B BOWERS
brothers concrete ltd

VERSALOC® GUIDE
VERY QUICK, VERY EASY

AN ADBRI MASONRY LICENCED PRODUCT

CONTENTS

PREFACE

Designs shown in the brochure are based on limit state design in accordance with the provisions of NZS3101-2006.

The retaining wall design details provided in this brochure have been prepared specifically for mortarless Versaloc® blocks and are applicable only to retaining walls using Bowers Brothers Versaloc® products for residential or light commercial applications up to 2.4m high with Type 1 and Type 2 bases and 200 series blocks.

Also included is a table showing compressive load capacity of Versaloc® walls up to 6.0m high with two load cases using 200 series blocks.

INTRODUCTION

Reinforced Bowers Brothers Versaloc® block retaining walls consist of a reinforced concrete base which anchors the wall against overturning and sliding, and a stem of mortarless Versaloc® blocks. Stems are reinforced with steel bars placed vertically and horizontally, and all cores in the blocks are filled with semi-fluid concrete known as 'grout'. Vertical reinforcing bars in the cores of reinforced walls are lapped with shorter 'starter bars' embedded firmly in the reinforced concrete base. The length of the lap is critically important and must be shown on the drawings.

The designs in this brochure have been checked and approved by:

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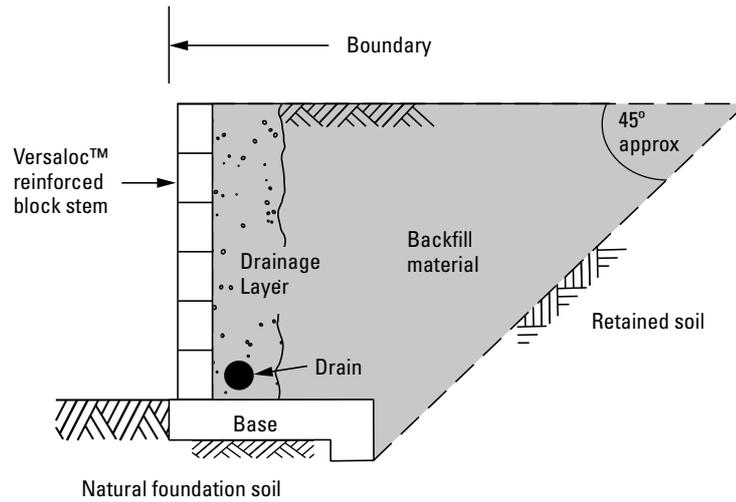
For any designs outside the scope of those included in this brochure, please contact Frontier Engineers directly.

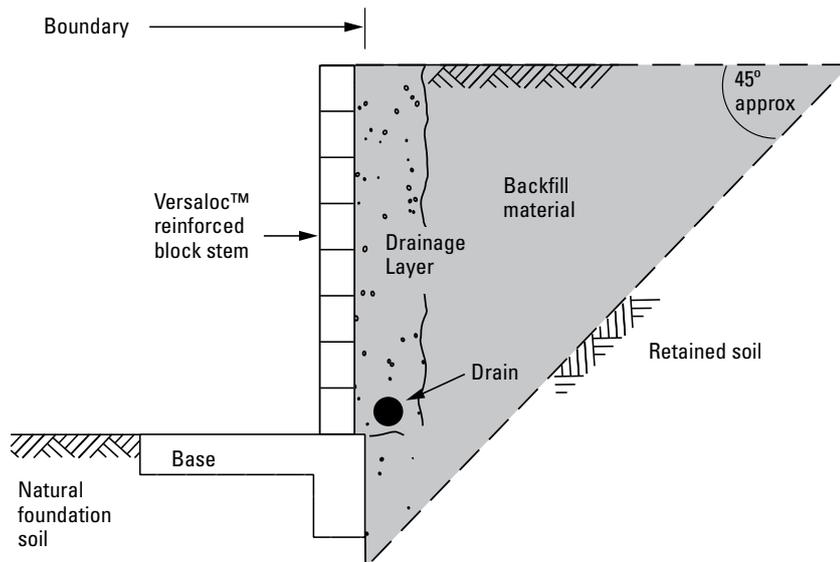# 1.0 VERSALOC® RETAINING WALLS

1.1 Designs for reinforced retaining walls type 1 and type 2

Designs consist of:
200 series block retaining walls up to 2.4m high for level backslope and 1.8m high for 1:4 backslope

Wall Type 1

Wall Type 2

1.2 Design details

1.2.1 Design details for walls up to 2400mm high with level backfill slope with Type 1 base

1.2.2 Design details for walls up to 1800mm high with 1:4 backfill slope with Type 1 base

1.2.3 Design details for walls up to 2400mm high with level backfill slope with Type 2 base

1.2.4 Design details for walls up to 1800mm high with 1:4 backfill slope with Type 2 base

1.3 Material specifications

Versaloc® Block	190mm f'm = 25.0 MPa
Concrete base	f'c = 25 MPa
Reinforcement	Grade 500 E
Grout	Refer section

1.4 Soil classification of backfill material, retained soil and foundation soil

1.4.1 Wall Type 1 and 2

For simplicity wall type 1 and 2 design details in this brochure for backfill material, retained soil and foundation soil are based on a common soil with the following typical properties; coarse grained with low permeability due to admixture of particles of silt size, residual soil with stones, fine silty sand and granular materials with conspicuous clay content with an internal friction angle of 30°. Note: often retained soil is used as backfill material if suitable.

Backfill Material & Retained Soil	Design Values for Wall Types 1 and 2
Characteristic internal angle of friction *	30
Design internal angle of friction (degrees) *	30
Design external angle of friction (degrees) *	15
Characteristic cohesion (kPa) assume c *	0
Soil density (kN/m3) *	18
Foundation Soil	**Design Values for Wall Types 1 and 2**
Characteristic internal angle of friction *	30
Design internal angle of friction (degrees) *	30
Design external angle of friction (degrees) *	20
Design cohesion (kPa) c* *	0
Soil density (kN/m3) *	18

Notes:

1) It is assumed the design external friction angle is equivalent to the design internal friction angle due to the roughness of the insitu concrete base on the foundation material.

2) Seek professional engineering advice if natural soil on the site varies from above, as different base dimensions may be required.

1.5 Backfill Material and Retained Soil

Retaining wall designs in this brochure have been calculated for backfill material and retained soil of soil classification as shown in section 1.4.

Note: The following poor quality soils are not allowed for in the designs:

- very soft clay of high plasticity
- very silty clays
- very loose variable clayey fill
- very loose sandy silts
- with characteristic internal angle of friction below 28 degrees.

If these soils are considered for use or aggressive groundwater exists an experienced professional engineer should be consulted and separate designs be obtained.

1.6 Foundation Soil

1.6.1 Wall Type 1 and 2
The design details have been based on a foundation soil as described in section 1.4 and which must be excavated to sufficient depth to expose undisturbed material which is firm and dry.

Note 1: Should a designer wish to analyse a retaining wall with better quality retained soil than the soil nominated in section 1.4, base dimensions different from the tabulated values could be appropriate and it is recommended professional engineering advice is sought.

Note 2: If any of the following foundation conditions exist: softness, poor drainage, filled ground, organic matter, variable conditions, heavily cracked rock, aggressive soils, then experienced professional engineering advice should be obtained.

1.7 Drainage System

It is essential that steps be taken to prevent the soil behind the wall from becoming saturated. These steps should include:

- Sealing the soil surface - this can be done by covering it with a compacted layer of material with low permeability (eg clay). The surface should be sloped towards an open drain.

- A drainage system within the soil - this should preferably be achieved by placing gravel to a width of approximately 300mm immediately behind the wall with a continuous 100mm diameter slotted pvc agricultural pipe with a geo fabric sock located at the base of the wall. The outlets from the pipe must be beyond the ends of the wall unless the pipe is connected to a proper storm water drainage system.

For higher walls, or in cases where excessive ground water exists, it may be necessary to provide another agricultural pipe drain at mid height of the wall. If it is not possible to discharge the drains beyond the end of the wall, weep-holes may be provided (see items for block laying following). In this case, a collecting system (eg spoon drains) must discharge the water into a drainage system to prevent saturation of the ground in front of the wall.

1.8 Water penetration

If considered necessary to reduce the passage of water through the wall, for aesthetic or other reasons such as aggressive ground water, the earth face of the wall should be treated using appropriate sealing techniques (see notes on tanking).

1.9 Tanking

Where the retaining wall is required to be waterproof, various proprietary tanking methods are available. One such method is a three coat liquid rubber compound incorporating a special reinforcing fabric for high stressed areas.

Another method is a heavy duty, pliable, waterproof sheet membrane fixed to the wall back surface. Surface coatings or sheet membranes must always be used in accordance with the manufacturer's specifications.

1.10 Backfill compaction and drainage system

Backfill material should not placed behind the wall until at least ten days after grouting.

- Backfill material should be placed and compacted in layers not more than 200 mm deep. The degree and method of compaction depends on the proposed use of the retaining wall. If unsure, obtain professional engineering device.

- The drainage system should be installed progressively as the backfill soil rises.

- The drainage system behind the wall should be connected to the main drainage system for the site.

- It is advisable to seal off the top surface of the backfill material with a semi impermeable layer of soil or earth (eg clay). Compact and grade the material to a gutter to provide surface drainage.

1.11 Seismic Zones

The retaining wall designs are suitable for seismic zones 1 and 2 as defined in NZS4429. This can be translated to a hazard factor of Z=0.3 as defined in NZS1170.5.

The retaining walls detailed are only suitable for importance level 1 applications (as defined in NZS1170 part 0). Furthermore, the designs are only suitable for applications where the retaining wall is not integral to dwelling / structure.

The tables have been designed assuming negligible vertical seismic acceleration. In applications where vertical seismic accelerations are deemed important, engineering input is required.

1.12 Good Ground

The retaining wall tables are only applicable for bearing on "Good Ground" as defined in NZS3604. This excludes (but is not limited to) the conditions listed below**:**

- Liquefiable soils.

- Expansive soils.

- Soils with an ultimate bearing capacity below 300kPa.

- Soils with an undrained shear strength below 50kPa.

- Any ground which may experience 25mm of settlement.

A geotechnical engineer should confirm the assumption of "Good Ground" on a site specific basis.

1.13 How to build the Versaloc® wall

1.13.1 Preliminary

- Excavate to a satisfactory foundation.

- Arrange for supply of materials to the specifications given previously.

1.13.2 Base and starter bars

- Form the base to the required dimensions and levels as shown in details.

- Place the base reinforcement as shown in the diagrams. Fix the starter bars for the vertical reinforcement (Y-bars) at the correct cover specified in the drawings from the back face of the wall (i.e 50mm) and in the correct positions relative to the block cores to be reinforced. Place horizontal bars in the center on the cross webs.

- Place the base concrete, preferably using ready-mixed concrete, and compact thoroughly by rodding, spading or vibrating. Wood float finish any surface to be exposed permanently. Take care not to dislodge reinforcement.

Note: First reinforcement bar is placed at 60mm from the end (to avoid cross web).

1.13.3 Block laying

- Block laying procedure follows that of the normal practice but without the need to mortar the blocks together.

Note: The first layer of blocks should be mortared to the concrete base in the normal way to provide line and level for the remaining block courses.

- The blocks are laid with the shallow recessed cross webs at the top (refer diagram 1.14.1). During construction, it is important to keep debris off the bed joint plane; otherwise the wall may begin to develop vertical curvature. In addition, as a unit is positioned, some small particles of concrete may be rubbed off the units and fall on the bed joint surface. Usually the force of placing the block

will crush these particles. Otherwise, rubbing the block back and forth along the joint will wear down the material. If a joint is visibly open, the unit should be removed and the debris removed.

Note: Small plastic wedges can be used under blocks to achieve vertical alignment.

- Provided the construction is started on a level surface, use of a line and carpenters' level should be all that are required to keep the wall aligned vertically and horizontally. In instances where the wall is accidentally laid out of line, this can usually be corrected by using a piece of wood to protect the wall and a heavy hammer to knock the wall back into line.

- At the end of walls, Half Sash blocks may be glued to the block directly below using an appropriate adhesive to increase stability. (eg 2 part epoxy or equivalent)

- Blocks should be laid in running bond with head joints aligned vertically every second course. Exact overlapping by half of a block will ensure that the webs and cells are aligned vertically.

- Weepholes can be provided by passing 50mm diameter upvc pipes holes through the wall at 1200mm centres.

- Reinforcement for wall stems must be positioned accurately, and tied securely before placing concrete or grout. Vertical reinforcing bars (X bars), including starter bars (Y bars), shall be placed to provide 50mm cover to the back face of the wall and bars shall lap 700mm.

1.13.4 Bracing

- During grouting of Versaloc® walls, it is recommended that suitable bracing be used to support the wall.

- Temporary bracing of partially built Versaloc® walls is also recommended and especially during windy conditions.

1.13.5 Grouting

Versaloc® blocks have large cores inside to allow for adequate flow of grout and ensuring complete coverage of reinforcing steel bars. As Versaloc® requires no mortar above the first course, there are no mortar dags on the steel, allowing adequate flow of the grout and minimal chance of voids in the wall.

The grout must be sufficiently fluid to fill all the voids, bond together adjacent masonry units, bond steel reinforcement into the cores, and to unify the wall into a single structure. It is therefore important that the cores are filled with grout which meets the specifications listed in the following section.

	1m³ of grout will fill approx.	Approx. No. of blocks per m³ of grout
200 Series	10.2m² of wall	130

Grout Filling

Block filling grout is designed to be sufficiently fluid to fill all the voids, bond together adjacent masonry units, bond steel reinforcement into the cores, and to unify the wall into a single structure. It is therefore important that the cores are filled with correctly designed grout, which meets the following specifications:

Grout Specifications

The grout specifications are performance based. Bowers Brothers recommends the grout supplier determine an appropriate mix design to meet the following performance requirements. The performance details are as follows:

1. Flow Characteristics

The grout shall have a minimum slump of 200 - 250mm maintained for the period of the pour.

Notes:

- Do not add extra water to retemper the grout, unless the grout supplier authorises it.

2. Strength Grade

For internal applications the minimum strength grade of the grout should be 25MPa.

For external applications in near-coastal zones (between 1km and 50km from coast), the minimum strength grade should be 25MPa.

For external applications less than 1km from the coast, the minimum strength grade should be 30MPa.

For specialist applications or more severe environments an engineer should be consulted.

3. Other

Maximum aggregate size shall be **10mm**. The grout shall be free of contaminating lumps **larger than 15mm** (this may require a screen over the pump hopper).

The grout shall be **smooth, free-flowing and cohesive.**

Notes:

- A 'cohesive' mix is one which has no tendency to segregate when pumped down into the Versaloc® cavity. The concrete supplier should use a high-quality superplasticiser to achieve the flow characteristics required.

- Due to hydrostatic pressure build up by the fluid core-fill grout, a maximum filling height between pours of 1.8m (i.e. 9 courses), is strongly recommended.

1.14 Exploded view of construction

(for both level backfill slopes and 1 in 4 backfill slopes)

1.14.1 Walls up to 2400mm high using 200 series blocks

Grout all cores

Grout Hopper

Blocks type Versaloc

Vertical X-bars (Stem) lapped with and tied to starter Y-bars

Horizontal bars in wall can be laid on webs of Versaloc™ blocks and directly beside the vertical steel

Wall base type 1 shown

Lap

Vertical starter Y-bars cast into base

Base transverse bars

Key

Base longitudinal bars
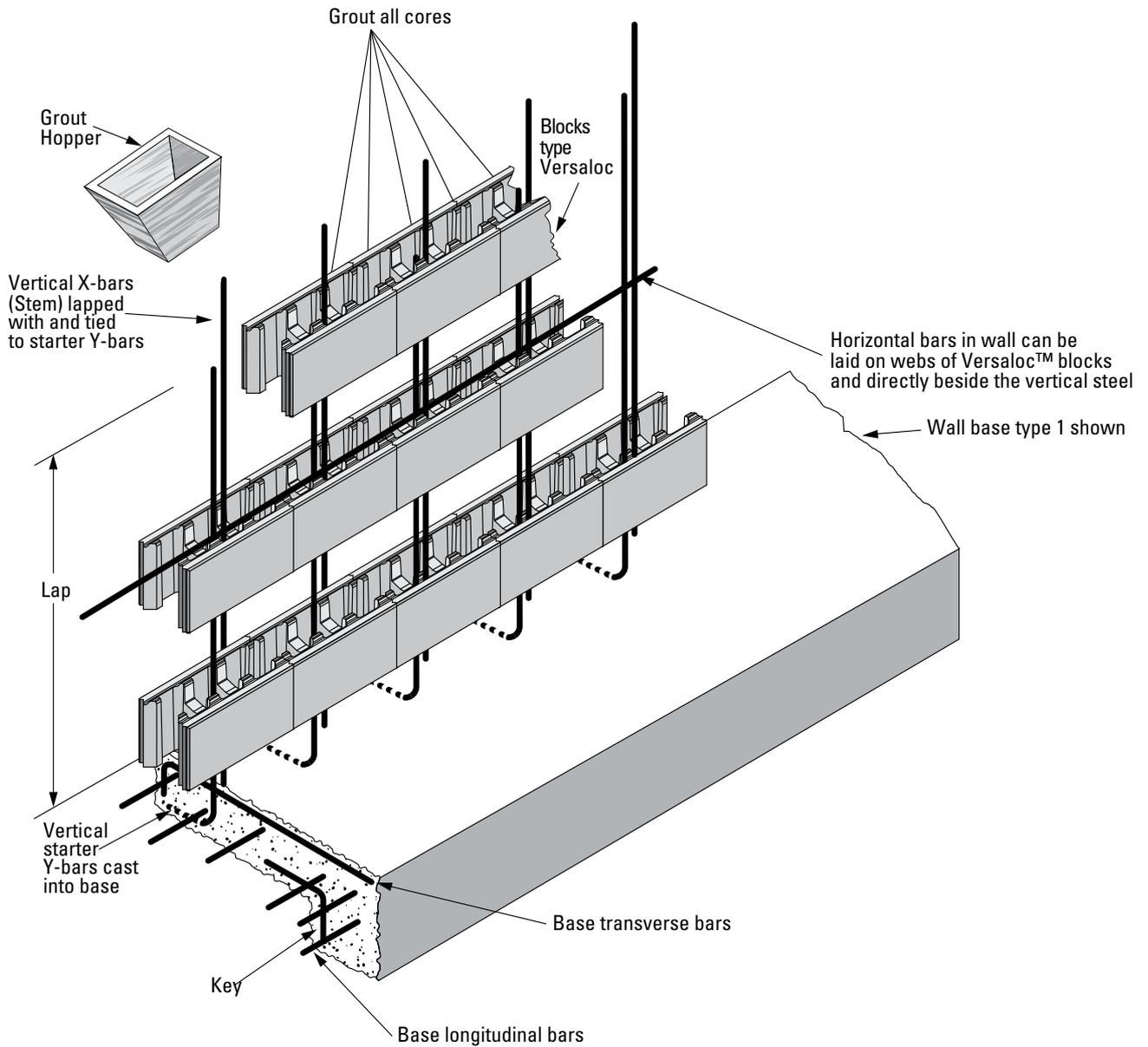
1.14.2 Typical reinforcing steel layout

60 340 400 300 90 90 300 400 340 60

Note: 60mm and 340mm spacing of end bar because of cross web location.
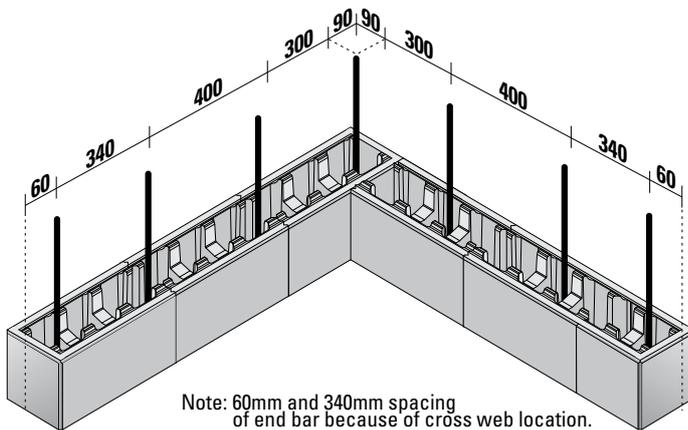
Diagrams not to Scale

1.15 Versaloc® type 1 retaining wall design details for level backfill slope using 200 series blocks

1.15.1 General layout for walls up to 2400mm high with level backfill slope
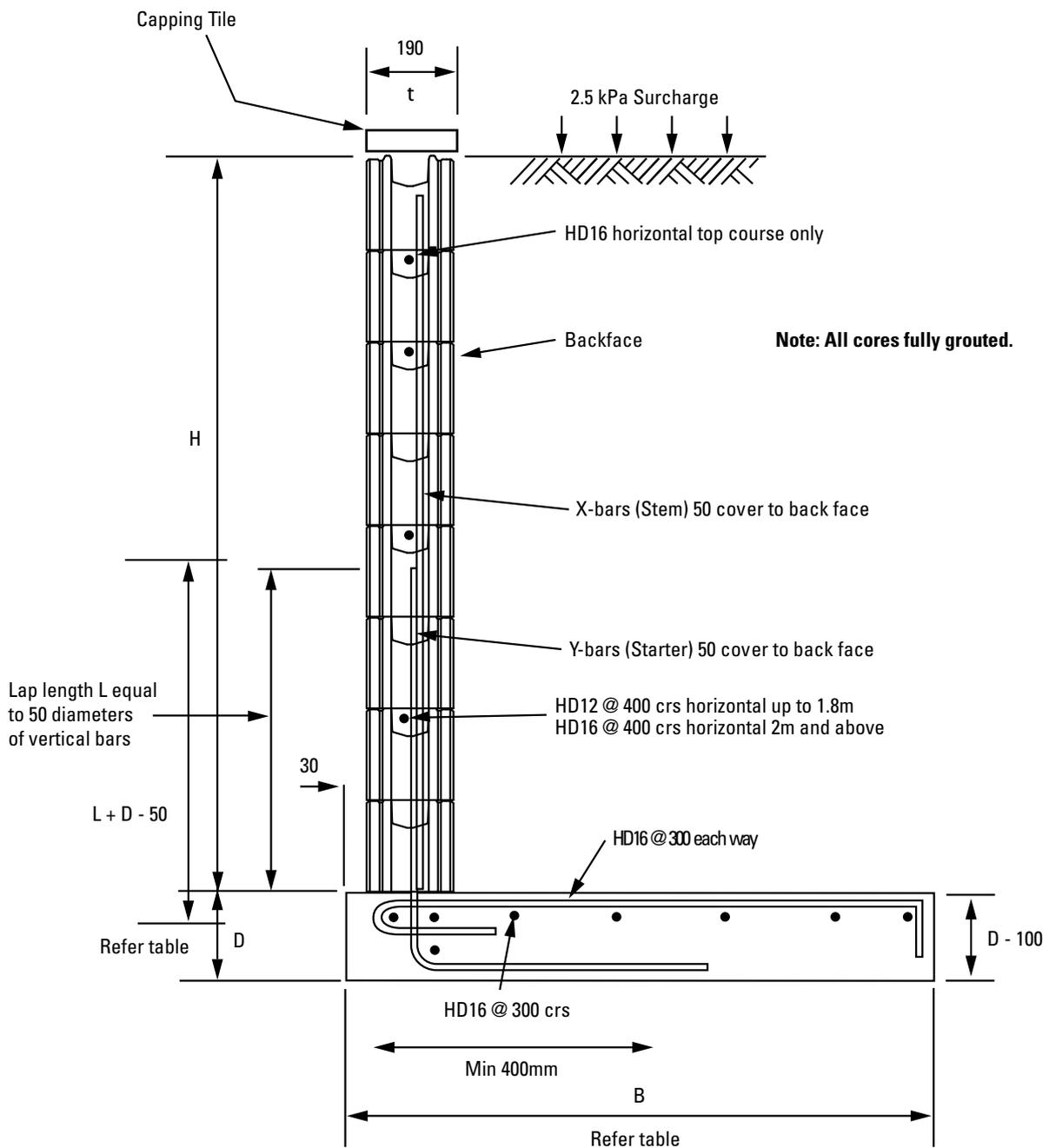
Capping Tile

190

t

2.5 kPa Surcharge

HD16 horizontal top course only

Backface

Note: All cores fully grouted.

H

X-bars (Stem) 50 cover to back face

Y-bars (Starter) 50 cover to back face

Lap length L equal
to 50 diameters
of vertical bars

HD12 @ 400 crs horizontal up to 1.8m
HD16 @ 400 crs horizontal 2m and above

30

L + D - 50

HD16 @ 300 each way

Refer table

D

D - 100

HD16 @ 300 crs

Min 400mm

B

Refer table

- Denotes mandatory placement of HD16 bars in addition
  to HD16 @ 300 each way bars.
  Standard 180° hook to be constructed as per NZS3101

Wall Type 1

Diagrams not to Scale

1.15.2 Design details for walls up to 2400mm high with level backfill slope

Wall Height H (mm)	Wall Width t (mm)	Base Width B (mm)	Base Depth D (mm)	Key Width W (mm)	Key Depth d (mm)	Backfill Slope	Reinforcements	
							X-bars (Stem)	Y-bars (Starter)

Characteristic internal friction angle of backfill material and retained soil 30°
Characteristic internal friction angle of foundation 30°

Wall Height H (mm)	Wall Width t (mm)	Base Width B (mm)	Base Depth D (mm)	Key Width W (mm)	Key Depth d (mm)	Backfill Slope	X-bars (Stem)	Y-bars (Starter)
2400	190	1800	350	-	-	level	HD16 at 400	HD20 at 400
2200	190	1700	350	-	-	level	HD16 at 400	HD16 at 200
2000	190	1500	350	-	-	level	HD16 at 400	HD16 at 200
1800	190	1500	250	-	-	level	HD16 at 400	HD16 at 400
1600	190	1200	250	-	-	level	HD16 at 400	HD16 at 400
1400	190	1000	250	-	-	level	HD12 at 400	HD12 at 400
1200	190	900	200	-	-	level	HD12 at 400	HD12 at 400
1000	190	800	200	-	-	level	HD12 at 400	HD12 at 400
800	190	700	200	-	-	level	HD12 at 400	HD12 at 400
600	190	600	200	-	-	level	HD12 at 400	HD12 at 400

Notes:

1) Cohesion is difficult to predict, is variable, may change over time, and is dependent on the effectiveness of surface sealing, surface drainage and subsurface drainage. These details are based on the assumption that drained and undrained cohesion (as appropriate) is assumed to be zero for active forces. Consideration must also be given to shrink/swell action of clay soils.

2) These details have been calculated on the basis of a rough interface between the base and the foundation soil, for which the external angle of friction, °, equals the internal angle of friction, °. The footing/foundation interface should be constructed such that this assumption is correct. The designer should consider the validity of this assumption.

3) A 2.5kPa surcharge applies.

4) All wall starter and stem reinforcing bars are located with 50mm cover to the back face of block.

5) All base and key reinforcing bars are to have 50mm clear cover to steel from face of concrete.

6) All footings to be founded on "Good Ground" as defined in Section 1.12

Wall Type 1

1.16 Versaloc® type 1 retaining wall design details for 1:4 backfill slope using 200 series blocks

1.16.1 General layout for walls up to 1800mm high with 1:4 backfill slope
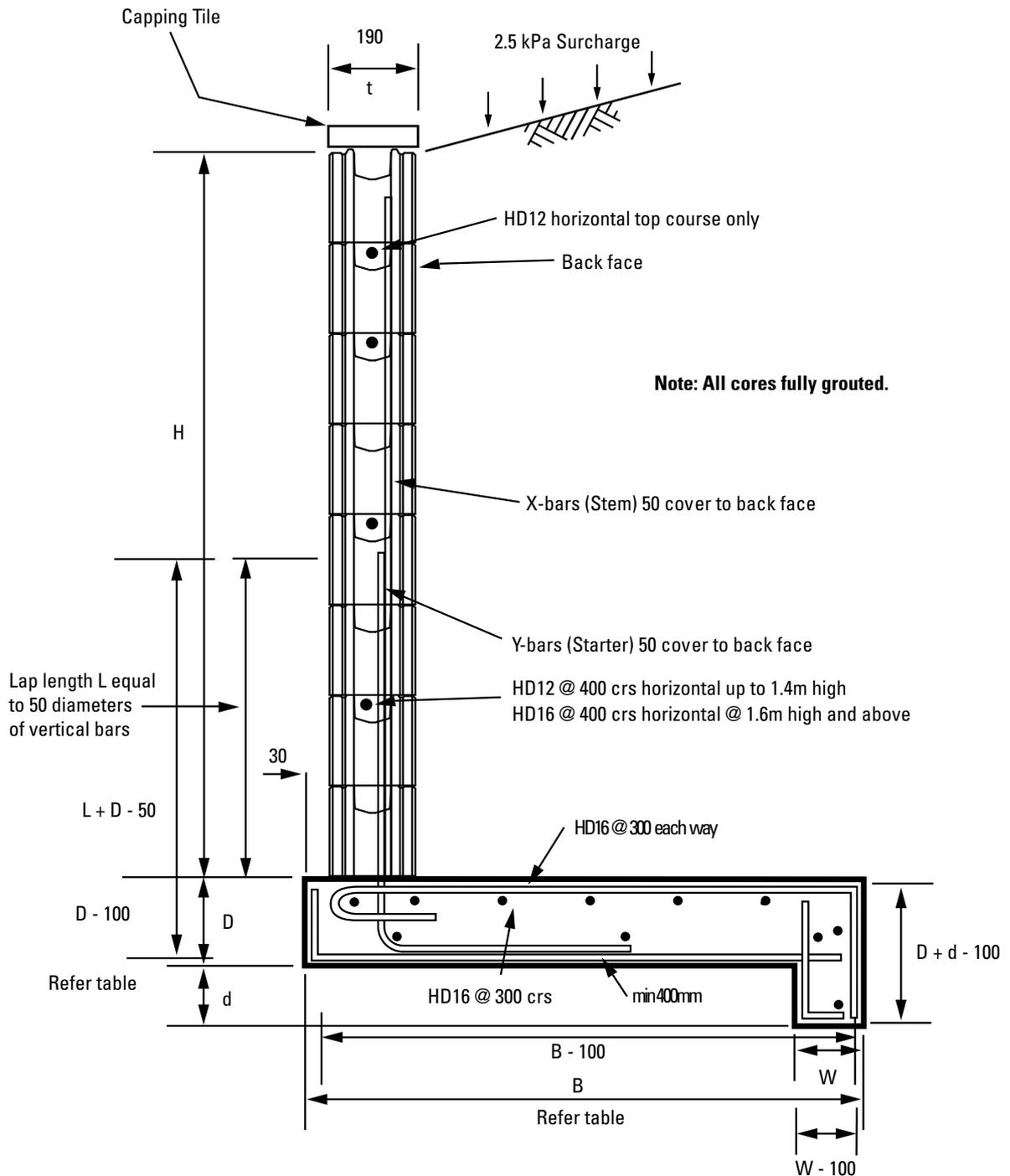
Capping Tile

190

t

2.5 kPa Surcharge

HD12 horizontal top course only

Back face

H

Note: All cores fully grouted.

X-bars (Stem) 50 cover to back face

Y-bars (Starter) 50 cover to back face

Lap length L equal to 50 diameters of vertical bars

HD12 @ 400 crs horizontal up to 1.4m high
HD16 @ 400 crs horizontal @ 1.6m high and above

30

L + D - 50

HD16 @ 300 each way

D - 100

D

D + d - 100

Refer table

d

HD16 @ 300 crs

min 400mm

B - 100

B

W

Refer table

W - 100

• Denotes mandatory placement of HD16 bars in addition
to HD16 @ 300 each way bars.
Standard 180° hook to be constructed as per NZS3101

Wall Type 1

Diagrams not to Scale

1.16.2 Design details for walls up to 1800mm high with 1:4 backfill slope

Wall Height H (mm)	Wall Width t (mm)	Base Width B (mm)	Base Depth D (mm)	Key Width W (mm)	Key Depth d (mm)	Backfill Slope	Reinforcements	
							X-bars (Stem)	Y-bars (Starter)

Characteristic internal friction angle of backfill material and retained soil 30°
Characteristic internal friction angle of foundation 30°

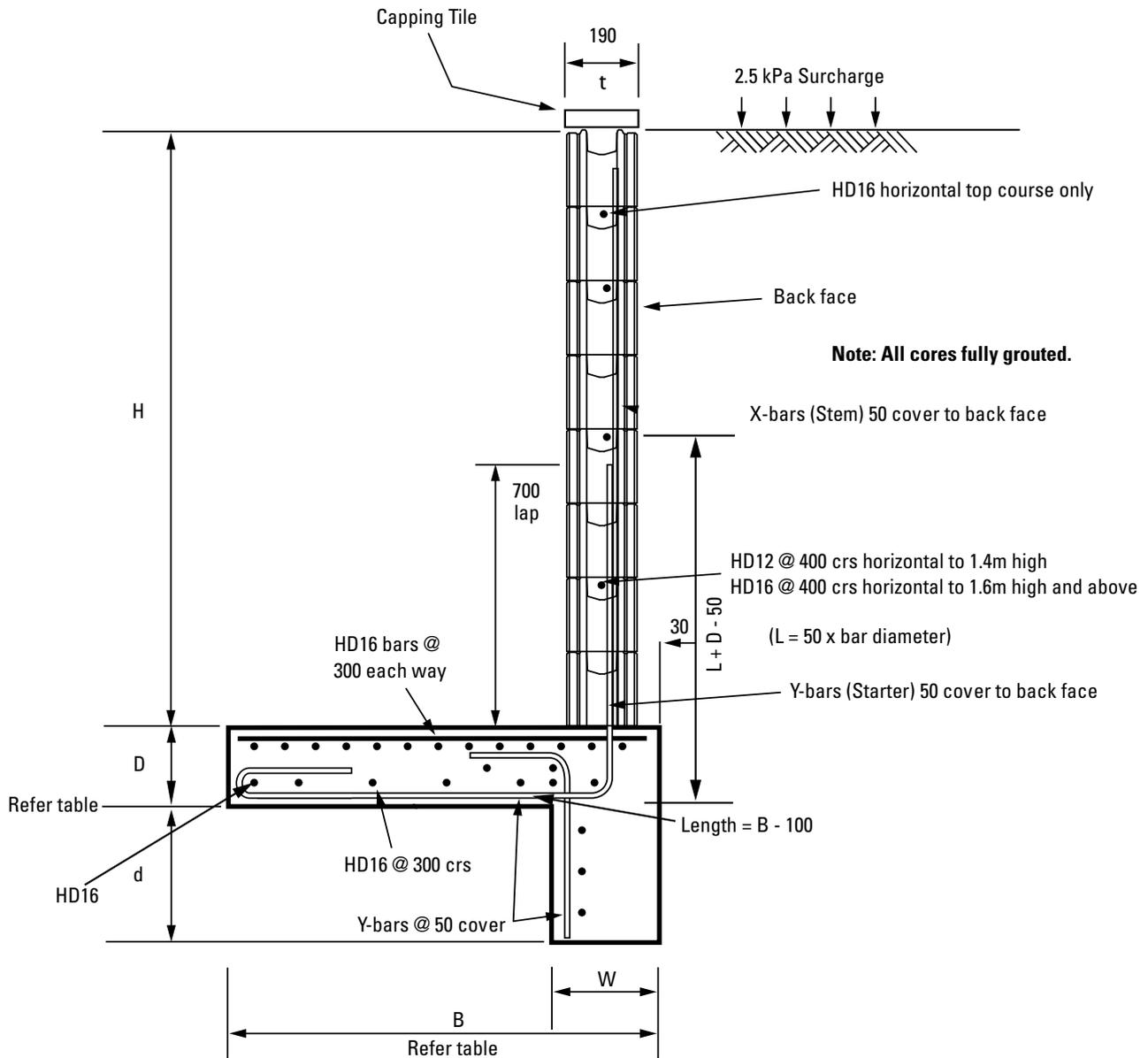| Wall Height H (mm)	Wall Width t (mm)	Base Width B (mm)	Base Depth D (mm)	Key Width W (mm)	Key Depth d (mm)	Backfill Slope	X-bars (Stem)	Y-bars (Starter)
1800	190	2400	250	200	200	1:4	HD16 at 400	HD20 at 400
1600	190	2300	250	200	200	1:4	HD12 at 400	HD16 at 400
1400	190	1500	250	-	-	1:4	HD12 at 400	HD12 at 400
1200	190	1300	200	-	-	1:4	HD12 at 400	HD12 at 400
1000	190	1200	200	-	-	1:4	HD12 at 400	HD12 at 400
800	190	1000	200	-	-	1:4	HD12 at 400	HD12 at 400
600	190	800	200	-	-	1:4	HD12 at 400	HD12 at 400

Notes:

1) Cohesion is difficult to predict, is variable, may change over time, and is dependent on the effectiveness of surface sealing, surface drainage and subsurface drainage. These details are based on the assumption that drained and undrained cohesion (as appropriate) is assumed to be zero for active forces. Consideration must also be given to shrink/swell action of clay soils.

2) These details have been calculated on the basis of a rough interface between the base and the foundation soil, for which the external angle of friction, °, equals the internal angle of friction, °. The footing/foundation interface should be constructed such that this assumption is correct. The designer should consider the validity of this assumption.

3) A 2.5kPa surcharge applies.

4) All wall starter and stem reinforcing bars are located with 50mm cover to the back face of block.

5) All base and key reinforcing bars are to have 50mm clear cover to steel from face of concrete.

6) All footings to be founded on "Good Ground" as defined in Section 1.12.

Wall Type 1

1.17 Versaloc® type 2 retaining wall design details for level backfill slope using 200 series blocks

1.17.1 General layout for walls up to 1800mm high with level backfill slope

Capping Tile

190

t

2.5 kPa Surcharge

HD16 horizontal top course only

Back face

Note: All cores fully grouted.

H

X-bars (Stem) 50 cover to back face

700 lap

HD12 @ 400 crs horizontal to 1.4m high
HD16 @ 400 crs horizontal to 1.6m high and above

30

(L = 50 x bar diameter)

L + D - 50

HD16 bars @ 300 each way

Y-bars (Starter) 50 cover to back face

D

Refer table

Length = B - 100

d

HD16 @ 300 crs

HD16

Y-bars @ 50 cover

W

B
Refer table

• Denotes mandatory placement of HD16 bars in addition
to HD16 @ 300 each way bars.
Standard 180° hook to be constructed as per NZS3101

Wall Type 2

Diagrams not to Scale

1.17.2 Design details for walls up to 2400mm high with level backfill slope

Wall Height H (mm)	Wall Width t (mm)	Base Width B (mm)	Base Depth D (mm)	Key Width W (mm)	Key Depth d (mm)	Backfill Slope	Reinforcements	
							X-bars (Stem)	Y-bars (Starter)

Characteristic internal friction angle of backfill material and retained soil 30°
Characteristic internal friction angle of foundation 30°

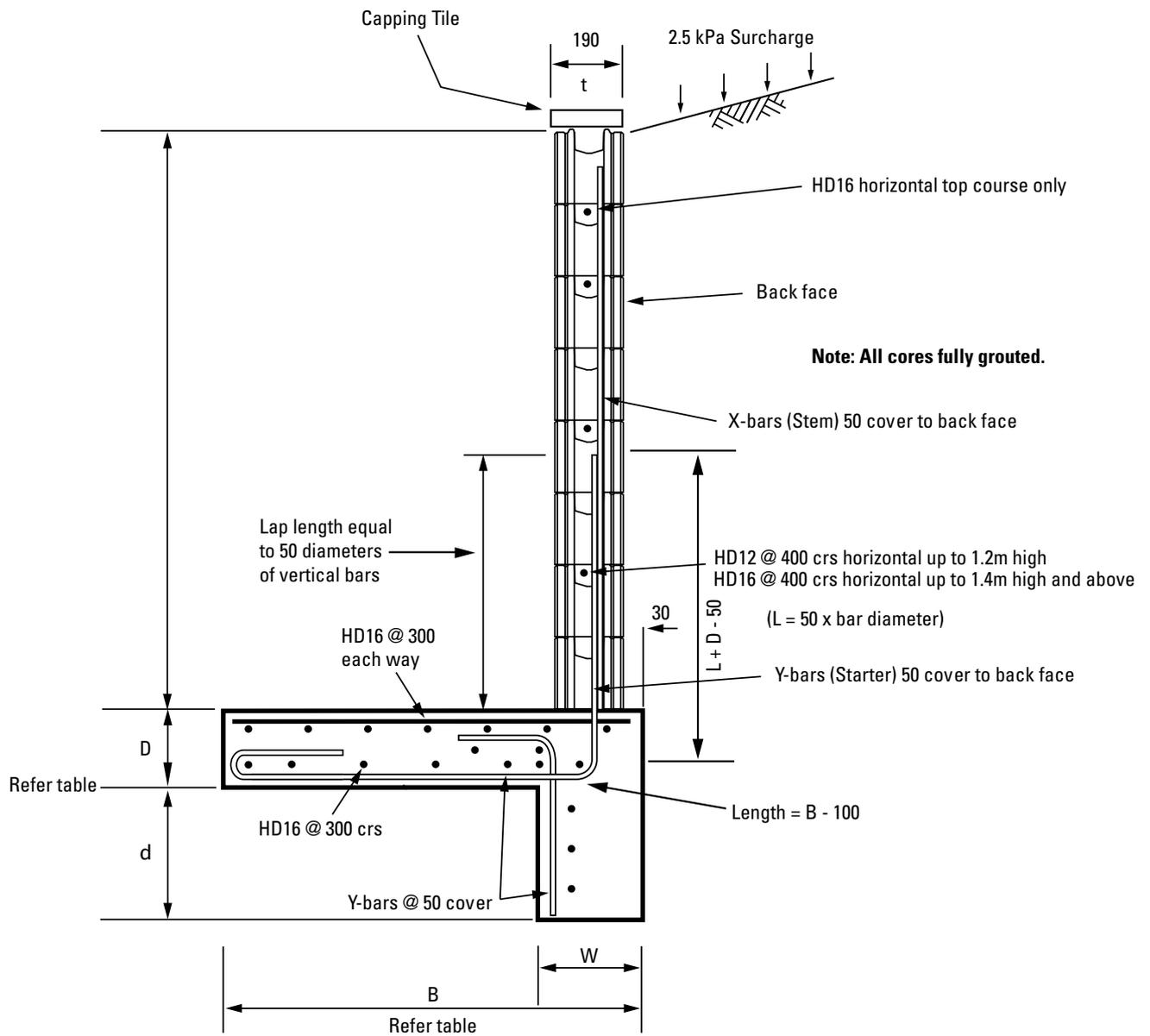| Wall Height H (mm)	Wall Width t (mm)	Base Width B (mm)	Base Depth D (mm)	Key Width W (mm)	Key Depth d (mm)	Backfill Slope	X-bars (Stem)	Y-bars (Starter)
2400	190	2200	400	300	300	level	HD16 at 400	HD20 at 400
2200	190	2000	400	300	300	level	HD16 at 400	HD16 at 200
2000	190	1800	400	200	200	level	HD16 at 400	HD16 at 200
1800	190	1600	350	200	200	level	HD16 at 400	HD16 at 400
1600	190	1400	300	200	200	level	HD12 at 400	HD12 at 400
1400	190	1200	200	200	200	level	HD12 at 400	HD12 at 400
1200	190	1000	200	200	200	level	HD12 at 400	HD12 at 400
1000	190	800	200	0	0	level	HD12 at 400	HD12 at 400
800	190	700	200	0	0	level	HD12 at 400	HD12 at 400
600	190	500	200	0	0	level	HD12 at 400	HD12 at 400

Notes:

1) Cohesion is difficult to predict, is variable, may change over time, and is dependent on the effectiveness of surface sealing, surface drainage and subsurface drainage. These details are based on the assumption that drained and undrained cohesion (as appropriate) is assumed to be zero for active forces. Consideration must also be given to shrink/swell action of clay soils.

2) These details have been calculated on the basis of a rough interface between the base and the foundation soil, for which the external angle of friction, °, equals the internal angle of friction, °. The footing/foundation interface should be constructed such that this assumption is correct. The designer should consider the validity of this assumption.

3) A 2.5kPa surcharge applies.

4) All wall starter and stem reinforcing bars are located with 50mm cover to the back face of block.

5) All base and key reinforcing bars are to have 50mm clear cover to steel from face of concrete.

6) All footings to be founded on "Good Ground" as defined in Section 1.12.

Wall Type 2

1.18 Versaloc® type 2 retaining wall design details for 1:4 backfill slope using 200 series blocks

1.18.1 General layout for walls up to 1800mm high with 1:4 backfill slope

Capping Tile

190

t

2.5 kPa Surcharge

HD16 horizontal top course only

Back face

Note: All cores fully grouted.

X-bars (Stem) 50 cover to back face

Lap length equal to 50 diameters of vertical bars

HD12 @ 400 crs horizontal up to 1.2m high
HD16 @ 400 crs horizontal up to 1.4m high and above

30

L + D - 50

(L = 50 x bar diameter)

HD16 @ 300 each way

Y-bars (Starter) 50 cover to back face

D

Refer table

HD16 @ 300 crs

Length = B - 100

d

Y-bars @ 50 cover

W

B

Refer table

• Denotes mandatory placement of HD16 bars in addition to HD16 @ 300 each way bars.
Standard 180° hook to be constructed as per NZS3101

Wall Type 2

Diagrams not to Scale

1.18.2 Design details for walls up to 1800mm high with 1:4 backfill slope

Wall Height H (mm)	Wall Width t (mm)	Base Width B (mm)	Base Depth D (mm)	Key Width W (mm)	Key Depth d (mm)	Backfill Slope	Reinforcements	
							X-bars (Stem)	Y-bars (Starter)

Characteristic internal friction angle of backfill material and retained soil 30°
Characteristic internal friction angle of foundation 30°

Wall Height H (mm)	Wall Width t (mm)	Base Width B (mm)	Base Depth D (mm)	Key Width W (mm)	Key Depth d (mm)	Backfill Slope	X-bars (Stem)	Y-bars (Starter)
1800	190	2200	350	300	300	1:4	HD16 at 400	HD20 at 400
1600	190	2000	300	200	200	1:4	HD16 at 400	HD16 at 200
1400	190	1700	300	200	200	1:4	HD12 at 400	HD12 at 400
1200	190	1400	300	0	0	1:4	HD12 at 400	HD12 at 400
1000	190	1100	200	0	0	1:4	HD12 at 400	HD12 at 400
800	190	800	200	0	0	1:4	HD12 at 400	HD12 at 400
600	190	600	200	0	0	1:4	HD12 at 400	HD12 at 400

Notes:

1)   Cohesion is difficult to predict, is variable, may change over time, and is dependent on the effectiveness of surface sealing, surface drainage and subsurface drainage. These details are based on the assumption that drained and undrained cohesion (as appropriate) is assumed to be zero for active forces. Consideration must also be given to shrink/swell action of clay soils.

2)   These details have been calculated on the basis of a rough interface between the base and the foundation soil, for which the external angle of friction, °, equals the internal angle of friction, °. The footing/foundation interface should be constructed such that this assumption is correct. The designer should consider the validity of this assumption.

3)   A 2.5kPa surcharge applies.

4)   All wall starter and stem reinforcing bars are located with 50mm cover to the back face of block.

5)   All base and key reinforcing bars are to have 50mm clear cover to steel from face of concrete.

6)   All footings to be founded on "Good Ground" as defined in Section 1.12.

Wall Type 2

2.0 COMPRESSIVE LOAD CAPACITY OF BOWER BROTHERS VERSALOC® MORTARLESS BLOCK WALLS

This section has been prepared for use by qualified and experienced structural engineers. The information is based on limit state design and is applicable specifically to Versaloc® block walls with properties as set out in the following table using Simplified Design Method for Braced Walls Subject to Vertical Forces Only.

Refer Table	200 Series Block
Block Width tu	190 (mm)
Block Height hu	200 (mm)
Block Length lu	400 (mm)
Net Block Width Less Chamfers tw	180 (mm)
Chamfer Each Face Shell	5 (mm)
Block Characteristic Compressive Strength f' uc block	25 MPa
Wall Grouted Compressive Strength f' mg	10.2 MPa
ø Strength Reduction Factor	0.6

| Wall Height Hwe (mm)	Nu Design Axial Strength 190 Block kN/m
2400	530
2600	519
2800	507
3000	493
3200	479
3400	464
3600	448
3800	431
4000	413
4200	394
4400	374
4600	353
4800	332
5000	309
5200	286
5400	261
5600	236
5800	210
6000	182

Notes:

1) For weather proofing plain face Versaloc® walling it is recommended coating wall with a proprietary concrete sealer.

2) For weather proofing aesthetically finished Versaloc walling it is recommended application of a single coat of render followed by a single coat of acrylic paint.
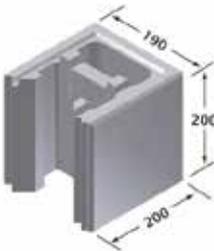
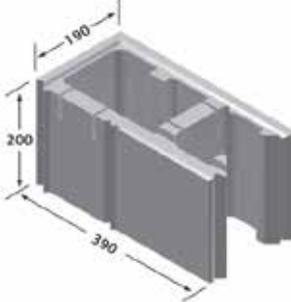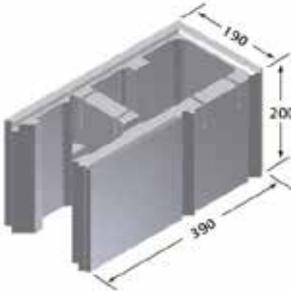# 3.0 VERSALOC® BLOCK SERIES

Versaloc® Block 190mm
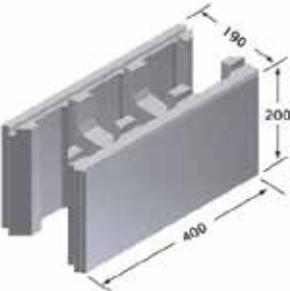
End Block
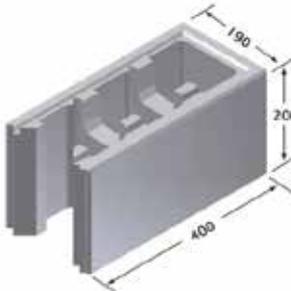
Half Block

Lefthand Corner

Righthand Corner

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