

EFFECTS OF WOOD PROPERTIES ON INCIDENTAL DAMAGES TO FELLED TREES IN SOME SELECTED NIGERIAN HARDWOOD SPECIES



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ABSTRACT

Tropical timbers are usually heavily crowned and bulky. Felling of a mature tree of any such species is always accompanied by considerable impact resulting in heavy dynamic stresses being set up within the felled tree. These stresses cause much damage to wood fibres in particular and to a larger extent, to the amorphous middle lamella. This study was carried out to investigate the influences wood properties on the magnitude of the induced stress and associated incidental damage in nine matured tropical timbers grown in Nigerian low land rain forest. Data were collected on tree characteristics with the aid of a checklist using time study and work analysis. During felling, duration of impact was estimated experimentally. Data collected were analyzed using a combination of multiple linear regression and correlation analyses to assess the extent of association and relationship as well as the level of predictability among the evaluated properties. Results showed that the average moisture of green wood ranged between 108% and 147% while the average density of green wood ranged from 939.91 Kg/m³ and 1845 Kg/m³ for all the species. Observed average maximum dynamic stress ranged between $8.38 \times 10^6 \text{N/m}^2$ and $18.75 \times 10^6 \text{N/m}^2$. Of the 27 fitted models for the study species per variable and on the basis of coefficient of multiple determination (R^2), standard error (SE) value and significance of the regression model, 3 models were selected for damages and 7 for maximum dynamic stress. Significant relationship was established between maximum dynamic stress, damage volume, tree species, tree height, tree mass stem diameter and angular velocity at $P < 0.05$. The magnitude of the dynamic stresses ($9.08 \times 10^6 \text{N/m}^2 - 18.75 \times 10^6 \text{N/m}^2$) and force generated at impact ($1.498 \times 10^6 \text{Ns} - 7.588 \times 10^6 \text{Ns}$) are considerably high and these are dictated by species, tree height, tree diameter, tree mass and angular velocity. Regression models showed that these factors can be responsible for as high as 71% of the MDS induced in the wood of the felled tree as in the case of *Terminalia superba*. The use of regression models to study the dynamic stresses induced in wood and the associated mechanical damages during felling is offers a valuable contribution to existing knowledge in logging industries in the tropical rain forest.

Keywords: Incidental damages, wood properties, dynamic stresses, tropical timbers