

often the case, some of the liveliest presentations and discussions took place in the smaller rooms, presumably intended for 'minority interest' topics. Session chairmen often faced the unwelcome task of declining discussion contributions from the floor in order to keep the programme on schedule.

The concluding presentation to the conference, by David Pocock, surveyed the current state of development of standards for concrete repair and cathodic protection. The paper served as a useful reminder to delegates, drawn mainly from the research community, that this will be the channel through which the majority of practising engineers will be appraised of the outcome of their work.

My view of the Conference must obviously be influenced by my choice of sessions and so the following observations on the general trends reported are therefore subjective to some degree. There were fewer papers on cathodic protection (CP) than might have been anticipated from conference programmes of five years back, probably reflecting the acceptance of CP as an established technique. Realkalization is clearly gaining ground as a viable approach, and experiences to date have been reported as positive. Reports also presented a more positive view of epoxy-coated reinforcement than in recent years. On techniques for monitoring corrosion, and in particular corrosion rates, several papers suggested that accuracy could not be guaranteed within 'an order of magnitude', and further developmental work is clearly necessary. There remains major uncertainty over the relationship between results of laboratory studies and service performance. Surprisingly little work was reported on structural consequences of reinforcement corrosion, nor was I aware of much effort to develop a Limit State philosophy for durability and deterioration — a philosophy that is consistent with the approach adopted for other aspects of structural performance in codes of practice for construction.

I cannot conclude this review without mention of a generous, evening social programme. Arrival at a reception in Matlock Bath following a coach tour of the Derbyshire countryside was delayed only slightly by an earlier impromptu decision to sample 'Old Peculiar', a heavy local beer, at Monsal Dale. At a reception hosted by the Lord Mayor and Lady Mayoress in Sheffield Town Hall the following evening, the Organising Committee's donation to the Lord Mayor's Fund for Rwandan Refugees was warmly applauded. The

Conference Banquet, held in the splendid Cutlers Hall on the final evening of the Conference, emphasized links between Sheffield and steel that pre-date reinforced concrete!

Realization of the aims of the Conference can only take place outside the Conference Hall. However, the Conference organizers can take much credit for providing a well organized forum for the dissemination of state-of-the-art knowledge. The *Conference Proceedings*, edited by Prof. R. Narayan Swamy, are published in two volumes by Sheffield Academic Press. Copies of this 'Proceedings' can be obtained from Mrs Norma Parkes, Conference Secretariat, Dept of Mechanical and Process Engineering, University of Sheffield, Mappin Street, PO Box 600, Sheffield S1 4DU, priced £100.00

J. Cairns

WORKSHOP ON FIBRE-REINFORCED CEMENT AND CONCRETE, 28-30 JULY 1994, SHEFFIELD, UK

The Workshop was jointly organized by the National Science Foundation (USA) and the University of Sheffield. Its main aim was to present and discuss the most recent advances and techniques in fibre-reinforced, cement-based materials. This rapidly developing group of materials is used nearly all over the world. Nevertheless, an occasion to make some reassessment and to discuss what should be done in the next few years was accepted by over 50 invited participants from several countries who presented over 30 papers. Most of them were presented in eight consecutive sessions, published in a simple, attractive volume and distributed to participants.

Besides general reviews of the scene, in which G. B. Batson and M. E. Criswell presented their viewpoints, several papers dealt with non-conventional fibres: glass fibres, polypropylene fibres and metallic, amorphous fibres. Also, special techniques used for steel fibres, high volume content (SIFCON) and increased bond, combined with traditional reinforcement were considered.

An excellent and particularly stimulating review was presented by V. S. Gopalaratnam and R. Gettu on the problem of how to characterize the flexural toughness of fibre-reinforced materials. An obvious belief for many researchers that toughness indices of different kinds are not sufficient was justified and completed by interesting

comparisons and practical indications. Also, V. Ramakrishnan and co-authors analysed this important problem after an extensive test programme. A few valuable papers on theoretical aspects were also presented, e.g. by D. V. Reddy on constitutive modelling of fibre-reinforced concrete. Other authors concentrated on new developments and applications through a large variety of materials and technologies which may be accepted for different structures and different conditions.

Discussions were vivid and penetrating after nearly every presentation. During the general discussion animated by Swamy and Ramakrishnan, special attention was paid to the question of what the research community should do in the near future to stimulate further development of fibre-reinforced concretes. It was impossible to answer completely such a basic question, but the main discussed points were:

- use of FRC in various structures together with traditional reinforcement,
- selection of special fields where application of fibres is a unique measure to satisfy requirements (e.g. structures in seismic regions),
- development of new technologies and applications of non-conventional materials using recycled products,

- testing for those properties which are actually applied by designers, and
- standardization of tests.

Strictly research problems were discussed in an interesting way by K. Thirumalai, who presented the research priorities from the viewpoint of sponsoring national projects.

Both principal organizers and chairmen of the Workshop — Swamy as the host and Ramakrishnan being responsible for the participation of an important group of well known specialists from the USA — did an excellent job and were successful in organizing a very stimulating event in a pleasant and informal atmosphere in which social functions and discussions during breaks played an important role.

A limited number of copies of the *Proceedings of the Workshop* are still available, at a cost of £30.00 including postage and packaging, by surface mail from Mrs N. Parkes, Conference Secretariat, Department of Mechanical and Process Engineering, University of Sheffield, PO Box 600, Mappin Street, Sheffield S1 4DU, UK. The Proceedings contain a valuable and informative set of papers.

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