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2008-03-28T09:49:56Z
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Amobi Ikechukwu

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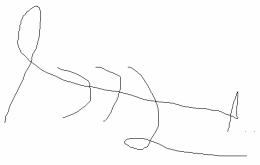
Student Number: 0507426E

A project report submitted to the Faculty of Engineering, University of the Witwatersrand, in partial fulfillment of the requirements for the degree of Master of Science in Engineering.

Johannesburg, August 2006.

DECLARATION

I declare that this project is my own unaided work. It is being submitted for the Degree of Master of Science in Engineering at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.



AMOBI IKECHUKWU

(Signature of Candidate)

__07TH__ day of ____December____, 2006.

ABSTRACT

As industries are upgrading rapidly from a lower steel grade to higher ones it has become necessary to study the effect of changing from lower steel grades to higher grades. This thesis reports on fatigue life and behaviour, economic implications and material composition of these higher strength steels (HSS) as compared to the conventional grades. Three grades are commercially available in South Africa: 300W, 350W and 460W. These different steel grades (conventional and HSS) with the same moment capacities where subjected to constant dynamic stresses and the fatigue crack growth of the overloading and unloading were monitored and compared with each other. The influences of the overloading and unloading made standard grades perform better under repeated loading than the HSS, since HSS have been proved to have poor ductility, resulting in lower number of cycles to failure. An 85% increase in material cost was generated as HSS replaces the conventional lower steel grades. Reduction in number of cycles to failure in HSS was over 500%.

A space analysis for a multi-storey building with 10 beam floors was conducted for the various steel grades using a software package. The buckling and linear behaviours of these structures were compared. Although the deflections were not too far apart, it was shown clearly that grade lower steel grades performed better than the higher grades.

An optimization was conducted using the parameters discussed in the text or obtained from experiment and computer modelling, in order to aid in the selection criterion of general purpose steel. Grade 300W was the optimal grade although the result was based mainly on the cost and fatigue behaviour of the three grades.

DEDICATION

To my son Chakky, who is about to join us.

ACKNOWLEDGEMENT

I am greatly indebted to the following for their support and guidance during the course of this project:

Prof Herbert C. Uzoegbo, for his supervisory support, guidance, insights and motivation throughout the life of the project.

The technical staff in the School of Civil and Environmental Engineering, University of the Witwatersrand, especially Mr. Ernest Roelofsz, Mr Les Wills, Eddy and Ziggy.

The South African Institute of Steel Construction, especially Mr Spencer Erling for their donation of the steel sections.

And my lovely bride, Lilia Potseluyko, for her patience, care, motivation and love throughout and beyond the life of the project.