The Effect of the Removal of Mass on the Calculated Efficiency of Structural Beams

Wotton, Heather

This experiment studied the relationship between mass and calculated structural efficiency in scale sized box girder beams constructed from clear poplar hardwood. By calculating the efficiency of each structure in newtons per gram this experiment attempted to research viable methods to increase efficiency in the construction and repair of load bearing structures. This research studied the effect the removal of mass has on increasing structural efficiency. Two identical groups of systematically constructed box girders were tested by applying an increasing amount of force until failure occurred. The first group had no change made to its design while the second group included the addition of eight, 0.95 cm holes to remove mass in the bottom flange. The mean calculated efficiency was 29.54 N/g and 33.01 N/g respectively. The mean value of the calculated efficiencies of the experimental group was higher than that of the control group, meaning that structural efficiency did increase as mass was removed from the structure. A standard two sample T test however, gave a P value of .0547, showing that this difference is not great enough to have statistical significance. More testing is needed to show that this conclusion did not occur by chance. In addition, testing limitations requiring certain aspects of the study to be altered caused caution in the confidence of these results. These findings have practical use in the repair and construction of many components of infrastructure and can be helpful in lowering the costs of routine maintenance on load bearing beams.

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