Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	PRESTRESSED CONCRETE DESIGN
COURSE CODE	:	BFS 40303
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTION	1.	ANSWER ALL QUESTIONS
	2.	THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSED BOOK.**
	3.	STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 **Figure Q1(a)** shows the floor plan of a stadium platform. The floor of the platform uses precast prestressed hollow core slabs. The hollow core slabs are sitting on the post-tensioned beams.The cross section of the hollow core slab is shown in **Figure Q1(b)**. Given the following data:

Hollow core slab:

Unit weight of concrete	=	25 kN/m^3
Cross sectional area	=	175 x 10^3 mm^2
Concrete topping and finishes	=	3.0 kN/m^2
Variable action	=	5.0 kN/m^2
Moment of inertia	=	1.56 x 10^9 mm^4

Prestressing tendon:

Eccentricity of tendons above soffit	=	20 mm
Total short term loss (α)	=	10%
Total long term loss (β)	=	20%
Maximum allowable concrete stress at transfer (f'_{max})	=	20 N/mm^2
Maximum allowable concrete stress at service (f_{max})	=	13.5 N/mm^2
Minimum allowable concrete stress at transfer (f'_{min})	=	-1.0 N/mm^2
Minimum allowable concrete stress at service (f_{min})	=	0 N/mm^2
Area of 7-wire 12.5 mm helical strand (A_{ps})	=	94.2 mm^2
Maximum strength of tendon (f_{pu})	=	1750 N/mm^2

(a) Determine the suitable range of prestressing force for the hollow core slab.
(16 marks)

(b) Evaluate the minimum number of tendons required. Assume the initial prestressing force is taken as 70%.
(4 marks)

(c) Estimate the minimum depth of the slab required, if the floor is decided to use a solid rectangular post-tensioned concrete slab.
(16 marks)

(d) What is the precaution need to be taken for the storage of precast hollow core slab?
(4 marks)

Q2 The end block of the post-tensioned beam (PB) in **Q1** is shown in **Figure Q2**. The end-block containing six cables, each of 7 strands of 18 mm diameter tensioned up to 1800 kN. The cables are anchored in the rectangular end block of 500 mm wide and 1000 mm deep using a 250 mm square bearing plate placed at a distance of 250 mm from the top surface. Given the following information:

Strength of concrete, f_{cu}	=	45 MPa
Strength of concrete at transfer, f_{ci}	=	30 MPa
Allowable maximum stress of steel	=	150 MPa

Based on beam analogy:

(a) Design the reinforcement for the end block to resist bursting tension forces.
(20 marks)

(b) Design the reinforcement for the end block to resist splitting tension force.
(6 marks)

(c) Draw the reinforcement details for the end block.
(4 marks)

Q3 Referring to the post-tensioned beam (PB) shown in **Figure Q1(a)** and its elevation in **Figure Q2**. Given the following data:

Strength of concrete at 28 days, f_{cu}	=	45 MPa
Young's Modulus of concrete, E_c	=	30 GPa
Strength of cable, f_{pu}	=	1700 N/mm^2
Cross sectional area of prestressing cable	=	223 mm^2
Total prestress loss	=	25%
Unit weight of concrete	=	25 kN/m^3

(a) Determine the ultimate moment resistance of the post-tensioned beam (PB).
(16 marks)

(b) Check the adequacy of the bending moment capacity of the post-tensioned beam (PB).
(8 marks)

(c) If the deflection check of the post-tensioned beam (PB) is failed, suggest **TWO (2)** solutions without changing the cross section of the beam.
(6 marks)

- END OF QUESTIONS-

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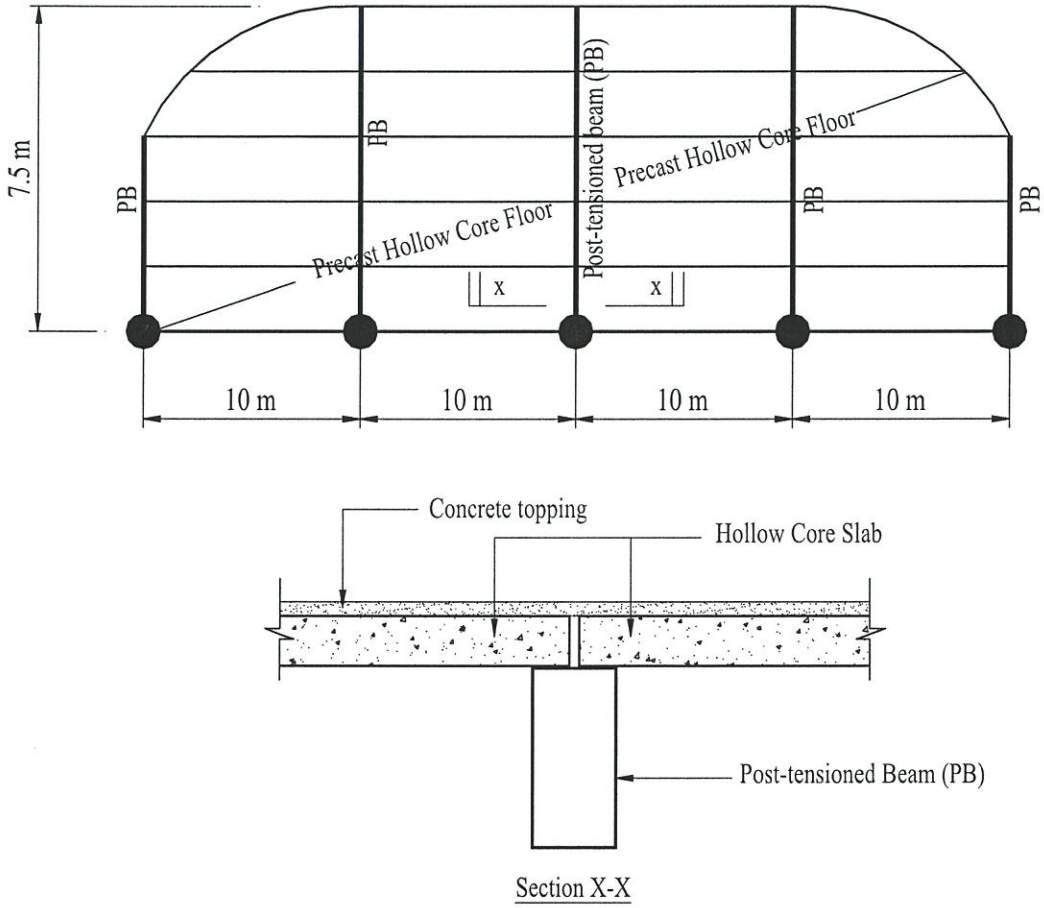

FIGURE Q1(a)

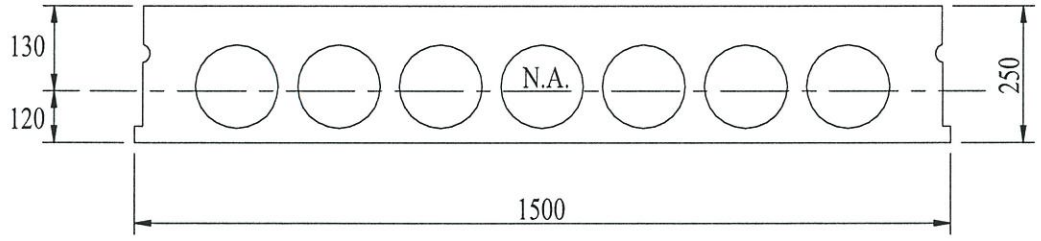

FIGURE Q1(b)

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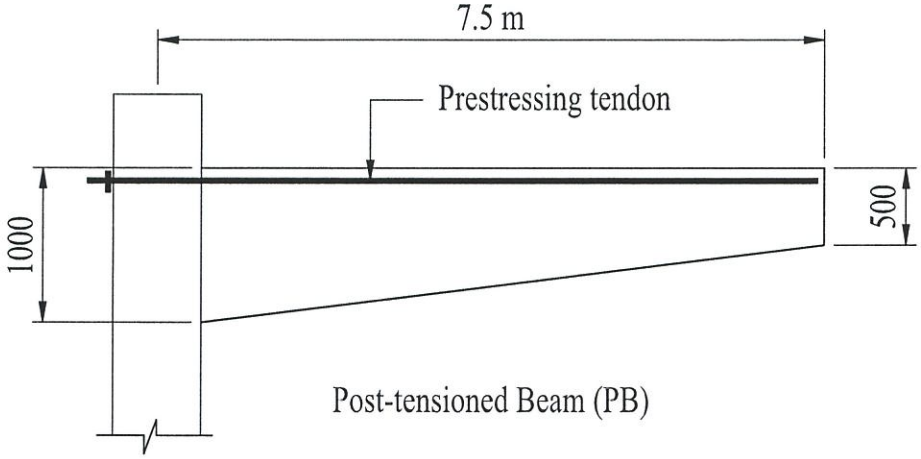
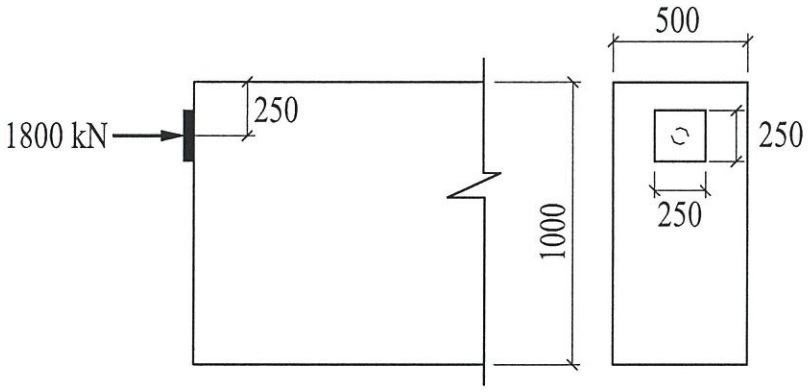


Post-tensioned Beam (PB)



End Block of Post-tensioned Beam

FIGURE Q2