Gravity retaining Terraforce wall

Designing better with Terraforce

When considering retaining wall options, it pays off to consider the many Terraforce wall design choices available. Cutting corners at this stage will lead to a disappointing result.

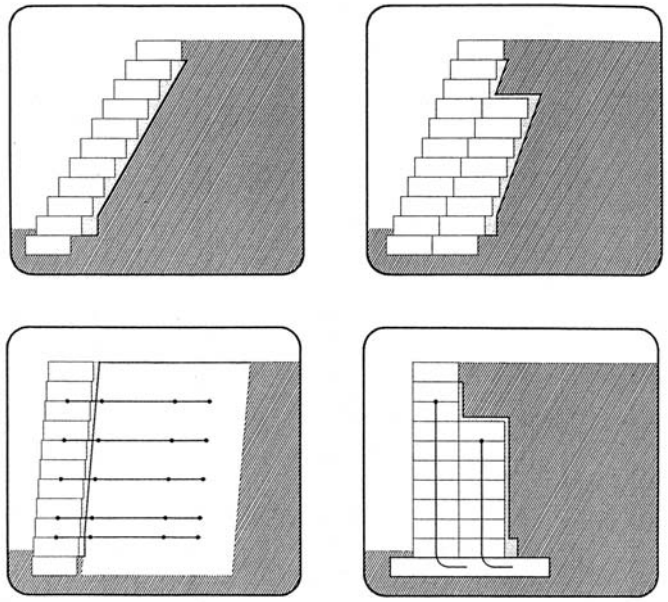
Who designed it first?

The question of 'who deserves the laurels' among CRB (concrete retaining block) designs has been hotly contested during the past 40 years. However, the reality is much more mundane, with a process that started over 3500 years ago, in various parts of the world. By mixing clay with straw, by neatly packing large boulders or by filling reed baskets with rocks and gravel, retaining walls or barriers were built. About 45 years ago, a German concrete pipe manufacturer started to produce the first hollow concrete retaining blocks. Since then many alternatives systems, in different shapes, sizes and functions have been developed, based on the concept of block weight, friction and interlock to stabilise down-slope movement.

First Things first.

At the beginning of the design process, site conditions must be assessed, geotechnical, loading and drainage. Next, the geometry of the wall, as well as aesthetic requirements are to be decided. Finally, the planner will have to look at design options as well as extended application that the specified system can offer.

Terraforce blocks are tested on a regular basis



Light to heavy, composite or vertical/RC filled retaining wall designs

Who or what?

Wall designers can choose between a few systems on the market, with elevations ranging from open face checkerboard appearance to a closed vertical surface structure. Although most suppliers claim to offer a plant supportive system, the reality looks less rosy.

Some systems are interlinked while others interlock on the vertical and/or horizontal plane. All systems rely primarily on constructed mass, (block weight and weight of soil, gravel or concrete contained within the

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block) and on inter-block friction to derive a measure of sliding resistance and to a lesser degree on an interlock between blocks. Clearly, no amount of interlocking or interlinking - nor the much punted stiff upper lip - will prevent a structure from collapsing or overturning when substantial active lateral earth pressure occurs.

Single skin wall, cement stabilised back-fill

The many design options Terraforce can offer in comparison to other systems on the market make it a great choice for end-users that are looking for top-quality, versatile solutions to their earth retaining challenges.

Show me those test results!

It is important that the supplier of any retaining wall provides information concerning general block specification, dimensional tolerances of blocks, as well as whole block compressive strength and inter-block shear or sliding resistance. Further test results, such as Geogrid pull-out resistance, must be available for the design of Composite or Mechanically Stabilised Earth (MSE) retaining walls.

1. Gravity Walls

Light gravity retaining walls normally consist of a single skin of blocks and should not exceed a certain height limit. Check with your local building authority to find out the height limits for your region.

Sometimes when excessive lateral earth forces are present or walls need to be vertical due to lack space, it is most cost-effective to apply a double layer of blocks, like two onion skins, to reach the required resisting mass for the wall. It may also be useful to apply a cement stabilised backfill, to ensure little or no settlement. To maintain the long-term integrity of the backfill in gravity walls it is vital to ensure no undue moisture (surface water or sub-soil) enters or remains within the backfill material. Systems with a closed vertical face should be preferred as they allow better compaction of the backfill.

2. Composite Walls

This method has gained in popularity since the appearance of industrially produced reinforcing sheets of geo-synthetics, also known as geogrids (woven or extruded).

Geo-synthetics are incorporated in layers into an engineered body of backfill and clamped into the fascia of CRB's to form an integrated, monolithic body of fascia and reinforced backfill. **Terraforce blocks performed above industry standard during pull-out resistance test performed in Canada.**

Because of their inherent flexibility, such retaining walls can accommodate moderate movement and settlement that is vital to mobilise the necessary resisting forces.

This explains why it is advisable to build composite walls with an inclination of not less than 3° off vertical, say 87° instead of 90°. Especially in territories where earthquakes may occur or where unstable ground conditions prevail, MSE's are increasingly first choice.

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Before: Double skin, geogrid reinforced

After: The wall fully planted

3. R.C. Concrete Filled Walls

This method resembles conventional reinforced concrete or reinforced building block retaining walls, where the foundation must be wide enough to cantilever and resist the bending moments exerted by the retained soil.

Hollow, interlocking CRB's with a closed face structure are sometimes used in these applications for certain site conditions, provided their shape allows the application of reinforcing bars with sufficient concrete cover. Advantages of this type of wall design include no formwork and some changes in setback for improved aesthetics.

4. Mixed Applications

Designs that combine more than one of the above options are increasingly being specified by Terrasafe CC, a service affiliated to Terraforce CC. Such designs can offer stability advantages, unrivalled by others, while keeping cost benefits associated with CRB wall construction. **These types of wall designs should only be attempted by experienced engineers.**

Experience and qualification rules ALL.

Whatever method is chosen for any CRB application, there are other aspects that must be kept in mind. Apart from the professional input on the design side, it is vital to appoint an installer who has the necessary experience to undertake the installation.

Foundation with protruding re-bars

Geogrid reinforcing is placed at intervals

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Finished wall ready for landscaping

The designer must also ensure that the system to be specified has been tested and evaluated by professional accreditation agencies, to meet the challenges of the project. Terraforce design tools, services, test results, and evaluation report are listed below.

Resources.

- Maxiwall design software to facilitate preliminary designs for costing purposes. Visit for more information on this free software.

- Terrasafe CC. Terraforce affiliated design service. Email for more information on this service: info@terraforce.com

- A collection of 250 case studies with examples depicting a large variety of applications. Contact info@terraforce.com

- Continued Professional Development (CPD) training course, covering design procedure and design guide, soon to be made available.

References, available at http://www.terraforce.com/downloads/

- Terraforce design guide for gravity retaining walls, with charts for L13 blocks and test results. 1991.

- N.C.M.A. design manual. (1993)

- Terraforce design and installation manual for composite and gravity retaining walls. 1995.

- I.C.B.O. Evaluation report 5448 of 2002.

- Terraforce minimum specifications.

- Laboratory test results and other applicable international standards. Request these at info@terraforce.com

Geogrid clamped between the blocks

The wall 50% completed