Engineering Tripos Part IIB, 4D5: Foundation Engineering, 2020-21

Module Leader

Dr S Stanier [1]

Lecturers

Dr S Stanier and Dr C N Abadie [2]

Timing and Structure

Michaelmas term. 14 lectures. Assessment: 100% exam

Prerequisites

3D2 assumed

Aims

The aims of the course are to:

- introduce the challenges of foundation design and examine possible solutions from simple pad footings, through piles and caissons.

Objectives

As specific objectives, by the end of the course students should be able to:

- assess the design requirements of a foundation;
- deduce appropriate soil properties for foundation design from site investigation data;
- decide whether to use a shallow or deep foundation;
- design shallow and deep foundations against collapse;
- design shallow and deep foundations against excessive settlement;
- explain the difference between drained and undrained response;
- recognise mechanisms which contribute to generating deformations and load capacity; and
- back-analyse observed foundation performance.

Content

All civil engineering structures from houses to tethered oil and gas platforms require foundations.

The module begins by examining the requirements of a foundation; the applied loading, the acceptable deformations and the derivation of appropriate soil properties for each aspect of design.

The module then builds on material from 3D2 (geotechnical engineering) to examine theoretical solutions for the capacity (strength) and settlement (stiffness) of shallow and deep foundations under simple loading conditions in idealised soils. Strength is dealt with using plasticity. Stiffness is dealt with using elasticity. These theoretical solutions are then extended to more complex loading conditions and less idealised soils.

Obtaining Geotechnical Data

- Site investigation methods;
- Field measurements of soil stiffness;
- Laboratory assessment of soil strength and stiffness parameters; and
- Small strain stiffness of soils.

Foundation Design

- Foundation types;
- Loading conditions;
- Relevant soil behaviour and soil models; and
- Selection of design soil properties.

Shallow Foundations

- Strength: undrained failure of strip footings: vertical (V), horizontal (H) and moment (M) capacity;
- Strength: drained failure of strip footings: V-H-M capacity, superposition of surcharge and self-weight effects;
- Effects of footing shape and embedment, and soil heterogeneity;
- Stiffness: elastic settlement of shallow foundations: drained and undrained; and
- Stiffness: settlement of shallow foundations on non-linear soil.

Deep Foundations

- Deep foundation types and construction methods; piles and caissons.
- Pile strength: axial and lateral capacity;
- Pile stiffness: axial and lateral deformations;
- Piles: load testing, influence of installation method on performance; and
- Pile groups: mutual influence, block behaviour, differential settlement.

Booklists

Please refer to the Booklist for Part IIB Courses for references to this module, this can be found on the associated Moodle course.

Examination Guidelines

Please refer to Form & conduct of the examinations [3].

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Links
[1] mailto:sas229@cam.ac.uk
[2] mailto:sas229@cam.ac.uk, cna24@cam.ac.uk
[3] https://teaching26-27.eng.cam.ac.uk/content/form-conduct-examinations