

## 49131 – Bridge Design, Autumn 2017

### Assignment 2

A cable-stayed pedestrian bridge is to be designed across a river (see the attached figures for technical details). The span of the bridge is 70m and the available deck width is 4m. The concrete deck consists of 5 precast segments of 14m in length, prestressed together for continuity. Free height above the flood flow is 0.7m. The deck is made of reinforced concrete and prestress is applied where necessary (partially prestressed). (Also prestressing forces are applied on to the deck by the stay cable forces).

The pylon is kept vertical under the action of dead load. The deck is kept horizontal by prestressing so that the deck is horizontal when there is no tension in the stay cables.

- (i) For the section(s) provided, calculate the second moment of area and the position of the centroidal axis at critical sections.
- (ii) Design the section as a reinforced concrete deck or reinforced concrete with some prestressing where appropriate considering the support positions of the cables and the position of the pylon. You may use the given amount of reinforcement and prestressing tendons as a guide – Note that in the given diagrams, mild steel round bars are used as reinforcement whereas your design should use high yield steel as reinforcement.
- (iii) Calculate the design tensile forces in the cables under static loads (Dynamics effects need not be considered).
- (iv) Find the Maximum axial load and lateral load on the pylon due to cable tensions.

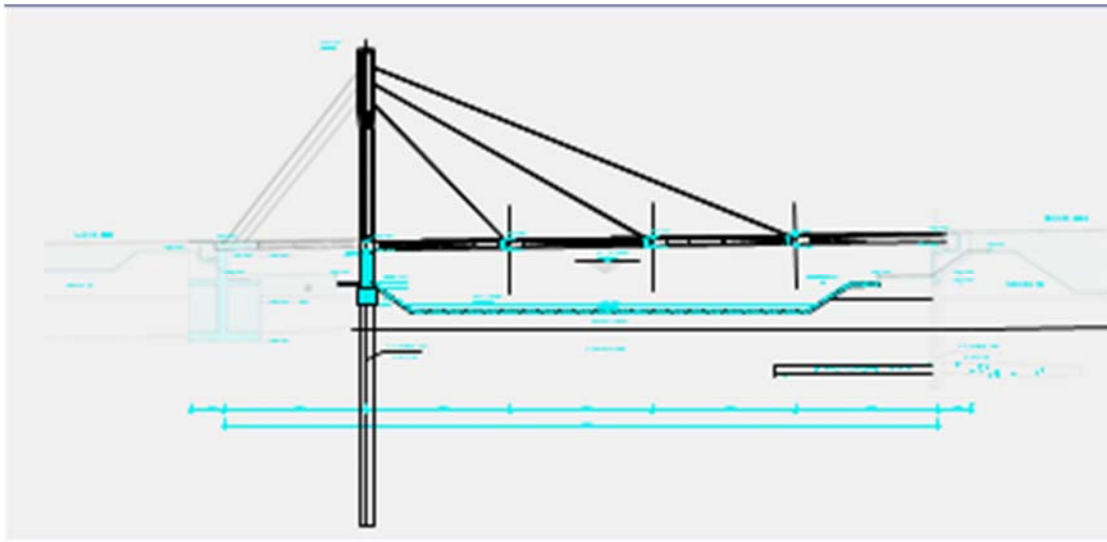



Figure 1 Longitudinal section – Layout Diagram

## Description of bridge structures

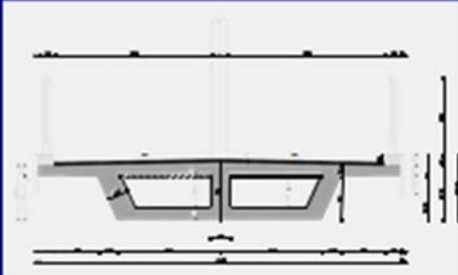
superstructure: **girder**

- Cross sections of the girder :

- section in the span



- Section in the support zone



- Section in the pylon zone

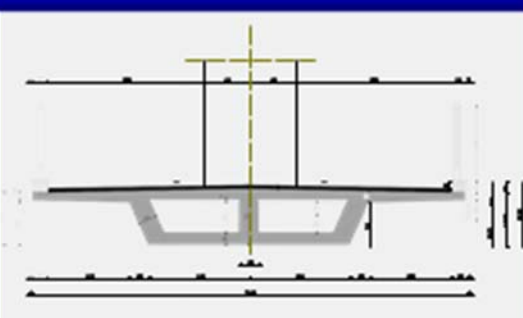


Figure 2 Typical cross sections of the Prestressed box section

# Reinforcement plans

- Reinforcement of the main girder

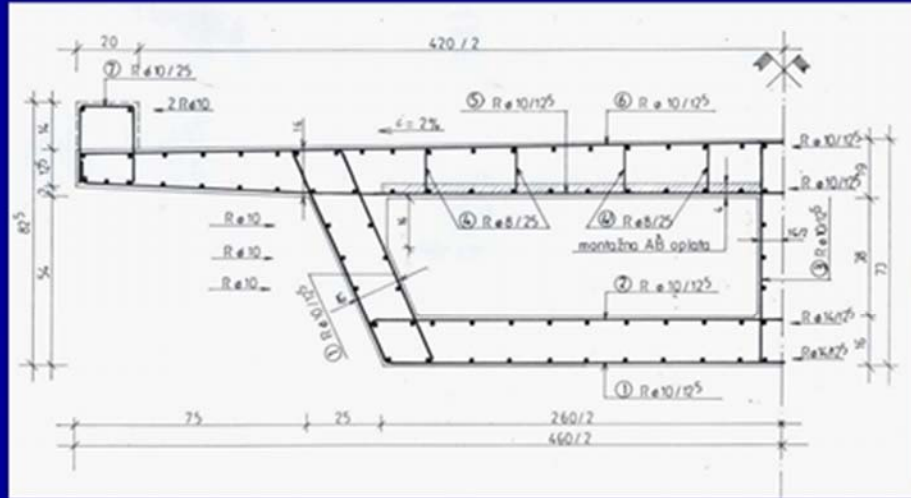
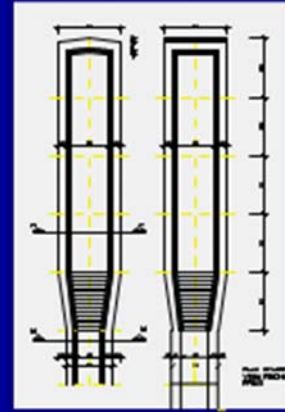
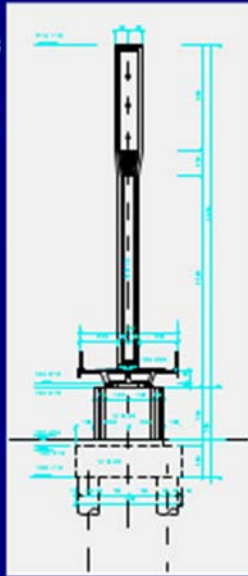
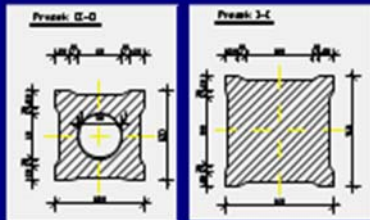


Figure 3 Detailed cross section showing reinforcement layout

# Description of bridge structures

superstructure: **pylon**

- First 1.5 m of pylon height the cross section of square shape, solid concrete,
- following 10.5 m the cross section is voided and mould, 120 x 120 cm,
- next 1.5 m – the transition to the pylon head (solid mould cross section)
- head of pylon - solid mould cross section 160.0 x 160.0 cm



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Figure 4 Cross Section of the Pylon and Layout Diagram

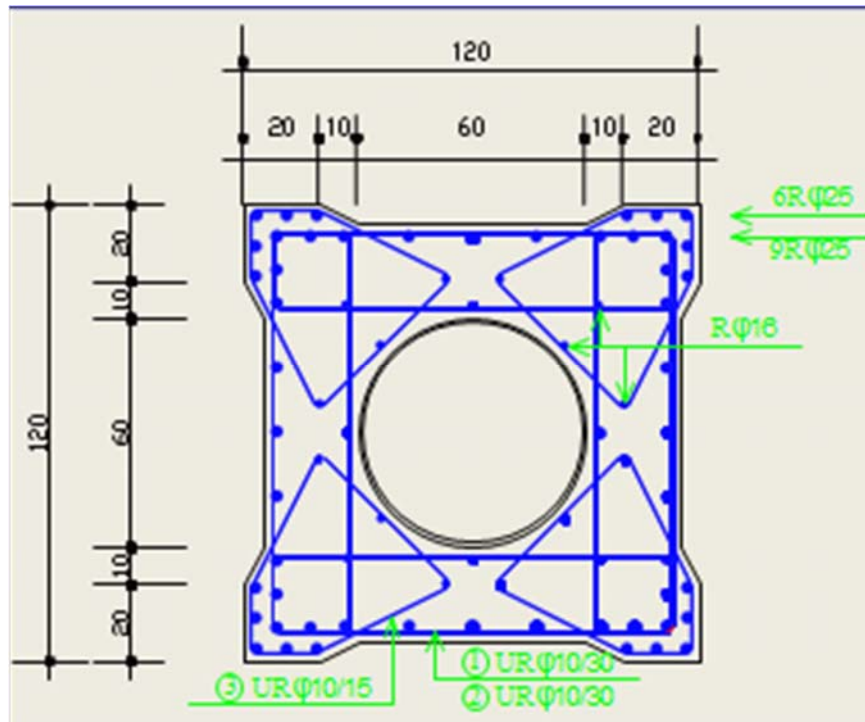


Figure 5 Typical Detailed cross section of the Pylon