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Subject Hydraulic Structures

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Assignment # 1

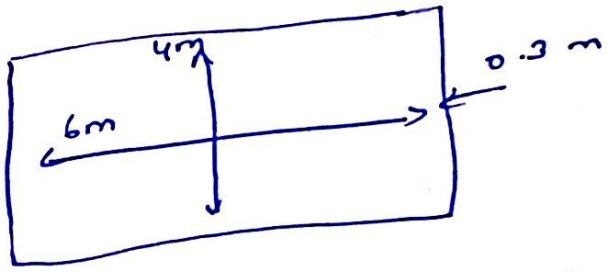
Q1 Establish the stage discharge relationship for a concrete rectangular box culvert.

Data:-

$L.L = 50\ KN/m^2$

$D.L = 12.8\ KN/m^2$

$\theta = 30^\circ$



Load Calculation:-

Total load on top slab = Self wt of slab + L.L + D.L

Self wt of slab = $0.3 \times 25 = 7.5\ KN/m^2$

w = total load = $7.5 + 50 + 12.8 = 70.3\ KN/m^2$

Coefficient of Earth Pressure:-

$$K_a = \frac{1-\sin\theta}{1+\sin\theta} = \frac{1-\sin 30}{1+\sin 30} = 0.33$$

Lateral pressure (DL + LL)

= total vertical load (LL + DL) $\times K_a$

$= (50 + 12.8)(0.33)$

$= 20.72\ KN/m^2$

Lateral pressure due to Soil:-

$= Ka * \gamma h$

$= 0.33 \times 18 \times 4.3$

$= 25.7\ KN/m^2$

Lateral pressure @ top

due to (DL + LL)

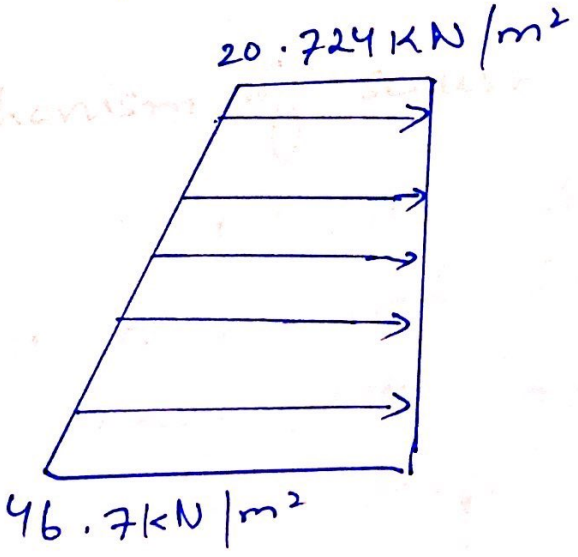
$= 20.724\ KN/m^2$

At bottom :-

Lateral pressure due to (DL+LL) + Lateral pressure due to soil

$= 20.724 + 25.7$

$= 46.7\ KN/m^2$



Q2) Loads on bridge's foundation due to Scour and their working mechanism.

Ans The success of a bridge relies on proper design and construction of its foundation. The high scouring rate of water will lead to washout the soil from the embankment of the abutment and the foundation piles which will cause the failure of the bridge. To protect the bridge foundation against scouring problem. It is recommded to use rock protection for the embankment and rive bed around the abutment.

Mechanism of scour:-

At the obstruction in form of pier or abutment, The unidirectional flow changes into three dimensional as the water pile up in front face of the obstruction and flow accelerates

around the nose. This phenomenon results in formation of vortex at the base of the pier known as horseshoe vortex and the vortex form in the vertical direction downstream of the pier known as wake vortex.