# PREDICTION OF SOIL COMPACTION FROM CONE INDEX AND MOISTURE CONTENT DATA

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# ABSTRACT

The soil compaction has to be monitored carefully to minimize its direct and indirect effects on plant growth and the society as a whole, to avoid unnecessary loosening of soil, and to determine the correct combinations of field conditions and tools for maximizing energy use efficiency. Soil dry density provides direct information on the level of soil compaction. The most commonly used soil core method becomes tedious and labour intensive when the samples must be collected from deep soil profiles. The difficulties in *in situ* determination of dry density necessitate alternate methods be developed for the above purposes. Therefore, this study was aimed at developing bulk density-cone index-moisture content models for two selected soils in Sri Lanka namely Reddish Brown Earth (RBE) and Reddish Brown Latasol (RBL), so that, those models could be used to save time and money spend on future studies on soil compaction or tillage.

A tractor-mounted, hydraulically-operated penetrometer was developed and used to collect cone index data. A computer-based data acquisition system was developed and used to collect cone index values at 1 cm depth intervals. Soil samples were collected from undisturbed, randomly selected locations in each selected soil. In the laboratory the soils were compacted in a mould to various levels at different moisture contents and the cone index values were recorded. Several mathematical models were fitted to these data and the model that represents a soil was selected by statistical means.

In the field bulk density, moisture content and cone index data were taken from places where the samples for laboratory analysis had been collected. The bulk density and moisture content data were obtained from core samples. Soil bulk density values were calculated for the moisture content and cone index data obtained in the field using the selected model from the laboratory study. These values were plotted against the observed bulk density values to verify prediction by the selected model.

The typical gravelly sub horizon of the RBE was found at a depth of 10 cm from the surface at the field experimental site. Because of the textural difference, above investigation had to be carried out for these two layers separately. The RBL had a uniform textured soil profile.

All the models considered in the laboratory study gave high $R^2$ (coefficient of determination) values ($R^2$>0.80). The model selected for the topsoil layer of the RBE closely predicted the bulk density from cone index and moisture content data. The model selected for the gravelly subsoil horizon of the RBE underpredicted soil bulk density. The model selected for the RBL slightly underpredicted soil bulk density.

The investigation demonstrates that the model selected for the subsoil horizon of the Reddish Brown Earth cannot be used. This may be due to high gravel content in that horizon. Therefore, further investigation has to be carried out with a larger sized cone.