

INVESTIGATION INTO STRUCTURAL BEHAVIOUR OF HIGH STRENGTH S690 STEELS AND THEIR WELDED SECTIONS

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ABSTRACT

In order to promote effective use of high strength steels in construction, a series of experimental and numerical investigations into structural behaviour of high strength S690 steels and their welded sections were conducted at the Chinese Engineering Research Centre for Steel Construction (Hong Kong Branch). These investigations include mechanical properties of S690 steels and their welded joints as well as structural behaviour of both stocky and slender columns of S690 welded H-sections, and partially restrained beams of S690 welded I-sections. This paper presents a technical report on the current status of these investigations. In general, structural behaviour of high strength S690 welded sections are demonstrated to follow closely to that of welded sections of normal strength S355 steels, and these include member buckling competing against material yielding in the presence of welding-induced residual stresses and geometrical initial out-of-straightness. Modern design rules such as EN 1993-1-1 & -12 are shown to be generally applicable to these S690 welded sections when suitably selected design data and parameters are employed. However, there are concerns on mechanical properties of S690 welded joints as there are significant reductions in their strength and ductility after welding. It should be noted that the heat input energy due to practical welding will initiate phase transformation and recrystallization in these steels, leading to changes in their microstructures. Hence, possible deterioration in mechanical properties of heat affected zones of the welded joints is often a concern to many design and construction engineers. Consequently, detailed investigations into the mechanical properties of these welded joints will also be reported.