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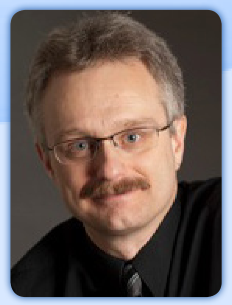

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Rethinking the evaluation of the robustness of steel structures

The foundational research used in current methods of evaluating the general robustness of steel buildings is still dominated by observations from the extensive studies over the last three decades of structures subjected to earthquake-type loading. While the main shortcomings of this approach have already been identified, this realisation has also revealed the urgent need for similar studies that are developed expressly for investigating collapse behaviour under localised damage scenarios. Several such research programs are already underway, but the understanding of generalised robustness criteria is still in its infancy. By far the most common type of connection in conventional steel buildings is the shear connection, although they take a variety of forms. As such, a thorough evaluation of the response and performance of various shear connection types is a critical component of the development of an overall understanding of how steel structures can be designed to mitigate the potential for progressive collapse. At the University of Alberta, tests of 72 full-scale steel shear connections with a variety of forms, both with and without a floor slab, have recently been completed under "column-removal" loading regimes. The tests evaluate most commonly-used shear connection types, including single and double angle, shear tab, and end plate connections. Complementary high-fidelity numerical modelling studies of these connections also incorporate tee shear connections. The overarching objective of this comprehensive research program is to provide new knowledge input for designing steel-framed buildings to minimise the possibility of progressive collapse scenarios occurring in the event of a column loss due to blast or another unanticipated localised trigger. Highly simplified connection models, validated via the physical test and numerical modelling data, are being developed that are much more accurate for characterising the behaviours of the various types of shear connections than those based on earthquake engineering research. These simplified models are appropriate for use in full-building analyses for making robustness assessments with confidence under a variety of potential progressive collapse circumstances.

Biography

Robert Driver is a Professor and Associate Chair of the Dept. of Civil and Environmental Engineering at the University of Alberta in Edmonton, Canada. He has a total of 30 years of experience in the steel fabrication industry, structural engineering consulting, applied engineering research and education, having taught structural engineering undergraduate and post-graduate courses in Canada, the United States and South Africa. He has received numerous awards for both research and teaching and is extensively involved in the development of structural design codes and standards in North America. He has published nearly 200 reports and papers in refereed journals and conference proceedings.

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