2012/13 Undergraduate Research Grant Scheme – Executive Summary

Project title:
Investigation of the buckling behaviour of steel web tapered tee section cantilevers

University:
Plymouth University

Supervisor: Boksun Kim

Contact details:
School of Marine Science & Engineering at Plymouth University, Drake Circus, Plymouth PL4 8AA
Telephone: N/A
Email: boksun.kim@plymouth.ac.uk

Student:
Christos Mountrichas and Praveen Gunarath Adikari

Project summary:
This study discusses the buckling behaviour of steel web tapered tee cantilevers subjected to a point load at the free end. A one dimensional (1D) analysis was carried out to determine the lateral torsional buckling loads of such beams. The critical buckling loads were determined from the solutions of a coupled differential equation involving the lateral displacement and the angle of twist. The coupled differential equation was solved numerically using the MAPLE computer algebra package. The local bucking capacities of the beams were also determined using the critical stress formula for plates. A finite element analysis (FEA) was carried out using the LUSAS finite element software package to predict the local buckling and lateral torsional buckling behaviour of such beams. A total of ten 1.8 meter tapered tee cantilever beams were tested in the Heavy Structures Laboratory at Plymouth University. Five cases distinguished by the degree of taper were used. The failure modes and critical loads of the beams were obtained from the experiments and compared with the theoretical and FEA predictions. Results show that the stress formula, 1D and FEA analyses overestimate the experimental load capacities of all five sections prior to local buckling failure. The FEA critical load predictions are within 6 - 18 % of the experimental results. The experimental results for all the tee cantilevers show local buckling behaviour before the onset of lateral torsional buckling behaviour.