Axial Compression Behaviour of Long Concrete Filled Double Skinned Steel Tubular Columns

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Abstract

Concrete filled double skinned steel tubes (CFDST) are proved to have good structural performance in terms of strength, stiffness, ductility and fire resistance. Long CFSDT columns find application in elevated corridors, bridge piers and also in buildings. However, the behaviour of CFDST long columns is still not fully understood and there is limited research in this area. In this paper, axial capacity equations for long column CFDST sections are proposed based on strength super-position method of design. Column capacity computed using the proposed equation is validated through experimental studies conducted by the authors (for columns having L/D ratio of 20) as well as additional tests reported in literature. Tests were conducted on CFDST, Concrete Filled Steel Tube (CFST) and Concrete Filled Hollow Single skinned Steel Tube (CFHSST) cross-sections. Parameters considered in the test include (i) length of the column, (ii) shape of the inner tube, and (iii) absence of inner tube. Results from the test viz., (a) load carrying capacity, (b) load vs. axial deformation curves, and (c) load vs. lateral deflection curves, have been reported. Test result shows that the contribution of inner tube on the axial capacity of long column is less than the predicted value, as the column undergoes elastic buckling prior to yielding. A reduction factor is proposed to account for the reduced contribution of inner steel tube, and it is applied as a correction to the initially proposed equations. The results from proposed capacity equation are compared with experimental results and are found to be in good agreement. It is concluded that the long column axial capacity equation specified for CFST in AISC-360 and EC4 could be extended for CFDST sections after incorporating the new reduction factor.