Structures and Buildings
Volume 166 Issue SB3

Editorial
Wellings

ice | proceedings

Proceedings of the Institution of Civil Engineers
Structures and Buildings 166 March 2013 Issue SB3
Pages 109–110 http://dx.doi.org/10.1680/stbu.2013.166.3.109

Editorial

Guy Wellings CEng, MICE
Director, WSP UK, London, UK

If this issue of *Structures and Buildings* was to be considered to have a theme I think it would have to be 'diversity'. It is a great demonstration of the rich variety that can be found in a typical issue, as it brings together the findings of research going on in Australia, Pakistan, South Korea and the UK. It ranges from the relatively raw results of explosive field tests that could influence the way we design for blast, to fine tuning of the structural modelling of cladding in order to improve the performance of fixings.

The first paper (Muhamad *et al.*) logically develops a method of calculating the deflection of reinforced concrete beams using a structural mechanics model. The method has been developed to simulate the observed behaviour of members in flexure. Unlike the common so-called 'rigorous methods' for calculation of deflection in reinforced concrete beams, the formation and opening of initial, primary and secondary cracks is modelled explicitly. The spacing and width of cracks are calculated on the basis of slip characteristics between reinforcement and concrete. The contribution to deflection of the cracked region of a beam is considered as the sum of the effects of discrete rotations at individual cracks. The theory is developed clearly and logically and may have a ring of familiarity for those with knowledge of crack control theory, suggesting that a consistent approach to a range of serviceability issues may emerge in the not too distant future. Predictions of deflection are compared with experimental data and with deflections calculated by effective flexural rigidity approaches and the results are impressive. Because the method is mechanics based rather than semi-empirical in nature, it promises to be useful in refining existing deflection design models and provide flexibility to consider new types of reinforcement.

Nowadays construction products undergo a thorough regime of design reviews, testing and certification before they are brought to the market. Yet engineers in many fields still rely on working assumptions and rules of thumb to apply those products to particular circumstances. There is nothing wrong with following reliable rules of thumb, however, difficulties arise when developments in materials and manufacturing technology allow familiar products to be applied in novel situations, and the second paper (Davies) identifies one such case. Fortunately Professor J. Michael Davies is no newcomer to the behaviour of composite cladding panels under thermal loads, having had papers first published back in the 1980s. His experiences of real issues that have arisen on buildings and seeming inconsistencies in the way in which the current design standards are applied has prompted him to challenge the commonly held belief that elongation of panels can be ignored because of the relieving effect of bowing. He demonstrates using examples, that although bowing due to differential movement between inner and outer cladding sheets does indeed reduce the overall elongation of the panel it, does not remove it completely. Simplified methods for predicting end movements are proposed and calibrated against a more rigorous finite-element analysis. For longer panels, it is shown that end movements can be significant and if they are ignored in the detailing of the fixings and panel joints they can result in significant maintenance problems. Recommendations on limiting the length of panels are provided.

The third paper (Kang and Choi) examines the results of over a thousand shear tests on concrete beams, with and without conventional links and surface bonded fibre reinforced polymer (FRP) reinforcement. They put forward a new design method based on a proposed shear strength model which has produced some very impressive results. The method is based on adding the separate strength contributions of the concrete, the bar reinforcement and the surface bonded FRP. Almost as an aside, Kang and Choi may have added fuel to the fire that rages regarding the current treatment of shear in design codes by comparing their own predicted results for concrete and bar reinforcement against designs from Eurocode 2 and ACI 318. It is difficult to argue with the results of a thousand tests. Although FRP reinforcement is the subject of the paper, it appears that when considered as individual components, it is the performance of the surface mounted FRP reinforcement that remains the most difficult to predict!

Experimental data in the blast field is hard to come by and this last paper (Ahmad *et al.*) is a valuable contribution to the testing base and produces useful data for calibrating empirical blast laws. Most methods of designing a structure for a surface explosion are based solely on the effect of air blast forces. This research recognises that the energy associated with a blast will reach the structure both by air blast and by ground shock. They report, both for the air blast and the ground shock, the results of actual tests with varying explosive charges and develop relationships between the distance and charge weight of the explosion and the pressure and profile at the structure. From this, an expression is developed for time lag between the ground shock and the air blast and some of the parameters with a significant influence are identified. Some ideas for finite-element modelling to study the effects of blast are introduced.

Some may be a little disappointed that the paper does not go as far as providing results leading to firm conclusions as to whether the ground shock component of blast does have significant effect on the overall response of a structure and therefore should be included in analysis for real design problems. Hopefully this will emerge from a future study.