FRACTURE MECHANICS AND DESIGN OF CONCRETE STRUCTURES - WORKSHOP SUMMARY REPORT

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The workshop on "Fracture Mechanics and Design of Concrete Structures" held in the afternoon of 26 July, 1995 during FRAMCOS 2 in Zurich was attended by nearly forty participants. Thanks to the diligence of all six invited speakers who had prepared in advance the written version of their introductory talks, the participants were provided with a full set of notes.

The speakers gave a brief overview of several applications in which the concepts of fracture mechanics have helped the designers of plain and reinforced concrete structures. These covered the following (i) the economic design of plain concrete pipes (Gustaffson); (ii) the understanding of ductile-brittle transition failure in longitudinally reinforced or fibre-reinforced concrete beams (Carpinteri/Massabó); (iii) the size effect in anchor pull-out force and bond failure (Elfgren); (iv) the prediction of shear capacity of longitudinally reinforced beams (Hawkins); (v) fracture mechanics as forensic tool in investigating the causes of cracking in large concrete structures, such as dams, and in judging the efficacy of repair and retrofit techniques (Ingraffea); (vi) the design of massive unusual structures, such as offshore platforms (Modéer) made from high strength concrete for which the traditional strength-based design rules are either entirely inadequate or not available at all.

The talks therefore provided the audience with a glimpse of the potential benefits that the application of fracture mechanics can bring to the design of concrete structures of a range of sizes. In connection with the structural size, several speakers emphasised the use of a structural brittleness number. In fact, it was suggested that an immediate impact of fracture mechanics could be felt if a material brittleness number were included in the Codes of practice, alongside the traditional compressive strength of concrete.

The discussion following the introductory talks was lively and fruitful. The participants pointed out the usefulness of the concepts of material and structural brittleness numbers and agreed with the suggestion that all efforts should be directed towards the inclusion of material brittleness number as a quality parameter in the Codes. It was argued that this would particularly facilitate the use of high strength and high performance concrete mixes.

It was also pointed out (Horii) that the lessons learned from the damage caused by the Kobe earthquake could provide a valuable impetus to the introduction of fracture mechanics in the design of concrete structures.