

TRUE STRESS-STRAIN CHARACTERISTICS OF HIGH STRENGTH S690 STEELS

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ABSTRACT

The Chinese National Engineering Research Centre for Steel Construction (Hong Kong Branch) was established in October 2015, and one of its primary objectives is to promote effective use of high strength steels in construction. Comprehensive experimental and numerical investigations into mechanical properties of high strength S690 steels to BS EN 10025-5:2005 have been carried out. This paper presents recent research findings on true stress-strain characteristics of high strength S690 steels according to test results of 33 monotonic tensile tests. Various transformation methods from engineering stress-strain curves to true stress-strain curves were reviewed, and they were adopted to generate different true stress-strain curves for comparison. With advanced measurement technique, strain field data and instantaneous dimensions of these test coupons were measured during testing. By direct adoption of these measured true stress-strain curves into an advanced finite element model, simulations of tensile tests were well established. It was found that the assumption of uniform distribution of stresses and strains across the minimum cross-section of a test coupon was generally not valid after necking. As such, a correction method to the measured true stress-strain curve is proposed, and its accuracy is fully demonstrated after adoption into the finite element model. Based on these tensile test results, true stress-strain characteristics of S690 steels were normalized as a generalized constitutive model for effective analysis and design of steel structures using high strength S690 steels.