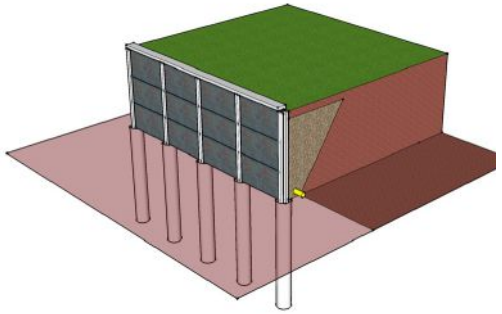
Retaining wall design and engineering

Everything you need to know about retaining wall design and engineering in 4 minutes

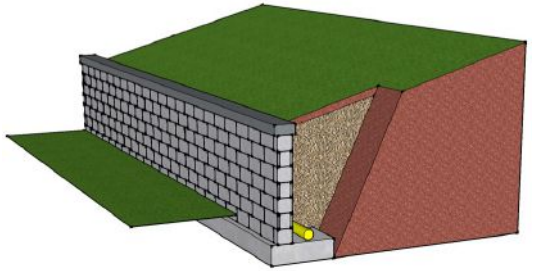
Bob Evans

Retaining Wall Solutions

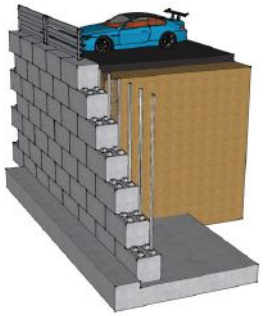


Cantilever – King Post

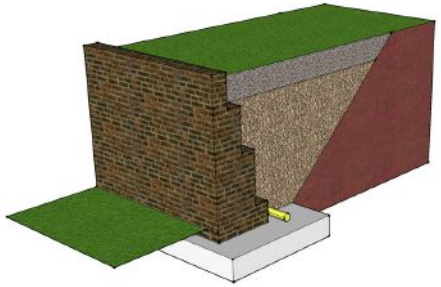
Cantilever - Precast L shape



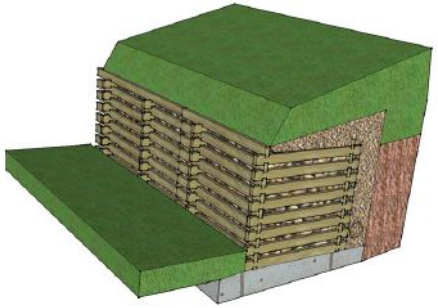
Cantilever - Reinforced Hollow Block



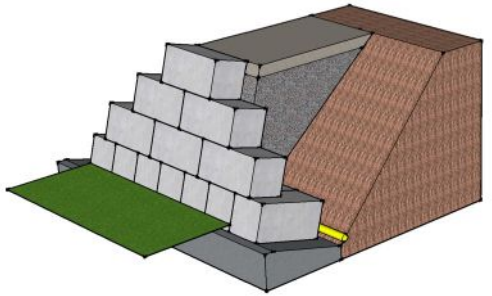
Cantilever - Reinforced Block



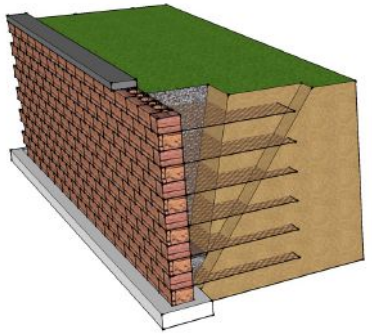
Gravity – Masonry



Gravity – Criblock



Gravity – Concrete Block/Gabion



Reinforced Soil

Cantilever, gravity, and reinforced soil retaining wall types

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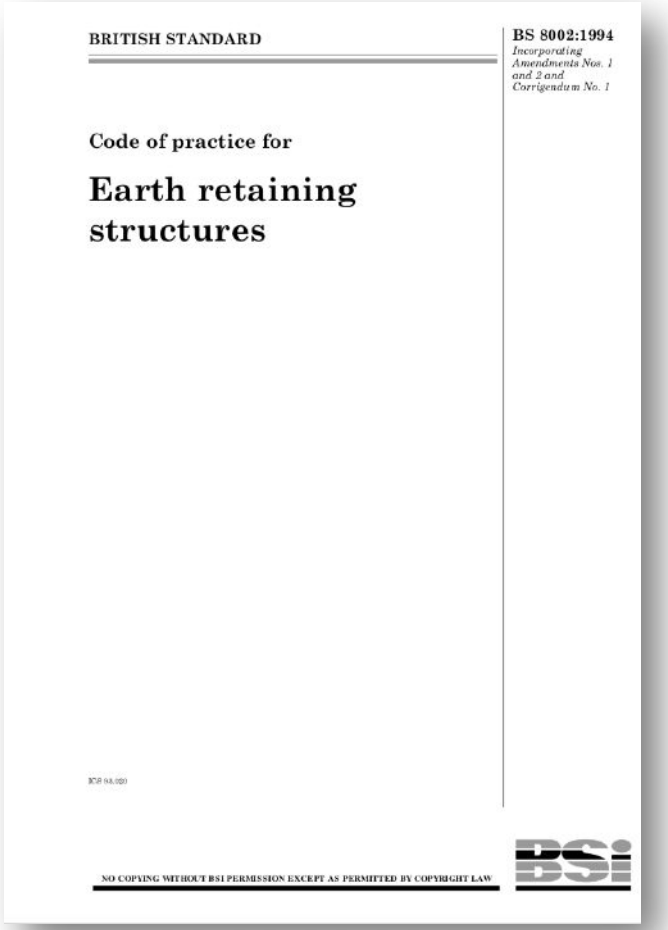
BRITISH STANDARD

BS 8002:1994
Incorporating Amendments Nos. 1 and 2 and Corrigendum No. 1

Code of practice for

Earth retaining structures

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Retaining wall are designed by structural engineers who are experienced in structural design of concrete, masonry, steel and structures.

They use the site investigation information about the soil types to carry out their design.

Retaining wall design codes of practice – Eurocode 7 or BS 8002 :1994

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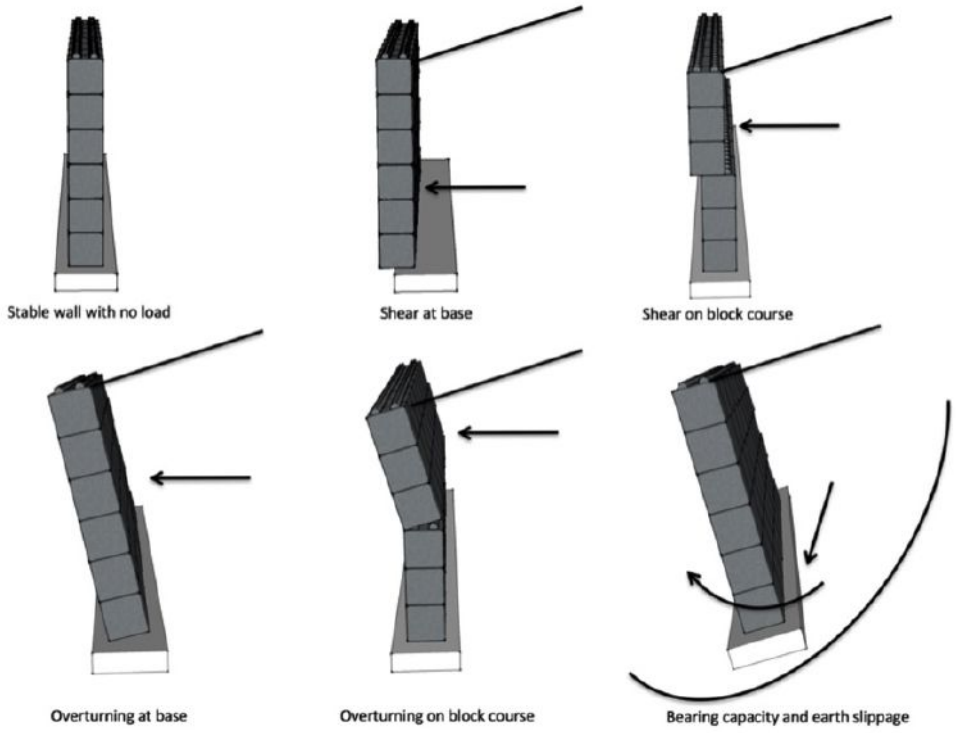

Overturning – The material being retained creates a force (moment) that causes toppling of the wall. .

Bearing capacity – The weight of the wall and earth is supported by the ground beneath. The wall can settle to much and fail.

Sliding – The retaining earth creates a horizontal force that can cause the retaining wall to slide. This is resisted by the friction between the wall and earth beneath, and the embedment of the wall.

Stability – The earth around the wall requires adequate strength to avoid an overall slip failure.

Shear – The blocks and masonry can shear at the base or on courses.

Bending – King post walls can bend if the steel section is not adequate for the load case.

Retaining wall failure modes

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A simple demonstration to understand overturning and slip

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The structural engineer needs ground information before a design can be carried out

- Site investigation bore holes
- Site investigation trial holes
- Site investigation desk top study

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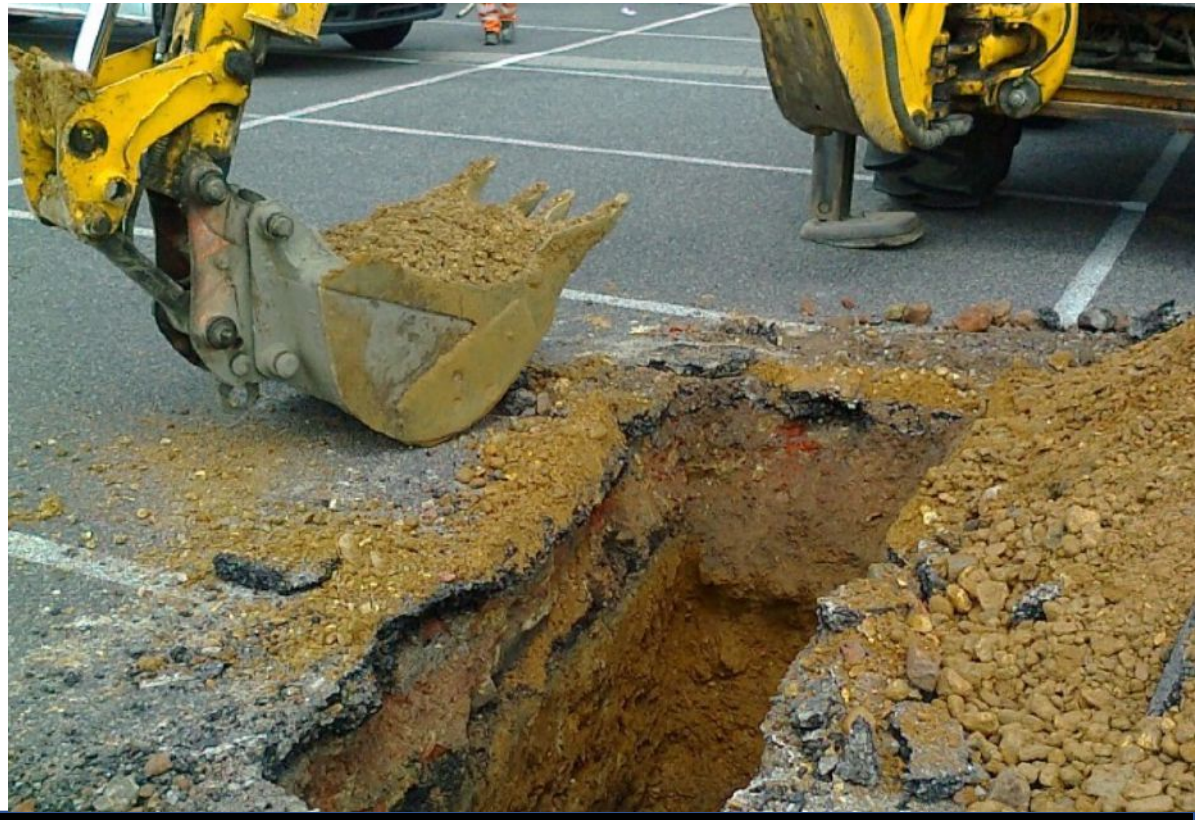
A hand or machine soil auger can be hired to carry out bore holes.

A trial pit can be excavated using a mini excavator or JCB



Soil sampling

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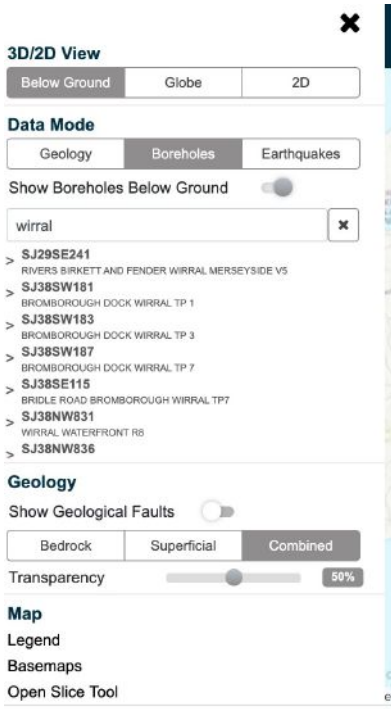

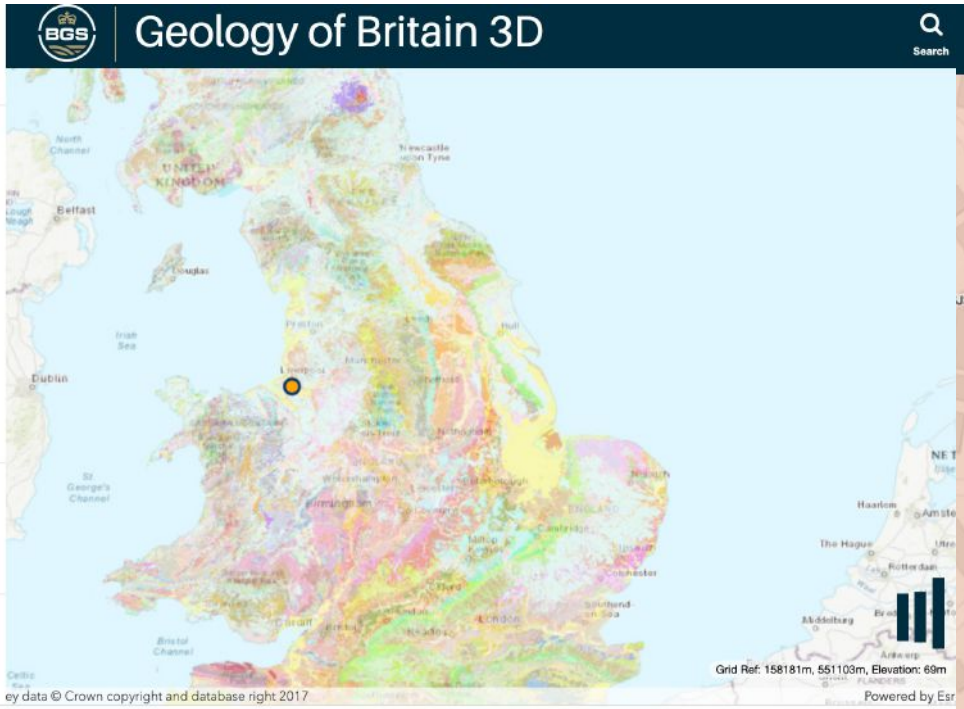

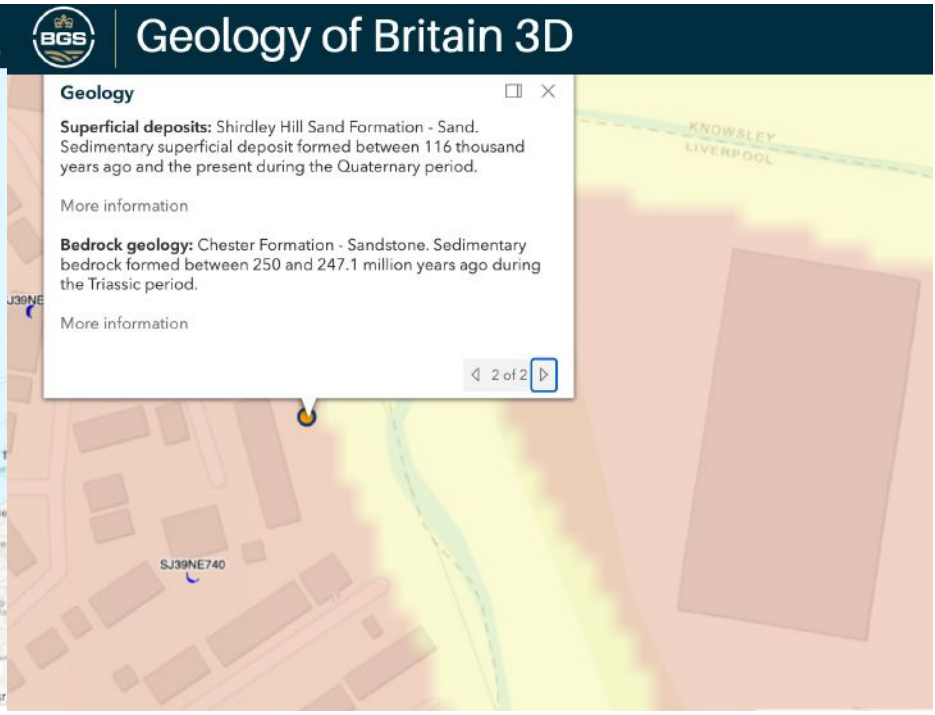

https://www.bgs.ac.uk/

Bore hole data – British Geological Survey

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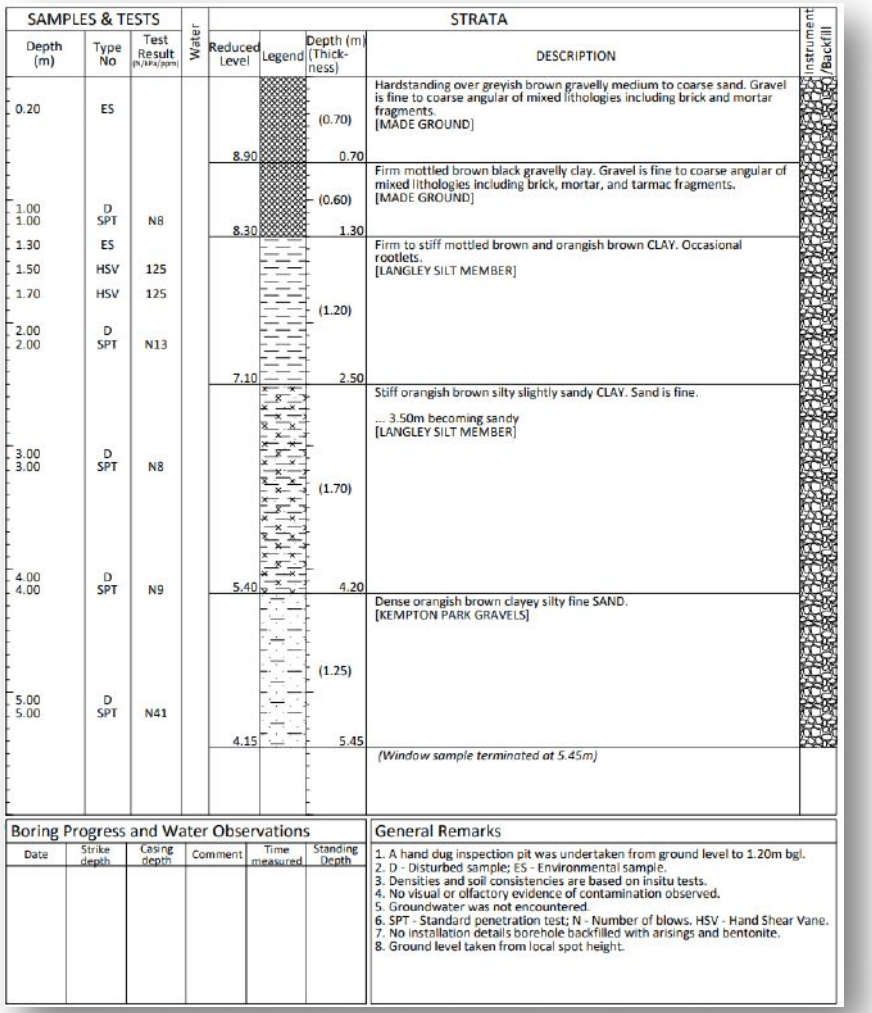

SAMPLES & TESTS

Depth (m)	Type No	Test Result (N/kPa/ppm)
0.20	ES	
1.00	D	
1.00	SPT	N8
1.30	ES	
1.50	HSV	125
1.70	HSV	125
2.00	D	
2.00	SPT	N13
3.00	D	
3.00	SPT	N8
4.00	D	
4.00	SPT	N9
5.00	D	
5.00	SPT	N41

Water

STRATA

Reduced Level	Legend	Depth (m) (Thick-ness)	DESCRIPTION
		(0.70)	Hardstanding over greyish brown gravelly medium to coarse sand. Gravel is fine to coarse angular of mixed lithologies including brick and mortar fragments. [MADE GROUND]
8.90		0.70	
		(0.60)	Firm mottled brown black gravelly clay. Gravel is fine to coarse angular of mixed lithologies including brick, mortar, and tarmac fragments. [MADE GROUND]
8.30		1.30	
		(1.20)	Firm to stiff mottled brown and orangish brown CLAY. Occasional rootlets. [LANGLEY SILT MEMBER]
7.10		2.50	
		(1.70)	Stiff orangish brown silty slightly sandy CLAY. Sand is fine. ... 3.50m becoming sandy [LANGLEY SILT MEMBER]
5.40		4.20	
		(1.25)	Dense orangish brown clayey silty fine SAND. [KEMPTON PARK GRAVELS]
4.15		5.45	
			(Window sample terminated at 5.45m)

Instrument / Backfill

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. A hand dug inspection pit was undertaken from ground level to 1.20m bgl.
2. D - Disturbed sample; ES - Environmental sample.
3. Densities and soil consistencies are based on insitu tests.
4. No visual or olfactory evidence of contamination observed.
5. Groundwater was not encountered.
6. SPT - Standard penetration test; N - Number of blows. HSV - Hand Shear Vane.
7. No installation details borehole backfilled with arisings and bentonite.
8. Ground level taken from local spot height.

A bore hole log shows you the ground strata.

Each layer is recorded for the depth and type of soil.

Tests are carried out on the soil during the drilling process to determine the soil strength.

A report is then prepared for the structural engineer.

Borehole log and report

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Simple field tests to determine ground condition

Type rock or soil	Condition	Simple field test	Wall type
Rock	Hard	Requires at least a pneumatic breaker to break up the rock to excavate	No good for king post, good for all other wall types
Gravel, sand	Compact	Requires pick for excavation. Wooden peg 50mm square hard to drive more than 150mm	Good for all wall types
Clay, sandy clay	Stiff	Cannot be moulded in the fingers. Requires pick or machine excavator to excavate	Poor for reinforced soil Good for all other wall types
Clay, sandy clay	Firm	Can be moulded with substantial pressure with the fingers and excavation with a spade	Poor for reinforced soil Good for all other wall types
Sand, silty sand, clayey sand	Loose	Dry lumps may have slight cohesion but easily breaks up in fingers. Readily excavated with spade. 50mm peg cam be easily driven.	Good for all wall types
Silt clay, sandy clay, silty clay	Soft	Easily moulded in the fingers and readily excavated with spade	Requires careful design
Silt clay, sandy clay, silty clay	Very soft	Exudes between fingers when squeezed in fist	Requires careful design
Peat	-	Organic material	Not suitable
Made ground	-	Ground that has been filled	Not suitable needs foundation below this level.

Retaining Wall Solutions

Key Benefits:

- The retaining wall will not fail subject to being built to the design.
- You will have the correct material specifications
- You will have a copy of the calculations for third parties
- You will have a section through drawing of the wall
- You will be protected by the engineer's professional indemnity insurance

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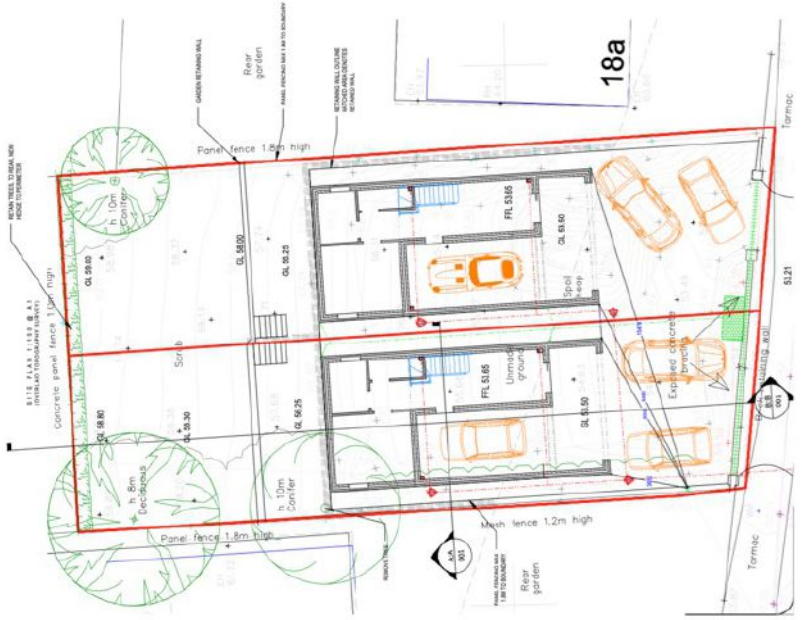

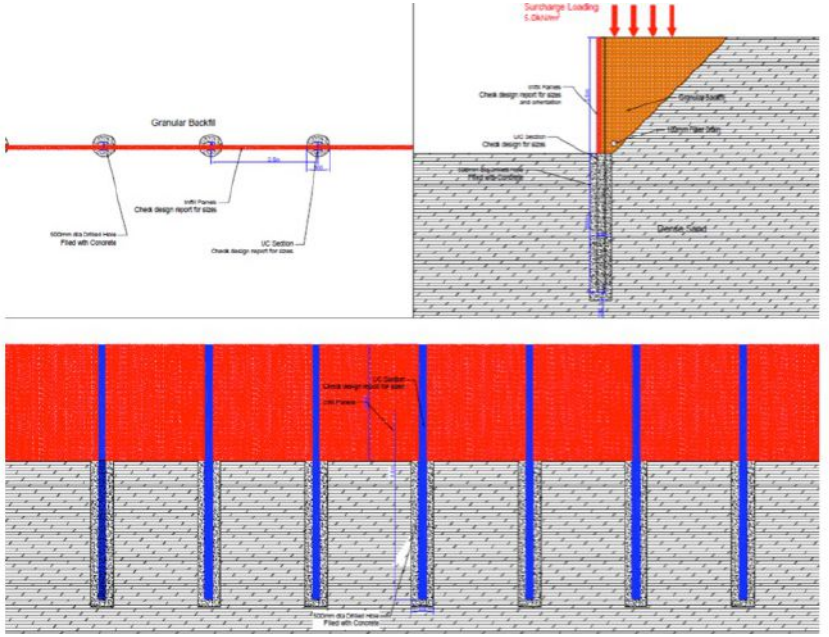

King post design for a small development

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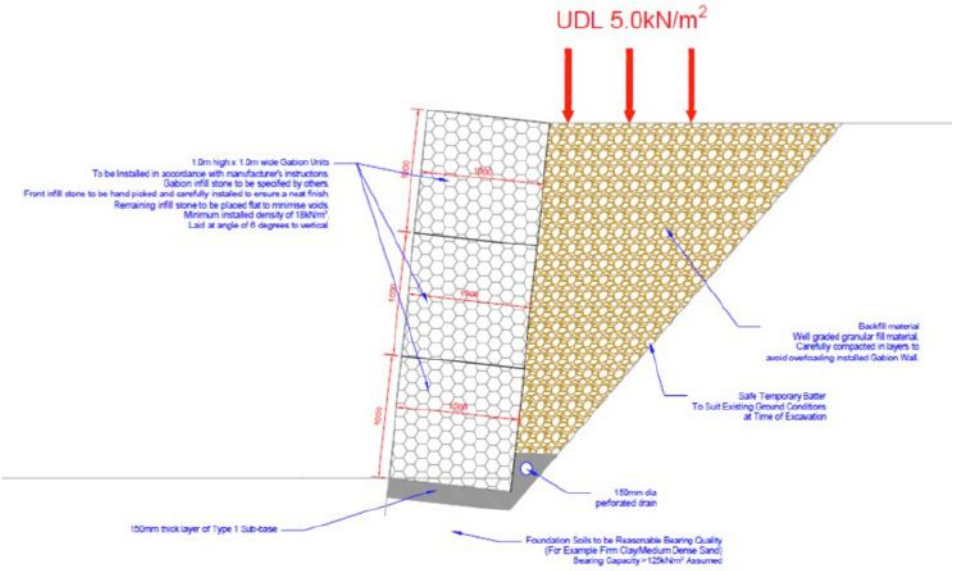

Gabion basket design for a developer

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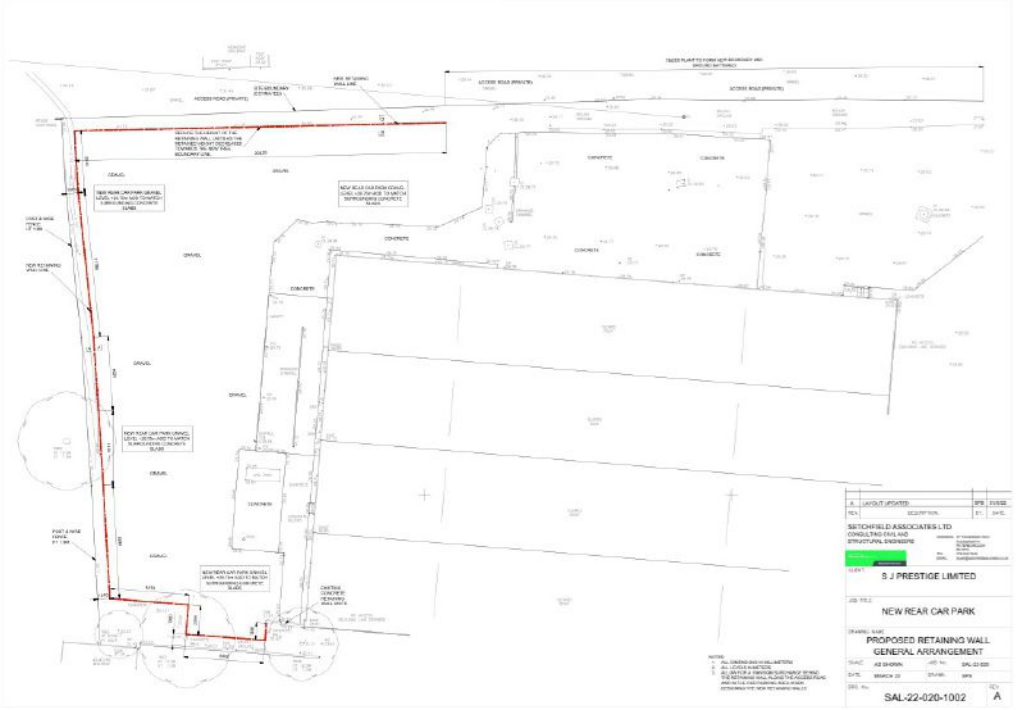

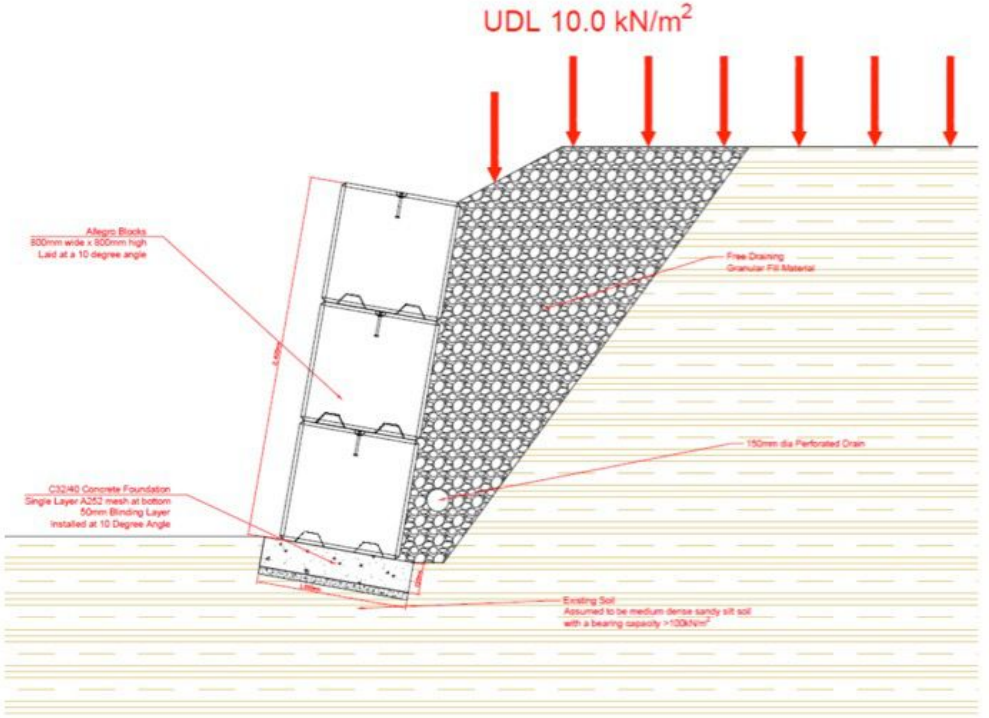

Concrete inclined block wall for a commercial project

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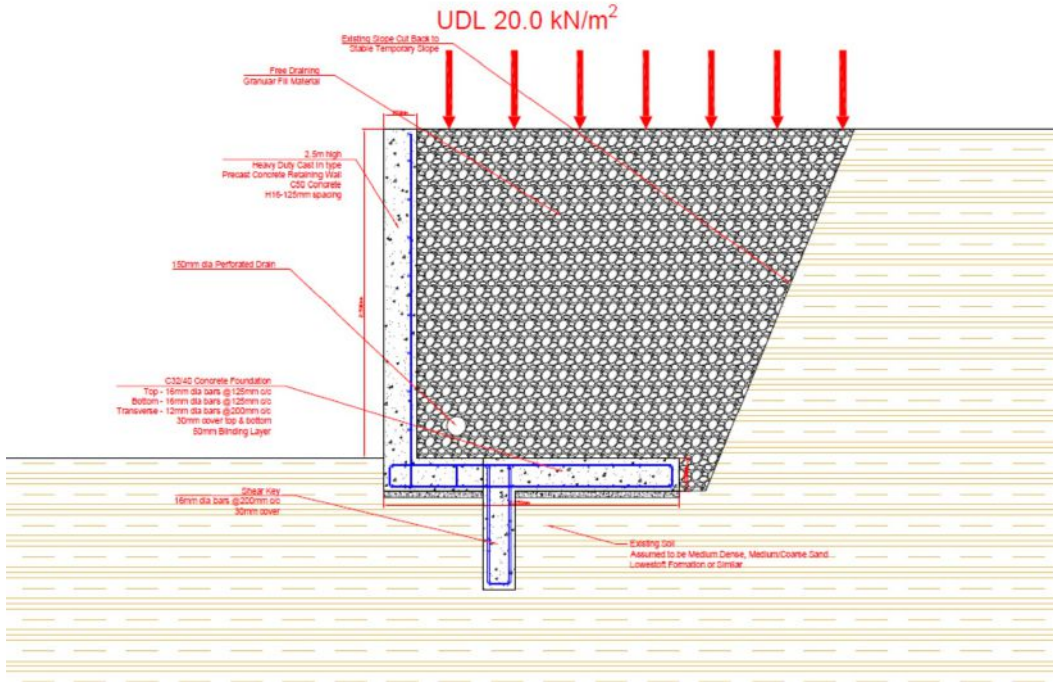

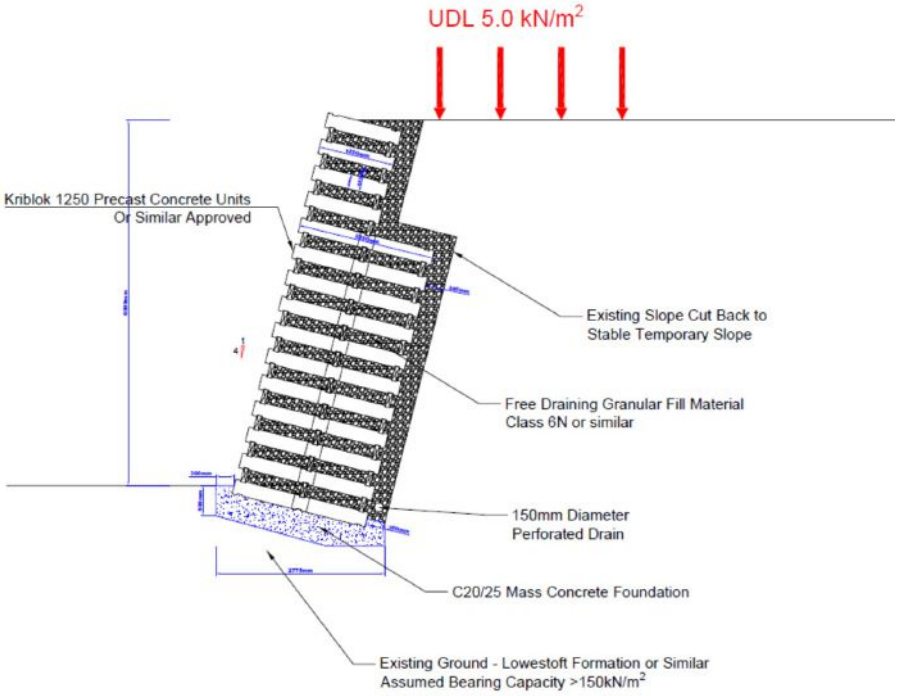

Cast in L shape and a criblock retaining wall designs

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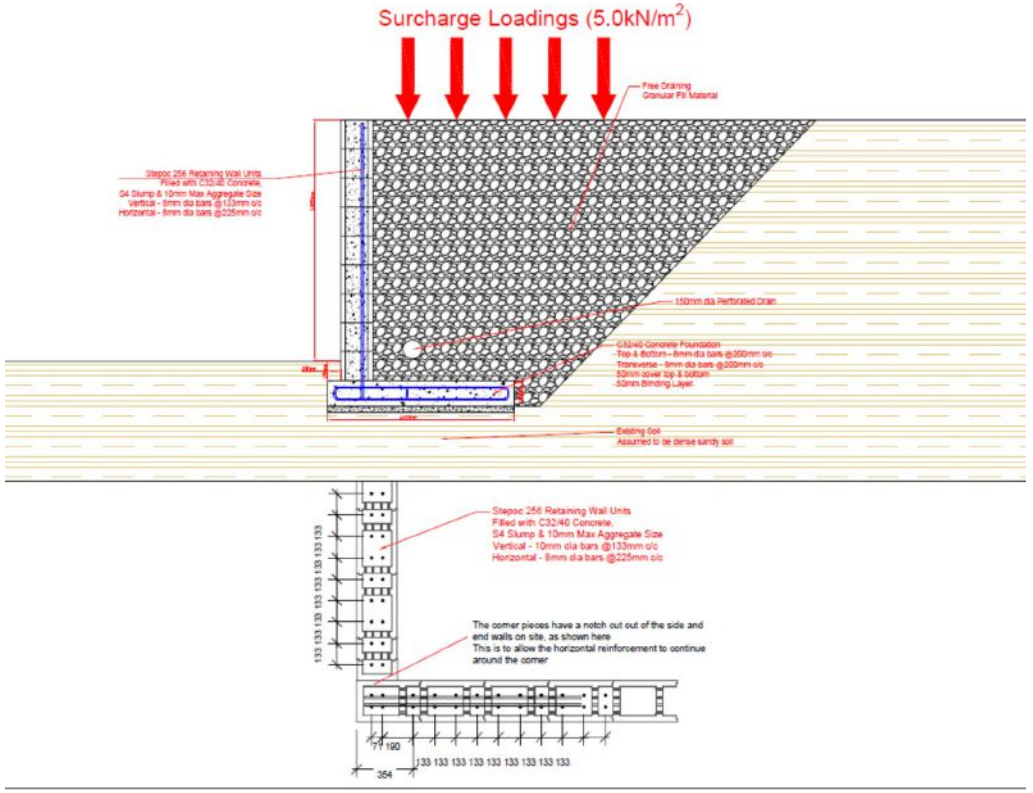

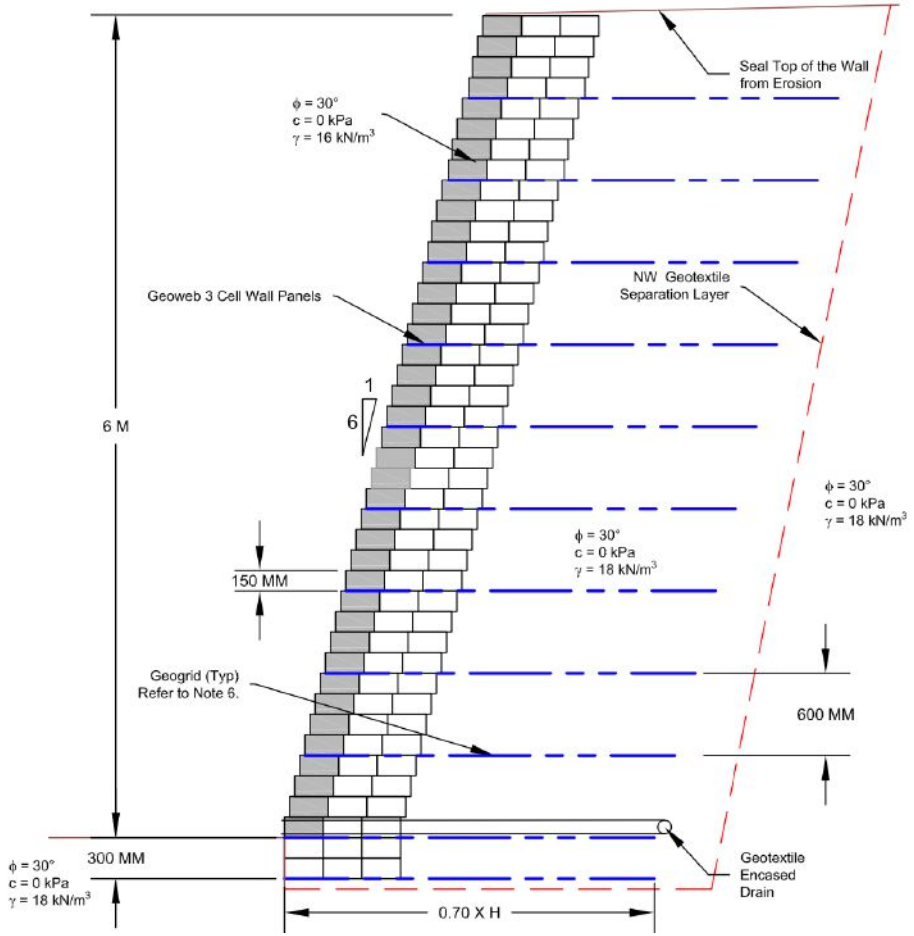

A hollow block (Stepoc) and a reinforced soil retaining wall designs

Retaining Wall Solutions

Every project is different with different soil types and site constraints. We highly recommend your retaining wall project begins with a structural design.

Conclusion

Retaining wall design and engineering

Bob Evans

The Next Step

- Tell us about your project.
- Complete the form.
- We are here to support you.