

## **Transition from Brittle Failure to Ductile Flow of a luvisol Soil**

### **Abstract:**

A comprehensive programme of triaxial compression tests was carried out on unsaturated samples of a sand, a loam soil and a clay. The samples were prepared under laboratory conditions in two microstructural states where the inter-particle cementation bonds were either mechanically destroyed (remoulded state) or allowed to form to their natural extent (cemented state). The tests were carried out to investigate brittle, transitional and ductile failure behaviour as controlled by moisture content, confining stress and the two microstructural states created in the laboratory. The results demonstrate that the brittle behaviour of unsaturated soils and their tendency to dilate at failure are both controlled by four main factors: soil texture, cementation processes in the microstructure, moisture content and ambient confining stress. A simple rule is presented for assessing the transition from brittle dilatatory behaviour to ductile compressive flow in terms of these four factors. This consists of developing a "transition surface" in a three-dimensional plot having axes representing transition pressure, moisture content and microstructural state. The values of these three parameters of a field soil can be used to locate a point within this diagram and its position relative to the transition surface could be used as a useful guide to the behaviour of the soil during tillage operations.