

## ABSTRACT

A project was undertaken to study the influence of tyre design parameters on the performance of the towed pneumatic wheels with a view to select a suitable tyre for camel carts used in sandy terrains. In the first phase of the study four animal drawn vehicle (ADV) tyres (5.00-19, 6.00-19, 7.00-19 and 8.00-19), one trailer tyre (7.50-16), one automobile discarded unbuffed tyre (9.00-20) and three automobile discarded buffed tyres (9.00-20, 10.00-20 and 11.00-20) were tested for their load-deflection characteristics. Based on this test the maximum load carrying capacity of each tyre was established at a particular inflation pressure within the desired deflection range of 30 percent.

In the second phase, four ADV tyres, one trailer tyre, one unbuffed tyre and one buffed tyre were selected and their performance was evaluated at different normal loads, inflation pressures and soil compaction levels keeping the forward speed of the tyre test carriage constant at 3.1 km/h. Based on the results the performance of the automobile discarded buffed tyre was found better than that of the other tyres tested. In order to select a suitable size of the buffed tyre for camel carts three buffed tyres of varying sizes were selected and tested at different inflation pressures (69-345 kPa), normal loads (200-1000 daN) and soil compaction levels (3.4-4.5 MPa/m) in sand. Out of the three tyres tested the 10.00-20 tyre indicated the minimum rolling resistance in the test range of normal load and inflation pressure. In the subsequent phase the effect of rim width on the tyre performance was studied and an optimum rim size for 10.00-20 tyre was found to be 250 mm.

The experimental data collected on performance evaluation of test tyres were used to develop regression models to predict rolling resistance and sinkage of different types of pneumatic tyres in sand. The developed model of rolling resistance was used to optimize the different design and operating parameters of the buffed tyres. From the analysis a buffed tyre of size 10.00-20 was found to indicate the minimum rolling resistance for a payload capacity of 1000 daN and inflation pressure of 69 kPa.

An effort was also made to compare the experimental results with the values predicted by the two other models, one based on the sand mobility number approach and another based on the Bekker's semi-empirical approach. The sand mobility number approach was found to predict the experimental results within  $\pm 20\%$  variation; while an over prediction was obtained with the Bekker's semi-empirical approach much beyond 20%. Considering the simplicity and good performance of sand mobility number approach, this model was finally recommended to be used for predicting the performance of animal drawn vehicle and automobile discarded buffed tyres under sandy terrain.

**Key words :** Camel cart, Towed wheel, Normal load, Inflation pressure, Soil compaction level, ADV tyre, Trailer tyre, Buffed tyre, Unbuffed tyre, Rolling resistance, Sinkage, Deflection characteristics, Sand mobility number, Regression model.