UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF INNOVATIVE ROLLED-IN STIFFENERS FOR PROFILED WEB GIRDERS SUBJECTED TO SHEAR LOADING

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ABSTRACT

A girder whose web is profiled can lead to a structural system of high strength-to-weight ratio. In 1960s, the usage of a flat web girder had been replaced with profiled web since this profiled web can increase stability against buckling. The usage of girders with profiled webs has become progressively popular as these girders can reduce self-weight of the structure and increase structural efficiency. Use of profiled configuration in the web provides uniformly distributed stiffening in the transverse direction of the girder. In this study, an innovative idea is introduced to improve the efficiency of the web through intermediate rolled-in stiffeners. The shear capacities of a series of profiled web girders with intermediate rolled-in stiffeners have been numerically studied using a commercially available finite element software LUSAS. The numerical study includes the development non-linearities of material and geometry of finite element models, whose results are compared with previous experimental results. The entire plate components such as flanges, web and rolled-in stiffeners were modelled using eight-noded quadrilateral thin shell elements. Each specimen was tested under a shear load placed on the top flange. The results from the finite element analysis are presented and discussed. The shear capacities of different configurations profiled webs with intermediate rolled-in stiffeners and their buckling modes are discovered. The buckling modes that have occurred in this study are local and global buckling mode. The typical failure mode of a girder with profiled web is initially in the local buckling mode. After reaching a peak load, the buckling propagated to other folds which then transformed and extended to a global buckling mode. In the process of buckling, the load displacement relationship of the girder was switched to a sudden and steep descending branch. The buckling can reduce the post-buckling shear capacity in the range of 20% to 50% of the ultimate shear capacity. Generally, whenever rolled-in stiffeners are introduced within the profiled web, the web is able to cater more loads.

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