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THE DEVELOPMENT OF THE STRAIN FIELD BENEATH A FOUNDATION IN SANDS

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The theories of elasticity and plasticity which were developed for metals, are used extensively for the solution of problems in soils, the former under working load conditions and the latter under failure conditions. This is despite the fact that soils do not possess linear stress-strain relationships; soils begin to yield even at low stress levels; and soils exhibit large dilatation or volume changes while shearing.

This paper sets out the experimental results of strain fields obtained in plane strain tests in foundations on sand. An X-ray technique was used to measure the displacements of leadshot buried in the sand, and the strain field was calculated from the measured displacement field.

It is shown that at very small foundation loads, the principal axes of strain orient themselves to coincide with the principal axes of stress. Subsequently, there is very little rotation of the principal axes of strain, indicating that the principal axes of strain rate and of strain coincide. The strain contours obtained are compared with the stress contours predicted using the theory of elasticity, and found to be very similar. Thus, it is reasonable to use pseudo elastic constants (E and V) for predicting the stress and strain fields in soils.

At failure, the theory of Plasticity identifies three shear zones—Active Rankine, Radial Shear, and Passive Rankine zones. It is shown that at loads very close to the failure load, very little strains are developed in the passive Rankine zone. However, the development of this shear region just prior to failure is not ruled out.