GRC in the 80s

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The glass-fibre-reinforced cement (grc) industry is barely 10 years old. The Glassfibre Reinforced Cement Association (GRCA), consisting mainly of manufacturers and users of this novel and rather versatile material, was formed in 1975 to look after the interests of this new industry. True to its charter, the GRCA has organized several international conferences already, and the proceedings of the latest, entitled *GRC in the 80s* and held in Paris on 10–12 November 1981, have been published recently.

Reflecting the newness of grc, the papers presented were diverse in scope although many were, rightly in the opinion of this reviewer, concerned with recent applications and the future potential of the material. These show clearly that grc is not a single material, but like concrete, is a class of materials. At its heart lies the concept of alkali-resistant (AR) zirconosilicate glass fibres as the reinforcement for the highly alkaline Portland cement matrix and most of the applications of grc described in the proceedings have used this type of fibre. Proctor (UK) gives a summary of the long-term properties (including weathering results from various parts of the world) of grc made from Pilkington's first generation AR fibre Cem-FIL. By comparing these with data from accelerated ageing tests, it is now possible to predict very-long-term properties of Cem-FIL/grc. Accelerated ageing tests are featuring strongly in the assessment of Pilkington's second generation AR fibre Cem-FIL 2. Present results indicate that, in natural weather, Cem-FIL 2/grc will retain a much higher proportion of its strength and strain capacity in the longer term than composites produced from Cem-FIL.

The search for even more alkali-resistant glass fibres continues. Some results on prototype fibres that are being investigated by Pilkingtons are given by Proctor and the current efforts at Battelle, Switzerland, in this direction are described by Shin. Obviously, the claims made for these new fibres will have to be substantiated by long-term property data on cement composites made from them.

A few years ago the Dutch State Mines Group marketed a different form of grc, Forton, in which the reinforcement is provided by borosilicate E-glass fibres and the cement mortar matrix is heavily modified by a polymer. Jacobs (Holland) describes the properties of this composite up to 3 years at ambient temperatures and claims, on the basis of accelerated ageing tests, that the long-term strain

capacity of Forton may be better than that of Cem-FIL/grc. In assessing Forton and also grc produced from other commercial glass fibres such as those manufactured in Japan, it would be instructive to compare future results with those of Cem-FIL 2/grc.

The need to base design parameters on the 'final' properties of grc and confirm them by accelerated ageing tests on components whenever possible is stressed by Heavens and Downey (UK), who refer to the case history of the Slimline drainage pipe development. It is not clear from the very interesting paper by Stickel (USA) describing the potential of grc in solar energy structures whether such an approach (i.e. accelerated testing) is going to be a part of the design philosophy in the proposed applications. One design envisages a 26 ft diameter grc truncated sphere to support a rather large collector panel also to be made in grc. Rothwell and Warrior (UK) draw attention to the chemical resistance (or the lack of it) of grc in potentially aggressive environments such as sea-water, sewage, soils etc., and point out that the matrix is more important than the fibres in these situations and cements other than Portland have advantages under certain conditions of exposure.

Several papers describe recent applications of grc in various parts of the world, reflecting the international nature of the industry. Details of specific projects in application areas familiar to grc users, e.g. cladding, refurbishment of old or damaged buildings, rendering, ducting etc., are included in the proceedings. Eastern Europe is represented by a paper from Romania, where the material is just beginning to be used. Merrett (UK) discussed the merits of grc as permanent formwork for bridges, using the analysis on shuttering for British Rail's E-type bridge decks as an example. Special mention should also be made of the paper by Ford which gives an account of the repair of a concrete navigation lock in the USA by grc latex spray-up. Estimates for conventional repairs were as high as 26 million dollars, whereas with grc the expenditure was only 1.2 million dollars. A particularly gratifying feature of the contract was the reopening of the lock for service only two days after the completion of repair.

In the replacement and refurbishment of the decaying sewer system in the UK, grc should play a major role (Kempster, UK). It also has great potential in replacing asbestos-cement products. Manufacturing methods for grc sheets using high

through-put machines have been developed in Japan (Takeda), and Smith (UK) describes the use of asbestos-cement machinery in the production of corrugated roofing, flue pipes, rainwater goods etc. in grc. Using 3% by weight of Cem-FIL 2 fibres and a modified Portland cement matrix, grc sheets have been produced on a commercial scale that will satisfy asbestos-cement standards and require only a small premium in price. Data on the long-term properties of the material will be required before such products are accepted by the industry.

The need for continuous production of grc sheets to minimize costs is also emphasized by Veldhoen (Holland). Using a special mix design that includes regulated-set cement, his firm has achieved a nearly continuous production of grc sheets with a choice of finishes at a rate of 3 m/minute in a commercial plant. A special 'brick strip' product that has been used in the renovation of houses that do not have cavity walls is manufactured along similar lines and can be demoulded within 3 to 6 minutes. For his outstanding contribution to the grc industry, George Veldhoen received the biennial award of the GRCA at the Paris Congress.

The impressive growth of the grc industry from its

inception is recorded in the paper by Blake (UK), who also provides some cost comparisons with other materials. Growth promotes innovations in manufacturing and some of these are described by Williams (UK). A comprehensive marketing philosophy applicable to a new construction material like grc is outlined by Day (USA) and Tallentire (UK) takes a forward look at possible areas of development in the grc industry in the 1980s.

GRC in the 80s is a faithful record of the proceedings at the 1981 GRC Congress and includes lively discussions of papers presented. The style in some of the papers is discursive, as is bound to happen if lectures are not amended in the written version. Black-and-white illustrations taken (presumably) from colour slides that abound through the volume do not make the same impact as in lectures. And, for some papers, only abstracts are available. A reader who did not attend the Congress will no doubt notice some of these deficiencies. But this should not detract from the value of the proceedings and the GRCA is to be congratulated for publishing them in the interest of those who wish to keep themselves up to date with developments in this new industry.

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