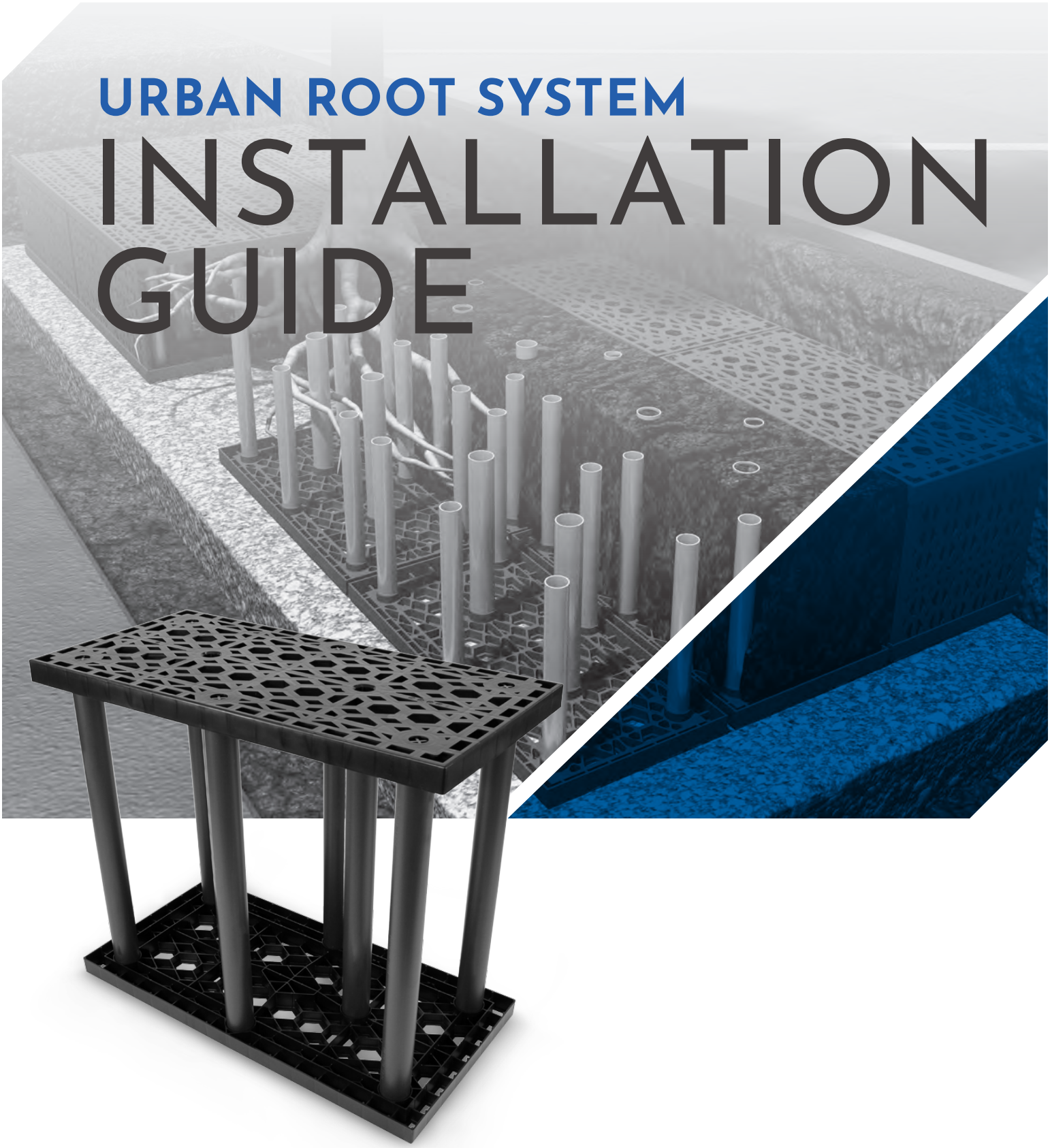
URBAN ROOT SYSTEM
INSTALLATION GUIDE



A BRAND OF BRENTWOOD®

STORMTANK

CONTENT

GENERAL NOTES

1. Review installation procedures and coordinate the installation with other construction activities, such as grading, excavation, utilities, construction access, erosion control, etc.
2. Engineered drawings supersede all provided documentation, as the information furnished in this document is based on a typical installation.
3. Coordinate the installation with the manufacturer's representative/distributor to be on-site to review installation instructions.
4. Components shall be unloaded, handled, and stored in an area protected from traffic in a manner to prevent damage and UV degradation.
5. Assembled Modules may be walked on, but vehicular traffic is prohibited until backfilled per manufacturer's requirements.
6. Ensure all construction occurs in accordance with federal, state, and local laws, ordinances, regulations, and safety requirements.
7. Extra care and caution should be taken when temperatures are at or below 40° F (4.4° C).
8. Check for any damaged material, report damage to a StormTank representative. All plastic wrap should be removed to prevent damage from heat or UV.
9. The StormTank Module carries a Limited Warranty, which can be accessed at www.stormtank.com.

1.0 EXCAVATION

1. Stake out and excavate, in accordance with OSHA regulations, to elevations per approved StormTank submittal details.

2. Recommended subgrade excavation is a minimum of 6” (152 mm) below the bottom of StormTank Modules.

3. The excavation should extend a minimum of 12” (305 mm) beyond the edge of the StormTank Modules (an additional 24” [610 mm] in total length and total width) to allow for adequate placement of side backfill material. StormTank submittal details may indicate a side fill dimension greater than the 12" (305 mm) minimum requirement.

4. Remove objectionable material encountered within the excavation, including protruding material from the walls.

2.0 SUBGRADE PREPARATION

1. Unstable, unsuitable, and/or compromised areas should be brought to the Engineer’s attention and mitigating efforts determined. Subgrade shall be unfrozen, free of lumps or debris, and contain no standing water or mud.

2. Subgrade must be compacted to 95% Standard Proctor density or as approved by the Engineer of Record to provide a minimum bearing capacity and to prevent settlement. Total settlement at any point should not exceed 1" (25.4 mm). Differential settlement between any two adjacent Modules should not exceed 1/2" (12.7 mm).

3. If subgrade compaction is restricted by project specifications or if weak/poor subgrade soils are encountered, then the project geotechnical engineer should evaluate the specific conditions and recommend appropriate subgrade preparations.

4. Subgrade must be designed to ensure soil bearing capacity is maintained throughout all soil saturation levels.

3.0 LEVELING BED INSTALLATION

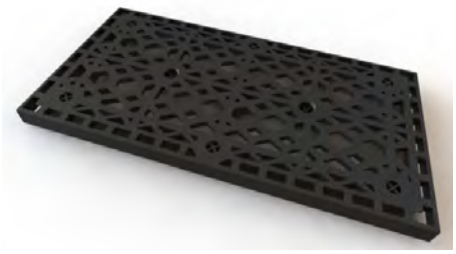
1. A layer of geotextile fabric is recommended between stone backfill envelope and surrounding soils to prevent material migration.
    a. Place geotextile fabric over prepared subgrade and up excavation walls.
    b. Geotextile fabric to be wrapped over the top of stone backfill later in the installation process.
    c. Install geotextile fabric and/or impermeable liner material (if required by engineer's design) per project specifications and manufacturer's recommendations.

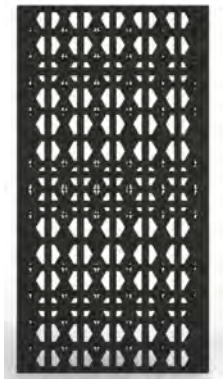
2. Place a leveling bed of clean, crushed, angular stone per approved StormTank submittals.
    a. Material should meet requirements in Appendix C - Acceptable Fill Material.
    b. Material should be raked free of voids, lumps, debris, and sharp objects.
    c. Leveling bed to be plate vibrated or rolled to achieve a flat surface (1% maximum slope).
    d. Leveling bed depth to be 6" minimum.

4.0 MODULE ASSEMBLY

Step 1:

Prepare the material to be assembled. Required materials include: (2) platens, (1) URS filling platen, (8) columns, (1) side panel, and (1) 1lb. rubber mallet. Side panels are only required on perimeter Modules. Refer to your project's layout drawings for perimeter Module locations.





Step 2:

Place a platen on a firm level surface and insert the (8) columns into the platen receiver cups. Firmly tap each column with a rubber mallet to ensure the column is seated.

Note: Perimeter Modules should be fully assembled through step 6. Interior Modules will be filled with soil before the top platen is installed.

Step 3:

Install the top platen by aligning the receiver cups with the columns, or flip the previously assembled components upside down onto the second platen, aligning the columns into the platen receiver cups.

Step 4:

Once aligned, seat the top platen by alternating taps with a rubber mallet at each structural column until all columns are firmly seated.

4.0 MODULE ASSEMBLY (CONT.)

Step 5:

If side panel is required, insert the side panel into the bottom platen before seating the edge columns into the receiving cups.

Step 6:

Align the top of the side panel with the top platen and firmly seat the top platen utilizing a rubber mallet.

Completed Module

A completed Module can support vehicular loading when installed per manufacturer recommendations.

5.0 STORMTANK MODULE PLACEMENT

1. A layer of geotextile fabric is recommended between the StormTank Modules and the stone backfill envelope to prevent material migration.
    a. Place geotextile fabric over prepared leveling bed and up excavation walls.
    b. Geotextile fabric to be wrapped over the top of the StormTank Modules later in the installation process.
    c. Install geotextile fabric and/or impermeable liner material (if required by engineer's design) per project specifications and manufacturer's recommendations.

2. Mark the footprint of the Modules per the approved StormTank submittal details.
    a. Ensure the footprint markings are square and straight across the length and width of the system footprint.
    b. Take care to note the location of tree openings, pipe connections to the system, underdrain pipes in the stone backfill envelope, adjacent structures, and irregular sections of the StormTank Module system.

5.0 STORMTANK MODULE PLACEMENT (CONT.)

3. Install the StormTank URS Modules by hand per the StormTank submittal details and as detailed below.

a. Modules to be installed at the perimeter of the system should be assembled with (2) platens, (8) columns, and required side panels.

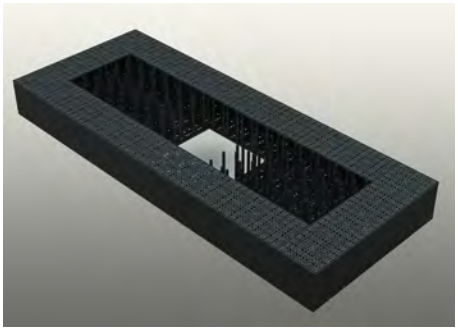
   Side panels should be installed where the Modules are facing the side backfill, typically along one short edge of the Module and occasionally along two edges of the Module, as indicated by the StormTank submittal details.

   Do not install side panels where the Modules are facing the tree opening.

b. Modules to be installed in a non-perimeter location should be partially assembled with (1) platen as a base and (8) columns.

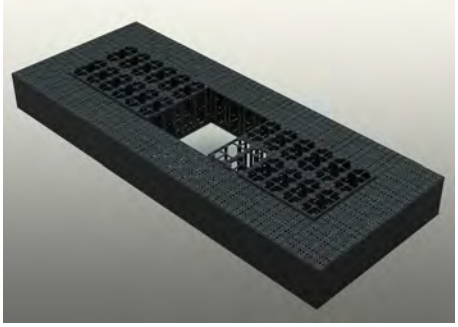
   Do not install the top platen.

c. Place fully assembled perimeter Modules and partially assembled interior Modules into the system footprint per the StormTank submittal details.



d. Typically, the perimeter Modules will be oriented so that the short side of the Module is facing outward (towards the side backfill to be placed later in the installation) unless otherwise shown on the StormTank submittal details.

e. Ensure that the Modules are abutting each other, that the edges of the platens are straight and square with the system footprint markings, and that the platens are aligned with each other vertically and horizontally to within a maximum deviation of 1/4" (6.4 mm).

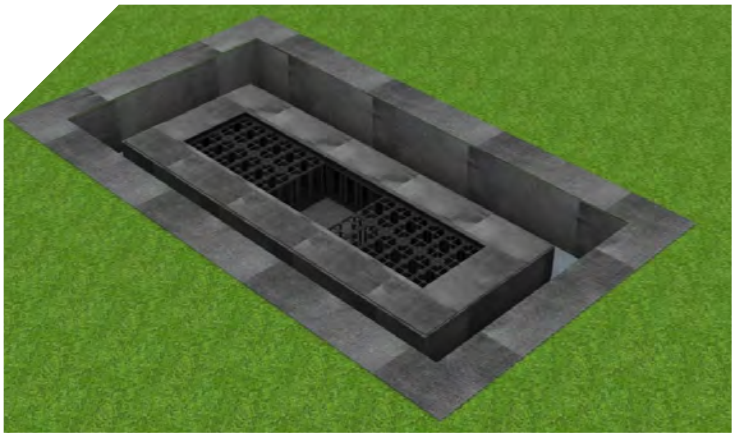


f. Place URS filling platens onto the columns of the partially assembled Modules.

6.0 SIDE BACKFILL AND URS SOIL FILLING

6.1 Initial Side Backfill

a. The geotextile fabric layer that will wrap the outside of the Modules should be pulled up and over the Modules to allow the placement of the first 12" lift of side backfill material. The fabric may be temporarily secured to the URS fill platens to prevent the fabric from sliding into the side fill area while the backfill material is placed.



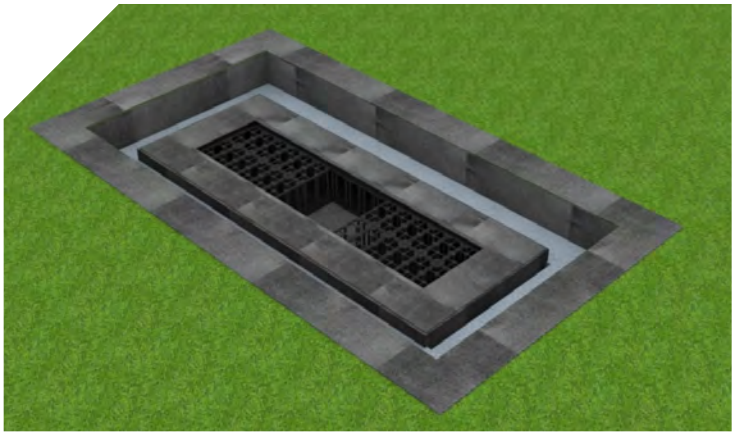
b. Evenly place the first 12" lift of side backfill material around the system perimeter. Material should be worked by hand or raked to ensure all voids are filled.

c. Do not continue backfilling the sides of the system at this stage of the installation.

d. Side backfill material should be clean, crushed, angular stone meeting the requirements of Appendix C - Acceptable Fill Material.

e. No compaction required for stone side fill.

f. Place backfill material utilizing an excavator, dozer, or conveyor boom from an area outside of the excavation. Do not directly access the system during side backfilling.



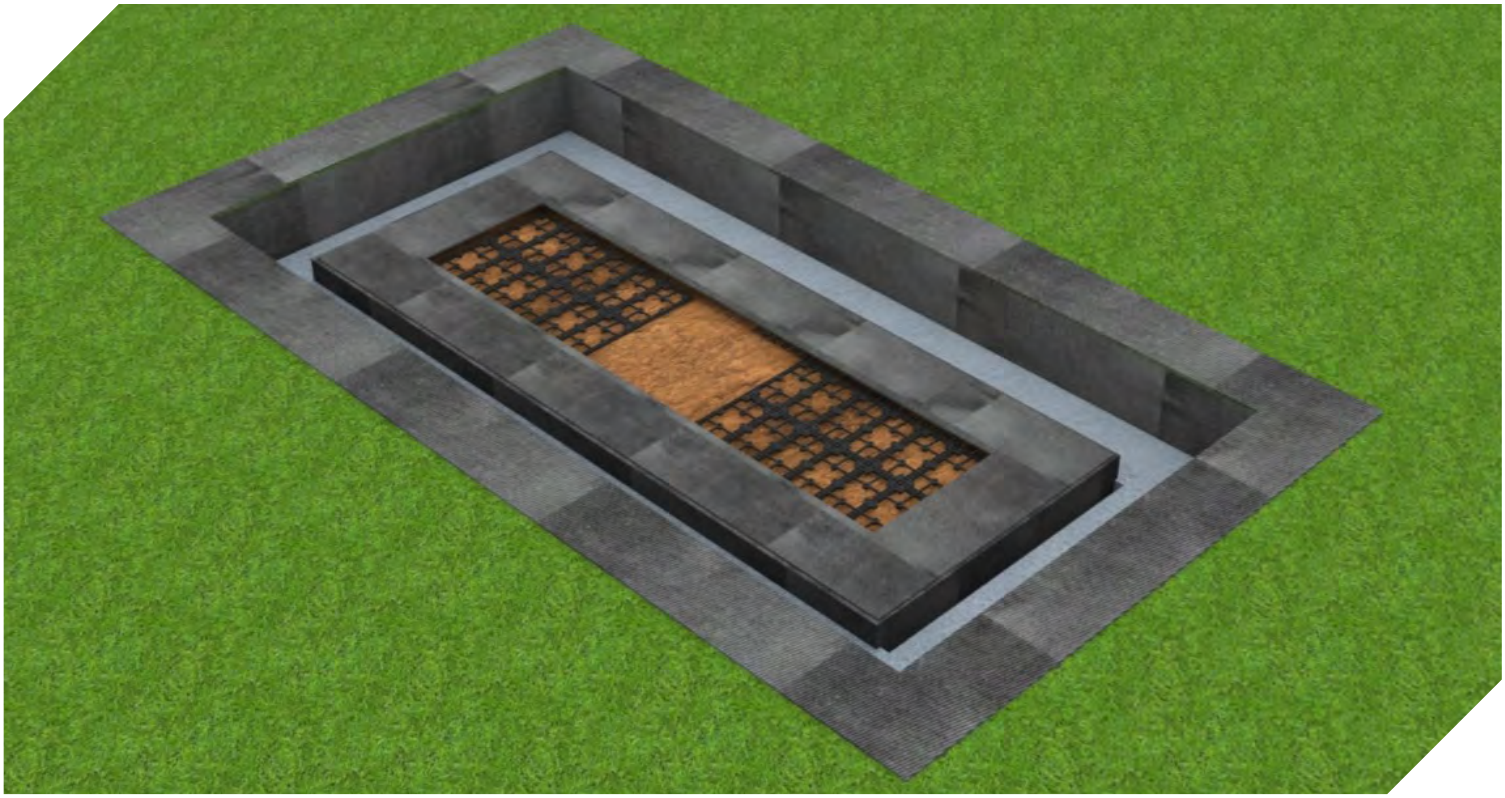
6.0 SIDE BACKFILL AND URS SOIL FILLING (CONT.)

6.2 URS Soil Filling

a. The URS filling platens have large openings in the platen surface to allow the placement of soil inside the Modules while maintaining column alignment. After the soil is installed in the system, the URS filling platens are removed and standard platens are installed to complete the Module assembly. The Step-Off Sockets allow the URS filling platen to be easily removed and reused to fill other sections of Modules.

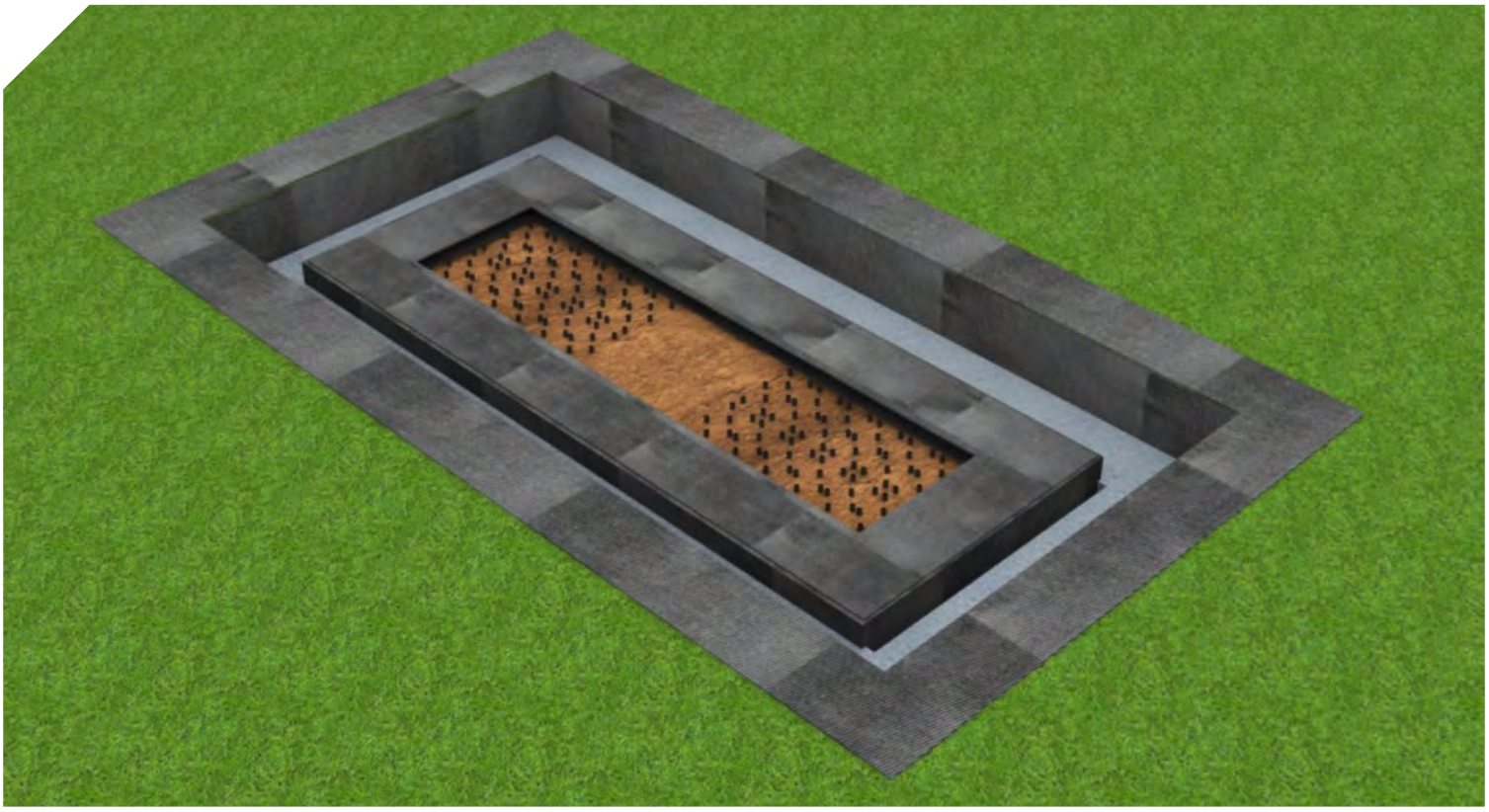
b. Evenly fill the StormTank Modules and tree opening area with soil. Soil lifts should not exceed 12". Level and lightly compact the soil between lifts by hand tamping and walking on the material.

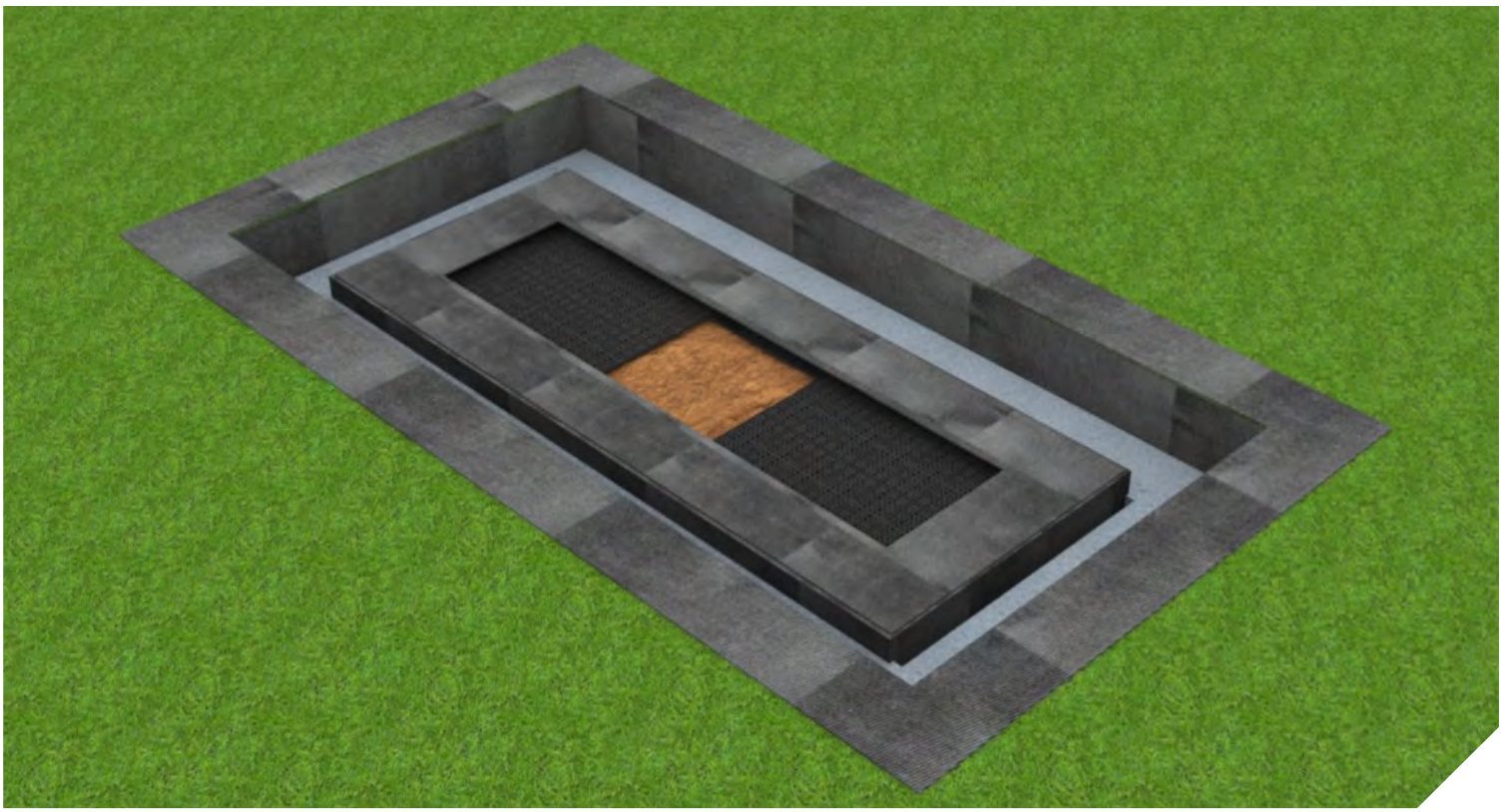
c. Leave 1" air gap between finished soil level inside Modules and top platen of assembled Module (~3" below top of Module elevation).



6.0 SIDE BACKFILL AND URS SOIL FILLING (CONT.)

d. Remove URS filling platens and install top platens.





6.0 SIDE BACKFILL AND URS SOIL FILLING (CONT.)

6.3 Finish Side Backfill

a. Install geotextile fabric on top of StormTank Modules.

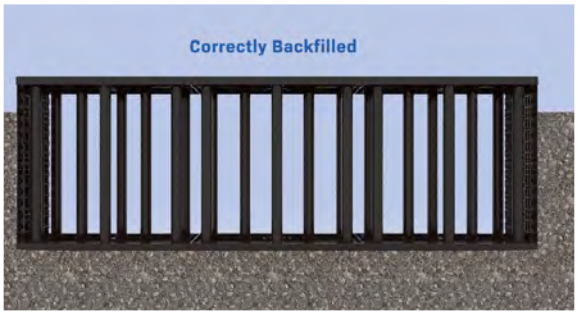
b. Continue to place side backfill material around the system perimeter in lifts not to exceed 12". Material should be worked by hand or raked to ensure all voids are filled.

c. The side backfill should be evenly placed on each side of the system before beginning the next lift.

d. Side backfill material should be clean, crushed, angular stone meeting the requirements of Appendix C - Acceptable Fill Material.

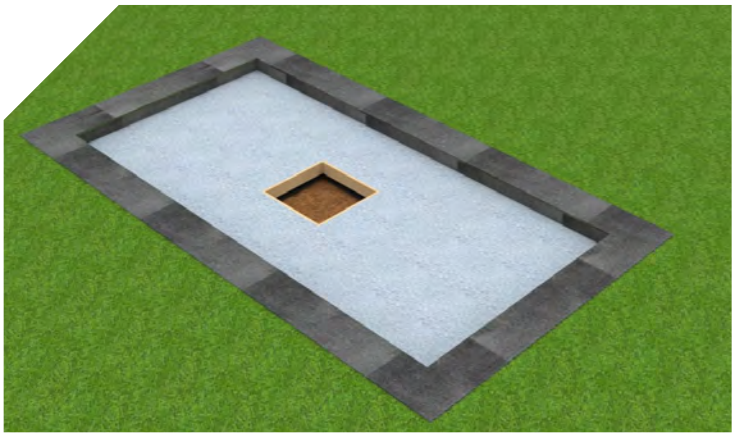
e. No compaction required for stone side fill.

f. Place backfill material utilizing an excavator, dozer, or conveyor boom from an area outside of the excavation. Do not directly access the system during side backfilling.



7.0 TOP BACKFILL

1. Begin to place the top backfill.
    a. Fill material should meet requirements in Appendix C - Acceptable Fill Material.
    b. Do not dump materials directly onto the StormTank system.
    c. Place material using low ground pressure (LGP) equipment and/or a conveyor boom.
    d. Do not drive on the StormTank system without a minimum 12" (305 mm) of cover.
    e. See Appendix D for the allowable construction equipment loading on the StormTank system.
    f. Fill material to be compacted per approved StormTank submittals and project specifications.
    g. Tree opening should be protected as necessary to allow installation of the root barrier (by others) and tree planting.



2. Upon completion of top backfilling, install geotextile fabric and/or impermeable liner material (if required by engineer's design) per project specifications and manufacturer's recommendations.

3. Optional: Install metallic tape around the perimeter of the system to mark the area for future utility detection.

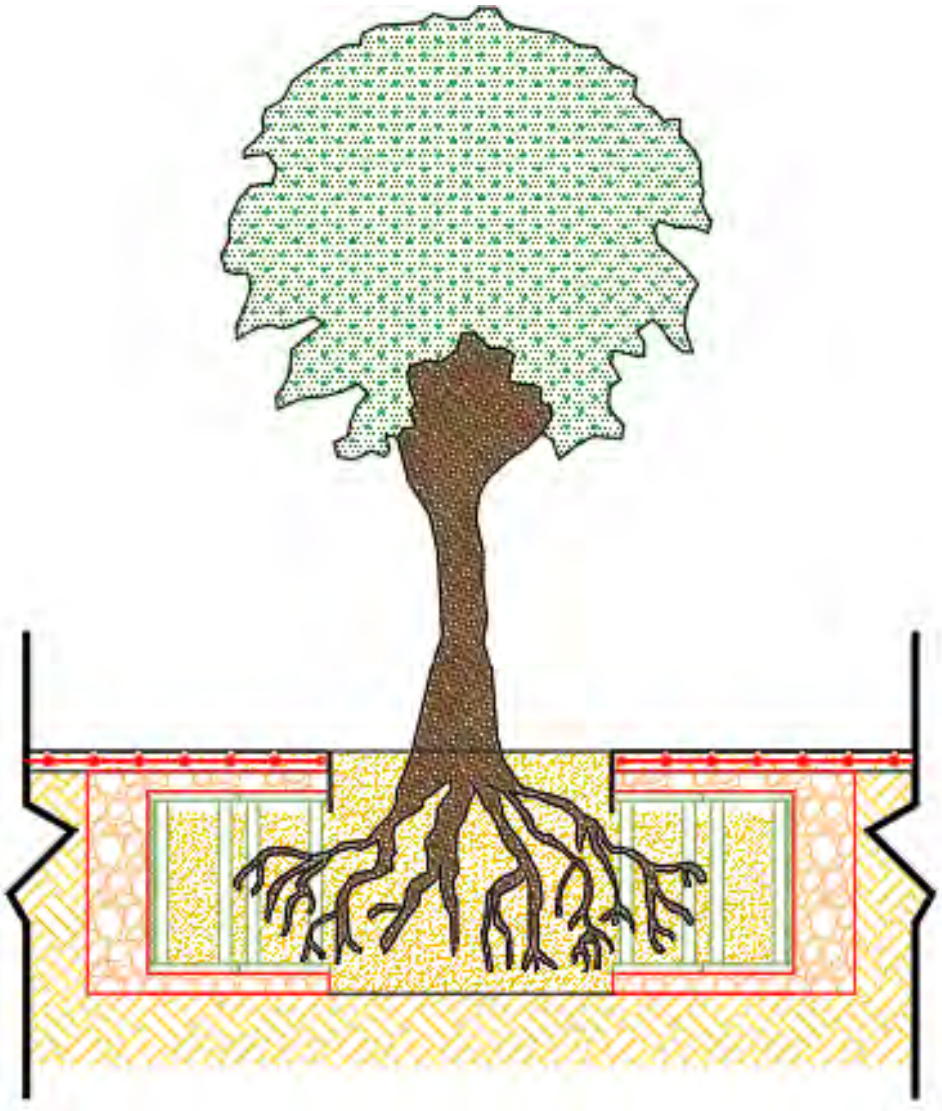
8.0 FINAL FILL

1. Place appropriate fill materials onto the geotextile in lifts not to exceed 12".
    a. Allowable fill material per project specifications.
    b. Do not dump materials directly onto the StormTank system.
    c. Fill material to be compacted to 90% Standard Proctor density or per engineer's design and project specifications.
    d. See Appendix D for the allowable construction equipment loading on the StormTank system.
    e. Do not drive on the Modules without a minimum 12" (305 mm) cover.
    f. Tree opening should be protected as necessary to allow installation of the root barrier (by others) and tree planting.

2. Reference approved StormTank submittal details for allowable minimum cover depth and maximum cover depth over the StormTank system for the designed surface loading.
3. Construct finished surface per project specifications.
4. The area over the StormTank system should not be used for the storage of construction materials, equipment, spoils, etc.

9.0 ROOT BARRIER AND TREE INSTALLATION

1. Protect tree openings as required during side fill, top fill, and compacted fill stages of the StormTank system installation to ensure an adequate space for the tree planting.
2. Install root barrier product (by others) around the tree opening per project specifications and manufacturer's recommendations. Root barriers direct tree roots away from the pavement and into the StormTank URS Modules.
3. Plant tree per project schedule and specifications.



APPENDIX A - BEARING CAPACITY CALCULATION

Applicable bearing capacity calculations are per the AASHTO LRFD for Bridge Design. The calculation considers a dead load, based on cover, with a dead load factor of 1.95. In addition, it applies a live load, with a multiple presence factor of 1.2 and a live load factor of 1.75, which is distributed at a 1.15 factor (for aggregate) through the cover depth. If the cover material is soil, this factor is reduced to 1.00.

The following are two examples of that calculation:

1. HS-25 with 24" aggregate and asphalt cover

   DL = Density * depth * DL Factor = 140.00 pcf * 2.00' * 1.95 = 546.00 psf

   LL = P * DLA * MP * LL Factor = 20,000 lbs * 1 * 1.2 * 1.75 / ((20" + 24" * 1.15) * (10" + 24" * 1.15) / 144)
   LL = 3,379.22 psf

   TL = Required Bearing Capacity = 546.00 + 3,379.22 = 3,925.22 psf

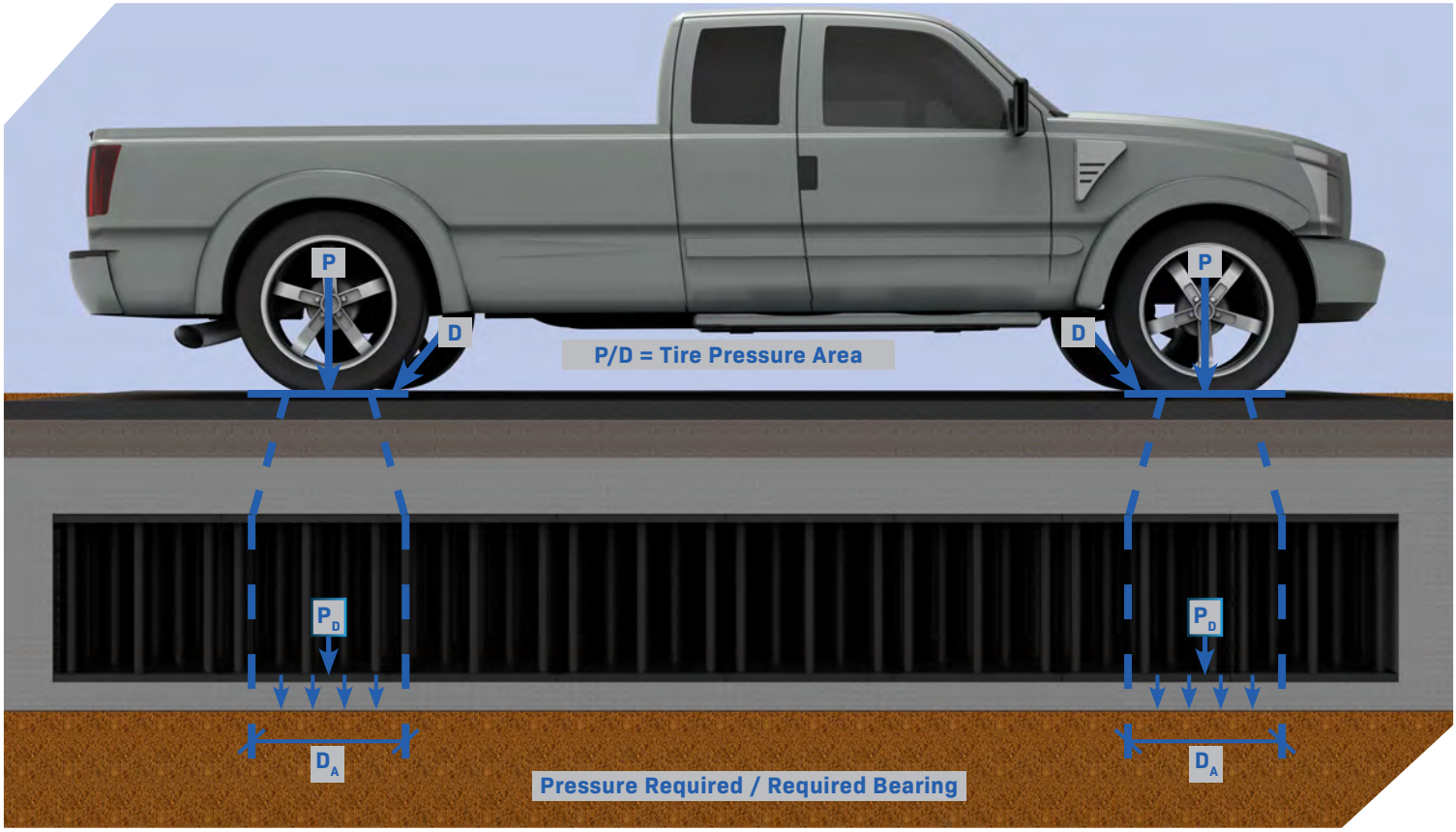
2. HS-20 with 48" aggregate and asphalt cover

   DL = Density * depth * DL Factor = 140.00 pcf * 4.00' * 1.95 = 1,092.00 psf

   LL = P * DLA * MP * LL Factor = 16,000 lbs * 1 * 1.2 * 1.75 / ((20" + 48" * 1.15) * (10" + 48" * 1.15) / 144)
   LL = 986.82 psf

   TL = Required Bearing Capacity = 1,092.00 + 986.82 = 2,078.82 psf

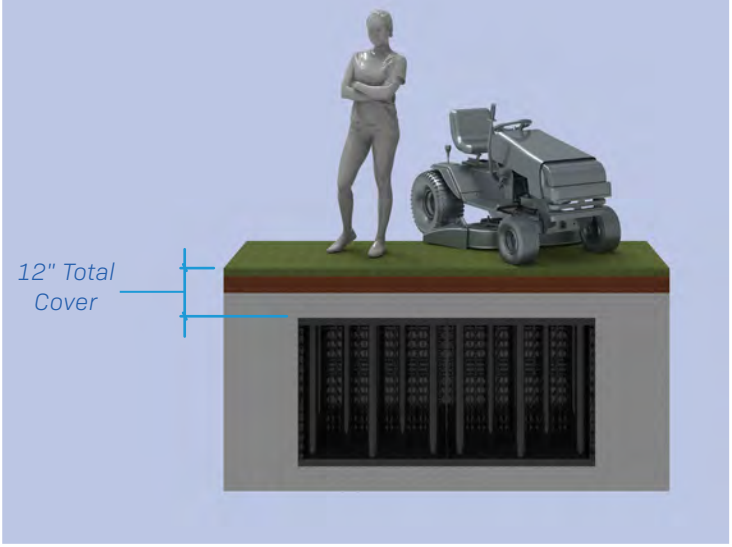
Note: All depths of cover greater than 32" require a minimum bearing capacity of 3.0 ksf.



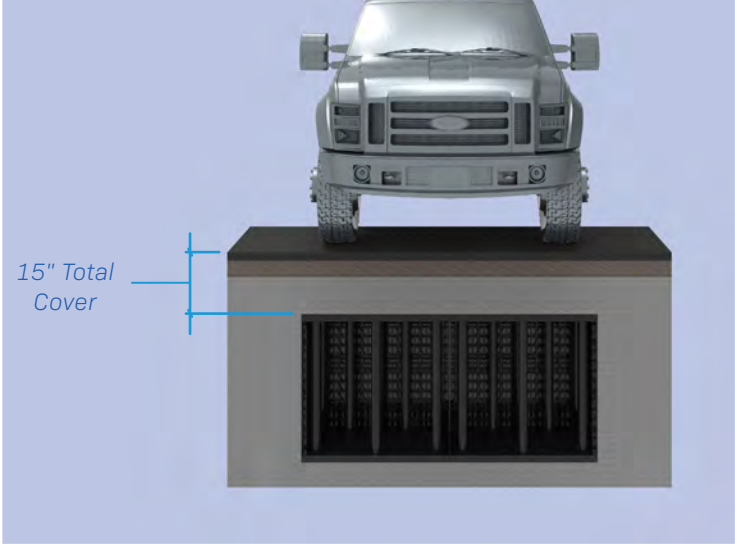
APPENDIX B - MODULE 25 SERIES LOAD RATING

The Module 25 Series has been designed to resist loads calculated in accordance with the American Association of State Highway and Transportation Official's (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design manual. Below are examples of various load ratings the Module 25 Series can achieve with the appropriate cover.

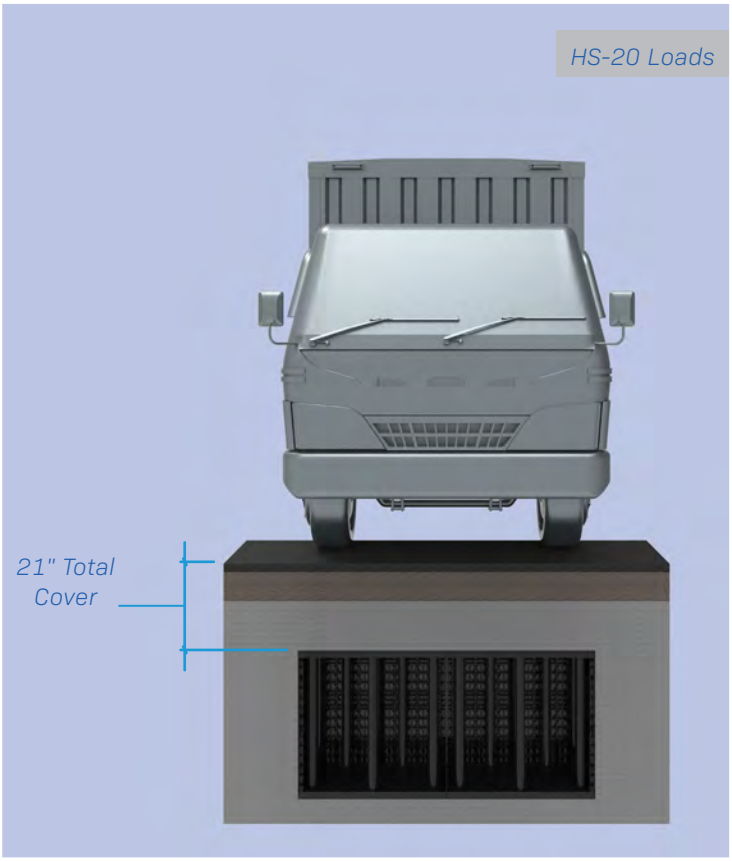
Pedestrian Loads



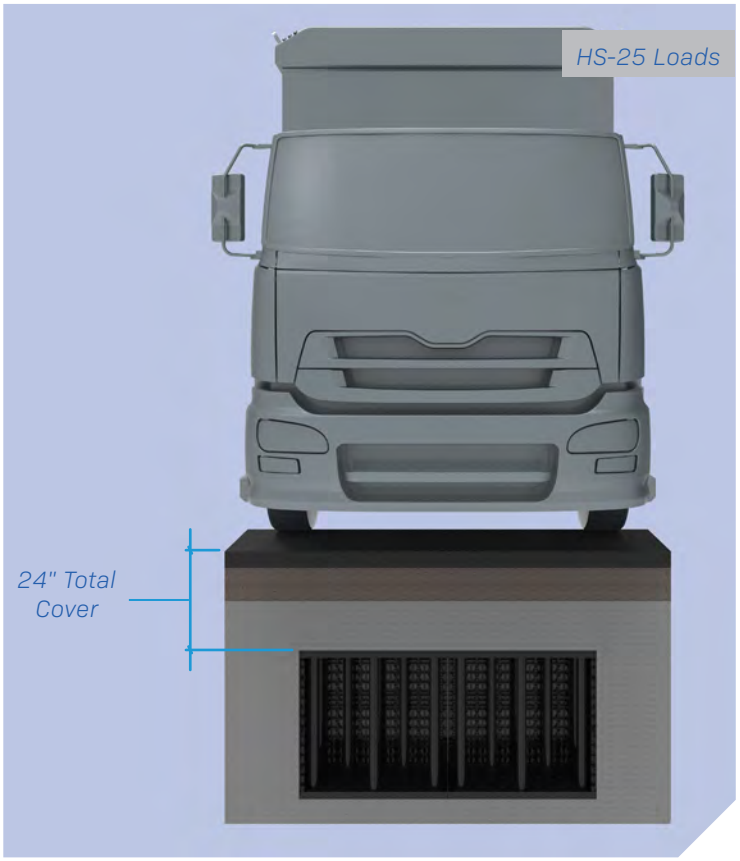
H-10 Loads



HS-20 Loads

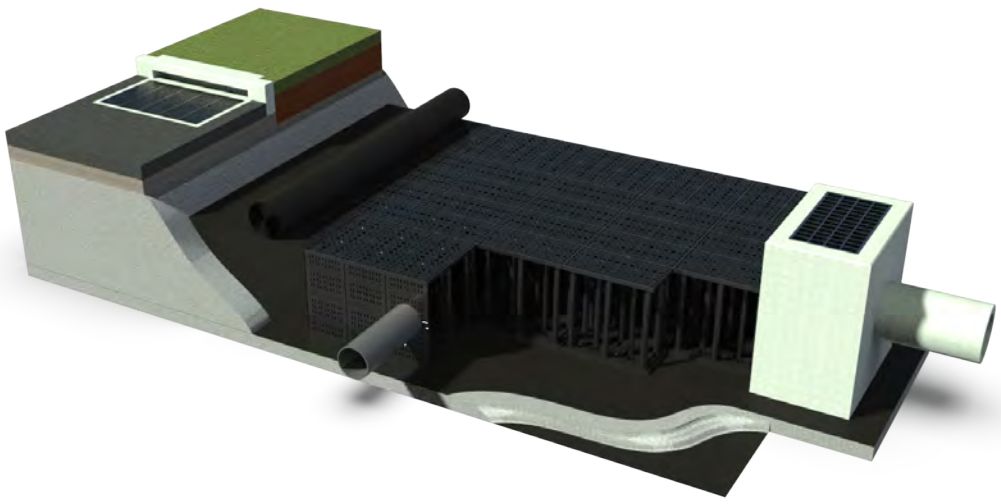


HS-25 Loads



APPENDIX C - ACCEPTABLE FILL MATERIALS

Material Location	Description	AASHTO M43 Designation	ASTM D2321 Class	Compaction/Density
Finished Surface	Topsoil, hardscape, stone, concrete, or asphalt per Engineer of Record	N/A	N/A	Prepare per engineered plans
Suitable Compactable Fill	Well-graded granular soil/aggregate, typically road base or earthen fil (maximum 4" particle size)	56, 57, 6, 67, 68	I & II III (Earth Only)	Place in maximum 12" lifts to a minimum 90% standard proctor density
Top Backfill	Crushed angular stone placed between Modules and road base or earthen fill	56, 57, 6, 67, 68	I & II	Plate vibrate to provide evenly distributed layers
Side Backfill	Crushed angular stone placed between earthen wall and Modules	56, 57, 6, 67, 68	I & II	Place and plate vibrate in uniform 12" lifts around the system
Leveling Bed	Crushed angular stone placed to provide level surface for installation of Modules	56, 57, 6, 67, 68	I & II	Plate vibrate to achieve level surface



Notes:

1. All stone must be angular stone meeting ASTM D2321. Recycled concrete may be utilized when meeting acceptable gradation and ASTM standards.
2. Storage of materials such as construction materials, equipment, soils, etc. over the Module system is strictly prohibited.
3. Please contact a geotechnical engineer and the Brentwood representative prior to utilization of any material not listed above.

STORMTANK® TECH BULLETIN

MADE IN THE USA

STORMTANK MODULE 25 SERIES CONSTRUCTION EQUIPMENT

BACKGROUND

To provide clarity on construction equipment that can travel over a StormTank Module system during construction, the below table has been created. This table is not all-inclusive and evaluation by the contractor on a case-by-case basis may be necessary before proceeding.

BASIC INFORMATION

	Wheel Load (Vehicles and Equipment)		Maximum Tracked Equipment		Roller Loads
Cover Depth over Module	**Maximum (Vehicle)**	**Maximum (Equipment)**	**Track Width**	**Maximum Weight (including material)**	**Maximum Drum Weight**
6 in.	Not Permitted	Not Permitted	N/A	LGP Equipment (<5 psi) Only	Not Permitted
12 in.	6,500 lbs.	8,000 lbs.	N/A	LGP Equipment (<5 psi) Only	< 10 psi
18 in.	11,000 lbs.	14,500 lbs.	12 in. 18in. 24in. 36 in.	20,000 lbs. 30,000 lbs. 40,000 lbs. 60,000 lbs.	20,000 lbs. (Static Only)
24 in.	16,000 lbs.	20,000 lbs.	12 in. 18in. 24in. 36 in.	40,000 lbs. 50,000 lbs. 60,000 lbs. 80,000 lbs.	40,000 lbs. (including Dynamic)

1. Vehicle has a tire contact area of 10”x10”.
2. Equipment has a tire contact area of 10”x20” (dual-wheel trucks like dump trucks).
3. Cover depth is based on angular material, utilization of other materials impacts load rating.
4. Dumping directly over the system is prohibited, excluding asphalt into a paver unit.
5. Consideration must be given for rutting into cover material when utilizing table.
6. Excavation equipment cannot operate (excavate) from over the system.
7. Material is prohibited from being stockpiled over a system.
8. For specialty equipment (material handlers, cranes, units with outriggers, etc.) contact a StormTank representative before utilization over the system.

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