Jumikis (1966) has amply pointed out some of the engineering difficulties that arise from dealing with highly anisotropic rocks. Specifically, he comments on the low shearing strength parallel to bedding and the differential expansion (swelling) observed in water saturated zones of the Triassic red shales of New Jersey.

Secondary Anisotropy

Of concern here are anisotropies introduced by the geologic deformation of the rocks. Habib and Bernaix (1966) call specific attention to fractures and the role they play in creating anisotropic behavior. Borg et al. (1960) and Friedman (1963) in studies of experimentally deformed sands and sandstones recognized that although the stresses in an aggregate are transmitted from one grain to another at points of grain contacts, microfractures, for example, that develop in the grains statistically do not radiate from these contacts but tend to be oriented such as to reflect the principal stress directions across the boundaries of the aggregate as a whole. Thus in nature it seems that deformation can produce or modify microscopic fabric elements in an ordered manner such as to create intrinsic lines or planes of anisotropy that could influence the subsequent mechanical behavior of the material.

Boretti-Onyszkiewicz (1966), Mauriño and Limousin (1966), and Paulmann (1966) in their contributions to this Congress describe three cases of tectonically induced anisotropy. Their reports are similar in scope even though their samples were taken from widely different geologic situations and different testing techniques were employed. Boretti-Onyszkiewicz (1966) describes a situation in the Podhale region of Poland where open macrofractures occur oriented parallel to older calcite filled macrofractures. The fracture sets are oriented at high angles to bedding in sandstones. Sample blocks were taken from unfractured material between the macrofractures, and were experimentally