TFEC 1-07 Standard for Design of Timber Frame Structures

By Jim DeStefano, P.E.

Timber framing is a type of construction that has existed since the dawn of civilization, and has been commonly used in Europe, Asia and North America for nearly three thousand years. Light wood frame construction is often mistakenly referred to as timber framing, but not all wood is timber. Timber framing, sometimes called post and beam construction, is characterized by large sawn timbers connected with mortise and tenon joints, dovetails, or scarfs that are secured with hardwood pegs. With the onset of the industrial revolution in the mid-nineteenth century, timber frame construction was slowly replaced by other more modern structural systems – light wood frame construction at first and later structural iron and reinforced concrete. By the turn of the twentieth century, timber frame construction was practically extinct and its application was limited to barns.

Timber frame construction has experienced a revival over the last 30 years. The revival started as a movement towards alternative building technologies in the 1970s, but has since moved into the mainstream of the building industry. What started as a movement away from mass produced housing towards hand-crafted building is today a highly technologically sophisticated industry utilizing automated fabrication equipment and advanced computer systems. Timber framing is almost always architecturally exposed, and it is used today not just for residences but also for institutional buildings such as schools, museums and churches.

Engineering of timber frame structures has always been challenging and the practice has been limited to a relatively small core group of specialty structural engineers. While the analysis and sizing of timbers is somewhat mundane, the engineering of the connections, or joints as they are more properly called, requires considerable skill and is as much an art as it is a science. The current *National Design Specification (NDS) for Wood Construction* contains design procedures and allowable stresses that are suitable for sizing timbers, but it is silent on the subject of timber joinery. There is considerable coverage in the NDS given to wood connections using bolts, lag screws or nails, but there is not much guidance given for evaluating the capacity of an interlocking timber joint secured with hardwood pegs. Engineers designing timber frame structures often find themselves flying by the seat of their pants without the safety net of industry standards. That is, up until now.

The Timber Frame Engineering Council (TFEC) has recently released *TFEC 1-07 Standard for Design of Timber Frame Structures and Commentary*. The TFEC is an organization of structural engineers who specialize in the design of timber frame structures and is affiliated with the Timber Framers Guild. The TFEC 1-07 standard represents the state of the art for the technology of timber frame structures and joinery. The standard includes methodologies for evaluating the structural capacity of joints with hardwood pegs loaded in shear. It provides guidance in proportioning mortises, tenons and notches in timbers. The standard also includes methodologies for evaluating the reduction in strength of timbers where their net section has been reduced by the joinery.

Much of the technical content of the TFEC 1-07 standard is based on research performed at the University of Wyoming, under the direction of Professor Dick Schmidt over the past decade. The standard was developed with funding from the Timber Framers Guild and the Timber Frame Business Council.

The TFEC is currently working in collaboration with the American Wood Council to incorporate portions of TFEC 1-07 into future editions of the NDS. Copies of the TFEC 1-07 may be purchased from the Timber Framers Guild or downloaded at no charge from the Guild website **www.tfguild.org**.▪

Jim DeStefano, P.E. is the President of DeStefano & Chamberlain, Inc., located in Fairfield, Connecticut. He is a founder and past chairman of the TFEC. Jim can be contacted at ***jimd@destefanoassociates.com****.*