A dual interface shear apparatus (simple or direct) has been developed to evaluate the distribution and magnitude of friction between granular materials and solid surfaces. Ideal and natural granular materials were sheared along controlled and random solid surface geometry's. The test results were evaluated through a model describing the interface friction mechanism based on a micromechanical approach. The influence of boundary conditions and interfacial shear modes were examined and compared to the results obtained in a modified direct shear device. The test results show that the grain shape and surface roughness quantified in respect to the grain size are the primary parameters controlling the interfacial shear at a given stress level. The use of a modified direct shear box for the evaluation of interfacial friction seems to be influenced by the boundary conditions, resulting in interface friction angles exceeding those that would develop along unrestricted interface soil and a solid surface for both modes of shear, along the solid surface or in the soil.