

S.Y.M.  
All B

, 2013

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## COLLEGE OF ENGINEERING, PUNE

S. Y. M. Tech. (Structures)  
Bridge Engineering (Elective II)

Time – 3 Hours

Max. Marks – 60

Instructions:

1. Figures to the right indicate full marks.
2. Use, of Non-programmable calculator is allowed.
3. Use of relevant IS codes, IRC codes, is allowed
4. Assume suitable data, if necessary.

**Q. 1]** A reinforced concrete box culvert is required for a national highway crossing with a clear vent way of 4 m X 4 m. Design the box culvert. **[15]**

- Superimposed dead load of 15 kN/m<sup>2</sup>
- Live load of 50 kN/m<sup>2</sup>
- Density of the soil is 16 kN/m<sup>3</sup>
- Angle of repose of the soil - 30°
- Concrete M 25, Steel Fe 415

**Q. 2a]** Explain the constructional methodology for the balanced cantilever bridge construction. **[06]**

**Q. 2b]** What are the vibration control devices? How are they useful for bridge construction? Explain in detail. **[09]**

**Q. 3]** A pier supports the deck forming a major highway. The various forces acting on the pier are listed below: *Two lane - 7.5m width & Passageway* **[15]**

- Dead loads from each span - 2000 kN
- Reaction due to live load on one span - 1300 kN
- Braking forces – 190 kN
- Wind pressure on the pier – 2.5 kN/m<sup>2</sup>
- Material of the pier - Reinforced Concrete of M-25 grade
- Density of concrete – 25 kN/m<sup>3</sup>

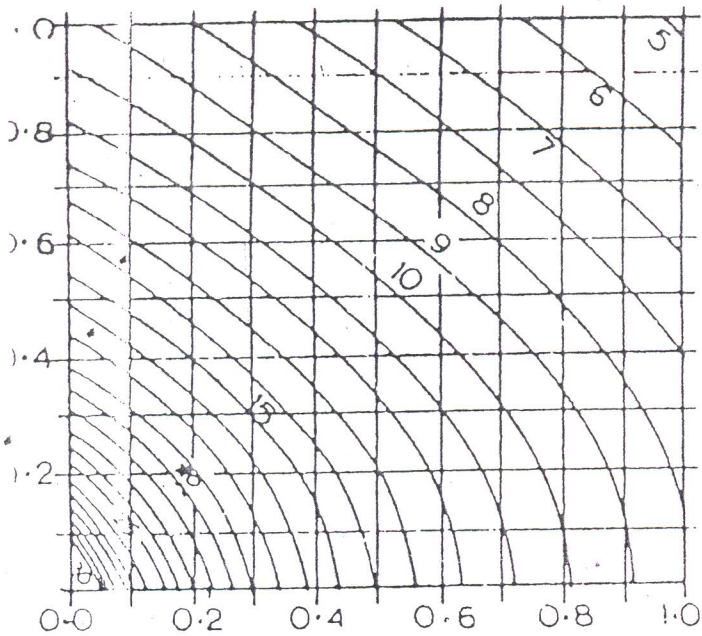
Estimate the maximum and minimum stresses developed at the base of pier due to the critical combinations of the various loads as per IRC.

- Pier details are - Height – 12.0 m, HFL – 10.0 m
- Pier width - at Top – 2.5 m, at bottom – 4.5 m, ends are shaped circular

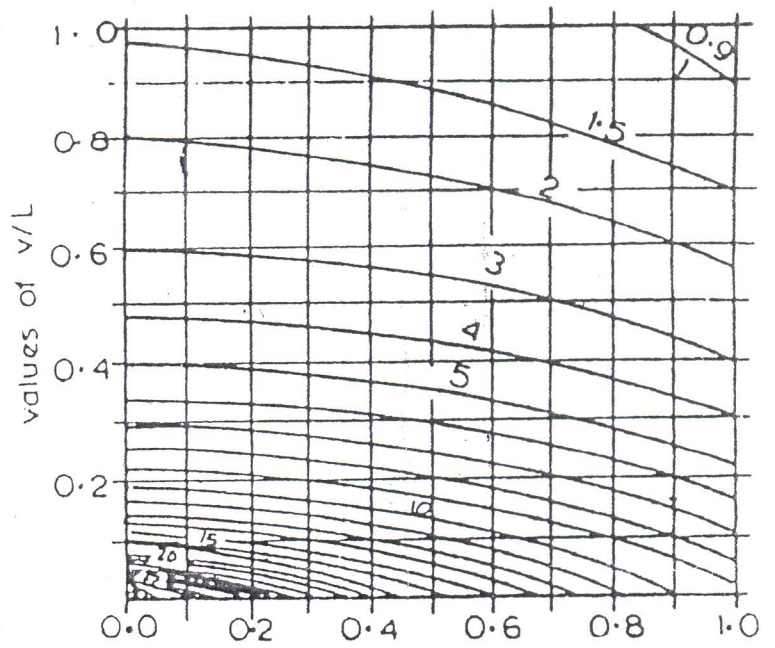
**Q. 4]** Calculate the foundation pressures at the base of the circular well with the following particulars: **[15]**

- Depth of well – 25 m, Diameter of well – 7.0 m,
- Depth below maximum scour – 10.0 m
- $Q = 1050$  kN acting at 35.0 m above the base of well under seismic condition
- Weight of superstructure – 8000 kN, Weight of pier – 1500 kN
- Weight of well - 900 kN
- Soil around the well is mixed type having  
(i)  $C = 0.2$  kg/cm<sup>2</sup> (ii)  $\Phi = 15^\circ$  (iii)  $\gamma = 1800$  kg/m<sup>3</sup>
- Permissible foundation pressures under seismic conditions are 500 kN/m<sup>2</sup> and no tension.

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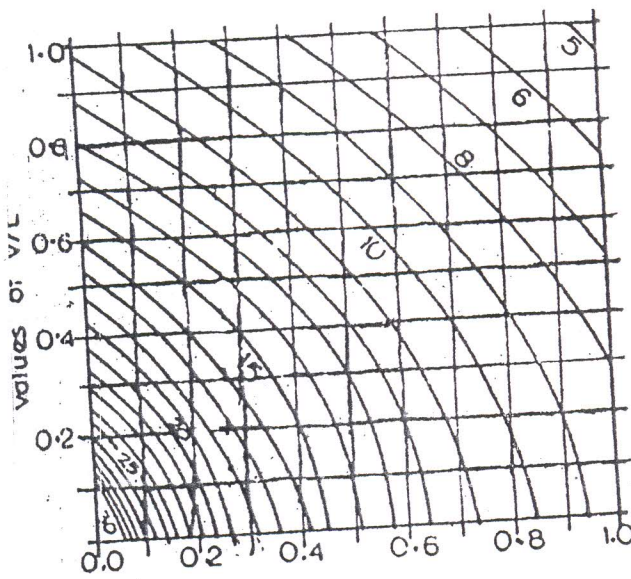


values of  $u/B$   
a. Coefficient  $m_1 \times 100$

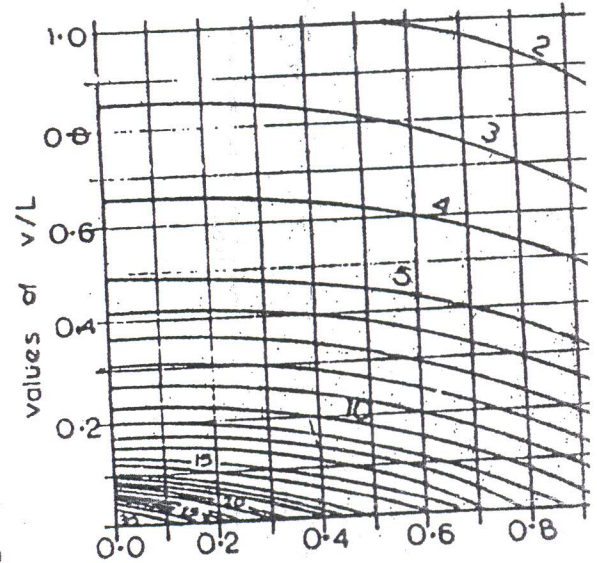


values of  $u/B$   
b. Coefficient  $m_2 \times 100$

for  $k=0.5$



values of  $u/B$   
a. Coefficient  $m_1 \times 100$



values of  $u/B$   
b. Coefficient  $m_2 \times 100$

for  $k=0.6$