

ABSTRACT

In steel construction, when beams have to be connected at the same elevation, beam flanges must often be coped to provide enough clearance for the supports. When a beam is coped, no matter at the top, the bottom or both flanges, the lateral torsional buckling capacity will be lower than the beam with no copes. The elastic lateral torsional buckling of coped steel I-beam was investigated extensively by Cheng et al. (1984). In this report, the finite element method (F.E.M.) is used to evaluate the elastic lateral torsional buckling capacity of stocky coped steel I-beams. The finite element results were compared with the interaction equations proposed by Cheng et al. (1984). It was found that for stocky sections, the interaction equations do not give conservative results when the ratio of cope length to web depth of the tee-section (c/h_o) is small, especially for short beam. When the ratio of cope length to web depth of the tee-section (c/h_o) is small, it is believed that local buckling of the tee-section occurs. Hence, the use of the overall lateral buckling equation for tee-section in Cheng's interaction equation may not be appropriate. In fact, local buckling of the tee-section was observed for small c/h_o based on further finite element analysis. Modified interaction equations based on the study of tee-section was proposed. The modified interaction equation still considers the interaction of the buckling of the coped region and the uncoped region. However, a plate buckling model was used in evaluating the buckling capacity of the tee-section. The modified interaction equation produces conservative estimate of the elastic lateral buckling of coped steel I-beam. Finite element analysis was also carried out to investigate the influence of loading locations. The results show that the interaction equations proposed by Cheng et al. (1984) do not give conservative results for loading case other than the mid-span loading even C_b (equivalent moment factor) has been taken into account in

calculating the lateral buckling moment for the uncoped section. Subsequently, the design interaction formula is modified for the symmetrical loading case and the results of the new modification equation compared well with finite element results. For constant moment, causing compression in top flange, elastic local web buckling of the tee-section will govern the capacity of the coped I-beam.

This report also includes an experimental study of local web buckling of coped I-beam with small cope depth to beam depth ratio (d_c/D) and the effectiveness of horizontal stiffeners. A series of seven full scale tests, four with d_c/D various from 0.05, 0.1, 0.2 and 0.3 and three with various types of stiffeners were conducted and reported. All the specimens were failed by local web buckling. Test results show that for the specimens whose cope depth to beam depth ratio are smaller than 0.2, the results which were predicted by using the plate buckling equation proposed by Cheng et al. (1984) underestimated the results by 20% to 30%. For the specimens in which horizontal stiffeners were used, test results show that no yielding of the web and/or stiffeners were observed and instead the specimens were failed by local web buckling.