Mobility Soil Mechanics

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ABRIDGMENT

•THE DEVELOPMENT of land locomotion mechanics has required a departure from soil mechanics as applied to highway design. When dealing with off-road vehicle design, the engineer is faced with extremely large shear and sinkage deformations that extend well beyond the elastic or linear stress-strain range of soil.

Equations describing soil pressure-sinkage relationships and shear strength-deformation are presented. The pressure-sinkage equation is of the form:

$$p = kz^n \tag{1}$$

where

p = pressure,
k = proportionality constant containing both soil and load constants,
z = sinkage, and
n = a dimensionless exponent.

The shear strength-deformation equation is of the form:

$$S_z (c + p \tan \phi) (1 - e^{-j/k}) \tag{2}$$

where

S = unit shear strength,
c = cohesion as measured by an annular shear device,
ϕ = angle of internal friction as measured by an annular shear device,
j = any shear deformation, and
k = the modulus of deformation (tangent modulus).

The motion resistance of a vehicle is proportional to the sinkage and the tractive effort is proportional to the shear strength. The development of equations describing these proportions permits the prediction of vehicle performance.

The problem of the highway engineer is quite different from the off-road vehicle design engineer in that the former is concerned with soil loading situations producing very small deformations. It is concluded, however, that despite the difference in soil problems, the civil engineer may find the approach taken by mobility soil mechanics useful when dealing with slope stability, piles, and other problems which may result in large deformations.

Paper sponsored by Committee on Mechanics of Earth Masses and Layered Systems.