Contents
1.0 INTRODUCTION .......................................................... 1
2.0 ROLL PACKAGING ...................................................... 1
3.0 MATERIAL DELIVERY .................................................. 1
4.0 UNLOADING & STORAGE PROCEDURES ......................... 1
5.0 SITE PREPARATION .................................................... 1
6.0 DEPLOYMENT .......................................................... 2
7.0 JOINING & SEAMS .................................................... 4
8.0 INSPECTION & REPAIRS ............................................. 8
9.0 COVER MATERIAL PLACEMENT ................................... 8
Appendix A: Inventory Check List ........................................ 10
1.0 INTRODUCTION
This manual provides an overview of the GSE Installation Quality Assurance procedures consistent with industry accepted practices to ensure that the RoaDrain product installed will best perform for its intended purpose. In addition, all installation work will be performed in strict accordance per the customer’s specifications. Please read the procedures below completely before you begin. If you need further clarification, contact the GSE Engineering Support Staff for assistance. Remember safety first and use safe practices always on every project.

2.0 ROLL PACKAGING
RoaDrain ships from the factory in on rolls, wrapped in an opaque protective covering to prevent damage and UV degradation and do not need to be further protected from UV degradation during shipping or storage.

3.0 MATERIAL DELIVERY
A. Upon arrival on site, QA personnel will inventory all materials on-site.
B. Roll numbers will be logged on the Inventory Check List (Appendix A) and cross-referenced with the Bill of Lading.
C. Copies of the Inventory Check List and signed Bill of Lading should be sent to GSE corporate headquarters while the on-site QA personnel retains the original copies.
D. Any visible damage to roll materials should be noted on the roll and Inventory Check List.

4.0 UNLOADING & STORAGE PROCEDURES
A. RoaDrain shall be unloaded with equipment that will not damage the tri-planar core or geotextile filters.
B. Fabric-straps, spreader bars, stinger bars, or other approved equipment shall be used for handling rolls of RoaDrain.
C. RoaDrain should be stored in a flat, dry and well drained area.
D. The surface shall be free of sharp rocks or other objects that could damage the materials.

5.0 SITE PREPARATION
A. All vegetation should be cleared from the site and the surface made smooth. Depending on the subgrade strength, low ground pressure equipment may be required to avoid over-stressing the subgrade.
B. If pockets of very weak or pumping soils are encountered, those spots should be excavated and replaced with granular fill to result in a firm, non-yielding subgrade. Per the direction of the engineer, other means of subgrade stabilization can be used.
C. The engineer shall verify that the surface of the area to receive the RoaDrain is smooth and well compacted, with no voids or humps, and has the proper design grade that slopes towards the edge drain (see figure 1), or other water collection/discharge location as required by the project engineer.
6.0 DEPLOYMENT
RoaDrain should always be handled with proper equipment and care to prevent damage from cuts, tears or punctures. In the presence of strong winds, RoaDrain may need to be weighted with sandbags or equivalent. Such sandbags shall be deployed during placement and shall remain until replaced with cover material.

A. RoaDrain is available in three configurations:
   I. RoaDrain RD
      a. RoaDrain has flow channels angled across the width of the roll so water is discharged water along the edges of the roll. It is designed to unroll parallel to the length of the roadway while still directed water outward toward the edge of the pavement. While RoaDrain RD can be cut to fit various widths, it is most efficient for projects where only full width panels are utilized. Efficiency reduces if it needs to be cut along its length. (see figure 2)

   II. RoaDrain MD
      a. RoaDrain MD has flow channels parallel to the length of the roll, water is discharged at the end of the roll. RoaDrain MD is designed to lie perpendicular to the centerline of the roadway, relying on the slope of the crown to direct water toward the edge of the roadway. With the RoaDrain MD roll supported from a pole mounted to a small implement, it can be conveniently “spooled” off and cut to the proper length. After each panel is placed and properly aligned, the implement backs up to allow unspooling and placement of the following panel. The process continues until all panels are placed. (see figure 3)
III. RoaDrain JD

a. RoaDrain JD is designed specifically to be used directly under expansion joints of rigid PCC pavements. Care must be taken to properly layout and mark expansion joint locations. RoaDrain JD should lie parallel to and center directly under the joint location. It is critical for the RoaDrain JD to lie under the entire length of the future expansion joint. (see figure 4)

a. RoaDrain JD can be used with or without prefabricated load transfer system (dowel baskets). Simply place the RoaDrain JD prior to placing the dowel baskets. RoaDrain JD can be secured in place with the same pins used to secure the dowel baskets. An alternative method to secure the RoaDrain JD is common framing nails drive by a pneumatic nailer. The entire strip lie flat against the subgrade without wrinkles or waves.

B. To prevent wrinkles, it is important to maintain proper tension and alignment when unrolling or unspooling any RoaDrain.
7.0 JOINING & SEAMS

A. RoaDrain MD and RD

I. RoaDrain RD and MD come prefabricated with sufficient filter material to properly seam the edges of adjacent panels. The geotextile filters on the top and bottom of the RoaDrain allow water to pass freely yet keep the tri-planar core clean and free of particulate matter. It is important to shingle the fabric seams to coincide with the placement direction of the cover material. Approved bonding methods include sewing, heat tacking or fabric cement. (It is not necessary to bond the bottom filters if properly folded back and shingled. Where ever the RoaDrain is cut, as on the ends for example, the top and bottom filters will be flush with the end of the cut. Peeling back the geotextile from the core will provide sufficient material to create the seam.

II. When two or more panels of RoaDrain (MD or RD) need to be spliced together to reach the distance to the edge drain, special care must be taken to ensure proper connection of the drainage cores to allow for continuity of unobstructed flow. This may include joining two rolls end to end, or with RoaDrain RD, this may also be joining two rolls side by side, adjacent to one another.

a. Connecting Cores; End to End (MD & RD)

i. Start by peeling back enough geotextile to expose 6” of the core along the full width of the roll. Shingle the core overlap to coincide with the slope. Shingle the top geotextile to coincide with cover material placement. (This may not be the same as the slope) Drainage cores of end to end panels should overlap a minimum of 6”. Ties may be used to maintain overlap. (see figure 5).

[Diagram: Figure 5: Typical Connection for End to End Rolls (MD & RD)]

b. Connecting Cores; Adjacent Rolls (RoaDrain RD only)

i. Excess geotextile is provided along the edges of the rolls. Simply fold these back (no peeling necessary) to expose the drainage cores. Shingle the core overlap to coincide with the slope. Shingle the top geotextile to coincide with cover material placement. (This may not be the same as the slope) Drainage cores of adjacent panels should overlap a minimum of 2”. (see figure 6)
c. Adjacent Rolls; Flowage Contained Within a Single Roll or Panel (RoaDrain MD only)
   i. With RoaDrain MD, all flowage is directed toward the ends of the rolls. With no flowage directed toward the edges of the roll or panel, continuity of flow between adjacent panels of RoaDrain MD is not required. Align adjacent drainage cores to come together as tight as possible. Overlapping the cores is not required unless directed to do so by the project engineer. Tuck the loose geotextiles so the top layer coincides with the direction of cover material placement. The bottom layer should tuck opposite the top layer. (see figure 7)

Figure 7: Flowage Isolated to a Single Roll or Panel - Overlap of Adjacent Panels (Between soil and aggregate)

III. Panel Ties

a. To aide in maintaining alignment and minimum overlaps, the cores may be tied along their length for adjacent panels and along their width for end to end panels. Tie cores using plastic cable ties. Ensure both edges are lying flat to prevent one panel from pulling on the other during the cover material placement. Use as many ties as necessary to prevent the cores form separating. For ties with tensile strength of 50lbs, this is usually no more than 1 tie every 3ft for adjacent rolls or 1 tie every 1ft for end rolls. As an alternative to ties, shoveling small piles of cover material may also be used. In certain applications, steel pins with washers may be used to pin the RoaDrain to the subgrade. If using pins, be prepared to reposition them from time to time to dissipate any waves which may form during the cover material placement.

IV. Terminating the RoaDrain and Repairs

a. Once completed, no open portion of the tip-planar core should be left exposed. Pay extra attention to cut edges or ends across the open flow channels as all of these locations should be wrapped with geotextile to prevent intrusion of fine particles. (see figure 8)
b. Where the factory edge remains intact, the loose filters can be bonded together without the need of an additional cover strip. (see Figure 9)

B. RoaDrain JD

I. Joining Strips of RoaDrain JD (end to end only)

a. Any time more than one strip of RoaDrain JD is used under a single joint, care must be taken to ensure continuity of flow between each strip. From the ends of the strips being joined together, peel back and expose approximately 2” of the triplanar core from the top of one strip and the bottom of the other. Overlap so the top and bottom core are together. Use the loose geotextile to cover the exposed end of the triplanar cores of both strips. Use steel pins or nails to secure both strips to the subgrade. (see figure 10)
b. When paving multiple, adjacent lanes in subsequent paving operations, it may not be practical to lay continuous strips of RoaDrain JD across the entire roadway. In cases where the strips may interfere with adjacent operations or be exposed to damage (i.e. material hauling and/or grading) we recommend to minimize exposure by extending the RoaDrain JD just 3” past the edge of the finished pavement. Weatherproof tape wrapped covering the top geotextile and wrapped over the exposed end will provide temporary protection from dirt and debris. Be sure to remove tape when connecting next strip of RoaDrain JD. (see figure 11)

![Figure 11: Subsequent Paving of Adjacent Lanes](image)

Figure 11: Subsequent Paving of Adjacent Lanes

c. The greatest risk to the exposed portion is adjacent grading operations where a bucket or blade could easily tear the composite. It is recommended to keep any grading operation a minimum of 1” away from the exposed strip. This can be accomplished by attaching a 4” spacer to the blade or bucket of the grading implement. Position the spacer the clear the RoaDrain JD yet stay on contact with the edge of the previously paved lane. Any “fluff” left from the grading operation can be brushed or blown away with compressed air. (see figure 12)

![Figure 12: Paving adjacent lanes in subsequent paving operations](image)
8.0 INSPECTION AND REPAIRS
Prior to cover material placement each panel and seam should be inspected for proper installation and/or damage.

A. Geotextile Filter Damage – Patch any visible holes with a patch made of geotextile similar to the geotextile filters. Patch should extend a minimum of 4” around all sides of the defect. Bond the patch with fabric cement or heat tacking.

B. Damage to Tri-Planar Core – The drainage core is robust and can sustain minor cuts and tears with negligible impact on performance. Unless there is major damage with and an obvious flow restriction we recommend repairing only the geotextile as described above. In the event of major damage, the damaged section must be cut out and replaced with an undamaged piece of RoaDrain. Cut a new piece of RoaDrain to fit the area removed. Be sure the flow channels are properly aligned prior to cutting. Use plastic ties to secure the patch neatly into the defect area. Using fabric cement or heat bond, secure a geotextile patch below and above the seamed areas of the patch. The geotextile should extend a minimum of 4” on both sides of the seam. (see figure 13)

Figure 13: Repairs to the triplanar core.

9.0 COVER MATERIAL PLACEMENT
Upon installation, the engineer should do a final inspection to make certain that all seams are done properly and any repairs made correctly. To minimize risk of damage, cover material should be placed as soon as possible. If the project allows, you should only place as much RoaDrain as you are able to cover the same day. Under no circumstances should RoaDrain be left exposed for more than 14 days.

A. Under Soil Or Aggregate Base (if directly under PCC, proceed to B)
   I. Initial load of fill should be back dumped onto the RoaDrain and spread evenly to creating a platform of no less than 6” in depth. Subsequent loads of shall be dumped onto the previous placed fill and spread with a tracked dozer of similar implement.
   II. Care must be taken to prevent equipment coming in direct contact with the RoaDrain as damage may occur.
   III. No equipment should be allowed to operate directly on the RoaDrain. At the discretion of the engineer, equipment with rubber tracks or tires may be permitted in isolated cases. Requirements for consideration are:
      a. The subgrade is very stiff and non-yielding
      b. The Engineer or owner’s representative is available to witness and oversee the operation allowing no sharp or standing turns, no sudden braking or acceleration that can damage the RoaDrain or the geotextile filters.
c. Limit tracking of excessive soil onto the RoaDrain.
d. All hot exhaust is directed away from the RoaDrain

IV. Follow project specifications for lift thickness and compaction requirements.

B. Directly Under PCC
I. If required, concrete trucks and tracked pavers can be allowed to operate directly on the RoaDrain. Requirements for consideration are:
   a. The subgrade is very stiff and non-yielding
   b. The Engineer or owner’s representative is available to witness and oversee the operation allowing no sharp or standing turns, no sudden braking or acceleration that can damage the RoaDrain or the geotextile filters.
   c. Limit tracking of excessive soil onto the RoaDrain.
   d. All hot exhaust is directed away from the RoaDrain

II. Load transfer systems such as dowel baskets can be anchored using conventional pins. The pins may be driven directly through the RoaDrain.

III. Wet the top surface of the RoaDrain just ahead of the paver.

IV. Follow project specifications for further paving operations and requirements.
# Inventory Check List

<table>
<thead>
<tr>
<th>Material</th>
<th>Roll #</th>
<th>Used</th>
<th>Material</th>
<th>Roll #</th>
<th>Used</th>
<th>Material</th>
<th>Roll #</th>
<th>Used</th>
</tr>
</thead>
</table>

**Project:** _______________________________________

**Site Manager:** ____________________________

**QA Technician:** ___________________________

**Project #:** ____________________________

**Date:** ____________________________

**Page:** ______ of ______
GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We’ve built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

For more information on this product and others, please visit us at GSEworld.com, call 800.435.2008 or contact your local sales office.

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