Q.1

Design the slab of the Bridge, use live load positive moment for calculating of top and bottom reinforcement, thickness of slab is 200mm and wearing surface is 6cm ($\gamma_{asphalt}$ =23kN/m^3).

[Hint: ***no need for check of crack control, reinforcement limits and spacing*****].**

Q.2

Design an interior girder for flexure (i.e. calculate required No. of strands) and calculate Safety factor for the section, use DM = 0.299.

[Hint: consider that the final stress at bottom to be tension and its value less than 3.0MPa under full-service load].

Q.3

Design an interior girder for shear, consider load combination STRENGHT I. Use DV = 0.468 and elastomeric pad dimensions are 25x25cm.

[Hint: consider only prestress strands for calculating dv].

Q.4

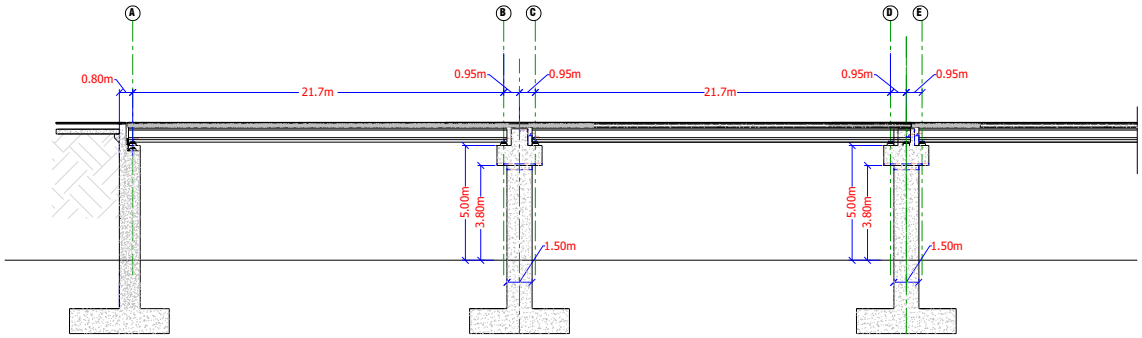
1. **Calculates stresses at top and bottom at mid-span of the girder immediately after transfer.**
2. **Calculate stresses at top and bottom at mid-span under full-service loads.**

Q.5

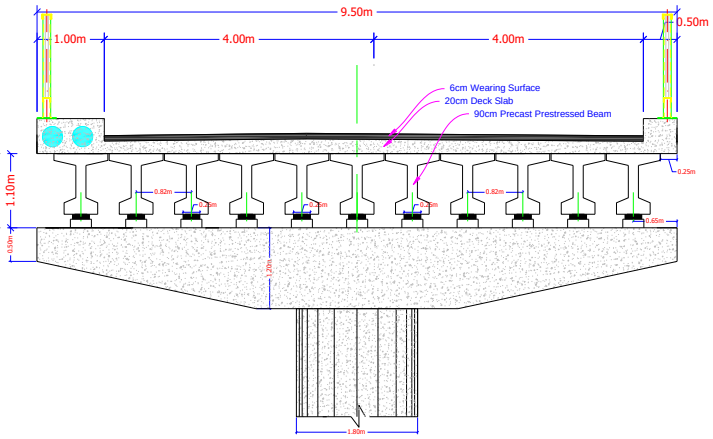
Calculate total deflections for an interior girder (dead load, live load and prestress), use load combination SERVICE I.

Given or design data:

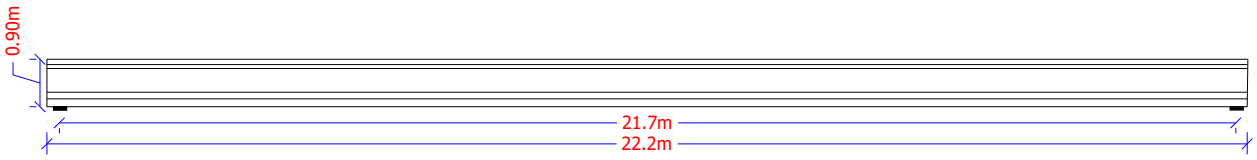
1. Girder properties, longitudinal and cross sections with detail of supports given in attached drawings.
2. Concrete properties; fc`=40MPa and fc`i=32MPa for the girder, fc`=25MPa for the slab, use $\gamma_c$=25kN/m$^3$, Ec = 4700$\sqrt{f`c}$.
3. Steel properties; fy = 420 MPa for all types of reinforcement, fs = 210MPa when required.
4. Strand properties; low relaxation strand used with fpu = 1862MPa, fpy = 1676MPa, initial stress in strands immediately after transfer, fsi = 1253MPa, effective stress after all losses, fse = 1076MPa, diameter of strands = 15.24mm, area of one strand = 140mm^2, eccentricity at mid-span = y_b – 10cm and EP = 197GPa .
5. Standard Truck: Either use HL-93 or IL-120. Use Truck + lane load and IM = 30%.



Longitudinal section



Cross section



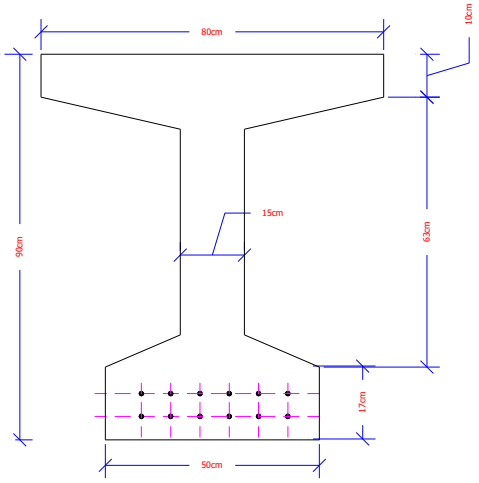
Typical girder

Pre-stress girder properties

$A_g = 0.284m^2$
$I_g = 0.03m^4$
$y_b = 0.484m$
$y_t = 0.416m$

stress composite girder properties

$A_g = 0.414m^2$
$I_g = 0.054m^4$
$y_b = 0.646m$
$y_t = 0.454m$



Section with pre-stress tendons