Interlocking, connectivity and friction in Terraforce walls:

Compared to conventional reinforced concrete retaining walls, segmental block walls offer several advantages. They are more versatile, easier to install and more cost effective. But therein also lies a challenge, namely to keep the counterfeiters and short cut takers at bay.

The intention of this document is to make our customers aware of the characteristics of various wall systems available and what is involved to produce, market and design sturdy concrete retaining block (CRB) walls.

There are a few systems to choose from, from open-face, interlinked systems with nibs to provide a measure of frictional resistance, to closed vertical face appearance, interlocking on the horizontal plane and/or on the vertical plane.

All retaining wall systems, when used as simple gravity walls, rely primarily on constructed mass, (block weight and weight of soil, gravel or concrete infill) and on inter-block friction/interlock to resist the overturning forces of the slope behind.

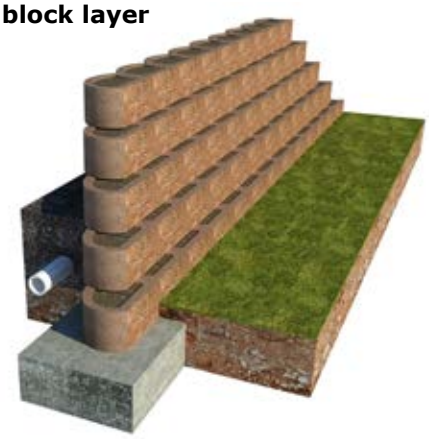
Clearly, no amount of interlinking or interlocking – nor the much punted "stiff upper lip" - will prevent a structure from collapsing or overturning when substantial active lateral earth pressure occurs.

When the designer's calculations show that the wall will not be stable, he will look at either adding more mass to the wall, by filling the blocks with concrete or by adding a second row of blocks behind the first row.

An experienced retaining wall designer will have numerous rational options at his disposal, options that no ready-made design software or excel program can realistically cover.

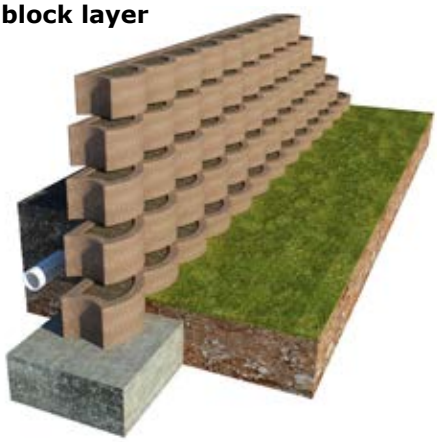
Some illustrations of designs possible, site dependent

Single block layer



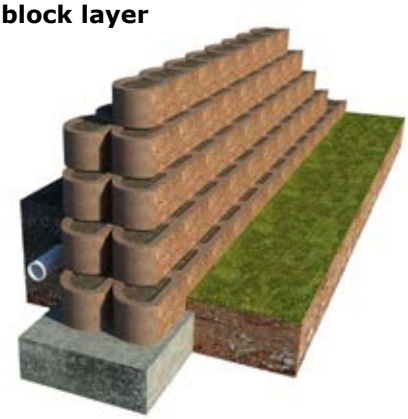
Light gravity retaining wall, rock face option

Single block layer



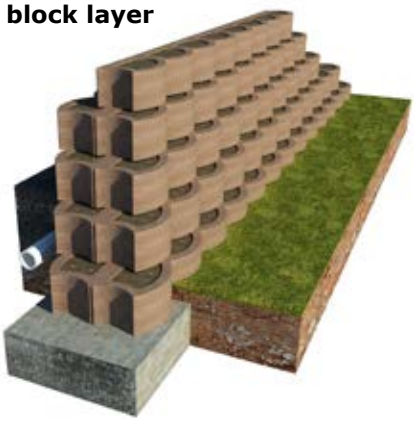
Light gravity retaining wall, round face option

Double block layer



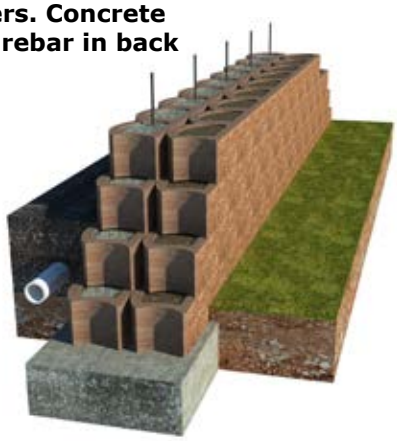
Heavy gravity retaining wall, rock face option

Double block layer



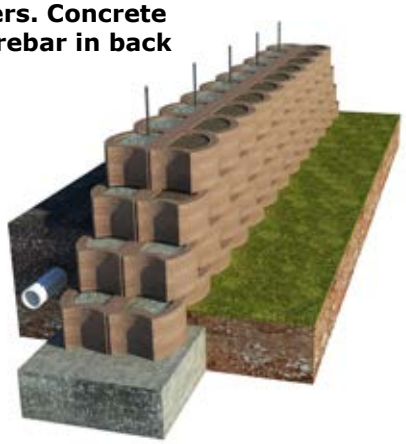
Heavy gravity retaining wall, round face option

Two block layers. Concrete infill and steel rebar in back layer



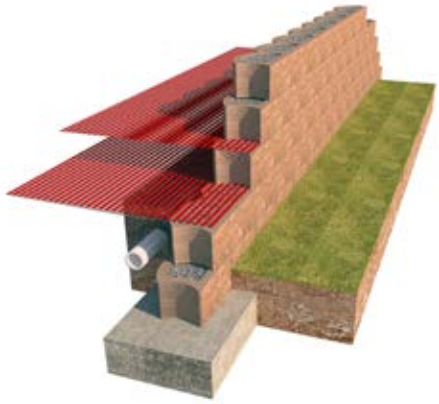
Reinforced gravity retaining wall, rock face

Two block layers. Concrete infilland steel rebar in back layer



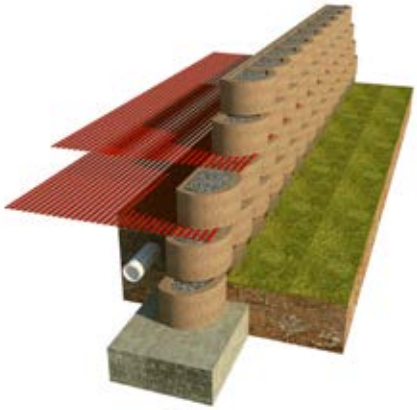
Reinforced gravity retaining wall, round face

Single block layer with geogrids



Composite retaining wall, rock face option

Single block layer with geogrids



Composite retaining wall, round face option

Should the designer find that even a heavy gravity retaining wall will not be able to withstand the forces, he can look at either a **composite wall** or wall built up with **reinforced concrete infill**.

For composite CRB retaining walls, geo-synthetic reinforced sheets are incorporated in layers into an engineered body of backfill and connected into the fascia of the CRB's to form an integrated, monolithic body of fascia and reinforced backfill.

Read more here: https://www.terraforce.com/7-2017-design-better-with-terraforce/

Reinforced concrete filled CRB walls are designed similar to the design of conventional retaining walls. This method can only be undertaken with hollow blocks such as Terraforce, that are large enough to acommodate rebar with sufficient concrete cover.

Experienced engineers will be able to produce a rational design, often combining two or more possible solutions.

The various Terraforce design tables, a table creator to aid in the initial planning and estimating progress, a substantial design manual that predates statutory design and specification requirements in some countries and a voluminous design guide for gravity and composite walls, are the results of exhaustive testing and research on four continents.

Initial tests (1991, Johannesburg, South Africa) focussed on block crushing strength and inter-block friction resistance, with or without different types of fill to determine the effect that the fill might have on the interlocking capacity of Terraforce walls.

Some years later, expanded tests and an evaluation report was commissioned to reconfirm those findings (2001, Ontario and California).

In those days there was only one lab available that was able to determine the connectivity testing or pull-out resistance between Terraforce blocks and geo-synthetic backfill reinforcement.

We are glad to share a quote from the report on pull-out resistance: **"Rupture of the grid always occurred outside of the blocks, when filled with gravel. The performance of Terraforce blocks exceeded industry standards."**

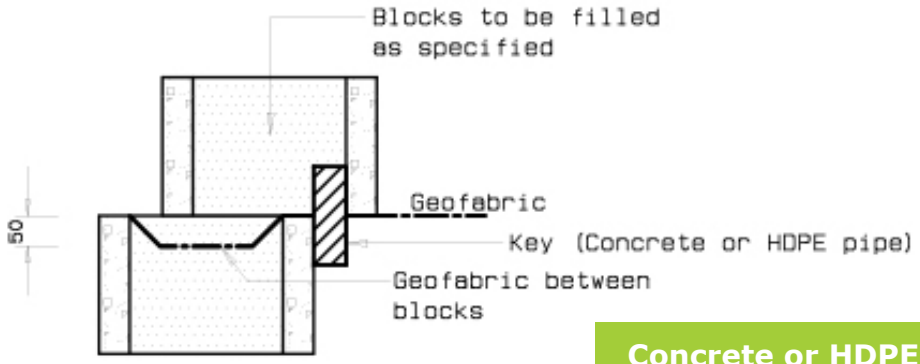
Follow-up tests were later conducted in Germany and recently in Australia to determine the effect of geogrid insertion on the inter-block friction resistance. The results of all these tests, evaluation report and feasibility studies have been incorporated into our recent (2022) comprehensive Terraforce Design Guide.

We occasionally receive enquiries about the interlocking capacity (horizontally through the shape of blocks and vertically through coarse infill or by installing internal keys, mortar, paving stones or HDPE pipe sections) of Terraforce blocks.

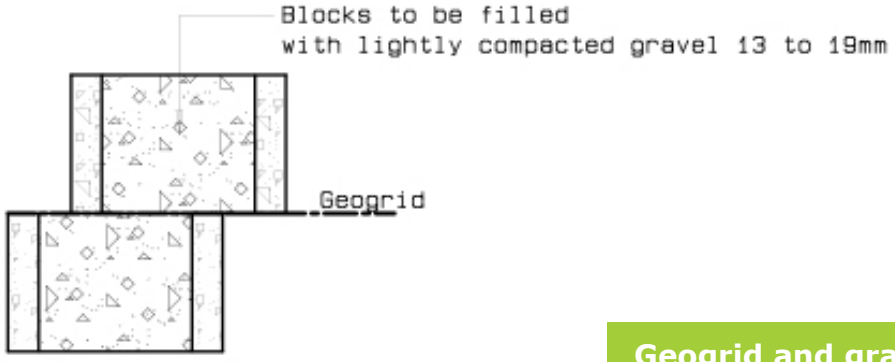
At Terraforce, we can confidently say all these methods have proven thier effectiveness. Some of the aboved mentioned methods, and the application of reinforced concrete within Terraforce retaining blocks, can provide a level of interlock that far surpasses what most other systems can deliver.

An experienced engineer, by applying rational design principles, will be able to deliver a robust and long lasting solution. Alternatively Terrasafe, the Terraforce design service can assist with such a design.

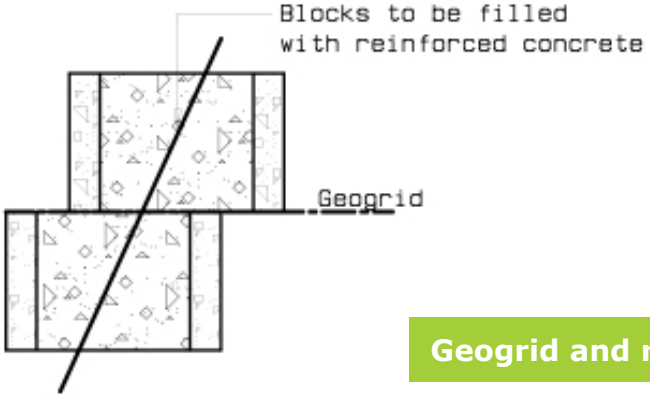
Possible interblock and geogrid/geofabric connections



Concrete or HDPE pipe as key



Geogrid and gravel infill



Geogrid and rebar and concrete infill

EXAMPLES

HDPE PIPE INTERLOCKING SECTIONS

HORIZONTAL AND VERTICAL REBAR

DOUBLE SKIN RC FILLED

GRAVEL FILLED WITH GEOGRID

REBAR REINFORCED CORNER

ROUND FACE WITH HEAVY REINFORCING

HEAVY DUTY VERTCICAL WALL, DOUBLE SKIN

EXAMPLES

RC FILLED WITH GEOFABRIC

COMPACTING CONCRETE INFILL IN BLOCKS

DOUBLE SKIN - CONCRETE FILLED

VERTICAL DOUBLE SKIN, RC FILLED WALL

SLOPING RC FILLED WALL

EXTRA HEAVY DUTY EARTH RETAINING

INFRASTRUCTURE AT IT'S FINEST