Editorial

Buick Davison BEng, PhD, MICE, CEng

Professor of Structural Engineering, Department of Civil & Structural Engineering, University of Sheffield, Sheffield, UK

Perhaps one of the most challenging aspects of a structural engineer's role is establishing the capacity of existing structures, particularly structural forms that are rarely used in modern construction. The first paper in this month's edition of *Structures and Buildings* is by Hicks and Sagaseta (2018) and deals with the analysis of masonry vaulted structures, in particular quadripartite vaults which are found in historic structures, often below ground. This interesting and practical paper develops a simple formula for assessing the strength of such structures and demonstrates the accuracy of the method by comparison with detailed FE analyses. Using a real project as a case study (the undercroft of London Bridge station), the paper provides a practical example of how the structural adequacy of these challenging structures can be assessed. Insights are also given into the conditions that affect the performance of these vaults (e.g. the use of ribs at the quadrant intersections and boundary conditions). The highest stresses in quadripartite vaults occur not in the vault quadrants themselves but at the elliptical intersection between them, hence the provision of ribbed in many cases. Interestingly, if these ribs are found to be deficient a possible remedy is to strengthen them with fibre reinforced polymer strips.

The use of FRP is the subject of the second paper in this month's issue. For a variety of reasons RC structures may require strengthening. As a result of decades of research effort, the use of externally bonded fibre reinforced polymers has become an established method. Nonetheless, the availability of new experimental data can assist in the development of more efficient methods of deploying the relatively expensive FRP materials and refinement of design approaches. 'Impact of bonded carbon fibre composite on the shear strength of reinforced concrete beams' (Shbeeb *et al.*, 2018) presents the findings of an experimental study of 22 RC beams reinforced in a variety of ways with Carbon Fibre Reinforced Polymer to enhance shear resistance. Detailed experimental data is presented which will enable fellow researchers to validate FE models or refine design models. The authors compare their data with a number of existing models and comment on their accuracy. Large increases in shear resistance are possible but at the expense of the use of large quantities of FRP material; so rather than simply considering the percentage improvement, the authors evaluate the efficiency of various FRP composites strengthening techniques in terms of the strength improvement to the quantity of CFRP used.

Corrosion of reinforcement in RC sections is a well-known problem and has received much attention over the years. Whilst

many engineers would expect a reduction in performance due to the loss of cross sectional area to resist tensile forces the paper by Feng *et al.* (2018) on the 'Effect of steel bar corrosion on flexural behaviour through bond' considers the effect of corrosion on the bond between the steel bars and concrete and the influence that this has on flexural behaviour. Using a sectional analysis technique developed in an earlier paper published in this journal (Oehlers *et al.*, 2014) the authors demonstrate that the critical section may not be where the moment is at a maximum and that good anchorage is important to ensure that debonding of bars does not occur along the entire length.

In many parts of the world the structural design of buildings is dominated by the need for seismic resistance. Irregularities in plan shape can have a detrimental effect on the response of a building during an earthquake and hence many buildings in earthquake prone regions have a very simple plan shape. However, situations arise where an irregular shaped plan form is required and this poses significant challenges for the designer. 'Seismic performance of L-shaped multi-storey buildings with moment-resisting frames' (Abdel Raheem *et al.*, 2018) presents a detailed comparative study of the seismic response of RC frames starting with a 10 bay by 10 bay symmetrical building and morphing through a series of steps into a L shaped building with stems of 10 by 2 bays. The study highlights the changes in response (e.g. inter storey drift) between regular and L shaped buildings and demonstrates the vulnerability of irregular shaped building to stress concentrations and coupled lateral-torsional movement.

Finally in this issue, 'Design of propping schemes of 60-storey reinforced concrete building: a case study' (Das *et al.*, 2018) examines in detail an often overlooked aspect of RC construction. Devising a propping scheme that minimises the total number of props required and the labour and time to reconfigure them as the concrete gains strength is a complex task. Propping schemes must also be capable of accounting for deviations from the intended slab casting cycle to account for accelerated turnarounds to make up for occasional delays in construction if the overall programme is to be met. This paper explains in detail a number of alternative strategies for a project in Mumbai and provides a useful insight into this important aspect of construction design.

I trust that you will enjoy this month's edition of *Structures and Buildings* and find something of interest and practical

value to you. Should you wish to discuss any of the papers please do so; details of how to contribute are given at the end of each paper. *Proceedings* journals rely entirely on contributions from practitioners and researchers in the civil engineering profession. Details of how you can submit a paper are available at <http://www.icevirtuallibrary.com/page/authors>.

REFERENCES

- Abdel Raheem SE, Ahmed MMM, Ahmed MM and Abdel-Shafy AGA (2018) Seismic performance of L-shaped multi-storey buildings with moment-resisting frames. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **171(5)**: 395–408, <https://doi.org/10.1680/jstbu.16.00122>.
- Das AK, Gupta AK and Nanthagopalan P (2018) Design of propping schemes of 60-storey reinforced concrete building: a case study. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **171(5)**: 409–424, <https://doi.org/10.1680/jstbu.15.00081>.
- Feng Q, Visintin O and Oehlers DJ (2018) Effect of steel bar corrosion on flexural behaviour through bond. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **171(5)**: 380–394, <https://doi.org/10.1680/jstbu.16.00168>.
- Hicks M and Sagaseta J (2018) Structural appraisal of existing masonry quadripartite vaults. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **171(5)**: 351–363, <https://doi.org/10.1680/jstbu.16.00184>.
- Oehlers DJ, Visintin P, Chen JF and Ibell TJ (2014) Simulating reinforced concrete members. Part 2: displacement-based analyses. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **167(12)**: 718–727, <https://doi.org/10.1680/stbu.13.00072>.
- Shbeeb NI, Al-Rousan R, Issa MA and Al-Salman H (2018) Impact of bonded carbon fibre composite on the shear strength of reinforced concrete beams. *Proceedings of the Institution of Civil Engineers – Structures and Buildings* **171(5)**: 364–379, <https://doi.org/10.1680/jstbu.16.00145>.