Queensberry
DESIGN LIMITED
Civil, Structural, Architectural & Geotechnical Consultants

Structural Design Calculations
Highway Retaining Walls Over Watercourse

Keresforth Road, Barnsley
Keepmoat Homes
QD0010

2nd December 2024

Office: Unit 5, The Staithes, The Watermark, Metro Riverside, Gateshead, NE11 9SN

Issue Sheet

Prepared By	Darren Rogers Structural Engineering Director
Reviewed By	Darren Phillipson Senior Structural Associate
Issue	- (02/12/2024)

Design Brief

Highway retaining walls are necessary in order to allow traffic to traverse an existing watercourse for the Keepmoat Homes Keresforth Road Site. Queensberry Design Ltd have been commissioned by Keepmoat Homes to prepare calculations which determine their design requirements. These are presented in this document.

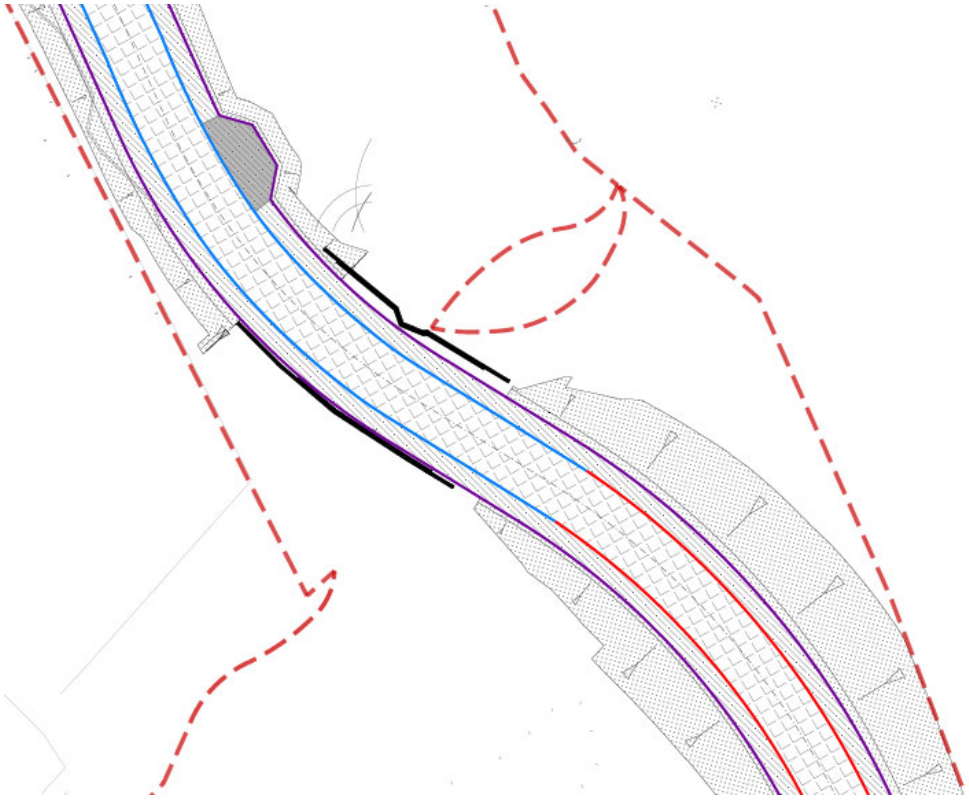


Figure 1 - Retaining Wall Location Plan

Scope

These calculations cover the retaining wall design only. Any precast items such as the precast culvert or headwall will be prepared by others.

Design Codes, Standards and Literature Used

Key documents listed below, full list contained in main AIP document.

- BS EN 1992-1:2004+A1:2014 - Eurocode 2: Design of concrete structures. General rules and rules for buildings.
- NA+A2:14 to BS EN 1992-1-1:2004+A1:2014 - UK National Annex to Eurocode 2. Design of concrete structures. General rules and rules for buildings.
- BS EN 1997-1-1:2004+A1:2013 - Eurocode 7. Geotechnical design. General rules.
- NA+A1:2014 to BS EN 1997-1:2004+A1:2013 - UK National Annex to Eurocode 7. Geotechnical design. General rules.
- PD6694 1-2011 - Recommendations for the design of structures subject to traffic loading to BS EN 1997-1
- NHBC Standards 2021
- DMRB and MCHW Standards

Construction

These retaining walls are to be constructed from reinforced concrete with a brickwork face. This is necessary to ensure they can resist a 25kPA vehicular surcharge load. The walls are to be provided with a single leaf of brickwork tied to their face to ensure their appearance is consistent with the other retaining structures on site. The retained heights vary up to a maximum of 4.8m.

Ground Conditions

At the time of writing this AIP, site specific ground investigation is not available. Ground investigation information for the adjacent site to the West is available via the BGS website. The available information denotes possible shallow rockhead in the area. For the purposes of this design we have allowed for an allowable ground bearing pressure of 125kPa.

Retaining Wall Loading

The retaining walls and foundations have been designed for the following loading criteria:

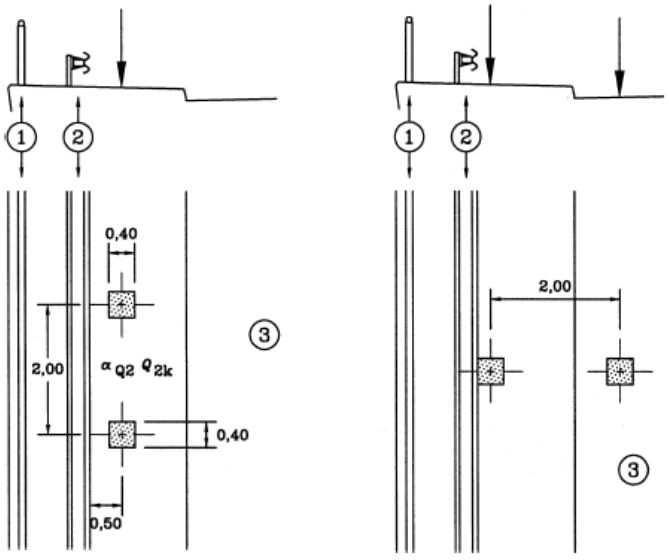
- **Vertical loading** – Vertical dead load provided by the backfill and self weight of the structure only.
- **Vehicular impact** - no allowance has been made.
- **Water pressure** - given the provision of a land drain and weep holes, it has been assumed that the groundwater on the retained side will not exceed the ground level on the opposing side. This has been reflected in the pore water pressure that has been allowed for in the designs.
- **Surcharge** - a 25kPA surcharge load has been adopted. This is to reflect any maintenance vehicles which may drive on the retained ground or compaction forces during construction. It is also to reflect the traffic surcharge loading that would occur from normal highway traffic that is at least 2m from the back face of the retaining wall. This has been taken from *PD 6694-1-2011 - Recommendations for the design of structures subject to traffic loading to BS EN 1997-1*. Given the implementation of the Trief Kerbs it is unlikely that any service vehicles will be mounted on the kerb. We therefore consider the 25kPa as a conservative loading. Refer

to figure 3 showing simplified traffic loading in line with PD6694-1-2011 and figure 4 showing loading locations from vehicles on footways in line with BSEN 1991-2-2003.

Table 5 — *Simplified traffic surcharge model for walls and other retaining structures adjacent to the carriageway, where the traffic does not cross over the structure*

Traffic type	**Characteristic vertical UDL (kPa) applied at ground level to the area extending from the back face of the wall to a distance at least 1.5*H* from the structure, where *H* is the total height of the structure.**						
Distance from the centreline of the closest wheel to the back face of the wall, *a*	$a < 1$ m	$a = 1$ m	$a = 2$ m	$a = 3$ m	$a = 4$ m	$a = 5$ m	$a \geq 6$ m
Normal highway traffic	Simplified approach not valid	25	15	10	10	5	5
SV80 + accompanying normal highway traffic		30	15	10	10	10	5
SV100 + accompanying normal highway traffic		40	20	15	10	10	10
SV 196 + accompanying normal highway traffic		45	30	25	20	20	15
SOV + accompanying normal highway traffic		45	35	25	20	20	15
Normal rail traffic	50						
Footways and cycle tracks	5						

Figure 2 - Extract from PD6694-1-2011 showing traffic surcharge loading.



Key
(1) Pedestrian parapet (or vehicle parapet if a safety barrier is not provided)
(2) Safety barrier
(3) Carriageway

Figure 3 - Loading location from vehicles on footways and bridges

Full AIP Document

APPROVAL IN PRINCIPLE
(HIGHWAY STRUCTURES)

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Name of Project: **New Development, Keresforth Road, Barnsley**

Name of Structure: **Retaining walls adjacent to central watercourse**

Structure Ref No: **Not Applicable**

1	**HIGHWAYS DESIGN**
1.1	Type of Highway – Housing estate road to access dwellings
1.2	Permitted traffic speed – 20mph.
1.3	Existing restrictions – There are currently no restrictions to the weight of vehicles which could use the carriageway. The wall has been designed in order to accommodate an allowable surcharge of 25kPa. The "Trief" kerbs used restrict access to the footpath from service vehicles.
2.	**SITE DETAILS**
2.1	Obstacles crossed – The existing culvert is to be removed and replaced with a precast concrete rectangular culvert. Refer to drawings for details.
3.	**PROPOSED STRUCTURE**
3.1	Description of structure – A reinforced concrete retaining wall is to to be constructed to allow the ground levels to be lifted to allow suitable vehicular access to both the North and South areas of the site. The wall crosses a proposed precast concrete culvert that is to be integrated into the proposed wall design. The retaining wall height varies up to a height of 4.7m. The length of the southern wall is approximately 27.3m and the length of the northern wall is approximately 23m.
3.2	Structural type – The wall is designed as a reinforced concrete cantilevered retaining wall.
3.3	Foundation type – It is assumed that the wall will be sat on shallow bedrock. The design calculations to date assume and allowable ground bearing pressure of 125kPa. This is to be confirmed once a ground investigation report has been commissioned.
3.4	Span arrangements – The maximum retained height is in the order of 4.7m from the top of foundation level
3.5	Articulation arrangements – Not applicable.
3.6	Type of road restraint systems – A proprietary pedestrian barrier will be constructed at the head of the wall. The carriageway will be restrained by the use of "Trief" kerbs.

3.7	Proposed arrangements for maintenance and inspection/Inspection for Assessment. Traffic management - Not applicable Access – From retained side. The levels to the lower side of the wall have been set circa 1:3 allowing safe access to watercourse level.
3.8	Sustainability issues considered. Materials and finishes/materials strengths assumed and basis of assumptions Material strength and grade: Reinforced Concrete - Concrete strength RC40 BS EN 206-1, Design sulphate class DS-1, ACEC Class AC-1, high yield steel reinforcement with 50mm cover. Sulphate resistance to be confirmed upon receipt of the Ground Investigation Report. Finishes: Concrete wall – Is to be clad with masonry, nominal cavity for alignment. Sustainability: Concrete provides an ideal solution for the wall due to its low maintenance requirements. At the end of its useful life the concrete could be crushed and used as sub-base on other projects.
3.9	Risks and hazards considered – Temporary works will be required to allow the contractor to construct the wall/ culvert, along with a temporary diversion of the existing watercourse. To allow installation of the central foundation and culvert, it is assumed that the existing watercourse will have a temporary diversion to the West of the existing culvert. This is to be confirmed once the contractor is appointed for the project.
3.10	Estimated cost of proposed structure together with other structural forms considered, including where appropriate proprietary manufactured systems and the reason for their rejection including comparative whole life costs with dates and estimates - To be advised
3.11	Proposed arrangements for construction • Traffic management – Wall will be constructed from within the site boundary. Hence no traffic management is required. • Service Diversions – No service diversions are required. • Interface with existing structures – Existing culvert to be diverted and removed to allow installation of new..
4.	**DESIGN/ASSESSMENT CRITERIA**
4.1 **4.1.8**	Live loading – The wall has been designed for a minimum surcharge load of 25kN/m^2 which is conservative for the proposed road use. Authorities Consulted and any Special Conditions Barnsley Metropolitan Borough Council – Highways and Structures Department

APPROVAL IN PRINCIPLE
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4.2	List of relevant documents from the TAS. – BS 5930 : 1999 – CP for Site Investigations BS 8002 : 1994 – CP for Earth Retaining Structures BS 8004 : 1986 – CP for Foundations BS 4449 : 2005 – Steel for the reinforcement of concrete BS 5400 : Parts 1,2 and 4 – Steel, concrete and composite bridges BS 6031 : 1981 Code of practice for earthworks BS 6779-2 : 1991 Parapets for vehicle containment on highways BS 6779-3 : 1994 Highway parapets for bridges and other structures BS 8110 : 1997 – Structural use of Concrete BS 8500-1 : 2015 – Complimentary British Standard to BS EN 206-1 – method of specifying and guidance for the specifier BS 8500-2 : 2015 - Complimentary British Standard to BS EN 206-1 – specification for constituent materials and concrete BS 8666 : 2005 – Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete specification BS 7818 : 1995 – Specification for Pedestrian Restraint Systems in Metal BS EN 1317-6 : 2012 – Road Restraint Systems – Part 6, Pedestrian Parapets Manual of Contract Documents for Highway Works Volumes 1 & 2 Design Manual for Roads and Bridges BA 24/87 – Highway structures :Approval procedures and general design. Early thermal cracking of concrete. BA 57/01 – Highway structures :Approval procedures and general design. Design for durability. BD 2/05 - Highway structures :Approval Procedures and General Design. Technical Approval of Highway structures. BD 15/92 - Highway structures :Approval procedures and general design. General principles for the design and construction of bridges. Use of BS5400: Part 1: 1988 BD 24/92 - Design of concrete highway bridges and structures. Use of BS5400: Part 4: 1990 BD 28/87 - Highway structures :Approval procedures and general design. Early thermal cracking of concrete (including amendment 1 dated 1989) BD 30/87 – Backfilled Retaining Walls and Bridge Abutments BD 35/06 - Highway structures: Design (substructures and special structures) materials. Paints and other protective coatings. Quality assurance scheme for paints and similar protective coatings BD 37/01 - Highway structures: Approval procedures and general design. General design. Loads for highway bridges (includes Correction pages dated February and May 2002) BD 42/00 - Highway structures: Design (substructures and special structures) material. Substructures. Design of embedded retaining walls and bridge abutments BD 57/01 - Highway structures: Approval procedures and general design. General design. Design for durability BD 74/00 - Highway structures: Design (substructures and special structures) material. Substructures. Foundations TD 19/06 - Guidance on the use of the Road Restraint Risk Assessment Process (RRRAP) associated with TD 19/06. Revision 1

	HD 22/02 - Geotechnics and drainage. Earthworks. Managing geotechnical risk Highway Agency Interim Advice Notes IAN 95/07 - Revised guidance regarding the use of BS 8500(2006) for the design and construction of structures using concrete IAN 70/06 - Implementation of new reinforcement standards (BS 4449:2005, BS 4482:2005, BS 4483:2005 and BS 8666:2005) IAN 69/05 - Designing for maintenance IAN 48/03 - Measures to minimise the risk of sulphate attack (including thaumasite) - New construction and structures under construction IAN 05/96 - BD 24/92 The Design of Concrete Highway Bridges and Structures. Use of BS 5400: Part 4:1990 BS EN 1992-1:2004+A1:2014 - Eurocode 2: Design of concrete structures. General rules and rules for buildings. NA+A2:14 to BS EN 1992-1-1:2004+A1:2014 - UK National Annex to Eurocode 2. Design of concrete structures. General rules and rules for buildings. BS EN 1997-1-1:2004+A1:2013 - Eurocode 7. Geotechnical design. General rules. NA+A1:2014 to BS EN 1997-1:2004+A1:2013 - UK National Annex to Eurocode 7. Geotechnical design. General rules. PD6694 1-2011 - Recommendations for the design of structures subject to traffic loading to BS EN 1997-1 NHBC Standards 2021 DMRB and MCHW Standards
4.2.1	Additional relevant standards. None
4.3	Proposed departures from standards given in 4.2 and 4.1. None
4.4	Proposed methods for dealing with aspects not covered by standards in 4.2 and 4.2.1. Not applicable.
5.	**STRUCTURAL ANALYSIS**
5.1	Methods of analysis proposed for superstructure, substructure and foundations – The retaining walls design has been analysed using the Masterseries design software.
5.2	Description and diagram of idealized structure to be used for analysis – The structure has been analysed as a cantilever retaining wall.
5.4	Proposed earth pressure coefficients (k_a, k_o, k_p) to be used in the design or assessment of earth retaining elements – Earth pressure coefficients. K_a =0.270

	K_p =3.000 Angle of Friction=0^0 C'=40 All TBC upon receipt of a site specific Ground Investigation Report.
6.	**GEOTECHNICAL CONDITIONS**
6.1	Ground investigation details - TBC upon receipt.
6.2	Expected ground conditions - Ground conditions expected to be shallow bedrock.
7.	**CHECKING**
7.1	Proposed category – Category 1 Structure.
8.	**DRAWINGS AND DOCUMENTS**
8.1	List of drawings (including numbers) and documents accompanying the submission – 0010-QD-XX-S-DR-S-41-60 – Highway Retaining Wall – Foundation Plan 0010-QD-XX-S-DR-S-41-61 – Highway Retaining Wall – Elevations and Section 0010-QD-XX-S-DR-S-41-62 – Highway Retaining Wall – Sections and Details Sheet 1 0010-QD-XX-S-DR-S-41-63 – Highway Retaining Wall – Sections and Details Sheet 2

APPROVAL IN PRINCIPLE
(HIGHWAY STRUCTURES)

Queensberry DESIGN LIMITED
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9. THE ABOVE IS SUBMITTED FOR ACCEPTANCE

Signed……  ……

Name……Mr DG Rogers……

Engineering Qualifications…BSc, MSc, Structural Engineering Director……

Name of organisation…Queensberry Design Limited……

Date… 2nd December 2024……

Signed……  ……

Name……Mr D.J. Phillipson……

Engineering Qualifications…BEng, CEng, IStructE, Senior Structural Associate……

Name of organisation…Queensberry Design Limited……

Date… 2nd December 2024……

APPROVAL IN PRINCIPLE
(HIGHWAY STRUCTURES)

Queensberry DESIGN LIMITED
RESIDENTIAL AND COMMERCIAL DESIGN CONSULTANTS

11. THE ABOVE IS REJECTED/AGREED SUBJECT TO THE AMENDMENTS AND THE CONDITIONS SHOWN BELOW.

Signed……

Name……

Position Held……

Engineering Qualifications……

Barnsley Metropolitan Borough Council

Date……

Masterseries Retaining Wall Calculations

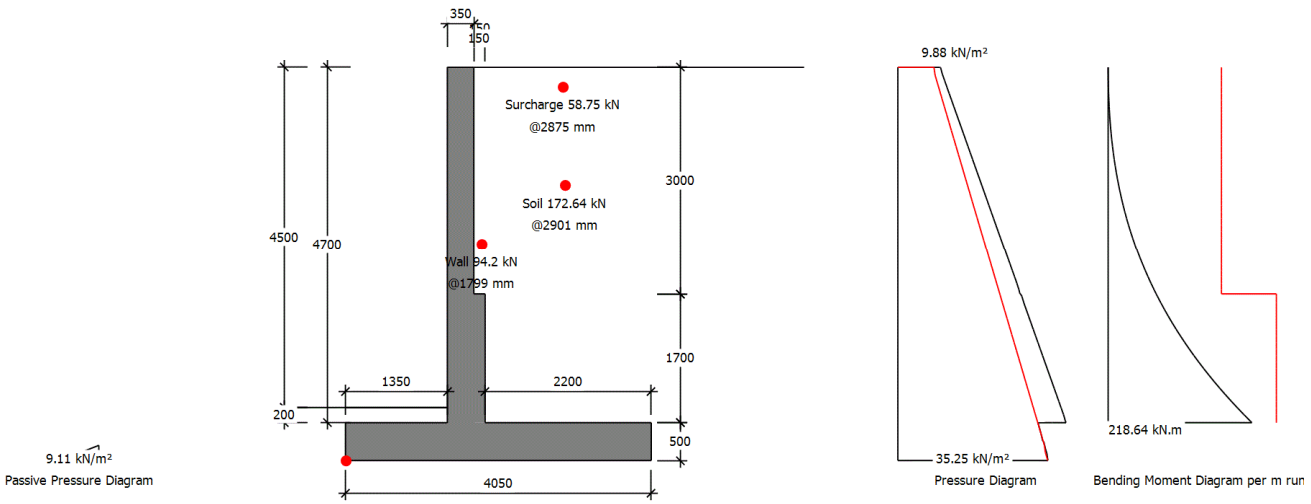
Queensberry Design Limited

Job ref	: QD0014
Sheet	: **Sheet Ref / 1**
Made By	:
Date	: **Dec 24**
Checked	: **DGR**
Approved	: **dp**

MASTERKEY : RETAINING WALL DESIGN TO BS 8002 : 1994 AND BS 8110 : 1997

TYPE A - 4.7m Retained Height - 25kPa surcharge

Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Back soil 16.00, Front soil 18.00, Concrete 24.00
Concrete grade	fcu 40 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)	Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 25.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 500 mm

† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Soil Properties

Bearing pressure	Premissable service pressure @ front 125.00 kN/m², @ back 125.00 kN/m²
Back Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°
Base Friction and Cohesion	δ = Atn(0.75xTan(Atn(Tan(30)/1.2))) = 19.84°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°

Loading Cases

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel,
P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge, P_p- Passive Earth Pressure

Case 1: Geotechnical Design	1.00 G_{Soil}+1.00 G_{Wall}+1.00 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p
Case 2: Structural Ultimate Design	1.40 G_{Soil}+1.40 G_{Wall}+1.60 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	234.205/832.562	0.281	OK

Wall Sliding - Virtual Back Pressure

$Fx/(Rx_{Friction}+ Rx_{Passive})$	113.581/(116.134+0.916)	0.970	OK

Soil Pressure

Virtual Back (No uplift)	Max(98.989/125, 59.944/125) kN/m²	0.792	OK
Wall Back (No uplift)	Max(116.058/125, 42.875/125) kN/m²	0.928	OK

Structural Design

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@150 (46 mm)	1340 mm²	OK
Compression Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@150 (46 mm)	1340 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	462 mm, 1000 mm, 1340 mm², 500 N/mm², 40.0 N/mm²	439 mm	

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Job ref	: QD0014
Sheet	: **Sheet Ref / 2**
Made By	:
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Mr=fn(above,As',d',x,x/d)	1340 mm², 38 mm, 37 mm, 0.08	255.9 kN.m	
Moment Capacity Check (M/Mr)	M 218.6 kN.m, Mr 255.9 kN.m	0.854	OK
Shear Capacity Check	F 116.2 kN, vc 0.472 N/mm², Fvr 218.1 kN	0.53	OK

Base Top Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	445 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	423 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.05	144.4 kN.m	
Moment Capacity Check (M/Mr)	M 126.3 kN.m, Mr 144.4 kN.m	0.875	OK
Shear Capacity Check	F 112.3 kN, vc 0.404 N/mm², Fvr 179.7 kN	0.62	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	445 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	423 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.05	144.4 kN.m	
Moment Capacity Check (M/Mr)	M 93.1 kN.m, Mr 144.4 kN.m	0.645	OK
Shear Capacity Check	F 136.9 kN, vc 0.404 N/mm², Fvr 179.7 kN	0.76	OK

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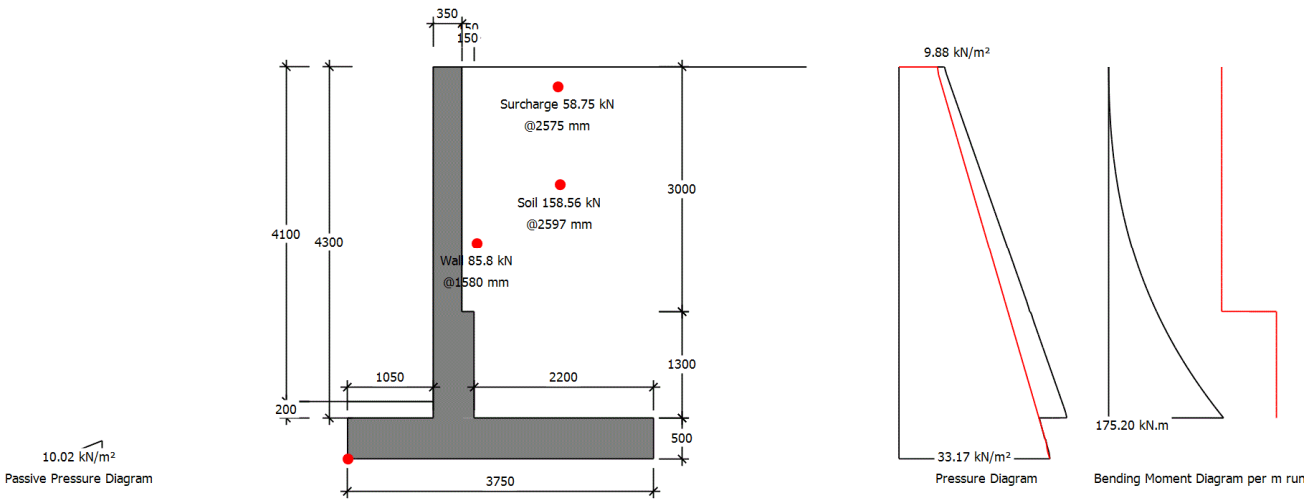
Job ref	: QD0014
Sheet	: **Sheet Ref / 3**
Made By	:
Date	**: Dec 24**
Checked	**: DGR**
Approved	: **dp**

MASTERKEY : RETAINING WALL DESIGN TO BS 8002 : 1994 AND BS 8110 : 1997

TYPE B - 4.3m Retained Height - 25kPa surcharge

Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Back soil 16.00, Front soil 18.00, Concrete 24.00
Concrete grade	fcu 40 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)	Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 25.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 480 mm

† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Soil Properties

Bearing pressure	Premissable service pressure @ front 125.00 kN/m², @ back 125.00 kN/m²
Back Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°
Base Friction and Cohesion	δ = Atn(0.75xTan(Atn(Tan(30)/1.2))) = 19.84°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°

Loading Cases

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel,
P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge, P_p- Passive Earth Pressure

Case 1: Geotechnical Design	1.00 G_{Soil}+1.00 G_{Wall}+1.00 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p
Case 2: Structural Ultimate Design	1.40 G_{Soil}+1.40 G_{Wall}+1.60 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	191.457/692.999	0.276	OK

Wall Sliding - Virtual Back Pressure

Fx/($Rx_{Friction}$+ $Rx_{Passive}$)	99.798/(108.022+1.107)	0.914	OK

Soil Pressure

Virtual Back (No uplift)	Max(105.326/125, 54.332/125) kN/m²	0.843	OK
Wall Back (No uplift)	Max(121.550/125, 38.108/125) kN/m²	0.972	OK

Structural Design

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@150 (46 mm)	1340 mm²	OK
Compression Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@150 (46 mm)	1340 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	462 mm, 1000 mm, 1340 mm², 500 N/mm², 40.0 N/mm²	439 mm	

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Approved	: **dp**

Mr=fn(above,As',d',x,x/d)	1340 mm², 38 mm, 37 mm, 0.08	255.9 kN.m	
Moment Capacity Check (M/Mr)	M 175.2 kN.m, Mr 255.9 kN.m	0.685	OK
Shear Capacity Check	F 100.8 kN, vc 0.472 N/mm², Fvr 218.1 kN	0.46	OK

Base Top Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	445 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	423 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.05	144.4 kN.m	
Moment Capacity Check (M/Mr)	M 116.0 kN.m, Mr 144.4 kN.m	0.803	OK
Shear Capacity Check	F 98.7 kN, vc 0.404 N/mm², Fvr 179.7 kN	0.55	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	445 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	423 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.05	144.4 kN.m	
Moment Capacity Check (M/Mr)	M 61.0 kN.m, Mr 144.4 kN.m	0.422	OK
Shear Capacity Check	F 114.6 kN, vc 0.404 N/mm², Fvr 179.7 kN	0.64	OK

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Job ref	: QD0014
Sheet	: **Sheet Ref / 5**
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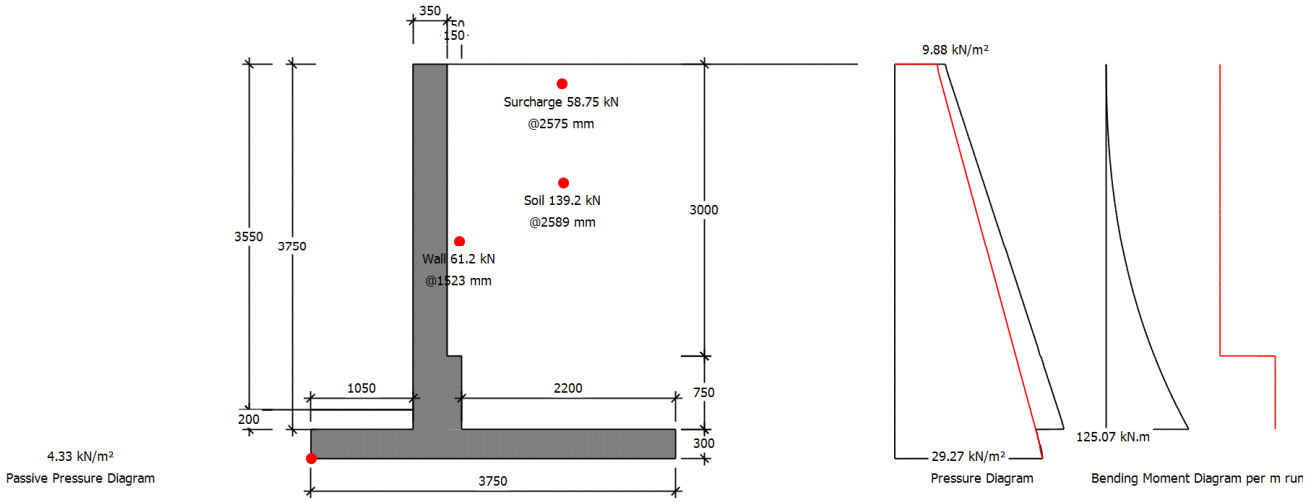
MASTERKEY : RETAINING WALL DESIGN TO BS 8002 : 1994 AND BS 8110 : 1997

TYPE C - 3.75m Retained Height - 25kPa surcharge
Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Back soil 16.00, Front soil 18.00, Concrete 24.00
Concrete grade	fcu 40 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)	Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 25.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 405 mm

† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Soil Properties

Bearing pressure	Premissable service pressure @ front 125.00 kN/m², @ back 125.00 kN/m²
Back Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°
Base Friction and Cohesion	δ = Atn(0.75xTan(Atn(Tan(30)/1.2))) = 19.84°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°

Loading Cases

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel,
P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge, P_p- Passive Earth Pressure

Case 1: Geotechnical Design	1.00 G_{Soil}+1.00 G_{Wall}+1.00 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p
Case 2: Structural Ultimate Design	1.40 G_{Soil}+1.40 G_{Wall}+1.60 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	125.510/599.365	0.209	OK

Wall Sliding - Virtual Back Pressure

$Fx/(Rx_{Friction}+ Rx_{Passive})$	76.235/(92.160+0.207)	0.825	OK

Soil Pressure

Virtual Back (No uplift)	Max(70.248/125, 65.965/125) kN/m²	0.562	OK
Wall Back (No uplift)	Max(81.022/125, 55.192/125) kN/m²	0.648	OK

Structural Design

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2			
Steel Provided (Cover)	Main H16@150 (30 mm)	Dist. H12@150 (46 mm)	1340 mm²	OK
Compression Steel Provided (Cover)	Main H16@150 (30 mm)	Dist. H12@150 (46 mm)	1340 mm²	

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Leverarm z=fn(d,b,As,fy,Fcu)	462 mm, 1000 mm, 1340 mm², 500 N/mm², 40.0 N/mm²	439 mm	
Mr=fn(above,As',d',x,x/d)	1340 mm², 38 mm, 37 mm, 0.08	255.9 kN.m	
Moment Capacity Check (M/Mr)	M 125.1 kN.m, Mr 255.9 kN.m	0.489	OK
Shear Capacity Check	F 81.4 kN, vc 0.472 N/mm², Fvr 218.1 kN	0.37	OK

Base Top Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	233 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.09	79.5 kN.m	
Moment Capacity Check (M/Mr)	M 70.0 kN.m, Mr 79.5 kN.m	0.880	OK
Shear Capacity Check	F 68.5 kN, vc 0.572 N/mm², Fvr 140.1 kN	0.49	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	233 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.09	79.5 kN.m	
Moment Capacity Check (M/Mr)	M 43.6 kN.m, Mr 79.5 kN.m	0.548	OK
Shear Capacity Check	F 84.1 kN, vc 0.572 N/mm², Fvr 140.1 kN	0.60	OK

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Sheet	: **Sheet Ref / 7**
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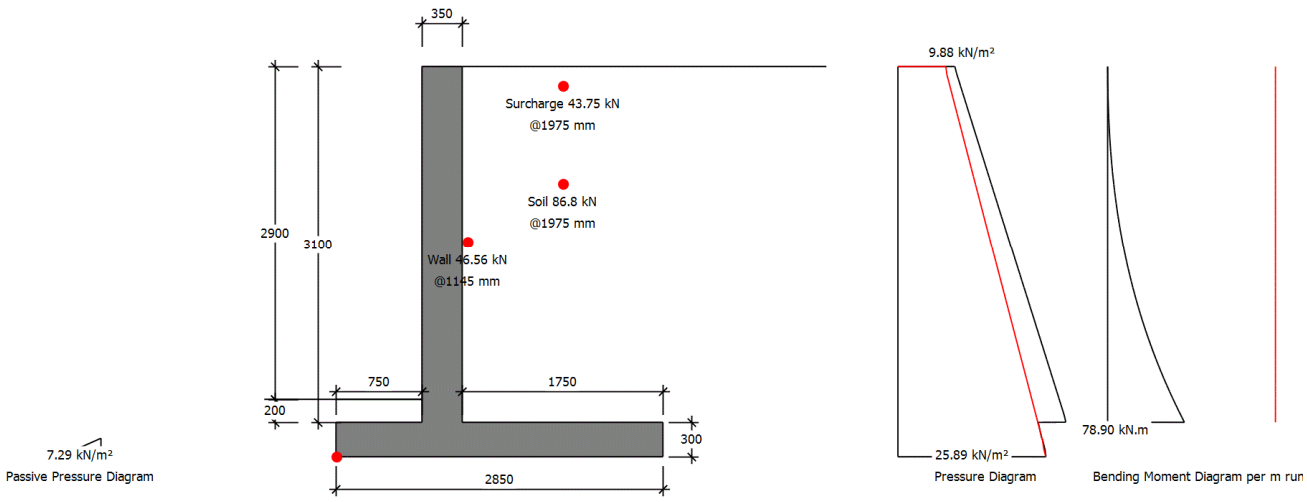
MASTERKEY : RETAINING WALL DESIGN TO BS 8002 : 1994 AND BS 8110 : 1997

TYPE D - 3.1m Retained Height - 25kPa surcharge

Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Back soil 16.00, Front soil 18.00, Concrete 24.00
Concrete grade	fcu 40 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)	Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 25.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 340 mm

† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Soil Properties

Bearing pressure	Premissable service pressure @ front 125.00 kN/m², @ back 125.00 kN/m²
Back Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°
Base Friction and Cohesion	δ = Atn(0.75xTan(Atn(Tan(30)/1.2))) = 19.84°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°

Loading Cases

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel,
P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge, P_p- Passive Earth Pressure

Case 1: Geotechnical Design	1.00 G_{Soil}+1.00 G_{Wall}+1.00 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p
Case 2: Structural Ultimate Design	1.40 G_{Soil}+1.40 G_{Wall}+1.60 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	81.869/311.164	0.263	OK

Wall Sliding - Virtual Back Pressure

Fx/($Rx_{Friction}$+ $Rx_{Passive}$)	58.205/(63.909+0.586)	0.902	OK

Soil Pressure

Virtual Back (No uplift)	Max(79.197/125, 45.090/125) kN/m²	0.634	OK
Wall Back (No uplift)	Max(91.322/125, 32.965/125) kN/m²	0.731	OK

Structural Design

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@150 (46 mm)	1340 mm²	OK
Compression Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@150 (46 mm)	1340 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	312 mm, 1000 mm, 1340 mm², 500 N/mm², 40.0 N/mm²	296 mm	

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Mr=fn(above,As',d',x,x/d)	1340 mm², 38 mm, 37 mm, 0.12	172.4 kN.m	
Moment Capacity Check (M/Mr)	M 78.9 kN.m, Mr 172.4 kN.m	0.458	OK
Shear Capacity Check	F 61.0 kN, vc 0.594 N/mm², Fvr 185.2 kN	0.33	OK

Base Top Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	233 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.09	79.5 kN.m	
Moment Capacity Check (M/Mr)	M 52.6 kN.m, Mr 79.5 kN.m	0.661	OK
Shear Capacity Check	F 57.1 kN, vc 0.572 N/mm², Fvr 140.1 kN	0.41	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	233 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.09	79.5 kN.m	
Moment Capacity Check (M/Mr)	M 24.4 kN.m, Mr 79.5 kN.m	0.307	OK
Shear Capacity Check	F 64.6 kN, vc 0.572 N/mm², Fvr 140.1 kN	0.46	OK

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Job ref	: QD0014
Sheet	: **Sheet Ref / 9**
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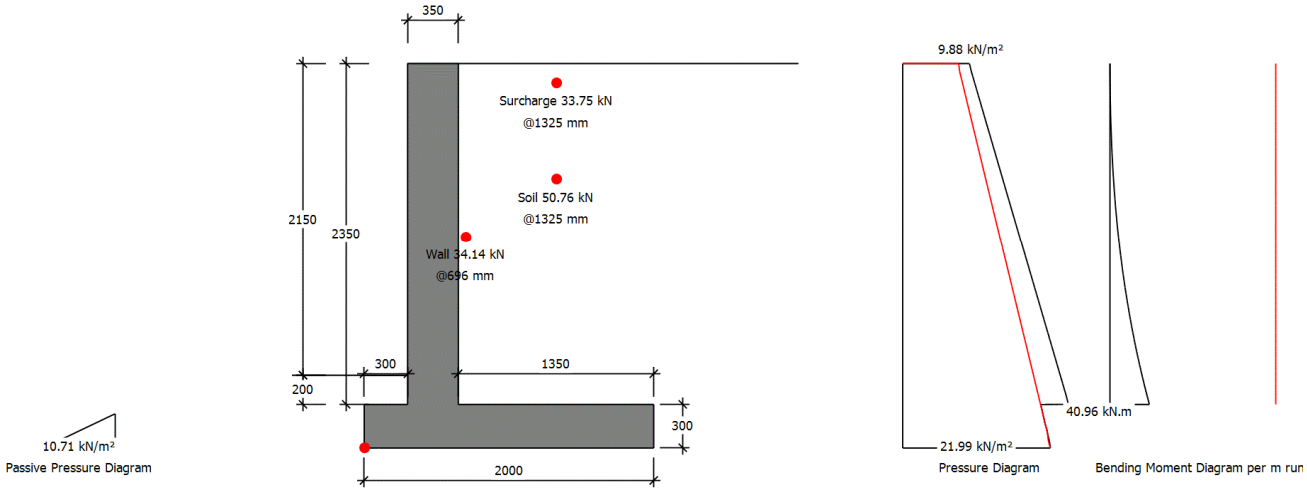
MASTERKEY : RETAINING WALL DESIGN TO BS 8002 : 1994 AND BS 8110 : 1997

TYPE E - 2.35m Retained Height - 25kPa surcharge
Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Back soil 16.00, Front soil 18.00, Concrete 24.00
Concrete grade	fcu 40 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)	Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 25.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 265 mm

† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Soil Properties

Bearing pressure	Premissable service pressure @ front 125.00 kN/m², @ back 125.00 kN/m²
Back Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°
Base Friction and Cohesion	δ = Atn(0.75xTan(Atn(Tan(30)/1.2))) = 19.84°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°

Loading Cases

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel,
P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge, P_p- Passive Earth Pressure

Case 1: Geotechnical Design	1.00 G_{Soil}+1.00 G_{Wall}+1.00 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p
Case 2: Structural Ultimate Design	1.40 G_{Soil}+1.40 G_{Wall}+1.60 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$+1.00 P_p

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	45.112/135.752	0.332	OK

Wall Sliding - Virtual Back Pressure

Fx/($Rx_{Friction}$+ $Rx_{Passive}$)	40.150/(42.814+1.265)	0.911	OK

Soil Pressure

Virtual Back (No uplift)	Max(101.339/125, 17.311/125) kN/m²	0.811	OK
Wall Back (No uplift)	Max(114.669/125, 3.981/125) kN/m²	0.917	OK

Structural Design

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@150 (46 mm)	1340 mm²	OK
Compression Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@150 (46 mm)	1340 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	312 mm, 1000 mm, 1340 mm², 500 N/mm², 40.0 N/mm²	296 mm	

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Job ref	: QD0014
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Mr=fn(above,As',d',x,x/d)	1340 mm², 38 mm, 37 mm, 0.12	172.4 kN.m	
Moment Capacity Check (M/Mr)	M 41.0 kN.m, Mr 172.4 kN.m	0.238	OK
Shear Capacity Check	F 40.6 kN, vc 0.594 N/mm², Fvr 185.2 kN	0.22	OK

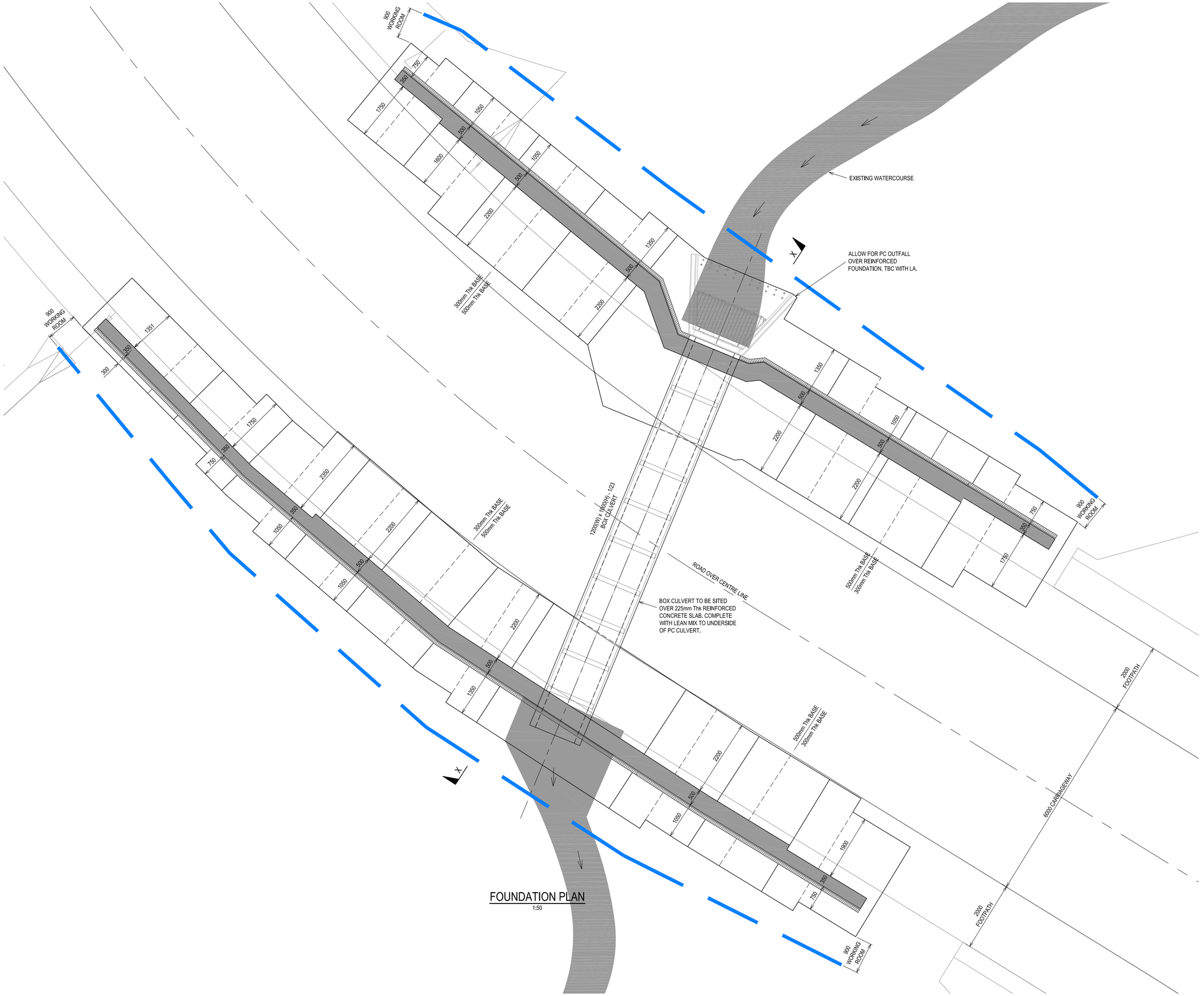
Base Top Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	233 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.09	79.5 kN.m	
Moment Capacity Check (M/Mr)	M 35.8 kN.m, Mr 79.5 kN.m	0.450	OK
Shear Capacity Check	F 40.3 kN, vc 0.572 N/mm², Fvr 140.1 kN	0.29	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	OK
Compression Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@100 (60 mm)	785 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 785 mm², 500 N/mm², 40 N/mm²	233 mm	
Mr=fn(above,As',d',x,x/d)	785 mm², 55 mm, 22 mm, 0.09	79.5 kN.m	
Moment Capacity Check (M/Mr)	M 5.1 kN.m, Mr 79.5 kN.m	0.064	OK
Shear Capacity Check	F 33.6 kN, vc 0.572 N/mm², Fvr 140.1 kN	0.24	OK

Structural Drawings



FOUNDATION PLAN
1:50

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HEALTH AND SAFETY

1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE ANY NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.

FOUNDATIONS

2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO CONCRETING FOUNDATIONS. THE TIME THAT FOUNDATIONS ARE LEFT OPEN ON SITE SHOULD BE KEPT TO A MINIMUM.
3. THESE WORKS INVOLVE WORKING AROUND A LIVE WATERCOURSE. THE CONTRACTOR IS TO PROVIDE ALL NECESSARY RISK ASSESSMENTS AND ETHOD STATEMENTS IN ORDER TO ENSURE A SAFE WORKING E ENVIRONMENT THROUGH THE COURSE OF THESE WORKS.

PIPES/ CABLES/ SERVICES

4. SERVICE RECORDS FOR THE SITE ARE TO BE SOURCED PRIOR TO ANY WORKS COMMENCING. THESE SHOULD BE SOUGHT ALLOWING SUFFICIENT TIME TO DIGEST THE INFORMATION BEFORE BEGINNING WORKS ON SITE. ANY SERVICES LOCATED WITHIN THE WORK AREA ARE TO BE FOUND USING HAND DIG METHODS.

EXCAVATION/ FILL

5. CONTRACTOR TO ENSURE THAT SUITABLE PROTECTIVE MEASURES ARE TAKEN TO ENSURE PLANT AND PEOPLE ARE KEPT A SAFE DISTANCE FROM STEEP SLOPES AND EXCAVATIONS DURING THE WORKS.
6. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE AT A SAFE DISTANCE FROM ANY OPERATING PLANT WHERE NECESSARY.
7. THE CONTRACTOR SHOULD REFER TO THE GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

GENERAL CONSTRUCTION NOTES

1. THE EXCAVATED FACE SHALL BE BATTERED TO A SAFE INCLINE OR TEMPORARILY PROPPED AND SHORED TO ENSURE THAT A SAFE WORKING SPACE IS MAINTAINED.
2. THE WALL BASE SHALL BE CAST ON A MINIMUM OF 50mm CONCRETE BLINDING.
3. BACKFILL SHALL COMPRISE WELL GRADED, FREE DRAINING STONE (6N6P)
4. RETAINING WALLS HAVE BEEN DESIGNED TO AN ALLOWABLE GROUND BEARING PRESSURE OF 125kPa. IT IS ASSUMED THAT THE SITE HAS SHALLOW SANDSTONE BEDROCK. THIS IS TO BE CONFIRMED UPON RECEIPT OF A SITE SPECIFIC GROUND INVESTIGATION REPORT.
5. THE CONTRACTOR/ CLIENT SHALL BRING THE THE ATTENTION OF THE ENGINEER ANY UNNATURAL OR UNSUITABLE GROUND CONDITIONS AS THESE WILL REQUIRE SPECIAL CONSIDERATION.
6. THE REINFORCED CONCRETE RETAINING WALL SHALL CONSIST OF RC40 CONCRETE AND BE FULLY VIBRATED.
7. THE BRICKWORK EXTERNAL CLADDING SHALL BE TIED TO THE STEM USING PROPRIETARY TIES AT THE CENTRES AS SHOWN ON THE SECTIONS AND DETAILS.
8. COVER TO THE REINFORCEMENT IS TO BE NOMINAL 45mm+10mm.
9. REINFORCING BARS LAP LENGTHS
   16mm Dia. 650mm
   10mm Dia. 400mm
10. REINFORCED CONCRETE WALL TO HAVE EXPANSION JOINTS AT MAXIMUM 12m CENTRES. REFER TO DRAWING 0010-QD-XX-S-DR-S-41-63 FOR EXPANSION JOINT DETAILS
11. WATERPROOFING DETAILS HAVE BEEN SHOWN TO THE REAR OF THE WALL. SHOULD THE CONTRACTOR WISH TO CHANGE TO A DIFFERENT SYSTEM THEY ARE TO MAKE SUGGESTIONS FOR COMMENTS.
12. 38mm Dia. WEEP HOLES ARE TO BE PLACED AT Max. 1.0m Ctrs.
13. BACK OF WALL DRAINAGE TO CONSIST OF 100mm PERFORATED LAND DRAIN OR WAVIN PIPE TO AN APPROPRIATE DISCHARGE POINT.

FOUNDATION NOTES

1. THE FORMATION LEVELS SHOWN ON THESE DRAWINGS ARE PROVISIONAL AND ARE SUBJECT TO APPROVAL OF THE LOCAL AUTHORITY AND THE ENGINEER.
2. ALL TOP SOIL AND EXISTING FILL SHALL BE REMOVED BELOW THE FOUNDATION AREA AND THE GENERAL FORMATION LEVEL BE APPROVED BY THE ENGINEER.
3. WHERE IT IS NECESSARY TO EXCAVATE BELOW THE PROVISIONAL FORMATION LEVELS TO REACH AN APPROVED STRATUM, AND ADDITIONAL EXCAVATIONS ARE TO BE BACKFILLED WITH SUITABLE FILL MATERIAL.
4. THE PERMISSIVLE DEVIATION IN LEVELS OF THE TOP OF THE BLINDING CONCRETE SHALL BE BETWEEN +0mm AND -25mm.
5. THE QUANTITY OF THE TEST CUBES CAST BY THE CONTRACTOR AND THE AGE AT WHICH THEY ARE TO BE TESTED WILL BE AS DIRECTED BY THE ENGINEER.
6. MESH REINFORCEMENT TO BE MEASURED AND ORDERED AS REQUIRED BY THE GENERAL CONTRACTOR.

FINAL REINFORCEMENT DRAWINGS TO BE COMPLETE UPON RECEIPT OF GROUND INVESTIGATION REPORT

THIS DRAWING IS SUBJECT TO THE APPROVAL OF ALL RELEVANT AUTHORITIES

Rev.	Date	Revision Details	Drawn	Checked
-	-	-	-	-

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Client: KEEPMOAT

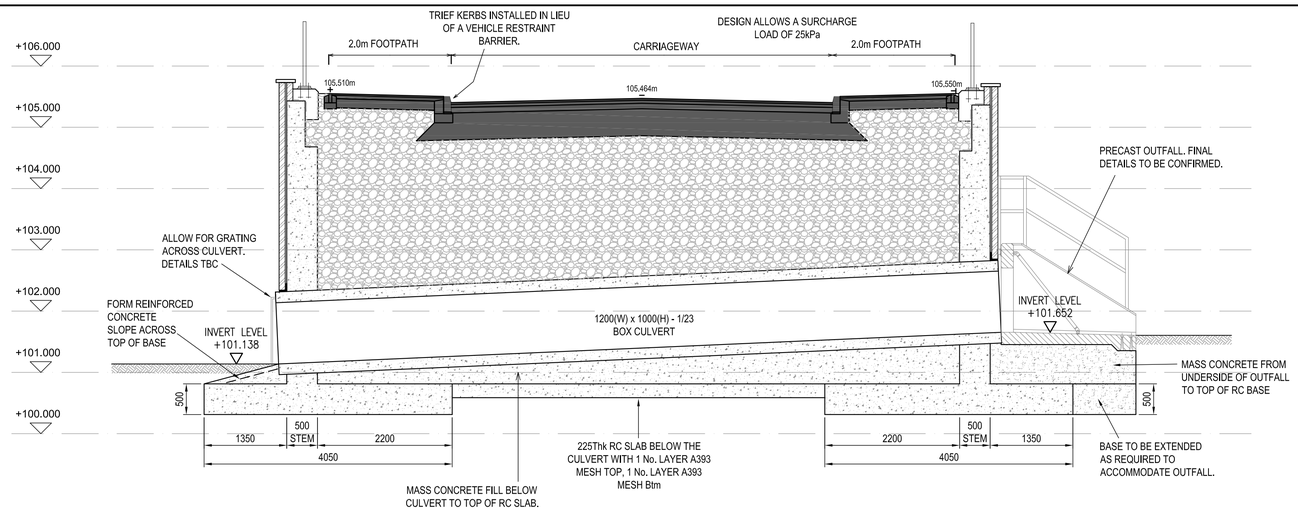
Project: KERESFORTH ROAD, BARNSLEY

Title: HIGHWAY RETAINING WALL FOUNDATION PLAN

Drawn	Checked	Date
DZ	DR	Nov' 24

Drawing Number: 0010-QD-XX-S-DR-S-41-60

Drawing Status	Scale	Rev.
PRELIMINARY	1:50 @ A1	-



SECTION X-X

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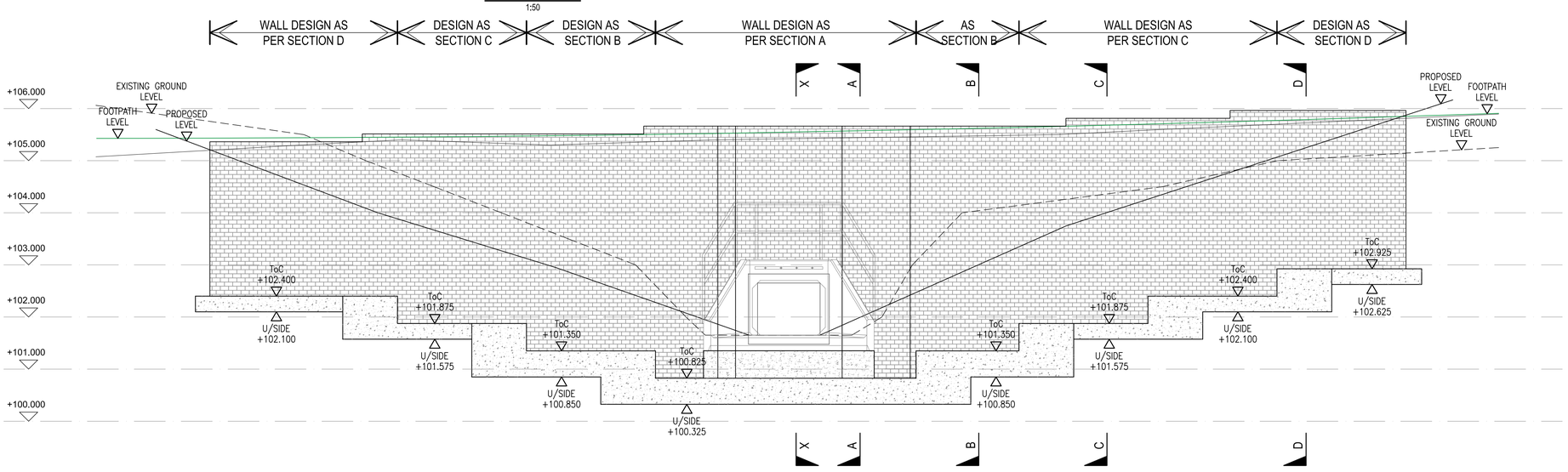
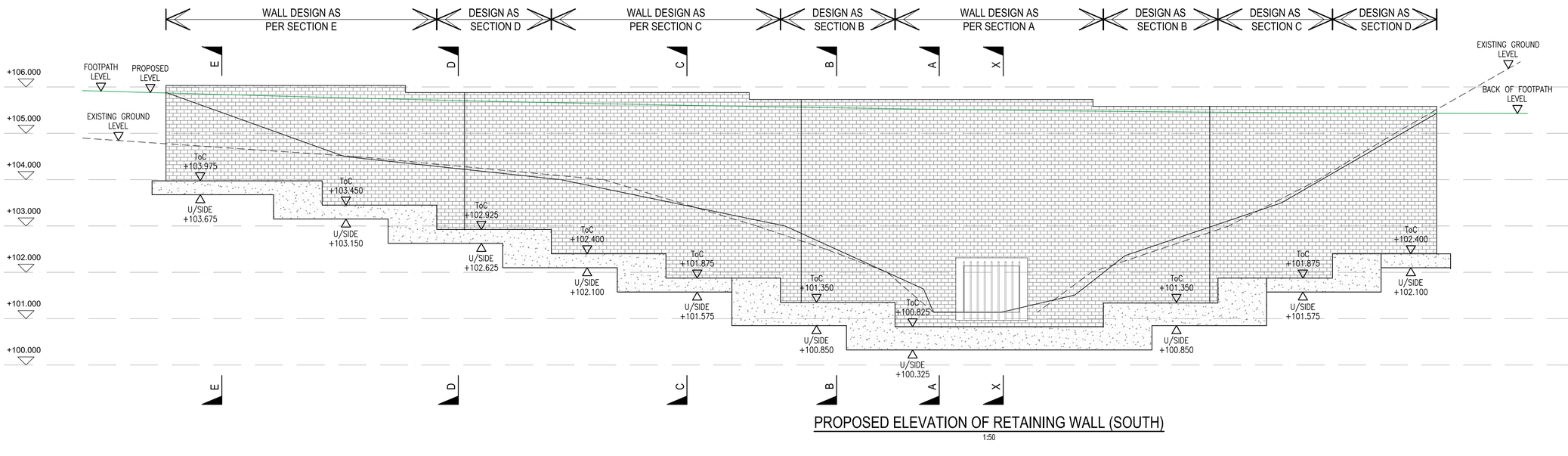


PROPOSED ELEVATION OF RETAINING WALL (NORTH)

1:50



PROPOSED ELEVATION OF RETAINING WALL (SOUTH)

1:50

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HEALTH AND SAFETY

1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE ANY NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.

FOUNDATIONS

2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO CONCRETING FOUNDATIONS. THE TIME THAT FOUNDATIONS ARE LEFT OPEN ON SITE SHOULD BE KEPT TO A MINIMUM.
3. THESE WORKS INVOLVE WORKING AROUND A LIVE WATERCOURSE. THE CONTRACTOR IS TO PROVIDE ALL NECESSARY RISK ASSESSMENTS AND ETHOD STATEMENTS IN ORDER TO ENSURE A SAFE WORKING E ENVIRONMENT THROUGH THE COURSE OF THESE WORKS.

PIPES/ CABLES/ SERVICES

4. SERVICE RECORDS FOR THE SITE ARE TO BE SOURCED PRIOR TO ANY WORKS COMMENCING. THESE SHOULD BE SOUGHT ALLOWING SUFFICIENT TIME TO DIGEST THE INFORMATION BEFORE BEGINNING WORKS ON SITE. ANY SERVICES LOCATED WITHIN THE WORK AREA ARE TO BE FOUND USING HAND DIG METHODS.

EXCAVATION/ FILL

5. CONTRACTOR TO ENSURE THAT SUITABLE PROTECTIVE MEASURES ARE TAKEN TO ENSURE PLANT AND PEOPLE ARE KEPT A SAFE DISTANCE FROM STEEP SLOPES AND EXCAVATIONS DURING THE WORKS.
6. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE AT A SAFE DISTANCE FROM ANY OPERATING PLANT WHERE NECESSARY.
7. THE CONTRACTOR SHOULD REFER TO THE GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

GENERAL CONSTRUCTION NOTES

1. THE EXCAVATED FACE SHALL BE BATTERED TO A SAFE INCLINE OR TEMPORARILY PROPPED AND SHORED TO ENSURE THAT A SAFE WORKING SPACE IS MAINTAINED.
2. THE WALL BASE SHALL BE CAST ON A MINIMUM OF 50mm CONCRETE BLINDING (C10).
3. BACKFILL SHALL COMPRISE WELL GRADED, FREE DRAINING STONE (6N/6P)
4. RETAINING WALLS HAVE BEEN DESIGNED TO AN ALLOWABLE GROUND BEARING PRESSURE OF 125kPa. IT IS ASSUMED THAT THE SITE HAS SHALLOW SANDSTONE BEDROCK. THIS IS TO BE CONFIRMED UPON RECEIPT OF A SITE SPECIFIC GROUND INVESTIGATION REPORT.
5. THE CONTRACTOR/ CLIENT SHALL BRING THE THE ATTENTION OF THE ENGINEER ANY UNNATURAL OR UNSUITABLE GROUND CONDITIONS AS THESE WILL REQUIRE SPECIAL CONSIDERATION.
6. THE REINFORCED CONCRETE RETAINING WALL SHALL CONSIST OF RC40 CONCRETE AND BE FULLY VIBRATED.
7. THE BRICKWORK EXTERNAL CLADDING SHALL BE TIED TO THE STEM USING PROPRIETARY TIES AT THE CENTRES AS SHOWN ON THE SECTIONS AND DETAILS.
8. COVER TO THE REINFORCEMENT IS TO BE NOMINAL 45mm+10mm.
9. REINFORCING BARS LAP LENGTHS
   16mm Dia. 650mm
   10mm Dia. 400mm
10. REINFORCED CONCRETE WALL TO HAVE EXPANSION JOINTS AT MAXIMUM 12m CENTRES. REFER TO DRAWING 0010-QD-XX-S-DR-S-41-63 FOR EXPANSION JOINT DETAILS
11. WATERPROOFING DETAILS HAVE BEEN SHOWN TO THE REAR OF THE WALL. SHOULD THE CONTRACTOR WISH TO CHANGE TO A DIFFERENT SYSTEM THEY ARE TO MAKE SUGGESTIONS FOR COMMENTS.
12. 38mm Dia. WEEP HOLES ARE TO BE PLACED AT Max. 1.0m Ctrs.
13. BACK OF WALL DRAINAGE TO CONSIST OF 100mm PERFORATED LAND DRAIN OR WAVIN PIPE TO AN APPROPRIATE DISCHARGE POINT.

FOUNDATION NOTES

1. THE FORMATION LEVELS SHOWN ON THESE DRAWINGS ARE PROVISIONAL AND ARE SUBJECT TO APPROVAL OF THE LOCAL AUTHORITY AND THE ENGINEER.
2. ALL TOP SOIL AND EXISTING FILL SHALL BE REMOVED BELOW THE FOUNDATION AREA AND THE GENERAL FORMATION LEVEL BE APPROVED BY THE ENGINEER.
3. WHERE IT IS NECESSARY TO EXCAVATE BELOW THE PROVISIONAL FORMATION LEVELS TO REACH AN APPROVED STRATUM, AND ADDITIONAL EXCAVATIONS ARE TO BE BACKFILLED WITH SUITABLE FILL MATERIAL.
4. THE PERMISSIVLE DEVIATION IN LEVELS OF THE TOP OF THE BLINDING CONCRETE SHALL BE BETWEEN +0mm AND -25mm.
5. THE QUANTITY OF THE TEST CUBES CAST BY THE CONTRACTOR AND THE AGE AT WHICH THEY ARE TO BE TESTED WILL BE AS DIRECTED BY THE ENGINEER.
6. MESH REINFORCEMENT TO BE MEASURED AND ORDERED AS REQUIRED BY THE GENERAL CONTRACTOR.

MATERIAL SPECIFICATION

CONCRETE

a) COMPRESSIVE STRENGTH C32/40
b) EXPOSURE CLASS - XD3
c) COVER TO REINFORCEMENT. NOMINAL 45mm + 10mm U.N.O.
d) MAX W/C RATION 0.4
e) MIN CEMENT CONTENT 380kg/m³ (TBC) - DEPT ON GI.
f) CEMENT TYPE (TBC) - DEPT ON GI.
g) MASS CHLORIDE CONTENT - 0.4 (TBC) - DEPT ON GI.
h) MAXX AGG - 20mm
i) CONSISTENCE CLASS - S3
j) SURFACE SPECIFICATION FOUNDATION - U1; SOIL FACE OF WALL - F1; MASONRY FACE OF WALL - F2

MASONRY

a) SUPERSTRUCTURE BRICKWORK - 20N/mm²
b) MORTAR STRENGTH - M6
c) FROST PROTECTION = F2

FINAL REINFORCEMENT DRAWINGS TO BE COMPLETE UPON RECEIPT OF GROUND INVESTIGATION REPORT

THIS DRAWING IS SUBJECT TO THE APPROVAL OF ALL RELEVANT AUTHORITIES

Rev.	Date	Revision Details	Drawn	Checked
-	-	-	-	-

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www.queensberrydesign.co.uk

Client: KEEPMOAT

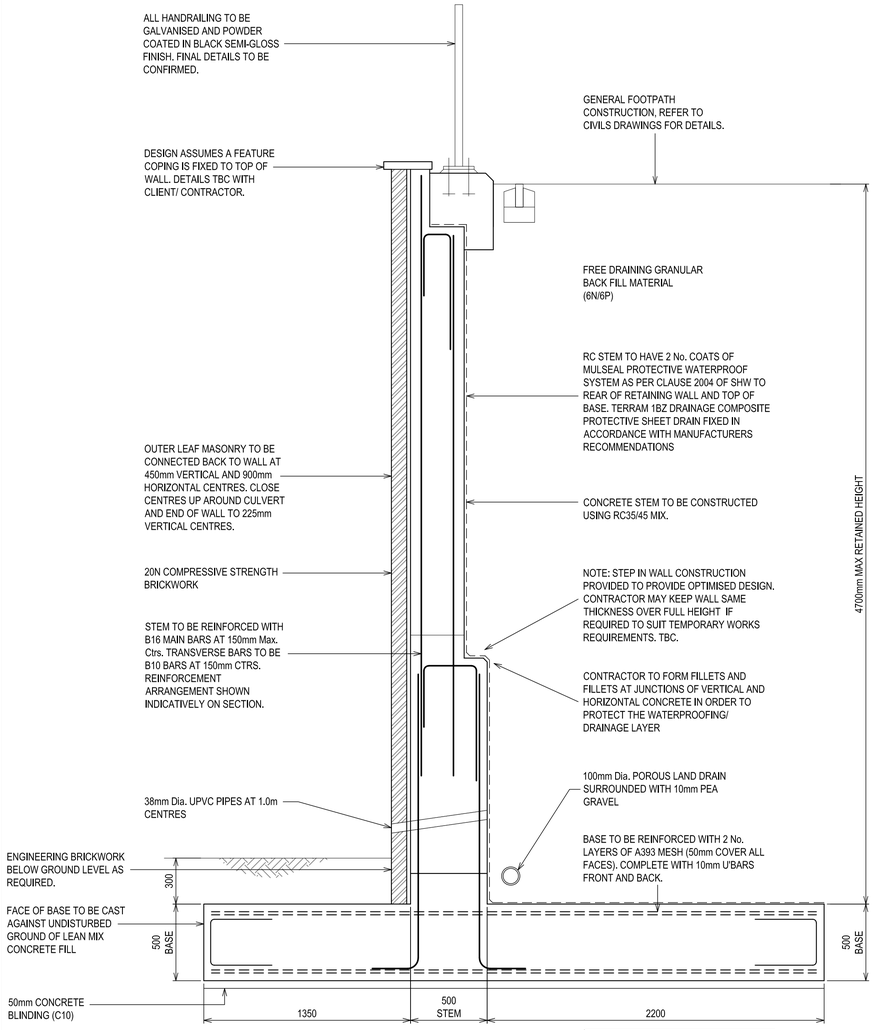
Project: KERESFORTH ROAD, BARNSLEY

Title: HIGHWAY RETAINING WALL EVELATIONS & SECTION

Drawn	Checked	Date
DZ	DR	Nov' 24

Drawing Number: 0010-QD-XX-S-DR-S-41-61

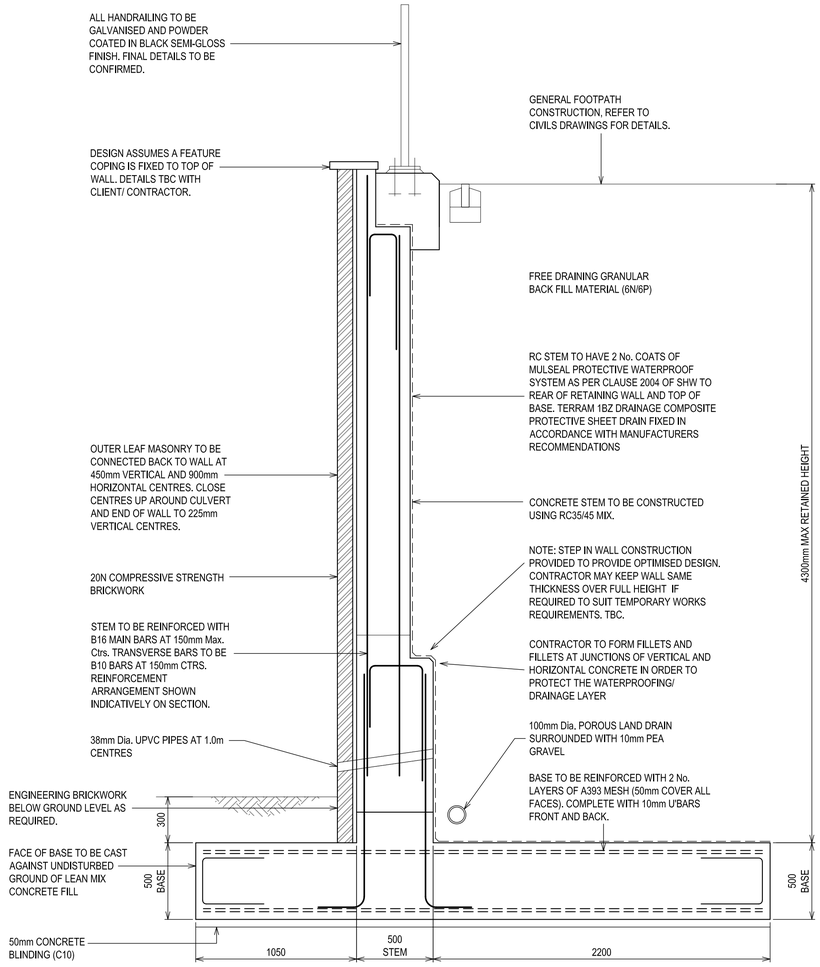
Drawing Status	Scale	Rev.
PRELIMINARY	1:50 @ A1	-



SECTION A - A

1:20

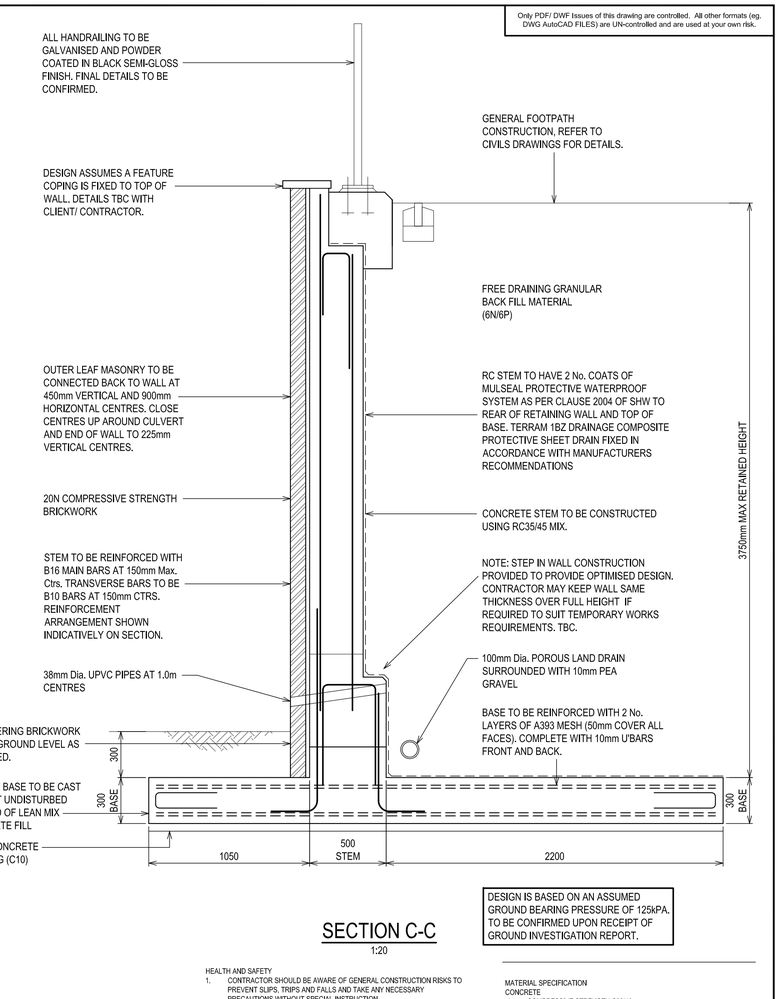
DESIGN IS BASED ON AN ASSUMED GROUND BEARING PRESSURE OF 125kPA. TO BE CONFIRMED UPON RECEIPT OF GROUND INVESTIGATION REPORT.



SECTION B-B

1:20

DESIGN IS BASED ON AN ASSUMED GROUND BEARING PRESSURE OF 125kPA. TO BE CONFIRMED UPON RECEIPT OF GROUND INVESTIGATION REPORT.



SECTION C-C

1:20

DESIGN IS BASED ON AN ASSUMED GROUND BEARING PRESSURE OF 125kPA. TO BE CONFIRMED UPON RECEIPT OF GROUND INVESTIGATION REPORT.

HEALTH AND SAFETY

1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE ANY NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.

FOUNDATIONS

2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO CONCRETING FOUNDATIONS. THE TIME THAT FOUNDATIONS ARE LEFT OPEN ON SITE SHOULD BE KEPT TO A MINIMUM.
3. THESE WORKS INVOLVE WORKING AROUND A LIVE WATERCOURSE. THE CONTRACTOR IS TO PROVIDE ALL NECESSARY RISK ASSESSMENTS AND ETHOD STATEMENTS IN ORDER TO ENSURE A SAFE WORKING E ENVIRONMENT THROUGH THE COURSE OF THESE WORKS.

PIPES/ CABLES/ SERVICES

4. SERVICE RECORDS FOR THE SITE ARE TO BE SOURCED PRIOR TO ANY WORKS COMMENCING. THESE SHOULD BE SOUGHT ALLOWING SUFFICIENT TIME TO DIGEST THE INFORMATION BEFORE BEGINNING WORKS ON SITE. ANY SERVICES LOCATED WITHIN THE WORK AREA ARE TO BE FOUND USING HAND DIG METHODS.

EXCAVATION/ FILL

5. CONTRACTOR TO ENSURE THAT SUITABLE PROTECTIVE MEASURES ARE TAKEN TO ENSURE PLANT AND PEOPLE ARE KEPT A SAFE DISTANCE FROM STEEP SLOPES AND EXCAVATIONS DURING THE WORKS.
6. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE AT A SAFE DISTANCE FROM ANY OPERATING PLANT WHERE NECESSARY.
7. THE CONTRACTOR SHOULD REFER TO THE GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

GENERAL CONSTRUCTION NOTES

1. THE EXCAVATED FACE SHALL BE BATTERED TO A SAFE INCLINE OR TEMPORARILY PROPPED AND SHORED TO ENSURE THAT A SAFE WORKING SPACE IS MAINTAINED.
2. THE WALL BASE SHALL BE CAST ON A MINIMUM OF 50mm CONCRETE BLINDING (C10).
3. BACKFILL SHALL COMPRISE WELL GRADED, FREE DRAINING STONE (6N/6P)
4. RETAINING WALLS HAVE BEEN DESIGNED TO AN ALLOWABLE GROUND BEARING PRESSURE OF 125kPa. IT IS ASSUMED THAT THE SITE HAS SHALLOW SANDSTONE BEDROCK. THIS IS TO BE CONFIRMED UPON RECEIPT OF A SITE SPECIFIC GROUND INVESTIGATION REPORT.
5. THE CONTRACTOR/ CLIENT SHALL BRING THE THE ATTENTION OF THE ENGINEER ANY UNNATURAL OR UNSUITABLE GROUND CONDITIONS AS THESE WILL REQUIRE SPECIAL CONSIDERATION.
6. THE REINFORCED CONCRETE RETAINING WALL SHALL CONSIST OF RC40 CONCRETE AND BE FULLY VIBRATED.
7. THE BRICKWORK EXTERNAL CLADDING SHALL BE TIED TO THE STEM USING PROPRIETARY TIES AT THE CENTRES AS SHOWN ON THE SECTIONS AND DETAILS.
8. COVER TO THE REINFORCEMENT IS TO BE NOMINAL 45mm+10mm.
9. REINFORCING BARS LAP LENGTHS
   16mm Dia. 650mm
   10mm Dia. 400mm
10. REINFORCED CONCRETE WALL TO HAVE EXPANSION JOINTS AT MAXIMUM 12m CENTRES. REFER TO DRAWING 0010-QD-XX-S-DR-S-41-63 FOR EXPANSION JOINT DETAILS
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MATERIAL SPECIFICATION

CONCRETE

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f) CEMENT TYPE (TBC) - DEPT ON GI.
g) MASS CHLORIDE CONTENT - 0.4 (TBC) - DEPT ON GI.
h) MAXX AGG - 20mm
i) CONSISTENCE CLASS - S3
j) SURFACE SPECIFICATION
   FOUNDATION - U1
   SOIL FACE OF WALL - F1
   MASONRY FACE OF WALL - F2

MASONRY

a) SUPERSTRUCTURE BRICKWORK - 20N/mm²
b) MORTAR STRENGTH - M6
c) FROST PROTECTION = F2

FINAL REINFORCEMENT DRAWINGS TO BE COMPLETE UPON RECEIPT OF GROUND INVESTIGATION REPORT

THIS DRAWING IS SUBJECT TO THE APPROVAL OF ALL RELEVANT AUTHORITIES

Rev.	Date	Revision Details	Drawn	Checked
-	-	-	-	-

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www.queensberrydesign.co.uk

Client: KEEPMOAT

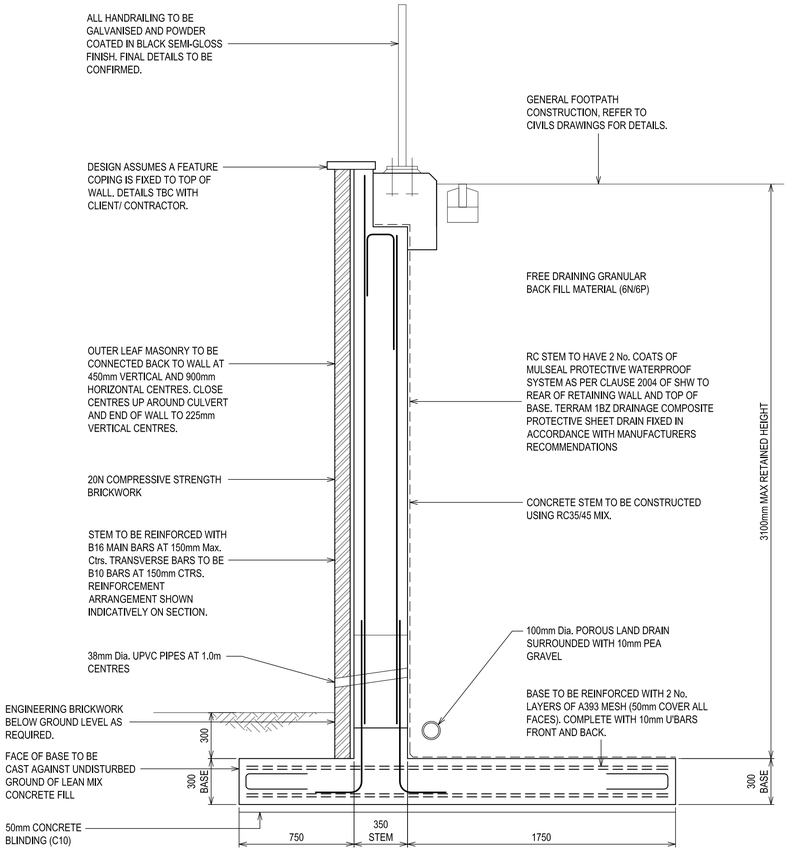
Project: KERESFORTH ROAD, BARNSLEY

Title: HIGHWAY RETAINING WALL SECTIONS & DETAILS SHEET 1 OF 2

Drawn	Checked	Date
DZ	DR	Nov' 24

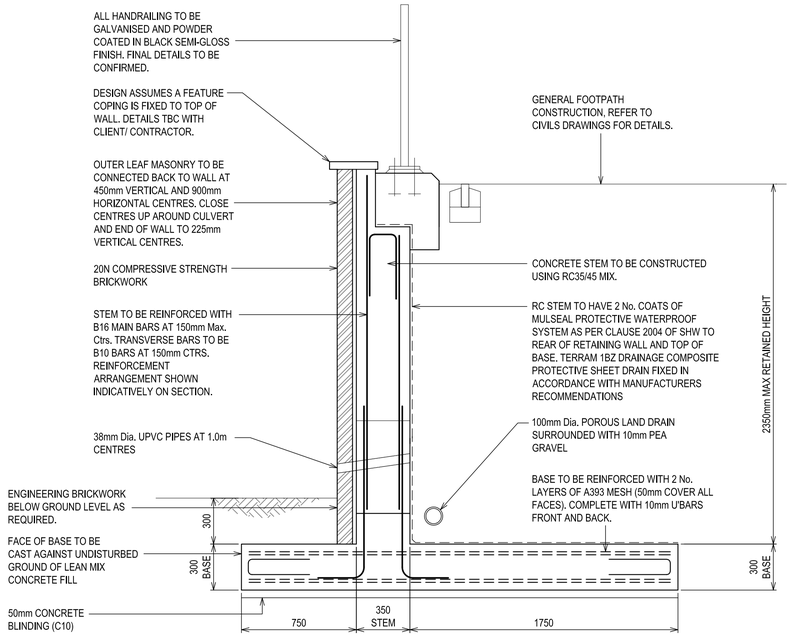
Drawing Number: 0010-QD-XX-S-DR-S-41-62

Drawing Status	Scale	Rev.
PRELIMINARY	1:50 @ A1	-



DESIGN IS BASED ON AN ASSUMED GROUND BEARING PRESSURE OF 125kPA. TO BE CONFIRMED UPON RECEIPT OF GROUND INVESTIGATION REPORT.

SECTION D-D
1:20



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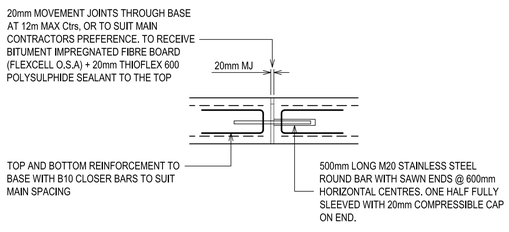
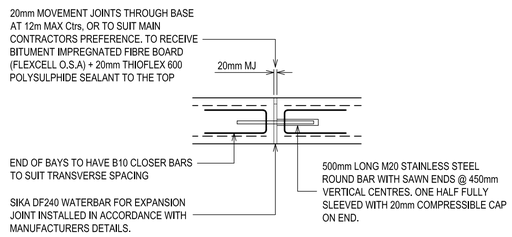
SECTION E-E
1:20



MOVEMENT JOINT DETAIL (BASE)
1:20



MOVEMENT JOINT DETAIL (STEM)
1:20

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MASONRY
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Rev.	Date	Revision Details	Drawn	Checked
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Client: KEEPMOAT

Project: KERESFORTH ROAD, BARNSLEY

Title: HIGHWAY RETAINING WALL SECTIONS & DETAILS SHEET 2 OF 2

Drawn	Checked	Date
DZ	DR	Nov' 24

Drawing Number: 0010-QD-XX-S-DR-S-41-63

Drawing Status	Scale	Rev.
PRELIMINARY	1:50 @ A1	-