



Nueva® Wall

ESTIMATING GUIDE | EDITION 2.0



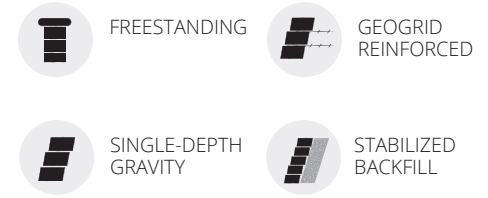
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ICON LEGEND

See Page 4 for more details on each of these wall types.

WALL TYPE



ALIGNMENT



NUEVA® 150 WALL UNITS



16" Unit
 15.75 x 5.91 x 11.81"
 (400 x 150 x 300mm)
 Connector Type:
 Split tongue
 Setback: 0°, 3.5°, 7°
 Smooth on both faces
 Pieces/layer: 2
 Coverage/layer: 20%



20" Unit
 19.69 x 5.91 x 11.81"
 (500 x 150 x 300mm)
 Connector Type:
 Split tongue
 Setback: 0°, 3.5°, 7°
 Smooth on both faces
 Pieces/layer: 2
 Coverage/layer: 25%

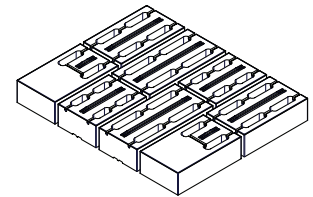


20" Corner/End Unit
 19.69 x 5.91 x 11.81"
 (500 x 150 x 300mm)
 Connector Type:
 Split tongue
 Setback: 0°, 3.5°, 7°
 Smooth on both faces
 and one end
 Pieces/layer: 2
 Coverage/layer: 25%



24" Unit
 23.62 x 5.91 x 11.81"
 (600 x 150 x 300mm)
 Connector Type:
 Split tongue
 Setback: 0°, 3.5°, 7°
 Smooth on both faces
 Pieces/layer: 2
 Coverage/layer: 30%

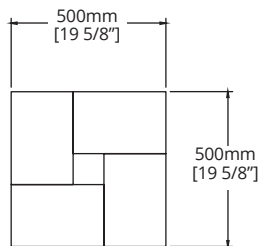
Combo Bundle



Combo Bundle Layout by Layer



Corner/Column Unit
 7.87 x 5.91 x 11.81"
 (200 x 150 x 300mm)
 No Connector, glue required
 Smooth on both faces and
 on both ends
 Pieces/layer: 15
 Coverage per layer: 100%



Makes a 500x500mm (19.69x19.69") square column

Individually Packaged

NUEVA® 75 WALL UNITS



16" Unit
 15.75 x 2.95 x 11.81"
 (400 x 75 x 300mm)
 Connector Type:
 Split tongue
 Setback: 0°, 3.5°, 7°
 Smooth on both faces
 Pieces/layer: 2
 Coverage/layer: 20%



20" Unit
 19.69 x 2.95 x 11.81"
 (500 x 75 x 300mm)
 Connector Type:
 Split tongue
 Setback: 0°, 3.5°, 7°
 Smooth on both faces
 Pieces/layer: 2
 Coverage/layer: 25%

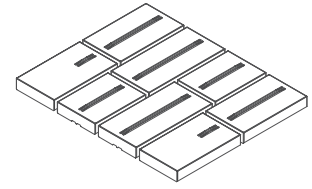


20" Corner/End Unit
 19.69 x 2.95 x 11.81"
 (500 x 75 x 300mm)
 Connector Type:
 Split tongue
 Setback: 0°, 3.5°, 7°
 Smooth on both faces
 and one end
 Pieces/layer: 2
 Coverage/layer: 25%



24" Unit
 23.62 x 2.95 x 11.81"
 (600 x 75 x 300mm)
 Connector Type:
 Split tongue
 Setback: 0°, 3.5°, 7°
 Smooth on both faces
 Pieces/layer: 2
 Coverage/layer: 30%

Combo Bundle



Combo Bundle Layout by Layer

NUEVA® COPING (Used with both Nueva® 75 and Nueva® 150)



Coping Unit
 23.62 x 2.95 x 13.38"
 (600 x 75 x 340mm)
 Smooth on both faces
 Pieces/layer: 2
 Coverage/layer: 67%

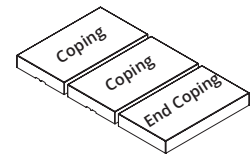
Packaged with End Coping Unit



End Coping Unit
 23.62 x 2.95 x 13.38"
 (600 x 75 x 340mm)
 Smooth on both faces
 and one end
 Pieces/layer: 1
 Coverage/layer: 33%

Packaged with Coping Units

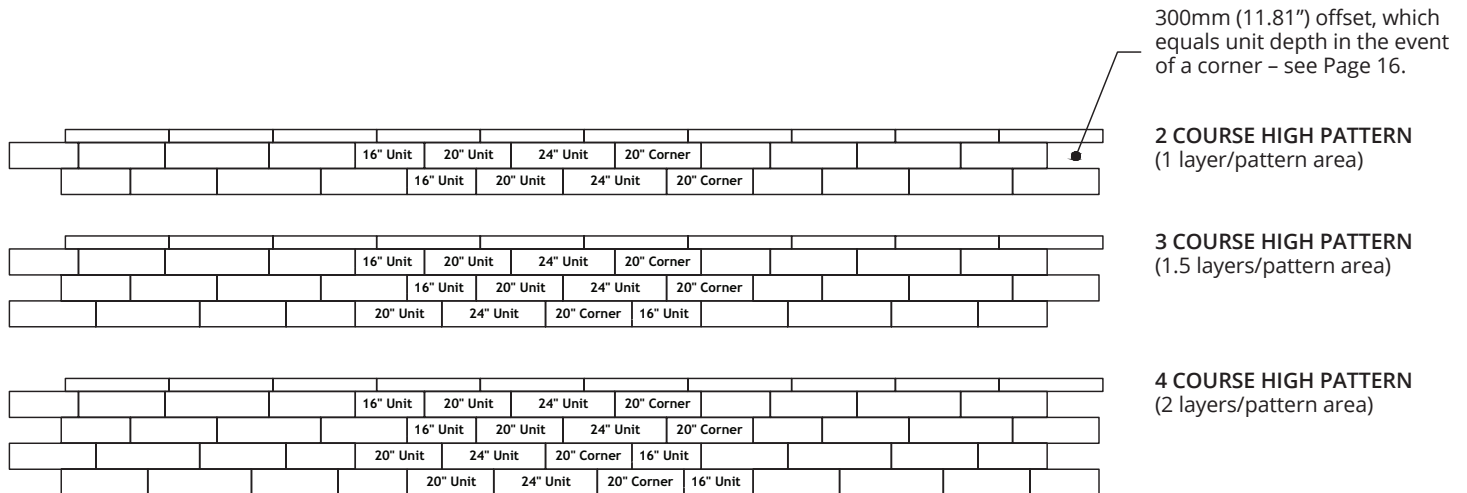
Coping Bundle



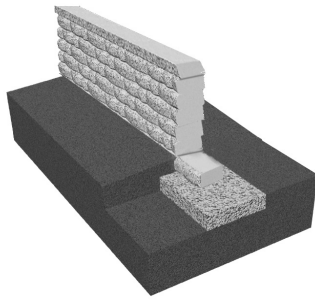
Coping/End Coping Combo Bundle by Layer

LAYING PATTERNS

Below are some sample laying patterns for low walls. The laying patterns were designed to avoid vertical lines in the walls, while using increments of full layers (i.e. all four units) within each pattern area.



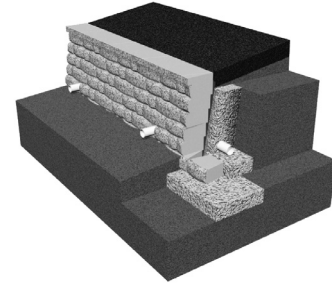
WALL TYPES OVERVIEW



FREESTANDING

Freestanding walls are vertical architectural features visible (and therefore finished) on both sides. Typically they are small sitting walls less than 600mm (2') high, but they have also been used as divider walls and even security features.

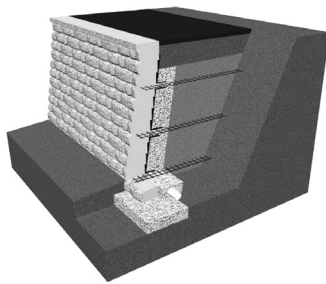
See Page 5 for more information on Freestanding Walls.



GRAVITY

Simple (single-depth) Gravity walls rely on the mass of individual wall units dry-stacked on top of one another to hold back the earth behind the wall. Due to their limited mass, they are typically restricted to low retaining walls.

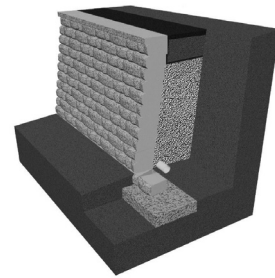
See below for more information on Gravity Walls.



GEOGRID

Geogrid reinforced walls include multiple layers of geosynthetic reinforcement sandwiched between the wall units and extending back into the specified soil behind the wall. The weight of the soil around the geogrid is used to structurally support the wall. Geogrid reinforced walls are used when the height limitations of a conventional single depth Gravity wall are exceeded.

See Page 6 for more information on Geogrid Reinforced Walls.



STABILIZED BACKFILL

The Stabilized Backfill system uses a layer of no fines concrete behind the wall to (A) increase the overall mass of the wall and (B) serve as the drainage layer. This approach is particularly well suited to the following applications:

- Where privacy fences, or traffic barriers, are proposed at the top of the wall.
- Where there are obstructions (rock outcroppings, manholes, etc) in close proximity to the high side of the wall.
- Along narrow side yards (the house is close to the property line).
- When there are trees or shrubs growing in directly behind a higher wall – see top right of Page 5 for a sample detail.

GRAVITY WALLS

When determining if a gravity wall will work for a given application, one not only has to consider the earth pressure exerted by the soil behind the wall but also any surcharge, which is anything permanent or temporary that will be within a distance of 2x the exposed wall height. For example, for a 1 metre high wall, any of the following within 2 metres of the back of the wall needs to be factored into the design:

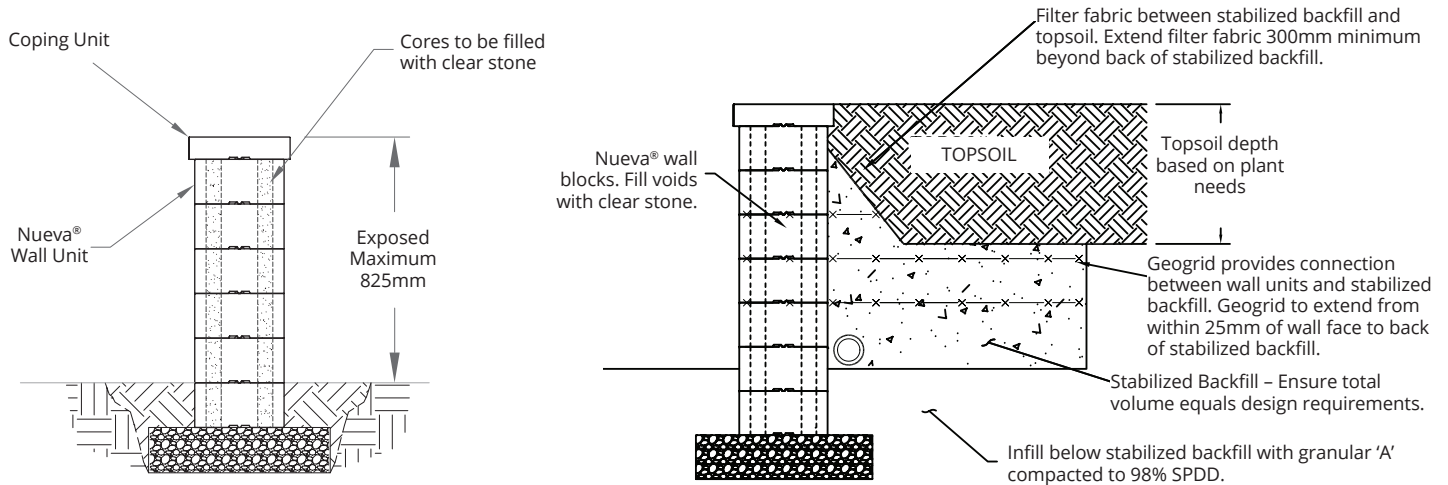
- 1) Back slopes – Steep slopes behind the wall can nearly double the earth pressure behind the wall.
- 2) Snow accumulations – In Ontario, design ground snow loads can vary from 0.8 to 4.5 kPa; reference the National Building Code of Canada for local snow load information.
- 3) People – The Ontario Building Code requires exterior areas to be designed for their intended use. Examples of different pedestrian loads are listed in Table 4.1.5.3 of the OBC.
- 4) Traffic – The intended traffic behind the wall should be considered (amount of cars, light trucks and heavy vehicles), as well as the potential for firefighting equipment.
- 5) Buildings or structures – Unless the footings are at or below the bottom of wall, then buildings and structures can apply loads onto the wall.
- 6) Material storage, including temporary snow storage.
- 7) Guards, fences or barriers – See Page 21 for more information.

To ensure the long term stability of a gravity wall, it is always prudent to consider worst case conditions. If there is any doubt, then a geogrid reinforced or stabilized backfill wall should be considered.

FREESTANDING WALLS

Freestanding walls are typically designed based on the local wind loads, and where applicable for seismic forces. The example below left is based on climatic conditions in the Greater Toronto Area without seismic forces.

The stability of the foundation soils is of particular importance with Freestanding walls as there may be no other points of support along the length of the wall. Concrete slabs can be used in lieu of the granular pad over weaker native soils.



USING STABILIZED BACKFILL WHERE TREES OR SHRUBS ARE GOING IN DIRECTLY BEHIND A HIGHER WALL

STABILIZED BACKFILL WALLS

WHAT IS STABILIZED BACKFILL?

Stabilized backfill is a low strength ready mix concrete consisting primarily of aggregate, cement and limited water (low slump); the sand component is not included. Additives are used as required for local conditions. Mix designs are available.

WHAT DOES STABILIZED BACKFILL DO?

Stabilized backfill serves two primary functions: it increases the overall mass of the retaining wall structure, and it serves as the drainage layer behind the wall (reason why no sand is included in the material).

HOW IS STABILIZED BACKFILL PLACED?

Stabilized backfill can be poured directly from a ready mix delivery truck; conveyors and/or pump trucks can also be used where available. The material should be placed in maximum 600mm (2') lifts, and because it has a low slump, it will need to be worked into place. Do not add water as this could compromise the strength of the end product. Geogrid is placed between the wall blocks and stabilized backfill at every third course to provide a connection between the two materials.

ISN'T THIS APPROACH MORE EXPENSIVE?

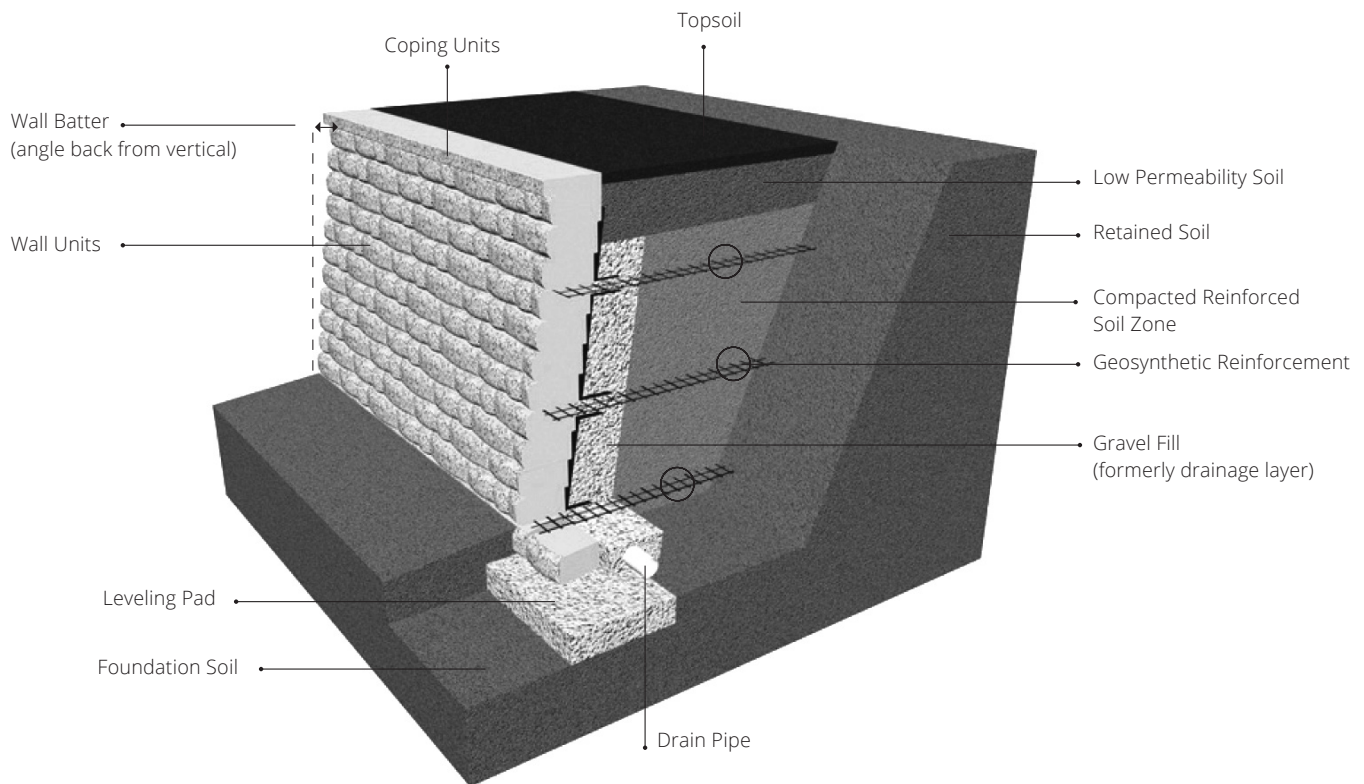
Although the concrete material is more expensive than aggregates, there is less labor involved and less material needed. Oaks has an estimating tool available to compare the costs of the two options – see Page 24 for more details.

Please consult with Oaks staff for names of suppliers of stabilized backfill.



GEOGRID REINFORCED WALLS

The use of reinforced soils dates back millennium (e.g. Great Wall of China); today geogrid reinforced walls is the most common type of segmental retaining wall construction. The diagram below lists the main parts of a typical geogrid reinforced wall.



Segmental Retaining Wall - Stacked concrete units intended to hold back the earth behind the wall, based on their mass.

Foundation Soil - Soil (typically native) below the wall that supports the retaining wall.

Drain Pipe - Perforated pipe minimum 100mm (4") in diameter placed within the gravel fill. Used to prevent hydrostatic (water) build-up behind the wall.

Geosynthetic Reinforcement - Horizontal layers of geosynthetic reinforcement (geogrid) pinched between wall blocks and extended into the reinforced soil zone behind the wall. Used to increase the overall mass of the wall structure.

Gravel Fill - A 300mm (12") thick layer of free-draining granular (3/4" clear stone) behind the wall. (see gradation below)

Leveling Pad - A 150mm (6") thick layer of crushed stone below the wall that provides a working surface for construction.

Low Permeability Soil - Layer of clay or similar material that prevents surface water from infiltrating into the reinforced soil zone and gravel fill.

Reinforced Soil Zone - Compacted structural fill placed around the geogrid. (see gradation below)

Retained Soil - Either native or clean backfill soil behind the reinforced soil zone (when used) and gravel fill.

The suggested gradation for the Gravel Fill and Reinforced Soil respectively are as follows:

GRAVIL FILL		REINFORCED SOIL	
Sieve Size	Percent Passing	Sieve Size	Percent Passing
25mm (1")	100	25mm (1")	100
19mm (¾")	75-100	No 4	100-20
No 4	0-60	No 40	0-60
No 40	0-50	No 200	0-35
No 200	0-5		

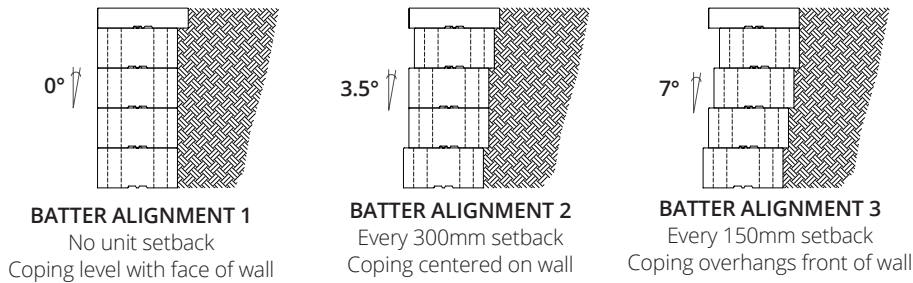
To prevent damage to the Geosynthetic Reinforcement, the largest stone size in the Reinforced Soil should be limited to 25mm (1"). Aggregates with larger sized particles (e.g. Granular B) will increase the installation damage to the Geosynthetic Reinforcement and their use is discouraged; where their use is still proposed, notify Oaks so that the geogrid lengths can be increased as needed.

SELECTING THE CORRECT ESTIMATING CHART

Pages 8 through 15 provide estimating charts for various different Nueva® wall designs. To select the most applicable chart for your given application, you must decide the:

- 1) **Type of wall construction** – Charts for geogrid reinforced (geogrid) and stabilized backfill (stabilized) options are provided.
- 2) **Wall batter** – Batter is the back slope of the retaining wall face expressed as an angle from the vertical. This guide provides estimating charts for the 0° and 3.5° batter (wall is setback 20mm (0.8”) for every 300mm (12”) of height); consult with Oaks staff when using other batter options. Since applying a back slop to the wall makes it more stable, Oaks recommends 3.5° minimum batter be used whenever possible.

BATTER OPTIONS

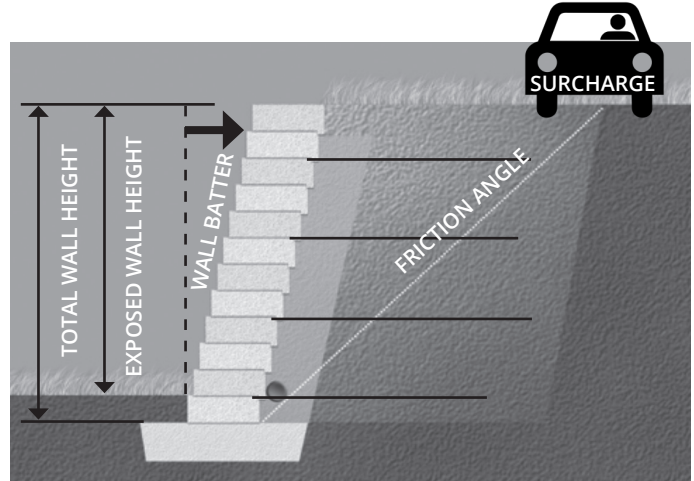


- 3) **Type of fill material** being used for the reinforced soil zone (in the case of geogrid reinforced walls) or backfill behind the wall (in the case of stabilized backfill walls). The options provided in the charts are imported granular material and native.
NOTE: We have assumed the native soil type to be clay, being the worst case conditions. The use of the native soil as fill material will be subject to approval by the design engineer.

SOIL CLASSIFICATION	FRICTION ANGLE
Clay	24-28°
Silt	26-30°
Fine to Medium Sand	28-32°
Gravel	32-36°

- 4) **Exposed wall height** being the height of the visible portion of the wall (i.e. does not include the buried portion of the wall – see NOTE below).
- 5) **Surcharge** which is discussed on Page 4. Surcharge conditions used in the estimating charts include:
 - a) 2.4 kPa (50 psf) – light pedestrian (e.g. residential backyards or raised patios)
 - b) 4.8 kPa (100 psf) – light vehicular traffic (e.g. residential driveway) or commercial pedestrian (e.g. emergency exit commercial building)
 - c) 3 to 1 earth slope above the wall

NOTE: The assumed buried depth is 155 mm (6”) or 5% of the total wall height, whichever is greater. For walls greater than 3m (10’) in height, where there is a slope in front of the wall (see Page 19 for more information), or in certain global stability situations, the buried depth would be increased; the material quantities should be adjusted accordingly.



The charts on the following pages are for **estimating purposes only** – a site design should be obtained prior to construction.

Surcharge of 50 psf (2.4 kPa) = light pedestrian. Inclusion of pedestrian guard when exposed height >600mm

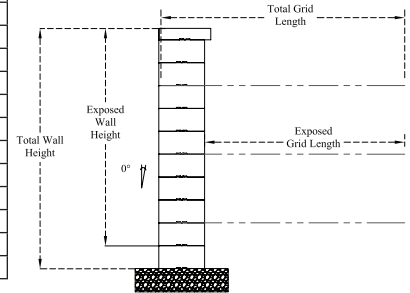
Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	-	-	-	1.67	0.45	-	0.51	1.48	-
4	523	1.72	-	-	-	1.67	0.60	-	0.51	1.97	-
5	673	2.21	1.30	4.27	3	1.67	0.75	3.90	0.51	2.46	12.80
6	823	2.70	1.40	4.59	3	1.67	0.90	4.20	0.51	2.95	13.78
7	973	3.19	1.40	4.59	3	1.67	1.05	4.20	0.51	3.45	13.78
8	1,123	3.68	1.50	4.92	4	1.67	1.20	6.00	0.51	3.94	19.69
9	1,273	4.18	1.60	5.25	4	1.67	1.35	6.40	0.51	4.43	21.00
10	1,423	4.67	1.70	5.58	4	1.67	1.50	6.80	0.51	4.92	22.31
11	1,573	5.16	1.80	5.91	5	1.67	1.65	9.00	0.51	5.41	29.53
12	1,723	5.65	1.90	6.23	5	1.67	1.80	9.50	0.51	5.91	31.17
13	1,873	6.15	2.00	6.56	6	1.67	1.95	12.00	0.51	6.40	39.37
14	2,023	6.64	2.10	6.89	7	1.67	2.10	14.70	0.51	6.89	48.23
15	2,173	7.13	2.20	7.22	7	1.67	2.25	15.40	0.51	7.38	50.53
16	2,323	7.62	2.30	7.55	7	1.67	2.40	16.10	0.51	7.87	52.82
17	2,473	8.11	2.40	7.87	8	1.67	2.55	19.20	0.51	8.37	63.00
18	2,623	8.61	2.50	8.20	8	1.67	2.70	20.00	0.51	8.86	65.62
19	2,773	9.10	2.60	8.53	8	1.67	2.85	20.80	0.51	9.35	68.24
20	2,923	9.59	2.60	8.53	8	1.67	3.00	20.80	0.51	9.84	68.24

Design – Geogrid Reinforced

Batter – 0 Degree

Retained Soil – Clay
(friction angle 28 degrees)

Reinforced Zone Soil – imported granular
(friction angle 35 degrees)



Surcharge of 100 psf (4.8 kPa) = light vehicular traffic.
Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	-	-	-	1.67	0.45	-	0.51	1.48	-
4	523	1.72	1.30	4.27	1	1.67	0.60	1.30	0.51	1.97	4.27
5	673	2.21	1.30	4.27	2	1.67	0.75	2.60	0.51	2.46	8.53
6	823	2.70	1.30	4.27	2	1.67	0.90	2.60	0.51	2.95	8.53
7	973	3.19	1.30	4.27	2	1.67	1.05	2.60	0.51	3.45	8.53
8	1,123	3.68	1.40	4.59	3	1.67	1.20	4.20	0.51	3.94	13.78
9	1,273	4.18	1.60	5.25	3	1.67	1.35	4.80	0.51	4.43	15.75
10	1,423	4.67	1.60	5.25	3	1.67	1.50	4.80	0.51	4.92	15.75
11	1,573	5.16	1.60	5.25	4	1.67	1.65	6.40	0.51	5.41	21.00
12	1,723	5.65	1.90	6.23	5	1.67	1.80	9.50	0.51	5.91	31.17
13	1,873	6.15	1.90	6.23	5	1.67	1.95	9.50	0.51	6.40	31.17
14	2,023	6.64	1.90	6.23	6	1.67	2.10	11.40	0.51	6.89	37.40
15	2,173	7.13	2.20	7.22	6	1.67	2.25	13.20	0.51	7.38	43.31
16	2,323	7.62	2.20	7.22	6	1.67	2.40	13.20	0.51	7.87	43.31
17	2,473	8.11	2.20	7.22	7	1.67	2.55	15.40	0.51	8.37	50.53
18	2,623	8.61	2.30	7.55	7	1.67	2.70	16.10	0.51	8.86	52.82
19	2,773	9.10	2.60	8.53	7	1.67	2.85	18.20	0.51	9.35	59.71
20	2,923	9.59	2.60	8.53	7	1.67	3.00	18.20	0.51	9.84	59.71

Top row of geogrid should be maximum 300mm below the coping block. Bottom row of geogrid should be within 300mm of the leveling pad.

3H:1V Slope above wall. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	-	-	-	1.67	0.45	-	0.51	1.48	-
4	523	1.72	1.30	4.27	1	1.67	0.60	1.30	0.51	1.97	4.27
5	673	2.21	1.30	4.27	2	1.67	0.75	2.60	0.51	2.46	8.53
6	823	2.70	1.30	4.27	2	1.67	0.90	2.60	0.51	2.95	8.53
7	973	3.19	1.30	4.27	2	1.67	1.05	2.60	0.51	3.45	8.53
8	1,123	3.68	1.50	4.92	4	1.67	1.20	6.00	0.51	3.94	19.69
9	1,273	4.18	1.60	5.25	4	1.67	1.35	6.40	0.51	4.43	21.00
10	1,423	4.67	1.60	5.25	4	1.67	1.50	6.40	0.51	4.92	21.00
11	1,573	5.16	1.80	5.91	5	1.67	1.65	9.00	0.51	5.41	29.53
12	1,723	5.65	2.00	6.56	5	1.67	1.80	10.00	0.51	5.91	32.81
13	1,873	6.15	2.00	6.56	5	1.67	1.95	10.00	0.51	6.40	32.81
14	2,023	6.64	2.20	7.22	7	1.67	2.10	15.40	0.51	6.89	50.53
15	2,173	7.13	2.30	7.55	7	1.67	2.25	16.10	0.51	7.38	52.82
16	2,323	7.62	2.30	7.55	7	1.67	2.40	16.10	0.51	7.87	52.82
17	2,473	8.11	2.60	8.53	8	1.67	2.55	20.80	0.51	8.37	68.24
18	2,623	8.61	2.70	8.86	9	1.67	2.70	24.30	0.51	8.86	79.73
19											
20											

Refer to Proterra Estimating Guide

Notes: 1 - Includes the portion of grid sandwiched between the wall units.

Surcharge of 50 psf (2.4 kPa) = light pedestrian. Inclusion of pedestrian guard when exposed height >600mm

Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	-	-	-	1.67	0.45	-	0.51	1.48	-
4	523	1.72	1.50	4.92	1	1.67	0.60	1.50	0.51	1.97	4.92
5	673	2.21	1.50	4.92	3	1.67	0.75	4.50	0.51	2.46	14.76
6	823	2.70	1.60	5.25	3	1.67	0.90	4.80	0.51	2.95	15.75
7	973	3.19	1.60	5.25	3	1.67	1.05	4.80	0.51	3.45	15.75
8	1,123	3.68	1.70	5.58	4	1.67	1.20	6.80	0.51	3.94	22.31
9	1,273	4.18	1.90	6.23	4	1.67	1.35	7.60	0.51	4.43	24.94
10	1,423	4.67	1.90	6.23	4	1.67	1.50	7.60	0.51	4.92	24.94
11	1,573	5.16	2.10	6.89	6	1.67	1.65	12.60	0.51	5.41	41.34
12	1,723	5.65	2.20	7.22	6	1.67	1.80	13.20	0.51	5.91	43.31
13	1,873	6.15	2.20	7.22	6	1.67	1.95	13.20	0.51	6.40	43.31
14	2,023	6.64	2.40	7.87	7	1.67	2.10	16.80	0.51	6.89	55.12
15	2,173	7.13	2.50	8.20	7	1.67	2.25	17.50	0.51	7.38	57.42
16	2,323	7.62	2.60	8.53	7	1.67	2.40	18.20	0.51	7.87	59.71
17	2,473	8.11	2.80	9.19	7	1.67	2.55	19.60	0.51	8.37	64.31
18											
19											
20											

Refer to Proterra Estimating Guide

Surcharge of 100 psf (4.8 kPa) = light vehicular traffic. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	1.30	4.27	1	1.67	0.45	1.30	0.51	1.48	4.27
4	523	1.72	1.30	4.27	1	1.67	0.60	1.30	0.51	1.97	4.27
5	673	2.21	1.30	4.27	2	1.67	0.75	2.60	0.51	2.46	8.53
6	823	2.70	1.50	4.92	2	1.67	0.90	3.00	0.51	2.95	9.84
7	973	3.19	1.50	4.92	2	1.67	1.05	3.00	0.51	3.45	9.84
8	1,123	3.68	1.60	5.25	3	1.67	1.20	4.80	0.51	3.94	15.75
9	1,273	4.18	1.90	6.23	3	1.67	1.35	5.70	0.51	4.43	18.70
10	1,423	4.67	1.90	6.23	4	1.67	1.50	7.60	0.51	4.92	24.94
11	1,573	5.16	1.90	6.23	5	1.67	1.65	9.50	0.51	5.41	31.17
12	1,723	5.65	2.20	7.22	5	1.67	1.80	11.00	0.51	5.91	36.09
13	1,873	6.15	2.20	7.22	5	1.67	1.95	11.00	0.51	6.40	36.09
14	2,023	6.64	2.20	7.22	6	1.67	2.10	13.20	0.51	6.89	43.31
15	2,173	7.13	2.50	8.20	6	1.67	2.25	15.00	0.51	7.38	49.22
16											
17											
18											
19											
20											

Refer to Proterra Estimating Guide

3H:1V Slope above wall. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	1.30	4.27	1	1.67	0.30	1.30	0.51	0.98	4.27
3	373	1.22	1.30	4.27	1	1.67	0.45	1.30	0.51	1.48	4.27
4	523	1.72	1.30	4.27	1	1.67	0.60	1.30	0.51	1.97	4.27
5	673	2.21	1.30	4.27	2	1.67	0.75	2.60	0.51	2.46	8.53
6	823	2.70	1.40	4.59	2	1.67	0.90	2.80	0.51	2.95	9.19
7	973	3.19	1.40	4.59	3	1.67	1.05	4.20	0.51	3.45	13.78
8	1,123	3.68	1.60	5.25	4	1.67	1.20	6.40	0.51	3.94	21.00
9	1,273	4.18	1.80	5.91	4	1.67	1.35	7.20	0.51	4.43	23.62
10	1,423	4.67	1.80	5.91	4	1.67	1.50	7.20	0.51	4.92	23.62
11	1,573	5.16	2.10	6.89	5	1.67	1.65	10.50	0.51	5.41	34.45
12	1,723	5.65	2.20	7.22	6	1.67	1.80	13.20	0.51	5.91	43.31
13											
14											
15											
16											
17											
18											
19											
20											

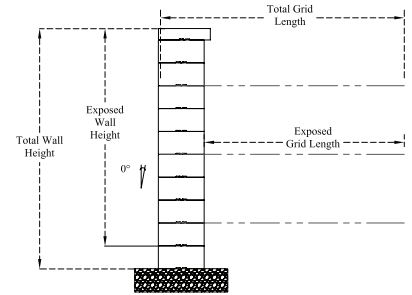
Refer to Proterra Estimating Guide

Design – Geogrid Reinforced

Batter – 0 Degree

Retained Soil – Clay
(friction angle 28 degrees)

Reinforced Zone Soil – native
(subject to approval by design engineer)



Top row of geogrid should be maximum 300mm below the coping block. Bottom row of geogrid should be within 300mm of the levelling pad.

Notes: 1 - Includes the portion of grid sandwiched between the wall units.

Surcharge of 50 psf (2.4 kPa) = light pedestrian. Inclusion of pedestrian guard when exposed height >600mm

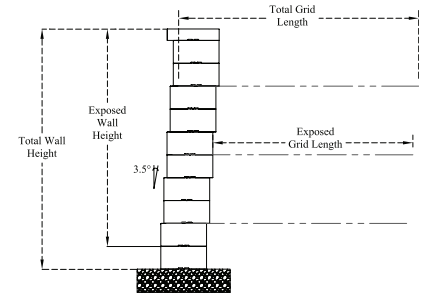
Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	-	-	-	1.67	0.45	-	0.51	1.48	-
4	523	1.72	-	-	-	1.67	0.60	-	0.51	1.97	-
5	673	2.21	-	-	-	1.67	0.75	-	0.51	2.46	-
6	823	2.70	1.30	4.27	3	1.67	0.90	3.90	0.51	2.95	12.80
7	973	3.19	1.40	4.59	3	1.67	1.05	4.20	0.51	3.45	13.78
8	1,123	3.68	1.50	4.92	4	1.67	1.20	6.00	0.51	3.94	19.69
9	1,273	4.18	1.60	5.25	4	1.67	1.35	6.40	0.51	4.43	21.00
10	1,423	4.67	1.60	5.25	4	1.67	1.50	6.40	0.51	4.92	21.00
11	1,573	5.16	1.80	5.91	5	1.67	1.65	9.00	0.51	5.41	29.53
12	1,723	5.65	1.90	6.23	5	1.67	1.80	9.50	0.51	5.91	31.17
13	1,873	6.15	1.90	6.23	5	1.67	1.95	9.50	0.51	6.40	31.17
14	2,023	6.64	2.00	6.56	6	1.67	2.10	12.00	0.51	6.89	39.37
15	2,173	7.13	2.20	7.22	7	1.67	2.25	15.40	0.51	7.38	50.53
16	2,323	7.62	2.20	7.22	7	1.67	2.40	15.40	0.51	7.87	50.53
17	2,473	8.11	2.30	7.55	8	1.67	2.55	18.40	0.51	8.37	60.37
18	2,623	8.61	2.40	7.87	8	1.67	2.70	19.20	0.51	8.86	63.00
19	2,773	9.10	2.50	8.20	8	1.67	2.85	20.00	0.51	9.35	65.62
20	2,923	9.59	2.60	8.53	8	1.67	3.00	20.80	0.51	9.84	68.24

Design – Geogrid Reinforced

Batter – 3.5 Degree

Retained Soil – Clay
(friction angle 28 degrees)

Reinforced Zone Soil – imported granular (friction angle 35 degrees)



Surcharge of 100 psf (4.8 kPa) = light vehicular traffic. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	-	-	-	1.67	0.45	-	0.51	1.48	-
4	523	1.72	1.30	4.27	1	1.67	0.60	1.30	0.51	1.97	4.27
5	673	2.21	1.30	4.27	2	1.67	0.75	2.60	0.51	2.46	8.53
6	823	2.70	1.30	4.27	2	1.67	0.90	2.60	0.51	2.95	8.53
7	973	3.19	1.30	4.27	2	1.67	1.05	2.60	0.51	3.45	8.53
8	1,123	3.68	1.30	4.27	3	1.67	1.20	3.90	0.51	3.94	12.80
9	1,273	4.18	1.50	4.92	3	1.67	1.35	4.50	0.51	4.43	14.76
10	1,423	4.67	1.50	4.92	3	1.67	1.50	4.50	0.51	4.92	14.76
11	1,573	5.16	1.60	5.25	4	1.67	1.65	6.40	0.51	5.41	21.00
12	1,723	5.65	1.80	5.91	4	1.67	1.80	7.20	0.51	5.91	23.62
13	1,873	6.15	1.80	5.91	5	1.67	1.95	9.00	0.51	6.40	29.53
14	2,023	6.64	1.90	6.23	6	1.67	2.10	11.40	0.51	6.89	37.40
15	2,173	7.13	2.10	6.89	6	1.67	2.25	12.60	0.51	7.38	41.34
16	2,323	7.62	2.10	6.89	6	1.67	2.40	12.60	0.51	7.87	41.34
17	2,473	8.11	2.10	6.89	7	1.67	2.55	14.70	0.51	8.37	48.23
18	2,623	8.61	2.20	7.22	7	1.67	2.70	15.40	0.51	8.86	50.53
19	2,773	9.10	2.50	8.20	7	1.67	2.85	17.50	0.51	9.35	57.42
20	2,923	9.59	2.50	8.20	7	1.67	3.00	17.50	0.51	9.84	57.42

Top row of geogrid should be maximum 300mm below the coping block. Bottom row of geogrid should be within 300mm of the levelling pad.

3H:1V Slope above wall. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	-	-	-	1.67	0.45	-	0.51	1.48	-
4	523	1.72	1.30	4.27	1	1.67	0.60	1.30	0.51	1.97	4.27
5	673	2.21	1.30	4.27	2	1.67	0.75	2.60	0.51	2.46	8.53
6	823	2.70	1.30	4.27	2	1.67	0.90	2.60	0.51	2.95	8.53
7	973	3.19	1.30	4.27	2	1.67	1.05	2.60	0.51	3.45	8.53
8	1,123	3.68	1.50	4.92	3	1.67	1.20	4.50	0.51	3.94	14.76
9	1,273	4.18	1.60	5.25	4	1.67	1.35	6.40	0.51	4.43	21.00
10	1,423	4.67	1.60	5.25	4	1.67	1.50	6.40	0.51	4.92	21.00
11	1,573	5.16	1.80	5.91	5	1.67	1.65	9.00	0.51	5.41	29.53
12	1,723	5.65	1.90	6.23	5	1.67	1.80	9.50	0.51	5.91	31.17
13	1,873	6.15	1.90	6.23	5	1.67	1.95	9.50	0.51	6.40	31.17
14	2,023	6.64	2.10	6.89	6	1.67	2.10	12.60	0.51	6.89	41.34
15	2,173	7.13	2.20	7.22	6	1.67	2.25	13.20	0.51	7.38	43.31
16	2,323	7.62	2.20	7.22	7	1.67	2.40	15.40	0.51	7.87	50.53
17	2,473	8.11	2.50	8.20	8	1.67	2.55	20.00	0.51	8.37	65.62
18	2,623	8.61	2.60	8.53	8	1.67	2.70	20.80	0.51	8.86	68.24
19	2,773	9.10	2.70	8.86	8	1.67	2.85	21.60	0.51	9.35	70.87
20	2,923	9.59	2.70	8.86	9	1.67	3.00	24.30	0.51	9.84	79.73

Notes: 1 - Includes the portion of grid sandwiched between the wall units.

Surcharge of 50 psf (2.4 kPa) = light pedestrian. Inclusion of pedestrian guard when exposed height >600mm

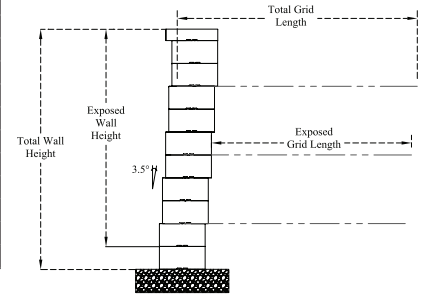
Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	-	-	-	1.67	0.45	-	0.51	1.48	-
4	523	1.72	1.40	4.59	1	1.67	0.60	1.40	0.51	1.97	4.59
5	673	2.21	1.40	4.59	3	1.67	0.75	4.20	0.51	2.46	13.78
6	823	2.70	1.60	5.25	3	1.67	0.90	4.80	0.51	2.95	15.75
7	973	3.19	1.60	5.25	3	1.67	1.05	4.80	0.51	3.45	15.75
8	1,123	3.68	1.70	5.58	4	1.67	1.20	6.80	0.51	3.94	22.31
9	1,273	4.18	1.90	6.23	4	1.67	1.35	7.60	0.51	4.43	24.94
10	1,423	4.67	1.90	6.23	4	1.67	1.50	7.60	0.51	4.92	24.94
11	1,573	5.16	2.00	6.56	5	1.67	1.65	10.00	0.51	5.41	32.81
12	1,723	5.65	2.20	7.22	5	1.67	1.80	11.00	0.51	5.91	36.09
13	1,873	6.15	2.20	7.22	6	1.67	1.95	13.20	0.51	6.40	43.31
14	2,023	6.64	2.30	7.55	7	1.67	2.10	16.10	0.51	6.89	52.82
15	2,173	7.13	2.50	8.20	7	1.67	2.25	17.50	0.51	7.38	57.42
16	2,323	7.62	2.50	8.20	7	1.67	2.40	17.50	0.51	7.87	57.42
17	2,473	8.11	2.60	8.53	8	1.67	2.55	20.80	0.51	8.37	68.24
18	2,623	8.61	2.70	8.86	8	1.67	2.70	21.60	0.51	8.86	70.87
19	2,773	9.10	2.90	9.51	8	1.67	2.85	23.20	0.51	9.35	76.12
20	Refer to Proterra Estimating Guide										

Design – Geogrid Reinforced

Batter – 3.5 Degree

Retained Soil – Clay
(friction angle 28 degrees)

Reinforced Zone Soil – native
(subject to approval by design engineer)



Surcharge of 100 psf (4.8 kPa) = light vehicular traffic. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	1.30	4.27	1	1.67	0.45	1.30	0.51	1.48	4.27
4	523	1.72	1.30	4.27	1	1.67	0.60	1.30	0.51	1.97	4.27
5	673	2.21	1.30	4.27	2	1.67	0.75	2.60	0.51	2.46	8.53
6	823	2.70	1.30	4.27	2	1.67	0.90	2.60	0.51	2.95	8.53
7	973	3.19	1.40	4.59	2	1.67	1.05	2.80	0.51	3.45	9.19
8	1,123	3.68	1.50	4.92	3	1.67	1.20	4.50	0.51	3.94	14.76
9	1,273	4.18	1.80	5.91	3	1.67	1.35	5.40	0.51	4.43	17.72
10	1,423	4.67	1.80	5.91	3	1.67	1.50	5.40	0.51	4.92	17.72
11	1,573	5.16	1.80	5.91	5	1.67	1.65	9.00	0.51	5.41	29.53
12	1,723	5.65	2.10	6.89	5	1.67	1.80	10.50	0.51	5.91	34.45
13	1,873	6.15	2.10	6.89	5	1.67	1.95	10.50	0.51	6.40	34.45
14	2,023	6.64	2.10	6.89	6	1.67	2.10	12.60	0.51	6.89	41.34
15	2,173	7.13	2.40	7.87	6	1.67	2.25	14.40	0.51	7.38	47.25
16	2,323	7.62	2.40	7.87	6	1.67	2.40	14.40	0.51	7.87	47.25
17	2,473	8.11	2.40	7.87	7	1.67	2.55	16.80	0.51	8.37	55.12
18	Refer to Proterra Estimating Guide										
19	Refer to Proterra Estimating Guide										
20	Refer to Proterra Estimating Guide										

Top row of geogrid should be maximum 300mm below the coping block. Bottom row of geogrid should be within 300mm of the levelling pad.

3H:1V Slope above wall. Use greater of this or top chart where a pedestrian guard is required.

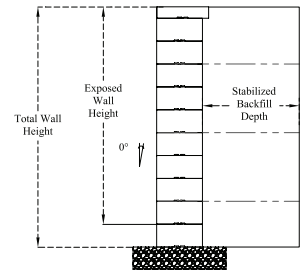
Total Courses	Exposed Wall Height		Min. Geogrid Length ¹		# of Geogrid Layers	Product per m of wall			Product per ft of wall		
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	Grid (sq m)	Coping (pc)	Wall Units (sq ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	0.51	0.98	-
3	373	1.22	1.30	4.27	1	1.67	0.45	1.30	0.51	1.48	4.27
4	523	1.72	1.30	4.27	1	1.67	0.60	1.30	0.51	1.97	4.27
5	673	2.21	1.30	4.27	2	1.67	0.75	2.60	0.51	2.46	8.53
6	823	2.70	1.30	4.27	2	1.67	0.90	2.60	0.51	2.95	8.53
7	973	3.19	1.30	4.27	2	1.67	1.05	2.60	0.51	3.45	8.53
8	1,123	3.68	1.60	5.25	4	1.67	1.20	6.40	0.51	3.94	21.00
9	1,273	4.18	1.70	5.58	4	1.67	1.35	6.80	0.51	4.43	22.31
10	1,423	4.67	1.70	5.58	4	1.67	1.50	6.80	0.51	4.92	22.31
11	1,573	5.16	2.00	6.56	5	1.67	1.65	10.00	0.51	5.41	32.81
12	1,723	5.65	2.10	6.89	5	1.67	1.80	10.50	0.51	5.91	34.45
13	Refer to Proterra Estimating Guide										
14	Refer to Proterra Estimating Guide										
15	Refer to Proterra Estimating Guide										
16	Refer to Proterra Estimating Guide										
17	Refer to Proterra Estimating Guide										
18	Refer to Proterra Estimating Guide										
19	Refer to Proterra Estimating Guide										
20	Refer to Proterra Estimating Guide										

Notes: 1 - Includes the portion of grid sandwiched between the wall units.

Surcharge of 50 psf (2.4 kPa) = light pedestrian. Inclusion of pedestrian guard when exposed height >600mm

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	-	-	-	1.67	0.45	-	-	0.51	1.48	-	-
4	523	1.72	-	-	-	1.67	0.60	-	-	0.51	1.97	-	-
5	673	2.21	0.40	1.31	2	1.67	0.75	0.21	1.35	0.51	2.46	2.24	4.43
6	823	2.70	0.40	1.31	2	1.67	0.90	0.27	1.35	0.51	2.95	2.89	4.43
7	973	3.19	0.50	1.64	2	1.67	1.05	0.41	1.55	0.51	3.45	4.42	5.09
8	1,123	3.68	0.50	1.64	3	1.67	1.20	0.49	2.33	0.51	3.94	5.23	7.63
9	1,273	4.18	0.50	1.64	3	1.67	1.35	0.56	2.33	0.51	4.43	6.03	7.63
10	1,423	4.67	0.60	1.97	3	1.67	1.50	0.76	2.63	0.51	4.92	8.21	8.61
11	1,573	5.16	0.60	1.97	4	1.67	1.65	0.85	3.50	0.51	5.41	9.18	11.48
12	1,723	5.65	0.70	2.30	4	1.67	1.80	1.10	3.90	0.51	5.91	11.84	12.80
13	1,873	6.15	0.80	2.62	4	1.67	1.95	1.38	4.30	0.51	6.40	14.82	14.11
14	2,023	6.64	0.80	2.62	5	1.67	2.10	1.50	5.38	0.51	6.89	16.11	17.64
15	2,173	7.13	0.90	2.95	5	1.67	2.25	1.82	5.88	0.51	7.38	19.58	19.28
16	2,323	7.62	0.90	2.95	5	1.67	2.40	1.95	5.88	0.51	7.87	21.03	19.28
17	2,473	8.11	1.00	3.28	6	1.67	2.55	2.32	7.65	0.51	8.37	24.99	25.10
18	2,623	8.61	1.10	3.61	6	1.67	2.70	2.72	8.25	0.51	8.86	29.26	27.07
19	2,773	9.10	1.10	3.61	6	1.67	2.85	2.88	8.25	0.51	9.35	31.04	27.07
20	2,923	9.59	1.20	3.94	7	1.67	3.00	3.33	10.33	0.51	9.84	35.80	33.88

Design – Stabilized Backfill
Batter – 0 Degree
Retained Soil – Clay (friction angle 28 degrees)
Backfill Soil – imported granular (friction angle 35 degrees)



Surcharge of 100 psf (4.8 kPa) = light vehicular traffic. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	-	-	-	1.67	0.45	-	-	0.51	1.48	-	-
4	523	1.72	0.30	0.98	1	1.67	0.60	0.11	0.58	0.51	1.97	1.20	1.89
5	673	2.21	0.30	0.98	2	1.67	0.75	0.16	1.15	0.51	2.46	1.68	3.77
6	823	2.70	0.30	0.98	2	1.67	0.90	0.20	1.15	0.51	2.95	2.17	3.77
7	973	3.19	0.40	1.31	2	1.67	1.05	0.33	1.35	0.51	3.45	3.54	4.43
8	1,123	3.68	0.40	1.31	3	1.67	1.20	0.39	2.03	0.51	3.94	4.18	6.64
9	1,273	4.18	0.50	1.64	3	1.67	1.35	0.56	2.33	0.51	4.43	6.03	7.63
10	1,423	4.67	0.60	1.97	3	1.67	1.50	0.76	2.63	0.51	4.92	8.21	8.61
11	1,573	5.16	0.60	1.97	4	1.67	1.65	0.85	3.50	0.51	5.41	9.18	11.48
12	1,723	5.65	0.70	2.30	4	1.67	1.80	1.10	3.90	0.51	5.91	11.84	12.80
13	1,873	6.15	0.80	2.62	4	1.67	1.95	1.38	4.30	0.51	6.40	14.82	14.11
14	2,023	6.64	0.80	2.62	5	1.67	2.10	1.50	5.38	0.51	6.89	16.11	17.64
15	2,173	7.13	0.90	2.95	5	1.67	2.25	1.82	5.88	0.51	7.38	19.58	19.28
16	2,323	7.62	1.00	3.28	5	1.67	2.40	2.17	6.38	0.51	7.87	23.37	20.92
17	2,473	8.11	1.10	3.61	6	1.67	2.55	2.55	8.25	0.51	8.37	27.48	27.07
18	2,623	8.61	1.20	3.94	6	1.67	2.70	2.97	8.85	0.51	8.86	31.92	29.04
19	2,773	9.10	1.20	3.94	6	1.67	2.85	3.15	8.85	0.51	9.35	33.86	29.04
20	2,923	9.59	1.20	3.94	7	1.67	3.00	3.33	10.33	0.51	9.84	35.80	33.88

Please note that geogrid reinforcement is required to provide a connection between the stabilized backfill and Nueva® wall blocks. Maximum spacing of geogrid 450mm. Upper row geogrid within 300mm of coping, lowest row of geogrid within 300mm of bottom of stabilized backfill.

3H:1V Slope above wall. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	-	-	-	1.67	0.45	-	-	0.51	1.48	-	-
4	523	1.72	0.30	0.98	1	1.67	0.60	0.11	0.58	0.51	1.97	1.20	1.89
5	673	2.21	0.50	1.64	2	1.67	0.75	0.26	1.55	0.51	2.46	2.80	5.09
6	823	2.70	0.60	1.97	2	1.67	0.90	0.40	1.75	0.51	2.95	4.33	5.74
7	973	3.19	0.70	2.30	2	1.67	1.05	0.57	1.95	0.51	3.45	6.19	6.40
8	1,123	3.68	0.90	2.95	3	1.67	1.20	0.87	3.53	0.51	3.94	9.41	11.57
9	1,273	4.18	1.00	3.28	3	1.67	1.35	1.12	3.83	0.51	4.43	12.07	12.55
10	1,423	4.67	1.20	3.94	3	1.67	1.50	1.53	4.43	0.51	4.92	16.42	14.52
11	1,573	5.16	1.30	4.27	4	1.67	1.65	1.85	6.30	0.51	5.41	19.89	20.67
12	1,723	5.65	1.40	4.59	4	1.67	1.80	2.20	6.70	0.51	5.91	23.68	21.98
13	1,873	6.15	1.50	4.92	4	1.67	1.95	2.58	7.10	0.51	6.40	27.79	23.30
14	2,023	6.64	1.60	5.25	5	1.67	2.10	2.99	9.38	0.51	6.89	32.23	30.76
15	2,173	7.13	1.80	5.91	5	1.67	2.25	3.64	10.38	0.51	7.38	39.16	34.04
16	2,323	7.62	1.90	6.23	5	1.67	2.40	4.12	10.88	0.51	7.87	44.40	35.68
17	2,473	8.11	2.00	6.56	6	1.67	2.55	4.64	13.65	0.51	8.37	49.97	44.79
18	2,623	8.61	2.30	7.55	6	1.67	2.70	5.68	15.45	0.51	8.86	61.18	50.69
19	2,773	9.10	2.30	7.55	6	1.67	2.85	6.03	15.45	0.51	9.35	64.89	50.69
20	2,923	9.59	2.40	7.87	7	1.67	3.00	6.65	18.73	0.51	9.84	71.59	61.44

Notes: 1 - Stabilized backfill extends from ground elevation to 152mm (6") from top of wall.
 2 - Geogrid extends from within 25mm (1") of front of wall blocks to back of stabilized backfill.

Surcharge of 50 psf (2.4 kPa) = light pedestrian. Inclusion of pedestrian guard when exposed height >600mm

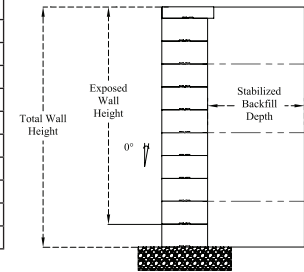
Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	-	-	-	1.67	0.45	-	-	0.51	1.48	-	-
4	523	1.72	0.40	1.31	1	1.67	0.60	0.15	0.68	0.51	1.97	1.60	2.21
5	673	2.21	0.40	1.31	2	1.67	0.75	0.21	1.35	0.51	2.46	2.24	4.43
6	823	2.70	0.40	1.31	2	1.67	0.90	0.27	1.35	0.51	2.95	2.89	4.43
7	973	3.19	0.50	1.64	2	1.67	1.05	0.41	1.55	0.51	3.45	4.42	5.09
8	1,123	3.68	0.50	1.64	3	1.67	1.20	0.49	2.33	0.51	3.94	5.23	7.63
9	1,273	4.18	0.50	1.64	3	1.67	1.35	0.56	2.33	0.51	4.43	6.03	7.63
10	1,423	4.67	0.60	1.97	3	1.67	1.50	0.76	2.63	0.51	4.92	8.21	8.61
11	1,573	5.16	0.60	1.97	4	1.67	1.65	0.85	3.50	0.51	5.41	9.18	11.48
12	1,723	5.65	0.70	2.30	4	1.67	1.80	1.10	3.90	0.51	5.91	11.84	12.80
13	1,873	6.15	0.80	2.62	4	1.67	1.95	1.38	4.30	0.51	6.40	14.82	14.11
14	2,023	6.64	0.80	2.62	5	1.67	2.10	1.50	5.38	0.51	6.89	16.11	17.64
15	2,173	7.13	0.90	2.95	5	1.67	2.25	1.82	5.88	0.51	7.38	19.58	19.28
16	2,323	7.62	0.90	2.95	5	1.67	2.40	1.95	5.88	0.51	7.87	21.03	19.28
17	2,473	8.11	1.00	3.28	6	1.67	2.55	2.32	7.65	0.51	8.37	24.99	25.10
18	2,623	8.61	1.10	3.61	6	1.67	2.70	2.72	8.25	0.51	8.86	29.26	27.07
19	2,773	9.10	1.10	3.61	6	1.67	2.85	2.88	8.25	0.51	9.35	31.04	27.07
20	2,923	9.59	1.20	3.94	7	1.67	3.00	3.33	10.33	0.51	9.84	35.80	33.88

Design – Stabilized Backfill

Batter – 0 Degree

Retained Soil – Clay
(friction angle 28 degrees)

Backfill Soil – native
(subject to approval by design engineer)



Surcharge of 100 psf (4.8 kPa) = light vehicular traffic. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	0.30	0.98	1	1.67	0.45	0.07	0.58	0.51	1.48	0.71	1.89
4	523	1.72	0.30	0.98	1	1.67	0.60	0.11	0.58	0.51	1.97	1.20	1.89
5	673	2.21	0.30	0.98	2	1.67	0.75	0.16	1.15	0.51	2.46	1.68	3.77
6	823	2.70	0.30	0.98	2	1.67	0.90	0.20	1.15	0.51	2.95	2.17	3.77
7	973	3.19	0.40	1.31	2	1.67	1.05	0.33	1.35	0.51	3.45	3.54	4.43
8	1,123	3.68	0.40	1.31	3	1.67	1.20	0.39	2.03	0.51	3.94	4.18	6.64
9	1,273	4.18	0.50	1.64	3	1.67	1.35	0.56	2.33	0.51	4.43	6.03	7.63
10	1,423	4.67	0.60	1.97	3	1.67	1.50	0.76	2.63	0.51	4.92	8.21	8.61
11	1,573	5.16	0.60	1.97	4	1.67	1.65	0.85	3.50	0.51	5.41	9.18	11.48
12	1,723	5.65	0.70	2.30	4	1.67	1.80	1.10	3.90	0.51	5.91	11.84	12.80
13	1,873	6.15	0.80	2.62	4	1.67	1.95	1.38	4.30	0.51	6.40	14.82	14.11
14	2,023	6.64	0.80	2.62	5	1.67	2.10	1.50	5.38	0.51	6.89	16.11	17.64
15	2,173	7.13	0.90	2.95	5	1.67	2.25	1.82	5.88	0.51	7.38	19.58	19.28
16	2,323	7.62	1.00	3.28	5	1.67	2.40	2.17	6.38	0.51	7.87	23.37	20.92
17	2,473	8.11	1.10	3.61	6	1.67	2.55	2.55	8.25	0.51	8.37	27.48	27.07
18	2,623	8.61	1.20	3.94	6	1.67	2.70	2.97	8.85	0.51	8.86	31.92	29.04
19	2,773	9.10	1.20	3.94	6	1.67	2.85	3.15	8.85	0.51	9.35	33.86	29.04
20	2,923	9.59	1.20	3.94	7	1.67	3.00	3.33	10.33	0.51	9.84	35.80	33.88

Please note that geogrid reinforcement is required to provide a connection between the stabilized backfill and Nueva® wall blocks. Maximum spacing of geogrid 450mm. Upper row geogrid within 300mm of coping, lowest row of geogrid within 300mm of bottom of stabilized backfill.

3H:1V Slope above wall. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	0.30	0.98	1	1.67	0.30	0.02	0.58	0.51	0.98	0.23	1.89
3	373	1.22	0.30	0.98	1	1.67	0.45	0.07	0.58	0.51	1.48	0.71	1.89
4	523	1.72	0.30	0.98	1	1.67	0.60	0.11	0.58	0.51	1.97	1.20	1.89
5	673	2.21	0.50	1.64	2	1.67	0.75	0.26	1.55	0.51	2.46	2.80	5.09
6	823	2.70	0.60	1.97	2	1.67	0.90	0.40	1.75	0.51	2.95	4.33	5.74
7	973	3.19	0.70	2.30	2	1.67	1.05	0.57	1.95	0.51	3.45	6.19	6.40
8	1,123	3.68	0.90	2.95	3	1.67	1.20	0.87	3.53	0.51	3.94	9.41	11.57
9	1,273	4.18	1.00	3.28	3	1.67	1.35	1.12	3.83	0.51	4.43	12.07	12.55
10	1,423	4.67	1.20	3.94	3	1.67	1.50	1.53	4.43	0.51	4.92	16.42	14.52
11	1,573	5.16	1.30	4.27	4	1.67	1.65	1.85	6.30	0.51	5.41	19.89	20.67
12	1,723	5.65	1.40	4.59	4	1.67	1.80	2.20	6.70	0.51	5.91	23.68	21.98
13	1,873	6.15	1.50	4.92	4	1.67	1.95	2.58	7.10	0.51	6.40	27.79	23.30
14	2,023	6.64	1.60	5.25	5	1.67	2.10	2.99	9.38	0.51	6.89	32.23	30.76
15	2,173	7.13	1.80	5.91	5	1.67	2.25	3.64	10.38	0.51	7.38	39.16	34.04
16	2,323	7.62	1.90	6.23	5	1.67	2.40	4.12	10.88	0.51	7.87	44.40	35.68
17	2,473	8.11	2.00	6.56	6	1.67	2.55	4.64	13.65	0.51	8.37	49.97	44.79
18	2,623	8.61	2.30	7.55	6	1.67	2.70	5.68	15.45	0.51	8.86	61.18	50.69
19	2,773	9.10	2.30	7.55	6	1.67	2.85	6.03	15.45	0.51	9.35	64.89	50.69
20	2,923	9.59	2.40	7.87	7	1.67	3.00	6.65	18.73	0.51	9.84	71.59	61.44

Notes: 1 - Stabilized backfill extends from ground elevation to 152mm (6") from top of wall.
2 - Geogrid extends from within 25mm (1") of front of wall blocks to back of stabilized backfill.

Surcharge of 50 psf (2.4 kPa) = light pedestrian. Inclusion of pedestrian guard when exposed height >600mm

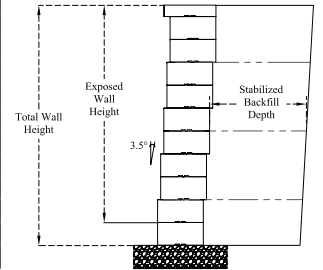
Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	-	-	-	1.67	0.45	-	-	0.51	1.48	-	-
4	523	1.72	-	-	-	1.67	0.60	-	-	0.51	1.97	-	-
5	673	2.21	-	-	-	1.67	0.75	-	-	0.51	2.46	-	-
6	823	2.70	0.40	1.31	2	1.67	0.90	0.27	1.35	0.51	2.95	2.89	4.43
7	973	3.19	0.40	1.31	2	1.67	1.05	0.33	1.35	0.51	3.45	3.54	4.43
8	1,123	3.68	0.40	1.31	3	1.67	1.20	0.39	2.03	0.51	3.94	4.18	6.64
9	1,273	4.18	0.50	1.64	3	1.67	1.35	0.56	2.33	0.51	4.43	6.03	7.63
10	1,423	4.67	0.50	1.64	3	1.67	1.50	0.64	2.33	0.51	4.92	6.84	7.63
11	1,573	5.16	0.60	1.97	4	1.67	1.65	0.85	3.50	0.51	5.41	9.18	11.48
12	1,723	5.65	0.60	1.97	4	1.67	1.80	0.94	3.50	0.51	5.91	10.15	11.48
13	1,873	6.15	0.70	2.30	4	1.67	1.95	1.20	3.90	0.51	6.40	12.97	12.80
14	2,023	6.64	0.70	2.30	5	1.67	2.10	1.31	4.88	0.51	6.89	14.10	15.99
15	2,173	7.13	0.80	2.62	5	1.67	2.25	1.62	5.38	0.51	7.38	17.40	17.64
16	2,323	7.62	0.90	2.95	5	1.67	2.40	1.95	5.88	0.51	7.87	21.03	19.28
17	2,473	8.11	0.90	2.95	6	1.67	2.55	2.09	7.05	0.51	8.37	22.49	23.13
18	2,623	8.61	1.00	3.28	6	1.67	2.70	2.47	7.65	0.51	8.86	26.60	25.10
19	2,773	9.10	1.00	3.28	6	1.67	2.85	2.62	7.65	0.51	9.35	28.21	25.10
20	2,923	9.59	1.00	3.28	7	1.67	3.00	2.77	8.93	0.51	9.84	29.83	29.28

Design – Stabilized Backfill

Batter – 3.5 Degree

Retained Soil – Clay (friction angle 28 degrees)

Backfill Soil – imported granular (friction angle 35 degrees)



Surcharge of 100 psf (4.8 kPa) = light vehicular traffic. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	-	-	1	1.67	0.45	-	-	0.51	1.48	-	-
4	523	1.72	0.30	0.98	1	1.67	0.60	0.11	0.58	0.51	1.97	1.20	1.89
5	673	2.21	0.30	0.98	2	1.67	0.75	0.16	1.15	0.51	2.46	1.68	3.77
6	823	2.70	0.30	0.98	2	1.67	0.90	0.20	1.15	0.51	2.95	2.17	3.77
7	973	3.19	0.30	0.98	2	1.67	1.05	0.25	1.15	0.51	3.45	2.65	3.77
8	1,123	3.68	0.40	1.31	3	1.67	1.20	0.39	2.03	0.51	3.94	4.18	6.64
9	1,273	4.18	0.40	1.31	3	1.67	1.35	0.45	2.03	0.51	4.43	4.83	6.64
10	1,423	4.67	0.50	1.64	3	1.67	1.50	0.64	2.33	0.51	4.92	6.84	7.63
11	1,573	5.16	0.60	1.97	4	1.67	1.65	0.85	3.50	0.51	5.41	9.18	11.48
12	1,723	5.65	0.60	1.97	4	1.67	1.80	0.94	3.50	0.51	5.91	10.15	11.48
13	1,873	6.15	0.70	2.30	4	1.67	1.95	1.20	3.90	0.51	6.40	12.97	12.80
14	2,023	6.64	0.80	2.62	5	1.67	2.10	1.50	5.38	0.51	6.89	16.11	17.64
15	2,173	7.13	0.80	2.62	5	1.67	2.25	1.62	5.38	0.51	7.38	17.40	17.64
16	2,323	7.62	0.90	2.95	5	1.67	2.40	1.95	5.88	0.51	7.87	21.03	19.28
17	2,473	8.11	0.90	2.95	6	1.67	2.55	2.09	7.05	0.51	8.37	22.49	23.13
18	2,623	8.61	1.10	3.61	6	1.67	2.70	2.72	8.25	0.51	8.86	29.26	27.07
19	2,773	9.10	1.10	3.61	6	1.67	2.85	2.88	8.25	0.51	9.35	31.04	27.07
20	2,923	9.59	1.10	3.61	7	1.67	3.00	3.05	9.63	0.51	9.84	32.81	31.58

Please note that geogrid reinforcement is required to provide a connection between the stabilized backfill and Nueva® wall blocks. Maximum spacing of geogrid 450mm. Upper row geogrid within 300mm of coping, lower row of geogrid within 300mm of bottom of stabilized backfill.

3H:1V Slope above wall. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	-	-	-	1.67	0.45	-	-	0.51	1.48	-	-
4	523	1.72	0.30	0.98	1	1.67	0.60	0.11	0.58	0.51	1.97	1.20	1.89
5	673	2.21	0.40	1.31	2	1.67	0.75	0.21	1.35	0.51	2.46	2.24	4.43
6	823	2.70	0.50	1.64	2	1.67	0.90	0.34	1.55	0.51	2.95	3.61	5.09
7	973	3.19	0.70	2.30	2	1.67	1.05	0.57	1.95	0.51	3.45	6.19	6.40
8	1,123	3.68	0.80	2.62	3	1.67	1.20	0.78	3.23	0.51	3.94	8.36	10.58
9	1,273	4.18	0.90	2.95	3	1.67	1.35	1.01	3.53	0.51	4.43	10.86	11.57
10	1,423	4.67	1.00	3.28	3	1.67	1.50	1.27	3.83	0.51	4.92	13.68	12.55
11	1,573	5.16	1.10	3.61	4	1.67	1.65	1.56	5.50	0.51	5.41	16.83	18.05
12	1,723	5.65	1.30	4.27	4	1.67	1.80	2.04	6.30	0.51	5.91	21.99	20.67
13	1,873	6.15	1.40	4.59	4	1.67	1.95	2.41	6.70	0.51	6.40	25.94	21.98
14	2,023	6.64	1.50	4.92	5	1.67	2.10	2.81	8.88	0.51	6.89	30.21	29.12
15	2,173	7.13	1.60	5.25	5	1.67	2.25	3.23	9.38	0.51	7.38	34.81	30.76
16	2,323	7.62	1.80	5.91	5	1.67	2.40	3.91	10.38	0.51	7.87	42.07	34.04
17	2,473	8.11	1.90	6.23	6	1.67	2.55	4.41	13.05	0.51	8.37	47.47	42.82
18	2,623	8.61	2.10	6.89	6	1.67	2.70	5.19	14.25	0.51	8.86	55.86	46.75
19	2,773	9.10	2.10	6.89	6	1.67	2.85	5.50	14.25	0.51	9.35	59.25	46.75
20	2,923	9.59	2.30	7.55	7	1.67	3.00	6.37	18.03	0.51	9.84	68.61	59.14

Notes: 1 - Stabilized backfill extends from ground elevation to 152mm (6") from top of wall.
2 - Geogrid extends from within 25mm (1") of front of wall blocks to back of stabilized backfill.

Surcharge of 50 psf (2.4 kPa) = light pedestrian. Inclusion of pedestrian guard when exposed height >600mm

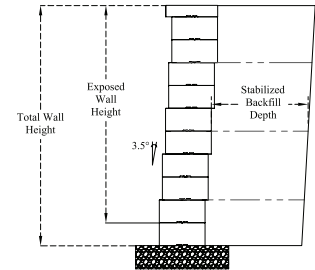
Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	-	-	-	1.67	0.45	-	-	0.51	1.48	-	-
4	523	1.72	0.40	1.31	1	1.67	0.60	0.15	0.68	0.51	1.97	1.60	2.21
5	673	2.21	0.40	1.31	2	1.67	0.75	0.21	1.35	0.51	2.46	2.24	4.43
6	823	2.70	0.40	1.31	2	1.67	0.90	0.27	1.35	0.51	2.95	2.89	4.43
7	973	3.19	0.40	1.31	2	1.67	1.05	0.33	1.35	0.51	3.45	3.54	4.43
8	1,123	3.68	0.40	1.31	3	1.67	1.20	0.39	2.03	0.51	3.94	4.18	6.64
9	1,273	4.18	0.50	1.64	3	1.67	1.35	0.56	2.33	0.51	4.43	6.03	7.63
10	1,423	4.67	0.50	1.64	3	1.67	1.50	0.64	2.33	0.51	4.92	6.84	7.63
11	1,573	5.16	0.60	1.97	4	1.67	1.65	0.85	3.50	0.51	5.41	9.18	11.48
12	1,723	5.65	0.60	1.97	4	1.67	1.80	0.94	3.50	0.51	5.91	10.15	11.48
13	1,873	6.15	0.70	2.30	4	1.67	1.95	1.20	3.90	0.51	6.40	12.97	12.80
14	2,023	6.64	0.70	2.30	5	1.67	2.10	1.31	4.88	0.51	6.89	14.10	15.99
15	2,173	7.13	0.80	2.62	5	1.67	2.25	1.62	5.38	0.51	7.38	17.40	17.64
16	2,323	7.62	0.90	2.95	5	1.67	2.40	1.95	5.88	0.51	7.87	21.03	19.28
17	2,473	8.11	0.90	2.95	6	1.67	2.55	2.09	7.05	0.51	8.37	22.49	23.13
18	2,623	8.61	1.00	3.28	6	1.67	2.70	2.47	7.65	0.51	8.86	26.60	25.10
19	2,773	9.10	1.00	3.28	6	1.67	2.85	2.62	7.65	0.51	9.35	28.21	25.10
20	2,923	9.59	1.00	3.28	7	1.67	3.00	2.77	8.93	0.51	9.84	29.83	29.28

Design – Stabilized Backfill

Batter – 3.5 Degree

Retained Soil – Clay (friction angle 28 degrees)

Backfill Soil – native (subject to approval by design engineer)



Surcharge of 100 psf (4.8 kPa) = light vehicular traffic. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	0.30	0.98	1	1.67	0.45	0.07	0.58	0.51	1.48	0.71	1.89
4	523	1.72	0.30	0.98	1	1.67	0.60	0.11	0.58	0.51	1.97	1.20	1.89
5	673	2.21	0.30	0.98	2	1.67	0.75	0.16	1.15	0.51	2.46	1.68	3.77
6	823	2.70	0.30	0.98	2	1.67	0.90	0.20	1.15	0.51	2.95	2.17	3.77
7	973	3.19	0.30	0.98	2	1.67	1.05	0.25	1.15	0.51	3.45	2.65	3.77
8	1,123	3.68	0.40	1.31	3	1.67	1.20	0.39	2.03	0.51	3.94	4.18	6.64
9	1,273	4.18	0.40	1.31	3	1.67	1.35	0.45	2.03	0.51	4.43	4.83	6.64
10	1,423	4.67	0.50	1.64	3	1.67	1.50	0.64	2.33	0.51	4.92	6.84	7.63
11	1,573	5.16	0.60	1.97	4	1.67	1.65	0.85	3.50	0.51	5.41	9.18	11.48
12	1,723	5.65	0.60	1.97	4	1.67	1.80	0.94	3.50	0.51	5.91	10.15	11.48
13	1,873	6.15	0.70	2.30	4	1.67	1.95	1.20	3.90	0.51	6.40	12.97	12.80
14	2,023	6.64	0.80	2.62	5	1.67	2.10	1.50	5.38	0.51	6.89	16.11	17.64
15	2,173	7.13	0.80	2.62	5	1.67	2.25	1.62	5.38	0.51	7.38	17.40	17.64
16	2,323	7.62	0.90	2.95	5	1.67	2.40	1.95	5.88	0.51	7.87	21.03	19.28
17	2,473	8.11	0.90	2.95	6	1.67	2.55	2.09	7.05	0.51	8.37	22.49	23.13
18	2,623	8.61	1.10	3.61	6	1.67	2.70	2.72	8.25	0.51	8.86	29.26	27.07
19	2,773	9.10	1.10	3.61	6	1.67	2.85	2.88	8.25	0.51	9.35	31.04	27.07
20	2,923	9.59	1.10	3.61	7	1.67	3.00	3.05	9.63	0.51	9.84	32.81	31.58

Please note that geogrid reinforcement is required to provide a connection between the stabilized backfill and Nueva® wall blocks. Maximum spacing of geogrid 450mm. Upper row geogrid within 300mm of coping, lowest row of geogrid within 300mm of bottom of stabilized backfill.

3H:1V Slope above wall. Use greater of this or top chart where a pedestrian guard is required.

Total Courses	Exposed Wall Height		Depth Stab. Backfill ¹		Number of Grid Layers ²	Product per m of wall				Product per ft of wall			
	(mm)	(ft)	(m)	(ft)		Coping (pcs)	Wall Units (sq m)	S.B. (cu m)	Grid (sq m)	Coping (pcs)	Wall Units (sq ft)	S.B. (cu ft)	Grid (sq ft)
2	223	0.73	-	-	-	1.67	0.30	-	-	0.51	0.98	-	-
3	373	1.22	0.30	0.98	1	1.67	0.45	0.07	0.58	0.51	1.48	0.71	1.89
4	523	1.72	0.30	0.98	1	1.67	0.60	0.11	0.58	0.51	1.97	1.20	1.89
5	673	2.21	0.40	1.31	2	1.67	0.75	0.21	1.35	0.51	2.46	2.24	4.43
6	823	2.70	0.50	1.64	2	1.67	0.90	0.34	1.55	0.51	2.95	3.61	5.09
7	973	3.19	0.70	2.30	2	1.67	1.05	0.57	1.95	0.51	3.45	6.19	6.40
8	1,123	3.68	0.80	2.62	3	1.67	1.20	0.78	3.23	0.51	3.94	8.36	10.58
9	1,273	4.18	0.90	2.95	3	1.67	1.35	1.01	3.53	0.51	4.43	10.86	11.57
10	1,423	4.67	1.00	3.28	3	1.67	1.50	1.27	3.83	0.51	4.92	13.68	12.55
11	1,573	5.16	1.10	3.61	4	1.67	1.65	1.56	5.50	0.51	5.41	16.83	18.05
12	1,723	5.65	1.30	4.27	4	1.67	1.80	2.04	6.30	0.51	5.91	21.99	20.67
13	1,873	6.15	1.40	4.59	4	1.67	1.95	2.41	6.70	0.51	6.40	25.94	21.98
14	2,023	6.64	1.50	4.92	5	1.67	2.10	2.81	8.88	0.51	6.89	30.21	29.12
15	2,173	7.13	1.60	5.25	5	1.67	2.25	3.23	9.38	0.51	7.38	34.81	30.76
16	2,323	7.62	1.80	5.91	5	1.67	2.40	3.91	10.38	0.51	7.87	42.07	34.04
17	2,473	8.11	1.90	6.23	6	1.67	2.55	4.41	13.05	0.51	8.37	47.47	42.82
18	2,623	8.61	2.10	6.89	6	1.67	2.70	5.19	14.25	0.51	8.86	55.86	46.75
19	2,773	9.10	2.10	6.89	6	1.67	2.85	5.50	14.25	0.51	9.35	59.25	46.75
20	2,923	9.59	2.30	7.55	7	1.67	3.00	6.37	18.03	0.51	9.84	68.61	59.14

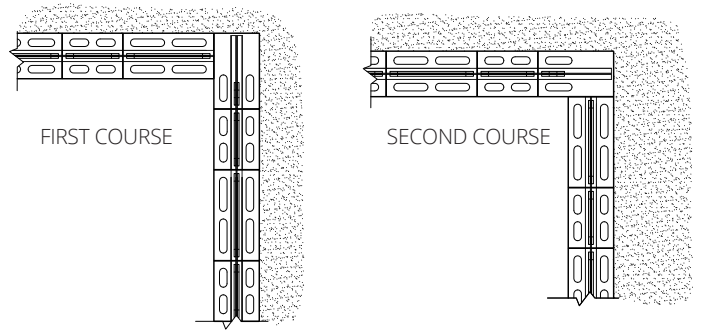
Notes: 1 - Stabilized backfill extends from ground elevation to 152mm (6") from top of wall.
2 - Geogrid extends from within 25mm (1") of front of wall blocks to back of stabilized backfill.

ESTIMATING TIPS – CORNERS, WALL ENDS AND COLUMNS

90 DEGREE INSIDE CORNERS

Build inside corners by overlapping the walls as shown in the image below as the; be sure to extend the buried unit to the back of the perpendicular wall so as to provide a foundation for the next wall course. When using quantity estimates based on the surface area of the wall (e.g. VESPA design software outputs – see Page 24), add an extra 0.1 square metres (1 square feet) of wall block for every 300mm (1 foot) of wall height excluding the coping to accommodate the overlap, and 680mm (28") of Coping to allow for mitering of the inside corner.

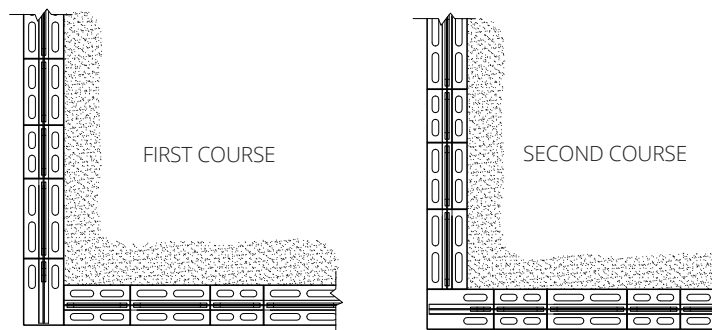
When doing block count estimates, account for 0.1 square metres (1 square foot) of wall blocks for every two courses of Nueva® 150 Wall (or four courses of Nueva® 75 Wall), and one extra coping to allow for mitering of the inside corner.



Note that corner units alternate between layers to finger joint together. Add adhesive between layers to reduce the risk of movement.

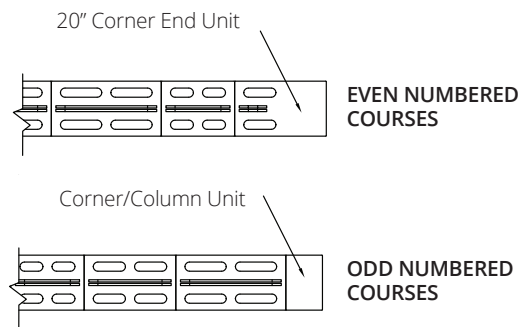
90 DEGREE OUTSIDE CORNERS USING END UNITS

End Units are available in every course of wall blocks, and should be used for outside corners as shown on the adjacent image as the End Units have finished ends that maintain the aesthetic appearance of the wall.



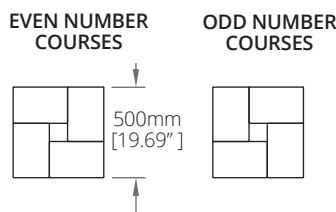
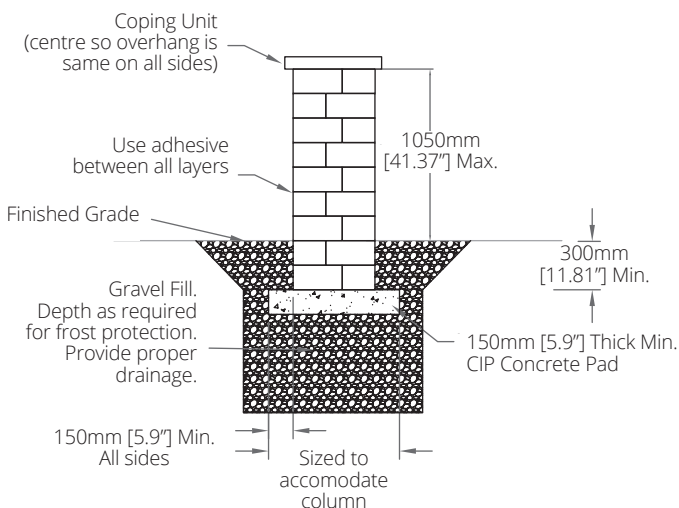
WALL ENDS

Where the end of the wall is exposed, a combination of the 20" Corner/End Units out of the Combo Bundle and the Corner/Column Units can be used to create a finished end "potentially" without having to make any cuts.



COLUMNS

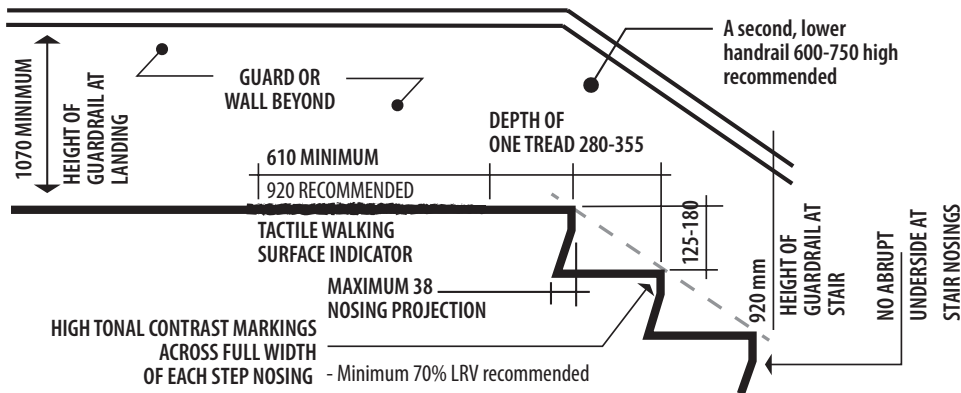
Columns can be used as stand alone items, or as a way to close off the ends or corners of a freestanding wall. The Corner/Column Unit was specifically designed to easily create a 500mm square column; all that is needed is 4 units per layer. Oaks does not currently manufacture a column cap so these will need to be sourced separately. A concrete pad and extra buried depth, as shown on the adjacent detail, are recommended for higher Columns.



ESTIMATING TIPS – STEPS

The diagram below is taken from the “Illustrated Technical Guide to the Accessibility Standard for the Design of Public Spaces” which is intended to help design professionals develop public spaces that are open and welcoming to everyone, including people with diverse abilities.

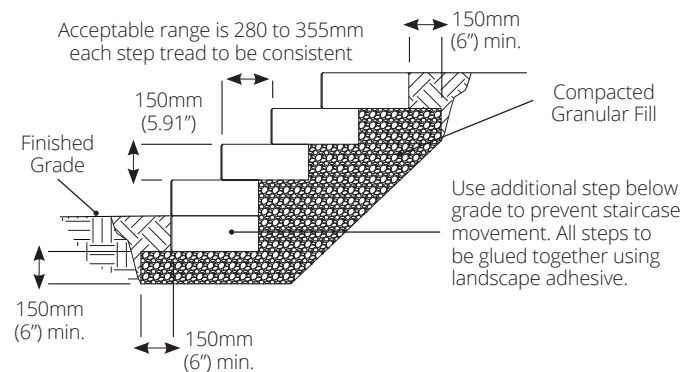
The Nueva® Step (additional information can be found on Page 27) was added to the Nueva® product line to provide a step product that complied to these Accessibility Standards, as well as the recently revised rise/run criteria stipulated in OBC Table 9.8.4.1 for private and public staircases.



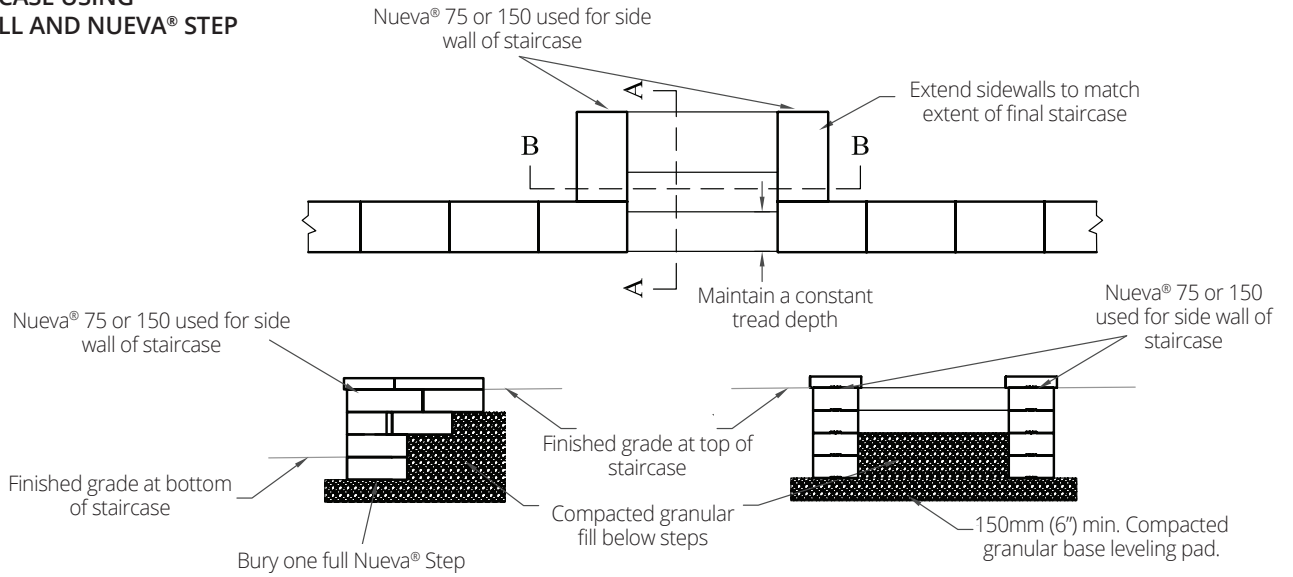
GENERAL STEP CONSTRUCTION

Here is some general information on basic step construction:

- 1) Ensure the native soil and backfill material below the staircase is compacted to at least 95% Standard Proctor.
- 2) To increase the long term performance of stairs, Oaks recommends overlapping steps at a minimum, and where possible providing some degree of interlock between risers to prevent forward sliding; with Nueva® Step, this involves applying some construction adhesive between steps.
- 3) If incorporating a pitch to the stairs to promote drainage, the Ontario Building Code states that “The slope of treads shall not exceed 1 in 50.” S9.8.4.4(5); in imperial terms, that is less than ¼” across a 12” deep tread.
- 4) The stairway width, after adjusting for any space taken by rails, should be no less than 900mm.
- 5) For stairways wider than a single unit, stagger the location of the joints.



INSET STAIRCASE USING NUEVA® WALL AND NUEVA® STEP



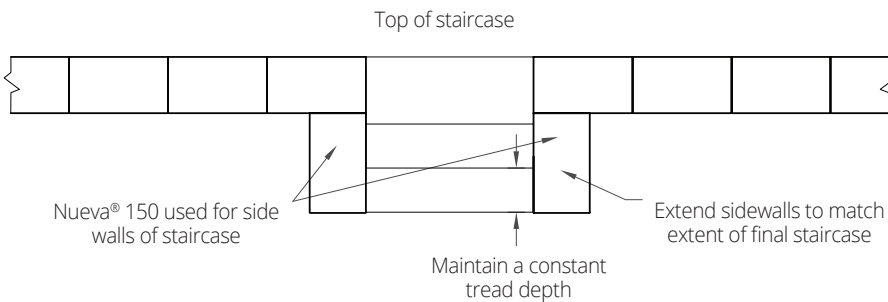
Inset staircases consist of two sidewalls with a staircase in between. When estimating materials for an inset staircase, note that:

- 1) The depth of the sidewalls should match the distance from the toe of the front step tread to the back of the top step tread, so add sufficient additional wall units and coping as needed to construct the sidewalls. Although stepping the bottom of the sidewalls may save some material costs, it is easier to construct these walls off of a well compacted single elevation levelling pad.
- 2) Use one fully buried course of Nueva® Step to bring the bottom of the staircase up to the finished grade. Again it is easier to construct the staircase off of the well compacted single elevation levelling pad used for the side walls.
- 3) Nueva® Steps have slight chamfers around the top and front faces of the units; therefore each step unit can only be used to create two partial pieces. Any segments that have both ends cut off should not be used as they lack the chamfer edges and will be prone to edge chipping.



OUTSET STAIRCASES

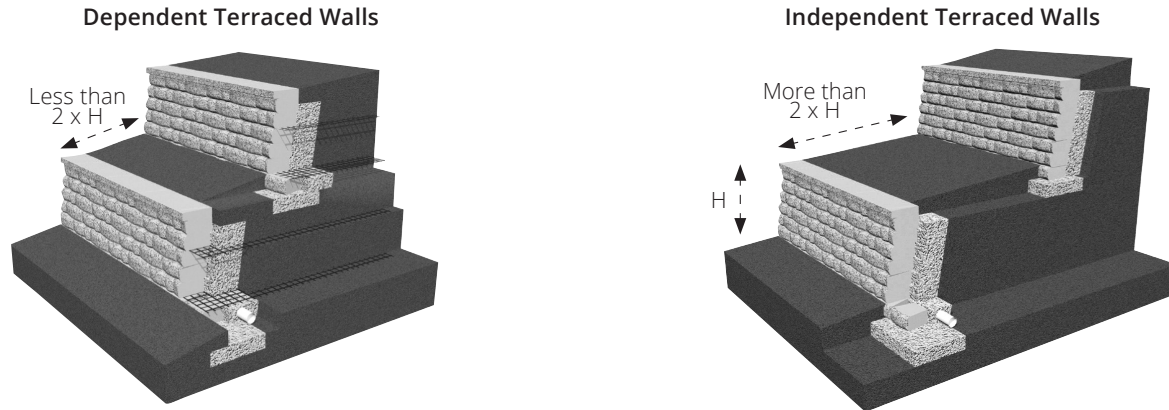
Outset staircases are constructed in much the same fashion as inset staircases, just that the sidewalls are more in part freestanding walls on either side of the staircase. The same estimating instructions outlined above apply.



THINGS TO KNOW – TIERED WALLS

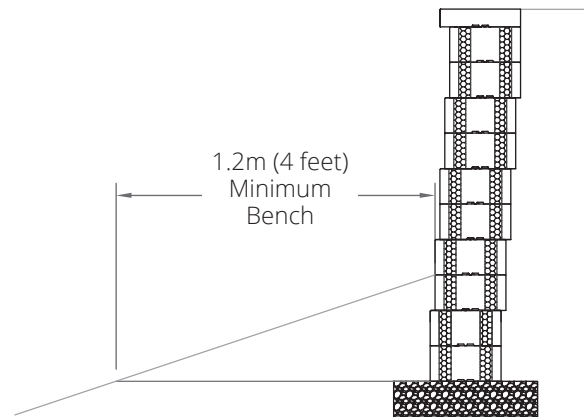
For the walls to be structurally independent of each other, the upper wall must (A) be a distance away from the lower wall of at least 2x the height of the lower wall, and (B) be equal to or less than the height of the lower wall. This is a general rule of thumb, and there are exceptions.

When the distance between the lower and upper walls is less than 2X the height of the lower wall, the walls become structurally dependent on each other. In this situation, global stability (the resistance to overall mass movement of the whole segmental retaining wall system in a circular or sliding mode) must be taken into account. **Additional geogrid or more buried courses may be required.**



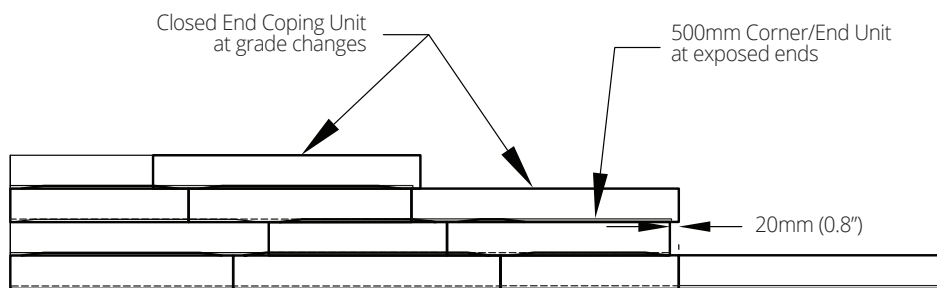
THINGS TO KNOW – TOE SLOPES

When there is a slope in front of the wall, or there is a risk of erosion at the toe of the wall due to water flow, additional buried courses are needed to protect the soil cover in front of the wall. As a general rule of thumb, make sure that the bottom of the wall is not higher than the ground elevation 1.2m (4') in front of the wall, as shown here.



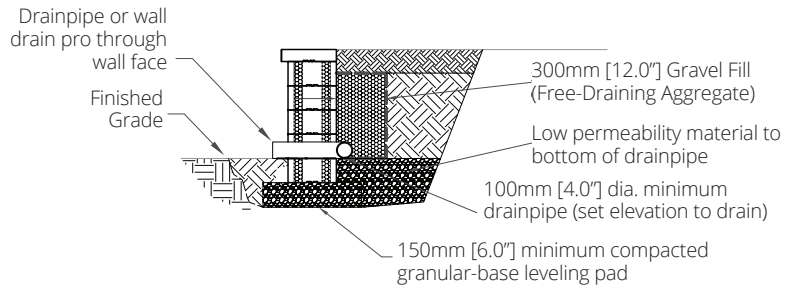
THINGS TO KNOW – ELEVATION CHANGES IN TOP OF WALL

Where there are grade changes in the top of the wall, it is recommended that End Coping and Corner/End Units be used as needed on the exposed sections of the wall (see detail below) so there is a clean and consistent finish. Reference the image on the front cover as an example. If standard Coping and Wall Unit are used, the interlock on the bottom of the units will be visible, and the ends of the units will not be finished the same as the face of the wall.

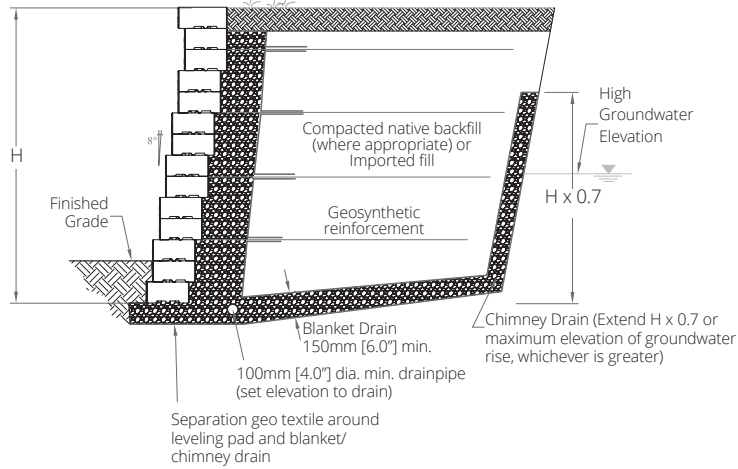


THINGS TO KNOW – WATER MANAGEMENT

Every retaining wall, irrespective of size, needs to have a drainage system behind the wall blocks; components include the gravel fill (or stabilized backfill) and drainpipe. The elevation of the drainpipe is subject to the discharge point; if a catch basin or drainage ditch is near by, the pipe can be set down behind the bottom buried course of wall blocks, but if nothing exists, the drainpipes will need to discharge out the face of the wall and therefore the pipes need to be located at ground level. In the case of the latter, outlets need to be located every 15m (50 feet) along the length of the wall.

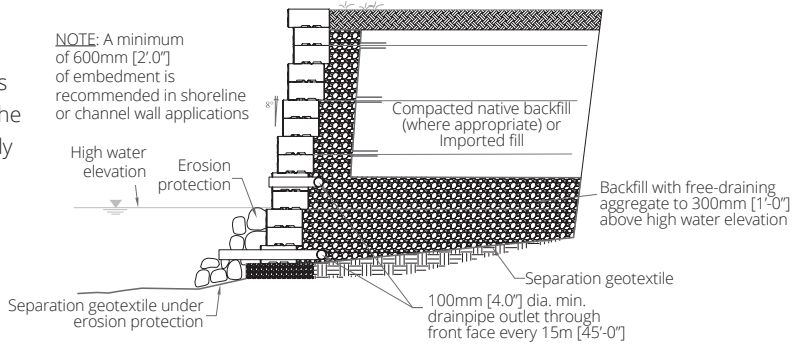


Groundwater can weaken foundation soils supporting the wall, clog drain pipes, and increase external loads on the wall. Blanket or chimney drains may be required to divert groundwater around the wall structure (see adjacent).

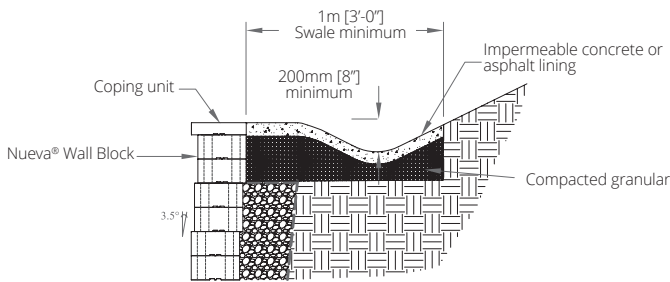


BLANKET OR CHIMNEY DRAIN FOR HIGH GROUNDWATER

When using retaining walls for shoreline stabilization or erosion/ sedimentation control along stream banks, some unique considerations need to be addressed in the wall design such as: erosion at the toe of the wall; potential buildup of hydrostatic pressure behind the wall (especially when rapid water level draw down occurs); the forces of waves and ice sheet flows exerted on the face of the wall.

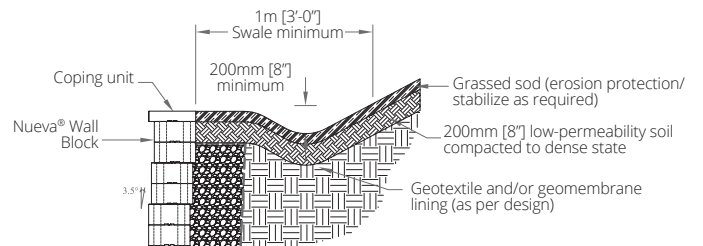


WATERFRONT APPLICATION



VEGETATED SWALE AT CREST OF WALL

Swales at the top of the wall help divert surface water around the wall thereby preventing it from potentially infiltrating down the back of the retaining wall and overloading the drainage system.



CONCRETE SWALE AT CREST OF WALL

THINGS TO KNOW – GUARDS, FENCES AND BARRIERS

GUARDS

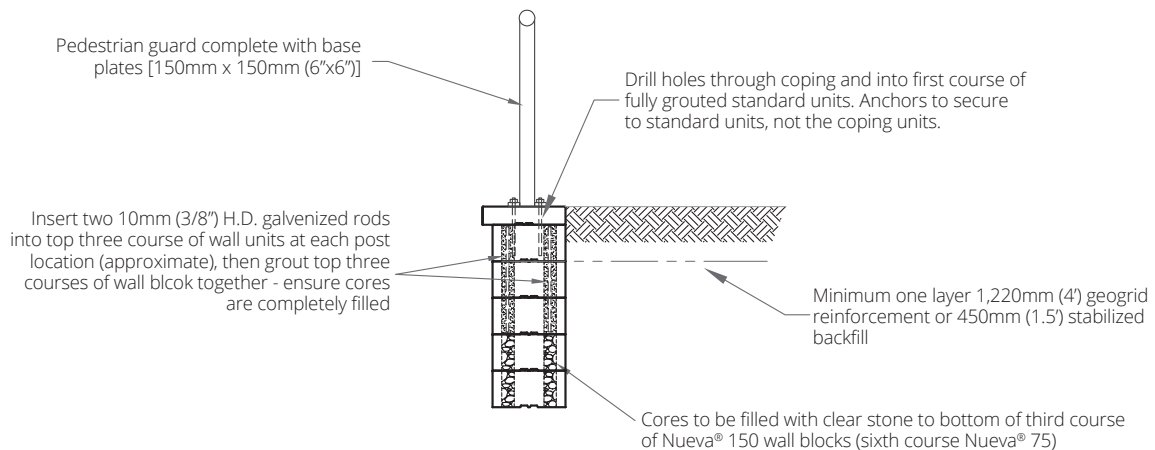
Guards are often required at steps, ramps, exterior landings, porches, balconies, mezzanines, galleries or raised walkways where:

- 1) There is a difference in elevation of more than 600mm (2') between the walking surface and the adjacent surface.
- 2) The adjacent surface within 1.2 m (4') of the walking surface has a slope greater than 1:2.

The pedestrian guards need to meet both of the following loading conditions:

- 1) A horizontal load applied inward or outward on any point at the top of the guard (e.g. 200 lbs at each post).
- 2) An evenly distributed vertical load applied at the top of the guard (e.g. 50 lbs/linear foot of wall).

When fastened the guard to a Nueva® retaining wall, the wall itself has to be able to handle the moment created by the aforementioned loading conditions without over turning. This is accomplished by mechanically fastening a minimum of three courses of Nueva® 150 wall blocks together by adding rebar and grout to the voids, and including at least one layer of geogrid reinforcing (see below). DO NOT simply glue the top few units together – testing has proven this to be insufficient.

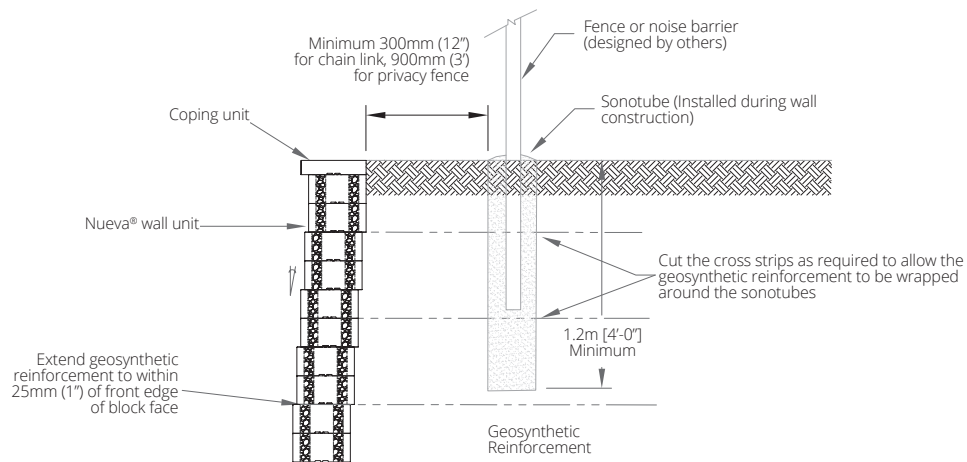


THINGS TO KNOW – GUARDS, FENCES AND BARRIERS

FENCES AND BARRIERS

Fences or noise barriers can be used in lieu of guards (where desired) and can range from chain link to wooden slat construction to concrete panels. Fences and noise barriers must meet the same loading conditions as guards plus the addition of wind loads based on the percentage of area obstructed by the fence components (3% for chain link and 100% for wooden slat or concrete panel). Wind pressures are available in Canada from the National Building Code, Appendix C; typically 1/30 hourly values are used.

With Nueva®, the recommended practice for fences and noise barriers is to install the fence/barrier posts in sonotubes behind the wall and grouting the posts into place. The image below provides minimum separation distances between the back of wall and sonotubes where the fence does not act significantly enough on the wall that additional impacts need to be considered. Where the fence is closer to the back of wall than listed, or in the case of noise barriers, the wall design will need to be adjusted to account for wind loads acting on the fence/barrier. Where there is a desire to mount the fence directly on the wall, it is recommended that Proterra™, being a larger version of Nueva®, be used.



In this specific case, the fence and wall both needed to be directly along the property line. At each fence post location, 1800mm (6') deep concrete piers were used to support the fence; these prevent the wind loads on the fence from being transferred onto the wall. By making the wall and fence structurally independent of each other, a gravity Nueva® Wall could then be used between the piers to retain the soil.

RETAINING WALL DESIGN REQUEST FORM

WHAT ARE THE RULES

The Ontario Building Code requires a site specific design, certified by a Professional Engineer licensed in Ontario, for retaining walls over 1m (3') that are adjacent to:


- 1) Public property
- 2) Access to a building
- 3) Private property which allows public access such as a resident's front yard for mail delivery to the front door

Some municipalities have expanded this requirement to include any retaining wall, including those on private property, over 1m (3') exposed. Check with your local municipality before proceeding with construction.

HOW CAN OAKS HELP

Oaks staff are available to:

- 1) Help you determine which product and design type combination will work best for your given application. Oaks created the adjacent check list to make sure we know all the required particulars of your given project. We ask that you submit this completed form, along with a site plan and geotechnical report (where available) so that we can properly evaluate the project.
- 2) Evaluate the economics of each wall design type so you can make an informed decision (see Page 24).
- 3) Generate preliminary quantity estimates so you can get material supply and installation quotes from contractors (see Page 24).
- 4) Supply site specific design drawings for submission to the local regulatory agency (see Page 25).



retaining wall design request form

GENERAL INFORMATION

Applicant: _____ Date: _____

Contact Name: _____ Wall Installer: _____

Phone #: _____ Wall Installer Contact #: _____

Email: _____ Wall Installer Email: _____

Applicant Type: Architect Engineer Landscape Architect Contractor
 Home Owner Developer Other _____

PROJECT INFORMATION

Project Name: _____

Project Address: _____

Contact: _____

Site Plan Available: Yes No Geotechnical Report Available: Yes No

DESIGN SERVICE INFORMATION

Date Needed: _____ Bid/Start Date: _____

Service Requested: Wall Design for Quoting Drawing for Building Permit Application
 Construction Drawings

Product Requested: Protterra Ortana/Ortana Plus Nueva® Wall

Wall Type: Single Unit Gravity Multi Unit Gravity Stabilized Backfill Geogrid Reinforced

BASIC SITE INFORMATION

Number of walls on project: _____ Wall batter: (check the appropriate boxes)

Maximum height: _____

Surcharge at top of wall: Landscape/Pedestrian Vehicular Slope
 Building Pool Other _____

Tiered: Yes No

If yes, provide tier information (setback, heights, # of tiers) _____

	0°	3.5°	7°	8°	16°
Ortana					
Protterra™ (split)					
Protterra™ (smooth)					
Nueva® 150 Wall					
Nueva® 75 Wall					

Rail or fence at top of wall? Yes No If yes, type of rail or fence: _____

Site soil description: Clean sands and gravel (φ=36°) Sands, sandy silts (φ=32°) Silts, sandy and silty clays (φ=27°)
 (if geotechnical report not available)

Slope below wall: Yes No How steep: _____ How high: _____

Site soil used for Infill? Yes No Engineered or native? _____

Water application? Yes No Details: _____

Special site requirements/Information: _____

To download a digital fillable version of this form scan below:



PROJECT SPECIFIC QUANTITY ESTIMATES

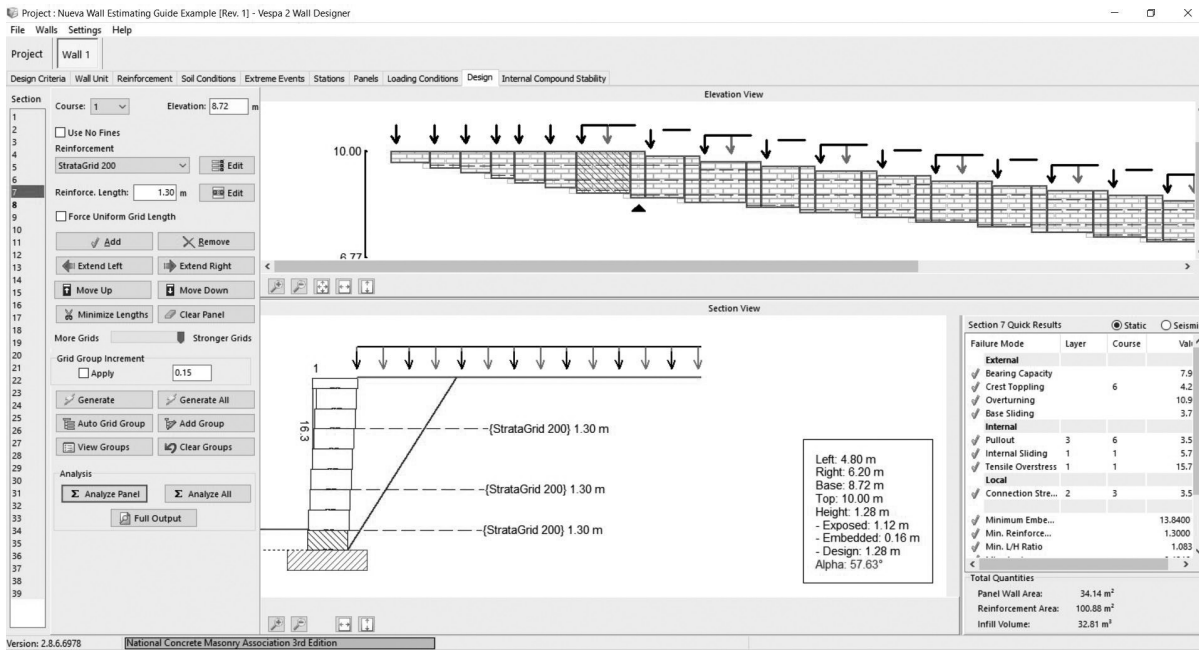
VESPA MSE (Mechanically Stabilized Earth) Design Software was created by experts in retaining wall design to provide accurate quantity estimates and comprehensive reports while simultaneously performing the necessary analysis in accordance with CMHA (Concrete Masonry and Hardscapes Association) methodologies.

WHAT WE NEED FROM YOU

Ideally a scalable site plan complete with TOW (top of wall) and BOW (bottom of wall) elevations is available. Hand sketches will work as long as the distances between elevations points are provided.

WHAT VESPA DOES

Once we input the dimensions of the wall, along with some site specific design details, VESPA generates a wall profile (upper part of screen) and series of cross sections (lower part of screen). The wall profile shows the location of every single unit within the wall. The cross sections show the required lengths of geogrid, or depths of stabilized backfill, for each panel in the wall.



WHAT OAKS GIVES TO YOU

Material quantities (see adjacent) can be exported directly from VESPA that list not only the area and length of the wall (from which we can determine the retaining wall product needs) but also the volume of aggregates needed for the levelling pad, reinforced fill (where applicable), and drainage fill as well as the quantity of geogrid and geotextile needed.

In short, there is more than sufficient information available for local contractors to generate an accurate price estimate for the owner.

Quantities

Wall	Facing	Wall/Cap Length [m]	TOW Steps	Facing Area [m²]	Total Wall Area [m²]
Wall 1	Nueva Wall 150	30	19	32	34
		30	19	32	34

Wall	Leveling Pad [m³]	Reinforced Fill [m³]	Drainage Fill [m³]	Core Fill [m³]
Wall 1	2.8	26.3	6.7	1.8
Totals:	2.8	26.3	6.7	1.8

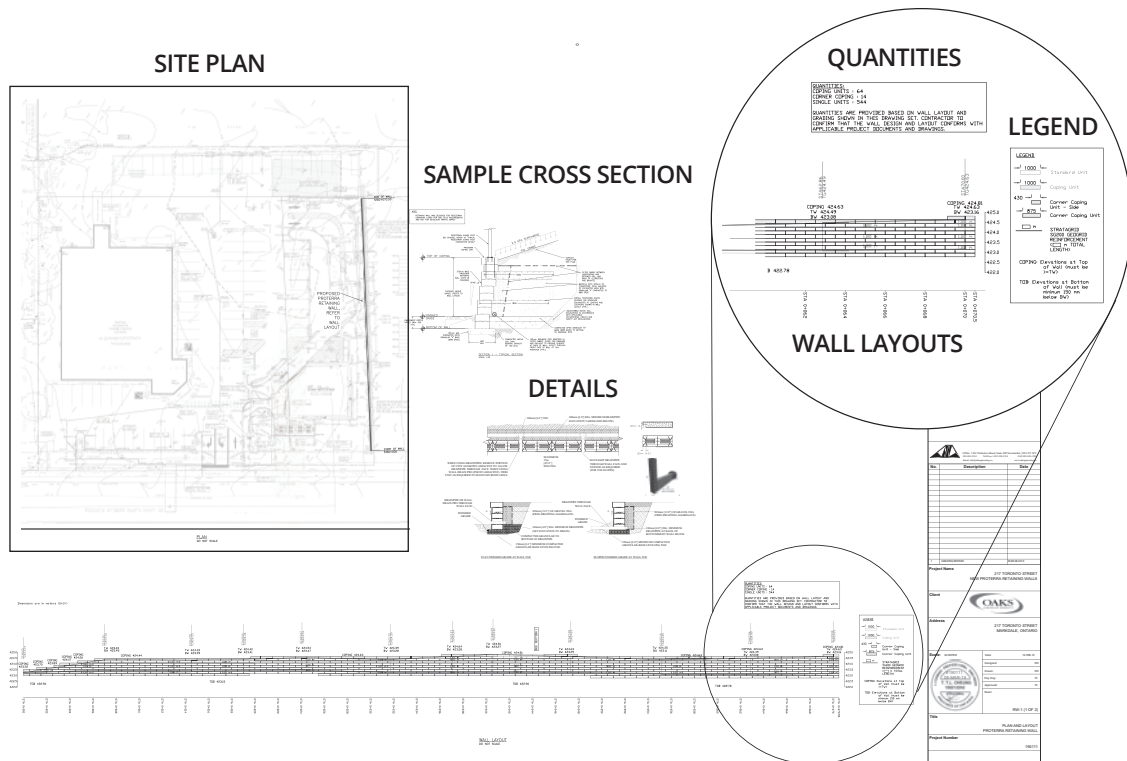
Reinforcements

Wall	SG200 [m²]	Geogrid Connectors
Wall 1	100.9	0
Totals:	100.9	0

STAMPED WALL DRAWINGS

As mentioned on Page 23, site specific design drawings may need to be submitted to the local regulatory agency for approval and/or construction drawings are desired for tender purposes. Oaks can assist with that.

Wall cross sections and elevation views generated by VESPA can be imported directly into AutoCAD to make a clear and comprehensive drawing package complete with material quantities, colour coding of different units for easy identification during construction, wall layouts complete with grid locations/lengths for the entire wall, and applicable details to ensure a quality installation.



Below is an example of a mosaic in a wall – this particular wall is adjacent to a wave pool, so the contractor decided to incorporate a wave into the wall itself. Where a mosaic is desired, we can show exactly what the mosaic will look like on the wall layout. Because every unit in the wall is shown on the layout, there is no guess work onsite during construction – in essence, we are providing a large scale Lego kit complete with instructions.



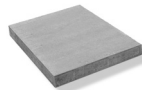
COMPLIMENTARY PRODUCTS - NUEVA® SERIES

The Nueva® Collection is a curation of Oaks Landscape Products that all share similar design characteristics. At the core of the collection is the namesake Nueva® Slab, with smooth, clean surfaces, straight edges, modular sizes, and a versatile, well-coordinated colour palette. Then, we've matched up complimentary paver, walls, steps, curbs and copings in a diverse collection of landscape products that will help unite your design, and carry the sleek, low-profile theme all the way from curbside to poolside.

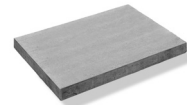
NUEVA® SLAB (60mm)



8x16 Small Rectangle
7.87 x 15.75"
(200 x 400mm)

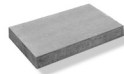


16x16 Stone
15.75 x 15.75"
(400 x 400mm)

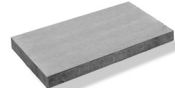


16x24 Stone
15.75 x 23.62"
(400 x 600mm)

3 STONE RANDOM BUNDLE



8x16 Small Rectangle
7.87 x 15.75"
(200 x 400mm)
Individually Packaged



12x24 Rectangle
11.81 x 23.62"
(300 x 600mm)
Individually Packaged

NUEVA® PAVER (80mm)



8x16 Small Rectangle
7.87 x 15.75"
(200 x 400mm)



16x16 Stone
15.75 x 15.75"
(400 x 400mm)



16x24 Stone
15.75 x 23.62"
(400 x 600mm)

3 STONE RANDOM BUNDLE

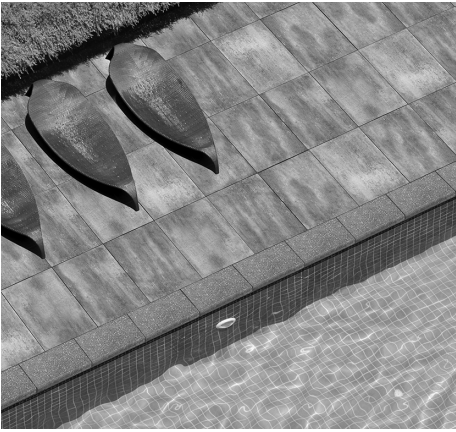


8x16 Small Rectangle
7.87 x 15.75"
(200 x 400mm)
Individually Packaged



16x32 Large Rectangle
15.75 x 31.50"
(400 x 800mm)
Individually Packaged

NUEVA® XL SLAB (60mm)



24x36 Stone
23.62 x 35.43"
(600 x 900mm)
Individually Packaged

NUEVA® STEP



1200mm Step Unit
47.24 x 5.91 x 15.75"
(1200 x 150 x 400mm)

Smooth on all faces
and ends.

NUEVA® CURB



Curb Unit
23.6 x 4.9 x 3.9"
(600 x 125 x 100mm)



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BRAMPTON, ON L7A 1E9

BOISBRIAND

4200, MARCEL-LACASSE
BOISBRIAND, QC J7H 1N3

BROCKVILLE

3007 COUNTY RD. #29, PO BOX 141
BROCKVILLE, ON K6V 5V2

CAMBRIDGE

1038 RIFE ROAD
CAMBRIDGE, ON N1R 5S3

HILLSDALE

2108 FLOS ROAD FOUR EAST
HILLSDALE, ON L0L 1V0

MARKHAM

455 RODICK ROAD
MARKHAM, ON L6G 1B2

DETROIT

51744 PONTIAC TRAIL
WIXOM, MI 48393

FARMERSBURG

1256 EAST COUNTY RD. 950 N.
FARMERSBURG, IN 47850



Product representations shown in this publication are intended to convey the general colour, texture and appearance of the product. Variations may occur in the manufacturing and printing process. Always select from current, physical product samples.