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Soil-Metal Sliding Resistance Forces of Some Trinidadian Soils at High Water Contents

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Abstract: *Soil-metal sliding resistance forces are influenced by factors such as soil physical properties, the geometrical characteristics of the tool and the speed between the two interacting surfaces. Soil-metal sliding resistance has a negative effect on the operation of earth-working machines. It results in increased downtime for cleaning tool surfaces, increased draft forces, and increased fuel consumption during the operation of the machinery thus leading to reduced operation efficiencies. This results in increased operational cost to the end user. Previous research exists on the subject area. However, there are few equipment that have been designed to adequately measure the dynamic forces that exist during this phenomenon. In this paper, soil-metal sliding resistance tests were performed by incorporating a soil-metal adapter tool (SMAT) to a Hounsfield tensometer. This permitted measurements of the dynamic forces on the SMAT as it moved on the soil surface. Data on the normal stress against shear stress at the soil-tool interface for some common soils in Trinidad were obtained. The measured shear stress at the soil-tool interface was separated into the components of adhesion constant and external friction angle. Soil penetration resistance measurements were also taken. Analysis of variance showed that the experimental factors such as soil type, water content and compaction effort had significant ($P < 0.001$) effect on adhesion constant and the external friction angle. Regression models were developed to predict the behaviour of the soil and the tool at the boundary surfaces. This information could be used in performing simulations at the soil-tool interface and thereby aid in improving designs of earth-working tools. Also the information could be used in improving soil management practices during tillage operations.*

Keywords: *Adhesion, Friction, Soil, Metal, Sliding, Resistance*