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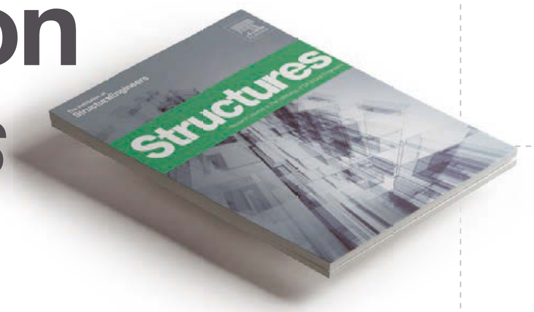

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Don't forget that you can read the winning papers in this year's *Structures* prizes free of charge until the end of October.

The **Best Research Paper Prize** was awarded to Islam Mantawy, Travis Thonstad, David Sanders, John Stanton and Marc Eberhard for their paper, 'Reinforcing steel fracture identification for a high-performance bridge system', published in June 2019.

The **Best Research into Practice Paper Prize** was awarded to Leroy Gardner, Andreas Fieber and Lorenzo Macorini for their paper, 'Formulae for calculating elastic local buckling stresses of full structural cross-sections', published in February 2019.

The prizes are sponsored by Elsevier and each carry an award of £500.

Best Research Paper

Reinforcing steel fracture identification for a high-performance bridge system

Islam M. Mantawy[a], Travis Thonstad[b], David H. Sanders[c], John F. Stanton[b] and Marc O. Eberhard[b]
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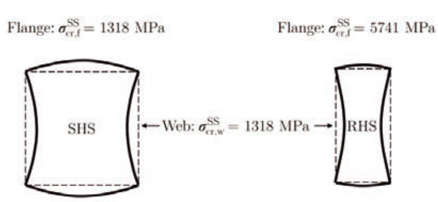
In high-performance bridge systems that inhibit concrete spalling in the columns, bar buckling is suppressed, and bar fracture is delayed. However, bar fracture can still occur due to low-cycle, axial fatigue. If bar fractures cannot be identified visually, a method is needed to identify these fractures indirectly to ensure that the bridge can remain in service. This paper describes an investigation of reinforcing bar fractures that occurred during shaking table tests of a two-span bridge with armored rocking columns. During the test, it was difficult to identify the timing and location of bar fractures, because the lack of spalling made visual inspection impossible and gauges monitoring strains in the reinforcement reached their deformation capacity long before the bars fractured. The number and timing of bar fractures were estimated: (1) by the visual identification of fractures during the demolition of the specimen; (2) from the audible fractures that were recorded by video cameras during each test; and (3) using estimates of the strain histories of the bars, computed from rigid-body mechanics of the columns. Two types of fracture strain criteria were considered to identify bar fractures from the estimated strain data. A strain threshold criterion tended to underestimate the number of bars that fractured in later tests. A low-cycle fatigue criterion, which reflected the full strain histories for the longitudinal bars, correlated much better with bar fractures identified from the audio recordings and visual observations. The proposed methods, using existing models for low-cycle fatigue, can be used to evaluate and improve the performance of similar systems for which axial fatigue fracture is a concern during large earthquake motions.

→| Read the full paper at **https://doi.org/10.1016/j.istruc.2018.11.017**

Best Research into Practice Paper

Formulae for Calculating Elastic Local Buckling Stresses of Full Structural Cross-sections

Leroy Gardner, Andreas Fieber and Lorenzo Macorini
Imperial College London, UK



Formulae for determining the full cross-section elastic local buckling stress of structural steel profiles under a comprehensive range of loading conditions, accounting for the interaction between the individual plate elements, are presented. Element interaction, characterised by the development of rotational restraint along the longitudinal edges of adjoined plates, is shown to occur in cross-sections comprising individual plates with different local buckling stresses, but also in cross-sections where the isolated plates have the same local buckling stress but different local buckling half-wavelengths. The developed expressions account for element interaction through an interaction coefficient ζ that ranges between 0 and 1 and are bound by the theoretical limits of the local buckling stress of the isolated critical plates with simply-supported and fixed boundary conditions along the adjoined edges. A range of standard European and American hot-rolled structural steel profiles, including I-sections, square and rectangular hollow sections, channel sections, tee sections and angle sections, as well as additional welded profiles, are considered. The analytical formulae are calibrated against results derived numerically using the finite strip method. For the range of analysed sections, the elastic local buckling stress is typically predicted to within 5% of the numerical value, whereas when element interaction is ignored and the plates are considered in isolation with simply-supported boundary conditions along the adjoined edges, as is customary in current structural design specifications, the local buckling stress of common structural profiles may be under-estimated by as much as 50%. The derived formulae may be adopted as a convenient alternative to numerical methods in advanced structural design calculations (e.g. using the direct strength method or continuous strength method) and although the focus of the study is on structural steel sections, the functions are also applicable to cross-sections of other isotropic materials.

→| Read the full paper at **https://doi.org/10.1016/j.istruc.2019.01.012**