BUILD RIGHT

Low retaining walls

There can be large forces at work on retaining walls so they need to be well designed and built to avoid failure.

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RETAINING WALLS support the ground where there is a slope or change of grade. They must withstand the combined loads of the soil, water content and any surcharge or extra load such as sloping backfill, building or vehicle loads.

Consents when over 1.5 m

A building consent is not required under clause 1(c) *Exempt building work* of Schedule 1 to the Building Act 2004 when:

- a wall retains no more than 1.5 m of ground and
- does not support any surcharge.

A building consent must be obtained in all other situations.

Where consent is not required, the wall must still comply with the Building Code including clauses B1 *Structure*, B2 *Durability* and F4 *Safety from falling*.

BRANZ recommends that advice is sought from a chartered professional (structural) engineer for all walls over 1 m high.

Drainage needed behind wall

Retaining walls must have drainage behind the wall to prevent water build-up that increases the load or lateral pressure and reduces its bearing capacity.

Place a minimum thickness of 300 mm of clean metal or gravel drainage material immediately behind the wall. Extend from the base up to within 150–200 mm of the top of the wall.

All retaining walls must have a subsoil drain falling to the stormwater system and covered with a filter cloth or sock installed behind the foot of the wall to remove water. Weepholes must be provided through the base of a mass gravity wall and may be installed as a hydrostatic relief in other solid walls. BRANZ also recommends that:

- subsoil drainage is installed behind open retaining wall systems such as crib walls
- a layer of filter cloth is installed to separate the drainage material and the soil behind the wall.

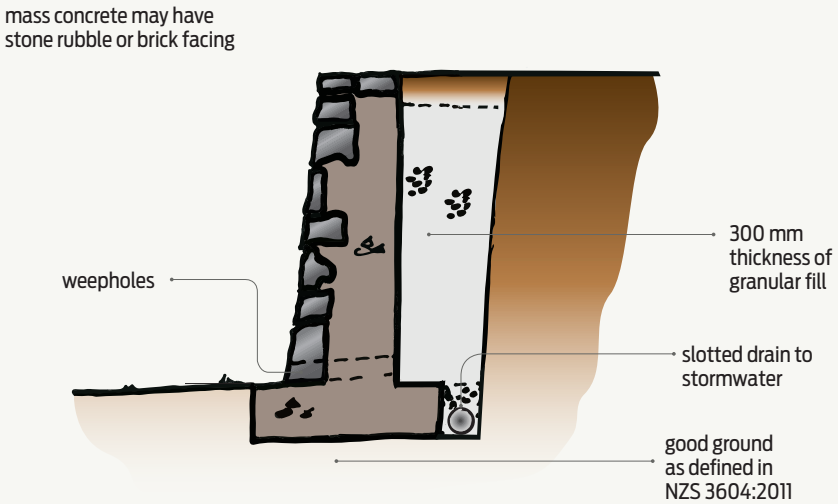

Figure 1 **Mass gravity retaining wall.**

Types of retaining walls

There are several different retaining wall construction systems, including:

- gravity walls, including mass gravity and crib walls
- segmental retaining walls, including mechanically stabilised embankment (MSE) walls
- concrete or concrete masonry cantilever retaining walls
- gabion walls.

Select a wall system that suits the site and soil conditions. Other factors to consider include the ability to get materials to the location of the wall, ease of construction, cost, appearance, drainage and water table level, and the distance from any adjacent slope.

Proprietary systems are available. These should be constructed in accordance with the manufacturer's information.

Mass gravity wall

A mass gravity wall gets its stability from its mass or weight. It has a low height-to-width ratio and is sloped back towards the bank (see

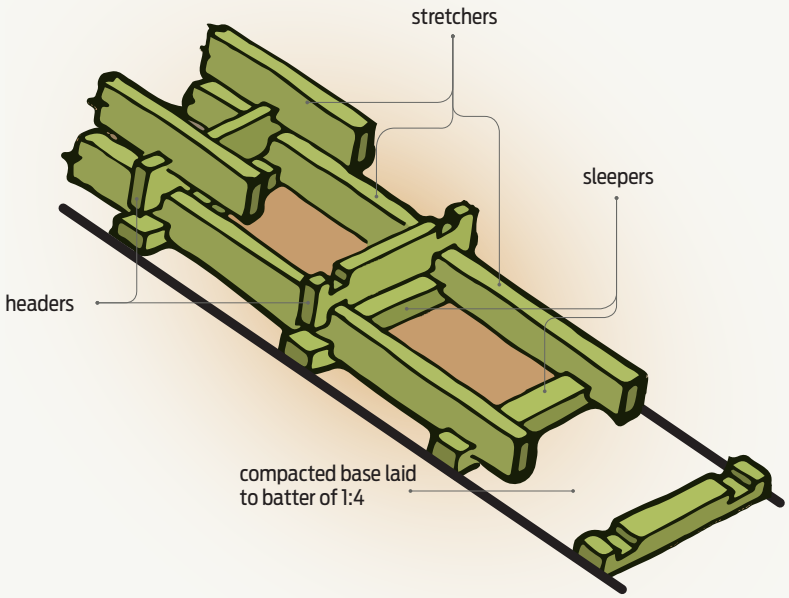

Figure 2 **Proprietary timber crib walling.**

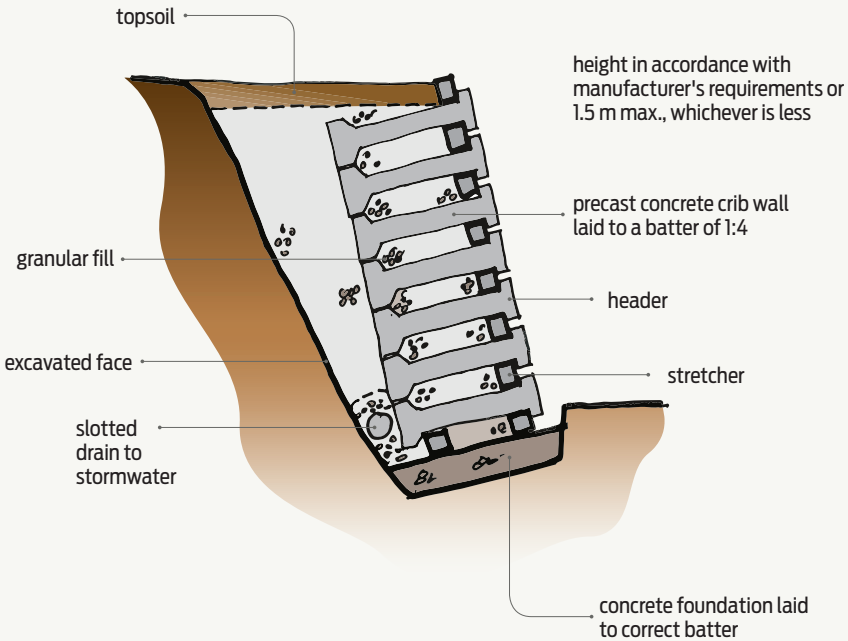

Figure 3 **Proprietary concrete crib walling.**

Figure 1). They are built of concrete or stone or a combination and laid on good ground as defined by NZS 3604:2011.

Crib retaining wall

Crib walls also retain by mass but the mass or weight is obtained from the backfilled material placed in the wall. They consist of either H5-treated timber or concrete interlocking header and stretcher units laid in tiers alternately, with a 1:4 backward slope or batter.

Once the units are laid, the whole structure is backfilled with granular drainage material (see Figures 2 and 3). The first stretcher course is laid on a concrete foundation or a compacted base to create the correct batter. They may have the outer section of the wall filled ➤

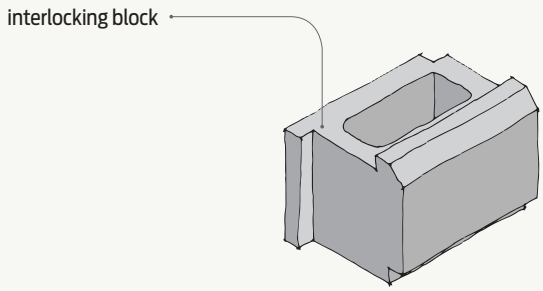

Figure 4 **Interlocking block.**

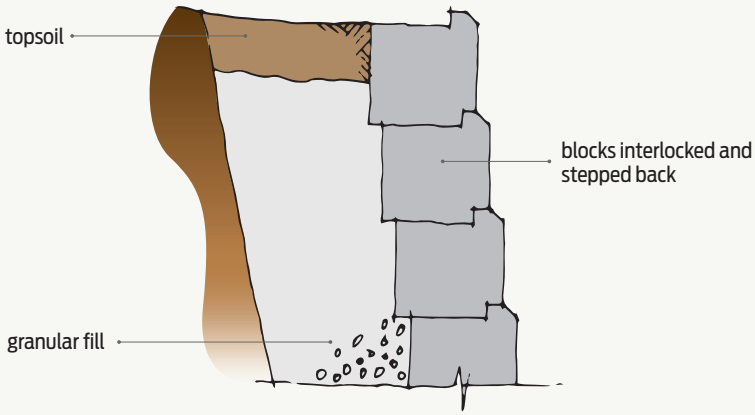

Figure 5 **Interlocked blocks in segmental retaining wall.**

with soil to enable planting of creeping or trailing plants.

Segmental retaining wall

Segmental or modular block retaining walls consist of dry stacked (without mortar), interlocking concrete blocks. The blocks interlock at each course (see Figures 4 and 5) and are stepped back to create the batter.

Additional stability is provided by filling the hollow blocks with soil. Alternatively, shear pin systems are sometimes used to secure the blocks .

Segmental retaining walls may also have geogrid reinforcing fabric buried in layers in the compacted backfill behind the wall to provide additional stability to the soil. These systems are referred to as mechanically stabilised embankment (MSE) walls.

Cantilever wall

Cantilever walls provide support either by the installation of a wide, horizontal footing at the base or by cantilevered poles embedded in the ground.

Wide-footing cantilever walls can be constructed from in situ reinforced concrete or precast concrete masonry block with a concrete footing (see Figures 6 and 7). For masonry cantilevered walls up to 2.2 m high, the details in NZS 4229:2013 may be used for the design.

Timber cantilever walls have H5 treated timber poles embedded vertically into concrete in the ground to approximately the same depth as the height of the wall. Poles are typically installed at between 900 mm and 1200 mm centres. They project above the ground to support horizontal, H4 treated timber half rounds or interlocking

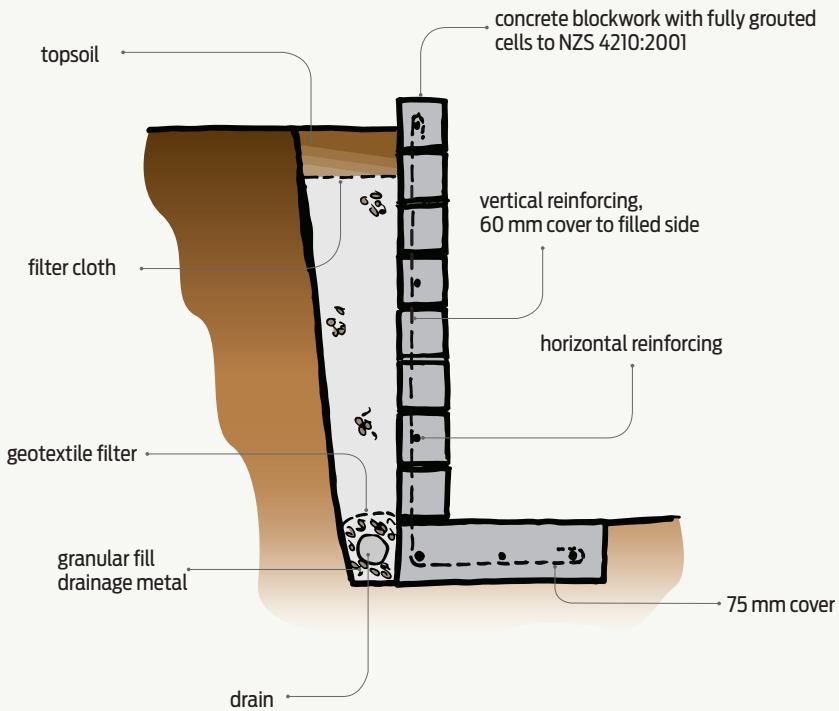

Figure 6 **Concrete masonry retaining wall for non-cohesive granular soil.**

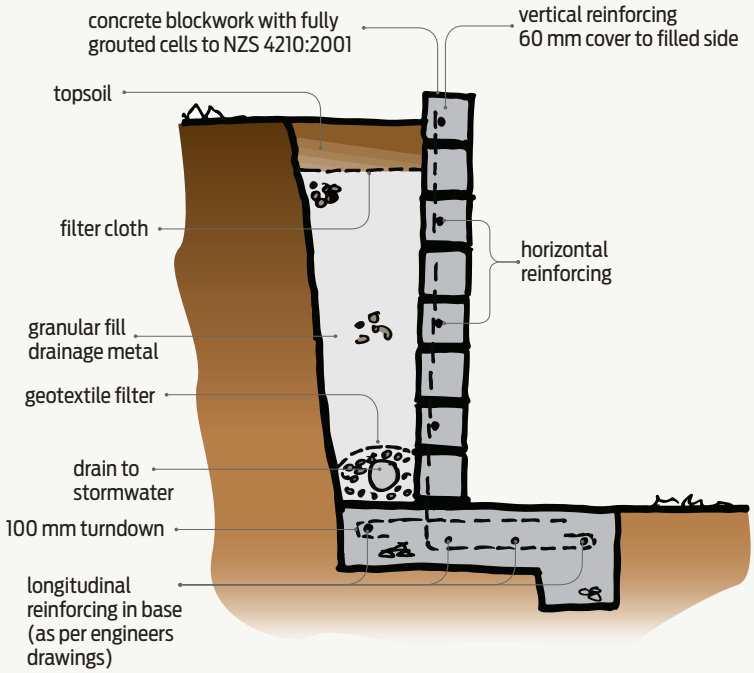

Figure 7 **Concrete masonry retaining wall for clay soil.**

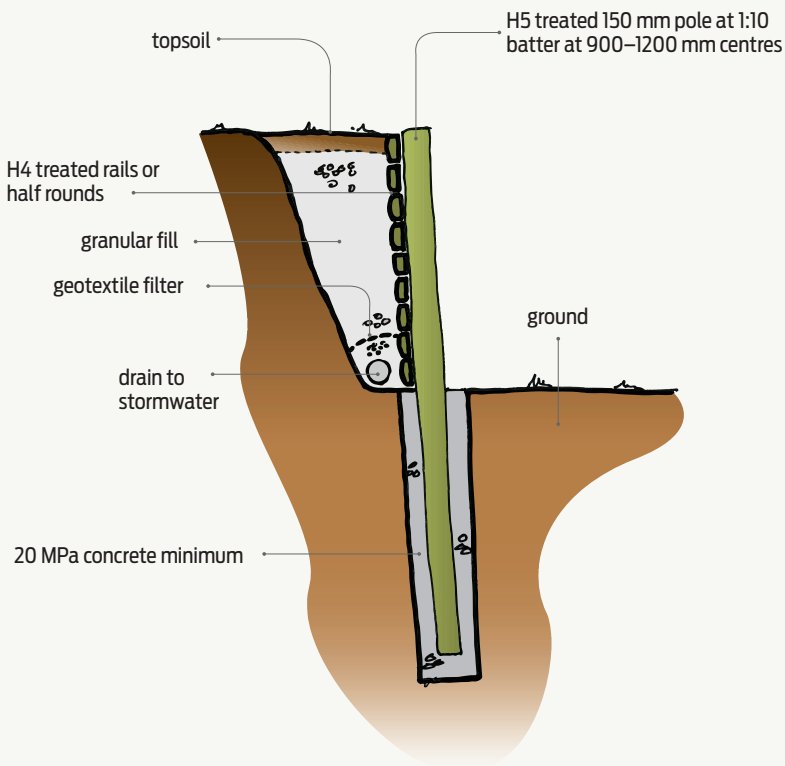

Figure 8 **Cantilevered pole retaining wall.**

tongue and groove boards behind the poles (see Figure 8). Design details may be available from pole suppliers.

Gabion wall

Gabion walls also rely on the mass of the wall to provide retaining. They consist of steel mesh baskets, filled with locally sourced rocks or stones, which may be tied together and stacked in tiers.

The baskets can be made to any shape or wall configuration but they should not exceed a 2:1 height to width ratio and may be inclined up to 7º.

Gabion walls do not need concrete foundations, but the bottom of the wall should be 150–200 mm below the finished ground level to provide stability. Geogrid reinforcing fabric is sometimes buried in the backfill behind the wall.

Relevant standards and extra information

Standards relevant to retaining walls include:

- NZS 3602:2003 *Timber and wood-based products for use in building*
- NZS 3604:2011 *Timber-framed buildings*
- NZS 3640:2003 *Chemical preservation of round and sawn timber*
- NZS 4210:2001 *Masonry construction: Materials and workmanship*
- NZS 4229:2013 *Concrete masonry buildings not requiring specific engineering design.*

For more Refer to BRANZ Bulletin 562 *Low retaining walls*.