

รายการคำนวณโครงสร้าง
หินทิ้ง (Riprap)

Project Tammalang
Subject Rip Rap Design

Sheet 1 of _____
Date _____
Worked by Harith
Checked by _____

1. Data:

Design Wave = 0.80 m

Wave Period = 3.62 sec.

Water depth at toe = 6.24 m

side slope = 1:2.5

unit weight of rock, $\gamma_r = 24,525 \text{ N/m}^3$

Permeability Coefficient = 0.10

Damage level = 2

2. output

2.1 Armour layer

Layer thickness = 0.62 m

Stones size:

$d_{15} = 160.00 \text{ mm (30.00 kg.)}$

$d_{50} = 310.00 \text{ mm (75.00 kg.)}$

$d_{85} = 390 \text{ mm (147.00 kg.)}$

2.2 Filter layer

Layer thickness = 0.30 m

Stones size

$d_{15} = 30 \text{ mm (0.05 kg.)}$

$d_{50} = 40 \text{ mm (0.15 kg.)}$

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3. Stone size Requirement due to current

$$D_{n50} = \frac{\Phi_c K_T K_h}{\Delta_m K_s} \frac{0.035}{\Phi_c} \frac{V^2}{2g}$$

$$\Phi_c = 1.25$$

$$K_T = 1.00$$

$$\Delta_m = (P_r - P_w) / P_w$$

$$= (2500 - 1025) / 1025$$

$$= 1.44$$

$$K_h = (h / D_m + 1.0)^{-0.2}$$

$$= (6.24 / 0.31 + 1.0)^{-0.2}$$

$$= 0.543$$

$$K_s = \sqrt{1 - \frac{\sin^2 \alpha}{\sin^2 \phi}}$$

$$= \sqrt{1 - \frac{\sin^2 21.80^\circ}{\sin^2 35^\circ}} = 0.5807$$

$$Q_c = 0.035 \quad \text{for Rip rap}$$

$$V = 0.50 \text{ m/s}$$

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$$\begin{aligned}
 D_{n50} &= \frac{1.25 \times 1.0 \times 0.543}{1.44 \times 0.5807} \frac{0.035}{0.035} \frac{(0.50)^{-5}}{2 \times 9.81} \\
 &= 0.010 \text{ m} \\
 &\approx 10 \text{ mm} < 310 \text{ mm}
 \end{aligned}$$

This size is less than d_{50} of under layer (40 mm). Therefore, even the under layer is exposed by some reason, it will not be washed out by scour.

4. Length of apron

4.1 Room wave action

$$\begin{aligned}
 L &= 2 \times 0.80 \\
 &= 1.60 \text{ m}
 \end{aligned}$$

4.2 Protection against scouring due to current

$$\text{Scour depth, } R = 1.35 \left(\frac{q}{f} \right)^{1/3}$$

$$f = \text{silt factor}$$

$$= 1.75 \sqrt{d_{50}}$$

$$= 1.75 \sqrt{1.0} \quad (\text{Avg. } d_{50} = 1.00 \text{ mm})$$

$$= 1.75$$

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$$\begin{aligned}\text{Average River flow} &= v \times d \quad \text{m}^3/\text{s}/\text{m} \\ &= 0.25 \times 6 \\ &= 1.50 \text{ m}^3/\text{s}/\text{m}\end{aligned}$$

Where 0.25 m/s is the average velocity of river and 6 m is the depth of water with respect to mean sea level.

$$\begin{aligned}\therefore R &= 1.35 \left(\frac{1.50}{1.75} \right)^{1/3} \\ &= 1.09 \text{ m}\end{aligned}$$

$$\begin{aligned}\therefore \text{Apron length, } L &= 1.5 R \\ &= 2.18 \text{ m}\end{aligned}$$

Provide 2.50 m wide apron.

RUBBLE MOUND REVETMENT DESIGN

Significant Wave Height	Hs:	0.80	m
Significant Wave Period	Ts:	3.62	sec
Cotangent of Nearshore Slope	COT(phi):	50.00	
Water Depth at Toe of Revetment	ds:	6.24	m
Cotangent of Structure Slope	COT(theta):	2.50	
Unit Weight of Rock	wr:	24525.00	n/m3
Permeability Coefficient	P:	0.10	
Damage Level	S:	2.00	

STONE SIZE GRADATION

ARMOR LAYER
 Layer Thickness = 0.62 m

PERCENT LESS THAN BY WEIGHT	WEIGHT (n)	DIMENSION (m)
0.00	91.76	0.16
15.00	293.64	0.23
50.00	734.10	0.31
85.00	1438.83	0.39
100.00	2936.40	0.49

FILTER LAYER
 Layer Thickness = 0.30 m

PERCENT LESS THAN BY WEIGHT	WEIGHT (n)	DIMENSION (m)
0.00	0.24	0.02
15.00	0.40	0.03
50.00	1.36	0.04
85.00	4.59	0.06
100.00	7.72	0.07

IRREGULAR WAVE RUNUP

EXPECTED MAXIMUM = 1.26 m
 CONSERVATIVE = 1.58 m

SURF PARAMETER = 1.6938
 CERC STABILITY NUMBER = 1.3281
 DUTCH STABILITY NUMBER = 1.7900