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Spotlight on *Structures*

Congratulations to the winners of the *Structures* prizes 2023! The prizes celebrate the best papers published in the journal in 2022 and recognise both more fundamental research and research likely to have a tangible impact on practice. This year, the 'Best Research Paper Prize' is shared by two papers. The winning papers will be free to access for three months.

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Best Research Paper

Component-based joint model for RC frames with conventional and special detailing against progressive collapse

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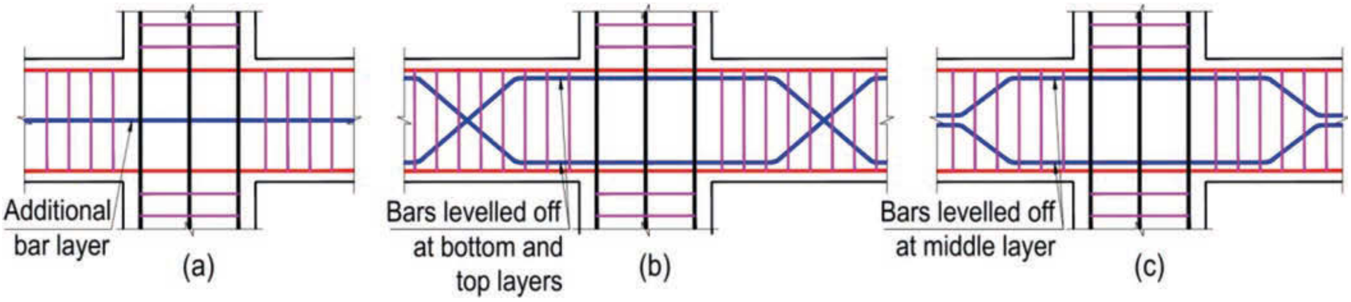
For reinforced concrete (RC) frames subjected to progressive collapse, severe damage is typically concentrated at beam-column connections or even joint panels. To accurately represent this type of local failure and the corresponding effect on progressive collapse resistance, component-based model (CBM) is employed. This paper proposes a refined configuration and calibration on compression bar force-slip springs of CBM for RC frames with conventional detailing at the joints and members. The compression springs account for varying neutral axis depth with applied loads to solve the issue of inaccurate prediction for progressive collapse resistance of RC structures due to over-/under-estimation of compression spring capacities by simplified methods in previous CBMs. In addition, the influence of joint location and tension–compression beam bar ratio on compression spring properties is also explored. Thereafter, the calibrated CBM is developed to simulate the RC frames with special detailing, including plastic hinge relocation (PHR) technique and additional bar layer (ABL) in the beam. It is shown that relocating plastic hinges further away from the joint interface results in a shorter effective beam length and a smaller ultimate deflection. The former increases flexural-compressive arch action and catenary action capacities, and the latter derives the recommendation of limiting the PHR to 1.5 times the effective beam depth. Providing an ABL significantly improves progressive collapse performance of RC frames. Finally, an alternative approach is proposed, in which an ABL is placed only at the support region, located at either the middle or the bottom quarter of the beam depth.

→| Read the full paper: **https://doi.org/10.1016/j.istruc.2022.10.032**



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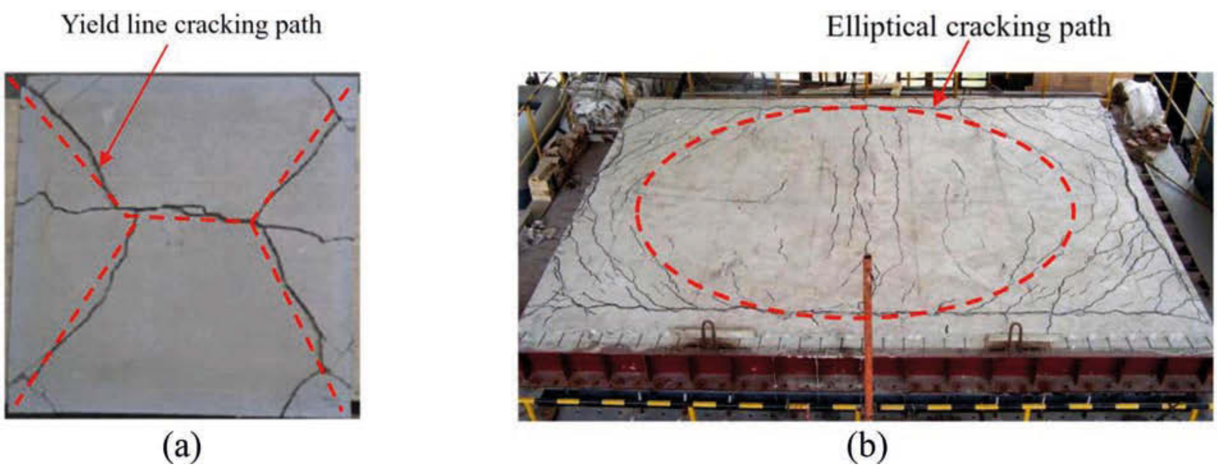

Improved tensile membrane action model of composite slabs at elevated temperatures

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Previous fire tests have showed that tensile membrane action (TMA) between composite slabs and reinforced concrete slabs is different. An improved TMA model is proposed in this paper to accurately and reasonably determine the fire resistance of composite slabs exposed to ISO834 fire. It is assumed that the fracture of steel reinforcement in the long span is the governing failure mode of composite slabs at elevated temperatures. The slab is divided into four concrete rigid plates and one elliptic reinforcement net at centre considering TMA, and the contribution of rotation of concrete rigid plates on the deflection in short-span is taken into account. Meanwhile, coupling thermo-mechanical finite element analyses are carried out to simulate the TMA response of composite slabs at elevated temperatures. The accuracy of the proposed improved model is validated against experimental and numerical results, with a maximum error within 10%. It is found that the improved model has a better prediction of the mid-span deflection and fire resistance than Li's model and Bailey's model. It is important to consider the stress redistribution of the reinforcement in two directions in determining TMA in composite slabs under fire conditions.

→| Read the full paper: **https://doi.org/10.1016/j.istruc.2021.11.042**

Best Research into Practice Paper

Re:Crete – Reuse of concrete blocks from cast-in-place building to arch footbridge

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About 9% of anthropogenic greenhouse gas emissions worldwide are due to the production of cement, key constituent of concrete. Concrete also contributes to a large share of demolition waste, usually coming from building structures that are discarded because of functional obsolescence rather than of technical deficiency. Current practice for treating end-of-life concrete is to landfill it or crush it into aggregates used in new concrete mixes. Instead, a little-explored strategy consists in extending the service life of concrete elements by reusing them in new constructions. Following this paradigm, this paper presents a proof-of-concept prototype that reuses blocks cut out of obsolete cast-in-place concrete walls for a new structural application: a 10 m-long post-tensioned segmented arch footbridge. The paper details the design, material sourcing, and construction processes while highlighting the unusual features of the approach. The structural behaviour is verified with a finite element analysis model and validated by load testing. A comparative life cycle assessment shows that the arch construction presents a significantly lower global warming potential then recycled concrete (–71%) or steel (–74%) alternatives and is very competitive to a timber one (+9%). In conclusion, the project proves the feasibility of a new circular economy application for the construction industry, in which new and reliable concrete structures are built with little to no cement inputs.

→| Read the full paper: **https://doi.org/10.1016/j.istruc.2022.07.012**