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Training in reinforced and prestressed concrete practice

Kurse über Eisenbenton und vorgespannten Beton

Cursos práticos de betão armado e preesforçado

Cours pratiques de béton armé et précontraint

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The rapid development of new structural techniques and the increased use of concrete for all types of constructional work since the war, has focused attention on the need for improvement in the standard of concrete construction practice in Great Britain. The Cement and Concrete Association instituted its Training Courses in 1950 with two main objects — to raise the general standard of concrete work and to help Engineers, Architects and Supervisors to keep abreast of new developments. In the past 6 $^1/_2$ years nearly 4000 people have attended one or more of these courses.

The Training Courses normally commence on Monday mornings and end at mid-day on the following Friday. The theoretical and laboratory work is done at the Training Centre, and the practical work and demonstrations at the Research Station. Lectures, illustrated with films and slides, are generally given by the Association staff, but outside lecturers, who are experts in their particular fields, assist in maintaining the highest possible standard of instruction. One of the aims of the courses is to give those attending practical experience in the latest methods and types of equipment employed in concrete work, and participants can gain experience in working with each process as well as seeing the latest developments. The numbers on each course are usually between 40 and 45.

The courses, though short, are intensive and while most cover a fairly wide syllabus, some deal with more specialised subjects. Most courses are held at two levels, one for engineers, the other for supervisory grades, and the syllabuses are changed from time to time in order to keep them uptodate. It is realised that these courses alone cannot deal adequately with the training of all the supervisory grades employed on concrete constructional work, but the trained engineers

return equipped with the latest information to pass on to their own staff and workmen on the site, so extending the field of education. Thus, while the Association's Training Courses cater for between 200 and 250 supervisors a year, the extension of the knowledge imparted to a similar number of engineers can reach many thousands each year.

Details have been given in my paper of the scope of these courses and the standards aimed at for both lectures and practical work. While the syllabus for the supervisors is similar in many respects to that for engineers, there is a different approach towards the improvement of general supervision and the avoidance of faults in construction. The courses have an essentially practical outlook.

Modern concrete practice is a skilled or semi-skilled job and the operatives need to be trained either beforehand or on the works. Supervisors need training even more and the courses therefore emphasise not only the correct way to do a specific job, but the reasons for so doing and what happens if other practices are followed.

These courses are providing engineers and supervisors in the concrete industry with uptodate information on the latest techniques in design and construction and the results of recent research, in a way in which industry is able to contribute and to benefit by the assimilation of new ideas. Each year since their inception the numbers making application far exceed the available capacity, usually twice the vacanies are applied for.

In recent years a few courses on somewhat similar lines have been organised by the provincial universities in conjunction with the Cement and Concrete Association, but mainly for engineers. In some cases lectures are held weekly over a period of two or three months, and in others, are arranged daily over a shorter period. Periods for practical instruction are also included. These enable practising engineers to attend refresher courses in the latest techniques and to equip themselves for passing on the information to their staff on the sites. There are in addition to lectures, courses on Concrete Technology which are a feature of many of the Technical Colleges programme of evening lectures for young engineers.

For a long time various other organisations in Great Britain have felt the need for some system of instruction in concreting techniques for those engaged on sites in a lower supervisory capacity, and especially the Reinforced Concrete Association, but great difficulty has been experienced in organising any systematic training. The unsuccessful efforts before and immediately after the war are described in my paper, and it was not until 1953 when the City and Guilds of London Institute was approached that real progress was made. A syllabus was drawn up and notes for the guidance of lecturers, which are given in detail in my paper, and arrangements made for instruction courses to be held at Technical Colleges.

The City and Guilds of London Institute now offer after examination a Certificate in Concrete Practice. Courses are held at over 50 Technical Colleges during the winter months consisting of 24 two hour lectures held weekly. The syllabus for each individual lecture has been drawn up in detail so that, if their work demands it, participants from one

College can change to another without loss of continuity. In 1955, 496 candidates entered for the written and oral examinations from 52 Colleges, and 374 (or 75 % of the entrants) successfully passed the examination.

These courses were directed to the foreman and potential foreman engaged on site work although they were open to other persons. Due to the sucess of this Grade 1 course, a rather more advanced course has been started at 28 colleges during last winter and the syllabus for this course is shown in Appendix 1 below. The award of an officially recognised certificate of proficiency for concrete supervisors and foremen by the City and Guilds of London Institute is an important development. A knowledge of good concreting practice by the site worker has previously been a matter of gradually gaining experience rather than of any definite training. This new project should produce a class of men who will not only know how good concrete is made, but will be able to pass on their knowledge to the men under their control. This innovation will benefit both employer and employee, the former because his product will gain in quality and his task of supervision will be made easier; the employee will find his work more interesting and the certificate will open up prospects of promotion. Concreting on the site is essentially the work of a team and the leaders of the team, the general and trades foremen and charge hands, should therefore be fully instructed in the elements and principles of concreting operations.

It may be some time before the full impact of these innovations will be measured on the site, but all sections of the building industry in Great Britain now have available suitable instruction courses in the latest techniques of concrete practice which must ultimately result in improvement on site works.

Appendix 1

CONCRETE PRACTICE COURSE
SYLLABUS FOR SECOND YEAR

LECTURE 1. *Introduction* — General introduction to course and recapitulation of salient points dealt with in first-year course.

LECTURES 2 and 3. *Properties of Plain and Reinforced Concrete* — Strength of concrete in tension and compression; drying shrinkage; moisture movement; creep; permeability; temperature effects; bond; abrasion, etc.

LECTURE 4. *Materials* — Cements, natural and artificial aggregates; particle shape; grading charts. Types of steel reinforcement.

LECTURE 5. *Admixtures* — Calcium chloride; wetting and air entraining agents; fly-ash, etc.

LECTURE 6. *Concrete* — Water/cement ratio, workability and segregation. Factors affecting slump; compacting factor test.

LECTURE 7. *Concrete* — Mix design and control. Methods based on accepted practice.

LECTURE 8. *Concrete* — Yield; estimation of quantities; effect of changes in proportions, effect of vibration and air entrainment.

LECTURES 9 and 10. *Formwork* — Elementary design; weight of, and pressure exerted by, concrete; working stress in timber and steel; struts and props. Simple examples; common errors. Care, maintenance and re-use of formwork.

LECTURES 11 and 12. *Plant* — Batching plants and mixers; concrete pumps; skips, conveyors and transporters; truck mixers; vibrators.

LECTURES 13 and 14. *Precast Products* — Variations in mixes for different kinds of products; variation in mould design to suit different methods of casting; use of admixtures; tolerances permitted; importance of correct placing of steel; machines and plant for making and handling products. Typical layouts of factories.

LECTURE 15. *Cast Stone* — Ways of producing decorative finishes. Application of cast stone to structural concrete and use as permanent formwork. Correct methods of repairing damaged units.

LECTURE 16. *Lightweight Concrete* — Clinker; foamed slag, 'no-fines', foamed concrete. Manufacture, properties and applications.

LECTURE 17. *Concrete Floor Surfaces and External Finishes* — Granolithic finish; mixing, laying and curing; joints; admixtures; non-slip treatments. Form-linings; decorative finishes; finishes to provide key. Repairs.

LECTURE 18. *Concrete Roads* — Preparation of subgrade; mixing concrete; laying; compaction; joints; finishing; curing.

LECTURE 19. *Loading* — Design loads for structures; incidental loading during construction.

LECTURE 20. *Elementary Principles of Reinforced Concrete* — Columns; beams and slabs (free spans and cantilevers).

LECTURE 21. *Joints* — Expansion joints; function, type and position. Construction joints. Bonding new concrete to old; bonding concrete to rock faces.

LECTURE 22. *Prestressed Concrete* — Detailed description of the various systems; practical factors relevant to prestressed work.

LECTURES 23 and 24. *Revision.*

SUMMARY

A description is given of the Training Courses provided since 1950 by the Cement and Concrete Association for Engineers, Architects and Supervisors on the latest developments and techniques available in concrete construction, and of similar courses now provided at some of the Universities. The introduction of further courses for Supervisors and those engaged in the making and placing of concrete on the site at Training Colleges throughout Great Britain has been successfully accomplished by the Reinforced Concrete Association in conjunction with the City and Guilds of London Institute, and details of the courses are described.

ZUSAMMENFASSUNG

Der Aufsatz gibt eine Beschreibung der Ausbildungskurse, wie sie seit 1950 durch die Cement and Concrete Association für Ingenieure, Architekten und Bauführer über die neuesten Entwicklungen im Betonbau durchgeführt werden und behandelt ähnliche Kurse, die neuerdings an einigen Universitäten abgehalten werden. Die Einführung weiterer Kurse für Bauführer und Poliere an Bauschulen in ganz England wurden erfolgreich abgeschlossen durch die Reinforced Concrete Association in Verbindung mit dem City and Guilds of London Institute. Die Kurse werden detailliert beschrieben.

RESUMO

O autor descreve cursos organizados desde 1950 pela Cement and Concrete Association, destinados a Engenheiros, Arquitectos e Capatazes, e tratando das técnicas e desenvolvimentos mais recentes das construções de betão, bem como cursos semelhantes organizados ùltimamente em

algumas Universidades. A Reinforced Concrete Association em colaboração com a City and Guilds of London Institute também organizou nas Escolas Técnicas Britânicas outros cursos destinados a Capatazes e aos que trabalham na fabricação e colocação do betão nas obras. O autor indica ainda pormenores referentes aos programas dos cursos.

RÉSUMÉ

L'aueur décrit des cours organisés depuis 1950 par la Cement and Concrete Association, à l'usage des Ingénieurs, Architectes et Contremaîtres, et traitant des techniques et des développements les plus récents de la construction en béton armé, ainsi que des cours semblables organisés dans quelques Universités. La Reinforced Concrete Association, en collaboration avec la City and Guilds of London Institute, a également organisé dans les Ecoles Techniques Britanniques, d'autres cours à l'usage des Contremaîtres et de tous ceux qui s'occupent de la fabrication et de la mise en place du béton dans les chantiers. L'auteur donne encore des détails concernant les programmes des cours.

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