Engineering Tripos Part IIB, 4D4: Construction Engineering, 2014-15

Module Leader
Prof R Mair

Lecturers
Prof R Mair, Dr I Brilakis, Dr M Elshafie and 1 external speaker

Timing and Structure
Lent term. 14 lectures. Assessment: 100% coursework

Prerequisites
3D1, 3D2 and 4D16 useful

Aims
The aims of the course are to:

- familiarise students with key design and construction aspects of those areas of ground engineering which are commonly encountered in many major civil engineering projects.

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

- understand the key issues in design and construction of major civil engineering infrastructure.
- understand the basics of construction site development, earth removing methods and earth excavation techniques.
- understand the practical considerations for loading and hauling operations including productivity estimation and equipment selection.
- address stability and deformation problems relating to different types of deep excavation construction (e.g. diaphragm walls, top-down construction, bottom-up construction) in different ground conditions.
- understand the principal design and construction problems associated with bored tunnel projects.
- estimate ground movements caused by deep excavations and tunnelling and assess their effects on buildings and services.
- select appropriate protective and ground improvement measures for different underground construction problems.
- understand the principal considerations associated with ground water control during construction.
- understand the conventional and advanced instrumentation techniques used for measuring ground movements and mechanical strain in practice including advantages and limitations.
- understand the basics for formwork design and the relevant installation procedures.
- understand the different crane systems used in practice including the basic principles involved in terms of selection and operation.

Content
This module aims to familiarise students with key design and construction aspects of those areas of ground engineering which are commonly encountered in many major civil engineering projects. These are underground construction and ground improvement. Underground construction is becoming increasingly important as underground space is being utilised in urban areas for mass transit systems and many other areas of infrastructure development. Ground improvement is a growing area with many new innovative techniques being introduced. The course will introduce students to the latest design and construction technologies being used in these areas, and will make extensive use of lecturers from industry.

1. Introduction and site development
2. Earth moving methods and excavation techniques
3. Loading and hauling
4. Deep excavations and bored tunnels
5. Tunnel stability and ground movements
6. Damage to buildings and services caused by deep excavations and tunnels, risk assessments
7. Protective measures and ground treatment for underground construction
8. Effects of tunnelling and deep excavations on Building performance – case histories
9. Groundwater control for underground construction
10. Compensation grouting protective measures – case histories (industry speaker)
11. Instrumentation and monitoring – 1
12. Instrumentation and monitoring – 2
13. Formwork design
14. Cranes and equipment fleet economics

5L, Prof R.J. Mair; 4L, Dr I. Brilakis; 4L, Dr M. Elshafie; 1L, Industry speaker

Booklists
Please see the Booklist for Group D Courses [2] for references for this module.

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

UK-SPEC
The UK Standard for Professional Engineering Competence (UK-SPEC) [4] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the 'Accreditation of Higher Education Programmes' (AHEP) document [5] which sets out the standard for degree accreditation.

The Output Standards Matrices [6] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.

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