

The Grove-Mass Grading and Stormwater (PL2017110)

Riprap Calculations

HEC-14, Third Edition, 2006

US Department of Transportation

Federal Highway Administration

Section 10.2 Riprap Apron

(Eq. 10.4)
$$D_{50} = 0.2D \left(\frac{Q}{\sqrt{g}D^{2.5}} \right)^{\frac{4}{3}} \left(\frac{D}{TW} \right)$$

where,

D_{50} = riprap size, m (ft)

Q = design discharge, m^3/s (ft^3/s)

D = culvert diameter (circular), m (ft)

TW = tailwater depth, m (ft)

g = acceleration due to gravity, $9.81 m/s^2$ ($32.2 ft/s^2$)

$$D_{50} = 0.2(11.5) \left(\frac{327}{\sqrt{32.2*11.5^{2.5}}} \right)^{\frac{4}{3}} \left(\frac{11.5}{4} \right) = .43 \text{ ft.} = 5.15 \text{ in.}$$

(Table 10.1) Riprap Classes and Apron Dimensions

Class	D_{50} (mm.)	D_{50} (in.)	Apron Length	Apron Depth
1	125	5	4D	3.5 D_{50}
2	150	6	4D	3.3 D_{50}
3	250	10	5D	2.4 D_{50}
4	350	14	6D	2.2 D_{50}
5	500	20	7D	2.0 D_{50}
6	550	22	8D	2.0 D_{50}

Class 2

Design Length: 4*Total Pipe Diameter = 4*11.5=46 ft.

Length Provided: 56 ft.

Design Depth: 3.3* D_{50} = 3.3*6=19. in.

Depth Provided: 24 in.