

## SELF-LAUNCHING STONE / WELL GRADED STONE

**Special  
Topic**

For bank protection measures, well graded (poorly sorted) stone is best. Well graded (the opposite of well sorted) stone has a tendency to interlock and adjust to small deformations in the underlying bank without jeopardizing the entire structure; however, recent research investigates particulars further – [see below](#). Poorly sorted stone also contains fine gravel-sized particles that enhance the opportunity for vegetation to become established. The fines and smaller stones fill voids between larger stones and retard interstitial water flow and subsequent erosion behind the riprap. This reduces the incidence of piping or sapping of fines and the need for filter layers and filter fabric. Thus, well graded stone with a sufficient fraction of "fine" particles are referred to as Self-filtering stone (Derrick, 2002).

Ecologists have reasoned that within certain limits, a stable structure composed of a wide range of stone sizes will provide a wider range of interstitial sizes and thus more diverse habitat than a stable structure made of more uniform stone.

Self-launching stone refers to poorly sorted stone that will fall (self-launch) into scour holes. Self-launching stone has been specified and used by the USACOE for decades in streams throughout Mississippi for such techniques as [Longitudinal Stone Toes](#), [Trench Fill Revetment](#), and [Bendway Weirs](#).

One of the most common approaches for obtaining well-graded stone is to specify quarry-run or "shot rock." Shot Rock is not sorted at all, merely loaded straight from the quarry, fines and all. Much care must be taken when purchasing this type of material to ensure that the stone does not include soil or soft shale.



Harland Creek, MS.



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**Self Launching Stone after several years.**

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**LPSTP (under people) with Stone Deflector (spur) after several years.**

Typical USACOE gradations for well graded stone are as follows:

**Class A:**

<b>Stone Weight k (lbs)</b>	<b>Cumulative % Finer by Weight</b>
2250 (5000)	100
1125 (2500)	70-100
225 (500)	40-65
45 (100)	20-45
2.25 (5)	0-15
0.5 (1)	0-5

**Note: Assuming stone shape midway between a sphere and a cube.**

**Class B:**

<b>Stone Weight k (lbs)</b>	<b>Cumulative % Finer by Weight</b>
550 (1200)	100
350 (750)	72-100
90 (200)	40-65
22.5 (50)	20-38
4.5 (10)	5-22

2.25 (5)	0-15
0.5 (1)	0-5

**Class C:**

Stone Weight k (lbs)	Cumulative % Finer by Weight
175 (400)	100
115 (250)	70-100
45 (100)	50-80
13.5 (30)	32-58
2.25 (5)	15-34
0.5 (1)	0-10

**Note: 5% of the material can weigh more than 400 pounds.  
However, no piece shall weigh more than 500 lbs.**

David Derrick describes the following criteria for selection of self-launching rock:

1. At the quarry or stockpile, walk up the pile of stone. If the stone falls down (self-launches) as you climb up, it meets the optimum self-launching criteria.



2. The stone must have a ratio of the longest axis to shortest axis of less than 3.5:1. Typically, concrete rubble is not self-launching. If the concrete was 10 cm (4 in) thick (C axis = 10 cm (4 in)) then the longest axis could only be 35 cm (14") and according to C Gradation above, 15-34% of the stone would need to be smaller and 32-58% of the stone larger. Therefore, only about 20% of well-graded, self-launching stone can be comprised of concrete rubble 10 cm (4 in) thick.

