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General

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Cover picture

A permeability test being conducted on concrete masonry samples at the TELARC registered civil engineering laboratory of W. Stevenson and Sons Ltd, Auckland.—*See article on p. 55.*

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Conspiring against the laity?

"ALL professions," remarks a character in George Bernard Shaw's *The Doctor's Dilemma*, "are conspiracies against the laity." Here, with Shavian sharpness, is a view the outside world can — and does — take.

Not always, of course. Nor, when the view is taken, is it necessarily fair. But when it is heard, it is a commentary on the lay intuition that a profession should exist in the public interest, and on the public image of a particular professional group.

Writing in the *Daily Telegraph* last September, Londoner J. R. Blanchfield succinctly listed the conditions that he believed a professional group needed to observe. To justify description as a profession, he said, an occupational group must fulfil not some, but all of the following criteria:

1. Its practice is based on a recognised body of learning.
2. It establishes an independent body for the collective pursuit of aims and objects related to these criteria.
3. Admission to corporate membership is based on strict standards.
4. It recognises that its practice must be for the benefit of the public as well as that of the practitioners.
5. It recognises its responsibility to advance and extend the body of learning on which it is based.
6. It recognises its responsibility to concern itself with facilities, methods and provision for educating and training future entrants and for enhancing the knowledge of present practitioners.
7. It recognises the need for its members to conform to and be seen to conform to high standards of ethics and professional conduct.

In the long run, of course, the question of public benefit is decided by the public itself. And for a hundred years of industrial revolution and colonisation the public was in little doubt. Technology was a benefit. The profession basked happily in the sunshine of public confidence. Then came the post-war elaboration in complexity and scale of industrial expansion, motorways, expanding fields of chemical and mechanical engineering, energy, nuclear power, new materials, higher pressures, scale order increases, large costs, environmental and social impacts. Disadvantages of technology became apparent. Secure in our cocoon of confidence, we had not analysed, assessed, and reported consequences and alternatives.

Hindsight tells us now that public confidence, public interest and status are dependent variables. Now that we know more about the public interest and modern technology, our own interest, and the public's, is best served by our own critical over-shoulder perception of the effects of our technologies. We can no longer, and automatically, be advocates.

In our present study of a possible Engineering Practitioners Act, we sit uncomfortably on the knife edge between the benefits of the public and our own. Public benefit is the only possible basis for legislation. We are probably best able to judge the technology risks which relate to public safety, and which are the basis of a case for a Practitioners Act. But our own interest is involved. Our judgment can be affected. If we get it wrong, that accusation, "conspiracy against the laity", could well be heard again.

All of which is to say that, in our discussions of possible new legislation, let alone in convincing Parliament in the matter, our maturity as a profession is being tested. A Practitioners Act, if justified on grounds of public benefit, would extend both our responsibilities and our privileges. We would be facing the responsible exercise of Mr Blanchfield's criteria as never before. ▽

* Unless specifically indicated, statements or opinions in *New Zealand Engineering* do not necessarily reflect the views of the Institution or the publishers. Correspondence on material published is welcomed.

Ferrocement and its use in vessels and offshore structures

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Nervi in post-World War II Italy developed a theory of fine-mesh reinforced mortar which he used in the application of ferrocement to boats; the 38 m m.v. Irene *was perhaps his best achievement. Also employing ferrocement, he created large span shell roofs and vaulted structures which remain as architectural examples. In 1965 Morley Sutherland, a New Zealand prestressing engineer, founded a ferrocement boat building firm which constructed many successful yachts, commercial fishing boats and tugs. Since 1965 there has been a proliferation in the use of ferrocement and significant events in its wider application were Windboats Ltd of England with their many pleasure boats constructed for use on inland waterways, and the Chinese construction of ferrocement sampans which probably was the first production line construction in this material.*

1. INTRODUCTION

WIDESPREAD acceptance of ferrocement has been slow and spasmodic and has had none of the momentum resulting from the impetus given to the other mainstream variant of reinforced concrete, the prestressing of concrete by Freyssinet. The prestressing concept was simple and easily comprehended, unique and singular. Ferrocement was a more complex concept and involved evaluation of a more esoteric nature; also ways to develop and use it were not apparent.

The distinguishing characteristic of ferrocement is the control over crack opening exercised by reinforcing with a high specific surface. Large values of specific surface which may be defined as the ratio of reinforcing surface area to ferrocement volume are achieved by using large numbers of fine wires and result in the initiation of many small cracks rather than the propagation of widely spaced cracks characteristic of reinforced concrete.

2. ADVANTAGES AND DISADVANTAGES OF FERROCEMENT

Widespread use of ferrocement in boat building has taken place over the last decade. The chief advantages claimed are low cost and ease of construction. On a comparative strength basis, it is doubtful if the claim of low cost can be sustained, for although the survival of many ferrocement vessels testifies to the competence of the designers, judgment has been the chief basis for design and has unfortunately led to many failures, mostly due to inadequate steel reinforcement.

The description "ease of construction" relates to the low level of skills required in fabrication and mortaring. This is a substantial advantage and one appropriate to the amateur boat builder and to the underdeveloped countries with a large underemployed, unskilled and low paid labour force. As the principal materials employed in ferrocement are largely indigenous to underdeveloped countries, this makes ferrocement an appropriate technology in terms of economic benefit when timber resources decline or become exhausted. In industrial nations, where there is little differentiation between the cost of skilled and unskilled labour, this advantage reduces because the laying up of the steel fabric is labour-intensive.

Ferrocement has advantages over steel and wood in being more resistant to corrosion than steel and immune to attack by teredo worm which is particularly damaging to timber in warm climates.

The principal disadvantages of traditional mesh reinforced ferrocement are that its weight is greater than alternatives of timber or steel if adequate strength is to be realised, and that its impact strength and piercing resistance are inferior to either steel or timber of equivalent weight. These disadvantages probably account for the slow progress in the acceptance of ferrocement in boat building, although tradition does play a large part in resistance to change and is nowhere more entrenched than amongst seafaring folk.

The newer high tensile wire reinforced fibrous ferrocement may not be subject to the above constraints.

3. TECHNICAL AGENCIES AND THE SPREAD OF INFORMATION

Ferrocement's potential as an appropriate technology has attracted the attention of aid programmes by the United Nations, World Bank, Asian Development Bank and other agencies concerned with underdeveloped countries. The fisheries section of the United Nations Food and Agriculture Organisation (FAO) in Rome has been an advocate of ferrocement in fishing vessels for a long time.

Academic and industrial research is contributing to the growing orthodoxy of the material. Some tentative codes of practice are administered by survey or classification authorities or societies, such as Lloyds[1] and the New Zealand Marine Department[2]. Det Norske Veritas have published tentative rules[3] incorporating a comprehensive design base for the construction of ferrocement vessels, and lay down guidelines for calculating scantling sizes.

Agencies such as FAO, Canadian Fisheries Research, the New Zealand Ferrocement Marine Association and the American Naval Research Organisation disseminate information on ferrocement. A Ferrocement Information Centre has been established under aid funding (chiefly from Canada) as an adjunct to the Asian Institute of Technology in Bangkok, as Asia needs a technology that may release part of its economy from the demands of steel technology and from the associated costs of importation of machine tools and raw materials.

4. CONTROL OF CRACKING

Ferrocement is basically a form of reinforced concrete with the same composite assemblage of cement aggregate matrix and reinforced steel. The difference lies in the use

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This paper was first received on 27 February 1978 and in its present form on 23 November 1978.