FATIGUE OF THE SUSPENSION REINFORCEMENT

LOADS

Self weight $g_s := 0.5 \cdot 1.43 m^2 \cdot 25 \frac{kN}{m^3} = 17.875 \cdot \frac{kN}{m}$

Ballast + rail $g_r := 0.5 \cdot \left(3300mm \cdot 550mm \cdot 18 \frac{kN}{m^3} + 6.2 \frac{kN}{m} \right) = 19.435 \cdot \frac{kN}{m}$

$G_s := g_s + g_r = 37.31 \cdot \frac{kN}{m}$

Dynamic factor

Spans $L_1 := 11m$ $L_2 := 11m$

Determinant length

$L_\Phi := 1.2 \cdot \frac{1}{2}(L_1 + L_2) = 13.2\,m$

$\Phi_{2.1} := \frac{1.44}{\sqrt{\frac{L_\Phi}{m}} - 0.2} + 0.82 = 1.239$

$$\Phi_2 := \begin{cases} 1 & \text{if } \Phi_{2.1} < 1 \\ \Phi_{2.1} & \text{if } 1 \le \Phi_{2.1} \le 1.67 \\ 1.67 & \text{otherwise} \end{cases} = 1.239$$

Train load (axle load) $Q_{vk} = 250 \cdot kN$

Divide length $L_q = 1.6\,m$

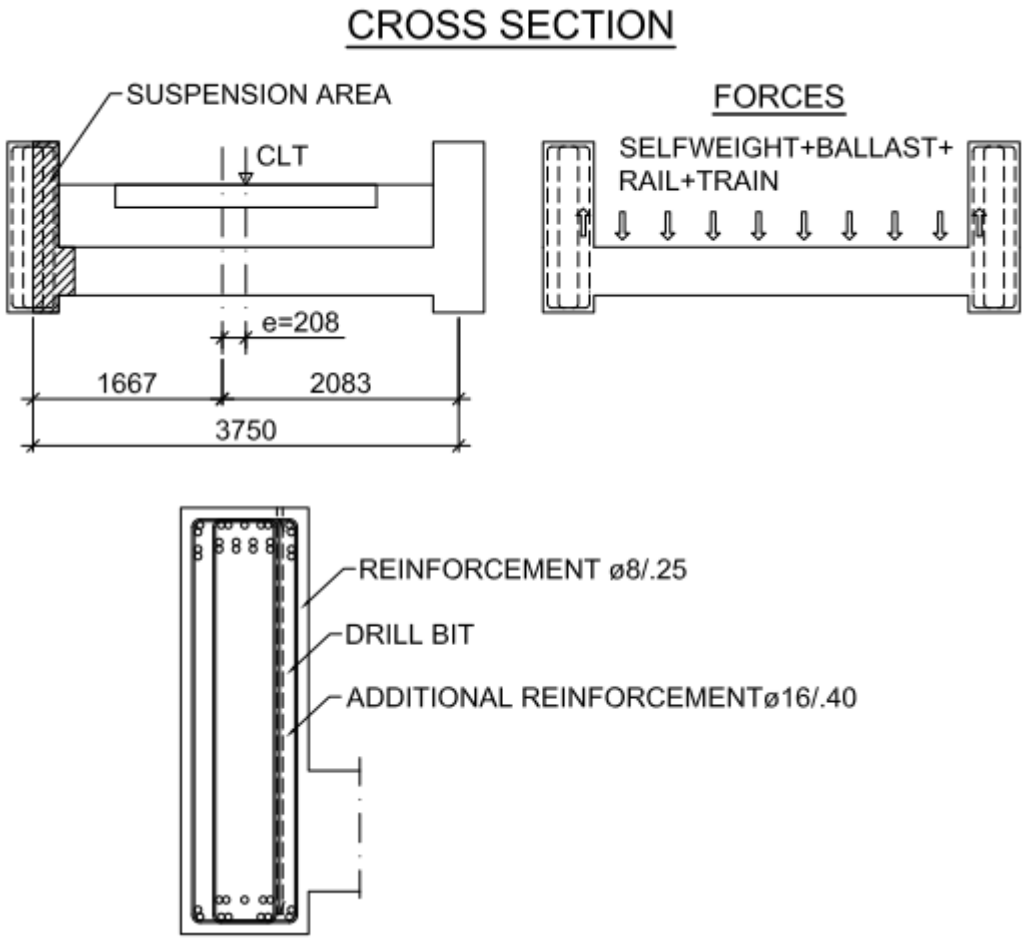
Divided load

$q_T := \frac{Q_{vk} \cdot \Phi_2}{L_q} = 193.662 \cdot \frac{kN}{m}$

Eccentricity of the train load $e_{LM} = 208 \cdot mm$

Span of the beams $L_S := 3750mm$

Train load to one beam $F_T := q_T \cdot \frac{\left[L_S - \left(0.5 \cdot L_S - e_{LM} \right) \right]}{L_S} = 107.573 \cdot \frac{kN}{m}$



Reinforcement (2*ø8 k250)

$$A_s := \frac{1000}{250}\cdot 2\cdot(0.5\cdot 8\text{mm})^2\cdot\pi = 402.124\cdot\text{mm}^2$$

Reinforcement design strength in fatigue $f_{fat} := 300\,\frac{N}{mm^2}$

Suspension resistance		suspension load
$N_{R.fat} := f_{fat}\cdot A_s = 120.637\cdot\text{kN}$	<	$F_T + G_s = 144.883\cdot\frac{kN}{m}$

Torsion and shear are not included => suspension reinforcement is not sufficient.

Suspension reinforcement in fatigue

$$A_{s.add} := \frac{F_T + G_s}{f_{fat}} = 482.942\cdot\frac{mm^2}{m}$$

Additional reinforcement for suspension ø16 k400

$$A_{s.d} := (0.5\cdot 16\text{mm})^2\cdot\pi\cdot\frac{1000}{400} = 502.655\cdot\text{mm}^2$$