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The Effects of Joint Forms (Shape) and Dimensions on the Strengths of Mortise
and Tenon Joints

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Abstract: Until recently, detailing of joints was largely a matter of tradition, based on trial and error methods. However, in the engineering design of furniture, it is necessary for designers to create joints with a specified strength. This study was undertaken accordingly, to obtain the strength of round tenon/round mortise, rectangular tenon/rectangular mortise and rectangular tenon/round mortise joints assembled under nominally identical conditions with different end configurations. In addition, each end configuration was compared at rail widths, each with 2 widths of tenon. The results showed that rectangular end mortise and tenons are about 15% stronger than both round end mortise and tenons and rectangular end tenons fitting into round end mortise joints. Meanwhile, joint geometry has a significant effect on the strength of those particular joints. As tenon width and length were increased, the strength of the joint was correspondingly improved. The type of mortise and tenon end has an appreciable effect on the breaking strength of the joints as rectangular end mortise and tenons are stronger than round end mortise and tenon joints; however, this does not limit the use of round end mortise and tenon joints in chair construction. It may actually be advantageous to use round end tenon and mortise joints for the front leg/side rail joint in a chair frame as the internal stresses may be more uniformly distributed over the rounded ends of the mortise, thus reducing the risk of splitting the leg member. The third type of construction, with a square end tenon fitting into a round end mortise, was, however, less satisfactory.

Key Words: Mortise and tenon joints, furniture, chair frame

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