



SOIL RETENTION
PRODUCTS INC.

**VERDURA[®] 30 RETAINING WALL
STANDARD DESIGN**

For Exposed Wall Heights of 3 to 6 Feet
ICC-ES Evaluation Report ESR-3073



Prepared by

Soil Retention Designs, Inc.

2501 State Street
Carlsbad, CA 92008

NOTE: All segmental retaining walls should be designed in accordance with recognized industry standards to obtain a building permit when required by the California Building Code. When a building permit is required for your retaining wall, you will need to provide structural calculations or a standard design. These enclosed designs satisfy that requirement.

Verdura® 30 Retaining Wall - Standard Design

The **Verdura**® Wall by Soil Retention Products, Inc of Carlsbad, California can be constructed as a gravity retaining structure or a geosynthetic reinforced segmental retaining wall, depending on the desired height. This Standard Design report addresses the use of our **Verdura**® 30 blocks and **Posi-Dura**® geosynthetic reinforcement for single-tier walls with exposed heights of 3.0 to 6.0 feet with a level ground surface in front of the wall. Walls with exposed heights of 3.0 feet or less may be constructed with either **Verdura**® 10 or **Verdura**® 30 blocks without the use of geosynthetic reinforcement or this design manual. Walls with exposed heights greater than 3.0 feet should be constructed with **Verdura**® 30 blocks and **Posi-Dura**® geosynthetic reinforcement; refer to Figure 1 and Figure 2 for more information on your specific application. This design manual should only be used for walls with exposed heights less than 6.0 feet. Walls with exposed heights greater than 6.0 feet should be designed for site specific conditions by a qualified engineer.

The **Verdura**® retaining wall system acts as an earthen buttress to resist lateral soil forces. Conventional retaining walls (typically constructed as reinforced concrete cantilever type structures) must resist all lateral forces by applying loads through rigid, poured-in-place, concrete foundations. Concrete foundations are not required with the **Verdura**® 30 retaining wall system. However, a gravel leveling pad can be used when the underlying soils consist of lower strength soils or soils that are difficult to level.

The construction sequence of the **Verdura**® 30 retaining wall system allows block and geosynthetic reinforcement placement to be installed concurrently with the backfill operation. For installation information, please visit our website at www.soilretention.com. With the **Verdura**® retaining wall system there is no waiting time for concrete and / or masonry to cure, thus allowing for a much quicker installation process. The stacked **Verdura**® 30 block face has been designed to allow for planting of the wall face in the gap between the blocks. A planted wall is not only more aesthetically pleasing, but is also essentially "graffiti-proof".

The open nature of the **Verdura**® 30 wall face prevents the possibility of hydrostatic pressure build-up behind the wall due to trapped water. Conventional retaining walls or other retaining wall systems must be waterproofed and provided with an extensive drainage system in order to prevent the build-up of hydrostatic pressure behind the wall.

The **Verdura**® 30 retaining wall construction methods allow for great flexibility in alignment and placement along both horizontal and vertical curves. These techniques avoid costly foundation stepping and complicated steel reinforcement.

Proper planning for the **Verdura**[®] 30 wall is imperative to a successful project. The planning process should include the following steps:

- Determine the desired wall layout, wall heights, and calculate the wall face square footage.
- Prepare a site and wall plan with the help of a civil engineer and/or architect (if required) and **obtain any necessary permits from your local building authority.**
- Classify site soils by a qualified geotechnical engineer. Find a local geotechnical engineer at www.calgeo.org.
- Apply structural designs for walls based on this Standard Design manual or another design by a qualified engineer. If walls are placed on a slope (see Figure 3) a geotechnical engineer should be consulted.
- Create a materials list for blocks, **Posi-Dura**[®] geosynthetic reinforcement, drainage rock and pipe, and filter fabric. Refer to the Design Checklist.
- Retain a qualified engineer to perform soil compaction testing and inspection services during wall construction as outlined within the ICC-ES Evaluation Report ESR-3073.

If you have questions about your wall, please contact Soil Retention Products, Inc. for more information. The **Verdura**[®] retaining wall system has been approved with the ICC-ES Evaluation Report ESR-3073 for conformance with 2015 IBC and 2013 CBC building codes.

The **Verdura**[®] 30 retaining wall can also be constructed in a tiered configuration to allow larger landscaping configurations. A qualified geotechnical engineer should be consulted to evaluate the tiered configuration, establish setbacks between walls and to verify that this Standard Design is still applicable.

Design Checklist

1. Determine the wall design case(s) based on the geometry of the cross section and any surcharge loading conditions in accordance with Figure 1.
2. Determine the Total Wall Height at one or multiple locations. Note that the designs are only valid for a level bottom of wall condition as depicted in Figure 1. **Walls with descending slopes at the base, as per Figure 3 should be evaluated by a qualified geotechnical engineer.** This standard design may not apply to walls with descending slopes below.

Exposed Height (H_{EXP}) = _____ feet

+

Embedment Depth (H_{EMB}) = _____ feet

(The minimum required embedment for all walls with exposed heights greater than 3 feet is 1 foot)

=

Total Height (H_{TOT}) = _____ feet

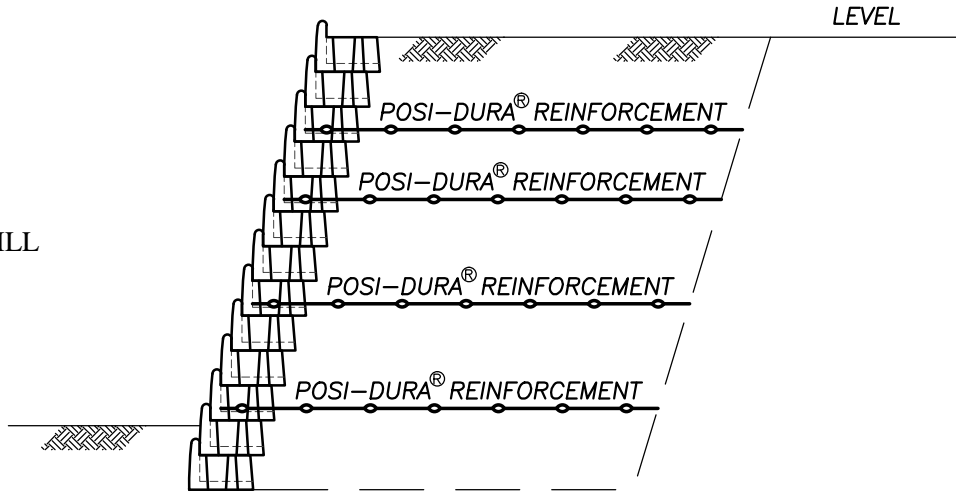
3. Determine soil types in accordance with the attached Table 1. Soils to be used in the **Posi-Dura**[®] geosynthetic reinforced zone should consist of Class 3 or 4. Class 5 soils (clays and silts) are allowed in the retained zone (behind the **Posi-Dura**[®] geosynthetic reinforced zone) only. **Class 5 soils should not be used in the Posi-Dura[®] geosynthetic reinforced zone.** When more than one soil type is involved, the more conservative (higher Class number) should govern. See the case design figures for details showing where the specified soil zones are located.
4. Use the appropriate design table to determine necessary spacing and length of **Posi-Dura**[®] reinforcements based on wall height and soil type. Refer to Figure 2 for the **Posi-Dura**[®] connection detail.

Posi-Dura® Installation Guidelines

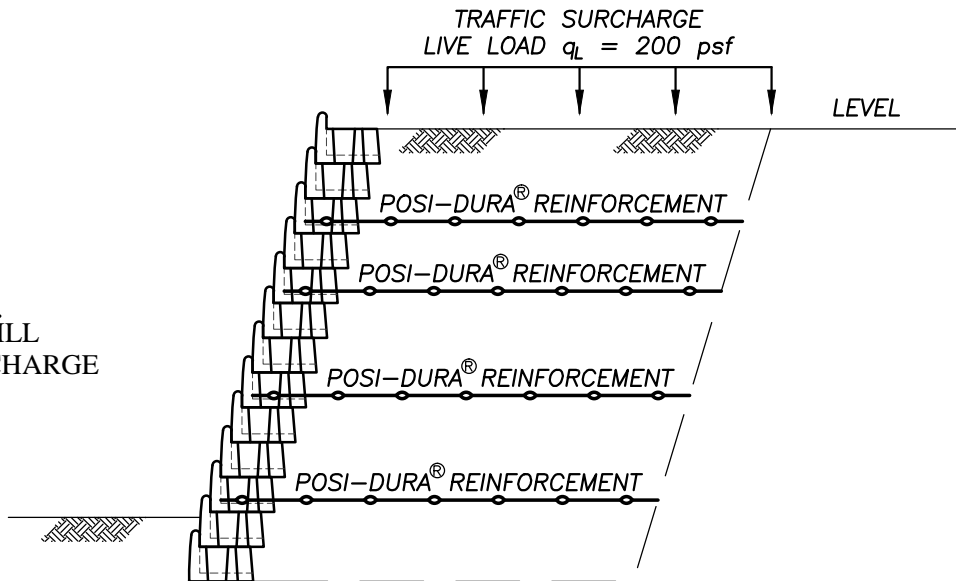
The construction of the **Verdura**® 30 Retaining Wall with **Posi-Dura**® reinforcement is the same as the method presented on our website at www.soilretention.com. The following guidelines are intended as a supplement to the ICC-ES ESR-3073 report and website instructions when using the standard designs in this manual. Visit www.soilretention.com to view installation instructions and ICC report.

1. Determine the required spacing of the **Posi-Dura**® reinforcement. In general, **Posi-Dura**® reinforcement layers will be installed in every third course of blocks as depicted in Figure 1. Near the top of the wall, a maximum of three **Verdura**® 30 block courses may be placed above the last (or highest) reinforcement layer.
2. Each **Verdura**® 30 block in a reinforced course shall receive a **Posi-Dura**® reinforcement strip. When the blocks are spaced 9" apart one **Posi-Dura**® reinforcement strip will be required every 2.25' of wall length. The length of the **Posi-Dura**® reinforcement is determined by the appropriate design table for your site conditions and may be measured, cut, and installed as indicated in Case 1, Case 2, Case 3, and Figure 2.
3. An 11 ¼-inch long 1-inch diameter Schedule 80 PVC pipe shall be used to anchor the **Posi-Dura**® reinforcement to the **Verdura**® 30 block. The pipe is inserted through a sleeve on the **Posi-Dura**® reinforcement and placed in the recess of the block between gussets prior to backfilling. Refer to Figure 2 for more information on the connection.
4. **Posi-Dura**® reinforcement layers should have a uniform length for each section of wall with a fixed height.
5. Opposite end of geosynthetic may be staked in place or held taut until backfill soils are placed on top of **Posi-Dura**® reinforcement strips.

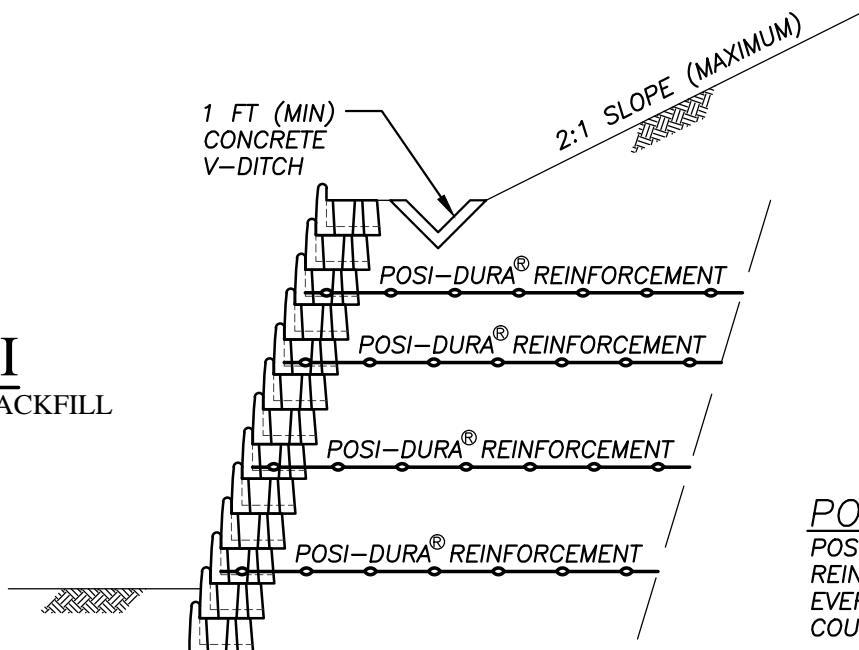
CASE I
LEVEL BACKFILL



CASE II
LEVEL BACKFILL
TRAFFIC SURCHARGE

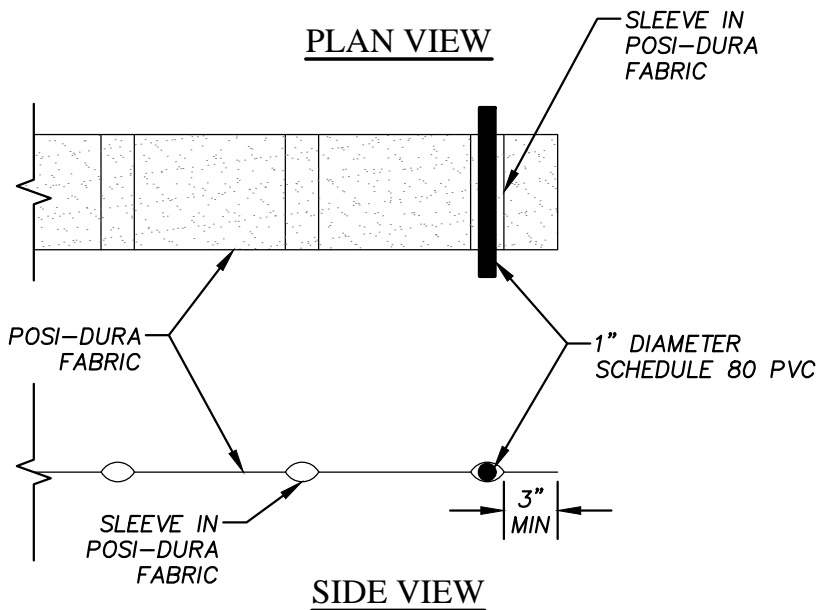


CASE III
2:1 SLOPING BACKFILL

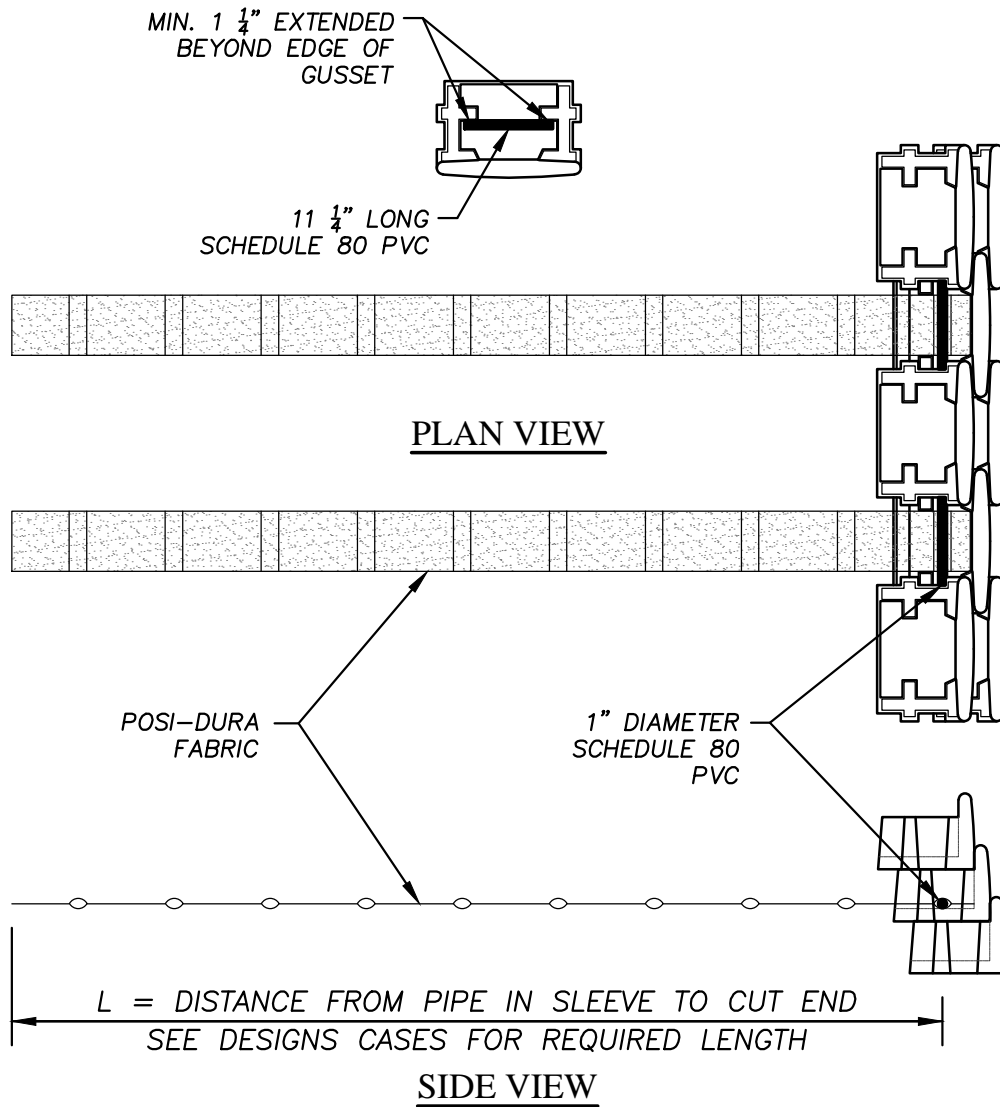


POSI-DURA NOTE:
POSI-DURA®
REINFORCEMENT PLACED AT
EVERY THIRD VERDURA BLOCK
COURSE

FIGURE 1 - WALL LOADING CASES



POSI-DURA PIPE THROUGH POSI-DURA FABRIC CONNECTION



POSI-DURA REINFORCEMENT CONNECTION

FIGURE 2 - POSI-DURA[®] REINFORCEMENT DETAILS

NOTE:

CONSULT A GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION TO DETERMINE IF YOUR WALL PROJECT IS FEASIBLE WITH THE EXISTING SLOPE AND TO SEE IF THE STANDARD DESIGN IS STILL APPLICABLE. A GEOTECHNICAL ENGINEER SHOULD EVALUATE THE GLOBAL STABILITY OF THE WALL AND SLOPE SYSTEM.

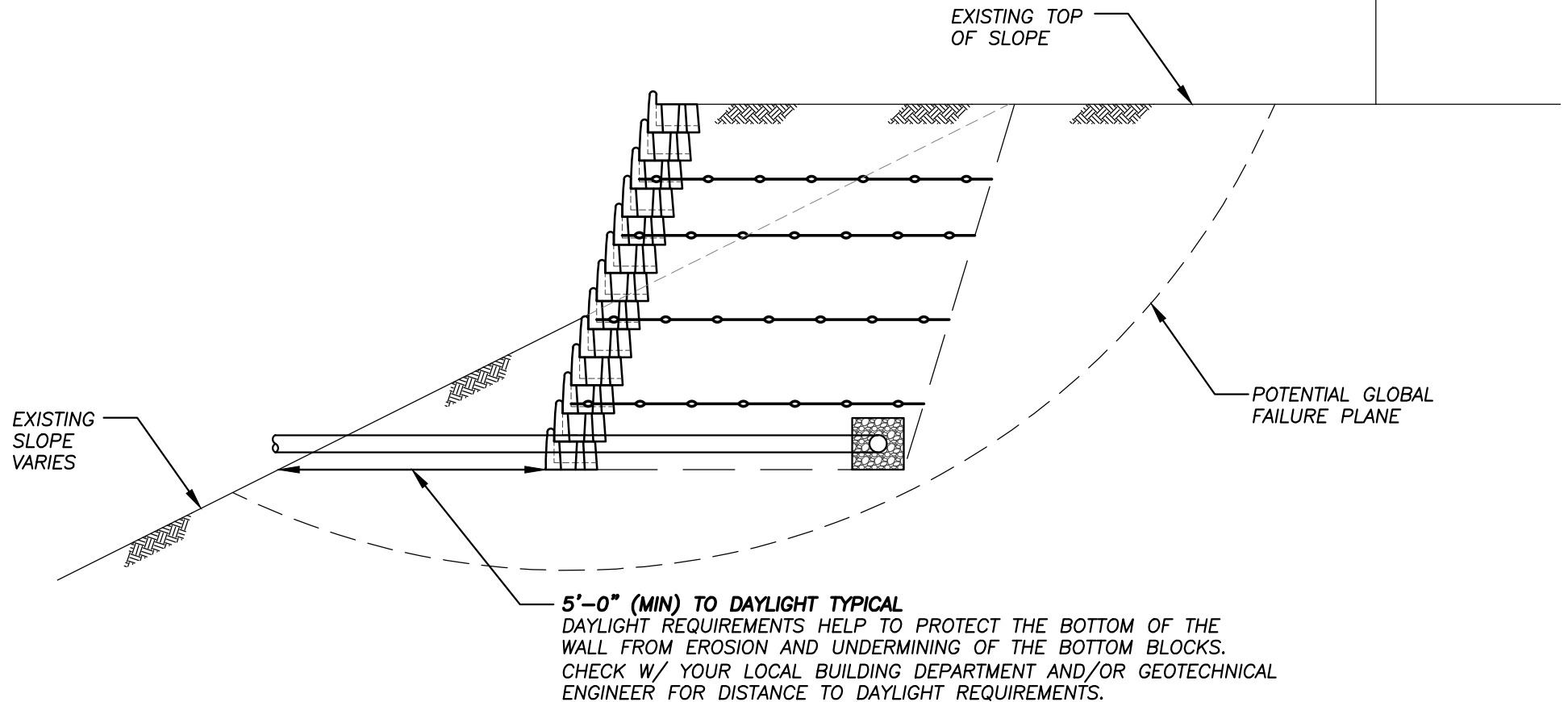
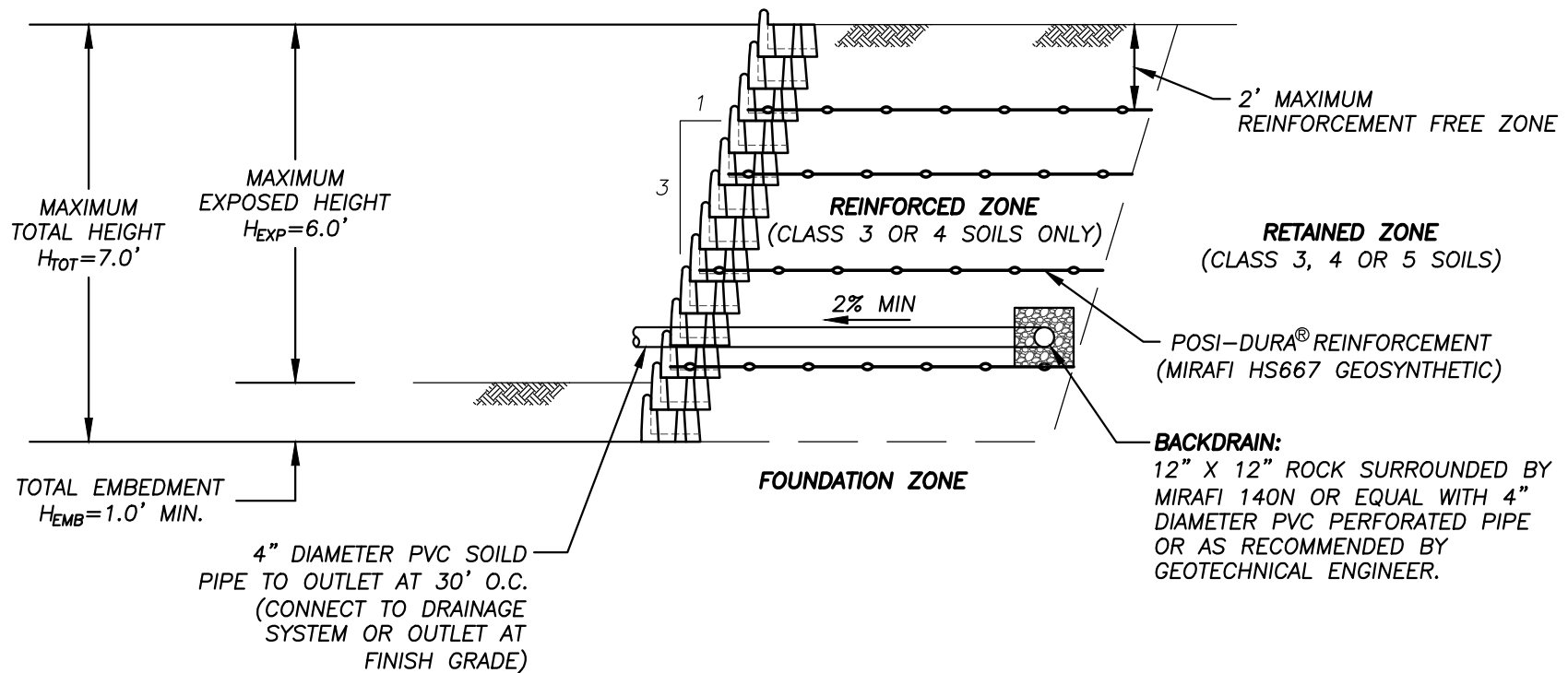


FIGURE 3 - VERDURA RETAINING WALL WITH A VARYING SLOPE BELOW

CASE I Level Backfill

CLASS OF SOIL per Table I	TOTAL WALL HEIGHT (H_{TOT}) (feet) INCLUDING EMBEDMENT	EXPOSED WALL HEIGHT (H_{EXP}) (feet)	EMBEDMENT DEPTH (H_{EMB}) (feet)	NUMBER OF POSI-DURA® LAYERS	LENGTH OF POSI-DURA® REINFORCEMENT (feet)
3 GW and GP	4.3 to 5.0	3.3 to 4.0	1.0	2	3.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	4.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	4.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	5.5
4 SW, SP, SM, SC, GM, and GC	4.3 to 5.0	3.3 to 4.0	1.0	2	3.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	4.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	5.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	6.5
5 CL, ML, MH, and CH	4.3 to 5.0	3.3 to 4.0	1.0	2	3.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	4.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	5.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	6.5



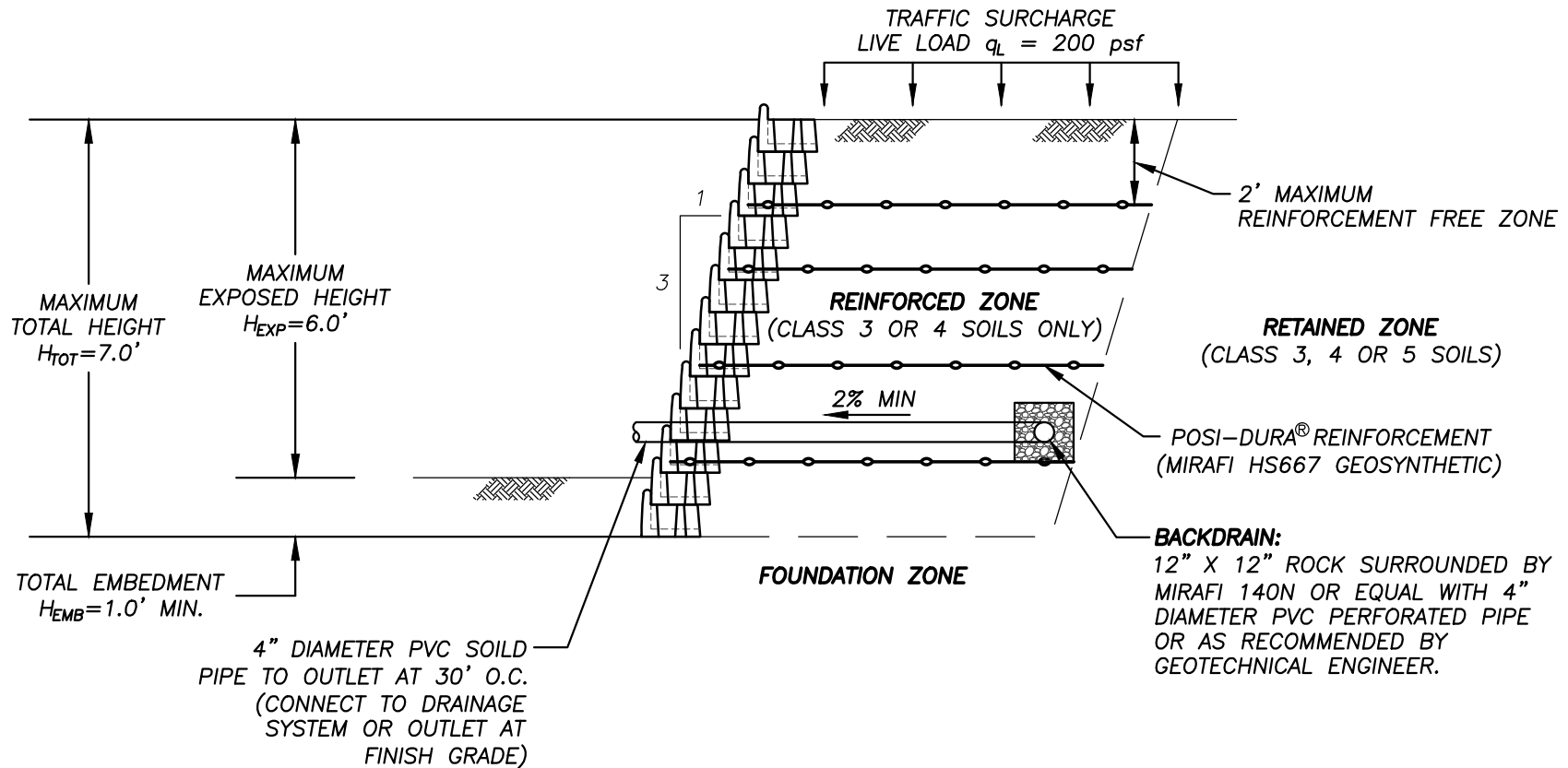
TYPICAL CROSS SECTION THROUGH MAXIMUM HEIGHT

CASE I
LEVEL BACKFILL

CASE II

Level Backfill – Traffic Surcharge = 200 psf

CLASS OF SOIL per Table I	TOTAL WALL HEIGHT (H_{TOT}) (feet) INCLUDING EMBEDMENT	EXPOSED WALL HEIGHT (H_{EXP}) (feet)	EMBEDMENT DEPTH (H_{EMB}) (feet)	NUMBER OF POSI-DURA® LAYERS	LENGTH OF POSI-DURA® REINFORCEMENT (feet)
3 GW and GP	4.3 to 5.0	3.3 to 4.0	1.0	2	3.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	4.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	4.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	5.5
4 SW, SP, SM, SC, GM, and GC	4.3 to 5.0	3.3 to 4.0	1.0	2	3.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	4.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	5.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	6.5
5 CL, ML, MH, and CH	4.3 to 5.0	3.3 to 4.0	1.0	2	3.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	4.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	5.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	6.5



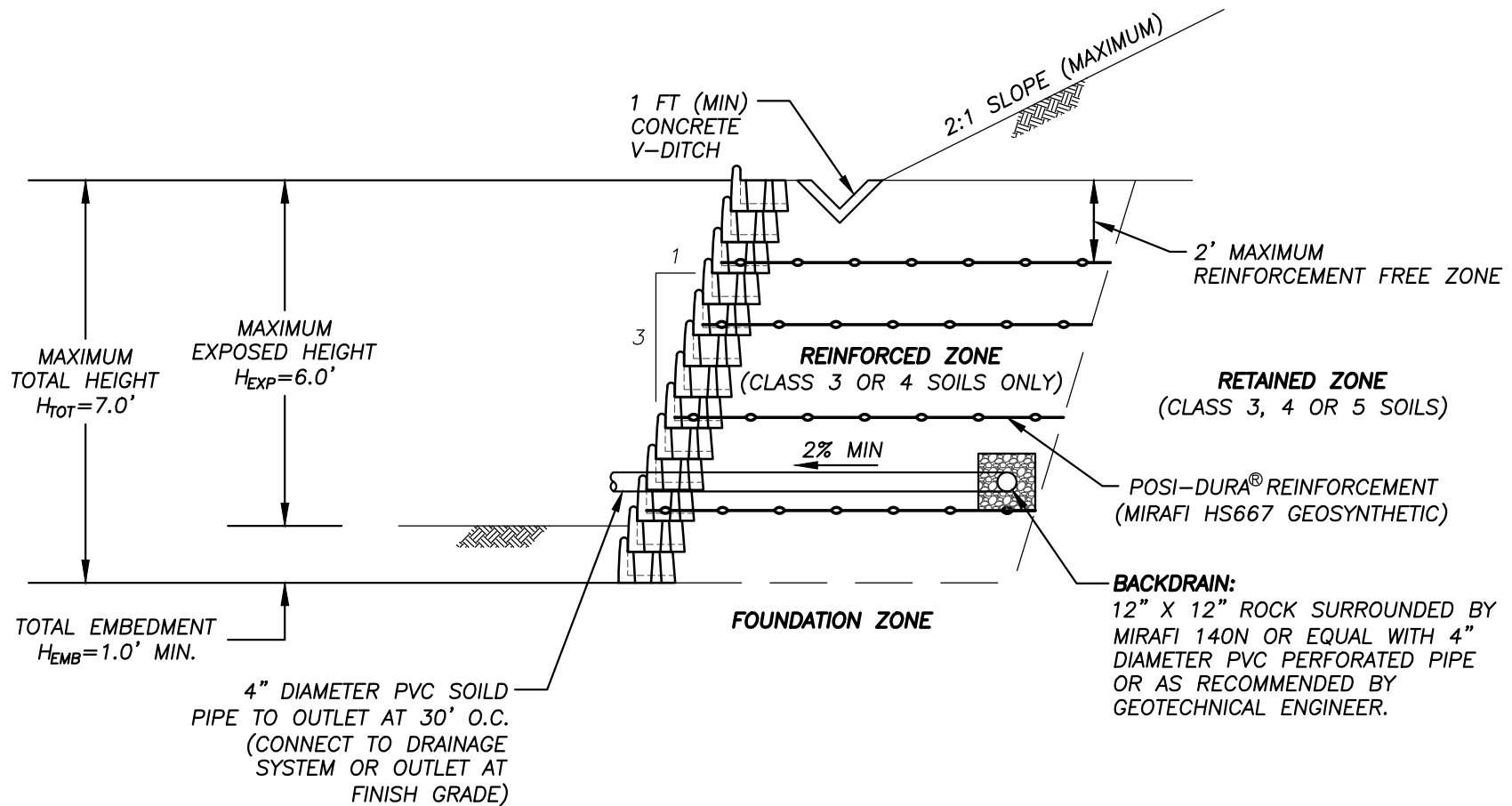
TYPICAL CROSS SECTION THROUGH MAXIMUM HEIGHT

CASE II
LEVEL BACKFILL
TRAFFIC SURCHARGE

CASE III

2:1 Sloping Backfill

CLASS OF SOIL per Table I	TOTAL WALL HEIGHT (H_{TOT}) (feet) INCLUDING EMBEDMENT	EXPOSED WALL HEIGHT (H_{EXP}) (feet)	EMBEDMENT DEPTH (H_{EMB}) (feet)	NUMBER OF POSI-DURA® LAYERS	LENGTH OF POSI-DURA® REINFORCEMENT (feet)
3 GW and GP	4.3 to 5.0	3.3 to 4.0	1.0	2	4.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	5.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	6.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	7.5
4 SW, SP, SM, SC, GM, and GC	4.3 to 5.0	3.3 to 4.0	1.0	2	5.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	6.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	7.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	8.5
5 CL, ML, MH, and CH	4.3 to 5.0	3.3 to 4.0	1.0	2	6.5
	5.0 to 6.0	4.0 to 5.0	1.0	3	7.5
	6.0 to 6.5	5.0 to 5.5	1.0	3	9.5
	6.5 to 7.0	5.5 to 6.0	1.0	4	10.5



TYPICAL CROSS SECTION THROUGH MAXIMUM HEIGHT

CASE III
2:1 SLOPING BACKFILL

TABLE I
Soil Classifications

CLASS OF SOIL	CLASS OF MATERIALS PER USCS	DESCRIPTION
3	GW and GP	SANDY GRAVEL AND/OR GRAVEL
4	SW, SP, SM, SC, GM, and GC	SAND, SILTY SAND, CLAYEY SAND, SILTY GRAVEL & CLAYEY GRAVEL
5	CL, ML, MH, and CH	CLAY, SANDY CLAY, SILTY CLAY, CLAYEY SILT, SILT & SANDY SILT

- *CONSULT A GEOTECHNICAL ENGINEER ON THE SOIL CLASSIFICATION FOR YOUR PROJECT.*
- *USCS – UNIFIED SOIL CLASSIFICATION SYSTEM*
- *CLASS OF SOIL PER TABLE 1806.2 OF CBC/IBC CODES*

Limitations

The designs presented herein are based on the use of the specified products manufactured by Soil Retention Products, Inc. and general soil types identified by the USCS and the 2013 California Building Code. It is the responsibility of the user of this design manual to verify the actual site soil conditions, and to construct the wall in accordance with this manual. A qualified geotechnical engineer should be retained to determine the soil type and any other geotechnical condition which may affect the design and stability of the wall and surrounding area, and to provide inspection services on a continuous basis during wall construction. The geotechnical engineer or his appointed representative shall observe and verify the installation of **Verdura**[®] blocks, geosynthetic reinforcement, and compaction of fill soil per ICC-ES ESR-3073 report. All fill soil should be compacted to at least 90% of ASTM D 1557 modified proctor density.

The user of this design manual or his/her representatives agree, to the fullest extent permitted by law, to limit the liability of Soil Retention Products, Inc. and Soil Retention Designs, Inc. for any and all claims, losses, costs, damages of any nature whatsoever or claims expenses from any cause or causes, so that the total aggregate liability of Soil Retention Products, Inc. and Soil Retention Designs, Inc. shall not exceed \$1,000.00 or the cost of wall materials, whichever is less. Such claims and causes include, but are not limited to negligence, professional errors or omissions, strict liability, breach of contract or warranty. The use of this design manual or his representatives also agree to fully protect, indemnify, hold harmless and defend Soil Retention Products, Inc. and Soil Retention Designs, Inc., their principles, officers, employees, and agents from and against any and all loss, cost, damage, injury, liability claims, liens, demands, taxes, penalties, interest or causes of action of every nature whatsoever resulting from the use of this design manual.