Structures and Buildings
Volume 170 Issue SB8
Editorial
Su

ice | proceedings

Proceedings of the Institution of Civil Engineers
Structures and Buildings 170 August 2017 Issue SB8
Pages 541–542 http://dx.doi.org/10.1680/jstbu.2017.170.8.541

ice Institution of Civil Engineers
publishing

Editorial

Ray K. L. Su BSc(Eng), PhD, CEng, MIStructE, RPE, MHKIE
Associate Professor, Department of Civil Engineering, The University of Hong Kong, Hong Kong, People's Republic of China

This issue of *Structures and Buildings* offers five papers on advanced numerical analyses and theoretical studies of different types of structures, from the simulation of anchor-jointed precast structural walls to modelling of light timber-framed walls, to evaluation of strain-hardening cementitious composites (SHCCs) for the seismic strengthening of reinforced-concrete (RC) columns, investigation of fibre-reinforced polymer (FRP) RC slabs, and finally, the development of a new shear strength model for RC exterior joints. These studies demonstrate that currently available commercial finite-element packages are capable of solving a wide range of engineering problems providing that appropriate material parameters and modelling techniques are applied.

The first paper by El Semelawy *et al.* (2017) presents a numerical simulation of an anchor-jointed precast structural wall system by using LS-DYNA. In this system, precast walls are joined together by using threaded steel anchor bolts. Owing to the local nonlinear effects of the connections, accurate prediction of the lateral response of the proposed system and the failure mode of the anchor bolts is a difficult task. In this study, a three-dimensional, non-linear finite-element model is formulated to simulate the lateral behaviour of the proposed system. The effects of concrete breakout, rupture of the steel anchors, dowel action, shear friction, anchor pre-tensioning and gravity load on the lateral load response have been fully taken into consideration. The numerical results demonstrate that the developed model can capture the complex internal load transfer mechanisms and failure modes as well as predict the failure loads of the system. Gravity loads are found to greatly enhance the lateral capacity of the system.

In the second paper by Togay *et al.* (2017), a static finite-element analysis of light timber-framed walls with oriented strand board (OSB) panels was conducted by using Ansys. This paper gives new insight into the accurate prediction of the load-deformation responses of timber-framed panels. In this study, stress–strain relationships between timber and OSB materials are obtained from tensile and compression tests. The behaviour of the nails was simulated as a nonlinear spring element with spring/dashpot properties. The timber frames were modelled as Timoshenko beams. The plastic behaviour of the timber and OSB panels was modelled by using a multi-linear kinematic hardening model. It was found that the numerical results are in good agreement with the test results. The study further demonstrated that the presence of wall openings can significantly affect the lateral strength of timber-frame panels. A relationship between the opening area ratio and load-carrying capacity was determined, which is helpful for designing timber-framed walls with openings.

SHCCs are an extremely tough construction material that exhibit multiple fine cracks and pseudo strain-hardening characteristics under tension. They have been applied to repair seismically damaged RC columns. The third paper by Zhang *et al.* (2017) presents a numerical simulation of seismically retrofitted RC columns by using a jacket fabricated from SHCC material. In this study, tensile and compressive constitutive laws for seismic deformation were proposed to simulate the SHCC material subjected to cyclic loads. A shear transfer model was proposed to quantify the shear transfer capacity on the adjacent crack surfaces of the SHCC, taking into account both the matrix contact and fibre bridging effects. The strain hardening effects of the reinforcements and the hysteresis response of concrete were also considered. The effectiveness and accuracy of the numerical model were validated with a comparison between the numerical results and the available test results.

FRP rebars are more durable than steel rebars. They can be used in place of traditional steel reinforcements for structures that are exposed to aggressive environments. The fourth paper by Stuart and Cunningham (2017) provides a comparative review of the design approaches to FRP RC slabs. The deflections of slabs and stresses in glass FRP rebars and steel rebars at the serviceability and ultimate limit states were evaluated by using various available design codes. Furthermore, a nonlinear finite-element analysis of glass FRP RC slabs was carried out by using Abaqus to compute the load deflection relationships and internal stresses. The use of the damaged plasticity model for concrete, elastic perfectly plastic model for steel, perfectly elastic model up to the ultimate stress for FRP, and perfect

bond between FRP and concrete was found to yield reasonable results. By comparing the numerical results with the results from design codes and guides, some potential shortcomings of the latter, which are worthy of further investigation, are revealed.

In contemporary seismic design, RC beam–column joints need to be protected from shear failure under earthquake attacks. The last paper by Tran and Hadi (2017) describes a simple theoretical model for predicting the shear strength of exterior joints based on average plane stress. An important feature of the model is that only a fraction of the tensile force in the longitudinal reinforcements of the beam is assumed to be transferred to the joint core, and the remaining force is assumed to be borne by the adjacent columns. Moreover, the contribution of the joint shear reinforcements and column axial load on the shear strength of the joints is considered in the formulation. An ultimate stress envelope of concrete under biaxial stress was then used to assess the joint shear strength. The accuracy of the proposed model has been validated through comparisons with a substantial amount of test results obtained from the literature.

I trust that you will find this issue interesting and relevant to structural modelling and analysis. Please also bear in mind that comments on these papers can be submitted in the form of Discussion articles. Additionally, the most recent articles published ahead of print are available on the journal's homepage on the ICE Virtual Library website (http://www.icevirtuallibrary.com/toc/jstbu/0/0) and are fully citable using the DOI system.

REFERENCES

El Semelawy M, El Damatty A and Soliman AM (2017) Finite-element analysis of anchor-jointed precast structural wall system. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **170(8)**: 543–554, http://dx.doi.org/10.1680/jstbu.15.00087.

Stuart V and Cunningham LS (2017) FRP reinforced-concrete slabs: a comparative design study. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **170(8)**: 581–602, http://dx.doi.org/10.1680/jstbu.16.00055.

Togay A, Anil Ö, Işleyen ÜK, Ediz İ and Durucan C (2017) Finite-element analyses of light timber-framed walls with and without openings. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **170(8)**: 555–569, http://dx.doi.org/10.1680/jstbu.16.00085.

Tran TM and Hadi MNS (2017) Shear strength model of reinforced-concrete exterior joint under cyclic loading. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **170(8)**: 603–617, http://dx.doi.org/10.1680/jstbu.15.00022.

Zhang Y, Peng H and Lv W (2017) Evaluation of strain-hardening cementitious composites for RC seismic strengthening. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **170(8)**: 570–580, http://dx.doi.org/10.1680/jstbu.16.00078.