

CIV-E4050 Prestressed and Precast Concrete Structures

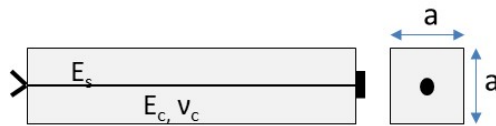
Examination 21.10.2020 (remote examination using My Course)

A precondition for the participation in the examination is the fulfilment of compulsory parts of the course in the autumn 2020 or earlier.

Question 2

Scan your handwritten answers and upload the scanned document as a pdf-file within the period given for this task

2. The unbonded tendon along the centerline of the section is jacked up to the 1800 MPa. The diameter of the tendon is 15.7 mm and the tendon force 348 kN. The length of the side a is 150 mm and the length of the pole is 4 m. (altogether 7p)



$$E_s = 200000 \text{ MPa}$$

$$E_c = 30000 \text{ MPa}$$

$$\text{Creep coefficient is } 2, E_{c \text{ with creep}} = E_c / (2+1)$$

$$\mu = 0.15 \text{ 1/rad}$$

$$k = 0.017 \text{ 1/m}$$

- a) What are the losses caused by elastic shortening and creep? (2p)
- b) What is the total loss caused by the friction and curvature? You may utilize the equation below. (1p)

$$F = (F_0 e^{-\mu\theta}) e^{-\mu kx} = F_0 e^{-\mu(\theta+kx)}$$

- c) What is the influence length of the loss caused by an anchorage set of 6 mm? (2p). What is the effect of this loss on the values of tendon stress at the ends of the tendon? (2p). You may utilize the equation below.

$$X = \sqrt{\frac{E_{ps} \delta}{f_1 \lambda}} \quad (\lambda x = \mu\theta + \mu kx)$$