

## Flow Transition Mats Rip Rap Alternatives



Source: FlexamatScourStop, 2006

### BENEFITS

	L	M	H
Flow Control	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Erosion Control	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sediment Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Runoff Reduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flow Diversion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Commented [SK1]:** Since this section now encompasses Scourstop, Flexamat, and articulated concrete blocks, should we develop a new name/description?

Rip rap Alternatives? Something better?

**Commented [SK2]:** Revised section to include Flexamat and articulated concrete blocks in addition to the existing scourstop description.

**Description:** As described within this section, rip rap alternatives. ~~Transition mats encompass a variety of products that can be used are a synthetic alternative to using rip rap in situations and locations where rip rap has traditionally been used or in locations where rip rap alone may not be sufficient.~~

**Typical Uses:** Used to dissipate energy at culvert outlets, provide wave protection at shorelines, stabilize streambanks, and prevent scour at the transition from highly concentrated flow outlets to channel flow.

#### Advantages:

- ~~Vegetated condition is more aesthetically pleasing than rip rap.~~
- ~~Some products can be vegetated, providing a "softer" appearance than traditional rip rap.~~
- ~~Some installations can be mowed with conventional equipment.~~
- ~~Some products may provide a greater level of protection than rip rap. May be utilized as a temporary measure.~~
- ~~Some products can be driven over, allowing access for maintenance vehicles. May be more economical than other "hard armor" methods.~~
- Installation does not require any heavy equipment.

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#### Limitations:

- ~~Continuous flow channels may not support vegetation.~~
- ~~Not appropriate for high-velocity discharges (>16 fps).~~

**Longevity:** Permanent

**SUDAS Specifications:** Refer to Section 9040, 2.19 and 3.25 for HDPE transition mats.

**Commented [SK3]:** Add Flexamat product to the specs?

## A. Description/Uses

This section describes a variety of manufactured products intended to be used in place of riprap for stabilization or scour protection.

1. Transition Mat: Flexible, UV stabilized HDPE, UV stabilized, plastic panels sheet, available in approximately 4-foot-foot by 4-foot-foot by 1/2 inch thick sheets with, comprised of multiple voids to which allow vegetation to grow through, provide energy dissipation and scour protection. The panels are typically installed at pipe outlets, or small gravel and pebbles to accumulate and stabilize the area. The mat protects the area at pipe outlets from scour until the water spreading out in the channel diminishes the turbulent forces. The channel downstream of the outlet, where flow becomes uniform, must still be evaluated to ensure that the channel lining can withstand the anticipated shear stress. Transition mats can typically be vegetated or installed over sod which will grow up through the mat, obscuring the visibility of the mat and enhancing the erosion protection of the system.
2. Grid-Tied Concrete Block Mat: Manufactured from individual concrete blocks tied together with high strength geogrid. Each block is tapered on all four sides, forming a pyramid shape. This product has a wide range of uses, including outlet protection, channel lining, shoreline protection, scour protection, streambank stabilization, slope protection, spillways and overflows, low water crossings, and boat ramps. Grid tied concrete block mats provide enough space between the blocks to allow vegetation to grow up through the block, obscuring the visibility of the mat and enhancing the erosion protection of the system.
3. Articulated Concrete Mat: Consists of individual concrete blocks connected together with cables to develop a mattress of interconnected concrete blocks. Articulated concrete mats provide a high level of resistance to scour and shear stress and can be used for outlet protection, channel lining, shoreline protection, scour protection, slope protection, spillways and overflows, low water crossings, and boat ramps. The blocks can be provided with either an open-cell or closed cell configuration allowing the system to be backfilled with soil and vegetated if desired.

## B. Design Considerations

Manufacturers of rip rap alternative products typically provide guidelines, design information, product specifications, installation instructions for their products. It is recommended that designers contact the product representative to assist with the design and specification of these products. Generally, vegetation alone and a vegetated turf reinforcement mat (TRM) (Section 7E-18) can carry significant storm water shear, but cannot withstand the turbulence and concentrated flow generated by a hard surface such as storm sewers, culverts, or parking lots. At these locations, additional measures are usually required to prevent scour. Transition mats are one option for protecting that critical area.

Transition mats can be installed in several different configurations to meet the particular site requirements.

Transition mats installed over sod are good applications for parking lot outlets or pipe outlets conveying storm water through residential developments. The installation can be mowed with standard equipment and unsightly rock rip rap is avoided.

Installing sod and a Type 1 TRM under the transition mat adds a strong supporting element to the system. Vegetated TRMs already have proven shear force resistance of 12 pounds per feet. The sod eliminates the germination issue of a plain TRM installation, even though it adds a slight cost of material and labor, as well as potential short term irrigation needs. Appropriate uses for a transition mat over a Type 1 TRM and sod would be 24 to 48 inch storm water pipes.

**Commented [SK4]:** Kept this generic and referenced manufacturer's design information. These design guidelines are readily available online and are frequently updated by the manufacturer's..

Transition mats may also be used without sod. A transition mat with a Type 1 TRMs over bare soil might be used in situations where turfgrass is not desired, such as a rural area, or as a temporary installation. When used without sod, the flows should be slow and the area fairly flat to encourage sediment accumulation in the voids, where vegetation could also start. Pipe sizes should be limited to 24 inches.

Higher flow installations without sod can be accommodated using a higher class, Type 3 TRM over the bare soil. This type of installation may be applicable for temporary, pre-vegetation erosion control use (temporary meaning remove and reinstall when vegetation can be established), or as a permanent installation requiring substantial soil protection and vegetation growth over time. This installation could also be used in a streambed, where the mats would collect small gravel and sediment in the voids and appear naturally stabilized.

Installations with continuous low flows, such as irrigation over charge, should utilize a sub-surface drainage system directly downstream of the outlet to drain that low flow from the surface, thus allowing vegetation to properly establish. Of course, adequate slope is required for a subdrain system. In some instances, marsh plants could be planted into a transition mat and TRM combination as another solution.

For installations where the slope of the discharge area or channel is greater than the outlet, but not a waterfall situation, transition mats should perform as specified. When the slope of the discharge area or channel is flatter than the outlet, and the grade break between the two exceeds 8%, the flow velocities and vector forces directed into the transition mat should be considered to determine if a flow transition mat is appropriate for the situation.

A temporary installation, for example the outlet of a temporary slope drain, can be readily achieved with a transition mat and TRM combination. Vegetation would generally not be necessary or desired, but scour protection would be quickly achieved, and the materials could be easily picked up and moved to another area on demand.

Transition mats do not dissipate energy by impact like rip rap, but generally rely on the expansion area downstream to dissipate scour forces. The expansion area should be as wide and flat as possible. Channel side slopes that restrict expansion require protection with either a TRM or other means.

In addition to the potential scour area at the outlet, the channel downstream of the transition mat should be evaluated to ensure that it can carry the anticipated flows without eroding the streambank. Additional information on evaluating channel linings can be found in [Section 7E-23—Grass Channel](#) and [7E-18—Turf Reinforcement Mats](#).

## C. Application

Rip rap alternative products are intended to be used where traditional rip rap will not provide the desired appearance or performance.

Outlet protection should be designed to withstand the 10-year storm event. The following table lists the recommended dimensions for transition mat and TRM (if used) installations based upon pipe diameter.

**Table 7E-21.01: Flow Transition Mat Application**

Pipe Diameter (inches)	Discharge <sup>†</sup> (cfs)	Transition Mats		TRM
		Width (ft) x Length (ft)	Quantity	Width (ft) x Length (ft)
12	8	4 x 4	1	6 x 8
24	30	4 x 8	2	11 x 12

36	75	8 x 12	6	17 x 16
48	100	12 x 16	12	23 x 20

<sup>4</sup>If the design discharge exceeds that for the diameter shown, alternative methods of outlet protection should be provided.

**D. Maintenance**

~~While Transition mats are generally permanent installations, and maintenance should not be necessary. Utilized in a temporary installation, the transition mats and TRMs can be picked up and moved when appropriate.~~  
rip rap alternative products are intended for permanent installations, maintenance and replacement may be required. They should be inspected on a regular basis to determine if there are performing adequately and for damage after large storms or overtopping events.