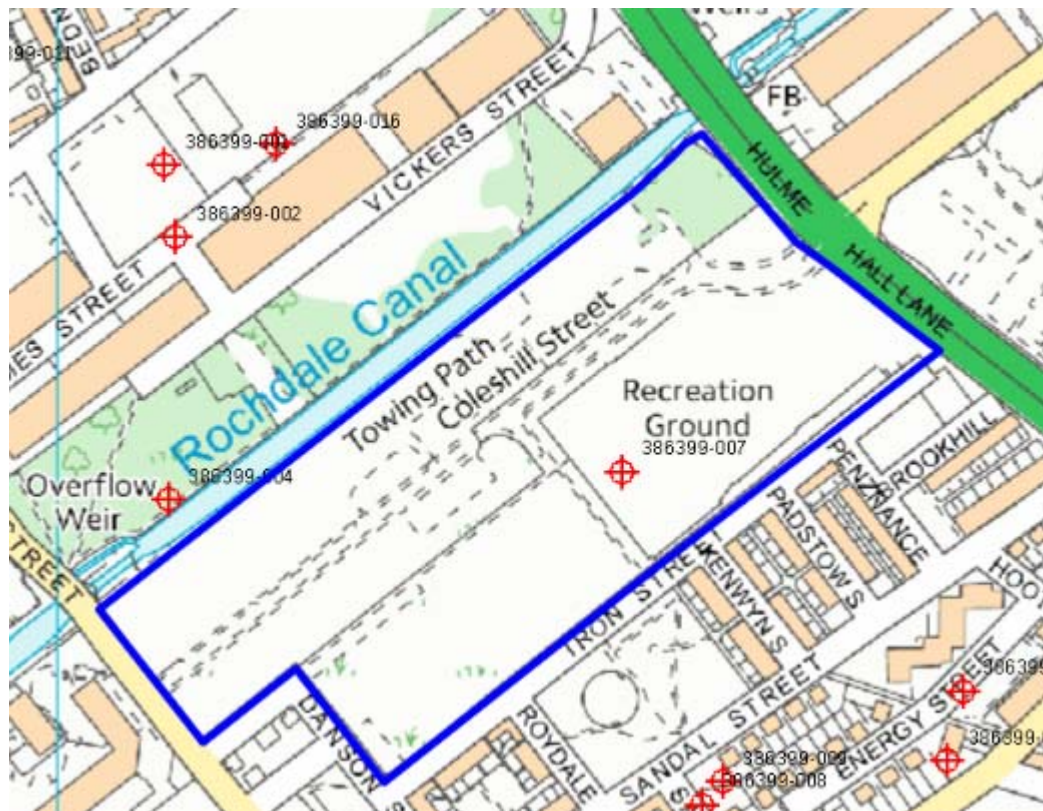


The Coal
Authority

Granted Permit Boundary

Permit Ref: 19640

Permit Boundary:

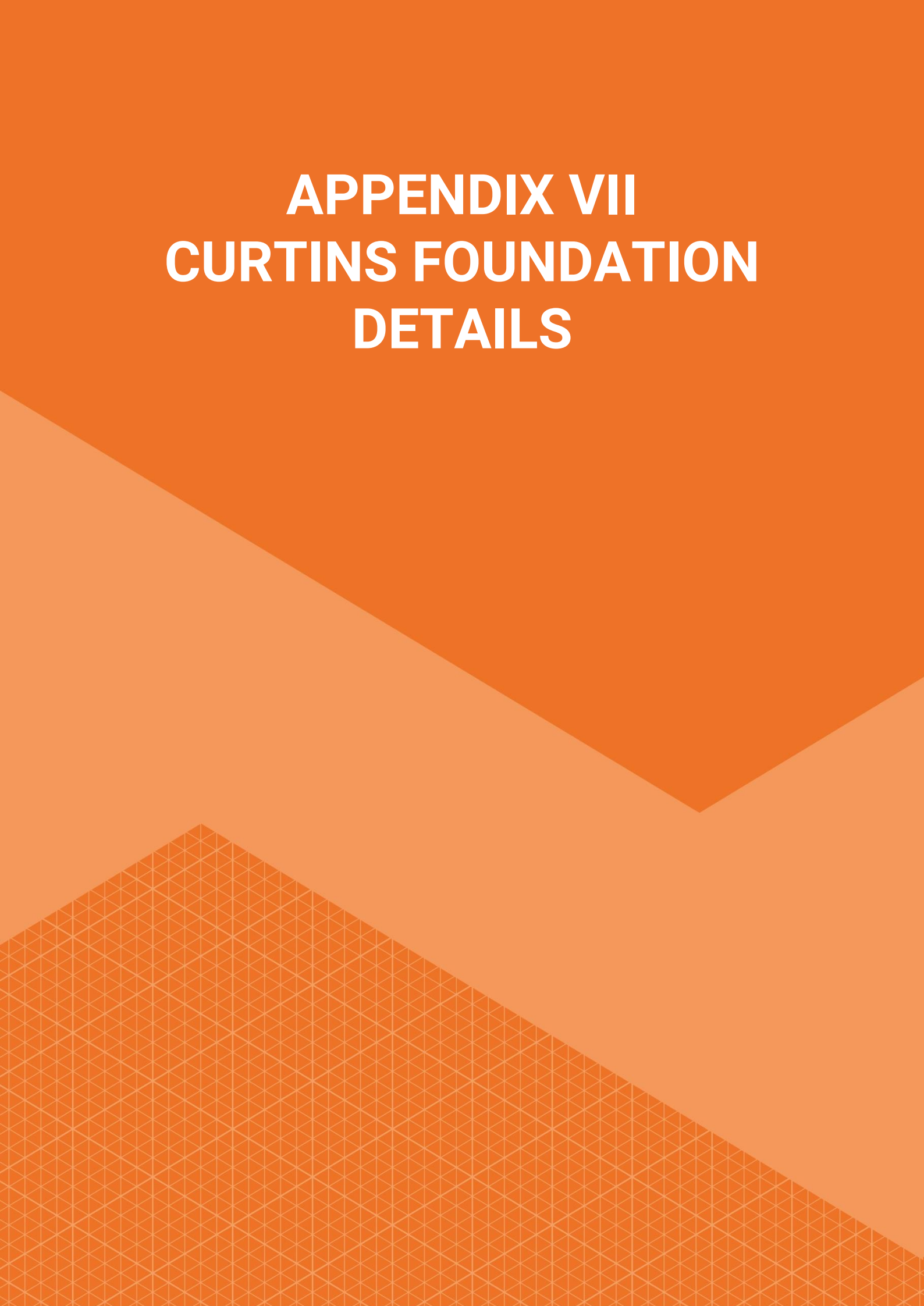


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APPENDIX VII

CURTINS FOUNDATION

DETAILS

The background of the page is composed of several geometric shapes. A large, dark orange triangle occupies the top right portion. Below it, a light orange triangle points upwards. The bottom left corner features a light orange triangle filled with a fine, white grid pattern. The remaining areas are solid light orange.

Introduction

This report presents the design calculations undertaken for the foundations of the buildings within the mineshaft zone on block L. These plots are highlighted in figure 1 below.

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Consulting Limited with respect to the information contained in the report will not extend to any third party.

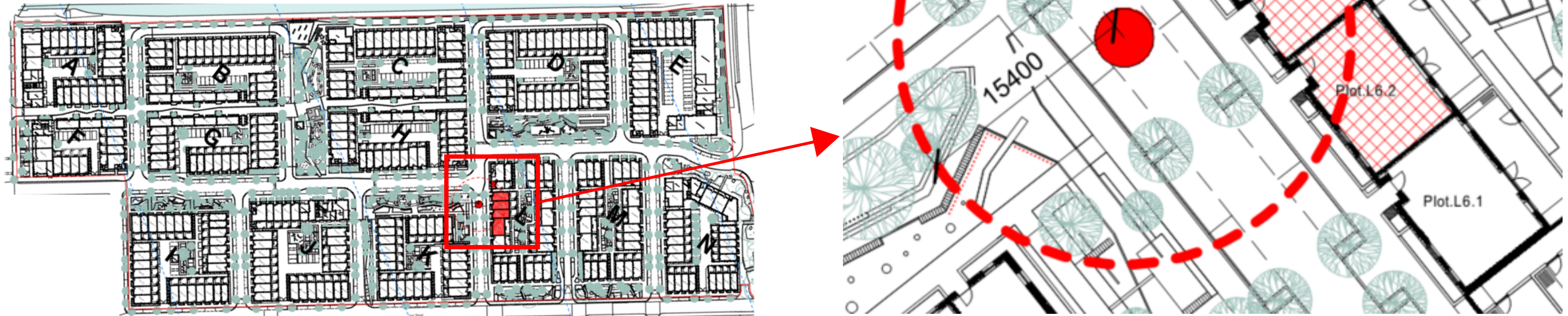


Figure 1 - Plots within conjectured zone of mineshaft

The proposed structural solution for the plots within the conjectured zone of the mineshaft is timber frame SIPS panels above ground floor. There is a suspended beam and block ground floor spanning onto reinforced concrete ground bearing strips footings. The proposal is to remediate the whole site for contamination purposes and install Vibro stone columns to improve the ground to provide the necessary allowable bearing capacity for the strip footings. From discussions with a specialist ground improvement contractor the anticipated allowable bearing capacity of the ground after vibro improving the ground is 100kN/m² if the Vibro stone columns are spaced at 1m centres. If the Vibro stone columns are spaced at 2m centres then the allowable bearing capacity reduces to 50kN/m². Taking this in to account the Vibro stone columns are spaced at 2m centres where the line loads on the strip footings are low. The spacing of the Vibro columns is reduced to 1m centres where the line loads are high and cannot be accommodated by the lower allowable bearing capacity provided by 2m spaced Vibro columns.

As the ground bearing strip footings are within the conjectured zone of the mine shaft, they have been designed to span 3m and cantilever 1.5m in the accidental case of any settlement.

Table 1 below list the details of the 3 types of strip footings, whilst figure 2 highlights the locations of the strip footings. Detailed calculations for the these strip footings are provided on page 3 of this report.

Table 1 - Strip Footing Details

Colour	Width (mm)	Depth (mm)	Assumed Vibro column spacing (mm)	Reinforcement rate (kg/m3)	SLS Line Load on foundation (kN/m)
Purple	600	450	1000	120	51
Orange	750	450	1000	120	71
Dark Green	750	450	2000	120	35

Notes
- Concrete grade to be C25/30

Key



DENOTES STEEL BEAM AND POSTS REQUIRED TO SUPPORT INSET EXTERNAL WALL OR INTERNAL FLOOR STRUCTURE



DENOTES ASSUMED SPAN DIRECTION OF GF BEAM & BLOCK FLOOR AND SUSPENDED TIMBER FRAME FLOOR(S)



DENOTES ASSUMED ROOF SPAN DIRECTION



DENOTES LOCALISED PAD FOUNDATIONS TO SUPPORT POSTS. REFER TO TABLE FOR INDICATIVE SIZE

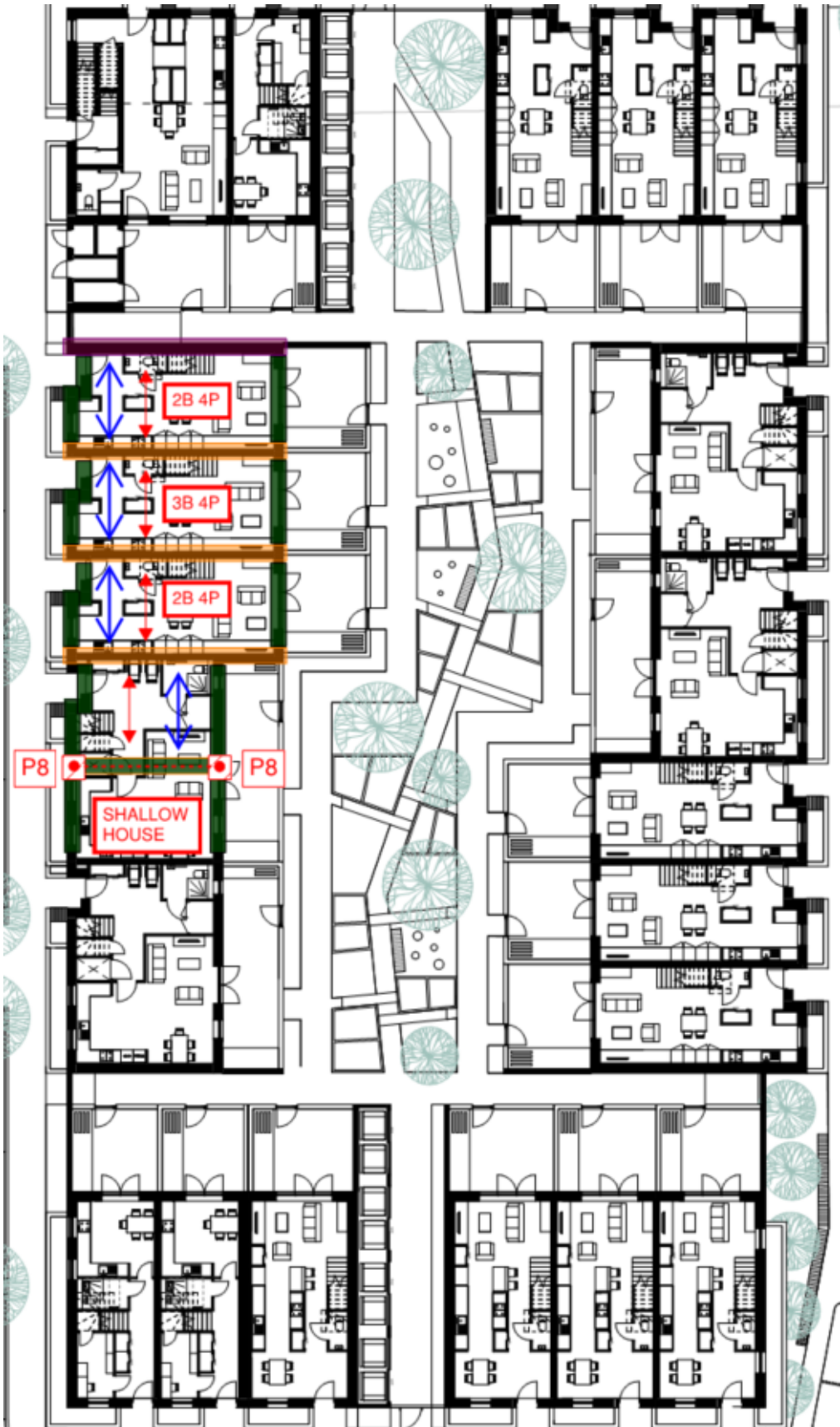


Figure 2 - Foundations within the mineshaft zone

Foundation Line loads - Load Take Down

WALL LOAD TAKEDOWN AND FOUNDATION DESIGN						WALL LOAD TAKEDOWN AND FOUNDATION DESIGN						WALL LOAD TAKEDOWN AND FOUNDATION DESIGN								
WALL REFERENCE:		WALL A				WALL REFERENCE:		WALL B				WALL REFERENCE:		WALL C						
		PARTY WALL						EXTERNAL WALL SIDE						EXTERNAL WALL FRONT/BACK						
		Area Loads		Load Width/ Height (m)	Line Loads				Area Loads		Load Width/ Height (m)	Line Loads				Area Loads		Load Width/ Height (m)	Line Loads	
		SLS (kN/m²)	ULS (kN/m²)		SLS (kN/m)	ULS (kN/m)			SLS (kN/m²)	ULS (kN/m²)		SLS (kN/m)	ULS (kN/m)			SLS (kN/m²)	ULS (kN/m²)		SLS (kN/m)	ULS (kN/m)
Floor Loads:						Floor Loads:						Floor Loads:								
Typical Roof						Typical Roof						Typical Roof								
Dead Load	1.25	1.69	5.0	6.25	8.44	Dead Load	1.25	1.69	2.5	3.13	4.22	Dead Load	1.25	1.69	1.0	1.25	1.69			
Imposed Load	0.60	0.90	5.0	3.00	4.50	Imposed Load	0.60	0.90	2.5	1.50	2.25	Imposed Load	0.60	0.90	1.0	0.60	0.90			
Typical Floor						Typical Floor						Typical Floor								
Dead Load	1.50	2.03	0.0	0.00	0.00	Dead Load	1.50	2.03	0.0	0.00	0.00	Dead Load	1.50	2.03	0.0	0.00	0.00			
Imposed Load	1.50	2.25	0.0	0.00	0.00	Imposed Load	1.50	2.25	0.0	0.00	0.00	Imposed Load	1.50	2.25	0.0	0.00	0.00			
Typical Floor						Typical Floor						Typical Floor								
Dead Load	1.50	2.03	0.0	0.00	0.00	Dead Load	1.50	2.03	0.0	0.00	0.00	Dead Load	1.50	2.03	0.0	0.00	0.00			
Imposed Load	1.50	2.25	0.0	0.00	0.00	Imposed Load	1.50	2.25	0.0	0.00	0.00	Imposed Load	1.50	2.25	0.0	0.00	0.00			
Typical Floor						Typical Floor						Typical Floor								
Dead Load	1.50	2.03	5.0	7.50	10.13	Dead Load	1.50	2.03	2.5	3.75	5.06	Dead Load	1.50	2.03	1.0	1.50	2.03			
Imposed Load	1.50	2.25	5.0	7.50	11.25	Imposed Load	1.50	2.25	2.5	3.75	5.63	Imposed Load	1.50	2.25	1.0	1.50	2.25			
Ground Floor						Ground Floor						Ground Floor								
Dead Load	4.35	5.87	5.0	21.75	29.36	Dead Load	4.35	5.87	2.5	10.88	14.68	Dead Load	4.35	5.87	1.0	4.35	5.87			
Imposed Load	1.50	2.25	5.0	7.50	11.25	Imposed Load	1.50	2.25	2.5	3.75	5.63	Imposed Load	1.50	2.25	1.0	1.50	2.25			
Wall Loads:						Wall Loads:						Wall Loads:								
External Wall						External Wall						External Wall								
Dead Load	2.45	3.31	0.0	0.00	0.00	Dead Load	2.45	3.31	6.1	14.95	20.18	Dead Load	2.45	3.31	7.3	17.89	24.14			
Imposed Load	0.00	0.00	0.0	0.00	0.00	Imposed Load	0.00	0.00	6.1	0.00	0.00	Imposed Load	0.00	0.00	7.3	0.00	0.00			
Party Wall						Party Wall						Party Wall								
Dead Load	1.50	2.03	6.1	9.15	12.35	Dead Load	1.50	2.03	0.0	0.00	0.00	Dead Load	1.50	2.03	0.0	0.00	0.00			
Imposed Load	0.00	0.00	6.1	0.00	0.00	Imposed Load	0.00	0.00	0.0	0.00	0.00	Imposed Load	0.00	0.00	0.0	0.00	0.00			
Substructure block work						Substructure block work						Substructure block work								
Dead Load	2.00	2.70	2.0	4.00	5.40	Dead Load	2.00	2.70	1.0	2.00	2.70	Dead Load	2.00	2.70	1.0	2.00	2.70			
Imposed Load	0.00	0.00	2.0	0.00	0.00	Imposed Load	0.00	0.00	1.0	0.00	0.00	Imposed Load	0.00	0.00	1.0	0.00	0.00			
				Total Load		66.7	87.3			Total Load		43.7	57.6			Total Load		30.6	39.1	

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 600x450 Purple				Start page no./Revision 1	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

RC MEMBER ANALYSIS & DESIGN (EN1992-1-1:2004)

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

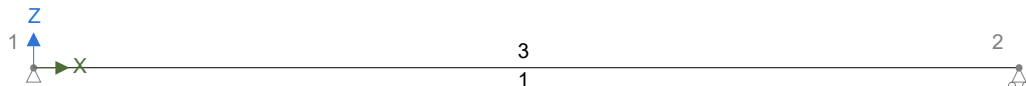
Tedds calculation version 3.3.03

ANALYSIS

Tedds calculation version 1.0.32

Geometry

Geometry (m) - Concrete (C25 2500 Limestone) - R 600x450



Loading

Self weight included

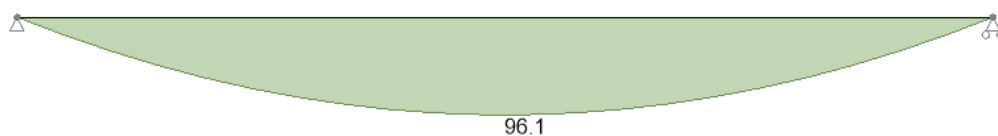
Imposed - Loading (kN/m)



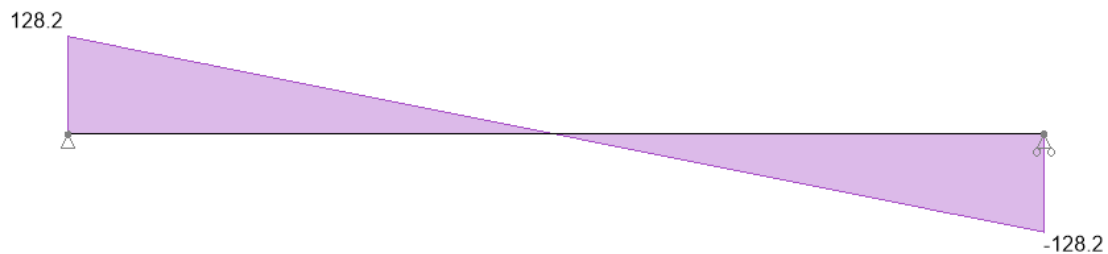
Results

Forces

Strength combinations - Moment envelope (kNm)



Strength combinations - Shear envelope (kN)



Concrete details (Table 3.1 - Strength and deformation characteristics for concrete)

Concrete strength class	C25/30	Char. comp. cylinder strength	$f_{ck} = 25 \text{ N/mm}^2$
Design comp conc. strength	$f_{cwd} = 16.7 \text{ N/mm}^2$	Maximum aggregate size	$h_{agg} = 20 \text{ mm}$

Reinforcement details

Char. yield strength of reinf.	$f_{yk} = 500 \text{ N/mm}^2$	Partial factor for reinf. steel	$\gamma_s = 1.15$
Design yield strength of reinf.	$f_{yd} = 435 \text{ N/mm}^2$		

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 600x450 Purple				Start page no./Revision 2	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

Nominal cover to reinforcement

Nominal cover to top reinf $C_{nom_t} = 50 \text{ mm}$

Nominal cover to bottom reinf $C_{nom_b} = 75 \text{ mm}$

Nominal cover to side reinf $C_{nom_s} = 50 \text{ mm}$

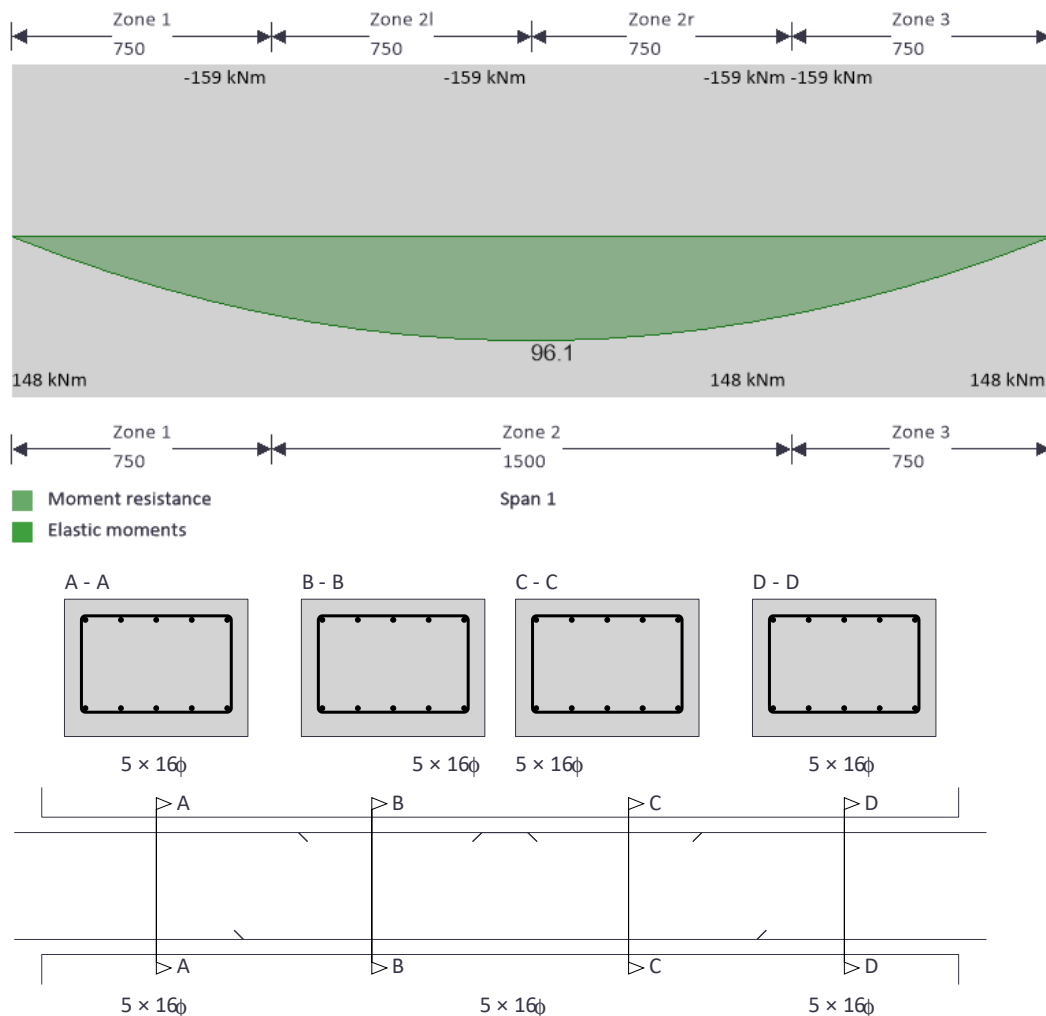
Beam - Span 1

Rectangular section details

Section width $b = 600 \text{ mm}$

Section depth $h = 450 \text{ mm}$

Moment design



Zone 1 (0 mm - 750 mm) Positive moment - section 6.1

Design bending moment $M = 72.1 \text{ kNm}$

Effective depth tension reinf. $d = 357 \text{ mm}$

Area of tension reinf. req'd $A_{s,req} = 489 \text{ mm}^2$

Area of tension reinf. prov $A_{s,prov} = 1005 \text{ mm}^2$

Min area of reinf. (exp.9.1N) $A_{s,min} = 286 \text{ mm}^2$

Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 10800 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width $w_k = 0.3 \text{ mm}$

Min area reinf req'd (exp.7.1) $A_{sc,min} = 398 \text{ mm}^2$

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 18.5 \text{ kNm}$

Actual tension bar spacing $S_{bar} = 116 \text{ mm}$

Max bar spacing (Table 7.3N) $S_{bar,max} = 300 \text{ mm}$

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 600x450 Purple				Start page no./Revision 3	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Zone 1 (0 mm - 750 mm) Negative moment - section 6.1

Design bending moment	M = 24.0 kNm	Effective depth tension reinf.	d = 382 mm
Area of tension reinf. req'd	A _{s,req} = 152 mm ²	Area of tension reinf. prov	A _{s,prov} = 1005 mm ²
Min area of reinf. (exp.9.1N)	A _{s,min} = 306 mm ²	Max area reinf. (cl.9.2.1.1(3))	A _{s,max} = 10800 mm ²

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

Crack control - Section 7.3

Maximum crack width	w _k = 0.3 mm	Min area reinf req'd (exp.7.1)	A _{sc,min} = 397 mm ²
---------------------	--------------------------------	--------------------------------	--

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	M _{QP} = 0.0 kNm		
Actual tension bar spacing	S _{bar} = 116 mm	Max bar spacing (Table 7.3N)	S _{bar,max} = 300 mm

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Minimum bar spacing (Section 8.2)

Top bar spacing	S _{top} = 100.0 mm	Min allow. top bar spacing	S _{top,min} = 25.0 mm
-----------------	------------------------------------	----------------------------	---------------------------------------

PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing	S _{bot} = 100.0 mm	Min allow. bottom bar spacing	S _{bot,min} = 25.0 mm
--------------------	------------------------------------	-------------------------------	---------------------------------------

PASS - Actual bar spacing exceeds minimum allowable

Zone 2 (750 mm - 2250 mm) Positive moment - section 6.1

Design bending moment	M = 96.1 kNm	Effective depth tension reinf.	d = 357 mm
Area of tension reinf. req'd	A _{s,req} = 652 mm ²	Area of tension reinf. prov	A _{s,prov} = 1005 mm ²
Min area of reinf. (exp.9.1N)	A _{s,min} = 286 mm ²	Max area reinf. (cl.9.2.1.1(3))	A _{s,max} = 10800 mm ²

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

Crack control - Section 7.3

Maximum crack width	w _k = 0.3 mm	Min area reinf req'd (exp.7.1)	A _{sc,min} = 398 mm ²
---------------------	--------------------------------	--------------------------------	--

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	M _{QP} = 24.7 kNm		
Actual tension bar spacing	S _{bar} = 116 mm	Max bar spacing (Table 7.3N)	S _{bar,max} = 300 mm

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Deflection control - Section 7.4

Allow. span to depth ratio	span_to_depth _{allow} = 40.000	Actual span to depth ratio	span_to_depth _{actual} = 8.403
----------------------------	--	----------------------------	--

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

Minimum bar spacing (Section 8.2)

Top bar spacing	S _{top} = 100.0 mm	Min allow. top bar spacing	S _{top,min} = 25.0 mm
-----------------	------------------------------------	----------------------------	---------------------------------------

PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing	S _{bot} = 25.0 mm	Min allow. bottom bar spacing	S _{bot,min} = 25.0 mm
--------------------	-----------------------------------	-------------------------------	---------------------------------------

PASS - Actual bar spacing exceeds minimum allowable

Minimum bar spacing (Section 8.2)

Top bar spacing	S _{top} = 100.0 mm	Min allow. top bar spacing	S _{top,min} = 25.0 mm
-----------------	------------------------------------	----------------------------	---------------------------------------

PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing	S _{bot} = 25.0 mm	Min allow. bottom bar spacing	S _{bot,min} = 25.0 mm
--------------------	-----------------------------------	-------------------------------	---------------------------------------

PASS - Actual bar spacing exceeds minimum allowable

Zone 3 (2250 mm - 3000 mm) Positive moment - section 6.1

Design bending moment	M = 72.1 kNm	Effective depth tension reinf.	d = 357 mm
Area of tension reinf. req'd	A _{s,req} = 489 mm ²	Area of tension reinf. prov	A _{s,prov} = 1005 mm ²
Min area of reinf. (exp.9.1N)	A _{s,min} = 286 mm ²	Max area reinf. (cl.9.2.1.1(3))	A _{s,max} = 10800 mm ²

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 600x450 Purple				Start page no./Revision 4	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

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

Crack control - Section 7.3

Maximum crack width $w_k = 0.3 \text{ mm}$ Min area reinf req'd (exp.7.1) $A_{s,min} = 398 \text{ mm}^2$

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 18.5 \text{ kNm}$

Actual tension bar spacing $S_{bar} = 116 \text{ mm}$ Max bar spacing (Table 7.3N) $S_{bar,max} = 300 \text{ mm}$

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Zone 3 (2250 mm - 3000 mm) Negative moment - section 6.1

Design bending moment $M = 24.0 \text{ kNm}$ Effective depth tension reinf. $d = 382 \text{ mm}$

Area of tension reinf. req'd $A_{s,req} = 152 \text{ mm}^2$ Area of tension reinf. prov $A_{s,prov} = 1005 \text{ mm}^2$

Min area of reinf. (exp.9.1N) $A_{s,min} = 306 \text{ mm}^2$ Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 10800 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width $w_k = 0.3 \text{ mm}$ Min area reinf req'd (exp.7.1) $A_{s,min} = 397 \text{ mm}^2$

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 0.0 \text{ kNm}$

Actual tension bar spacing $S_{bar} = 116 \text{ mm}$ Max bar spacing (Table 7.3N) $S_{bar,max} = 300 \text{ mm}$

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Minimum bar spacing (Section 8.2)

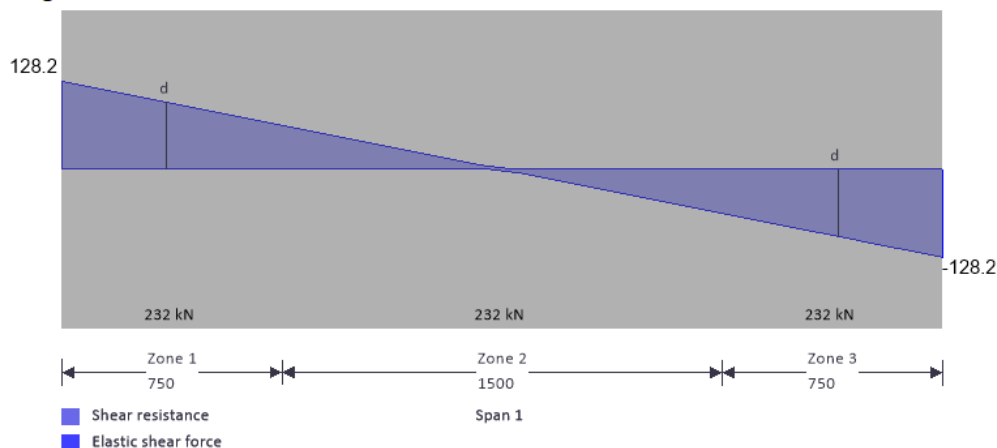
Top bar spacing $S_{top} = 100.0 \text{ mm}$ Min allow. top bar spacing $S_{top,min} = 25.0 \text{ mm}$

PASS - Actual bar spacing exceeds minimum allowable

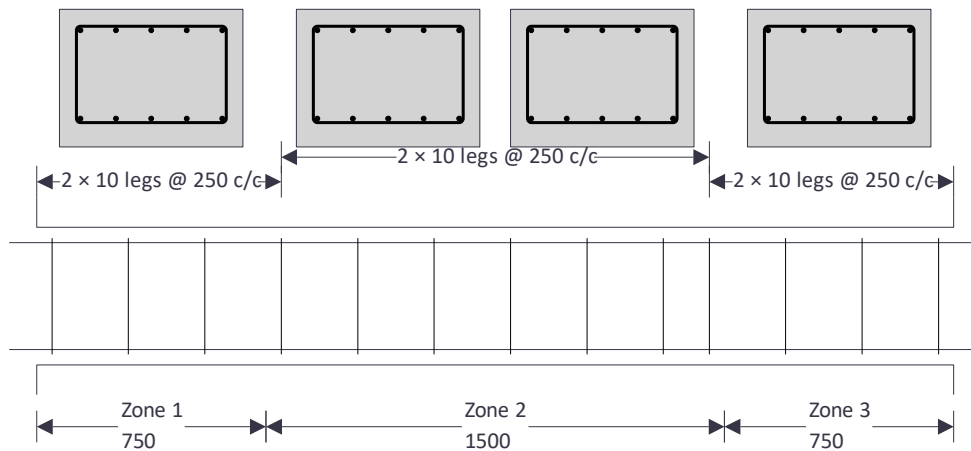
Bottom bar spacing $S_{bot} = 100.0 \text{ mm}$ Min allow. bottom bar spacing $S_{bot,min} = 25.0 \text{ mm}$

PASS - Actual bar spacing exceeds minimum allowable

Shear design



Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 600x450 Purple				Start page no./Revision 5	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date



Angle of comp. shear strut $\theta_{\max} = 45 \text{ deg}$

Compression chord coefficient $\alpha_{cw} = 1.00$

Strength reduction factor $v_1 = 0.540$

Minimum area of shear reinf. $A_{sv, \min} = 480 \text{ mm}^2/\text{m}$

Zone 1 (0 mm - 750 mm) shear - section 6.2

Shear force at support $V_{Ed, \max} = 128 \text{ kN}$

Max design shear resistance $V_{Rd, \max} = 916 \text{ kN}$

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 98 \text{ kN}$

Area shear reinf. req'd $A_{sv, \text{req}} = 480 \text{ mm}^2/\text{m}$

Area of shear reinf prov. $A_{sv, \text{prov}} = 628 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl, \max} = 268 \text{ mm}$

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

Zone 2 (750 mm - 2250 mm) shear - section 6.2

Shear force at support $V_{Ed, \max} = 64 \text{ kN}$

Max design shear resistance $V_{Rd, \max} = 916 \text{ kN}$

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 64 \text{ kN}$

Area shear reinf. req'd $A_{sv, \text{req}} = 480 \text{ mm}^2/\text{m}$

Area of shear reinf prov. $A_{sv, \text{prov}} = 628 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl, \max} = 268 \text{ mm}$

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

Zone 3 (2250 mm - 3000 mm) shear - section 6.2

Shear force at support $V_{Ed, \max} = 128 \text{ kN}$

Max design shear resistance $V_{Rd, \max} = 916 \text{ kN}$

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 98 \text{ kN}$

Area shear reinf. req'd $A_{sv, \text{req}} = 480 \text{ mm}^2/\text{m}$

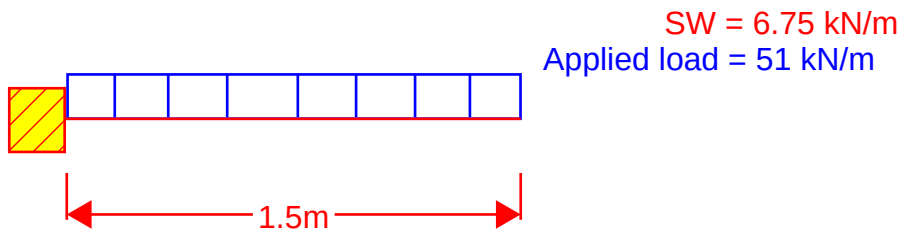
Area of shear reinf prov. $A_{sv, \text{prov}} = 628 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl, \max} = 268 \text{ mm}$

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

BLOCK L - MINESHAFT ZONE - 600X450 CANTILEVER - PURPLE



$$M_{\max} = \frac{((1.35 \times 6.75) + (1.5 \times 51)) \times 1.5^2}{2} = 100 \text{ kNm}$$

$$V_{\max} = ((1.35 \times 6.75) + (1.5 \times 51)) \times 1.5 = 130 \text{ kN}$$

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 600x450 Purple Cantilever				Start page no./Revision 1	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

RC BEAM DESIGN

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

Tedds calculation version 3.3.03

Concrete details (Table 3.1 - Strength and deformation characteristics for concrete)

Concrete strength class	C25/30	Char. comp. cylinder strength	$f_{ck} = 25 \text{ N/mm}^2$
Design comp conc. strength	$f_{cud} = 16.7 \text{ N/mm}^2$	Maximum aggregate size	$h_{agg} = 20 \text{ mm}$

Reinforcement details

Char. yield strength of reinf.	$f_{yk} = 500 \text{ N/mm}^2$	Partial factor for reinf. steel	$\gamma_s = 1.15$
Design yield strength of reinf.	$f_{yd} = 435 \text{ N/mm}^2$		

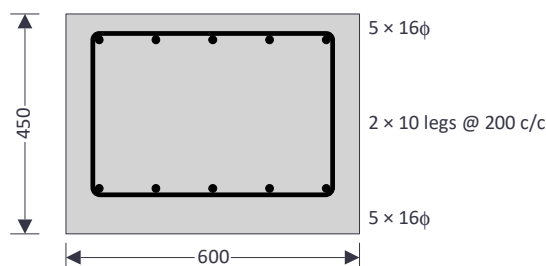
Nominal cover to reinforcement

Nominal cover to top reinf	$c_{nom_t} = 35 \text{ mm}$	Nominal cover to bottom reinf	$c_{nom_b} = 75 \text{ mm}$
Nominal cover to side reinf	$c_{nom_s} = 50 \text{ mm}$		

Section 1

Rectangular section details

Section width	$b = 600 \text{ mm}$	Section depth	$h = 450 \text{ mm}$
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Positive moment - section 6.1

Design bending moment	$M = 110.0 \text{ kNm}$	Effective depth tension reinf.	$d = 357 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 749 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 1005 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 286 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 10800 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width	$w_k = 0.3 \text{ mm}$	Min area reinf req'd (exp.7.1)	$A_{s,min} = 398 \text{ mm}^2$
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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	$M_{QP} = 80.0 \text{ kNm}$		
Actual tension bar spacing	$s_{bar} = 116 \text{ mm}$	Max bar spacing (Table 7.3N)	$s_{bar,max} = 205.6 \text{ mm}$

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Negative moment - section 6.1

Design bending moment	$M = 110.0 \text{ kNm}$	Effective depth tension reinf.	$d = 397 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 671 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 1005 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 318 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 10800 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width	$w_k = 0.3 \text{ mm}$	Min area reinf req'd (exp.7.1)	$A_{s,min} = 397 \text{ mm}^2$
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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	$M_{QP} = 80.0 \text{ kNm}$		
Actual tension bar spacing	$s_{bar} = 116 \text{ mm}$	Max bar spacing (Table 7.3N)	$s_{bar,max} = 236.3 \text{ mm}$

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 600x450 Purple Cantilever				Start page no./Revision 2	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Minimum bar spacing (Section 8.2)

Top bar spacing $S_{top} = 100.0$ mm

Min allow. top bar spacing $S_{top,min} = 25.0$ mm

PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing $S_{bot} = 100.0$ mm

Min allow. bottom bar spacing $S_{bot,min} = 25.0$ mm

PASS - Actual bar spacing exceeds minimum allowable

Section in shear (section 6.2)

Angle of comp. shear strut $\theta_{max} = 45$ deg

Strength reduction factor $V_1 = 0.540$

Compression chord coefficient $\alpha_{cw} = 1.00$

Minimum area of shear reinf. $A_{sv,min} = 480$ mm²/m

Shear force at support $V_{Ed,max} = 140$ kN

Max design shear resistance $V_{Rd,max} = 912$ kN

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 140$ kN

Area shear reinf. req'd $A_{sv,req} = 480$ mm²/m

Area of shear reinf prov. $A_{sv,prov} = 785$ mm²/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $S_{vl,max} = 268$ mm

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

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 750x450 Dark Green				Start page no./Revision 1	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

RC MEMBER ANALYSIS & DESIGN (EN1992-1-1:2004)

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

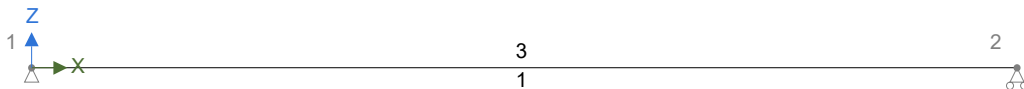
Tedds calculation version 3.3.03

ANALYSIS

Tedds calculation version 1.0.32

Geometry

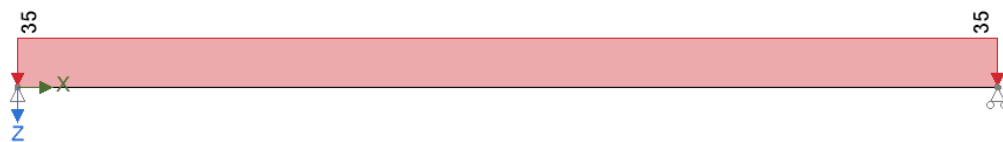
Geometry (m) - Concrete (C25 2500 Limestone) - R 750x450



Loading

Self weight included

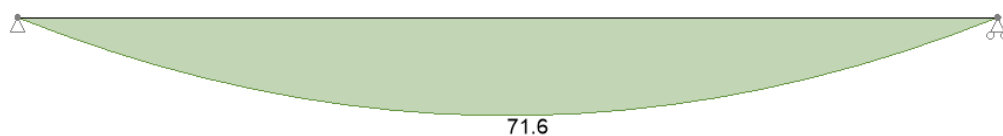
Imposed - Loading (kN/m)



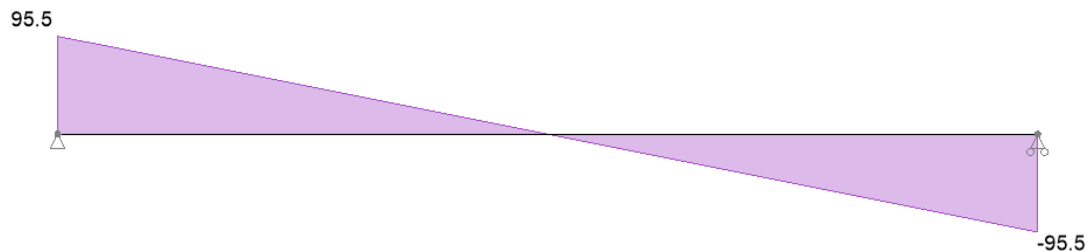
Results

Forces

Strength combinations - Moment envelope (kNm)



Strength combinations - Shear envelope (kN)



Concrete details (Table 3.1 - Strength and deformation characteristics for concrete)

Concrete strength class	C25/30	Char. comp. cylinder strength	$f_{ck} = 25 \text{ N/mm}^2$
Design comp conc. strength	$f_{cwd} = 16.7 \text{ N/mm}^2$	Maximum aggregate size	$h_{agg} = 20 \text{ mm}$

Reinforcement details

Char. yield strength of rinf.	$f_{yk} = 500 \text{ N/mm}^2$	Partial factor for reinf. steel	$\gamma_s = 1.15$
Design yield strength of reinf.	$f_{yd} = 435 \text{ N/mm}^2$		

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 750x450 Dark Green				Start page no./Revision 2	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

Nominal cover to reinforcement

Nominal cover to top reinf $C_{nom_t} = 50$ mm

Nominal cover to bottom reinf $C_{nom_b} = 75$ mm

Nominal cover to side reinf $C_{nom_s} = 50$ mm

Beam - Span 1

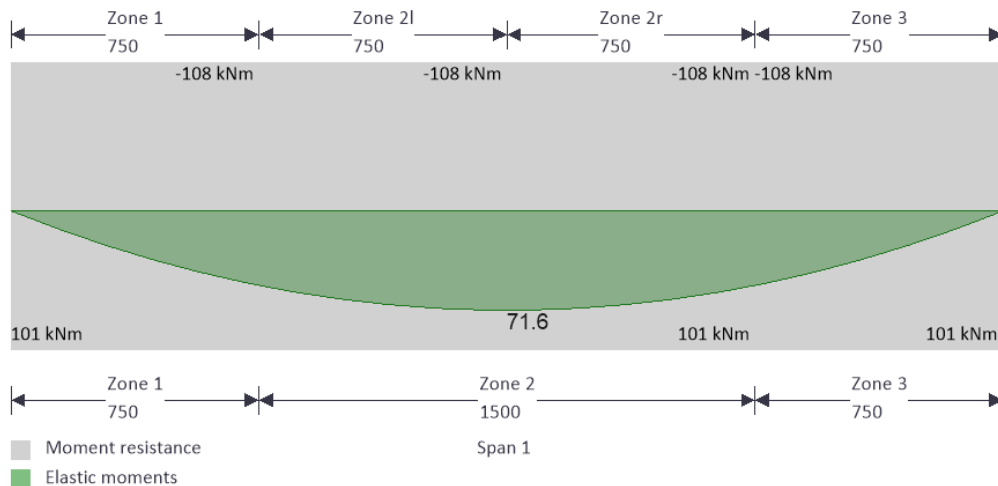
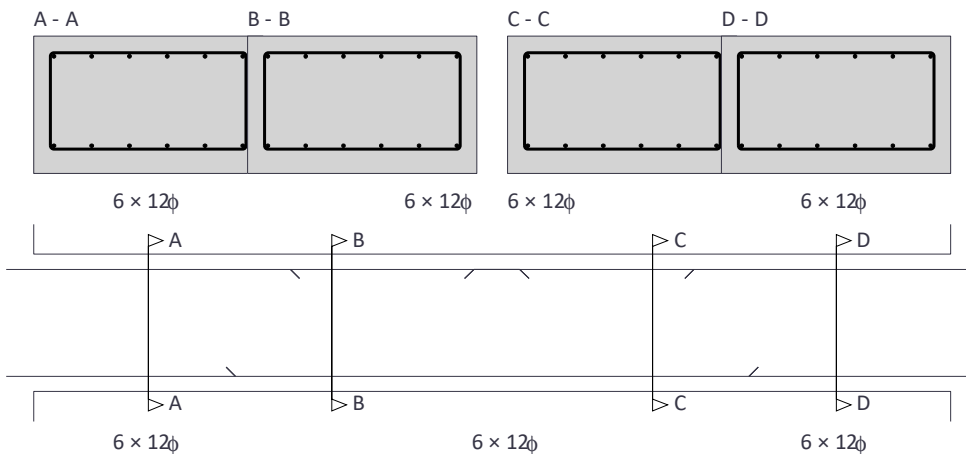
Rectangular section details

Section width $b = 750$ mm

Section depth

$h = 450$ mm

Moment design



Zone 1 (0 mm - 750 mm) Positive moment - section 6.1

Design bending moment $M = 53.7$ kNm

Effective depth tension reinf. $d = 359$ mm

Area of tension reinf. req'd $A_{s,req} = 362$ mm²

Area of tension reinf. prov $A_{s,prov} = 679$ mm²

Min area of reinf. (exp.9.1N) $A_{s,min} = 359$ mm²

Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 13500$ mm²

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

Crack control - Section 7.3

Maximum crack width $w_k = 0.3$ mm

Min area reinf req'd (exp.7.1) $A_{sc,min} = 511$ mm²

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 15.8$ kNm

Actual tension bar spacing $S_{bar} = 123.6$ mm

Max bar spacing (Table 7.3N) $S_{bar,max} = 300$ mm

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 750x450 Dark Green				Start page no./Revision 3	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

Zone 1 (0 mm - 750 mm) Negative moment - section 6.1

Design bending moment	$M = 17.9 \text{ kNm}$	Effective depth tension reinf.	$d = 384 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 113 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 679 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 384 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 13500 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width	$w_k = 0.3 \text{ mm}$	Min area reinf req'd (exp.7.1)	$A_{sc,min} = 510 \text{ mm}^2$
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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	$M_{QP} = 0.0 \text{ kNm}$		
Actual tension bar spacing	$S_{bar} = 123.6 \text{ mm}$	Max bar spacing (Table 7.3N)	$S_{bar,max} = 300 \text{ mm}$

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Minimum bar spacing (Section 8.2)

Top bar spacing	$S_{top} = 111.6 \text{ mm}$	Min allow. top bar spacing	$S_{top,min} = 25.0 \text{ mm}$
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PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing	$S_{bot} = 111.6 \text{ mm}$	Min allow. bottom bar spacing	$S_{bot,min} = 25.0 \text{ mm}$
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PASS - Actual bar spacing exceeds minimum allowable

Zone 2 (750 mm - 2250 mm) Positive moment - section 6.1

Design bending moment	$M = 71.6 \text{ kNm}$	Effective depth tension reinf.	$d = 359 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 483 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 679 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 359 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 13500 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width	$w_k = 0.3 \text{ mm}$	Min area reinf req'd (exp.7.1)	$A_{sc,min} = 511 \text{ mm}^2$
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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	$M_{QP} = 21.1 \text{ kNm}$		
Actual tension bar spacing	$S_{bar} = 123.6 \text{ mm}$	Max bar spacing (Table 7.3N)	$S_{bar,max} = 300 \text{ mm}$

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Deflection control - Section 7.4

Allow. span to depth ratio	$\text{span_to_depth}_{allow} = 40.000$	Actual span to depth ratio	$\text{span_to_depth}_{actual} = 8.357$
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PASS - Actual span to depth ratio is within the allowable limit

Minimum bar spacing (Section 8.2)

Top bar spacing	$S_{top} = 111.6 \text{ mm}$	Min allow. top bar spacing	$S_{top,min} = 25.0 \text{ mm}$
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PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing	$S_{bot} = 25.0 \text{ mm}$	Min allow. bottom bar spacing	$S_{bot,min} = 25.0 \text{ mm}$
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PASS - Actual bar spacing exceeds minimum allowable

Minimum bar spacing (Section 8.2)

Top bar spacing	$S_{top} = 111.6 \text{ mm}$	Min allow. top bar spacing	$S_{top,min} = 25.0 \text{ mm}$
-----------------	------------------------------	----------------------------	---------------------------------

PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing	$S_{bot} = 25.0 \text{ mm}$	Min allow. bottom bar spacing	$S_{bot,min} = 25.0 \text{ mm}$
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PASS - Actual bar spacing exceeds minimum allowable

Zone 3 (2250 mm - 3000 mm) Positive moment - section 6.1

Design bending moment	$M = 53.7 \text{ kNm}$	Effective depth tension reinf.	$d = 359 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 362 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 679 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 359 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 13500 \text{ mm}^2$

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

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 750x450 Dark Green				Start page no./Revision 4	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

Crack control - Section 7.3

Maximum crack width $w_k = 0.3$ mm Min area reinf req'd (exp.7.1) $A_{sc,min} = 511$ mm²

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 15.8$ kNm

Actual tension bar spacing $s_{bar} = 123.6$ mm Max bar spacing (Table 7.3N) $s_{bar,max} = 300$ mm

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Zone 3 (2250 mm - 3000 mm) Negative moment - section 6.1

Design bending moment $M = 17.9$ kNm Effective depth tension reinf. $d = 384$ mm

Area of tension reinf. req'd $A_{s,req} = 113$ mm² Area of tension reinf. prov $A_{s,prov} = 679$ mm²

Min area of reinf. (exp.9.1N) $A_{s,min} = 384$ mm² Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 13500$ mm²

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

Crack control - Section 7.3

Maximum crack width $w_k = 0.3$ mm Min area reinf req'd (exp.7.1) $A_{sc,min} = 510$ mm²

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 0.0$ kNm

Actual tension bar spacing $s_{bar} = 123.6$ mm Max bar spacing (Table 7.3N) $s_{bar,max} = 300$ mm

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Minimum bar spacing (Section 8.2)

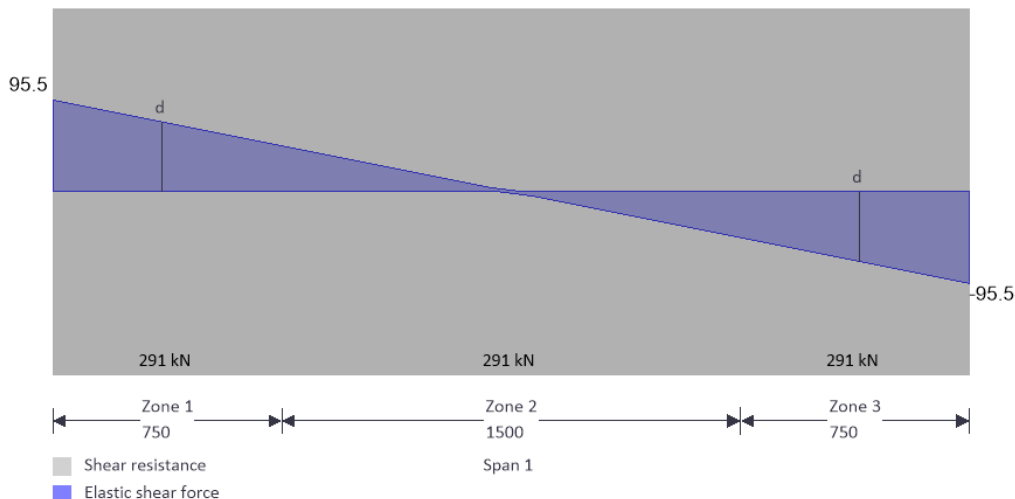
Top bar spacing $s_{top} = 111.6$ mm Min allow. top bar spacing $s_{top,min} = 25.0$ mm

PASS - Actual bar spacing exceeds minimum allowable

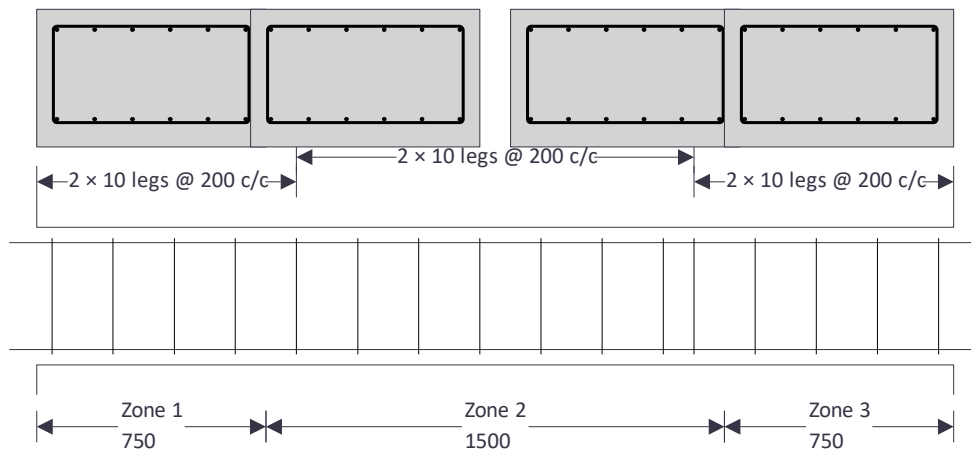
Bottom bar spacing $s_{bot} = 111.6$ mm Min allow. bottom bar spacing $s_{bot,min} = 25.0$ mm

PASS - Actual bar spacing exceeds minimum allowable

Shear design



Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 750x450 Dark Green				Start page no./Revision 5	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date



Angle of comp. shear strut $\theta_{max} = 45 \text{ deg}$

Compression chord coefficient $\alpha_{cw} = 1.00$

Strength reduction factor $v_1 = 0.540$

Minimum area of shear reinf. $A_{sv,min} = 600 \text{ mm}^2/\text{m}$

Zone 1 (0 mm - 750 mm) shear - section 6.2

Shear force at support $V_{Ed,max} = 96 \text{ kN}$

Max design shear resistance $V_{Rd,max} = 1151 \text{ kN}$

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 73 \text{ kN}$

Area shear reinf. req'd $A_{sv,req} = 600 \text{ mm}^2/\text{m}$

Area of shear reinf prov. $A_{sv,prov} = 785 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl,max} = 269 \text{ mm}$

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

Zone 2 (750 mm - 2250 mm) shear - section 6.2

Shear force at support $V_{Ed,max} = 48 \text{ kN}$

Max design shear resistance $V_{Rd,max} = 1151 \text{ kN}$

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 48 \text{ kN}$

Area shear reinf. req'd $A_{sv,req} = 600 \text{ mm}^2/\text{m}$

Area of shear reinf prov. $A_{sv,prov} = 785 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl,max} = 269 \text{ mm}$

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

Zone 3 (2250 mm - 3000 mm) shear - section 6.2

Shear force at support $V_{Ed,max} = 96 \text{ kN}$

Max design shear resistance $V_{Rd,max} = 1151 \text{ kN}$

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 73 \text{ kN}$

Area shear reinf. req'd $A_{sv,req} = 600 \text{ mm}^2/\text{m}$

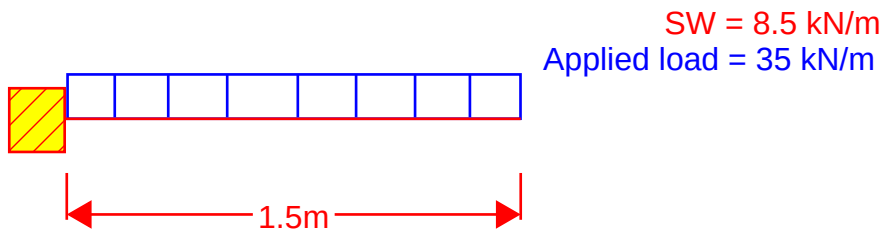
Area of shear reinf prov. $A_{sv,prov} = 785 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl,max} = 269 \text{ mm}$

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

BLOCK L - MINESHAFT ZONE - 750X450 CANTILEVER - DARK GREEN



$$M_{\max} = \frac{((1.35 \times 8.5) + (1.5 \times 35)) \times 1.5^2}{2} = 75 \text{ kNm}$$

$$V_{\max} = ((1.35 \times 6.75) + (1.5 \times 35)) \times 1.5 = 100 \text{ kN}$$

Project Manox Housing Development				Job no.	
Calcs for Block L - Mineshaft Zone- 750x450 Orange				Start page no./Revision 1	
Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

RC BEAM DESIGN

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

Tedds calculation version 3.3.03

Concrete details (Table 3.1 - Strength and deformation characteristics for concrete)

Concrete strength class	C25/30	Char. comp. cylinder strength	$f_{ck} = 25 \text{ N/mm}^2$
Design comp conc. strength	$f_{cwd} = 16.7 \text{ N/mm}^2$	Maximum aggregate size	$h_{agg} = 20 \text{ mm}$

Reinforcement details

Char. yield strength of reinf.	$f_{yk} = 500 \text{ N/mm}^2$	Partial factor for reinf. steel	$\gamma_s = 1.15$
Design yield strength of reinf.	$f_{yd} = 435 \text{ N/mm}^2$		

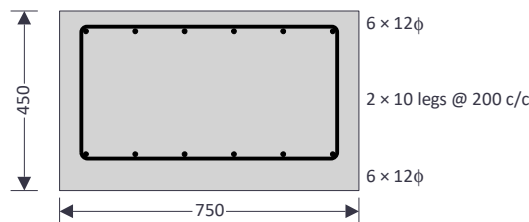
Nominal cover to reinforcement

Nominal cover to top reinf	$c_{nom_t} = 35 \text{ mm}$	Nominal cover to bottom reinf	$c_{nom_b} = 75 \text{ mm}$
Nominal cover to side reinf	$c_{nom_s} = 50 \text{ mm}$		

Section 1

Rectangular section details

Section width	$b = 750 \text{ mm}$	Section depth	$h = 450 \text{ mm}$
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Positive moment - section 6.1

Design bending moment	$M = 75.0 \text{ kNm}$	Effective depth tension reinf.	$d = 359 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 506 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 679 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 359 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 13500 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width	$w_k = 0.3 \text{ mm}$	Min area reinf req'd (exp.7.1)	$A_{sc,min} = 511 \text{ mm}^2$
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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	$M_{QP} = 60.0 \text{ kNm}$	Max bar spacing (Table 7.3N)	$s_{bar,max} = 175.9 \text{ mm}$
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PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Negative moment - section 6.1

Design bending moment	$M = 75.0 \text{ kNm}$	Effective depth tension reinf.	$d = 399 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 455 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 679 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 399 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 13500 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width	$w_k = 0.3 \text{ mm}$	Min area reinf req'd (exp.7.1)	$A_{sc,min} = 510 \text{ mm}^2$
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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	$M_{QP} = 60.0 \text{ kNm}$	Max bar spacing (Table 7.3N)	$s_{bar,max} = 208.4 \text{ mm}$
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PASS - Maximum bar spacing exceeds actual bar spacing for crack control

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Minimum bar spacing (Section 8.2)

Top bar spacing $S_{top} = 111.6$ mm

Min allow. top bar spacing $S_{top,min} = 25.0$ mm

PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing $S_{bot} = 111.6$ mm

Min allow. bottom bar spacing $S_{bot,min} = 25.0$ mm

PASS - Actual bar spacing exceeds minimum allowable

Section in shear (section 6.2)

Angle of comp. shear strut $\theta_{max} = 45$ deg

Strength reduction factor $V_1 = 0.540$

Compression chord coefficient $\alpha_{cw} = 1.00$

Minimum area of shear reinf. $A_{sv,min} = 600$ mm²/m

Shear force at support $V_{Ed,max} = 100$ kN

Max design shear resistance $V_{Rd,max} = 1151$ kN

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 100$ kN

Area shear reinf. req'd $A_{sv,req} = 600$ mm²/m

Area of shear reinf prov. $A_{sv,prov} = 785$ mm²/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $S_{vl,max} = 269$ mm

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

Project Manox Housing Development				Job no.	
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RC MEMBER ANALYSIS & DESIGN (EN1992-1-1:2004)

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

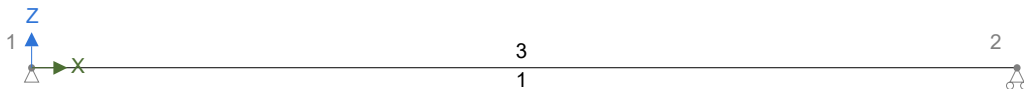
Tedds calculation version 3.3.03

ANALYSIS

Tedds calculation version 1.0.32

Geometry

Geometry (m) - Concrete (C25 2500 Limestone) - R 750x450



Loading

Self weight included

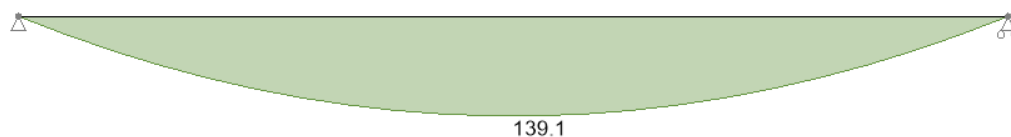
Imposed - Loading (kN/m)



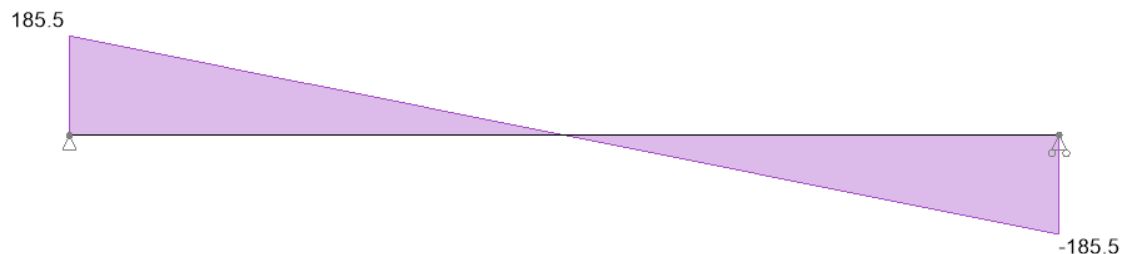
Results

Forces

Strength combinations - Moment envelope (kNm)



Strength combinations - Shear envelope (kN)



Concrete details (Table 3.1 - Strength and deformation characteristics for concrete)

Concrete strength class	C25/30	Char. comp. cylinder strength	$f_{ck} = 25 \text{ N/mm}^2$
Design comp. conc. strength	$f_{cwd} = 16.7 \text{ N/mm}^2$	Maximum aggregate size	$h_{agg} = 20 \text{ mm}$

Reinforcement details

Char. yield strength of reinf.	$f_{yk} = 500 \text{ N/mm}^2$	Partial factor for reinf. steel	$\gamma_s = 1.15$
Design yield strength of reinf.	$f_{yd} = 435 \text{ N/mm}^2$		

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Nominal cover to reinforcement

Nominal cover to top reinf $C_{nom_t} = 50 \text{ mm}$

Nominal cover to bottom reinf $C_{nom_b} = 75 \text{ mm}$

Nominal cover to side reinf $C_{nom_s} = 50 \text{ mm}$

Beam - Span 1

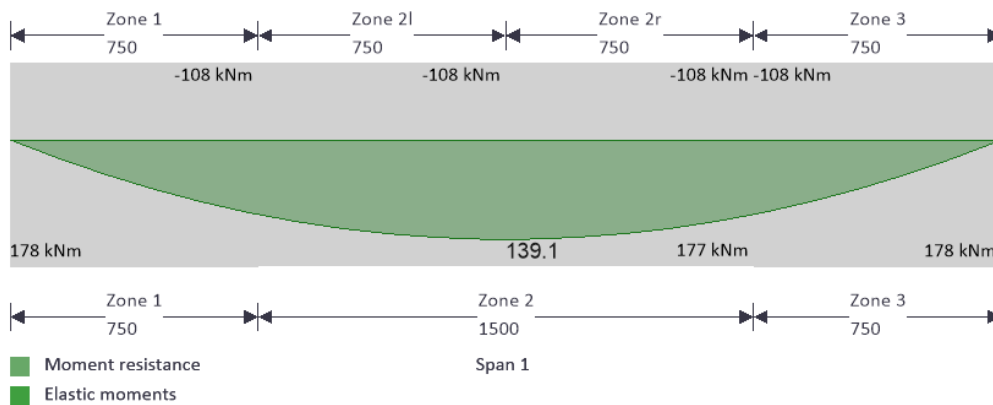
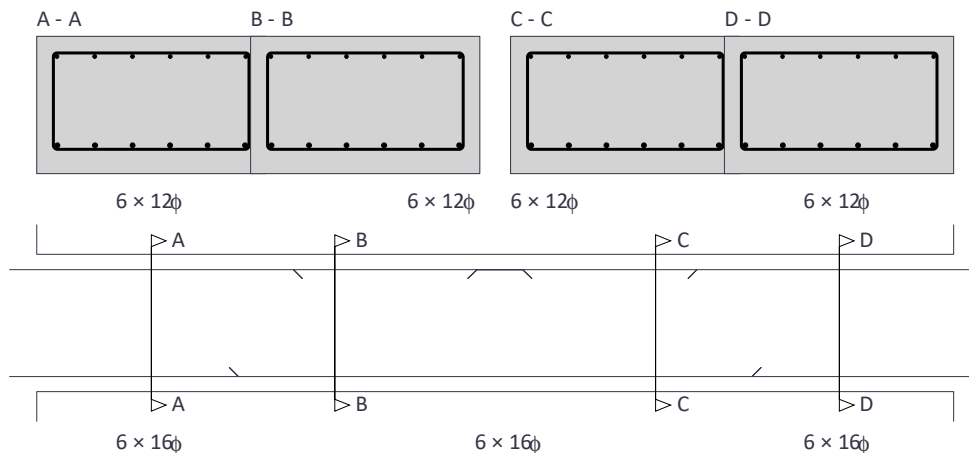
Rectangular section details

Section width $b = 750 \text{ mm}$

Section depth

$h = 450 \text{ mm}$

Moment design



Zone 1 (0 mm - 750 mm) Positive moment - section 6.1

Design bending moment $M = 104.3 \text{ kNm}$

Effective depth tension reinf. $d = 357 \text{ mm}$

Area of tension reinf. req'd $A_{s,req} = 708 \text{ mm}^2$

Area of tension reinf. prov $A_{s,prov} = 1206 \text{ mm}^2$

Min area of reinf. (exp.9.1N) $A_{s,min} = 357 \text{ mm}^2$

Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 13500 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width $w_k = 0.3 \text{ mm}$

Min area reinf req'd (exp.7.1) $A_{s,min} = 507 \text{ mm}^2$

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 26.0 \text{ kNm}$

Actual tension bar spacing $s_{bar} = 122.8 \text{ mm}$

Max bar spacing (Table 7.3N) $s_{bar,max} = 300 \text{ mm}$

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Zone 1 (0 mm - 750 mm) Negative moment - section 6.1

Design bending moment $M = 34.8 \text{ kNm}$

Effective depth tension reinf. $d = 384 \text{ mm}$

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Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

Area of tension reinf. req'd $A_{s,req} = 219 \text{ mm}^2$ Area of tension reinf. prov $A_{s,prov} = 679 \text{ mm}^2$
Min area of reinf. (exp.9.1N) $A_{s,min} = 384 \text{ mm}^2$ Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 13500 \text{ mm}^2$
PASS - Area of reinforcement provided is greater than area of reinforcement required

Crack control - Section 7.3

Maximum crack width $w_k = 0.3 \text{ mm}$ Min area reinf req'd (exp.7.1) $A_{s,min} = 510 \text{ mm}^2$
PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 0.0 \text{ kNm}$
Actual tension bar spacing $s_{bar} = 123.6 \text{ mm}$ Max bar spacing (Table 7.3N) $s_{bar,max} = 300 \text{ mm}$
PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Minimum bar spacing (Section 8.2)

Top bar spacing $s_{top} = 111.6 \text{ mm}$ Min allow. top bar spacing $s_{top,min} = 25.0 \text{ mm}$
PASS - Actual bar spacing exceeds minimum allowable
Bottom bar spacing $s_{bot} = 106.8 \text{ mm}$ Min allow. bottom bar spacing $s_{bot,min} = 25.0 \text{ mm}$
PASS - Actual bar spacing exceeds minimum allowable

Zone 2 (750 mm - 2250 mm) Positive moment - section 6.1

Design bending moment $M = 139.1 \text{ kNm}$ Effective depth tension reinf. $d = 357 \text{ mm}$
Area of tension reinf. req'd $A_{s,req} = 948 \text{ mm}^2$ Area of tension reinf. prov $A_{s,prov} = 1206 \text{ mm}^2$
Min area of reinf. (exp.9.1N) $A_{s,min} = 357 \text{ mm}^2$ Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 13500 \text{ mm}^2$
PASS - Area of reinforcement provided is greater than area of reinforcement required

Crack control - Section 7.3

Maximum crack width $w_k = 0.3 \text{ mm}$ Min area reinf req'd (exp.7.1) $A_{s,min} = 507 \text{ mm}^2$
PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 34.6 \text{ kNm}$
Actual tension bar spacing $s_{bar} = 122.8 \text{ mm}$ Max bar spacing (Table 7.3N) $s_{bar,max} = 300 \text{ mm}$
PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Deflection control - Section 7.4

Allow. span to depth ratio $span_to_depth_{allow} = 32.877$ Actual span to depth ratio $span_to_depth_{actual} = 8.403$
PASS - Actual span to depth ratio is within the allowable limit

Minimum bar spacing (Section 8.2)

Top bar spacing $s_{top} = 111.6 \text{ mm}$ Min allow. top bar spacing $s_{top,min} = 25.0 \text{ mm}$
PASS - Actual bar spacing exceeds minimum allowable
Bottom bar spacing $s_{bot} = 25.0 \text{ mm}$ Min allow. bottom bar spacing $s_{bot,min} = 25.0 \text{ mm}$
PASS - Actual bar spacing exceeds minimum allowable

Minimum bar spacing (Section 8.2)

Top bar spacing $s_{top} = 111.6 \text{ mm}$ Min allow. top bar spacing $s_{top,min} = 25.0 \text{ mm}$
PASS - Actual bar spacing exceeds minimum allowable
Bottom bar spacing $s_{bot} = 25.0 \text{ mm}$ Min allow. bottom bar spacing $s_{bot,min} = 25.0 \text{ mm}$
PASS - Actual bar spacing exceeds minimum allowable

Zone 3 (2250 mm - 3000 mm) Positive moment - section 6.1

Design bending moment $M = 104.3 \text{ kNm}$ Effective depth tension reinf. $d = 357 \text{ mm}$
Area of tension reinf. req'd $A_{s,req} = 708 \text{ mm}^2$ Area of tension reinf. prov $A_{s,prov} = 1206 \text{ mm}^2$
Min area of reinf. (exp.9.1N) $A_{s,min} = 357 \text{ mm}^2$ Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 13500 \text{ mm}^2$
PASS - Area of reinforcement provided is greater than area of reinforcement required

Crack control - Section 7.3

Maximum crack width $w_k = 0.3 \text{ mm}$ Min area reinf req'd (exp.7.1) $A_{s,min} = 507 \text{ mm}^2$

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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 26.0 \text{ kNm}$
 Actual tension bar spacing $S_{bar} = 122.8 \text{ mm}$ Max bar spacing (Table 7.3N) $S_{bar,max} = 300 \text{ mm}$

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Zone 3 (2250 mm - 3000 mm) Negative moment - section 6.1

Design bending moment $M = 34.8 \text{ kNm}$ Effective depth tension reinf. $d = 384 \text{ mm}$
 Area of tension reinf. req'd $A_{s,req} = 219 \text{ mm}^2$ Area of tension reinf. prov $A_{s,prov} = 679 \text{ mm}^2$
 Min area of reinf. (exp.9.1N) $A_{s,min} = 384 \text{ mm}^2$ Max area reinf. (cl.9.2.1.1(3)) $A_{s,max} = 13500 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width $w_k = 0.3 \text{ mm}$ Min area reinf req'd (exp.7.1) $A_{sc,min} = 510 \text{ mm}^2$

PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment $M_{QP} = 0.0 \text{ kNm}$
 Actual tension bar spacing $S_{bar} = 123.6 \text{ mm}$ Max bar spacing (Table 7.3N) $S_{bar,max} = 300 \text{ mm}$

PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Minimum bar spacing (Section 8.2)

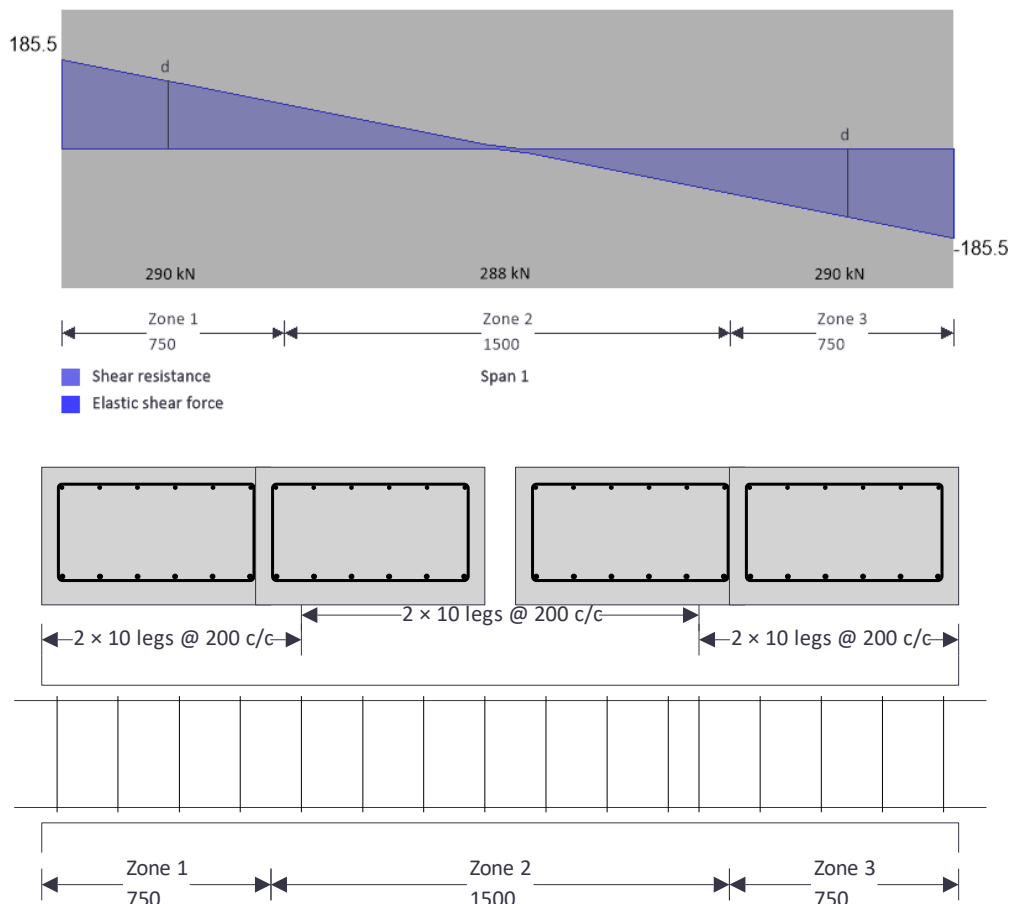
Top bar spacing $S_{top} = 111.6 \text{ mm}$ Min allow. top bar spacing $S_{top,min} = 25.0 \text{ mm}$

PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing $S_{bot} = 106.8 \text{ mm}$ Min allow. bottom bar spacing $S_{bot,min} = 25.0 \text{ mm}$

PASS - Actual bar spacing exceeds minimum allowable

Shear design



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Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

Angle of comp. shear strut $\theta_{\max} = 45 \text{ deg}$ Strength reduction factor $v_1 = 0.540$
 Compression chord coefficient $\alpha_{cw} = 1.00$ Minimum area of shear reinf. $A_{sv,\min} = 600 \text{ mm}^2/\text{m}$

Zone 1 (0 mm - 750 mm) shear - section 6.2

Shear force at support $V_{Ed,\max} = 186 \text{ kN}$ Max design shear resistance $V_{Rd,\max} = 1145 \text{ kN}$
PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 141 \text{ kN}$ Area shear reinf. req'd $A_{sv,\text{req}} = 600 \text{ mm}^2/\text{m}$

Area of shear reinf prov. $A_{sv,\text{prov}} = 785 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl,\max} = 268 \text{ mm}$

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

Zone 2 (750 mm - 2250 mm) shear - section 6.2

Shear force at support $V_{Ed,\max} = 93 \text{ kN}$ Max design shear resistance $V_{Rd,\max} = 1139 \text{ kN}$

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 93 \text{ kN}$ Area shear reinf. req'd $A_{sv,\text{req}} = 600 \text{ mm}^2/\text{m}$

Area of shear reinf prov. $A_{sv,\text{prov}} = 785 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl,\max} = 268 \text{ mm}$

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

Zone 3 (2250 mm - 3000 mm) shear - section 6.2

Shear force at support $V_{Ed,\max} = 186 \text{ kN}$ Max design shear resistance $V_{Rd,\max} = 1145 \text{ kN}$

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 141 \text{ kN}$ Area shear reinf. req'd $A_{sv,\text{req}} = 600 \text{ mm}^2/\text{m}$

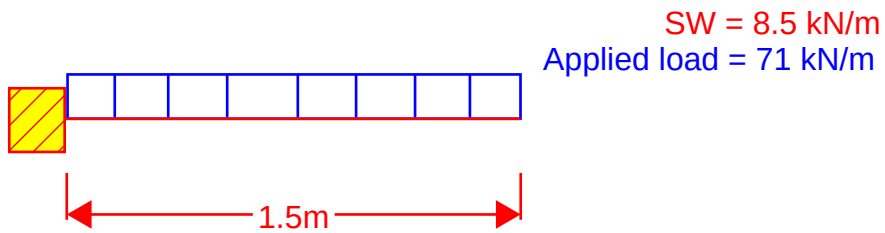
Area of shear reinf prov. $A_{sv,\text{prov}} = 785 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $s_{vl,\max} = 268 \text{ mm}$

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

BLOCK L - MINESHAFT ZONE -750X450 CANTILEVER - ORANGE



$$M_{\max} = \frac{((1.35 \times 8.5) + (1.5 \times 71)) \times 1.5^2}{2} = 140 \text{ kNm}$$

$$V_{\max} = ((1.35 \times 6.75) + (1.5 \times 71)) \times 1.5 = 185 \text{ kN}$$

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RC BEAM DESIGN

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

Tedds calculation version 3.3.03

Concrete details (Table 3.1 - Strength and deformation characteristics for concrete)

Concrete strength class	C25/30	Char. comp. cylinder strength	$f_{ck} = 25 \text{ N/mm}^2$
Design comp conc. strength	$f_{cwd} = 16.7 \text{ N/mm}^2$	Maximum aggregate size	$h_{agg} = 20 \text{ mm}$

Reinforcement details

Char. yield strength of reinf.	$f_{yk} = 500 \text{ N/mm}^2$	Partial factor for reinf. steel	$\gamma_s = 1.15$
Design yield strength of reinf.	$f_{yd} = 435 \text{ N/mm}^2$		

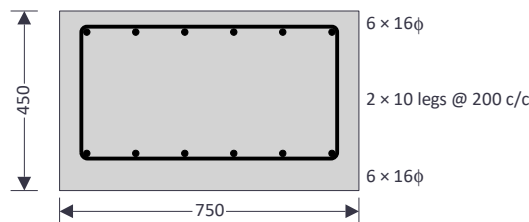
Nominal cover to reinforcement

Nominal cover to top reinf	$c_{nom_t} = 35 \text{ mm}$	Nominal cover to bottom reinf	$c_{nom_b} = 75 \text{ mm}$
Nominal cover to side reinf	$c_{nom_s} = 50 \text{ mm}$		

Section 1

Rectangular section details

Section width	$b = 750 \text{ mm}$	Section depth	$h = 450 \text{ mm}$
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Positive moment - section 6.1

Design bending moment	$M = 150.0 \text{ kNm}$	Effective depth tension reinf.	$d = 357 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 1027 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 1206 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 357 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 13500 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width	$w_k = 0.3 \text{ mm}$	Min area reinf req'd (exp.7.1)	$A_{sc,min} = 507 \text{ mm}^2$
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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	$M_{QP} = 110.0 \text{ kNm}$	Max bar spacing (Table 7.3N)	$s_{bar,max} = 160.8 \text{ mm}$
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PASS - Maximum bar spacing exceeds actual bar spacing for crack control

Negative moment - section 6.1

Design bending moment	$M = 150.0 \text{ kNm}$	Effective depth tension reinf.	$d = 397 \text{ mm}$
Area of tension reinf. req'd	$A_{s,req} = 915 \text{ mm}^2$	Area of tension reinf. prov	$A_{s,prov} = 1206 \text{ mm}^2$
Min area of reinf. (exp.9.1N)	$A_{s,min} = 397 \text{ mm}^2$	Max area reinf. (cl.9.2.1.1(3))	$A_{s,max} = 13500 \text{ mm}^2$

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

Crack control - Section 7.3

Maximum crack width	$w_k = 0.3 \text{ mm}$	Min area reinf req'd (exp.7.1)	$A_{sc,min} = 505 \text{ mm}^2$
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PASS - Area of tension reinforcement provided exceeds minimum required for crack control

Quasi-permanent moment	$M_{QP} = 110.0 \text{ kNm}$	Max bar spacing (Table 7.3N)	$s_{bar,max} = 197.8 \text{ mm}$
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PASS - Maximum bar spacing exceeds actual bar spacing for crack control

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Calcs by VK	Calcs date 26/11/2020	Checked by	Checked date	Approved by	Approved date

Minimum bar spacing (Section 8.2)

Top bar spacing $S_{top} = 106.8$ mm

Min allow. top bar spacing $S_{top,min} = 25.0$ mm

PASS - Actual bar spacing exceeds minimum allowable

Bottom bar spacing $S_{bot} = 106.8$ mm

Min allow. bottom bar spacing $S_{bot,min} = 25.0$ mm

PASS - Actual bar spacing exceeds minimum allowable

Section in shear (section 6.2)

Angle of comp. shear strut $\theta_{max} = 45$ deg

Strength reduction factor $V_1 = 0.540$

Compression chord coefficient $\alpha_{cw} = 1.00$

Minimum area of shear reinf. $A_{sv,min} = 600$ mm²/m

Shear force at support $V_{Ed,max} = 200$ kN

Max design shear resistance $V_{Rd,max} = 1134$ kN

PASS - Design shear force at support is less than maximum design shear resistance

Design shear force $V_{Ed} = 200$ kN

Area shear reinf. req'd $A_{sv,req} = 600$ mm²/m

Area of shear reinf prov. $A_{sv,prov} = 785$ mm²/m

PASS - Area of shear reinforcement provided exceeds minimum required

Max. long. spacing - exp.9.6N $S_{vl,max} = 268$ mm

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