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## Construction materials: today and tomorrow

### ABSTRACT

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Members of the *Construction Materials* editorial advisory panel provide overviews of their areas of expertise, highlighting recent and forthcoming developments likely to affect engineers and others working in the field of construction materials.

### 2. CONCRETE RESEARCH BY PETER CLAISSE

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[Figure 1](#) shows the proportions of papers submitted to this journal on different topics for the first year of publishing. The aims and scope of the journal printed in the publicity flyer list 'metals, timbers, glass, ceramics, cement, concrete, bricks, terracotta, stone, rubber, finishes, plastic, sealants, adhesives, bitumen and fabrics' in which cement and concrete may be seen to be just two out of 16 materials listed. This discussion explores the reasons for the evident preponderance of papers on cement and concrete and whether our attempts to give coverage of other materials (which may be seen from the contents of this issue) is appropriate.



**Fig. 1.**

The proportions of papers submitted to this journal on different topics for the first year of publishing (up to April 2006)

Fig. 1.

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The bias towards cement and concrete is not only seen in research and publication. I teach materials to undergraduates on civil engineering courses. Around 60% of my notes on specific materials are about concrete, with all of the others covered in the remaining 40%. This dominance of concrete in the modules has been a frequent topic of discussion with colleagues. It is also known to be a cause of contention for steel suppliers who see their market share in construction very poorly reflected in the syllabus at universities.

It is tempting to explain the position with a 'conspiracy theory'. Many researchers (myself included) carried out research for PhD theses on concrete and have gone on to supervise more PhD students carrying out research on concrete. Each concrete researcher will thus train many more and the numbers increase. As we gain positions on funding (and editorial) committees we might be expected to have a strong interest in carrying the whole process forward!

An alternative explanation is the cost of research. Concrete is generally a very cheap material to research and the apparatus is generally available in most civil engineering laboratories. If a student enquires about undertaking research on a new type of concrete, they can be readily accommodated but if the same student wishes to research the weathering properties of slate or cladding, a significant new facility may be

required. Similarly, the cost of the materials for research on concrete is likely to be less than for any other topic.

There are, however, many very good reasons for the abundance of concrete research. One of the foremost of these is the unfortunate aspect of the cement manufacturing process which requires the release of significant amounts of carbon in the form of about 850 kg of carbon dioxide for every tonne of cement produced. This is as much as would normally be present in all of the air in a building 90 m square on plan and 20 m tall. Even allowing for a proportion of carbon dioxide sequestration in the form of carbonation during the life of structures (possibly 5% of emissions), this leaves the cement industry responsible for approximately 2% of total UK greenhouse gas emissions. Worldwide the emissions from cement manufacture are estimated at 5–10% of the total global output. Improvements in formulations and manufacturing processes for concrete are thus likely to play a key part in meeting sustainability targets for greenhouse gas reductions and recycling. The need for more good research to promote the use of replacement materials for both the cement and the aggregate in concrete is widely recognised. My own research has moved away from cement to gypsum and slag as binders in concrete.

Another reason to promote papers on concrete is that it is one of the few materials that civil engineers actually make. There may be plenty of research to be reported on the manufacture of steel but it is not generally appropriate for a civil engineering journal. This is also the main reason for the dominance of concrete in my teaching. There is simply too much core information about concrete that must be covered. The students do not need to know how to make steel but they do need to know how to mix, pour and cure concrete.

Possibly the most pressing argument is the responsibility to help the world's poor to meet their needs. It is clear that these needs are being met and will continue to be met with cement-based products. It is, however, equally clear that they cannot be met with the tonne of concrete per year for each member of the population that is currently used to maintain standards of living in rich countries. Research and publication is needed on other materials that might meet the shortfall.

It may therefore be seen that there are many arguments both in favour and against a high proportion of papers on concrete. Clearly, editorial decisions will be based on the quality of papers submitted but I would personally encourage authors to submit as many papers as possible on other topics. Our publishers already have two journals entitled *Magazine of Concrete Research* and *Advances in Cement Research* but have no journal apart from this one to cover other materials.