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OLLSCOIL NA hÉIREANN, GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY

Academic Year 2005-06
SEMESTER I EXAMINATIONS
B.E. DEGREE

CE405 / CE427 DESIGN OF CONCRETE STRUCTURES

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Time allowed: 2 hours

Answer *two questions* - Question 1 (30 marks) and *either* Question 2 or Question 3 (20 marks)

1. The use of *Extracts from British Standards for Students of Structural Design* is permitted. Alternatively, BS8110 may be used.
2. (a) All dimensions are in mm., unless noted otherwise.
For Q1 and Q3 assume moderate conditions of exposure, and 1 hour fire resistance.
For Q2, assume severe conditions of exposure, and no fire resistance requirement.
Concrete grades will be the minimum required for these conditions.
 $f_y = 460 \text{ N/mm}^2$ for longitudinal reinforcement and
 $f_y = 250 \text{ N/mm}^2$ for shear reinforcement.
(b) For Question 1 reinforcement detailing must be sufficient to permit scheduling.
Less detail is expected in Q2 and Q3. Neat pencil sketches will be adequate for all questions.
(c) In this examination, soundly based *approximate* calculations combined with sketches are preferable to highly detailed calculations submitted without accompanying drawings.
Exercise engineering judgement, where necessary, to progress a design.
Avoid unnecessary iteration or refinement of calculation in the examination.

1. (a) An air-conditioned multi-storey office building is being considered for a town centre site, for which a concrete or mixed steel-concrete solution is envisaged. Discuss the principal constructional options which should come under scrutiny. (8 marks)

(b) Fig. Q1 shows part of the structural grid for a multi-storey office building which is to be cast in-situ. Determine a suitable thickness for the floor slab, and *design, detail and schedule* the shaded slab panel G1 – F2, together with beam G2-F2. Indicate any simplifying assumptions.

Loadings are as follows:

floor finishes	1.25 kN/m ²
mechanical & electrical services	0.5 kN/m ²
false ceilings	0.35 kN/m ²
removable partitioning	1.75 kN/m ²
imposed floor loading	2.5 kN/m ²

(22 marks)

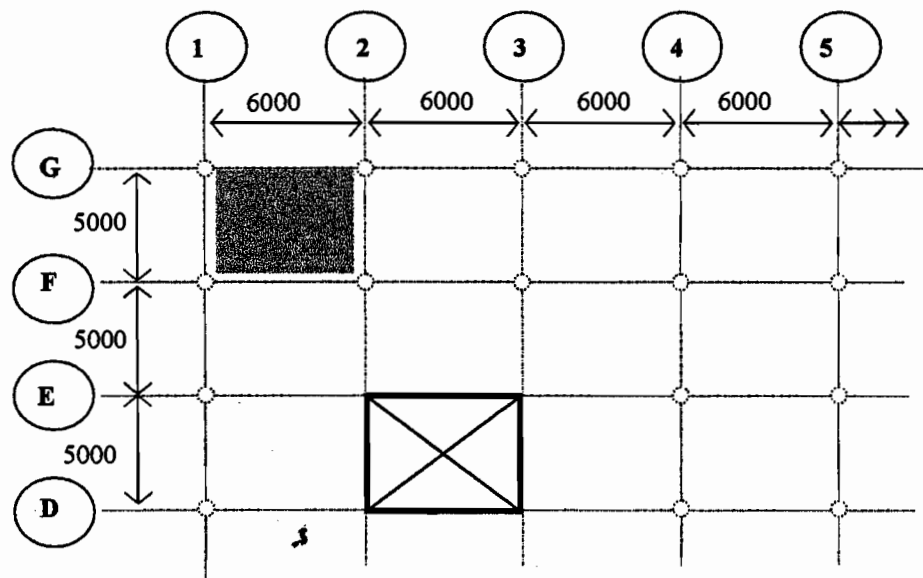
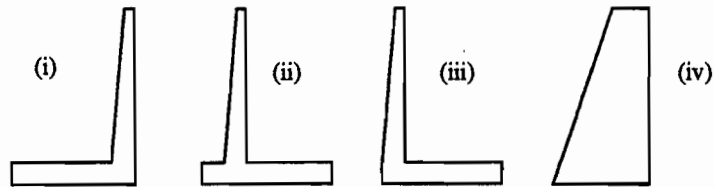


Fig. Q1

2. (a) Comment briefly on the efficiency of the following shapes of concrete retaining wall.

(4 marks)



- (b) A cantilever retaining wall is required to sustain the difference in ground level shown in fig.Q2, in addition to a uniformly distributed surcharge of 13.5 kN/m^2 .

- (i) Select trial dimensions for the wall, outlining reasons for your choices. (2 marks)
- (ii) Calculate stability relative to overturning and sliding (6 marks)
- (iii) Calculate pressures under the base. (5 marks)
- (iv) Discuss the rationale determining curtailment of stem reinforcement. (3 marks)

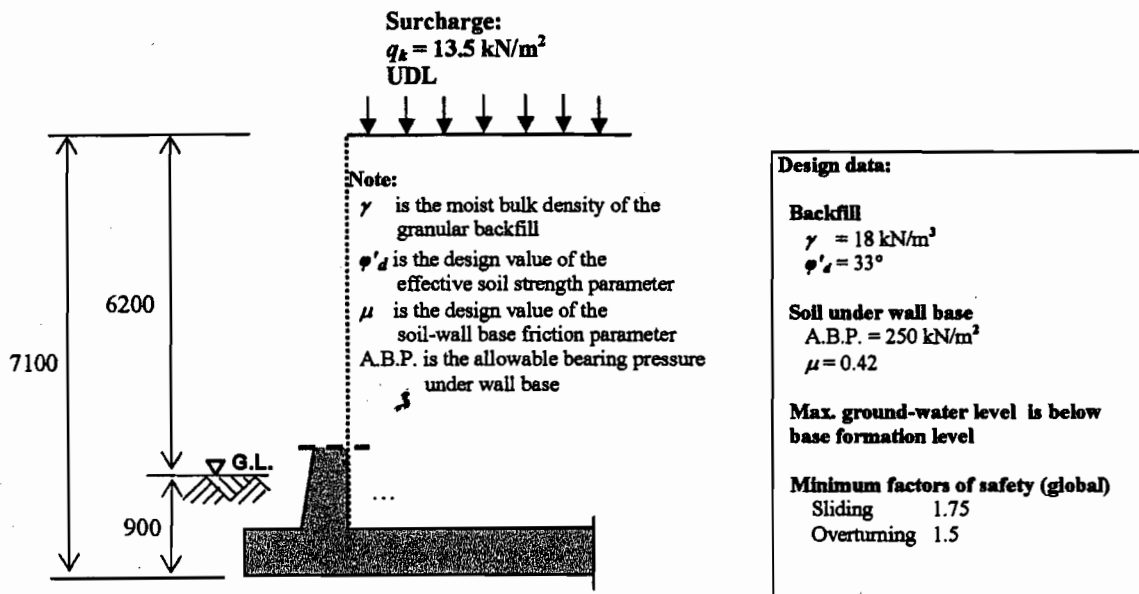


Fig. Q2 Wall and soil data

3. (a) With reference to the beam shown IN Fig. Q3, indicate how familiarity with influence lines might assist qualitatively in the assessment of the most critical loading patterns - from the point of view of bending moments - for the two outer spans.

(3 marks)

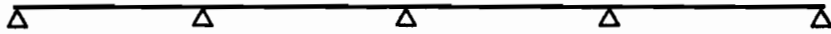


Fig. Q3

- (b) (i) Using approximate design procedures, obtain an estimate of axial loads on columns G1, F1 and F2 in Fig. Q1, directly above foundation level, assuming the building to consist of 12 storeys. (5 marks)
- (ii) Explain why pile caps should not be designed on the basis of conventional engineers' bending theory. (2 marks)
- (ii) Assuming that a piled foundation consisting of 4 No. 300 diameter cast-in-situ piles is required to support column B2, design a suitable pile cap, and sketch reinforcement details. (10 marks)