Spotlight on Structures

Research Journal of The Institution of Structural Engineers

In this section we shine a spotlight on papers recently published in *Structures* – the Research Journal of The Institution of Structural Engineers.

Structures is a collaboration between the Institution and Elsevier, publishing internationally-leading research across the full breadth of structural engineering which will benefit from wide readership by academics and practitioners.

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New impact statement

Impact Statement on 'Prestressing in Coventry Cathedral'

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The problems of corrosion in prestressing tendons in other structures built in the 1960s led the cathedral authorities to seek more information about their building. This led to a study of the cathedral to identify the locations of the prestressing tendons, which are mainly in the roof structure. None of the tendons are visible and an intrusive investigation would be very damaging to the fabric. The archive research is documented in the paper, from the various sources that have engineering information available on the cathedral's structure. The discovered locations of the prestressing tendons are identified in the paper and the simple but effective structural system of which they form part is described. Estimates of the amount of prestress are presented, which will be of interest to architectural and engineering historians, and practising engineers, as well as those charged with maintenance of the cathedral.

The authors point out that despite some local water penetration, there is no current evidence of corrosion in the tendons. They go on to ask what would happen to the structure if corrosion were to take place at any time in the future. It was concluded that, because the principal prestressed elements are grouted tension ties in the roof trusses, there would be little outward evidence of ongoing corrosion, individual wire breakage or warning of impending failure.

There is tensile strength in the concrete but if the prestress were lost through corrosion, the concrete would be likely to crack across its full section. The strains that occur during this process are small and localised, and would be very difficult to distinguish from those caused by temperature changes. The remaining strain capacity of the tendons and the rebar would then be very limited, meaning that failure might occur with very little warning.

It is concluded that in order to successfully determine the progress of any future degradation in structural performance, replaceable structural health monitoring systems need to be developed that could measure a few microstrain over short gauge lengths, in perpetuity, all along the prestressed elements. The paper concludes with a question that should concern all engineers: 'at what point does a perfectly adequate structure become compromised because of ignorance of what is going on internally?'

The full paper is available at https://doi.org/10.1016/j.istruc.2017.04.003.

Articles in press

The following articles have recently been made available online:

Optimizing the Architectural Layouts and Technical Specifications of Curtain Walls to Minimize Use of Aluminium

Adam D. Lee[a,b], Paul Shepherd[a], Mark C. Evernden[a] and David Metcalfe[c]
[a] Department of Architecture and Civil Engineering, University of Bath, UK
[b] PTCC Facade Design, Makati City, Metro Manila, Philippines
[c] Centre for Window and Cladding Technology (CWCT), Bath, UK
https://doi.org/10.1016/j.istruc.2017.10.004

Highlights
- Efficient design reduces a curtain wall's embodied energy and construction cost
- Changes to extrusion shapes and facade layout geometry result in substantial savings
- A genetic algorithm has been used to optimize thousands of curtain wall designs
- Findings are summarized in simple heuristics for practising design professionals

Seismic Behavior of Under Confined Square Reinforced Concrete Columns

Aditya Singh Rajput and Umesh Kumar Sharma, Indian Institute of Technology, Roorkee, India
https://doi.org/10.1016/j.istruc.2017.10.005

Mathematical Model to Determine the Weld Resistance Factor of Asymmetrical Strength Results

M. Dundu, Department of Civil Engineering Science, University of Johannesburg, South Africa
https://doi.org/10.1016/j.istruc.2017.10.002

Wind Loading of Structures: Framework, Phenomena, Tools and Codification

Giovanni Solari, Department of Civil, Chemical and Environmental Engineering (DICCA), Polytechnic School, University of Genoa, Italy
https://doi.org/10.1016/j.istruc.2017.09.008

Stability of Multiple-crossarm Prestressed Stayed Columns with Additional Stay Systems

Luke Lapira, M. Ahmer Wadee and Leroy Gardner, Department of Civil and Environmental Engineering, Imperial College London, UK
https://doi.org/10.1016/j.istruc.2017.09.010