ID 7655

Subject Hydraulic Structure

Submitted to Engineer Adeed

Submitted by USAMA AKHTAR

Date of Submission 18/4/2020

Q1) Define reservoir also explain which type of Embankment dam you will suggest in a hilly area and why?

Ans) Reservoir;

A man made lake of large Fresh water body of water. Many people think of a resorvoir as a lake and might even use the words interchangeably. However the key difference is that reservoir are artifitial and lakes are natural.

Mainly it has three types;

- Valley damed,
- Bank side,
- Service resorvoir.

In above service resorvoir is most economical because it is entirely man made. Its frame construction is as well as no need of any natural water body diverstion. It also required small space.

→ For Factor of safety against sliding

Condition $(\mu \Sigma F_V + Bq)/\Sigma F_H) > 1$

$q = 1400$

$\mu = 0.7$ (0.65 to 0.75)

$((\mu \Sigma F_V + Bq)/\Sigma F_H) = 4.57$

Condition ⇒ Safe in sliding (OK)

Q1) (b)

→ Rock fill Embankments are economical of the two types, these are effective because force of the river or resorvoir hits the impervious zone and is tranfered to the firmly packed transition zone, where water can slowly begin to filter through dams.

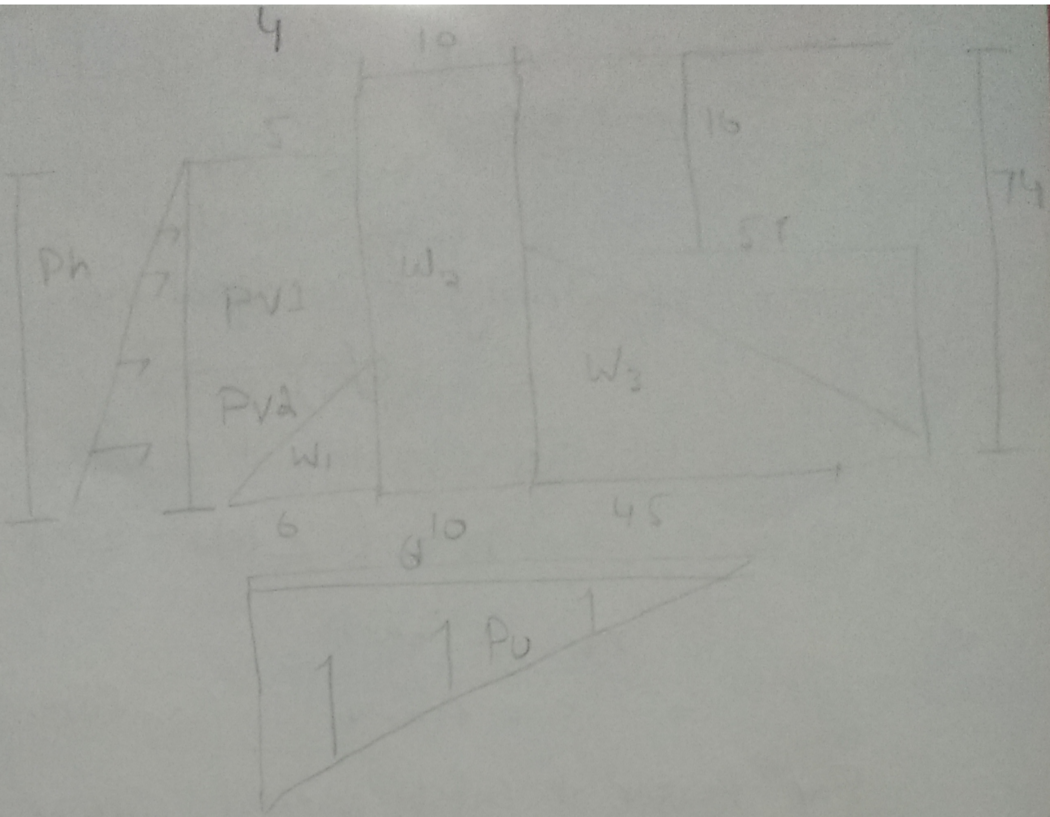
Q2)

Types of spillways;

- Straight drop spillways,
- Ogee spillway,
- Shaft spillway,
- chute spillways,
- side channel spillways,
- Siphon spillway
- Labyrinth spillways

b) As for chosing ~~each~~ a spillway for weather below 10° degree we know that it doesn't depend on weather or temprature but on quantity of water. So hence you can chose any type of spillway according to quantity or flow of water.

①



Assume,

Unit weight for concrete = 24 kN/m^3
Unit weight for water = 10 kN/m^3

Forces	Force Formula	Fy	Fx	Lever Arm (m)	Mr	Mo
W_1	$\frac{1}{2} \times L \times W \times \gamma_d$	2376	0	57	1354320	0
W_2	$L W \gamma_d$	17760	0	50	888000	0
W_3	$\frac{1}{2} L W \gamma_d$	31320	0	30	909600	0
PV_1	$\frac{1}{2} L W \gamma_d$	990	0	59	58410	0
PV_2	$L W \gamma_w$	2160	0	88	56410	0
Pu	$(-\frac{1}{2} L W \gamma_w)$	-21045	0	40.67	0	855830
Ph	$(-\frac{1}{2} L W \gamma_w)$	0	-23805	23.00	0	547535
	Σ	3361	-23805	Σ	2146720	1403345

2 → For Factor of safety against Tension

condition $e < B/6$

$B/6 = 10.17m$

→ eccentricity of resultant force;

$e = (B/2) - \bar{x}$

$\bar{x}$ = location of resultant force from Toe

$\bar{x} = (\Sigma M_r - \Sigma M_o) / \Sigma F_v$

$\bar{x} = 22.15$

So $e = 8.35m$ Condition safe in tension.

For Factor of safety against stress;

Condition → $\gamma_{heel} > 0$

$$\gamma_{Toe} = (\Sigma F_v / B)(1 \pm (6e/B))$$

$$\gamma_{Toe} = 1002.0484 \ KN/m^3$$

$$\gamma_{heel} = (\Sigma F_v / B)(1 - (6e/B))$$

$$\gamma_{heel} = 98.31 \ KN/m^3$$

Condition → Safe in stress (ok)

→ For Factor of safety against overturning

Condition → not safe in overturning (Not ok)

$(\Sigma M_r \ \Sigma M_o)$

$\Sigma M_r = 2146722$

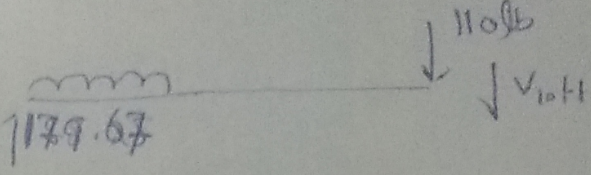
$\Sigma M_o = 1403345$

Condition → Safe (ok)

(8)

Now shear force at 10ft

$\Sigma F_y = 0$ +↑ –



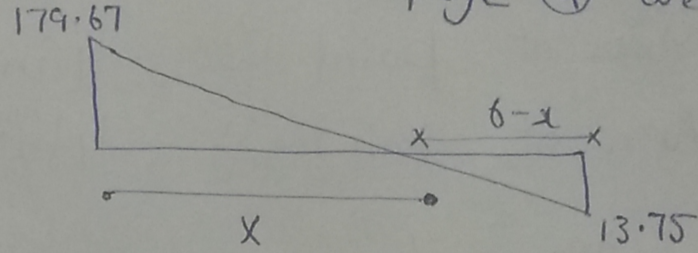
$$179.67 - 16.5 \times 6 - 110 - V_{10ft} = 0$$

$$V_{10\,ft} = 29.33 \text{ Lb}$$

- Point of max boundry movement

as we know that the point where shear force is mini the bending movement is max so from point of zero shear correspondng point will have max bending movment.

From shear force dia on page ② we have



. we know

$$\frac{179.67}{x} = \frac{13.75}{6-x}$$

$$x/(6-x) = \frac{13.75}{179}$$

$$x = 5.166 \text{ ft}$$

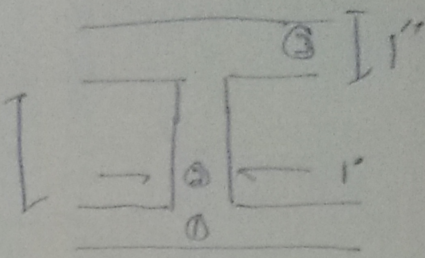
Now determin the value of movement at 5.166 ft

$$M_{5.166\,ft} - 440.4015 + 215.50 = 0$$

$$M_{5.166} = 224.899 \text{ lb-ft}$$

For shear stress we have $\tau = \frac{VQ}{Ib}$

So 1st we deter movement of Inertia I from given section



As given figure is symetrical along both the axiss,

So $\bar{x} = 4/2 = 2$ in ; $y = 6/2 = 3$ in

ie $(\bar{x}, \bar{y}) = (2,3)$ (center of gravity)

from extrem left and bottom

Area of Point ① = 4 in²

Area of point ② = 4 in²

Area of Point ③ = 4 in²

Movement of inertia about x axis (centroid)

→ Detering distances b/w C.G of the whole section find the correponding parts

$K_1 = \bar{y} - y_1 \quad = 3 - 0.5 = 2.5$ in

$K_2 = \bar{y} - y_2 \quad = 3 - 3 \quad = 0$ in

$K_3 = \bar{y} - y_3 \quad = 3 - 0.5 \quad = 2.5$ in

$I_{xx} = 4/12 + 25 + 64/12 + 4/12 + 25$

$I_{x} = 56$ in⁴

Now $I_{yy} = \frac{(4)^3(1)}{12} + \frac{(1)^3(4)}{12} + \frac{(4)^3(1)}{12} = 11$ in⁴