INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

In this thesis, a systematic investigation of the effect of cross sectional parameters such as flange thickness (t_f), flange width (w_f), and shear span (a) on the shear behaviour *viz.*, shear capacity and failure mechanisms, of LDSS rectangular hollow beams (box girders) is presented, using finite element (FE) analysis. On the basis of the understanding gained from the FE analyses, presented herein, appropriateness of the design rules of EN 1993-1-4 (2006/A1:2015) and Direct Strength Method (DSM) are assessed. Based on the comparison, possible modifications to both EN 1993-1-4 (2006/A1:2015) and DSM have been suggested by bifurcating into two span ratios: 1) $a/h_w \leq 1.0$ and 2) $1 < a/h_w \leq 2.0$.

The FE study is then extended to investigate the effect of single circular web perforation in the shear characteristic of LDSS rectangular hollow beams. Primarily, the effect of single perforation size / diameter and locations (along longitudinal, transverse, and diagonals) are assessed with a focus on the shear capacity, deformed shapes (or failure modes) etc. Further, following the method proposed by Hagen, (2005), the proposed modification to EN 1993-1-4 (2006/A1:2015) (mentioned above) for un perforated LDSS hollow beam has been further modified to incorporate the effect of circular perforation, considering two span cases 1) $a/h_w \leq 1.0$ and 2) $1 < a/h_w \leq 2.0$.

Further, the study on perforated LDSS hollow beam has been extended to determine the shear behaviour of stiffened single perforated LDSS rectangular hollow beam, considering various orientations / patterns *viz.*, inclined (*IS*), vertical (*VS*), horizontal (*HS*) and ring (*RS*); and cross-sections i.e. flat, angular and semi-circular. Based on the study, it has been found that inclined stiffener (with flat cross-section) is relatively most effective in enhancing the shear capacity of perforated beams.