

## BOOK REVIEW

### **International Experience with Durability of Concrete in Marine Environment: Proceedings of a Symposium Honoring Professor Ben C. Gerwick, Jr.**

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**REFERENCE:** These *Proceedings* were published by the Department of Civil Engineering, University of California at Berkeley, and were edited by Professor P. Kumar Mehta, 723 Davis Hall, Berkeley, California 94720, 1989, 250 pp.

There was an opening session on 16 January 1989 at which the Dean of the College of Engineering at Berkeley, Karl Pister, welcomed the audience and paid tribute to Ben Gerwick, Jr. Then Ben discussed pressing needs and opportunities in durability of concrete in the marine environment. He made cogent remarks regarding undersea tunnels in Japan, Hong Kong, Dubai, and Suez; the Saudi Arabia-Bahrain Bridge; the English Channel Tunnel; the Hibernia platform off Newfoundland; and the Great Belt Bridge and Tunnels in Denmark. T. Y. Lin discussed the International Peace Bridge project to unite Alaska and Siberia. George Hoff discussed high-strength, lightweight concrete for the Arctic.

There were then four technical sessions with recorded and published discussion of each. The first: Physical and Chemical Causes of Deterioration of Concrete in Seawater (pp. 20–76) included papers by Professor Mehta, Dr. G. M. Idorn of Denmark, and Mr. John Figg of the U.K. In the discussion (p. 75), Dr. Idorn commented “in most cases we have alkali-silica reactions, but only in a few cases this turns out to be deleterious.” I quote this in reply to an inquiry the day after I read it; it needs saying, often.

The second session concerned corrosion of reinforcing steel in concrete and included papers by Professor GjØrv of Norway; Bob LaFraugh of Wiss, Janney, Elstner; and Ken Clear. Clear’s discussion of cathodic protection is the clearest, most complete

story on this that I have seen; it is on pp. 100–123 and includes 65 references.

The third session concerned concrete construction and repair practice. It included papers by Mr. Moksnes of Norwegian Contractors on the 20 concrete platforms in the North Sea beginning with Ekofisk in 70 m of water containing 80 000 m<sup>3</sup> of concrete installed in 1973 going to Gullfaks C in 206 m in 1989 or Statfjord B with 140 000 m<sup>3</sup> of concrete in 1981. The Dutch experience with construction and repair of marine structures was given in two parts; Leendertse and Oud of the Locks and Weirs Division of the Department of Public Works discussed concrete practice and the relations to durability. Work in the Netherlands where corrosion was found when the specified cover of 30 mm was actually only 10 to 20 mm is noted; in this case a thin “oxygen-sealing coating” was applied to “prevent corrosion in spite of further penetration of chloride.” Also discussed was corrective maintenance of the Al-Shindagha Tunnel in Dubai. The second part by Bijen of Delft University asked “Can We Construct Durable Marine Structures with Neat Concrete and Can We Repair Durability?” His answers are: Yes, durable structures can be built but durable repair of structures with corroded reinforcing is questionable. Ken Saucier reviewed the major program of the U.S. Army Corps of Engineers that is developing tools for repair, evaluation, maintenance, and rehabilitation of its civil works structures of which at least a third are over 40 years old. In the discussion of this session Rusty Morgan gave a most encouraging account of success in using shotcrete as a repair technique especially when silica fume is used as an ingredient.

The fourth session concerned tests for evaluation of concrete durability. Professor Muguruma of Kyoto reported work on low-cycle fatigue behavior of concrete under submerged conditions. The reduced fatigue strength of plain concrete under water was shown to be due to “the wedge action of absorbed water” by acoustic emission tests. Mohan Malhotra from Canada reviewed the development of freezing and thawing test procedures, both in the laboratory and in the field. He cites 24 references.

There were about 100 invited participants. This book should be available to all who care about doing something to achieve durable concrete in the marine environment.