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Torsional Rigidities of Reinforced Concrete Beams Subjected to Elastic Lateral Torsional Buckling

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Abstract : Reinforced concrete (RC) beams rarely undergo lateral-torsional buckling (LTB), since these beams possess large lateral bending and torsional rigidities owing to their stocky cross-sections, unlike steel beams. However, the problem of LTB is becoming more and more pronounced in the last decades as the span lengths of concrete beams increase and the cross-sections become more slender with the use of pre-stressed concrete. The buckling moment of a beam mainly depends on its lateral bending rigidity and torsional rigidity. The nonhomogeneous and elastic-inelastic nature of RC complicates estimation of the buckling moments of concrete beams. Furthermore, the lateral bending and torsional rigidities of RC beams and the buckling moments are affected from different forms of concrete cracking, including flexural, torsional and restrained shrinkage cracking. The present study pertains to the effects of concrete cracking on the torsional rigidities of RC beams prone to elastic LTB. A series of tests on rather slender RC beams indicated that torsional cracking does not initiate until buckling in elastic LTB, while flexural cracking associated with lateral bending takes place even at the initial stages of loading. Hence, the present study clearly indicated that the un-cracked torsional rigidity needs to be used for estimating the buckling moments of RC beams liable to elastic LTB.

Keywords : lateral stability, post-cracking torsional rigidity, uncracked torsional rigidity, critical moment
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