Test of Circular Steel Tubes in Bending

by Donald R. Sherman, (M.ASCE), Prof. of Struct. Engrg.; Univ. of Wisconsin-Milwaukee, Milwaukee, Wisc.,

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Abstract:

A series of tests on 10-3/4in. (270-mm) tubes was conducted to determine the plastic rotation capacity of tubular beams. Six different D/t values ranging from 18-102 were used in the tests. Cantilever and fixed-ended beams, with moment gradients (shears) and restraints against ovalizing at the end, are compared with the behavior of the constant moment region of simple beams. Tubes with D/t greater than about 50 do not have sufficient plastic hinge rotation capacity to develop the classical ultimate strength. In the absence of a small moment gradient or stiffening, the plastic moment is not quite reached in tubes with D/t of 35. For inelastic buckling in the range of D/t of 18-80, critical strains appear to be proportional to $(t/D)^2$, as opposed to the conventionallinear relationship. Information concerning the complex post-buckling behavior is also presented.

Subject Headings: Material tests | Steel columns | Bending (structural) | Plastics | Rotation | Moment (mechanics) | Plastic hinges | Tubes (structure)

The concrete core and the steel tube in a cross-section are each divided into a large number of horizontal layers parallel to the neutral axis. The area of each layer of the concrete core and the steel tube is calculated based on the geometry of the cross-section. The stresses in the concrete and steel layers are determined using their respective constitutive models.Â The beneficial effects of post-tensioning on the flexural strength of a concrete-filled circular steel tube were observed in the bending tests. Due to post-tensioning, the moment capacity of PTCFT219 was larger than that of CFT219 (92-4 kN m and 87Â·6 kN m, respectively), as shown in Table I. Han et al.