ABSTRACT

In steel construction hot-rolled members and cold-formed members are the two main families of structural members. Even though cold formed structural members are less familiar it has a growing importance relative to the traditional heavier hot-rolled steel structural members. Steel products are extensively used in building industries such as bridges, roof trusses, transmission line towers, multi storied buildings etc. Because of its high strength to weight ratio, Cold Formed Steel member results in the reduction of deadweight.

This study is aimed at developing an innovative latticed cold-formed steel beam by utilizing the advantages of lacing and cold-formed steel to enhance flexural capacity at minimum fabrication cost. The latticed hot rolled section beams are in existence and they are widely used in industrial sectors. In this research an attempt has been made to use similar type of latticed beam just by replacing the hot rolled section by cold-formed steel sections. This study therefore involves investigations into flexural behaviour of latticed beams comprising various steel grades, steel thickness, section sizes and span to fully understand the primary buckling and ultimate failure characteristics.
The primary objective is to investigate the fundamental buckling behaviour and ultimate strength of a group of innovative cold-formed steel beam sections as latticed flexural member and to develop appropriate design rules for the same. The investigation is carried out in three different stages.

In the first stage a massive experimental investigation had been carried out on three different profiles selected based on the preliminary study. The mechanical properties of materials used for making the specimens were found out by conducting tensile coupon tests. Totally 101 beams were tested under simply supported end condition and their failure modes and ultimate moment capacities were presented. The experimental results were compared with the available design rules AS/NZS 4600 and Direct Strength Method (DSM).

In the second stage all the tested beams were modeled using a finite element tool ANSYS and they were analysed to investigate the flexural behaviour of latticed built-up beams. The failure modes and ultimate moment capacity of the simulated FEA models were compared with experimental results, they suits well.

In the third stage, the results of the parametric analysis were presented and a regression analysis was carried out to develop a new design curve to predict the ultimate moment capacity of cold-formed steel latticed beams.
Overall, this thesis has demonstrates that the innovative cold-formed steel latticed beams can perform well as economically and structurally efficient flexural members. Developed new design rule can be used to design any latticed built-up beams made of cold-formed steel.