

Guide Bank Design Steps Key

- ① Lacey waterway formula $(L = 4.75 \sqrt{Q})$
- ② Provide 20% more length for thickness of pier
- ③ Total length $L = ① + ②$
- ④ u/s L for guide Bund = $\frac{5}{4} L$
- ⑤ d/s L for guide Bund = $\frac{L}{4}$
- ⑥ Radius for u/s Curved = $0.45L$ at 145°
- ⑦ Radius for d/s Curved = $\frac{0.45L}{2}$ at 60°
- ⑧ (Given H.F.L.) + (Assuming free board = 1.5m) = level of top of guide bund
- ⑨ Height of Bund above river bed = High flood level - Bed level.

Design of stone pitching and apron

- ⑩ Thickness of stone pitching (T) = $0.06 (Q)^{1/3}$ & kept 1m above
- ⑪ Depth of scour (R) = $0.47 \left[\frac{Q}{P} \right]^{1/3}$
For straight portion of guide Bund
- ⑫ max Scour = $1.25 R$
- ⑬ RL at max scour = H.F.L. - max scour
- ⑭ Depth of max scour (D) = Bed level - RL
- ⑮ Length of apron = 1.5 D
For Curvilinear Portion of guide Bund
- ⑯ max scour = 1.5 R
- ⑰ Find RL, Depth, length of apron from above method
- ⑱ Thickness of launching apron = 1.9 T

Volume of stones

- 19) A + Shank: on slope = $\sqrt{5} ((H.F.L. + 1) - \text{Bed level}) \times T \times 1$
on apron with slope 2:1
Vertical length of D Thickness of 1.25 T
Volume = $\sqrt{5} \times D \times 1.25 T \times 1$

21) u/s & d/s Curved Portion

- Vol of apron
- Vol on slope = same as for Shank
- Thickness of launching apron = $\frac{\text{Vol of apron}}{\text{width}}$

20.29. NANAL PLANTATION

Nanal is a plant like cane. It is 3 m to 4.5 m height of which bottom 1.5 m is about 12 and 25 mm in diameter and hollow like bamboo. Nanal grass planted along rivers will spread roots and sprouts quickly. The growth of nanal checks the velocity and induces deposition of sediment along the river bank.

Example 20.1. Design a guide bank required for a bridge on a river having the following particulars :

Design flood discharge = 50000 cumecs

Silt factor = 1.10

Bed level of river = 130.00 m

High flood level = 140.00 m

Also find the volume of stone required per m length of the guide bank.

Solution

$$Q = 50000 \text{ cumecs ; } f = 1.10$$

$$\text{Lacey's water way} = 4.75 \sqrt{50000} = 1062 \text{ m.}$$

Provide 20% more length to account for thickness of piers and end contractions due to piers and abutments

$$= 212 \text{ m}$$

$$\text{Gross length between banks} = L = 1274 \text{ m}$$

$$\text{Upstream length of guide bund} = \frac{5}{4} L = \frac{5}{4} \times 1274 = 1592 \text{ m}$$

$$\text{Downstream length of guide bund} = \frac{L}{4} = \frac{1}{4} \times 1274 = 318 \text{ m}$$

Radius of u/s curved head $= 0.45 L = 573$ m.

The u/s end of the guide bank may, therefore, be curved by 145° with a radius of 573 m.

Radius of d/s curved head may be kept as 287 m with an angle of 60° at the centre.

Cross section of guide bund

The given H.F.L. at the bridge site $= 140.0$ m

Assuming free board $= 1.5$ m.

Level of top of guide bund equals 141.5 m. To be more safe and making an allowance for further settlement etc., let us adopt the top level of bund as 142.00 m.

Height of bund above river bed $= 142.0 - 130.0 = 12.0$ m.

Keep the top width of bund as 4 m and the side slope may be kept as 2:1.

The stone pitching and a launching apron must be provided on the slope on water side for the entire length of the bund. However the rear side also will be pitched for curved portions of the bund.

Design of stone pitching and apron

The thickness of stone pitching is given by

$$T = 0.06 [Q]^{1/3} = 0.06 [50000]^{1/3} = 2.21 \text{ m.}$$

This can be kept 1.0 m above H.F.L. i.e. upto level 141.00 m.

$$\text{Depth of scour } R = 0.47 [Q/f]^{1/3} = 0.47 \left(\frac{50000}{1.1} \right)^{1/3} = 16.77 \text{ m.}$$

For straight reach of guide bund,

$$\text{Maximum scour} = 1.25 R = 1.25 \times 16.77 = 20.97 \text{ m}$$

$$\begin{aligned} \text{R.L. at maximum anticipated scour} &= 140 - 20.97 \\ &= 119.03 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Depth of maximum scour } D &= 130 - 119.03 \\ &= 10.97 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Length of apron} &= 1.5 D = 1.5 \times 10.97 \\ &= 16.45 \text{ m} \end{aligned}$$

For curvilinear transition portion of guide bund,

$$\text{Maximum scour} = 1.5 R = 25.16 \text{ m}$$

$$\text{R.L. of maximum scour} = 140 - 25.16 = 114.84 \text{ m}$$

$$\begin{aligned} \text{Depth of maximum scour } D &= 130 - 114.84 \text{ m} \\ &= 15.16 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Length of apron} &= 1.5 D = 1.5 \times 15.16 \\ &= 22.74 \text{ m} \end{aligned}$$

$$\text{Thickness of launching apron} = 1.9 T = 1.9 \times 2.21 = 4.2 \text{ m}$$

Volume of Stones

$$\begin{aligned}\text{At shank : on slope} &= \sqrt{5} (141 - 130) \times T \times 1 \\ &= \sqrt{5} \times 11 \times 2.21 = 54.36 \text{ m}^3/\text{m}\end{aligned}$$

On apron with a slope 2 : 1

In a vertical length of D and a thickness of $1.25 T$

$$\begin{aligned}\text{Volume} &= \sqrt{5} \times D \times 1.25 T \times 1 \\ &= \sqrt{5} \times 10.97 \times 1.25 \times 2.21 = 66.76 \text{ m}^2/\text{m}\end{aligned}$$

U/S and D/S curved portions

$$\text{Volume of apron} = \sqrt{5} \times 15.16 \times 1.25 \times 2.21 \times 1 = 93.65 \text{ m}^3/\text{m}$$

Volume on slope = Same as for shank

$$= 54.36 \text{ m}^3/\text{m}$$

Thickness of launching apron

$$\begin{aligned}&= \frac{\text{Volume of apron}}{\text{Width}} = \frac{93.65}{1.5 \times 15.16} \\ &= 4.12 \text{ m} \approx 1.9 T.\end{aligned}$$

PROBLEMS

1. Describe various types of river training and protection works.
2. What do you understand by meandering ? What are its causes?
3. Sketch a suitable cross-section of a guide banks as used in river training works. Explain the process of launching of aprons in such works.
4. Describe in brief various types of groynes used for river training. Draw a section of