Technical Support Sheet

The Lusit Angle Support System

Scan for more information

Technical information to support specification of the Lusit Angle Support System

Introduction

The Lusit retaining wall system is a precast concrete engineered wall suitable for a wide variety of ground retention uses.

Pre-production of units in the factory prior to retaining work commencing on site offers a huge project timesaving benefit and is not dependent on the weather.

The ease and speed of installation of the units also offers a big time saving advantage.

A unique and useful feature is the slightly narrower foot, which allows the wall to be constructed to a moderate convex radius. A much larger concave radius can be achieved.

The wall is manufactured in 1m wide standard units, is available in heights ranging from lm to 4m and is available for a range of design load cases. (See Tables 1, 2 & 3).

Applications

- Motorway retaining walls
- Garden and terracing retaining walls
- Courtyard retaining walls
- Parking area retaining walls
- Basement retaining walls
- Staircase retaining walls
- Walkway retaining walls
- Pond retaining walls
- Containment bunds
- Silage bins

Features

- Functional and elegant
- Engineered to NZ codes
- High quality
- Durable-100 year design life
- Cost effective
- Versatile, enabling maximum use of valuable land
- Simple and quick installation
- Self-supporting - no propping required
- Minimal labour required
- Saves on construction time of project
- Optimises use of available site space
- Uniform appearance
- Units can be removed and reused if desired

The Lusit Angle Support System

The Lusit Angle Support System was developed in Germany, where it has become a very popular engineered retaining wall solution over the last 30 years. It is now available in New Zealand where it has been reengineered to comply with New Zealand standards, environment and soil conditions, including earthquake loading.

The Lusit retaining wall system is very versatile and can be used in residential, commercial, industrial and reading applications. The Lusit Angle Support System's configuration gives the retaining wall it's structural integrity. The Lusit elements are quick and easy to install, creating a huge time saving advantage over site-built retaining walls. It also eliminates the need for specialist construction staff.

Lusit standard panels are 1m wide, with a 940mm wide footing. A 10mm joint gap is provided. The footing generally has projecting reinforcing which will be lapped with in-situ reinforcing, so that the footing can be extended in-situ to the required length as required by the applied loading. The panels range from 1m high to 4m high, in 200mm increments. If required, panels can be made narrower than 1m as a special. Thicknesses increase from 150mm for the shorter panels to 250mm for the higher panels. The slimness of the units results in savings on concrete and transportation costs.

Design Criteria

Hynds offers a range of standard Lusit wall units suitable for three different load cases, namely:

Light Duty:	Suitable for level backfill behind wall, with a 0-2.5kPa surcharge.
Medium Duty:	Suitable for 0-20 sloping backfill behind wall, with a 2.5-12kPa surcharge.
Heavy Duty:	Suitable for TNZBM 2003 HN-HO loading, including a 3.SkPa surcharge.

In cases where vehicular traffic is allowed, no wheel load should be allowed closer than 1m to the inside edge of the wall.

In designing our standard units to suit the above three load types, we have used the following design parameters, which satisfy NZS 3101:

Concrete:	50MPa
Cover:	40mm
Intended Life:	100 years
Exposure Class:	A2, B1 and B2
Reinforcing:	Grade 500E reinforcing bars and ductile Grade 500E Seismic Mesh compliant with NZS3604:2011 (Timber framed buildings standard), AS/NZS 4671:2001 (Steel Reinforcing Materials Standard) and Department of Building and Housing new standard has applied from Feb 2012.

To withstand earthquake loading an EQ horizontal acceleration coefficient Kh = 0.2 (NZBC 81/VM4) has been used - Suitable throughout New Zealand

To conform to the most commonly encountered soil values encountered in New Zealand, Hynds has made the following design assumptions:

Foundation Soils:

(beneath the Foundation Pad)
Minimum bearing capacity Øqu: 150kPa (NZS 3604 Sec 3. Good Ground)
(e.g. stiff SILTS/CLAYS, very stiff SILTS, cohesive fill of SILTS and CLAYS, or CRUSHED ROCK)

Foundation Pad:

There are three possible foundation options, the first option being the preferred and most common option.

<u>Option 1:</u>
Base layer= 150mm layer compacted GAP 65 hardfill
Middle layer= 50mm mass concrete/ blinding with a compressive strength of 15MPa
Top layer= nominal 25mm layer 40MPa non shrink grout (such as Sika Grout 212)
<u>Option 2:</u>
Base layer= 150mm layer compacted GAP 65 hardfill
Top layer= nominal 25mm layer 3:1 earth moist mortar
<u>Option 3:</u>
Base layer= 150mm layer compacted GAP 65 hardfill
Top layer= 100mm layer sand

Backfill material:

(behind the LAS unit)
Backfill to be GAP65 with 60’ max allowable batter with 100Ø novacoil drain behind base of wall
Maximum specific weight of backfill: 18kN/m^3
Minimum internal angle of friction phi: 28°

If your site specific conditions differ from the above commonly encountered New Zealand soil values and structural conditions, or if you are in any doubt, then you should have the site assessed by a CPEng geotechnical engineer.

Corners:

Corners are not a problem with Lusit retaining wall systems. For internal corners a blunt 90° corner Is formed and the footings do not interfere with each other.
For external corners there are two options- a blunt 90° corner or a mitred 90° corner can be formed. As the footings would interfere with each other, an angled smaller footing is provided.

Transport and Installation:

All LAS Elements are delivered on heavy duty wooden pallets. These should be returned to Hynds for a credit once the units are off-loaded. LAS elements up to a height of 1.6m are generally delivered in an upright position, but higher panels are delivered lying down on their face side.

Unloading at the construction site is the responsibility of the contractor, who must ensure that the equipment that is used (crane, digger, forklift, etc) is rated to lift the units. See Tables 1 to 3 for the weights (masses) of the individual units. The units have 2.5 tonne Reid swiftlift anchors cast into the back face for lifting.

If the unit is fitted with two loops in the back face near the top of the panel (optional), these loops MUST NOT BE USED FOR LIFTING. These loops are only to be used for fitting a 16mm diameter bar through that may be used to ensure that the tops of the units remain flush with one another during the backfilling and compaction processes.

Unloading:

The LAS units are to be unloaded individually by attaching lifting chains to the 2.5 tonne Reids swiftlift lifting anchors cast into the back face. If the units are to be stored at the construction site, then they should either be stood upright on their feet on level ground or placed lying face down on pallets. Please note that if the units are stored lying down, no more than two units may be placed on top of each other and an appropriate distance packer should be placed between the units. Upright storage is preferred to keep the fair face unblemished.

Erecting:

When erecting the LAS units, the lifting chains should be attached to the two top lifting anchors. A strip of wood may be attached to the rear side head of the unit to ensure that the lifting chains don't damage the head. Also, the foot of the element may be supported by an appropriate elastic support (e.g. an old car tyre) to prevent impact on the footing during installation. The units should be handled in a smooth, controlled manner, as any impact or jerking could damage the units and cause cracking.

The Lusit LAS units are self-supporting, hence no propping is required. Nevertheless the units should be handled with sensible care, as the units are only totally stable once the in-situ portion of the concrete foundation has been cast and the units have been backfilled.

After each unit is installed in position, a permanently elastic joint tape is applied to the centre of the side wall of the unit, prior to aligning the next unit. Hynds recommends Compriband, a bitumen impregnated, waterrepellant strip. The joint width is typically 10mm wide.

Joint sealing:

Once alignment is complete, the joint on the back (soil side) of the units are sealed using a 100mm wide bitumen band.

Anchoring the LAS units:

Once the LAS units have been installed next to each other, they form a continuous retaining structure. To assist in preventing the heads of the units going out of alignment during the backfilling process, the units can be provided with two loops about 300 to 400mm from the top of the units. A 16mm¢ bar is threaded through these loops, then the loops are hammered over to firmly secure the bar in place, prior to backfilling and compacting.

External corners:

Given that the foot length on the LAS external corner units (and sometimes also the foot length of the neighbouring units) is shorter, it is often necessary to strengthen and stabilise the corner by placing a layer of site concrete in the corner.

Angle brackets may also be necessary to further stabilise the corner.

Backfilling:

To ensure that water can be drained away from the rear side of the units, it is advisable to install a drainage filter layer as well as an adequately sized subsoil drain.

Only a non-binding, free draining, granular, good quality backfill material should be used (e.g. GAP 65). The backfill should be laid in approximately 150 - 200mm thick layers, with each layer being suitably compacted with lightweight compaction machinery. Any compaction machinery should not generate a load greater than that which the wall has been designed to withstand. The compaction machinery should not be placed closer than 500mm to the back of the wall, to avoid displacement of the units during compaction.

Although there is no required minimum fill to the front of the wall, a minimum depth of 150mm would be considered practical to provide a neat finish and to cover up the foundations.

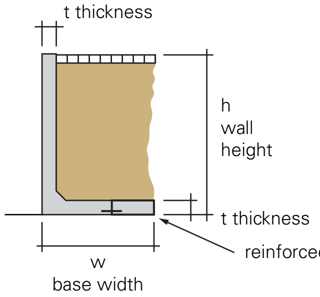


TABLE 1 **Light Duty Panels. Design Loads: 0 - 2.5kPa surcharge with 0° backslope**

Code	**Wall Height h** (m)	**Wall Thickness t** (mm)	**Precast Mass** (T)	**Precast Footing Length** (m)	**In-Situ Footing Length** (m)	**Total Base Width w** (m)
LSSL4000250	4.0	250	3.3	1.3	1.7	3.0
LSSL3800250	3.8	250	3.1	1.3	1.3	2.6
LSSL3600250	3.6	250	3.0	1.2	1.2	2.4
LSSL3400250	3.4	250	2.8	1.2	1.0	2.2
LSSL3200250	3.2	250	2.6	1.1	1.0	2.1
LSSL3000250	3.0	250	2.5	1.1	0.9	2.0
LSSL2800250	2.8	250	2.2	0.95	0.95	1.9
LSSL2600200	2.6	200	1.7	0.95	0.75	1.7
LSSL2400200	2.4	200	1.5	0.8	0.8	1.6
LSSL2200200	2.2	200	1.4	0.8	0.6	1.4
LSSL2000200	2.0	200	1.3	0.65	0.6	1.25
LSSL1800150	1.8	150	0.9	0.65	0.45	1.1
LSSL1600150	1.6	150	0.8	0.5	0.5	1.0
LSSL1400150	1.4	150	0.7	0.5	0.4	0.9
LSSL1200150	1.2	150	0.6	0.4	0.4	0.8
LSSL1000150	1.0	150	0.5	0.4	0.3	0.7

Design Parameters:

Concrete: 50MPa
Cover: 40mm
Intended Life: 100 years
Exposure Class: A2,B1,B2

Design Assumptions:

Level backslope with 0 - 2.5kPa surcharge, NO vehicle loading
Maximum specific weight of backfill: 18kN/m^3
Minimum internal angle of friction phi: 28°
Minimum bearing capacity Øqu: 150kPa (NZS 3604 Sec 3. Good Ground)
Founding material:
Backfill to be GAP65 with 60° max allowable batter with 100Ø novacoil drain behind base of wall
EQ horizontal acceleration coefficient Kh = 0.2 (NZBC B1/VM4) - Suitable throughout New Zealand
Generally 4 No. 2.5 tonne swiftlift anchors for lifting

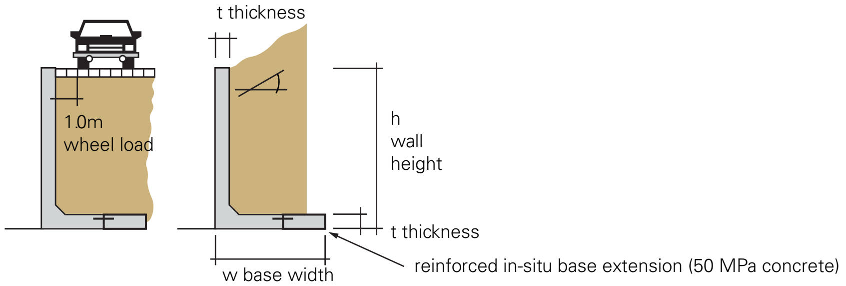


TABLE 2 **Medium Duty Panels. Design Loads: 2.5 - 12kPa surcharge OR O - 20 ° backslope**

Code	**Wall Height h** (m)	**Wall Thickness t** (mm)	**Precast Mass** (T)	**Precast Footing Length** (m)	**In-Situ Footing Length** (m)	**Total Base Width w** (m)
LSSM4000250	4.0	250	3.5	1.6	1.7	3.3
LSSM3800250	3.8	250	3.3	1.6	1.3	2.9
LSSM3600250	3.6	250	3.1	1.4	1.4	2.8
LSSM3400250	3.4	250	2.9	1.4	1.3	2.7
LSSM3200250	3.2	250	2.7	1.3	1.2	2.5
LSSM3000250	3.0	250	2.6	1.3	1.1	2.4
LSSM2800250	2.8	250	2.3	1.1	1.2	2.3
LSSM2600200	2.6	200	1.8	1.1	1.1	2.2
LSSM2400200	2.4	200	1.6	0.95	1.05	2.0
LSSM2200200	2.2	200	1.5	0.95	0.95	1.9
LSSM2000200	2.0	200	1.3	0.8	1.0	1.8
LSSM 1800150	1.8	150	0.9	0.8	0.9	1.7
LSSM 1600150	1.6	150	0.8	0.65	0.95	1.6
LSSM 1400150	1.4	150	0.7	0.65	0.75	1.4
LSSM 1200150	1.2	150	0.6	0.5	0.7	1.2
LSSM 1000150	1.0	150	0.5	0.5	0.5	1.0

Design Parameters:

Concrete:	50MPa
Cover:	40mm
Intended Life:	100 years
Exposure Class:	A2,B1,B2

Design Assumptions:

Level backslope with wheel load not closer than 1.0m from internal edge of top of wall OR
Maximum 20° backslope with no surcharge
Maximum specific weight of backfill: 18kN/m^3
Minimum internal angle of friction phi: 28°
Minimum bearing capacity Øqu: 150kPa (NZS 3604 Sec 3. Good Ground)
Founding material:
Backfill to be GAP65 with 60° max allowable batter with 100Ø novacoil drain behind base of wall
EQ horizontal acceleration coefficient Kh = 0.2 (NZBC B1/VM4) - Suitable throughout New Zealand
Generally 4 No. 2.5 tonne swiftlift anchors for lifting

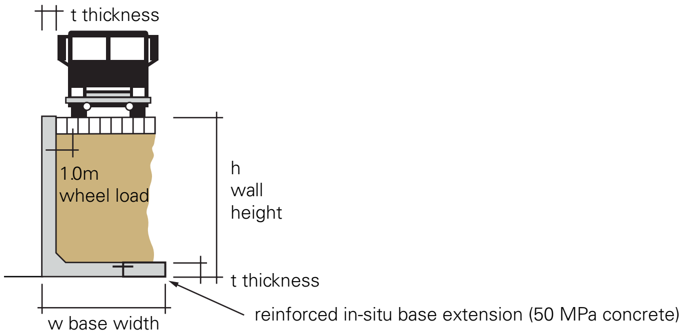


TABLE 3 Heavy Duty Panels. Design Loads: TNZBM 2003 HN-HO Loads including 3.5kPa surcharge

Code	Wall Height h (m)	Wall Thickness t (mm)	Precast Mass (T)	Precast Footing Length (m)	In-Situ Footing Length (m)	Total Base Width w (m)
LSSH3500250	3.5	250	3.2	1.75	2.95	4.7
LSSH3400250	3.4	250	3.1	1.75	2.75	4.5
LSSH3200250	3.2	250	2.9	1.6	2.7	4.3
LSSH3000250	3.0	250	2.8	1.6	2.3	3.9
LSSH2800250	2.8	250	2.6	1.4	2.2	3.6
LSSH2600200	2.6	200	1.9	1.4	1.9	3.3
LSSH2400200	2.4	200	1.7	1.2	1.8	3.0
LSSH2200200	2.2	200	1.6	1.2	1.5	2.7
LSSH2000200	2.0	200	1.4	1.0	1.4	2.4
LSSH1800150	1.8	150	1.0	1.0	1.1	2.1
LSSH1600150	1.6	150	0.9	0.8	1.1	1.9
LSSH1400150	1.4	150	0.8	0.8	0.9	1.7
LSSH 1200150	1.2	150	0.7	0.6	0.8	1.4
LSSH1000150	1.0	150	0.6	0.6	0.6	1.2

Design Parameters:

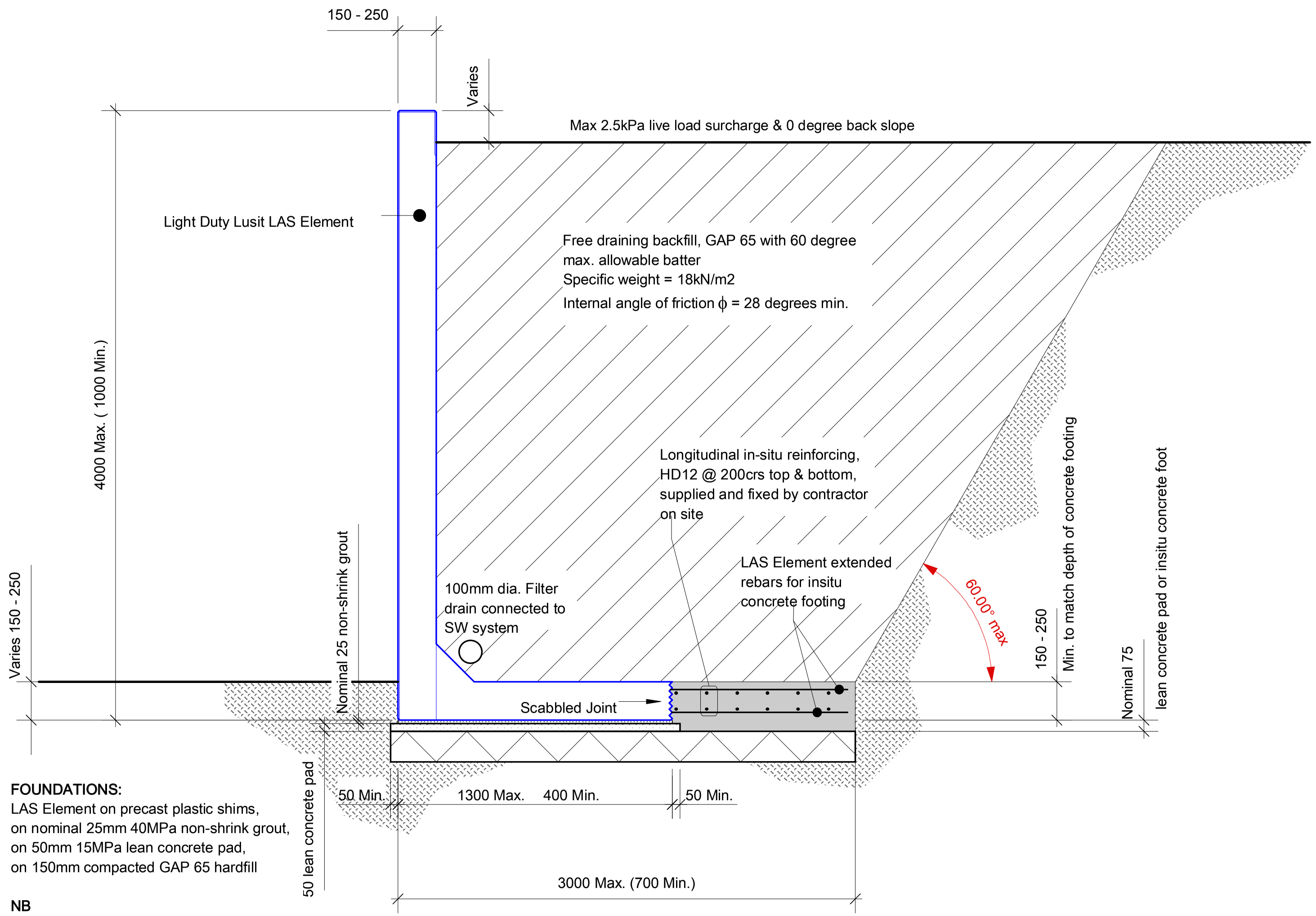
Concrete:	50MPa
Cover:	40mm
Intended Life:	100 years
Exposure Class:	A2,B1,B2

Design Assumptions:

Level backslope with wheel load not closer than 1.0m from internal edge of top of wall
Maximum specific weight of backfill: 18kN/m3
Minimum internal angle of friction phi: 28°
Minimum bearing capacity Øqu: 150kPa (NZS 3604 Sec 3. Good Ground)
Founding material:
Backfill to be GAP65 with 60° max allowable batter with 100Ø novacoil drain behind base of wall
Seismic case not included (separate case)
Generally 4 No. 2.5 tonne swiftlift anchors for lifting

NOTES:

1. Minimum allowable bearing capacity of soil foundation = 100kPa (Øqu = 150kPa (NZS 3604, Sec 3, Good Ground)
2. Placement and compaction of backfill to be done a minimum of 7 days after insitu footing pour, or when concrete has reached a minimum strength of 25MPa



FOUNDATIONS:
LAS Element on precast plastic shims,
on nominal 25mm 40MPa non-shrink grout,
on 50mm 15MPa lean concrete pad,
on 150mm compacted GAP 65 hardfill

NB
Alternative foundations on,
nominal 25mm 3:1 mortar, lean concrete pad
and hardcore

TYPICAL SECTION
SCALE 1:30 A3

NOTES:

1. Concrete : $f'c$ = 50MPa
2. Reo : fy = Grade 500E
3. Reo Cover (40mm min) : See reinforcing details
4. Min Lap Length : 40 x Bar Dia
5. Dimensional tolerances : Table 5.1-NZS3109:1997
6. Do not re-bend reinforcing steel
7. Design Loading:
   0 - 2.5kPa surcharge, 0 degree backslope
   Max. specific weight of backfill γmax = 18kN/m3
   EQ horizontal acceleration coefficient Kh=0.2 (NZBC B1/VM4)
8. Exposure classification B2. Design life 100 years
   NZS 3101 Tables 3.1 & 3.6

MATERIALS:

VOL (m3/unit)=	0.20 to 1.28 m3 (precast portion)
WT (ton/unit)=	0.490 to 3.190 tonnes
CODE =	LSSL1000150 to 4000250

REVISIONS:

REV#	REVISION DESCRIPTION:	DATE:	DRAWN:
1	FOR CONSTRUCTION	10 SEP 2012	DF
2	FOOT LENGTH CHANGED	20 OCT 2012	DF

PO Box 58142, Botany, Auckland, 2163
Tel: 09 274 0316
Fax: 09 274 8393
email: technicalservices@hynds.co.nz

ISO 9001 CERTIFIED MANAGEMENT SYSTEM

PROJECT DESCRIPTION:

HYNDS STANDARD DRAWING

Typical Section - Light Duty Lusit LAS Element

SERVICE DETAIL:

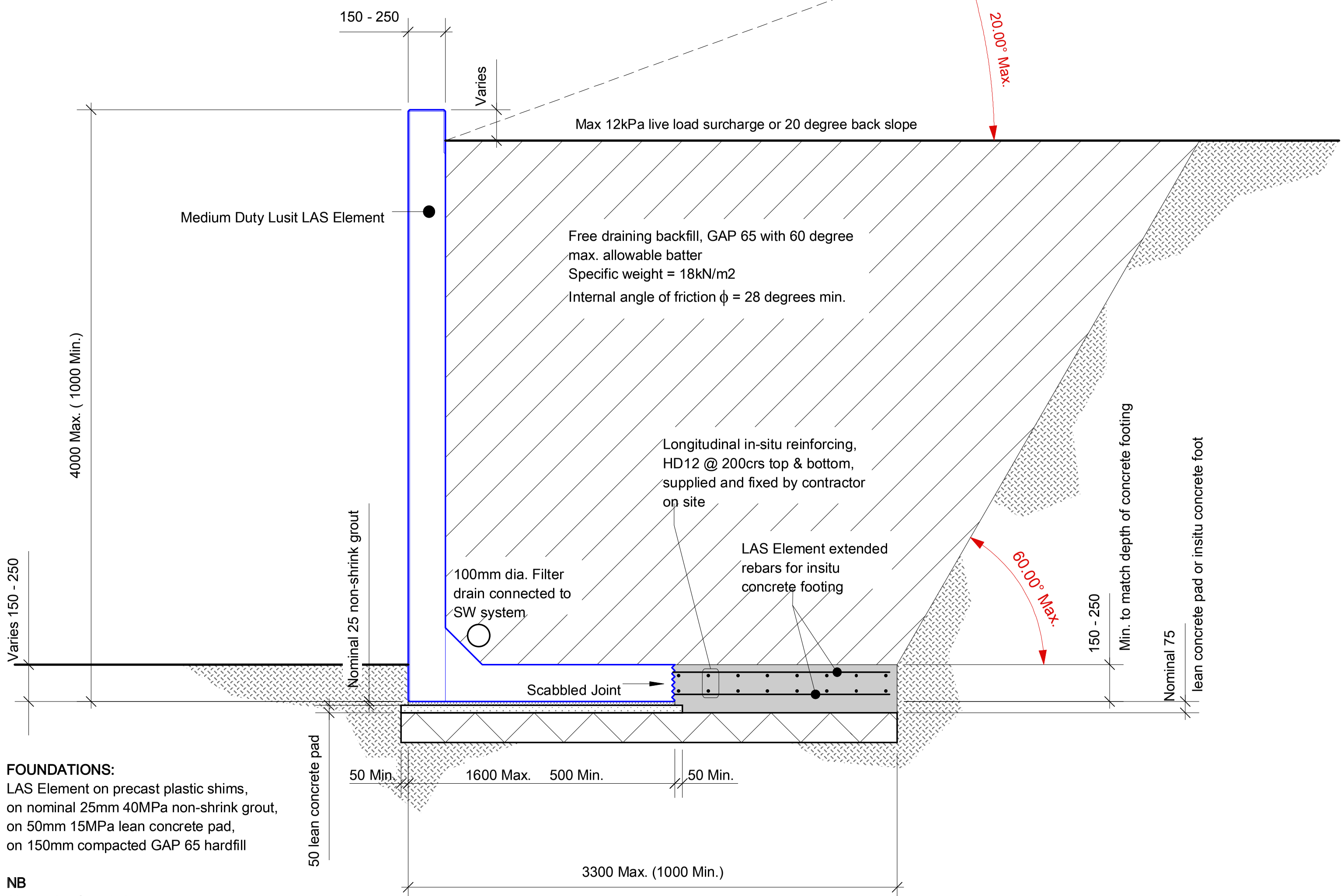
1 to 4m high x 150 to 250mm thick

Generic Retaining Wall Details

REFERENCE/QUOTE NUMBER:	20283	
DRAWN: DF	DESIGN: JBH	CHECKED: LvE
SIGNATURE:	SIGNATURE:	SIGNATURE:
SCALE: AS SHOWN	Note: Do not scale drawing if in doubt **ASK!!!**	DATE: 27 AUGUST 2012
PAPER SIZE: A3		
DRAWING NUMBER: T4301 - 33		REVISION: 2

NOTES:

1. Minimum allowable bearing capacity of soil foundation = 100kPa (Øqu = 150kPa (NZS 3604, Sec 3, Good Ground)
2. Placement and compaction of backfill to be done a minimum of 7 days after insitu footing pour, or when concrete has reached a minimum strength of 25MPa



FOUNDATIONS:
LAS Element on precast plastic shims,
on nominal 25mm 40MPa non-shrink grout,
on 50mm 15MPa lean concrete pad,
on 150mm compacted GAP 65 hardfill

NB
Alternative foundations on,
nominal 25mm 3:1 mortar, lean concrete pad
and hardcore

TYPICAL SECTION
SCALE 1:30 A3

NOTES:

1. Concrete : $f'c$ = 50MPa
2. Reo : fy = Grade 500E
3. Reo Cover : 40mm Min
4. Min Lap Length : 40 x Bar Dia
5. Dimensional tolerances : Table 5.1-NZS3109:1997
6. Do not re-bend reinforcing steel
7. Design Loading:
   2.6 -12kPa surcharge, or 0 - 20 degree backslope
   Max. specific weight of backfill γmax = 18kN/m3
8. Exposure classification B2. Design life 100 years
   NZS 3101 Tables 3.1 & 3.6

MATERIALS:

VOL (m3/unit)=	0.21 to 1.35 m3 (precast portion)
WT (ton/unit)=	0.525 to 3.367 tonnes
CODE =	LSSM1000150 to 4000250

REVISIONS:

REV#	REVISION DESCRIPTION:	DATE:	DRAWN:
1	FOR CONSTRUCTION	19 SEP 2012	DF
2	FOOT LENGTH CHANGED	20 OCT 2012	DF

PO Box 58142, Botany, Auckland, 2163
Tel: 09 274 0316
Fax: 09 274 8393
email: technicalservices@hynds.co.nz

ISO 9001 CERTIFIED MANAGEMENT SYSTEM

PROJECT DESCRIPTION:

HYNDS STANDARD DRAWING

Typical Section - Medium Duty Lusit LAS Element

SERVICE DETAIL:

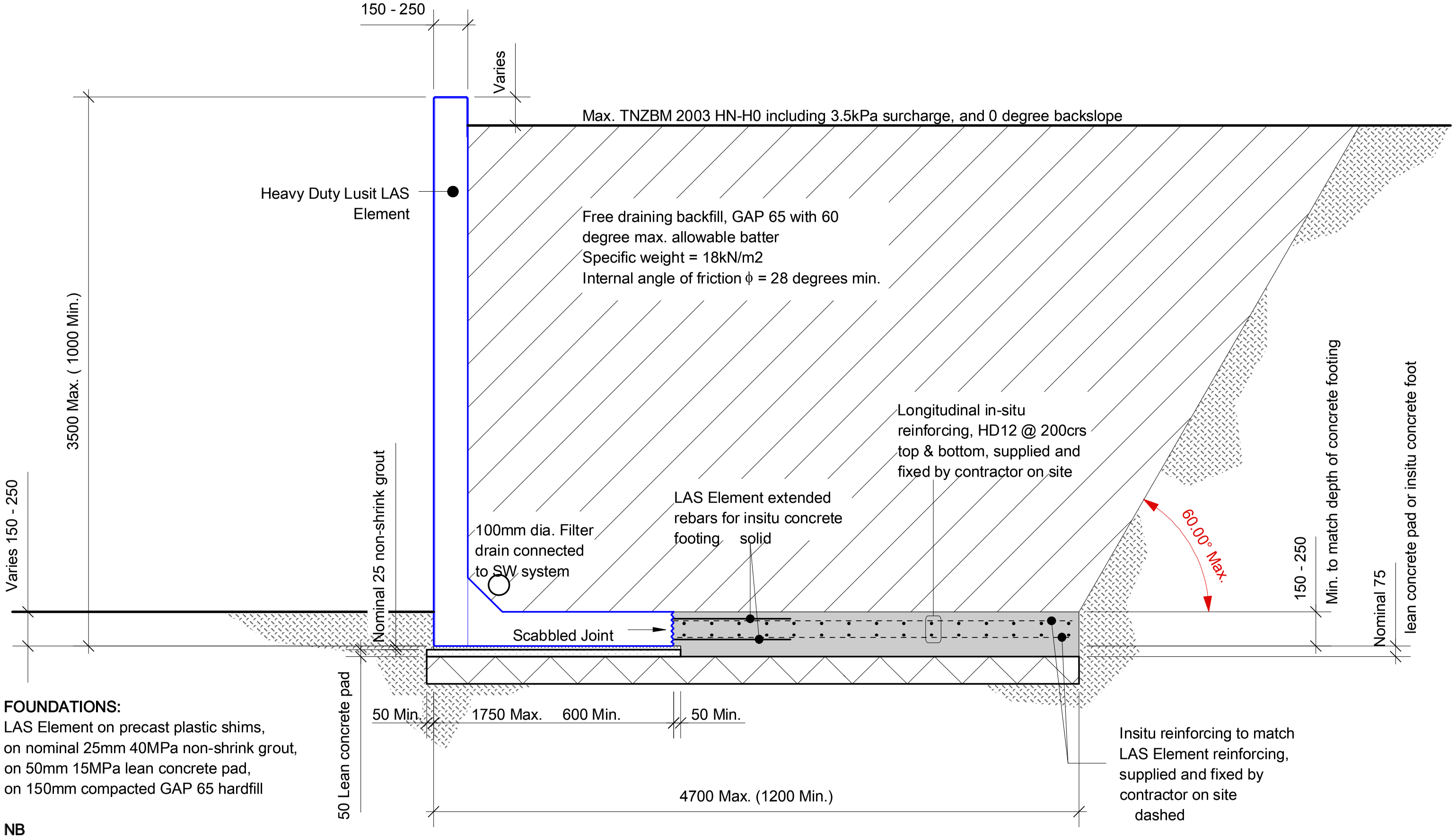
1 to 4m high x 150 to 250mm thick

Generic Retaining Wall Details

REFERENCE/QUOTE NUMBER:	20283	
DRAWN: DF SIGNATURE:	DESIGN: JBH SIGNATURE:	CHECKED: LvE SIGNATURE:
SCALE: AS SHOWN PAPER SIZE: A3	Note: Do not scale drawing if in doubt **ASK!!!**	DATE: 27 AUGUST 2012
DRAWING NUMBER: T4302 - 33		REVISION: 2

NOTES:

1. Minimum allowable bearing capacity of soil foundation = 100kPa (Øqu = 150kPa (NZS 3604, Sec 3, Good Ground)
2. Placement and compaction of backfill to be done a minimum of 7 days after insitu footing pour, or when concrete has reached a minimum strength of 25MPa



FOUNDATIONS:
LAS Element on precast plastic shims,
on nominal 25mm 40MPa non-shrink grout,
on 50mm 15MPa lean concrete pad,
on 150mm compacted GAP 65 hardfill

NB
Alternative foundations on,
nominal 25mm 3:1 mortar, lean concrete
pad and hardcore

TYPICAL SECTION
SCALE 1:35 A3

NOTES:

1. Concrete : $f'c$ = 50MPa
2. Reo : fy = Grade 500E
3. Reo Cover : 40mm Min
4. Min Lap Length : 40 x Bar Dia
5. Dimensional tolerances : Table 5.1-NZS3109:1997
6. Do not re-bend reinforcing steel
7. Design Loading:
   TNZBM 2003 HN-H0 including 3.5kPa surcharge, 0 degree backslope
   Max. specific weight of backfill γmax = 18kN/m3
8. Exposure classification B2. Design life 100 years
   NZS 3101 Tables 3.1 & 3.6

MATERIALS:

VOL (m3/unit)=	0.22 to 1.26 m3 (precast portion)
WT (ton/unit)=	0.560 to 3.142 tonnes
CODE =	LSSH1000150 to 3500250

REVISIONS:

REV#	REVISION DESCRIPTION:	DATE:	DRAWN:
1	FOR CONSTRUCTION	19 SEP 2012	DF
2	FOOT LENGTH CHANGED	29 OCT 2012	DF

PO Box 58142, Botany, Auckland, 2163
Tel: 09 274 0316
Fax: 09 274 8393
email: technicalservices@hynds.co.nz

ISO 9001 CERTIFIED MANAGEMENT SYSTEM

PROJECT DESCRIPTION:

HYNDS STANDARD DRAWING

Typical Section - Heavy Duty Lusit LAS Element

SERVICE DETAIL:

1 to 3.5m high x 150 to 250mm thick

Generic Retaining Wall Details

REFERENCE/QUOTE NUMBER:	20283	
DRAWN: DF SIGNATURE:	DESIGN: JBH SIGNATURE:	CHECKED: LvE SIGNATURE:
SCALE: AS SHOWN PAPER SIZE: A3	Note: Do not scale drawing if in doubt **ASK!!!**	DATE: 27 AUGUST 2012
DRAWING NUMBER: T4303 - 29		REVISION: 2