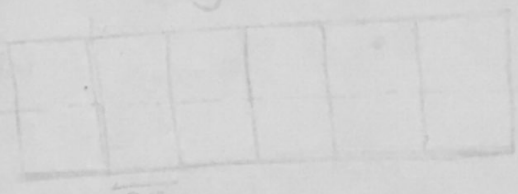
Railway Bridge

Q41

↳ Ballasted through bridge

XG spacing = 2.5m



* Dead Loads:

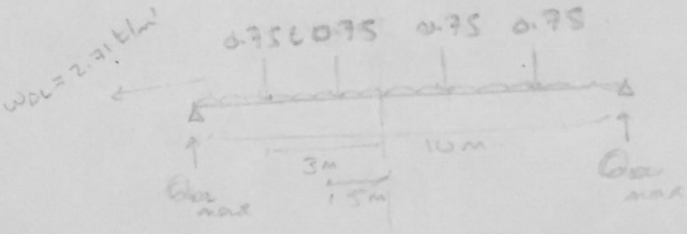
assume $o_w = 0.25\ t/m'$

$$w_{DL} = w_{ow} + w_{ballast} + w_{conc}$$
$$= (0.25) + (1.8 * 0.2 * 2.5) + (2.5 * 0.25 * 2.5) = 2.7125\ t/m'$$

→ load from rails $= \frac{0.6}{2} * 2.5 = 0.75t$

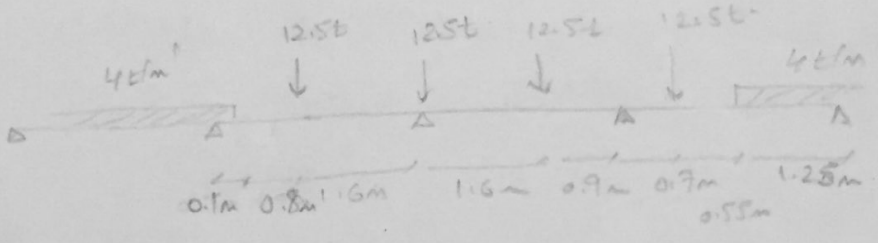
$$Q_{DL_{max}} = 2.7125 * \frac{10}{2} + \left(\frac{0.75 * 4}{2}\right) = 15.06t$$

$$M_{DL_{max}} = (15.06 * 5) - (1.5 * 3) - (1.5 * 1.5) - \left(2.71 * \frac{5^2}{2}\right) = 38.05\ t.m$$



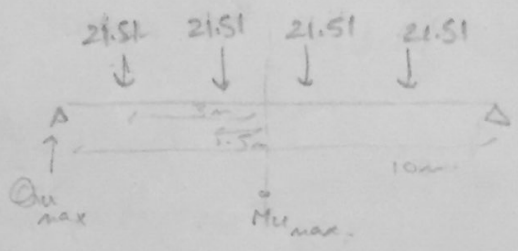
* Live Loads:

$$P_{LL} = (12.5) + \left(\frac{12.5 * 0.9}{2.5}\right) + \left(\frac{12.5 * 0.9}{2.5}\right) + \left(\frac{4 * 0.1^2/2}{2.5}\right)$$
$$= 21.51t$$



$$Q_{LL_{max}} = \frac{21.51 * 4}{2} = 43.02t$$

$$M_{LL_{max}} = (43.02 * 5) - (21.51 * 1.5) - (21.51 * 3) = 118.3\ t.m$$



→ impact factor (I):

$$\phi = 0.73 + \frac{2.16}{\sqrt{LI} - 0.2}$$

2 tracks.

LI = 2 * spacing bet xG * 2 = 2 * 2.5 * 2 = 10 m.

$$\phi = 0.73 + \frac{2.16}{\sqrt{10} - 0.2} = 1.46$$

$I = \phi - 1 = 0.46 > 0.1$ & < 1 ∴ OK.

→ Ballasted effect:

∵ $t_{Ballast} = 20cm$ $(< 50cm)$ ∴ $I_{real} = 0.8\,I = 0.8 * 0.46 = 0.37$

$M_{u+imp} = 1183 \times (1+0.37) = 162.07 mT$

$Q_{u+imp} = 43.02 \times (1+0.37) = 58.94 t.$

$Q_T = Q_{DL} + Q_{u+imp} = 15.06 + 58.94 = 74 t$

$M_T = M_{DL} + M_{u+imp} = 38.05 + 162.07 = 200.12 mt$

⟹ NO BREAKING or DRAGGING FORCES or LATERAL SHOCKS

∵ BALLASTED ∴ CONCRETE ACTS AS DIAPRAGM