



*Robert L. ("Ben") Brungraber,
Ph.D., P.E.*

TIMBER FRAME CONSTRUCTION

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Timber framing, for the purposes of this talk, is defined as the craft of building structures that are supported by exposed, heavy timbers. The timber connections are, generally, based in traditional methods; employing: pegged mortise and tenons, splines, keys, wedges, and simple bearing joinery. This talk covers the past, present, and future of timber framing in The United States. Examples of timber framed residential and commercial structures illustrate some of the various timbers and connections that can be used. Some discussion of traditional joinery may prove unavoidable. Various new methods of installing heating, wiring, plumbing and other services have proven to be the major innovation in American timber frame home building.

The **history** of timber framed structures is long and rich, indeed. Surviving European timber framed structures date back almost a thousand years, and include: stave churches, cathedral roofs, half-timbered homes, and covered bridges. Mid and Far Eastern cultures were building elegantly joined, heavy timber structures long before that. Surviving examples of their work include: temples, gates, pagodas, and palaces. Since North America was taken over, largely, by European nations, it is not surprising that many of their colonial structures were constructed with methods based in European models. Surviving New England examples of early timber frame structures include: churches, mills, barns, bridges, and homes.

Timber framing **reigned** as the dominant method of construction in North America; from the Mayflower landed the first colonists until the Chicago Fire in the late 19th century. The tremendous population growth and rapid spread across our continent created tremendous pressure for faster, simpler, and more flexible building systems. The cheap wire nail and high production saw mills of the Industrial Revolution, combined with our fabulous native forests, encouraged the development of the amazingly pervasive “stick-built” building, or platform framing with standardized sizes of dimensional lumber. By the start of the twentieth century, timber framing had been largely replaced; by studs in residential building, and by cast iron and steel fittings in those relatively few commercial structures which were still framed with timbers rather than steel or concrete.

In America, timber framing lay **dormant** through about four generations. In Europe and the Far East, homes and commercial structures continued to be built with heavy timbers and traditional connection methods. This was partly because of their far more established building traditions and industries, partly because of the lower demand for new buildings, and partly because the capital intensive steel and concrete industries were kept busy building and rebuilding far heavier infrastructure around several destructive wars. Most of their homes and many light public and commercial buildings still used exposed heavy timbers, in increasingly innovative and economical ways.

North American timber framing has seen a remarkable **revival**, starting around 1970 in New England – or the northeastern part of The United States. This was the first area settled by colonists, and still has the largest concentration of older buildings, including original timber framed structures. A small group of young baby boomers, disenchanted by the mass-produced buildings, methods, and processes found in typical American residential developments discovered inspiration in the magnificent surviving examples of timber framing. Crafting a timber frame proved to be engaging work, involving: care, attention to detail, and sawdusty photo opportunities. Enclosing a timber frame in relatively newly popular foam-core panel insulation system allowed the carefully crafted timber frame to be left exposed to the home’s occupants, while providing an energy efficient home. From these very humble start up companies, the North American timber framing industry has grown to one which employs several thousand dedicated craftsmen and which builds many thousands of buildings a year.

The **future** of North American timber framing is even more exciting than is the story of rebirth. Interestingly, while timber framing's revival was originally based in explicit reverence for a traditional, somewhat obsolete, method of building, it has evolved into a system that can offer many advantages over the still-dominant stick-built (dimensional lumber sizes) system. Large and stable timbers are readily available, due to some technological and cultural advances. Timber frames and foam core panels are both well suited to shop prefabrication and systems approaches. Much of the intensive labor involved in fabricating timber frames is subject to mechanization, using large numerically controlled timber cutting machines developed in Europe and Japan. But most compellingly, the modern timber framed home can be a far better and more effective structure for the way we live.

Stick built construction was nearly miraculously effective at providing housing for a newly populated continent through the twentieth century. Whether it is still **the best way to build** in the twenty-first century, however, is an interesting question. When stud building was developed, we were neither centrally heating nor cooling our homes. We were not even insulating them; we expected that our homes provided shelter, not comfort. We had not invented: electric wiring, indoor plumbing, telephones, computers, televisions, lighting, audio systems, security systems; not, even, central vacuum cleaning. What once went in the attic, now fills our garages. With our prefabricated roof trusses, we no longer even have attics. While we still use standardized studs, joists, and trusses to build amazingly disparate structures in notably few days, we then spend the next several weeks sawing and drilling through dimensional lumber on sixteen-inch centers. We do this in order to install all the ancillary systems expected in our modern homes. Then, we bury that butchered structure with gypsum board. And woe betide the poor owner who has to upgrade, reconfigure, or repair one of these crucial and sophisticated, but buried, systems. This process involves tearing into walls and floors, butchering the structure some more, and then recovering the damage with more gypsum board.

North American commercial buildings have evolved far more adaptable structural systems than have the now outdated residential builders. A modern timber framed home borrows some **key modern components** from the commercial builders, while retaining the beauty and charm of the exposed heavy timber structure. By wrapping their timber frames in foam-core panels, modern timber framers had already taken a large step toward a modern building system – the insulating layer is separated from the structure; rather than trying to share the same space while providing room for certain services. Separating building components has been termed: “disentanglement,” and is one of the basic principles of building our modern flexible and adaptable homes. Timber frame home builders were confronted, right from the start, with having to develop ways to incorporate the services expected in modern homes. “How do you wire/plumb/air condition these things?” has been a pressing issue; one which has inspired and driven much development and innovation. Thirty years of working on answers to these questions has seen us develop systems approaches to built-in services, which are run through accessible raceways, conduits, and interstitial floor layers – much as in our contemporary commercial buildings. The second floor system, in a modern American timber frame home, is enviably easy to fit with the original services, and simple to repair and remodel; all while being lovely to look at from the first floor beneath.

The vast majority of the North American timber framing market is still **residential**. An amazingly varied body of work is the result of thirty years of creative craftsmanship. Apartment buildings and street long developments have been timber framed. Timber framed rooms have been added to new and old homes. While many of them remain very custom homes, often at the high end of the local market, others have been offered in highly standardized and economical forms. The one element shared by all these various examples is the significant aesthetic impact of the exposed timbers. The speaker will share examples of some of his favorite timber framed rooms.

The past ten years has seen tremendous increase in timber framing's use for **public and commercial** structures. Developers have recognized timber's appeal to the public, and have used timber framing to build stores, restaurants, ski lodges, and churches. Timber framing methods have also been used on pedestrian bridges, sculptures, and brew pubs. The speaker will discuss examples of these, describing the process and the product.

The modern timber framer has some **wonderful timbers** to work with, many nearly unimaginable to early timber framers. While the great virgin forests are largely gone or protected, we can still acquire fabulously large and high quality timbers, and from arguably sustainable Northwestern sources. We can still get fine quality oak and pine timbers from our third growth Eastern forests. Only recently, we have been able to get these timbers pre-dried to moisture contents that are near to the equilibrium levels. Radio frequency, or micro-wave, kilns have proven capable of drying timbers in reasonable time frames and for nearly reasonable costs. Engineered woods,(glulam, parallam, micro=lam) are increasingly accepted in timber framers; both by clients and framers. Dry stable timbers can be recycled from large and obsolete industrial buildings; that are now being dismantled and harvested, rather than be ground into landfill.

Structures have been defined (if only by structural engineers) as: "**Connections**, joined to each other by members." If the distinguishing features of timber frames had to limited to two, they would be: the knee braces and the crafted joinery methods. While many of timber framing's patrons come for the "timber look," a large number seem to draw inspiration and pleasure from the craftsmanship displayed in the joinery. Timber framing celebrates, rather than, conceals the connections. While the prevalent connection is still the European pegged mortise and tenon, the more Eastern spline system is enjoying growing popularity – for several good reasons. Incorporating these ancient connection methodologies in modern structures can present challenges, as well as thrills, for the analyst/designer. The speaker will discuss some of his past research, ongoing research in American universities, and the future for code acceptance of pegs.

REFERENCES

Although American technical/architectural literature saw a fifty year void in timber framing coverage, much has been written in the past twenty five years. Vast numbers of magazine articles have appeared. Some of the popular books include:

Building the Timber Frame House, Tedd Benson, Scribners, 1980.

The Timber Frame Home, T. Benson, Taunton Press, 1988 (Revised Edition: 1997).

Timberframe, The Art and Craft of the Post and Beam Home, T. Benson, Tauton Press, 1999.

Build a Classic Timber-Framed House, Jack Sobon, Garden Way Publishing, 1993.

Timber Construction for Architects and Builders, Eli Goldstein, AIA, editor, McGraw-Hill, 1999.

Timber Framers Guild of North America

This loose, but extraordinarily congenial, association of North American timber framers started in 1985. Their annual conferences are nearly legendary; for the conviviality, technical content, and occasional noble and tremendous communal building project. The Guild maintains lists of their 900 individual and 400 company members, as well as serving as a clearing house for informing the public about the wonder that is modern timber framing construction in North

America. A tremendous resource for those interested in the field. The Guild may be reached in the myriad and usual ways:

Timber Framers Guild of North America

PO Box 60

Becket, MA 01223

Toll-free voice mail-fax 888-453-0879

Will@tfguild.org their tremendous website is to be found at: www.tfguild.org

Benson Woodworking Co. Inc.

The speaker joined the circus that is Benson Woodworking Co. Inc. after leaving academia in 1987. At 32 years old, this is one of the very oldest timber framing companies in the States. The crew of fifty is about half professional timber framers who carefully erect what they lovingly fabricate, and two dozen architects, designers, engineers, and other overhead types. Benson Woodworking Co. Inc. is housed in a thoroughly impressive self-built pair of plants along the Connecticut River in Walpole, NH. They may best be reached by phone: 603-756-3600, e-mail: info@bensonwood.com, or by visiting their impressive and highly invested website: www.bensonwood.com

Speaker: Robert L. (“Ben”) Brungraber, Ph. D., P.E. Engineer/Worrier

The speaker holds engineering degrees from several impressive American institutions of higher learning (including Cornell University, Colorado State University, and Stanford University), and has taught at a few more. The nearly inexplicable (at least to his mother) turn in his career, started with his helping to repair and rehabilitate 150 year old covered timber bridges in the oh-so-turbulent ‘70’s. His Ph.D. involved testing and analyzing timber frame connections and structures. In certain quirky, and thankfully small circles, he is known as Doctor Joint or The Joint Buster. Ben lives in an old timber framed barn/woodshed/home, to which he added an obsessive timber-framed great room. He is doing his best to support a father’s role with two teenage sons, while still working on useless olde English sports cars. He may be reached, if it really seems the thing to do, through Benson Woodworking Co. Inc.

I thank you for your kind (presuming the best) attention to my talk. I further hope that timber framing seems, at least, more user-friendly than it may have.