

Effect of specimen geometry and testing method on mixed Mode I-II fracture toughness of a limestone rock from Saudi Arabia

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Abstract: The effect of testing method and specimen geometry such as diameter, thickness, and crack length and type on measured fracture toughness was investigated using specimens collected from a limestone rock formation outcropping in the Central Province of Saudi Arabia. Straight Edge Cracked Round Bar Bend (SECRBB), semicircular disk specimens under three point bending, and Brazilian disk specimens under diametrical compression were used in this investigation. SECRBB specimens were used for the Mode-I study, and notched Brazilian disk and semicircular specimens were used for the mixed Mode I-II study. The results show that specimen diameter and crack type have a substantial influence on the measured fracture toughness; however, loading rate, crack size, and specimen thickness seem to have a negligible effect on the fracture toughness. Mode-I fracture toughness is significantly influenced by specimen diameter and crack type, while their effects on Mode-II fracture toughness are generally negligible. The different specimens (SECRBB, Brazilian disk, and semicircular) can give comparable results only when the proper span to diameter ratio is used. The Brazilian disk with a straight notch was found to be the most convenient geometry to use for fracture toughness determination. A simple method of making a precise notch inside the disk is presented, using the combination of a drilling machine and a wire saw.