

NOVEMBER 2016

# GRANDWALL

*retaining walls installation guide*



# RETAINING WALL

## *information*

Austral Masonry Grandwall retaining wall blocks are an ideal choice for retaining walls in gardens, other residential applications and commercial projects. The interlocking and dry stacked nature of these, makes them easy to install for the “Do It Yourself” landscaper. No matter what the project, the result is always an attractive and low maintenance retaining wall. The flexibility of the system provides tremendous scope, from edging to terraces, straight walls to curves.

**Note: Information contained in this installation guide is offered as general advice only.** Please consult with regulating council for local design requirements prior to the commencement of any retaining wall and consult with a professional engineer prior to commencing any retaining wall project. Councils may request walls over 0.5m in height and / or where a surcharge exists (e.g. driveway, house, fence or other structure) be designed and certified by a suitably qualified engineer.

### Specifications

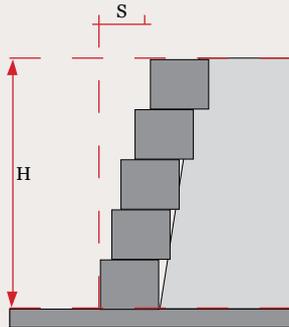
Product	Range	Description	Max Wall Height	Size	Weight	Coverage
	Grandwall	Wall Block	810mm*	390L x 245W x 162H	17.5kg	16 Blocks per m <sup>2</sup>
	Grandwall	Corner Block	-	340L x 140W x 162H	20kg	N/A
	Grandwall	Capping Unit	-	195L x 245W x 65H	6kg	2.56 Blocks per lineal metre

Maximum wall heights in good soils (gravels, sandy gravels, crushed sandstone).

\* Grandwall can be built up to 3m when designed by a qualified engineer and combined with soil reinforcement or No Fines concrete.

**Wall Setback**

On straight walls, each course of blocks is set back 10mm (slightly more on curves). The table to the left shows the estimated setback based on wall height and is offered as a guide only.



**Wall Set Back 1:20 Easy Reference Chart**

Wall Height (H)	Horizontal Setback Distance (S)
1m	40mm
2m	90mm
3m	140mm

**Estimating Materials**

**Calculating Block Quantities - Example Wall**

10m long by 3 courses high

*Blocks*

(10 metres x 2.57 blocks per metre) x 3 courses = 77.1 blocks (78 blocks total)

Add 5% Extra (Breakages, curved walls, cuts) = 82 Blocks

*Capping*

10 metres x 2.57 capping blocks per metre = 25.7 capping blocks (26 blocks total)

Add 5% Extra (breakages, curved walls, cuts) = 28 capping blocks

**Your Checklist**

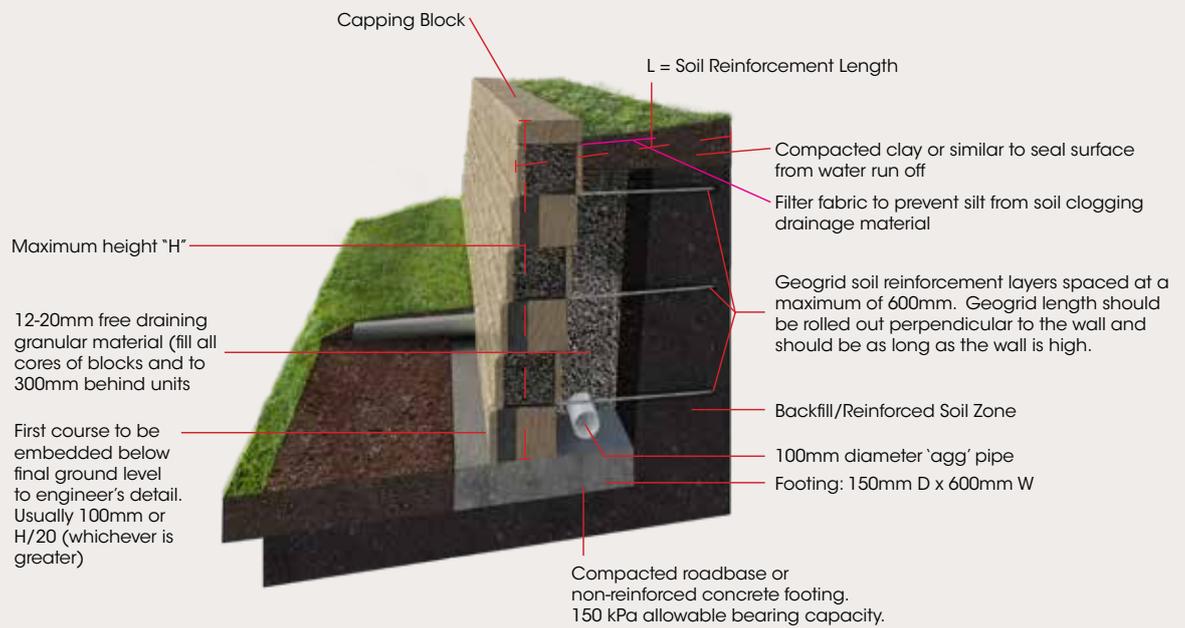
- |                          |                 |                          |                                       |
|--------------------------|-----------------|--------------------------|---------------------------------------|
| <input type="checkbox"/> | String line     | <input type="checkbox"/> | Agriculture Drain Pipe                |
| <input type="checkbox"/> | Tape measure    | <input type="checkbox"/> | Pegs or stakes                        |
| <input type="checkbox"/> | Walling units   | <input type="checkbox"/> | Broom                                 |
| <input type="checkbox"/> | Compaction Tool | <input type="checkbox"/> | Gloves & eye protection               |
| <input type="checkbox"/> | Shovel          | <input type="checkbox"/> | Mitre saw (to cut blocks if required) |
| <input type="checkbox"/> | Spirit level    | <input type="checkbox"/> | 10-20mm Crushed stone                 |
| <input type="checkbox"/> | Wheel barrow    | <input type="checkbox"/> | Crushed rock (for base)               |

# SOIL REINFORCED WALLS WITH GEOGRID

## Overview

Austral Masonry's Grandwall segmental block retaining wall system utilizes its shape and weight in order to resist the lateral earth pressures. In combination with geogrid soil reinforcement, these walls can be built to substantial heights, without costly structural reinforced concrete footings.

## Cross Section Diagram - Grandwall Soil Reinforced Walls with Geogrid



## Geogrid Requirements

The length, location and grade strength of geogrid is dependent on the wall height, loading on top of the structure, and soil properties. The following table is in accordance with AS4678: 2002 - Earth Retaining Structures.

**Note:** Please consult with appropriate council for design and construction regulations. Councils in general require walls to be designed and certified by a suitably qualified engineer where the wall is over 500mm in height or will have a surcharge load such as a road, building or hydrostatic pressure is present. The suitability of the information contained in the table must be referred to a qualified consulting engineer. These tables are provided as a guide only.

# SOIL REINFORCED WALLS WITH GEOGRID

## Geogrid Table - Guide Only

Surcharge	Wall Height (m)	Geogrid Layers	COURSE Number on which Geogrid is Placed (m high)						Geogrid Length L (m)			
			Number of Geogrid layers						Soil Type ( $\theta$ )			
			1	2	3	4	5	6	25	30	35	
5kPa Driveway Surcharge	0.9	2	1st (0.16)	4th (0.65)						1.7	1.7	1.7
	1.224	2	2nd (0.32)	5th (0.81)						1.7	1.7	1.7
	1.386	2	2nd (0.32)	5th (0.81)	7th (1.13)					2.0	1.7	1.7
	1.548	3	2nd (0.32)	5th (0.81)	7th (1.13)					2.2	1.7	1.7
	1.872	3	2nd (0.32)	5th (0.81)	9th (1.46)					2.2	1.7	1.7
	2.034	4	2nd (0.32)	5th (0.81)	9th (1.46)	11th (1.78)				2.3	2.0	2.0
	2.196	4	2nd (0.32)	5th (0.81)	9th (1.46)	11th (1.78)				2.5	2.0	2.0
	2.358	4	2nd (0.32)	5th (0.81)	9th (1.46)	12th (1.94)				2.6	2.1	2.0
	2.520	4	2nd (0.32)	5th (0.81)	10th (1.6)	13th (2.11)				2.8	2.2	2.2
	2.844	5	2nd (0.32)	5th (0.81)	9th (1.46)	12th (1.94)	16th (2.59)			2.9	2.5	2.4
3.006	6	1st (0.16)	4th (0.65)	7th (1.13)	11th (1.78)	15th (2.43)	15th (2.75)		3.1	2.8	2.6	

## Soil Types

- Poor ( $\theta = 25^\circ$ ): Soils with friction angle  $\geq 25^\circ$ , may include sandy clays, gravelly clays and sand. Expansive clays and organic soil MUST not be used within the soil reinforced zone.
- Average ( $\theta = 30^\circ$ ): Soils with friction angle  $\geq 30^\circ$ , may include gravelly sands and well graded sands.
- Good ( $\theta = 35^\circ$ ): Soils with friction angle  $\geq 35^\circ$ , may include gravels, sandy gravels, weathered sandstone and crushed sandstone.

## Design Considerations

- Maximum wall heights table is based on a 5kPa surcharge load acting on top of the wall as per AS4678: 2002. This table is supplied as a guide only and must be referred to a qualified professional engineer. If imposed surcharge loads above 5kPa are applied, these designs are not appropriate.
- The Table above assumes the foundation material has a minimum bearing capacity of 150kPa.
  - Designs assume no hydrostatic loading.
- The minimum embedment of wall below ground level is assumed to be the greater of H/20 or 100mm.
  - Designs are based on Geogrid strength of 55kN/m<sup>2</sup>

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# SOIL REINFORCED WALLS WITH GEOGRID

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## Construction Steps

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### ***Step 1: Excavation and Foundations***

Excavate in accordance with the specific design requirements. Bench out site to allow for full length of geogrid as per design. Excavate levelling pad trench 600mm wide by a minimum 250mm deep. This allows for a 150mm deep levelling pad + 100mm minimum block embedment.

### ***Step 2: Levelling Pad***

The footing shall be 600mm wide x 150mm deep, of compacted roadbase or un-reinforced concrete.

### ***Step 3: First Course***

The first course is to be laid on the levelling pad and aligned using a string line along the back of the units. Ensure units are levelled side to side and front to back. It is critical that the first course is accurate and level in order to ensure acceptable horizontal and vertical tolerances. Sand or mortar can be used as a levelling aid on the first course.

### ***Step 4: Drainage Materials***

Place a 100mm agricultural drainage pipe for subsoil drainage behind the first course of blocks, with a minimum fall to the drainage outlet of 1:100. Fill all the voids within the blocks and extend 300mm behind the blocks with 12- 20mm clean granular material, to the top of the first course.

### ***Step 5: Placement of Geogrid***

The geogrid must be placed between the blocks as specified on the drawings. Geogrids shall be cut to the required length. Place the next course of blocks on top of the geogrid. Gently pull taut to remove any slack in the geogrid. Secure the back end of the geogrid before repeating Step 3 and proceeding with Step 6.

### ***Step 6: Backfill and Compaction***

Place approved backfill material over the geogrids. Backfill shall be spread in a maximum of 200mm lifts, starting at the front of the wall (behind the drainage zone) to back of the soil reinforced zone. Compaction equipment must not make contact with the geogrids. Hand held plate compactors to be used within 1.5m from the front of the wall. Heavier compaction equipment may be used 1.5m away from the front of the wall face. Compaction to be 98% of Standard Maximum Dry Density. Surface drainage during and after construction of the wall shall be provided to minimise water infiltration in the compacted soil reinforced zone.

### ***Step 7: Subsequent Courses***

Repeat steps 4 through to 6. Ensure compaction lifts are kept at 200mm. Blocks need to be levelled after compacting each lift.

### ***Step 8: Capping of Wall***

Install capping units and fix with concrete adhesive (Maxbond/Liquid Nails).



# NO FINES CONCRETE

## Overview

'No Fines' concrete is ideal for cut sites and boundaries, where the use of soil reinforcement and excavation of the backfill is impractical. The use of 'No Fines' adds mass to the Grandwall retaining wall system allowing for the overall height to be increased from a standard gravity wall without the need for geogrid reinforcement.

## No Fines Concrete Specification

- Footing: 25 MPa Concrete
- Fill block cores and behind the wall with 15MPa concrete.
- Backfill behind wall with 15 MPa concrete with a 6:1 ratio (Gravel: Cement).
- Density range: 1800kg/m<sup>3</sup> to 2100kg/m<sup>3</sup>.
- Void ratio of the mix is expected to be between 20% to 30% and should be free draining.

**Note:** Please consult with appropriate council for design and construction regulations. Councils in general require walls to be designed and certified by a suitably qualified engineer where the wall is over 500mm in height or will have a load such as a road, building or hydrostatic pressure.

## Cross Section Diagram - No Fines Concrete



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# NO FINES CONCRETE

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## Construction Steps

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### **Step 1: Excavation and Leveling Pad**

Excavate a trench 600mm wide by a minimum of 250mm deep (150mm depth of concrete footing + 100mm minimum block embedment). Place 25MPa non-reinforced concrete to form the footing.

### **Step 2: First Course**

The back “wings” of the blocks need to be bolstered off to ensure the No-Fines concrete in the blocks engages with the No-Fines concrete behind the wall, and becomes a monolithic mass. Place blocks onto levelling pad and align with string line at the rear of units. Ensure blocks are level side to side and front to back tapping gently with rubber mallet to make the necessary adjustments. It is critical the first course be level. Brush any excess ‘No Fines’ concrete material from the top of the blocks (before it is allowed to harden). Place the next course of blocks and repeat steps 2 and 3 until the required wall height is reached.

### **Step 3: ‘No Fines’ Concrete Backfill**

Fill block cores and backfill to the specified depth with ‘No Fines’ concrete. The vertical height of pour must not exceed 600mm. Alternatively the wall may be propped. Ensure the face of the wall is not stained with the concrete, as once set will be difficult to remove.

### **Step 5: Placement of Capping Units**

Secure capping units with a flexible adhesive such as Maxbond or Liquid Nails to finish the wall.

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## Design Considerations

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- The ‘No Fines’ concrete maximum wall heights table is based on a 5 kPa surcharge load acting on top of the wall as per AS4678: 2002. This table is supplied as a guide only.
  - For higher walls the use of geogrid soil reinforcement is recommended. Contact Austral Masonry for further details.
  - This product has zero slump exerting similar pressures on the soil and formwork, as loosely poured aggregate.
- The vertical height of any pour of ‘No Fines’ concrete is to be limited to 3 blocks high (approx. 600mm). The concrete must be allowed to harden before pouring the next lift.
- Global stability should be checked by a suitably qualified engineer. - The design assumes no ground water to be present. For site conditions where ground water exists, the wall must be re-designed by a suitably qualified engineer.

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## Wall Height and Retained Soil Quality

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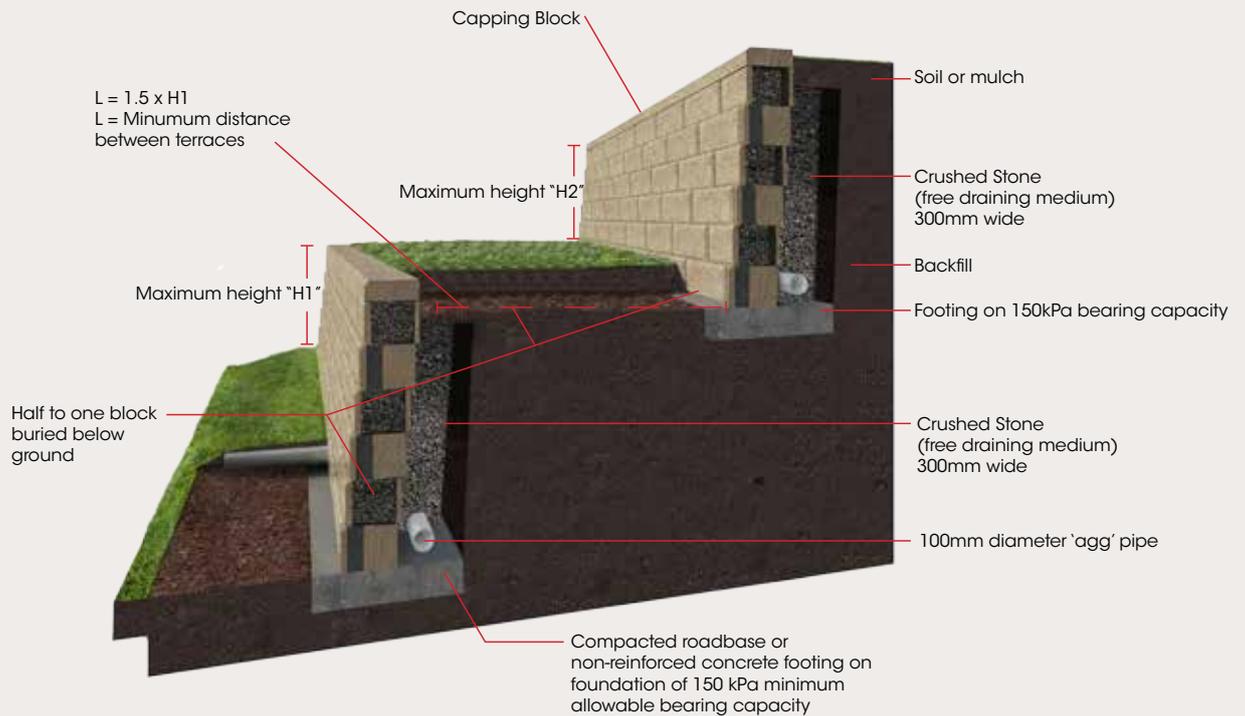
Wall Height H (mm)	Retained Soil CLAY = 26° (POOR) T (mm)	Retained Soil SAND=30° (AVERAGE) T (mm)	Retained Soil GRAVEL = 34° (GOOD) T (mm)
890	500	500	500
1224	750	650	600
1548	1100	900	800
2034	1300	1000	1000
2358	1400	1200	1100
2844	1900	1500	1400

## TYPICAL TERRACED WALL APPLICATIONS

### Overview

- Walls may be terraced for a number of reasons. To increase the aesthetic appeal of the retaining wall, to level off a sloping site, and in some instances to reduce the single wall heights to levels where they can behave as gravity walls, thus reducing the need to use geogrid or 'no fines' concrete. In the latter instances, it is important to remember that the upper terrace wall can put pressure on the lower terrace when the walls are built close together.
- As a general rule, for the terraces to act as individual retaining walls, the minimum distance between the wall terraces must be at least 1.5 times the height of the lower wall. Note, this rule does not address global stability issues where walls are built on steep sites or in poor soils. A Global stability analysis should be undertaken by a suitably qualified engineer where such conditions may exist.
- Where insufficient room exists on site to space the terraces at  $1.5 \times H_1$ , the bottom terrace must be designed to accommodate the loading from the top terrace. The design analysis may model the structure as a single wall (i.e.  $H_1 + H_2$ ) to allow for the additional load from the upper terrace wall on the lower terrace.

### Cross Section Diagram - Typical Terraced Wall Application

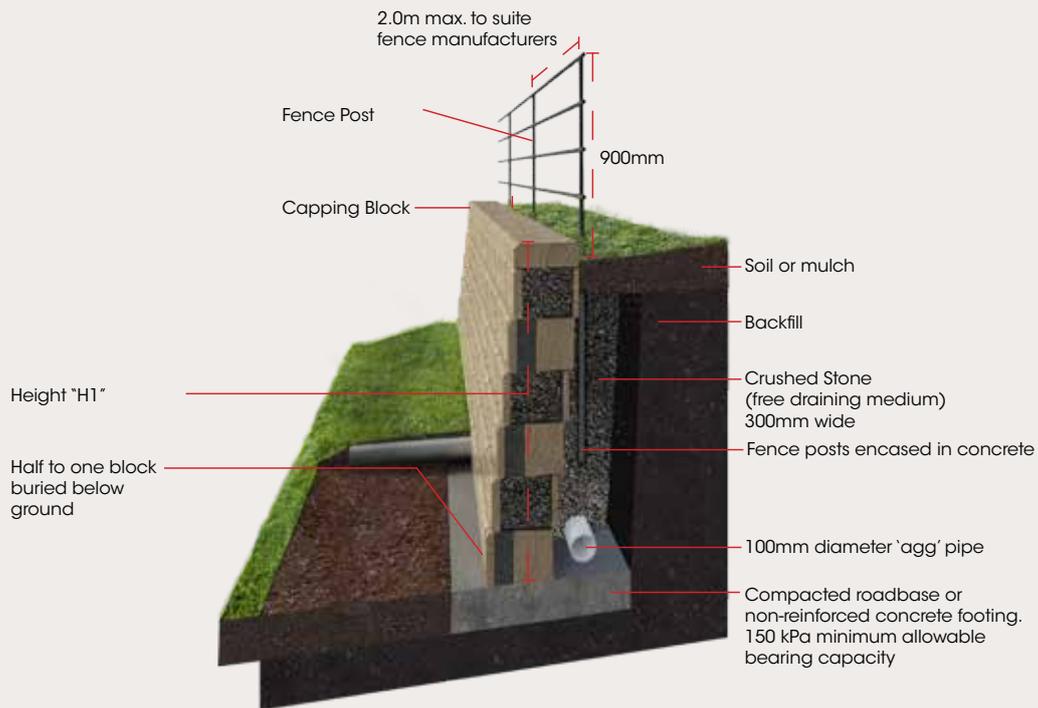


# FENCE APPLICATIONS

## Overview

- Fence posts should be embedded a minimum of 800mm from top of cap, and post encased with concrete. All other cores to be filled with gravel for drainage, or 'no fines' concrete as required. This embedment depth is for open fences only, where no wind loading is imposed on the wall and no impact loading is applied.
- Walls must be suitably designed to accommodate additional wind loading imposed on all types of closed fences; for example, increasing the embedment for the posts.
- When incorporating fences into the Grandwall Retaining wall system, the fence posts are to be placed behind the wall as shown.

## Cross Section Diagram - Fence Application





STYLE AND FUNCTION

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**1. Stock colours.** Colours other than stock colours are made to order. Contact your nearest Austral Masonry office for your area's stock colours. A surcharge applies to orders less than the set minimum quantity. **2. Colour and texture variation.** The supply of raw materials can vary over time. In addition, variation can occur between product types and production batches. **3.** We reserve the right to change the details in this publication without notice. **4.** For a full set of Terms & Conditions of Sale please contact your nearest Austral Masonry sales office. **5. Important Notice.** Please consult with your local council for design regulations prior to the construction of your wall. Councils in general require those walls over 0.5m in height and/or where there is loading such as a car or house near the wall be designed and certified by a suitably qualified engineer. **6. Max wall heights disclaimer.** The gravity wall heights are maximum heights calculated in accordance with CMAA MA-53 Appendix D guidelines and a qualified engineer should confirm the suitability of the product for each application. As such, due consideration must be given to but not limited to: Cohesion. Dry backfill, no ingress of any water into the soil behind the retaining wall. All retaining walls are designed for zero surcharge unless noted otherwise. These walls are intended for structure Classification A walls only as defined in AS4678 Earth Retaining Structures as being where failure would result in minimal damage and/or loss of access.