

ABSTRACT

In the highly industrialised nations, where most of the world's agricultural tractors are manufactured, there has been a steady trend during recent decades toward heavy, high-powered, sophisticated and costly tractors. While such tractors are suitable for large size farms, there is also an expanding need -- primarily in the developing nations -- for compact tractors suited to the special requirements of small-holding farmers. Commercial compact tractors are often just scaled-down models of the larger tractors, without adequate consideration of traction and stability in the design.

In the present work a systematic approach to the design of compact tractors has been developed. To this end, equations have been derived for predicting tractive performance and stability, directly from tractor and soil parameters. The procedures are applicable to both front wheel drive and rear wheel drive tractors, three-wheeled and four-wheeled configurations, sloping land as well as level land, and a wide variety of soil types and soil strengths.

Essential steps have been taken to provide the necessary inputs for the performance prediction system. These include a practical method for predicting traction and rolling resistance coefficients of single wheels on soil, a statistical procedure for predicting tractor weights and centre of gravity locations, several improvements in performance analysis and in the method of presenting performance curves, and new concepts which allow analysis of performance on slopes. Data from tractor field tests were analysed to verify the prediction system and determine the depths to which soil cone index values should be averaged.

The developed methods can be applied to a design-oriented process, to the selection of existing tractors suited to specific

ACKNOWLEDGEMENTS

conditions, and to the choice of suitable ballast arrangements. The performance prediction system was utilised to determine which design parameters have a significant influence on tractor performance, and the nature of their influence. The developed procedures and accumulated data were used to obtain recommended basic design parameters for a compact tractor which would be well-suited for the requirements of small-holding farmers in the Caribbean region.

Prof. S. Sathuramthen, Head of the Department of Mechanical Engineering, for his interest and support.

The staff of the Mechanical Engineering Laboratory for their full cooperation in the operation of the field test equipment and in carrying out the field tests.

The U.W.I. Crop Science Department for making available their facilities at the University Field Station — in particular, Mr. P. Bishop, Workshop Supervisor, who gave enthusiastic assistance during the field testing.

The staff of the U.W.I. Computer Centre for the generous allowance of computer time.

Dr. F. A. Sc. Cyr and Dr. Winston Richards for their valuable guidance in the use of statistical methods.

Universidad del Zulia, Maracaibo, Venezuela, for granting a scholarship which enabled the author to undertake the research.

Dr. K. Studdell, who was co-supervisor during the early stages of the work, for his valuable suggestions and encouragement.

The author owes profound gratitude to his wife, for her patience and devotion which sustained the atmosphere for study and research.