



Installation Manual



PaveDrain: The Cheat Sheet

- **Print the Layout**
- **Do the Base Right!** Compact in 4"-6" lifts
- **Open Joints-** NO SAND, GRAVEL, ROCK, ETC. in the joints
- **Tricks to save on Installation \$\$\$ and Time**



Pattern is designed to end in a clean edge with minimal cutting



Square off manholes, observation ports, etc. with concrete collars



Square off curves



Pour the adjacent asphalt or concrete **after** placing the blocks

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PaveDrain® Installation Manual

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Section 1

Base Preparation

Open Graded Base & Bedding Course Aggregate: If more than 6" of base stone is required, only the top 4-6" shall be Typ. AASHTO/ASTM #57 Stone bedding layer (*clean/washed, angular on all sides, no fines*). The final depth to be determined by Engineer. This layer is used as a leveling/bedding course directly beneath the blocks (see Fig. 1). Additional stone depth should consist of either AASHTO/ASTM #2 or #3 stone (*clean/washed, angular on all sides, no fines*). The final depth to be determined by Engineer.

Edge Restraint: Defining the edges of the PaveDrain system is important (see examples on page 16). Concrete curbing is the most commonly used material. However, using other materials such as plastic strip edging (commonly used in typical pavers) is not advisable.

Separation Fabric: A high strength woven monofilament geotextile (Heavy Duty or Poor Soils: Mirafi RS 380i or equal, Light Duty and Firm Soils: Mirafi FW402 or equal) is highly recommended (required for warranty) to be installed as a base reinforcement and separation layer between the aggregate storage bedding layer (depth to be determined) and the native sub-grade. The native sub grade should be scarified—mechanically scratched. The geosynthetic is a key component of the PaveDrain system. Negating its use could be detrimental to the function, performance, and life cycle of the PaveDrain system. The "vertical walls" of your prepared area should also be lined with an appropriate geosynthetic to prevent soil and aggregate migration (see Fig. 2, 3 and 4).

Figure 1



Figure 2



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Figure 3



Figure 4

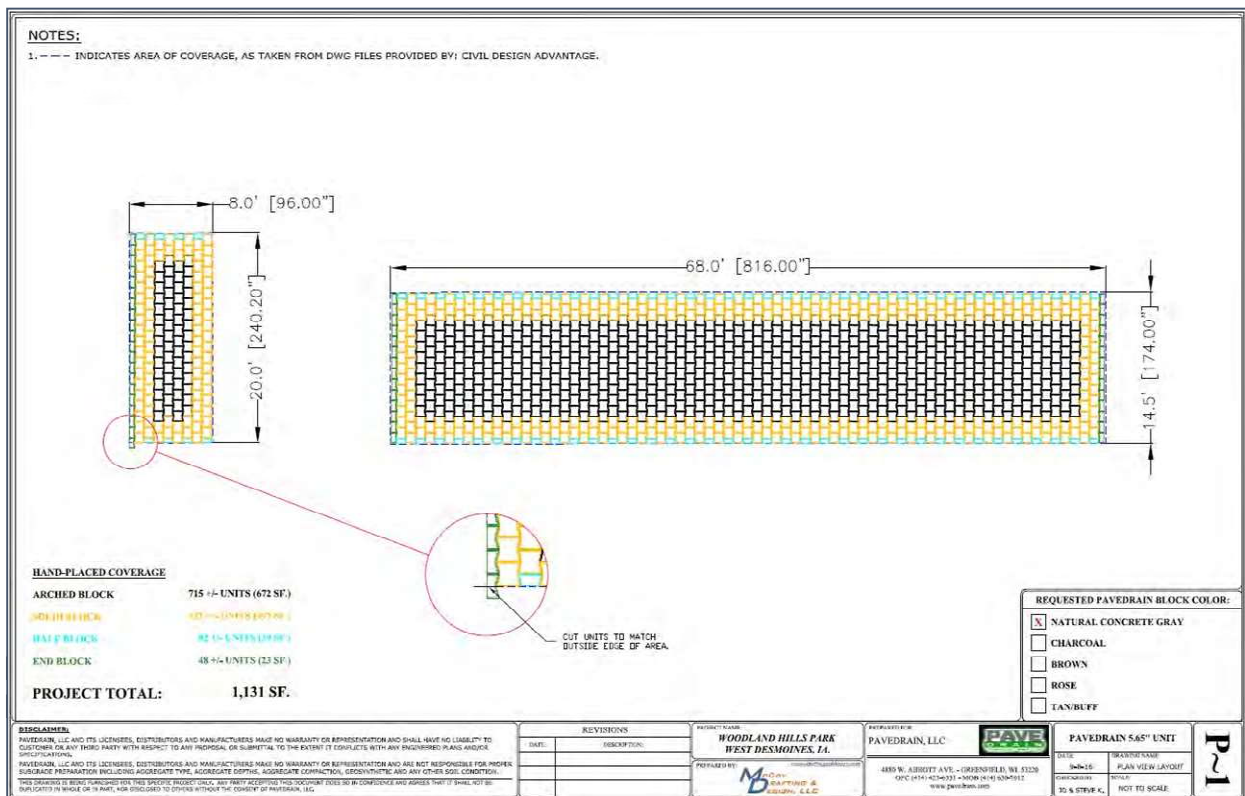


Before digging, always call your local utility companies to locate any underground utilities.

LAYOUT & PREPARATION

PaveDrain units will arrive wrapped on pallets. Pallets will weigh approximately 4,000 lbs or less. **Please make sure to print out the approved layout drawings on the large jobsite engineer sized paper. It is crucial to see where all the required block are to be laid within the approved area of coverage.**

Schematic 1



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California Bearing Ratio (CBR) should be established well in advance of the installation. The appropriate geosynthetic is critical and should prevent rutting. If the subgrade appears weak or damp following the installation of the appropriate geosynthetic, contact a professional geotechnical engineer or local PaveDrain representative for further assistance.

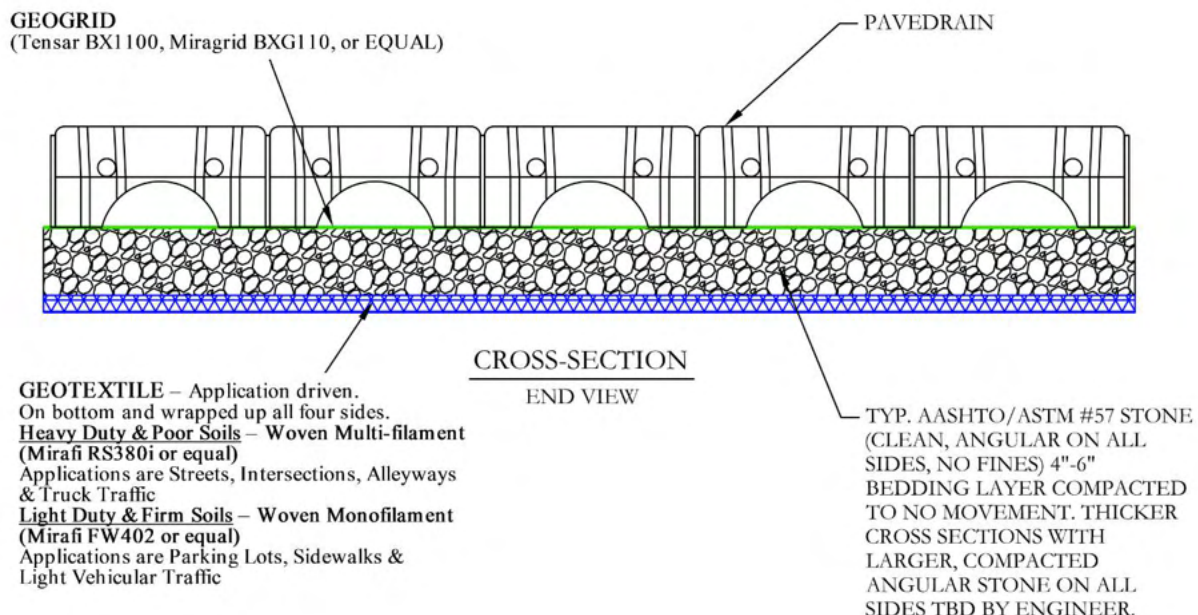
PREPARATION OF OPEN GRADED BASE

The depth of stone should be determined well in advance of the installation of the PaveDrain system by the engineer of record, based on the CBR and stormwater storage requirements.

Open graded base materials **must** be free of fines. Take care not to track soil onto the geosynthetic or allow sediment to wash into the excavation during construction.

Typ. #57 stone is recommended as the bedding layer of stone (see description below). Place the stone on the appropriate geosynthetic in 4-6" lifts and compact with a vibratory roller. **The use of a vibratory plate compactor in both directions is best for final compaction of the bedding layer of AASHTO #57 stone that will be in direct contact with the bottom of the PaveDrain units unless the optional geogrid is used** (see FIG. 6 on next page). There should be **no visible movement of the material once compacted and the base should be smooth** when tamping is completed.

Schematic 2



If it is determined by the engineer of record that a rock depth in excess of 12" is required, then the cross-section below (Schematic 3) should be followed.

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Schematic 3

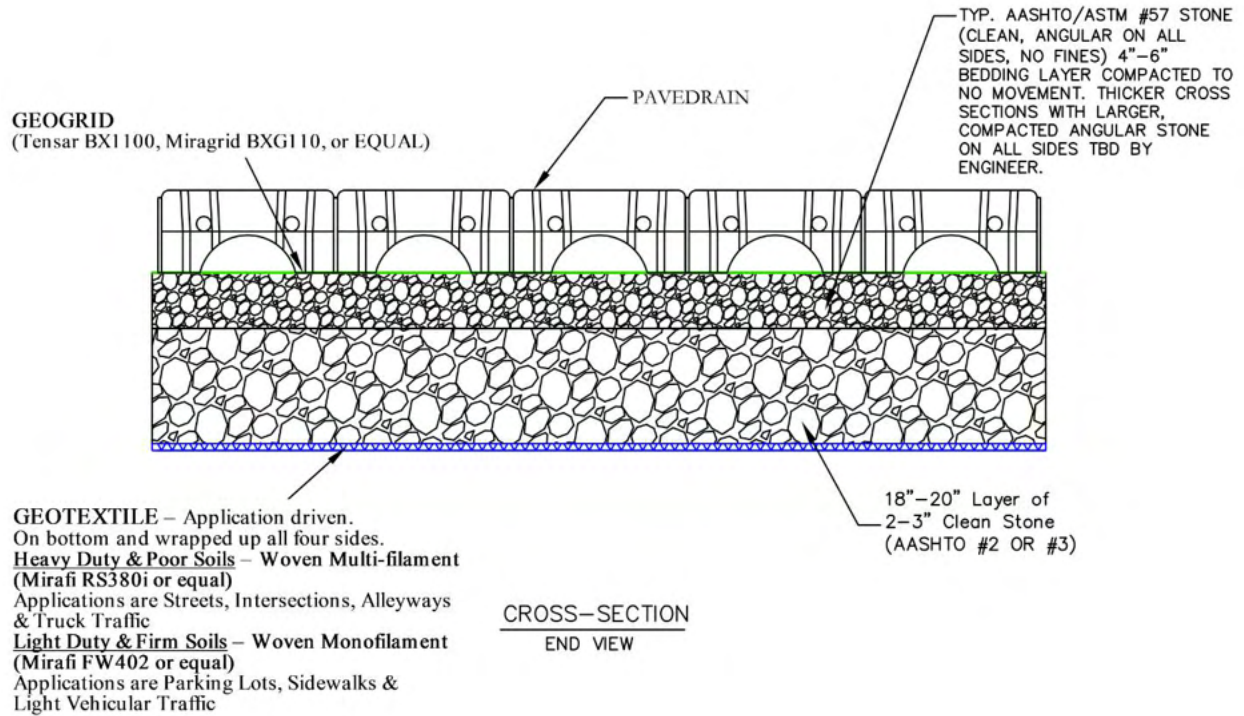


Figure 6



REMEMBER: Subgrade preparation is **CRITICAL!**

Finishing the Stone Base

On top of the stone base a Geogrid is required to be placed (Tensar BX1100, Miragrid BXG110, or equal). The Geogrid should not overlap (which would allow for slippage). Its orientation should be determined by the Engineer. It is recommended to extend the geogrid under the adjacent pavement.

The Geogrid serves three purposes: 1) gives a snowshoe effect to compacted aggregate allowing for minor foot traffic during construction 2) helps to broadly distribute point loads, and 3) helps mitigate some settling.

The PaveDrain system will mirror any grade changes or discrepancies made with the subgrade. **Many contractors have found adding an extra 1/4" of stone helps address settling against adjacent surfaces.**

DO NOT construct on frozen soil. When water freezes it expands. As it melts this will cause the ground to shift. Construction needs to occur below the frost line.

DO NOT build on saturated soils. If you can see ponding the soil is structurally deficient. Wait until the soil is dry.

Section 2

Introduction to PaveDrain

Crucial Tools

Professional survey equipment is always recommended; other suggested materials are pipe lasers (if available), marking paint, tape measure, chalk line, block markers/crayons, string line, survey stakes, rubber mallets, 4'-5' pry bars, 4 1/2" angle grinder with concrete cutting blade, masonry saw (wet/dry) with diamond cutting blade, spade and flat shovel, hard-tooth garden rake, geosynthetic, "peanut" or double roller, and plate compactor.

While not required it is recommended that you have a SlabGrabber (Probst), PaverPuller (Probst), or similar tool. An alignment bar for shifting blocks once placed can also be helpful.

Figure 7



Figure 8



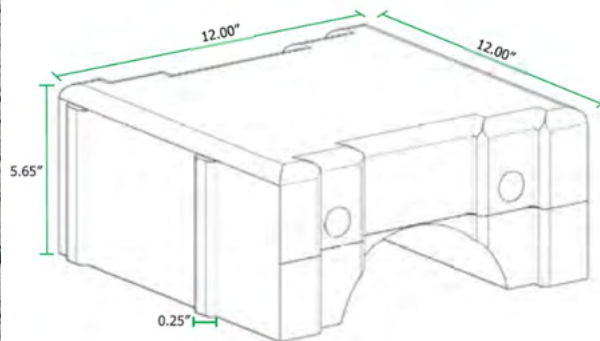
The 4 PaveDrain Blocks

PaveDrain blocks form a single interlocking pattern as seen here. Successive rows are offset by one-half of a unit forming an interlocking pattern.

Figure 9





Figure 10





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The bulk of the pattern is formed by one or both of these two block options

Arched Block	Heavy-Duty (Solid) Block
	
Most common, provides ideal mix of stormwater performance and strength	Used for edges Suitable for heavy-duty applications

Half and End blocks are used to complete the pattern in a clean edge.

Half Block	End Block
	
Used to finish a line in a clean edge	

Section 3

Placement of PaveDrain Blocks

Which Method Should You Use?

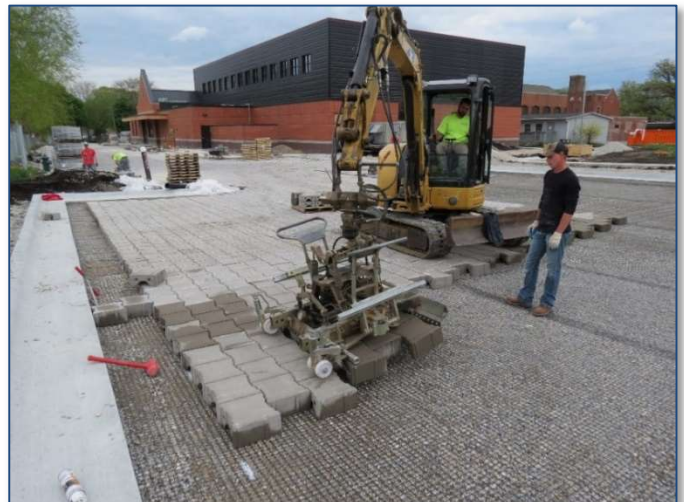
	Hand Placement	Machine Lay
Recommended Labor	1 Foreman + 3 general laborers	1 Foreman + 3 general laborers
Equipment	Machine to move pallets is recommended	PaverMax or mini-excavator with hydraulic clamp
Speed	1,500 SF/day	3,500-5,000 SF/day
Size	<7,000 SF	>7,000 SF
Pallet	No special requirements	For machine lay pallets must be prepared as per Figure 13
Notes about Labor	Foreman will be able to operate any of the necessary equipment (i.e. forklift, bobcat or mini-excavator) while directing the laborers	Foreman will be able to operate any of the necessary equipment (i.e. PaverMax or mini-excavator with hydraulic clamp, forklift or bobcat), while directing the laborers.
Education	A pre-construction meeting is expected for all parties involved in install. Prior experience with this or similar systems is beneficial but is not a substitute for a pre-construction meeting. Contractor education is invaluable, and PaveDrain is committed to the process.	

Probst PaverMax Machine with Clamp or Mini-Excavator with Clamp can be used to install.

Figure 11



Figure 12

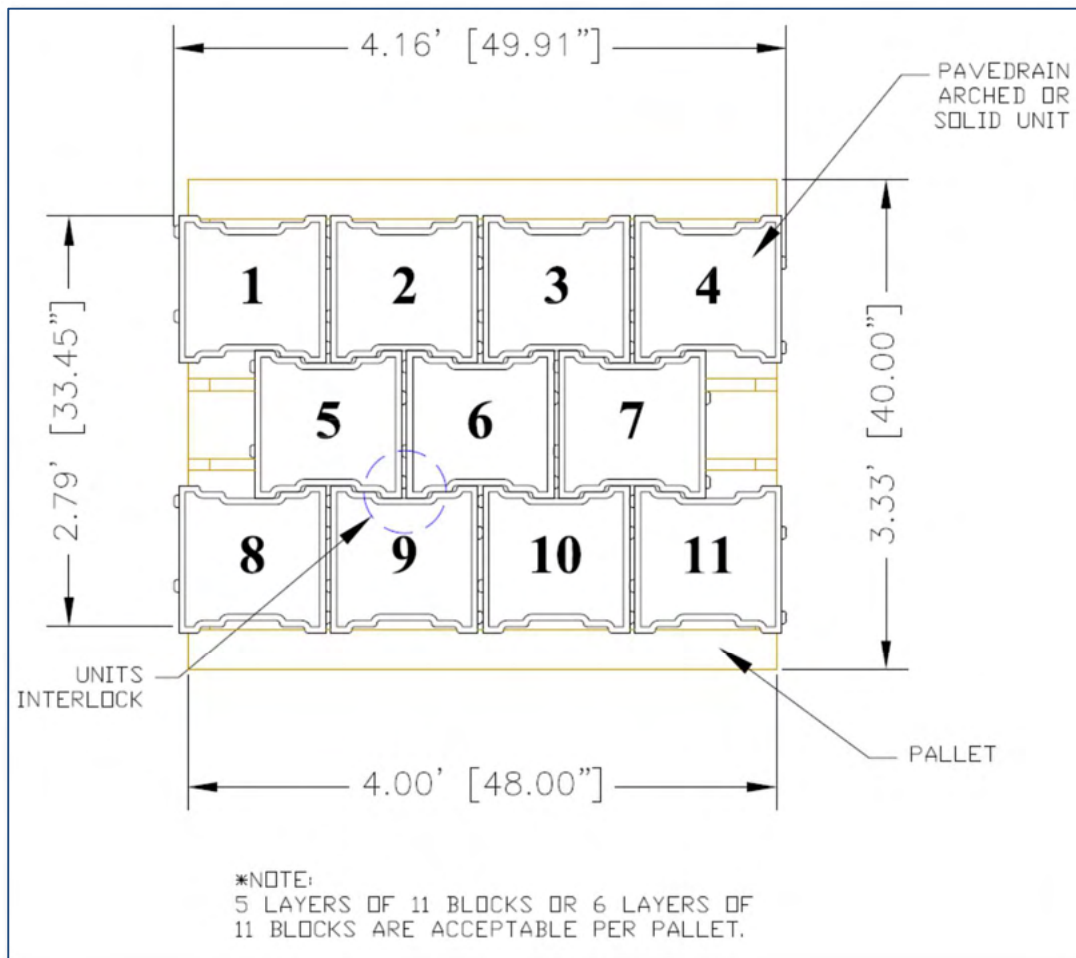


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Material Arrival

PaveDrain units will arrive wrapped on pallets. Pallets will weigh approximately 4,000 lbs or less. Pallets typically have 55-75 SF, depending on which block is chosen, and whether they are ready for machine-lay. Please provide a suitable site to set down. Pallets can be stacked 2 high or placed on completed PaveDrain surface. To machine-lay units must be palletized as in layout below.

Figure 13: Interlocked PaveDrain Pallet configuration



Step #1: If existing hardscapes are to remain (i.e. asphalt or concrete) the prepared area needs to be 3" (three inches) larger than the area receiving the individual units. In some applications a concrete collar can be poured before the units are installed (see Fig. 6 & 7). However, we always recommend installing the PaveDrain block before any other perimeter restraints are installed. Doing so reduces the number of block that would need to be cut (see pages 17-19 for the Two Stage Curb).

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Figure 14



Figure 15



Figure 16



Figure 17



Figure 18



Figure 19



Step #2: *Base preparation is CRITICAL!!!*

Undulations and grade changes in the rock base will be reflected in the PaveDrain system. A plate compactor is the best way to level and flatten the base rock before and during installation (see Fig. 6). A well-prepared rock base is shown in Figures 16 and 17.

When the biaxial or triaxial geogrid is placed on the surface, there should be no overlap. If pavement is to be placed adjacent it is beneficial (but not required) to extend the geogrid under the adjacent pavement.

Step #3: STARTING POINT. It is beneficial to take the entire area into consideration and lay your first unit in the middle or in one corner. String lines will help facilitate your placement. If you decide to place your first unit in the middle, you must mark that unit in the middle with a "+". Then use your string lines to find the exact middle of your open area. Place the unit with the "+" under the intersection of your string lines and you are ready to begin (see Fig. 18). If you start in one corner, you want to use your string line to make an exact 90° corner where you will lay your first unit (see Fig. 19).

Step #4: Keep the units tight during installation and follow the string lines. Rubber mallets can help you "seat" the units after they are placed (see Fig. 20 & 21).

Figure 20



Figure 21



NOTE: Foot traffic should be kept to a minimum on the rock. If the rock is compacted correctly, little movement should be apparent once stepped on. Use the plate compactor to fix any major damage.

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Step #5: The individual PaveDrain units can be cut or tailored to accommodate a variety of different shaped working areas or obstacles. Using a concrete block masonry saw with a diamond tipped blade will allow you to custom fit your site (see Fig. 22 & 23). Always use proper safety gear.

Figure 22



Figure 23

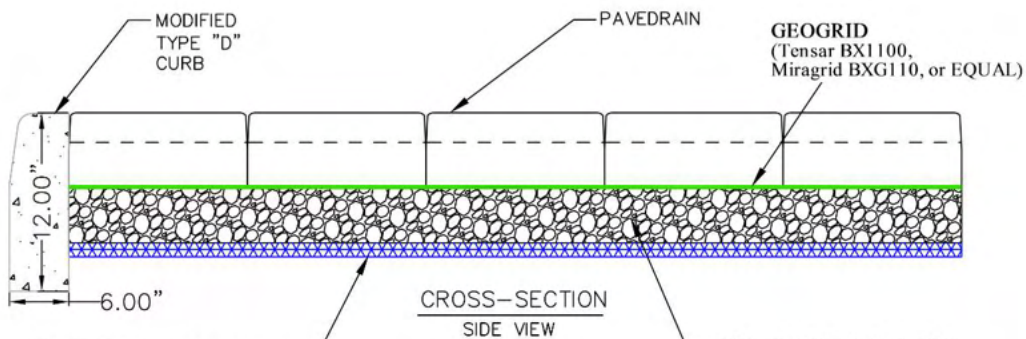


Section 4

Edge Restraints

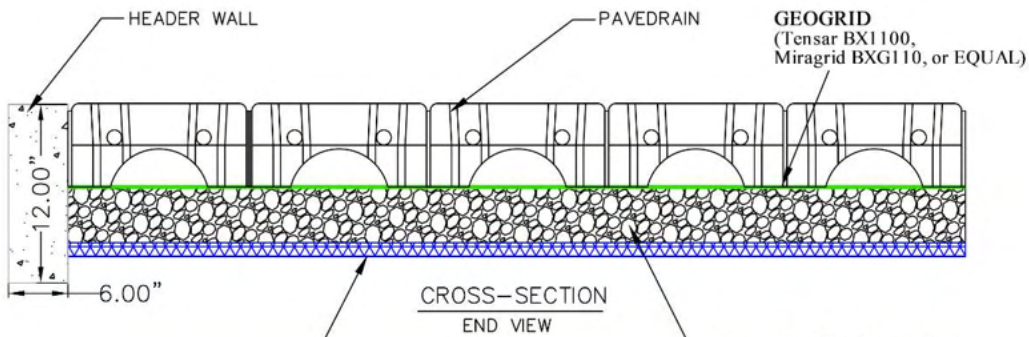
Edge restraints are used to delineate and confine a PaveDrain system and are highly recommended whenever vehicular loads are present. There are many acceptable options for edge restraints with the PaveDrain System. The details below show the most common methods utilizing a poured-in-place concrete flush curb. If you wish to consider other alternates, please contact your local sales representative for support.

Schematics 4 + 5



GEOTEXTILE – Application driven.
On bottom and wrapped up all four sides.
Heavy Duty & Poor Soils – Woven Multi-filament (Mirafi RS380i or equal)
Applications are Streets, Intersections, Alleyways & Truck Traffic
Light Duty & Firm Soils – Woven Monofilament (Mirafi FW402 or equal)
Applications are Parking Lots, Sidewalks & Light Vehicular Traffic

TYP. AASHTO/ASTM #57 STONE (CLEAN, ANGULAR ON ALL SIDES, NO FINES) 4"–6" BEDDING LAYER COMPACTED TO NO MOVEMENT. THICKER CROSS SECTIONS WITH LARGER, COMPACTED ANGULAR STONE ON ALL SIDES TBD BY ENGINEER.



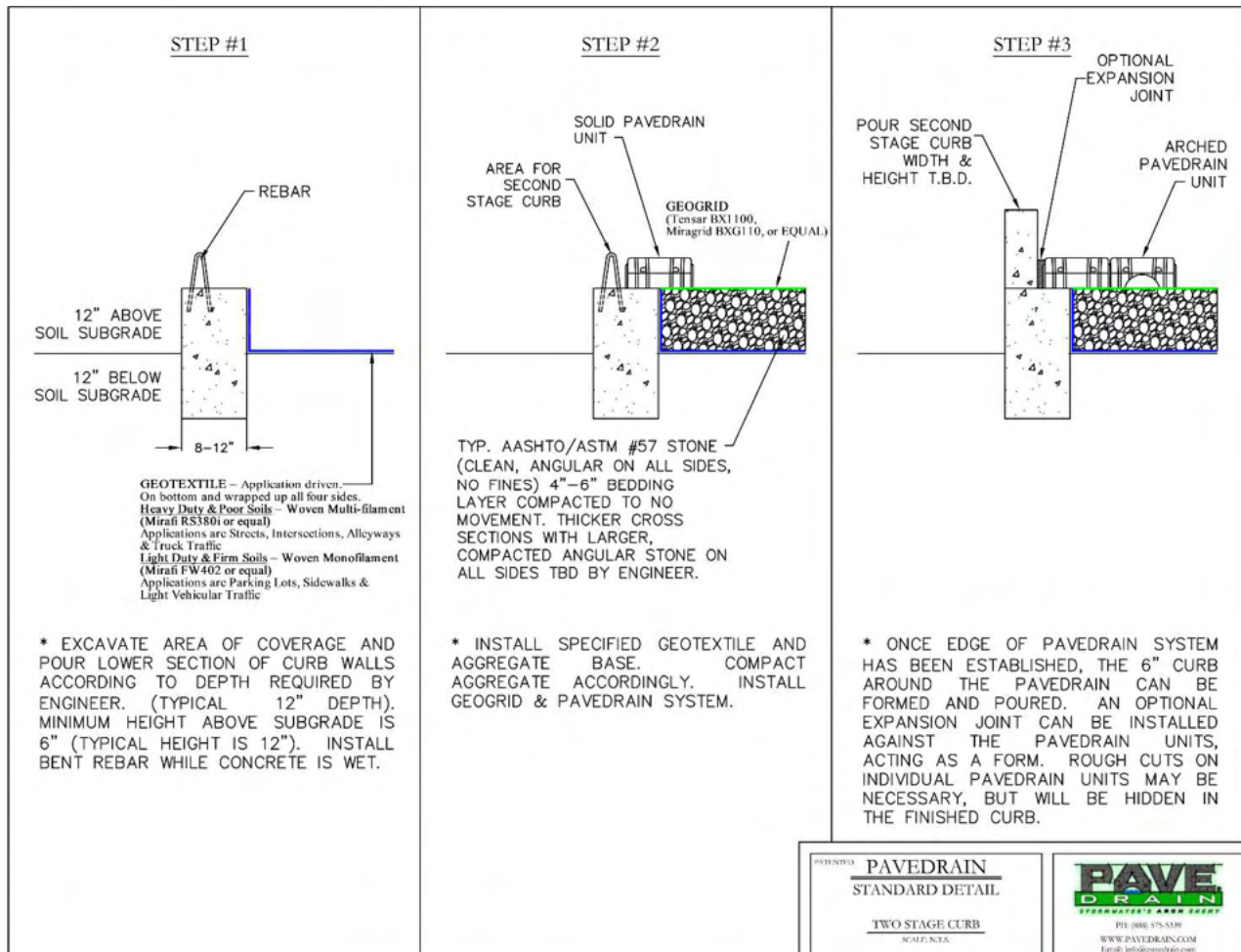
GEOTEXTILE – Application driven.
On bottom and wrapped up all four sides.
Heavy Duty & Poor Soils – Woven Multi-filament (Mirafi RS380i or equal)
Applications are Streets, Intersections, Alleyways & Truck Traffic
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The **Two Stage Curb** detail below is an edge restraint solution that can be used when the PaveDrain System terminates on a curve or radius. The Two Stage Curb detail eliminates the need for field cutting of the PaveDrain blocks to match the required curve or radius.

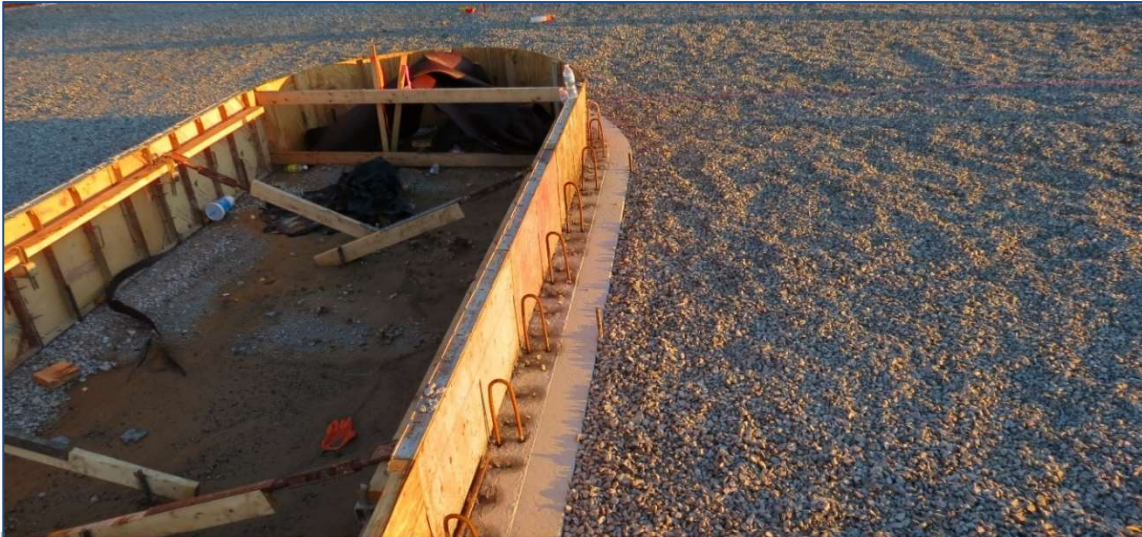
Two Stage Curb Installation Detail

Schematic 6



Two Stage Curb Installation Photos

Figure 24



1. Minimal cutting of the PaveDrain blocks.
2. Compacted rock is brought to proper height.
3. Exposed rebar is for securing poured curb after the block are installed.

Figure 25



Curb is poured ON TOP of PaveDrain

Completed Two Stage Curbs

Figure 27



Figure 28



When Pouring Adjacent to PaveDrain

It is recommended that when pouring asphalt or concrete next to PaveDrain that the surface is protected.

Figure 29



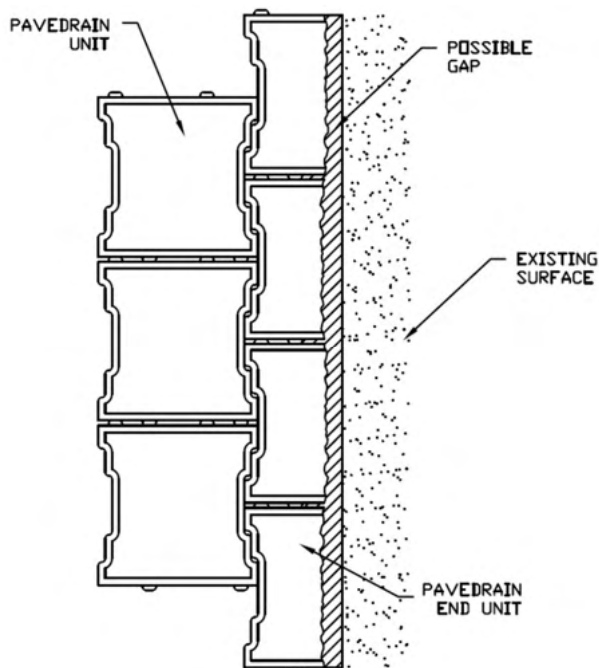
The Edge and Gaps

Edge Blocks- *Half Blocks* and *End Blocks* are designed to give a smooth transition between the PaveDrain system and the existing surfaces. To fill the gap conventional materials, such as rock, 1/2" expansion board, asphalt or concrete, are easily placed directly between the PaveDrain® edge and the existing structure. Polymeric material can also be used to help lock up the stone.

Figure 30



Schematic 7



Gap options (include, but not limited to):

- expansion board
- fill the gap with river rock, pea gravel, dense-graded aggregate, or crusher run
- fill the gap partway with rock chips and top off with polymeric material
- fill the entire gap with non-shrink grout or concrete

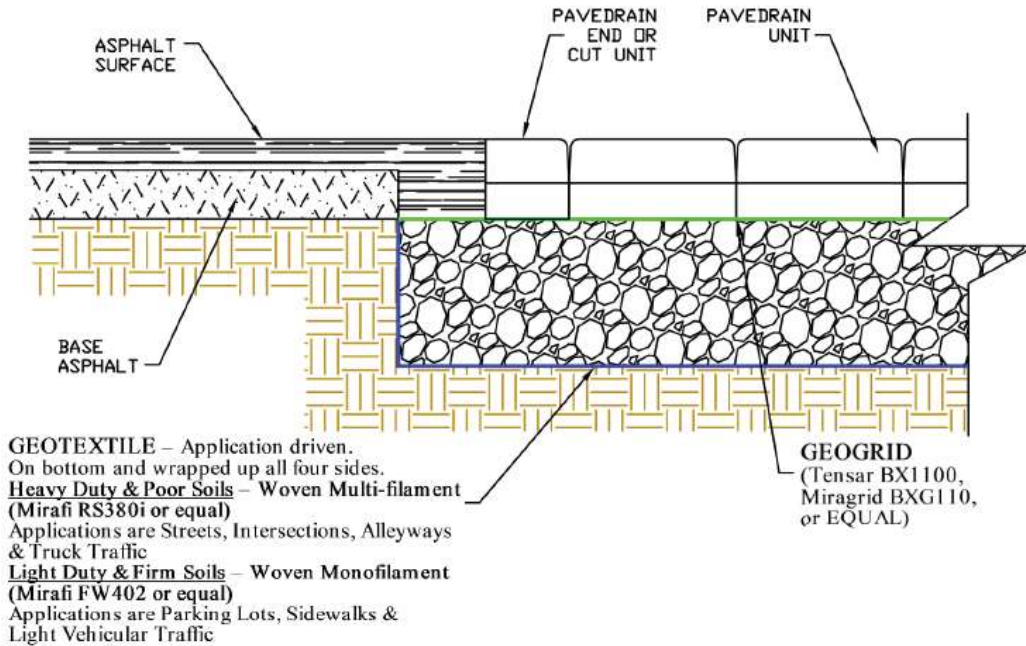
The PaveDrain System is not a paver. The best way to integrate the PaveDrain System into other infrastructure is to simply pour traditional asphalt or concrete up against the PaveDrain system. If that cannot or is not possible, then a gap may be created between the PaveDrain System and an existing curb, header curb, or adjacent concrete/asphalt; this is common. Gaps greater than what is permissible for ADA compliance or

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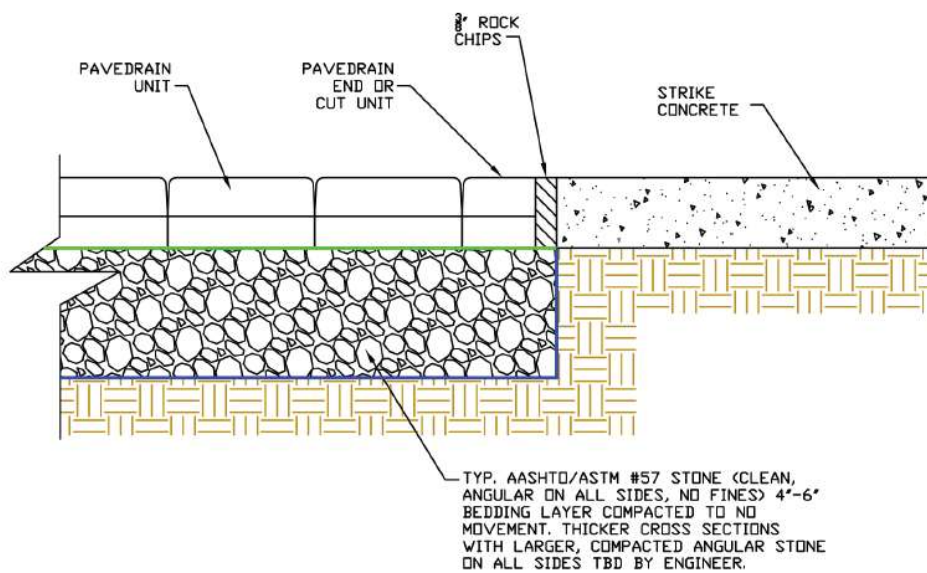
acceptance by owner can be addressed. The option should be chosen by the owner or engineer of record (EOR). The ultimate decision is that of the owner or EOR and not PaveDrain, LLC, its affiliates, or partners.

The size of the gap and its structural integrity should be determined by the EOR. Maintenance or vacuuming of the joint material may remove it.

Schematic 8



Schematic 9



Section 5

Finishing the PaveDrain System

Smoothing

The joints within the PaveDrain system are designed to be left open. Placing sand or small rock chips within the open joints is prohibited. Following the installation of the PaveDrain system, slight unevenness between the individual blocks may be evident. To resolve this, a (non- vibrating) double-drum roller, paver roller, or the tracks of a skid steer may be run over the top (see Fig. 16 & 17 below). A rubber surface in contact with the blocks is preferable.

Figure 31



Figure 32



Striping

If paint or other striping must be applied to the surface, no special precautions need to be taken. Paints or techniques that work on concrete should present no challenges when used.

Sealing

If the PaveDrain site is expected to see road traffic, or if there is potential for accidental salt exposure, it is required to seal the PaveDrain block. A commercial sealer (e.g., or equal) should be rolled on (recommended) or sprayed on. It is recommended that all sealer manufacturer's guidance be followed, including safety precautions.

Stormwater Performance Verification

Upon completion of the PaveDrain installation, the surface infiltration rate of the pavement shall be verified by ASTM C1701M-09 or ASTM C1781 to confirm the required infiltration rate of the pavement (avg of 1,000 in/hr from 3 tests). If the system fails to perform as required, it shall be removed and replaced at the supplier's cost.

Section 6

In-Situ Sensor Installation *(optional)*

Step #1: Identify the site per the plans, in which to install the INFIL-tracker sensor. If the site has not been identified, please use these conditions as a guide to identify an appropriate site to install the sensor:

- The system requires two adjacent blocks
- The site should receive adequate sunlight to power the solar panel
- The site should be out of the way of traffic
- The site should be away from electrical/magnetic interference
- Avoid siting over any drainage, pipe, or other buried infrastructure.
- Close to nearby Rain-MX or other real-time rainfall sensor

Step #2: Remove the block under which the sensor will be placed. Place the guide and shim so that the tube in which the sensor will be placed will be drilled straight down.

Figure 33



Figure 34



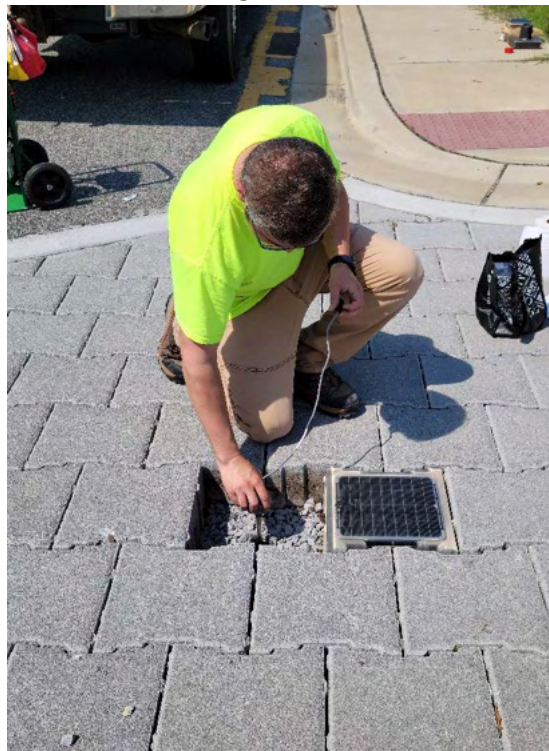
Step #3: Using a fence post driver, drill the bit until it is flush with the stone base.

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Figure 35



Figure 36



Step #4: Insert the sensor and screw until HAND-tight. Remove the adjacent block and replace with the computer block. You will need to turn on the computer block before placing. Connect the cables (may want to use a cable tie to tightly bundle and ensure cabling is securely within the conduit). Place the conduit block. System should be flush with surrounding blocks, which may require minor adjustments with the stone.

Figure 37



Figure 38



For additional help or troubleshooting please contact P4 Infrastructure: info@p4i.io

Section 7

Troubleshooting

Curb is Not Straight

Do not curve the PaveDrain blocks to try to match the drifting curb. Allow for the drift and either fill in with concrete or stone (see Edge and Gaps p. 20). It is always recommended to pave adjacent asphalt or concrete after placing the PaveDrain blocks (see Section 4).

Broken or Damaged Block

Set aside. If it was noticed after installation, use a slab grabber or paver puller remove and replace. Should it be due to manufacturing or shipping, we will replace.

Surface Imperfections

Most surface imperfections are not structural in nature. The ASTM D6684, allows for up to 3% imperfections. If the client has issues, please remove and set aside.

Maintenance

The maintenance manual can be found online: www.pavedrain.com

Please note this system requires no preventative maintenance. Only clean when clogged.

Other Questions

Please contact our technical team info@pavedrain.com or 888-575-5339