

Riprap Rock Sizing Calculator

This application implements several different equations to calculate the size of riprap.

Isbash Equation

Water velocity approaching riprap	$V := 1.5 \text{ m} \cdot \text{s}^{-1}$
Flow type	$\text{flow_type} := \text{"high turbulence"}$
Isbash constant	$C := \begin{cases} 0.86 & \text{flow_type} = \text{"high turbulence"} \\ 1.2 & \text{flow_type} = \text{"low turbulence"} \end{cases}$
Rock specific gravity	$S := 2.65$
Gravity	$g := 9.81 \text{ m} \cdot \text{s}^{-2}$
Median stone diameter	$\text{Dia} := \frac{V^2}{2 \cdot g \cdot C^2 \cdot (S - 1)} = 0.094 \text{ m}$

CALTRANS Method

Stream velocity at bank	$V := 14.3 \text{ ft} \cdot \text{s}^{-1}$
Angle (70 deg for randomly placed rubble)	$\rho := 70 \text{ deg}$
Bank angle	$\theta := 30 \text{ deg}$
Specific gravity of stone	$SG := 2.65$
Minimum weight of outside stone	$W := \frac{0.00002 \cdot \left(\frac{V}{\text{ft} \cdot \text{s}^{-1}} \right)^6 \cdot SG}{(SG - 1)^3 \cdot \sin(\rho - \theta)^3} \cdot \text{lb} = 379.872 \text{ lb}$

USBR

Average channel velocity

$$V_a := 14 \text{ ft} \cdot \text{s}^{-1}$$

Stone size

$$D_{50} := 0.0122 \cdot \left(\frac{V_a}{\text{ft} \cdot \text{s}^{-1}} \right)^{2.06} \text{ ft} = 2.801 \text{ ft}$$

ASCE Method

Specific gravity of stone

$$SG := 2.65$$

Unit weight of stone

$$\gamma_s := 200 \text{ lb} \cdot \text{ft}^{-3}$$

Local depth averaged velocity

$$V := 14 \text{ ft} \cdot \text{s}^{-1}$$

Weight of stone

$$W := \frac{0.000041 \cdot SG \cdot \left(\frac{V}{\text{ft} \cdot \text{s}^{-1}} \right)^6}{(SG - 1)^3 \cdot \cos(\theta)^3} \text{ lb} = 280.385 \text{ lb}$$

Median stone diameter

$$D_{50} := \left(\frac{6 \cdot W}{\pi \cdot \gamma_s} \right)^{\frac{1}{3}} = 1.389 \text{ ft}$$