

**RIPRAP GRADATION LIMITS**  
([USDOT](#), FHWA, HEC-11)

Stone Size Range (ft.)	Stone Weight Range (lb)	Percent of Gradation Smaller Than
1.5 $d_{50}$ to 1.7 $d_{50}$	3.0 $W_{50}$ to 5.0 $W_{50}$	100
1.2 $d_{50}$ to 1.4 $d_{50}$	2.0 $W_{50}$ to 2.75 $W_{50}$	85
1.0 $d_{50}$ to 1.15 $d_{50}$	1.0 $W_{50}$ to 1.5 $W_{50}$	50
0.4 $d_{50}$ to 0.6 $d_{50}$	0.1 $W_{50}$ to 0.2 $W_{50}$	15

**Thickness** - The riprap-layer thickness shall be the greater of 1.0 times the  $d_{100}$  value, or 1.5 times the  $d_{50}$  value. But the thickness need not exceed twice the  $d_{100}$  value. The thickness is measured perpendicular to the slope upon which the riprap is placed.