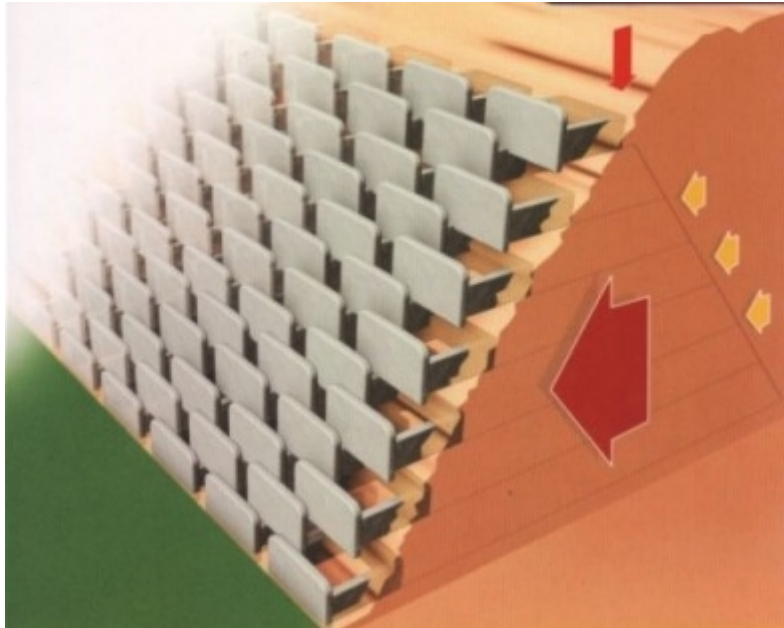
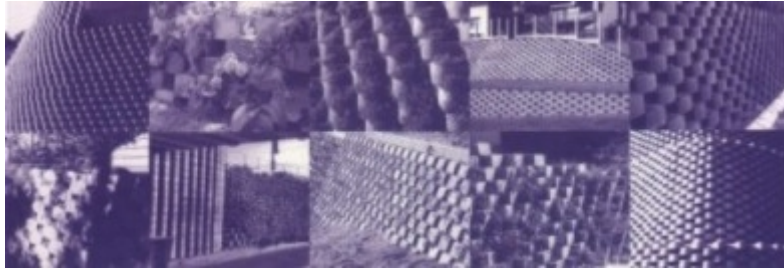


CONCRETE RETAINING BLOCK WALL DESIGN CHECK LIST



Side elevation of CRB wall depicting gravity forces and soil pressure exerted on the wall



This checklist is published by the
CONCRETE MANUFACTURERS ASSOCIATION as a guide for engineers
in the design of Concrete Block Retaining Walls

General

Check with local authorities regarding their requirements for design and supervision of such structures and the submission of plans, calculations and stability certificate.



Geotechnical considerations

The design of a concrete retaining block (crb) wall involves geotechnical rather than structural considerations and as such, the properties of the insitu soil and fill are of paramount importance:

- a. At what level are the foundations to be constructed?
- b. Is the retaining wall to be built in cut or fill?
- c. What are the insitu soil parameters for cut, i.e. friction angle, cohesion characteristics, volume changes on wettings, effect of compaction on soil parameters, amount of compaction required, density of soil?
- d. What are the insitu soil parameters (as for c) at foundation level?
- e. What are the parameters (as for c) of imported soil to be used in fill situations?
Granular fills should be used wherever possible.



Loading Considerations

- a. What surcharge loading can be expected, after construction and in the future?
Are any structures to be built on top of the retained fill within a distance of less than 1,5 x the height of the wall?
Are there any lateral loads from guardrails and barriers?
- b. What are the horizontal earth pressures on the wall?
- c. Is the wall likely to be extended? Often walls are designed and built for a certain height, but then are extended higher without the knowledge of the original designer.
- d. Are the wall and crb units to be subjected to hydraulic forces, waave action etc.?
Scour action can undermine the wall foundations.
Walls have to be founded at a depth below which wave action will not affect them



Drainage Considerations

- a. What are the seepage and groundwater conditions likely to be?
- b. What are the surface drainage conditions, gradient, direction of flow, type of surface, vegetation?
- c. Is a cut-off drain required at the top of the wall?
- d. Has the possibility of the erosion of soil through the voids between the blocks been considered?



Stability of wall

Check the wall against all the failure modes as shown in the diagrams below



Design Considerations

- a. What is the mass per square metre of walling (the mass of crb as well as the infill soil)?
In some cases, two or more adjacent rows of blocks may be required or the blocks may need to be filled with concrete to achieve the required mass per square metre.
- b. At what batter is the wall to be designed and built? Batters are normally achieved by stepping the blocks back or by rotating the base blocks and foundation.
- c. Are geosynthetics required to reinforce the soil behind the wall?
Geosynthetics should be considered for all walls greater than two metres in height, or with a batter steeper than 70°. Use of geosynthetics incorporated in the soil behind the wall will create a composite gravity mass structure.
- d. What properties are required of geosynthetics? Note that geosynthetics cover a wide range of geotextiles, geofabrics and geomembranes with varying properties.
Check with supplier regarding these properties.
- e. How is the geosynthetic to be fixed to the crb units? The method of fixing the geosynthetic to the crb units and the Young's Modulus of the geosynthetics are important to ensure that the designed stresses are activated within the acceptable movement of the fill and facing.
- f. How far must the geosynthetic extend into the fill, and what vertical spacings?
- g. Are the construction procedures and controls in place to ensure proper construction and compaction both behind the wall and in the blocks?

Note: Improper compaction is a common factor causing failure of crb walls.



Quality of Concrete Retaining Blocks

- a. Are the concrete retaining blocks of sufficient strength and within acceptable tolerances?
- b. Are the crb units subjected to aggressive water or chemicals?
If so, a higher cement content should be considered.
- c. Is the shear nib or the shear key of sufficient strength to resist the shear forces between blocks?



Services

- a. What services are behind or in front of the toe of the wall and how will they be accessed if repairs are necessary? It is not advisable to place water or irrigation pipes behind the wall as this can cause failure of the wall if the pipe bursts.
- b. Ensure that steps are taken to prevent excavation of trenches in front of the toe of the wall, as this undermines the stability of the wall. No excavations are allowed within at least 1m from the toe without consulting the design engineer.

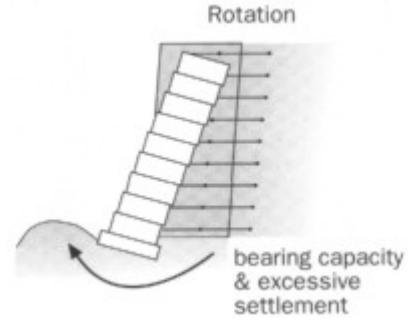
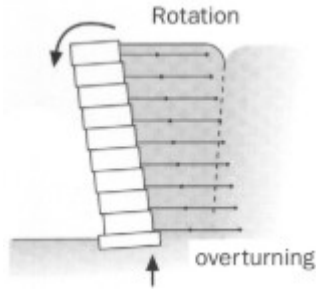
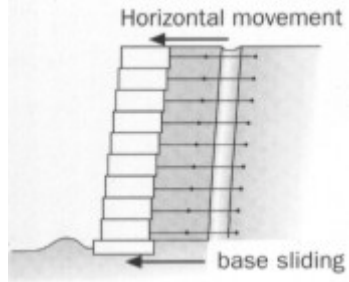


Aesthetics

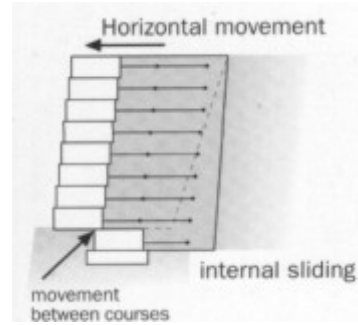
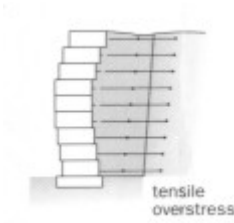
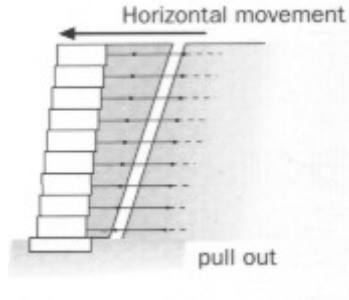
- a. Is the layout of the wall in harmony with and enhancing the environment?
- b. If the wall is to be vegetated, have the following factors been taken into account: fertilizers and top soil in front of the blocks, types of plants to be planted, the planting, watering and maintenance of plants?
Refer to CMA technical note on **Plantability of concrete retaining block walls**.

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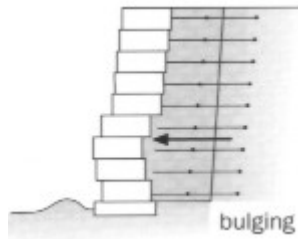
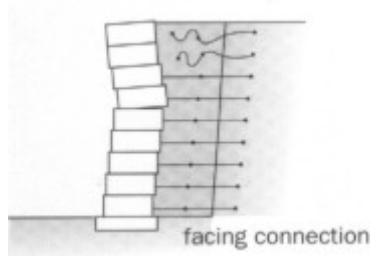
External stability



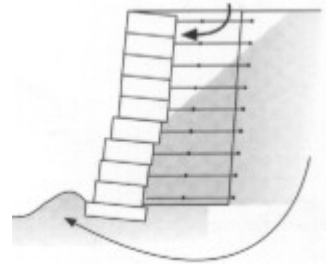
Internal Stability



Local stability of CRB units



Global / Overall/ Local Slope stability





CAUTIONARY NOTE

The use of concrete retaining blocks (crb) for the construction of retaining walls is growing at a rapid rate, due to the low cost, the ease of installation and the ability to vegetate the walls. However, the ease of installation has resulted in the perception that little technical input is required to build such a wall, irrespective of the height.

It is important to note that these walls, which are built with a batter (sloping back towards the soil), are subjected to tremendous loading and in cases of high walls, do require the input of a professional engineer of competent person.

A rule of thumb is, where the wall is less than 1,2m built to a batter of 70° (from horizontal) and where soil and drainage conditions are good, there should be no need for an engineer. Where however, the height of the wall exceeds 1,2m, or if problem soils (clay) or a high water table exists, or where a structure is to be erected on top of the retained fill close to the wall, then the services of an engineer or competent person are required. In such cases, the local authorities should insist on a design and stability certificate from the engineer.



note: The design manual for Segmental Retaining Walls from the National Concrete Masonry Association of the U.S.A is available from the Concrete Manufacturers Association at a cost of R400-00 *(Subject to exchange rate)*

CMA MEMBERSHIP LIST

T = ROOF TILES P = PAVING
R = RETAINING WALLS M = MASONRY S = SLABS

CRB Wall - Producer Members

Bay Stone Sales	(0351) 91 931
Concor Technicrete	(011)495 2200 (013)96 1153 (013)758 1203 (057)391 4200 (017)636 0666 (018)781 6061 (017)689 2100 (015)293 2631 (018)484 3089
Corobrik (pty) ltd	(031)560 3911 (0331)45 6231
Deranco Blocks (Pty) Ltd	(041)63 3338
Grinaker Precast (Pty) Ltd	(012) 652 0000 (031)84 1304
Inca Masonry Products (Pty) Ltd	(0431)945 1215
Inca (Cape)	(021)904 1620
Klapmuts Concrete (Pty) Ltd	(021) 541 2056
Neat Contech	(046)648 1359
Vanstone	(012)541 2056
Watson Tile & Concrete (Pty) Ltd	(011)740 0910

MPR	Teraforce (Pty) Ltd	(021)45 1907
MPR	Wates, Mering & Barnard	(011)315 0316
MPRT	Other Producer Members	
MPR	Bafokeng Brick & Tile	(0142)96 0842
MPR	Blocon Cement Producers (Pty) Ltd	(03431)58 060
MPR	Brickcast	(031)507 5525
MPR	Columbia DCM (Pty) Ltd	(021)946 3290
MPR	Coverland Roof Tiles	(016)421 4010
MPRT	Craig Roof Tiles	(011)914 1730
PR	Echo Floors (Pty) Ltd	(031)957 2033
MPR	Echo Prestress (Pty) Ltd	(011)393 4655
MPR	Fastfloor Systems	(011)826 9111
MPRS	Lategan's Cement Works	(021)873 1154
MPR	Marley Roofing	(011)316 2121
PRS	Mimosa Brick (Pty) Ltd	(016)620 507 (09264) 612804113
MPRT	Precast Concrete Industries	(09254)253 0504
MPR	Simbarite Limited	(09254)253 0504
R	Stanger Brick & Tile (Pty) Ltd	(032)457 0237
MPRS	Superslabs SA (Pty) Ltd	(011)952 1610
PR	Vibro Bricks (Pty) Ltd	(012)374 2032
MRT		

Non-Producer Members

Boss Paving (Pty) Ltd	(031)466 1368
Fosroc (Pty) Ltd	(011)908 1890
Natal Paving (Pty) Ltd	(031)29 3115
Pave Show cc	(012)46 9545
PPC Cement (Pty) Ltd	(021)550 2100
Procter Johnson SA	(041)51 5206
PYW Paving cc	(031)903 2104
Rampf Formen GmbH - Germany	(0949)7391 5050
Randpave Industrial Contracts	(011)805 1894
SA Paving (Pty) Ltd	(011)483 1350
Siliseal Waterproof Systems	(031)705 4261 (011)464 1409
Slagment (Pty) Ltd	(011)403 4215
Thermolite (Pty) Ltd	(011)728 3575
W R Grace (Pty) Ltd	(011)923 4600

CRB Wall - Contractors

BCT Construction cc	(011)788 8732
Earth Retaining Eng Systems	(01211)53 5081
Echo Terracing	(011)782 0686
Friction Retaining Structures	(011)622 2704
Kalode Construction	(011)447 6740

Non-Producer Members

Africolour	(011)474 0620
Ash Resources (Pty) Ltd	(011)886 6200
Bayer (Pty) Ltd	(011)921 5911
Besser Company	(091)517 354 4508
Birkenmayer H (Pty) Ltd	(011)970 3880

Cement Producer Members

Alpha Cement	(011)780 1000
Blue Circle Cement (Pty) Ltd	(011)447 8360
Cement & Concrete Institute	(011)315 0300
Natal Portland Cement	(031)450 4411
PPc Cement (Pty) Ltd	(011)488 1700