

SLOPE INSTALLATION AND MAINTENANCE GUIDELINES-PYRAMAT® 75 HIGH PERFORMANCE

Thank you for purchasing the Pyramat® 75 High Performance Turf Reinforcement Mat (HPTRM) by Propex Operating Company, LLC (Propex). This document provides installation and maintenance guidelines for Pyramat® 75 High Performance used as slope armouring to increase earthen slope resiliency. Pyramat® 75 High Performance provides permanent erosion protection on either the flood side and/ or protected side of an earthen slope.

Temporary securing pins (pins) are used during installation to hold Pyramat® 75 High Performance in place. Pins also promote vegetation establishment keeping Pyramat® 75 High Performance in intimate contact with the soil.

Pyramat® 75 High Performance is an engineered solution with a unique design for each specific project. While Propex has made every effort to ensure general validity, this information should not be used for a specific application without independent professional examination and verification of its suitability, applicability, and accuracy. The information provided herein is for general information only, and is intended to present installation guidance. Project specific contract documents take precedence when pin placements are different than what is represented in this document. Depending upon the critical nature of the structure to be armoured, work restrictions may be in place such as limiting work based on growing seasons, weather patterns, etc. Work should be performed under the provisions set forth for the specific project. Please feel free to call our local Global Synthetics representative, refer www.globalsynthetics.com.au for support during installation as required.

BEFORE INSTALLATION BEGINS

- Coordinate with a Global Synthetics Representative: A pre-construction meeting with the construction team and a representative from Global Synthetics is recommended prior to installation. This meeting should be scheduled by the contractor with sufficient notice prior to construction.
- Gather the Tools Needed: Tools that you will need to install Pyramat® 75 High Performance include a pair of industrial shears to cut Pyramat® 75 High Performance, tape measure, and a mallet or hammer.
- Determine Vegetation Establishment Strategy: The method of vegetation establishment should be determined prior to the start of installation. Different vegetation establishment methods require different orders of installation. Refer to Establish Vegetation for further guidance.

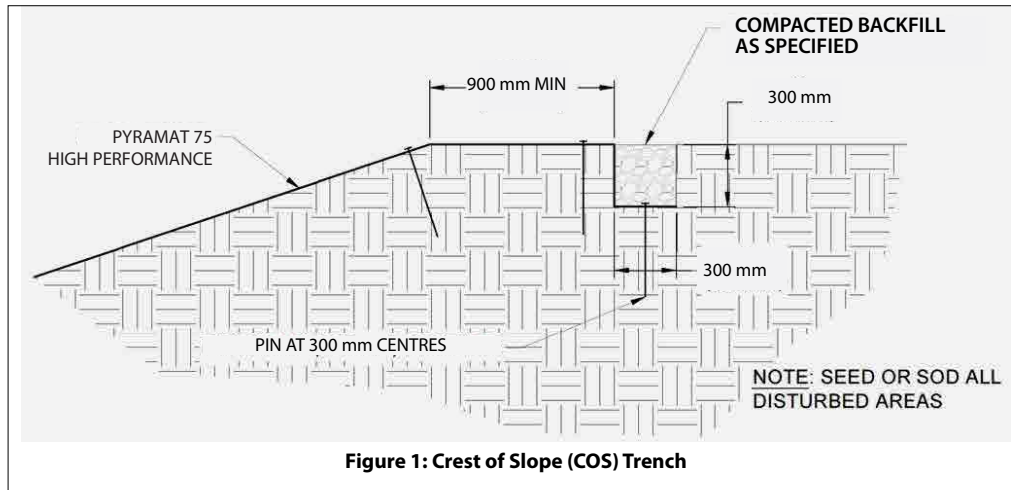
INSTALLATION OF PYRAMAT® 75 HIGH PERFORMANCE ON SLOPES

PREPARE THE SITE

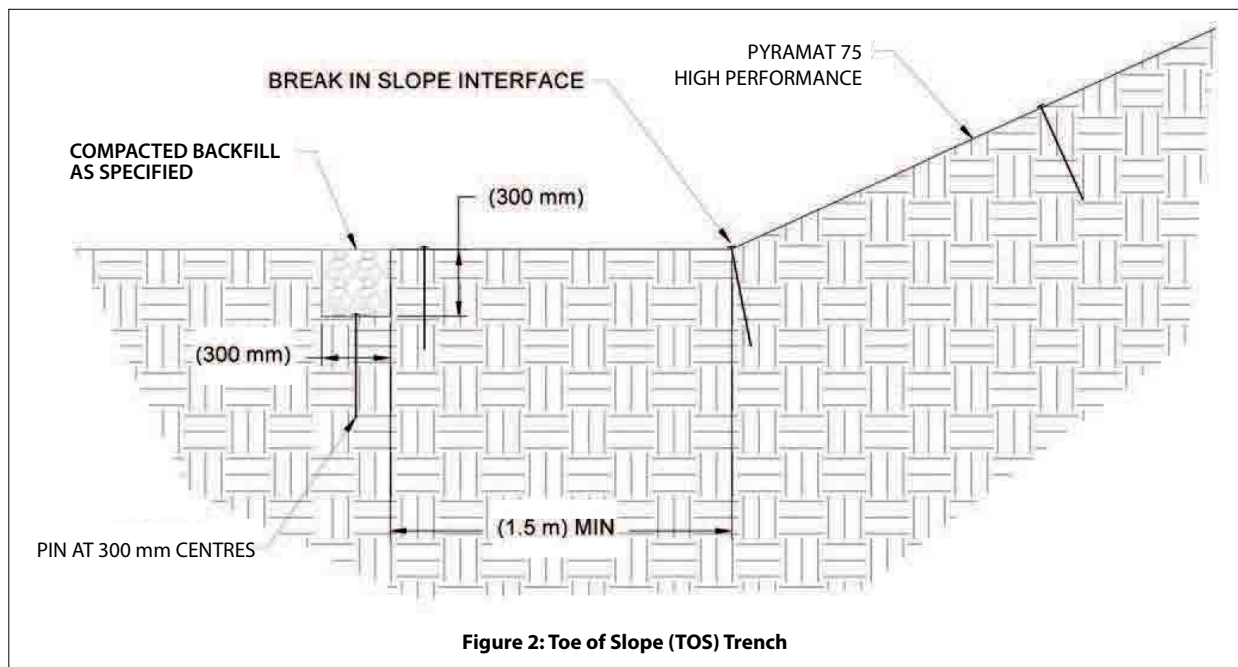
It is recommended during all stages of site preparation that disturbed soils remain unprotected for not more than a single day. Depending on project size this may require progressive site preparation during installation.

1. Grade and compact the area on the slope where Pyramat® 75 High Performance will be installed. The slope surface should be uniform and smooth, having deleterious matter such as rocks, clods, vegetation or other objects removed so that during placement, Pyramat® 75 High Performance comes in direct, intimate contact with the slope surface.

2. Prepare the area to be armoured with Pyramat® 75 High Performance by loosening the topsoil to promote better vegetation establishment. This may be accomplished with a rotary tiller on slopes 3:1 or flatter. For slopes greater than 3:1, prepare topsoil in a safe manner.
3. Excavate a Crest of Slope (COS) trench 300 mm deep x 300 mm wide minimum at a distance of 900 mm from the crest of the slope. (Figure 1).

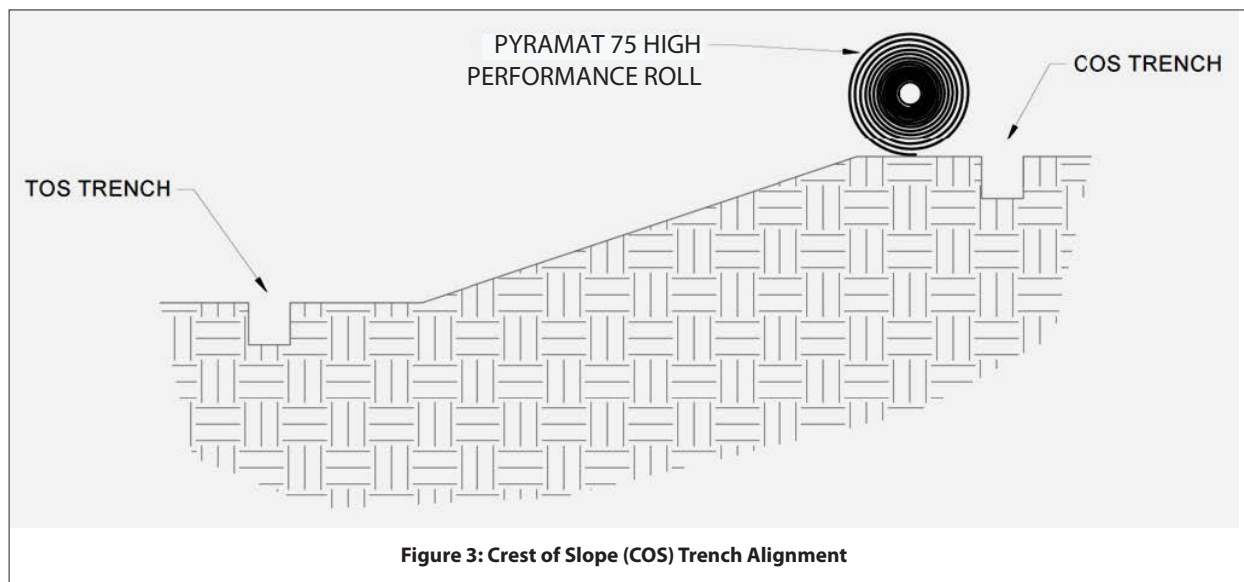


4. Excavate a Toe of Slope (TOS) trench 300 mm deep x 300 mm wide minimum at a minimum distance of 1.5 m from the toe of the slope. (Figure 2)
5. If seeding, refer to Vegetation Establishment for additional considerations during site preparation.



PYRAMAT® 75 HIGH PERFORMANCE LAYDOWN

1. Begin the Pyramat® 75 High Performance Laydown process by starting with the downstream / downwind end of the site. To ensure proper pinning of the overlapped areas the proceeding roll width must be laid out before the current roll width can be pinned with exception to the final roll width. For straight sections of a slope, Pyramat® 75 High Performance panel lengths should be long enough to construct COS and TOS trenches while also covering the surface of the slope being armoured (Figure 12). Panel edges should rest approximately perpendicular to the slope centre line. For best results, panels of Pyramat® 75 High Performance should be continuous and free from seams or roll end overlaps that are parallel to the centre line of the slope. Panel edge overlapping should follow a pattern of placing each proceeding panel's edge over the top of the previous panel edge, shingling the panels in the direction of the water flow or prevailing wind.
2. Starting at the COS trench, lay Pyramat® 75 High Performance roll so that the roll ends point towards the crest of the slope (Figure 3), with a 75 mm overlap created at adjacent panel edge locations. Ensure that adjacent panel edges maintain a minimum 75 mm overlap during Pyramat® 75 High Performance Laydown. (Figure 8)



3. Secure Pyramat® 75 High Performance with pins in the COS trench. Pins should be made of mild steel with a 4 mm minimum diameter, and a length between 150 and 300 mm with sufficient ground penetration to resist pullout (Figure 4). Longer pins may be required for looser soils. Heavier metal stakes may be required in rocky soils. Suggested placement of pins for the COS trench is along the bottom of the trench with pins on 300 mm centres. Pins should also be installed on panel edge overlaps in the COS trench.

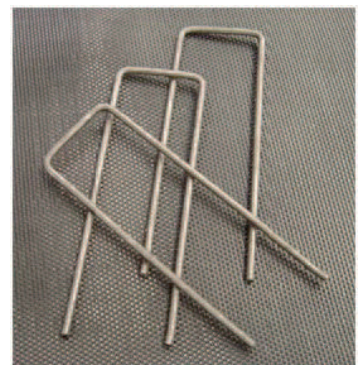
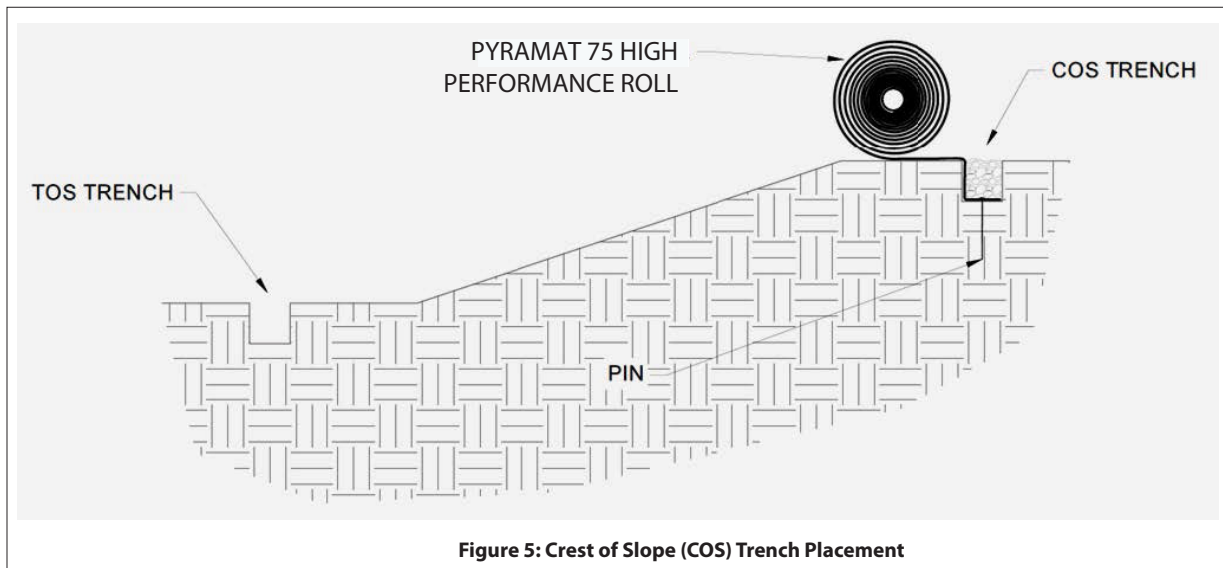


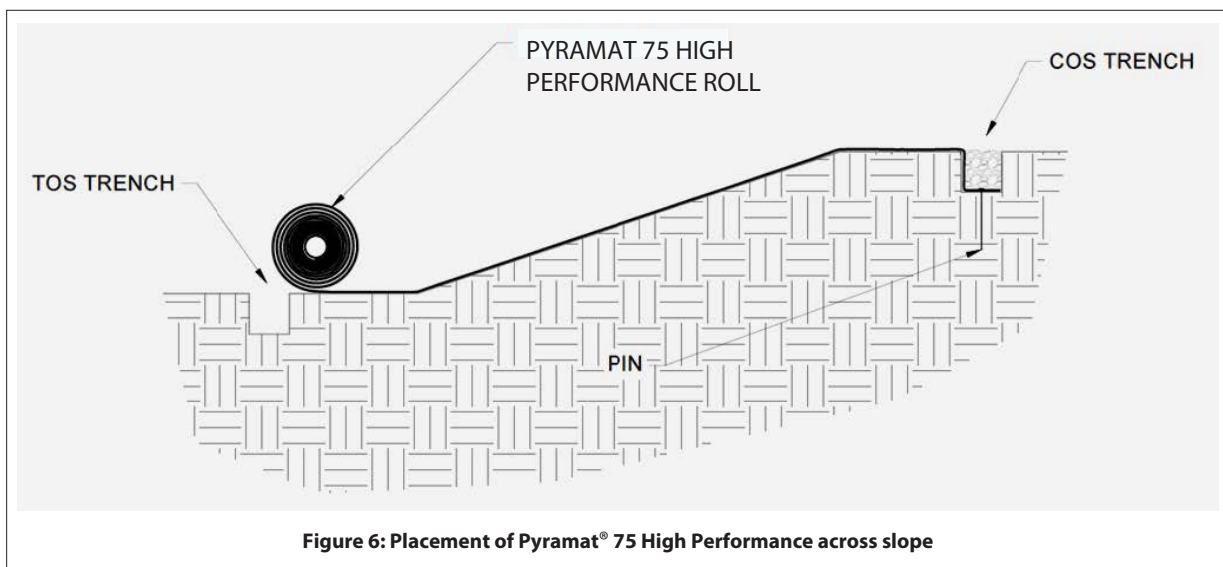
Figure 4: Securing Pin



4. Backfill and compact the COS trench in the location of the first Pyramat® 75 High Performance panel only (Figure 5).



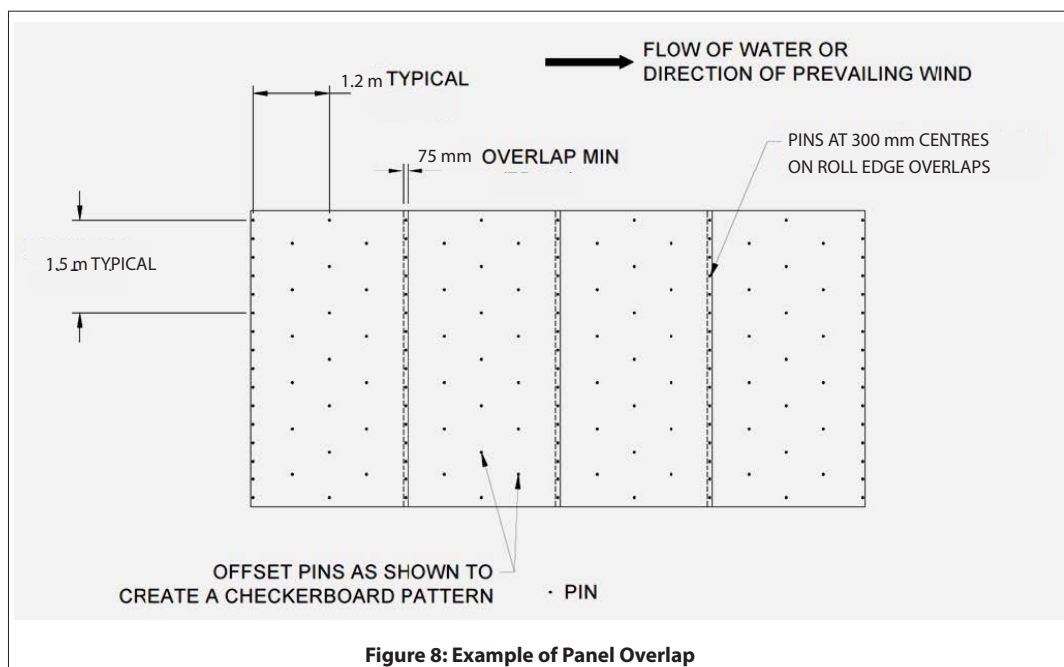
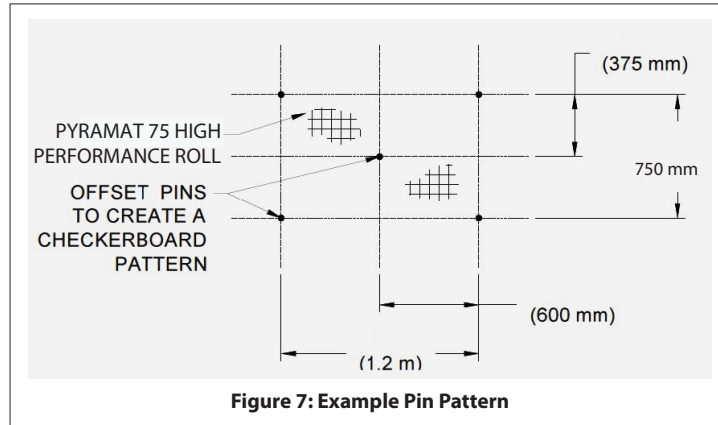
5. Unroll the Pyramat® 75 High Performance roll on the slope surface in the area to be armoured (Figure 6). Ensure that Pyramat® 75 High Performance has intimate contact with the ground and all irregular surfaces beneath Pyramat® 75 High Performance are removed.

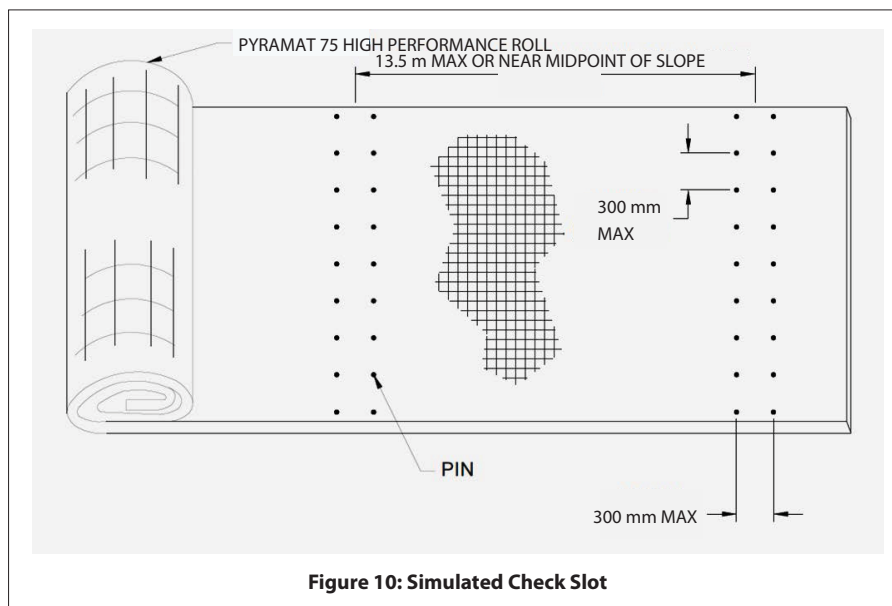
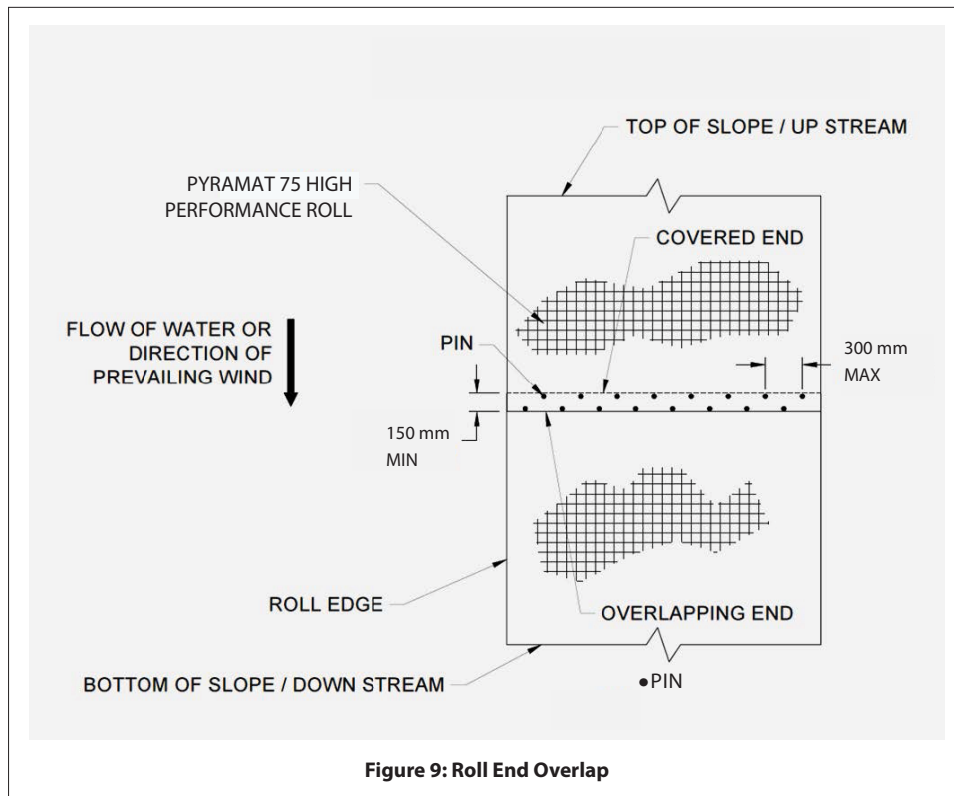


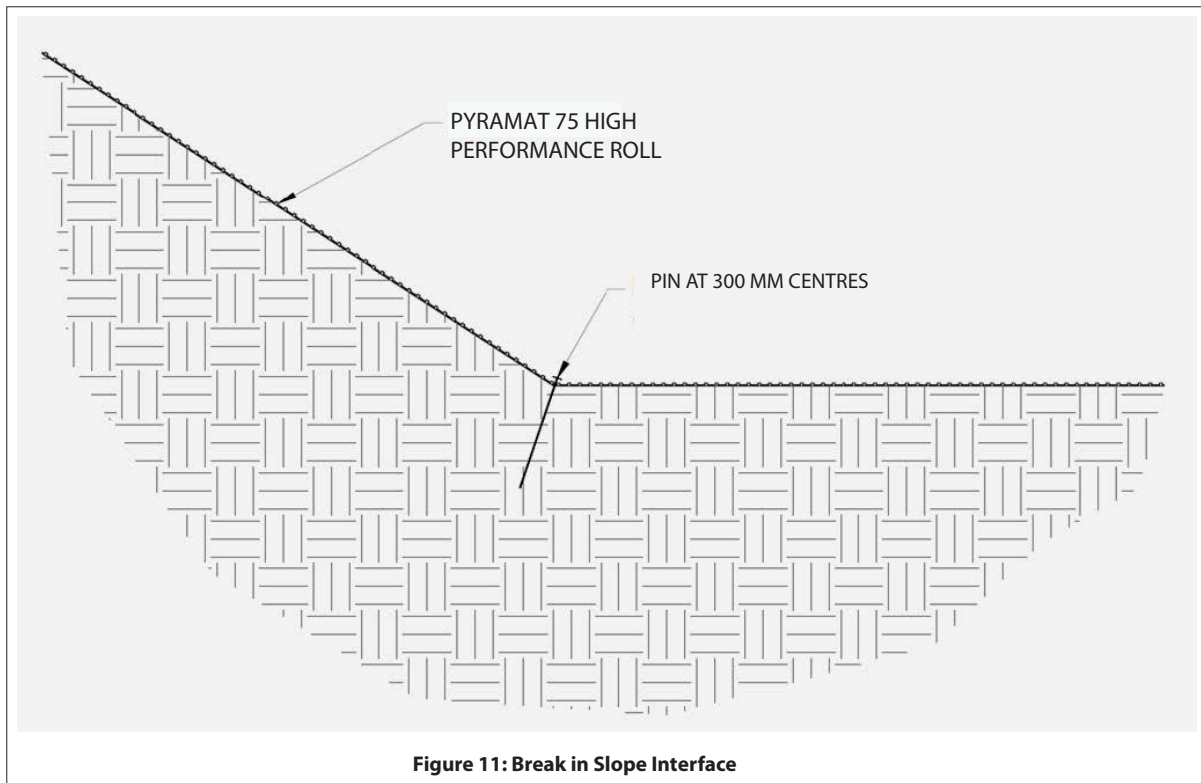
6. Secure Pyramat® 75 High Performance panels in place using pins across the slope surface according to the project's engineered design. Pin placement shall be at no more than 1 m centres.
- The leading edge of the first Pyramat® 75 High Performance panel should be secured on the Slope Armouring Edge (SAE) with pins at 300 mm centres.
 - Roll edges shall be overlapped a minimum of 75 mm with pins placed at 300 mm centres (Figure 8).



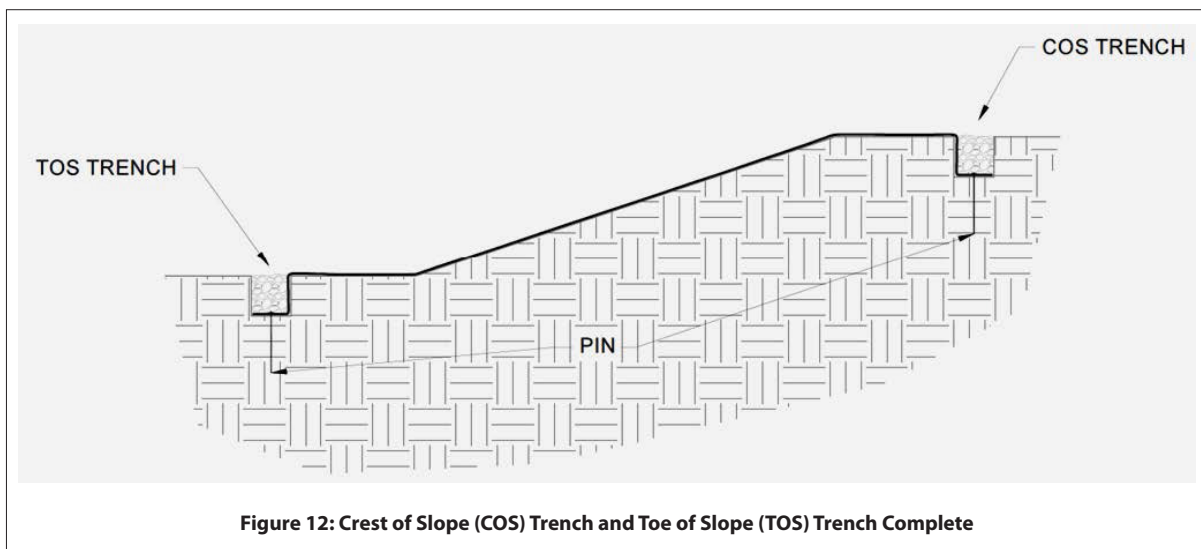
- Roll ends shall be overlapped a minimum of 150 mm with upstream / upwind panel on top. Secure roll end overlaps with two rows of pins staggered 150 mm apart on 300 mm centres (Figure 9).
- For slope lengths greater than 13.7 m, install simulated check slots. This method includes placing two rows of pins 300 mm apart at 300 mm centres at 13.7 m maximum intervals or across the midpoint of the slope for slope lengths less than 18.2 m (Figure 10).
- At the break in slope interface towards the TOS, it is suggested that pins be installed at 300 mm centres (Figure 11).







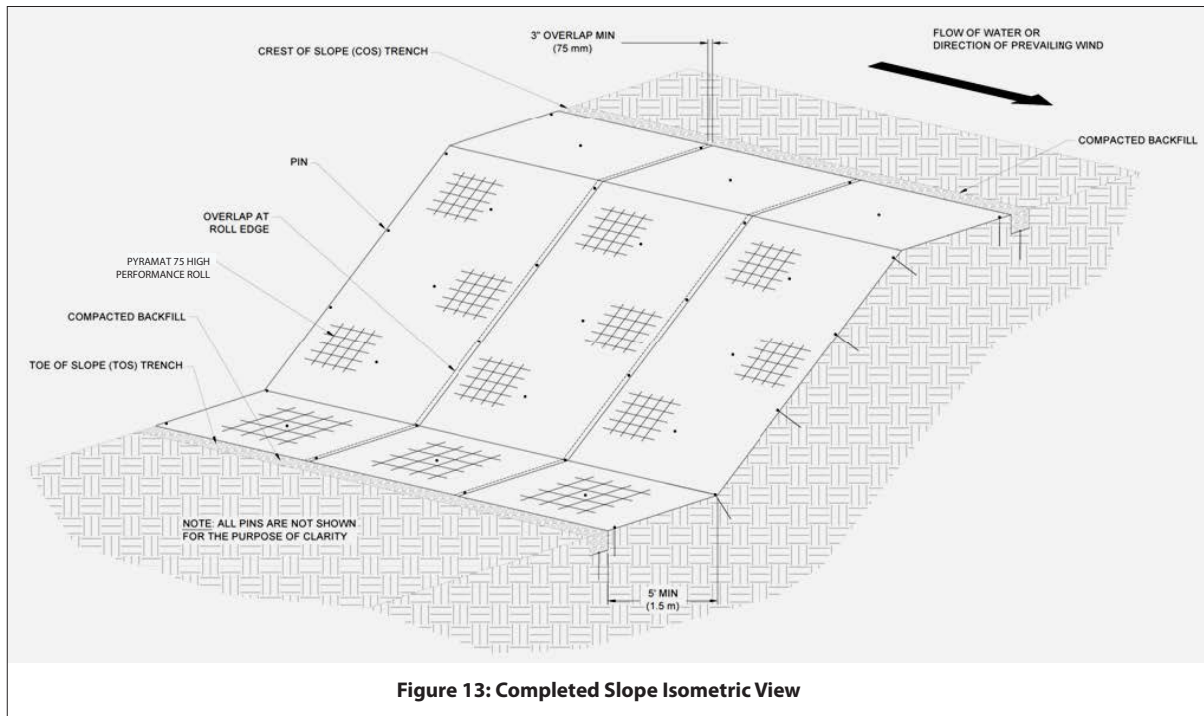
7. Secure Pyramat® 75 High Performance with pins in the TOS trench. Suggested placement of pins for the TOS trench is along the bottom of the trench with pins on 300 mm centres (Figure 12).



8. Backfill and compact the TOS trench. (Figure 12)



- Continue to work down the length of the slope by repeating steps 1 through 8 overlapping each adjacent Pyramat® 75 High Performance panel by 75 mm (Figure 8). The last Pyramat® 75 High Performance panel should terminate on the Slope Armouring Edge (SAE) with pins on 300 mm centres. At a minimum, Pyramat® 75 High Performance panels should be pinned entirely across the slope surface, pins should be installed in the trenches, and the trenches should be backfilled and compacted at the end of each day to minimise rework in the case of a major rain event. Specific project conditions may warrant further evaluation of installation order for ease. An example isometric view (Figure 13) of a slope armoured with Pyramat® 75 High Performance can be seen below for overall reference. Consult Global Synthetics at www.globalsynthetics.com.au with any questions that you may have.



ESTABLISH VEGETATION

Vegetation can be established with Pyramat® 75 High Performance by broadcast seeding, hydraulic seed application (hydroseeding) turf, or Hydromulching over or under the Pyramat® 75 High Performance. Seed application rate, seed type, sod type, and irrigation rate should be selected based on local or site specific knowledge and time of year. For best results, consider having a site specific soil test performed to help determine what soil amendments, such as lime and fertiliser, need to be incorporated into the soil to promote healthy vegetation.

WITH SEED

- Determine the seed location. Seed can be placed entirely on top of soil filled Pyramat® 75 High Performance, or alternatively 50% below Pyramat® 75 High Performance prior to pinning, with the remainder placed on top of soil filled Pyramat® 75 High Performance. If a rain event occurs prior to vegetation establishment, having 50% of the seed below Pyramat® 75 High Performance ensures that some seed remains in place. Seed placed entirely on top of soil filled Pyramat® 75 High Performance will allow for faster vegetation establishment.



2. If seeding below Pyramat® 75 High Performance, ensure 50% of the seed is placed prior to the installation of Pyramat® 75 High Performance.
3. Once Pyramat® 75 High Performance is in place, distribute soil on top by filling the pyramid like projections of Pyramat® 75 High Performance. The proper amount can be visually measured by making the top ridges of the pyramid projections barely visible, or is approximately 25 mm thickness. Soil filling can be accomplished manually or by using a small piece of equipment. Do not place excessive soil above Pyramat® 75 High Performance. See Consider Project Specific Needs for guidance on driving equipment across Pyramat® 75 High Performance.
4. Irrigate as necessary to establish and maintain vegetation until 75% of vegetation has established and has reached a height of 50 mm. Frequent, light irrigation will need to be applied to seeded areas if natural rain events have not occurred within two weeks of seeding. When watering seeded areas, use a fine spray to prevent erosion of seeds or soil. Do not over irrigate. Proper irrigation guidance is provided under the Maintenance portion of this document.

WITH HYDROMULCH

1. Hydromulch can be placed beneath Pyramat® 75 High Performance however hydroseed alone is sufficient when spraying before Pyramat® 75 High Performance placement.
2. Hydromulch can be applied over Pyramat® 75 High Performance due to the open nature of Pyramat® 75 High Performance.

WITH TURF

1. Turf can be placed on top of Pyramat® 75 High Performance for immediate vegetative growth.
2. Pins should be used to secure the sod against Pyramat® 75 High Performance. During the placement of the turf/ sod, ensure that Pyramat® 75 High Performance is 100% covered by tightly adjoining rolls or squares of sod along edges. Any voids in between sod pieces should be filled with clean loose soil.
3. Irrigate as necessary. Proper irrigation guidance is provided under the Maintenance portion of this document.
4. Monitor to identify areas where browned/dead turf/ sod emerges. These areas may need to be addressed to ensure proper grass establishment.

CONSIDER PROJECT SPECIFIC NEEDS

1. A deeper terminal trench and/or hard armouring may be required when slopes have severe scour potential at the toe location.
2. For installing Pyramat® 75 High Performance panels around curved sections of a slope, trim panels at an angle so that no more than two layers of Pyramat® 75 High Performance overlap at any point in time. Additional pins may be needed to secure panel edges towards the toe of the slope depending upon the radius of the curved slope. Install pins as necessary to securely fasten Pyramat® 75 High Performance to the ground.
3. Vehicular Traffic should not be allowed on Pyramat® 75 High Performance at any time.
4. Disturbed areas should be reseeded. If ruts or depressions develop for any reason, rework soil until smooth and reseed or turf such areas.



SHORT-TERM AND LONG-TERM MAINTENANCE OF PYRAMAT® 75 HIGH PERFORMANCE

The purpose of this section is to provide some general guidelines for performing short-term and long-term maintenance of Pyramat® 75 High Performance with respect to maintaining vegetation reinforced with Pyramat® 75 High Performance, and patching of Pyramat® 75 High Performance (in the event it needs to be removed or replaced). These procedures are to be considered minimum guidelines for proper maintenance, and further maintenance techniques may be appropriate considering local practices and procedures.

PYRAMAT® 75 HIGH PERFORMANCE PROTECTED SLOPES

For Pyramat® 75 High Performance to be most effective, it is important to ensure that it is properly maintained both during construction and after construction. Identifying trouble areas is easy with Pyramat® 75 High Performance, and it can make identifying potential threats much simpler and manageable. Look for areas with sparse, dying, or no vegetation as these are obvious signs that Pyramat® 75 High Performance is losing intimate contact with the slope surface. If loss of ground surface occurs, Pyramat® 75 High Performance will need to be removed and reinstalled as described in Patching and Repairs Section after the eroded area is backfilled with compacted soil that is similar to material of the slope. After Pyramat® 75 High Performance is reinstalled, re-establish vegetation on the newly installed Pyramat® 75 High Performance and disturbed areas. Monitor the sites to determine if frequent watering may be required to establish vegetation.

To minimise exposure to unwanted maintenance and repair, Pyramat® 75 High Performance armoured slopes should be free of unauthorised vehicular traffic. Routine maintenance and slope inspections should be performed by foot traffic only. Tracked equipment such as skid steers, excavators, or dozers should only be allowed to traffic over Pyramat® 75 High Performance in times of emergency after vegetation establishment is complete. Failure to control unauthorised traffic can result in Pyramat® 75 High Performance being damaged resulting in erosion below Pyramat® 75 High Performance during storm events.

MAINTAINING VEGETATION

Good vegetative cover will ensure maximum performance of Pyramat® 75 High Performance. Vegetative cover care starts before a project is complete and is ongoing until all Pyramat® 75 High Performance is installed. Vegetative cover should be given every opportunity to grow and establish well. This will require that a contractor periodically fertilise, water, and mow the grasses as needed until a project is complete in the short-term, with the owner of the slope fulfilling the maintenance of the slope in a similar fashion for the long-term. For the entire lifecycle of Pyramat® 75 High Performance, every effort must be made to prevent unauthorised encroachments, grazing, vehicle traffic, the misuse of chemicals, or burning during inappropriate seasons.

PATCHING AND REPAIRS

Pyramat® 75 High Performance may require localised repair at times. For emergency repairs, an adequate supply of Pyramat® 75 High Performance should be maintained in inventory with the necessary tools to install. This will allow for a timely, initial repair of the system.

1. In order to identify areas in need of repair, the site should be patrolled immediately after mowing and after rain events of 50 mm or more. When patrolling look for areas of sparse vegetation, exposed edges of Pyramat® 75 High Performance, and areas where direct contact between Pyramat® 75 High Performance and the slope surface is compromised. Pyramat® 75 High Performance should be rated as Acceptable, Minimally Acceptable, or Unacceptable during inspection.



- A. Acceptable (A) - The rated area is in satisfactory, acceptable condition, and will function as designed and intended during the rain event. Pyramat® 75 High Performance has no exposed edges, is installed tightly by maintaining direct contact to the slope surface with no rilling beneath, and has over 90% vegetation cover. There is no noticeable damage present.
 - B. Minimally Acceptable (M) - The rated area has a minor deficiency that needs to be corrected. The minor deficiency will not seriously impair the functioning of the area during the next rain event; however, the overall reliability of the project will be lowered because of the minor deficiency. Pyramat® 75 High Performance has 75% vegetation cover with un-vegetated patches as large as one square metre. Edges of Pyramat® 75 High Performance are exposed with noticeable damage. Minimal erosion has occurred underneath
 - C. Unacceptable (U) - The rated area is unsatisfactory. The deficiency is so serious that the area will not adequately function in the next rain event. Pyramat® 75 High Performance has been physically torn, ripped, or lifted from the slope surface. Less than 75% vegetation cover is present with un-vegetated patches being greater than one square metre, and there is evidence that erosion is occurring beneath Pyramat® 75 High Performance
2. Repair any raised or exposed edges of Pyramat® 75 High Performance by driving existing and additional pins along the edges as necessary to securely fasten to the ground. Inspect areas where the vegetation is not growing on top of Pyramat® 75 High Performance. Many times this is an indicator that Pyramat® 75 High Performance has lost contact with the ground beneath. Check for voids beneath Pyramat® 75 High Performance and fill any holes, gullies, etc. with compacted fill material if possible. Replace Pyramat® 75 High Performance as described below.
 3. To repair Pyramat® 75 High Performance, cut out and remove damaged areas in a square configuration a minimum size of 600 mm by 600 mm. Remove all vegetation and debris atop of Pyramat® 75 High Performance. Loosen the top 25 to 50 mm of soil in the patch area then seed. The subgrade of area to be patched shall be prepared to be smooth and uniform and transition smoothly into the in-situ area. Cut a square Pyramat® 75 High Performance patch a minimum of 300 mm greater than the damaged area for all four sides of the patch. Overlap the patch area in all directions a minimum of 300 mm. The patch overlaps shall be tucked under the existing damaged Pyramat® 75 High Performance material (Figure 14 and Figure 15)

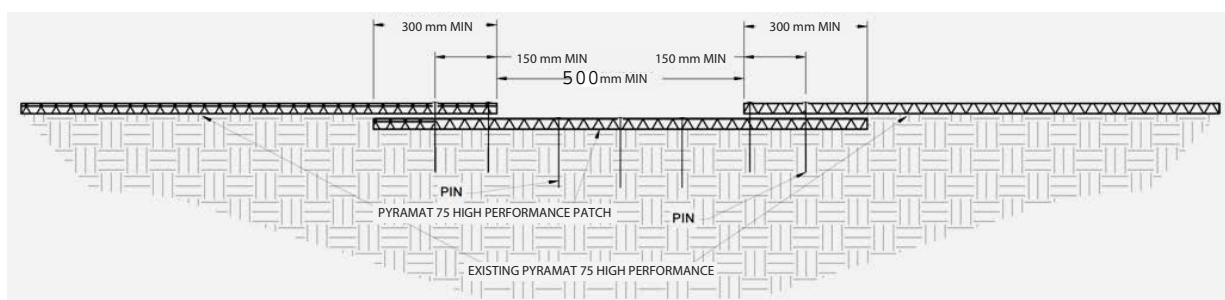
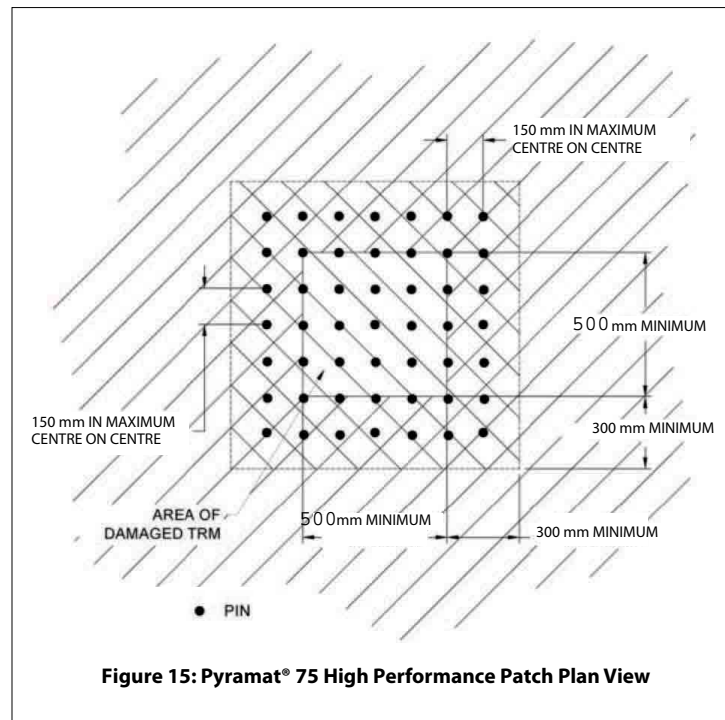


Figure 14: Pyramat® 75 High Performance Patch Cross Section





4. Install pins at 150 mm (max) centres. For larger areas of damage, pins should be installed to match existing pin pattern. Once Pyramat® 75 High Performance is in place, vegetate per project specifications.

SUMMARY

Maintenance should consist of watering and weeding, repair of all erosion, and any re-seeding as necessary to establish a uniform stand of vegetation during construction and beyond. A minimum of 70% of the armoured area should be covered with no bare or dead spots greater than one square metre. Establishing vegetation should not be mowed prior to 70% vegetative density and a minimum grass growth of 100 mm. Throughout the duration of the project, the contractor water all grassed areas as often as necessary to establish satisfactory growth and to maintain its growth throughout the duration of the project. After the project is complete, it is the responsibility of the owner to maintain and upkeep all Pyramat® 75 High Performance installed areas for long term performance and best results as described herein for superior slope armouring.

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