

Fox Maple School of Traditional Building



Timber Framing

Natural Building Systems

Traditional Design



It would be part of my scheme of physical education that every youth in the state should learn to do something finely and thoroughly with his hand, so as to let him know what touch meant...Let him once learn to take a straight shaving off a plank, or draw a fine curve without faltering, or lay a brick up level in its mortar; and he has learned a multitude of other matters...

—John Ruskin

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Introduction to the School Site

In March of 1996, we broke ground on our 40 acre site in the foothills of the White Mountains of western Maine, in what would become our new office headquarters and school campus. Aside from providing the space that we needed to conduct business and grow, it offered us an opportunity to provide real world projects for our students and apprentices, and at the same time, a chance to experiment with a variety of new and promising traditional building systems.

In the initial phase, our plan was to construct a new office building, a library/conference center, a dining hall and a workshop large enough to conduct both summer and winter workshops. Four structures to provide the basic infrastructure of our new educational facility. In the process of designing the site and structures, we made an attempt to incorporate a variety of traditional systems that would utilize locally available and natural materials as much as possible. With these first four structures nearing completion, our waste piles have consisted of little more than timber and wood scraps, straw, reed and clay— these being the essential materials in the construction to date.

The building systems we have chosen incorporate both ancient methods and progressive modern approaches based on traditional systems. Timber framing, straw bales, traditional wattle and daub, wood chip and clay, reed thatching and compressed wheat straw panels are all incorporated. Our motivation for working with natural materials—beyond that of creating comfortable and healthy working environments—is geared toward understanding and developing systems that may increase speed and efficiency in a straightforward manner. We are essentially testing the viability of each method with the overriding goal of determining if they can be adapted to any building site, by any builder, with consistent results—while providing reliable, practical and efficient results for modern dwellings. At the same time, we see it as an opportunity to train individuals interested in pursuing these building methods for personal and professional reasons.

—Steve Chappell
Founder & Director



*Student dressing
thatching on the
library.*

History & Mission

Apprenticeship

The Apprenticeship program at Fox Maple was established in the late 1980s as a natural outgrowth of the biannual timber framing workshops conducted by Fox Maple Post & Beam, in conjunction with Joiners' Quarterly. The primary emphasis of these workshops was to develop and instill within the participants a deeper sense of craftsmanship, coupled with a comprehensive technical overview of the systems, techniques and approach to crafting high quality timber frames using traditional methods of design and execution. Through the 1980s, many of our students went on to build their own homes, work for other timber framers and to start their own timber framing companies.

As the demand for timber framing increased, so also did the demand for trained and qualified timber framers. To help serve this need, we developed a comprehensive two week course in which students would be guided through the design and construction of both introductory and advanced framing projects. Those who wished to pursue timber framing as apprentices were then connected with timber framing shops, in various parts of the country, with whom they would complete the training process under terms and conditions negotiated on a shop-by-shop basis. While this proved to be quite successful in its simplicity, we always felt that a more comprehensive program could and should be developed in which the apprentices could go through a longer term training program—6 months to 1 year—in which the process of constructing the completed home could be taught through hands-on involvement. The development of our campus facilities allows this to work much more efficiently.

Our current apprenticeship program allows from two to three people per year to carry out their apprenticeship at FMSTB. This is dependent upon our needs and apprentice openings. It is common that we will accept only one or two per year. Applications for apprenticeship are accepted only from individuals who have completed our two week Intro and Advanced workshops. If openings are not available, we then help to get the student set up as an apprentice in another shop. Since the number of applicants dramatically exceeds the number of apprentices we can handle in a given year, this is the most likely scenario. This has been very successful over the years, with nearly 100% placement of all students.

The Corn Hill School Site

The campus site is located on 40 acres of southeasterly sloping wooded land in the rural foothills of western Maine. To date, the four structures that make up the core campus complex are operational (if not fully completed). Each of the structures were built primarily by students and apprentices in structured workshops and incorporate a

variety of traditional and indigenous building systems and approaches. Natural, locally obtained materials were used as much as was practicable.

Each building is intended to be a model for responsible, efficient and cost effective approaches to building in northern New England, and to some extent, are experimental in nature. Craftsmanship and quality is of primary importance in our building philosophy, and each of these existing structures represent an attempt to combine quality, style and affordability in an environmentally sustainable way. We strongly believe that if we build structures which are respected by their inhabitants, then they will be maintained in such a way that they will last for many generations to come. Longevity, after all, is an important aspect of sustainability.

FMSTB Mission

The primary goal of the FMSTB and the Apprenticeship is to provide individuals seeking knowledge and experience in traditional, natural and sustainable building systems the opportunity to learn, firsthand, by working on real-world projects that exemplify the qualities, characteristics and practicality we believe to be appropriate and representative of the way of our building future.

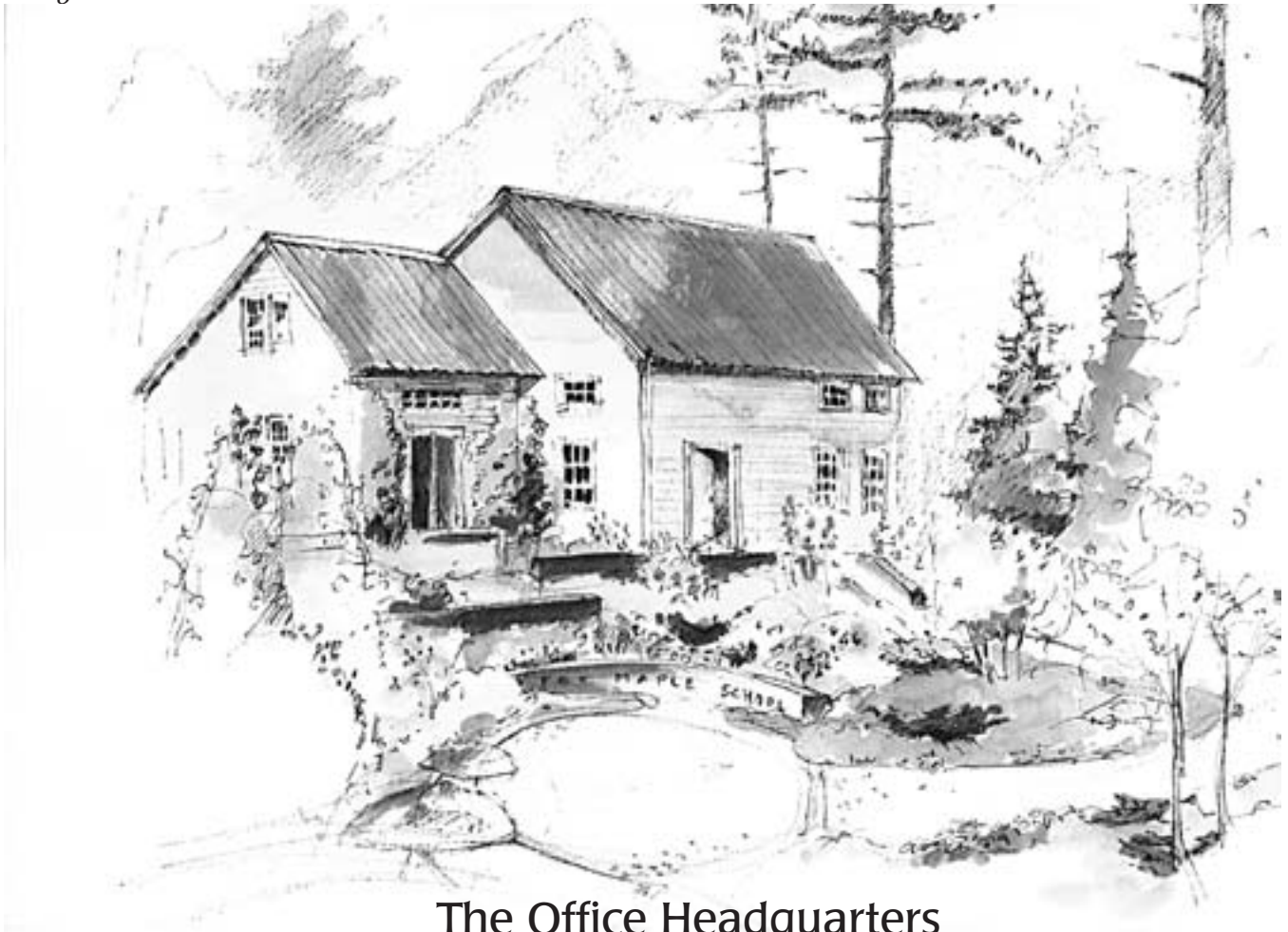
While there are many new building concepts that seem to offer wonderful possibilities in solving some of the building issues we will be facing in the new millennium, we believe that for any real strides to be made, these unique and novel systems must first be designed, built and tested in a variety of building environments if they are to prove to be practical and efficient alternatives. Secondly, for a system or technique to be integrated into the broader stream, there needs to be a body of trained individuals capable of designing and directing the construction process in a professional manner. To provide this comprehensive training, we are in the process developing longer-term sessions geared for architectural and engineering students, professional trades people and trade apprentices. These will offer both classroom and hands-on experience in all phases of the construction process. It is our intent to develop working relationships with universities, colleges and trade schools in which we can provide valuable hands-on experience, from which, students will receive course credits.

Those with insight, vision and enthusiasm are invited to take part.



“I enjoyed the workshop so completely—the experience is forever etched in my mind. Everything about it was exceptional—the chance to work with such fine tools, under the guidance of such fine individuals, the food—oh, what wonderful, satisfying food—the atmosphere, the camaraderie...it was wonderful.”

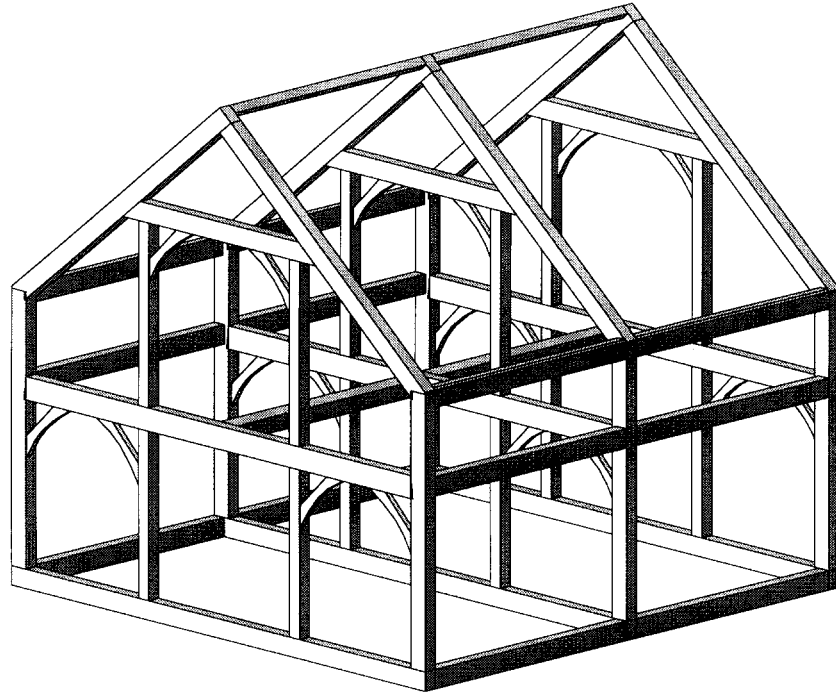
*—Tom Holmes, Baraboo, Wisconsin
Spring 1983 Workshop*



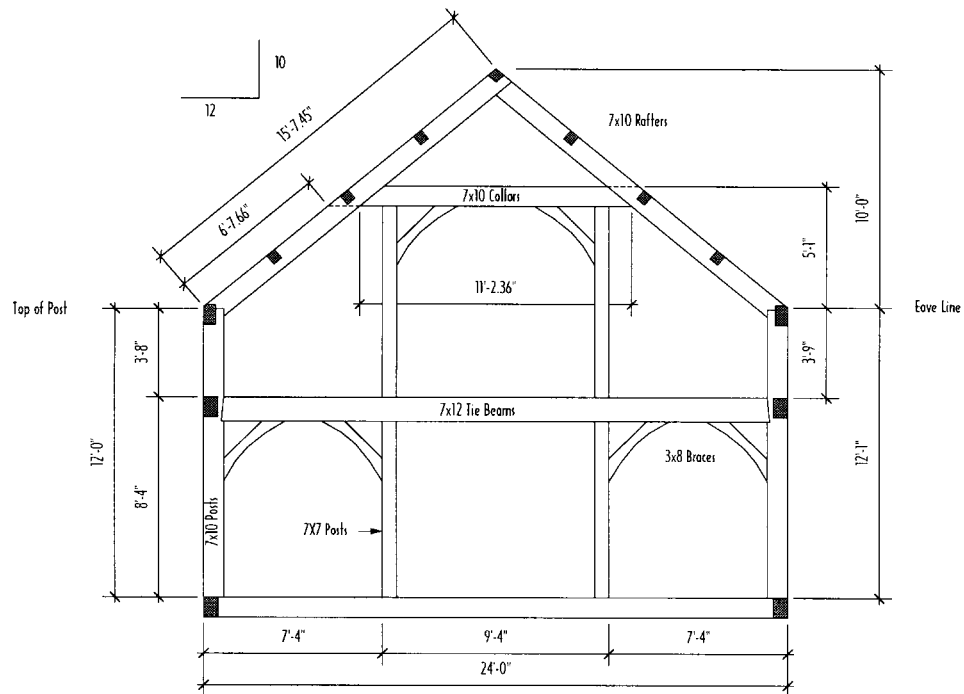
The Office Headquarters

The design goal in the construction of our new office was to provide an economic and efficient model for a modest dwelling, based on a traditional design, which utilized a natural enclosure system. The 1,600 square foot building combines two workshop frames—a two bent saltbox, and a three bent high posted cape. The frames were cut in workshops by students in the Fall 1994 & Spring 1996 workshops. They were raised as two freestanding frames, butted together with a straw panel sandwiched in between, and enclosed with compressed wheat straw panels. This system is representative of how one could build one section to accommodate a later addition. Clay plaster covers a portion of the interior walls. Pine boards provide the balance of the construction material, aside from the steel roofing and concrete frost wall foundation.

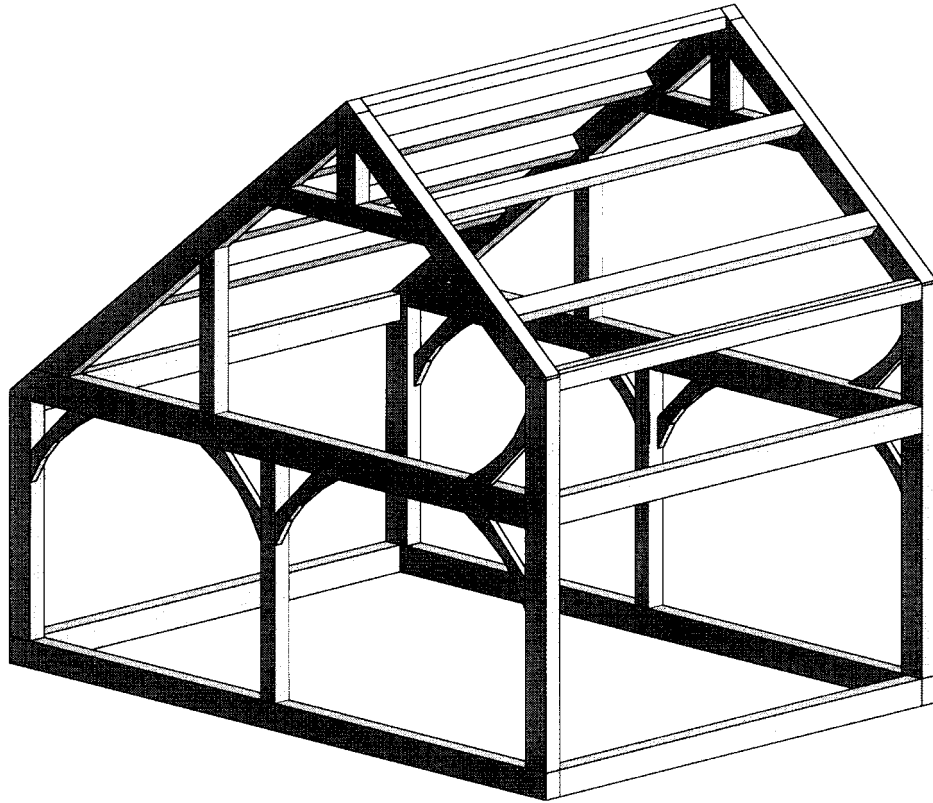




High Posted Cape / Isometric View



Bent Framing Plan

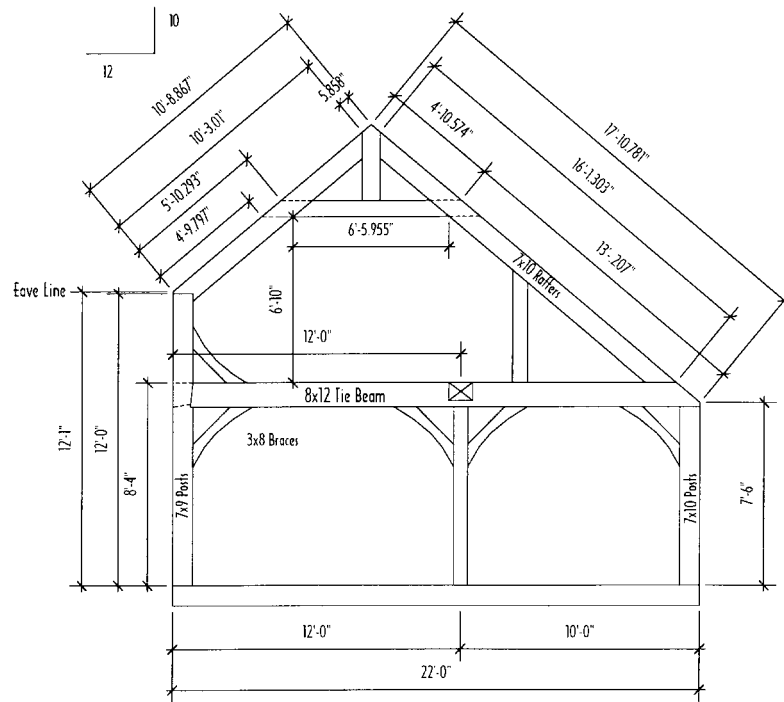


Saltbox / Isometric View

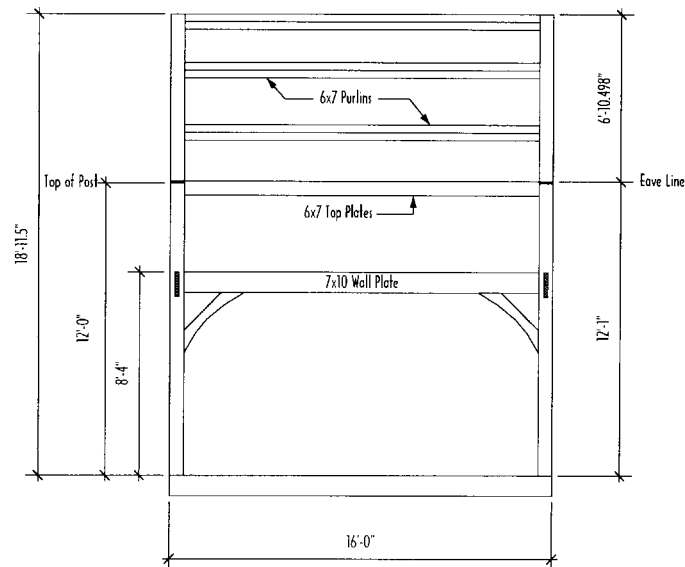
The saltbox design above is one of our most common teaching models. It contains a wide variety of joinery details, and can be increased in size to accommodate the size of the group by adding an additional bent for every five students.

The office frames were enclosed with compressed wheat straw panels, strapped with 2 by 4s to frame door and window openings, then sheathed with horizontal pine siding.

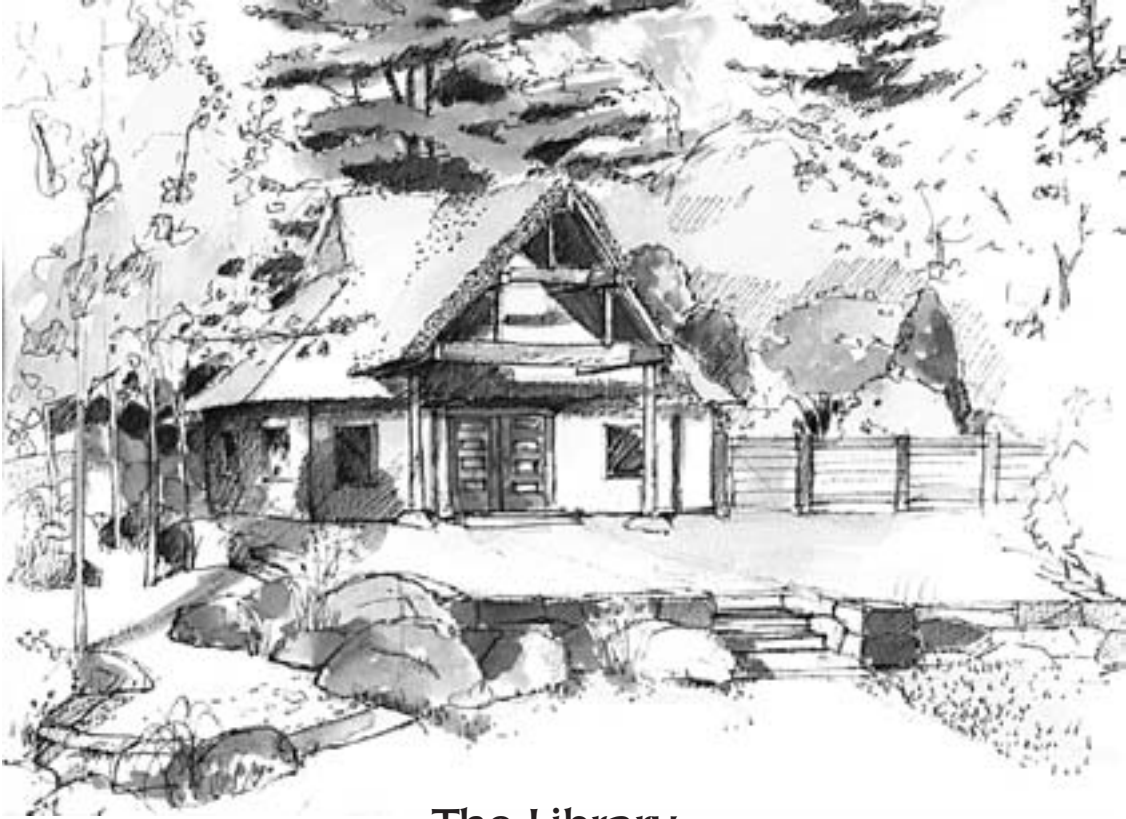




Bent Framing Plan



Framing Elevation

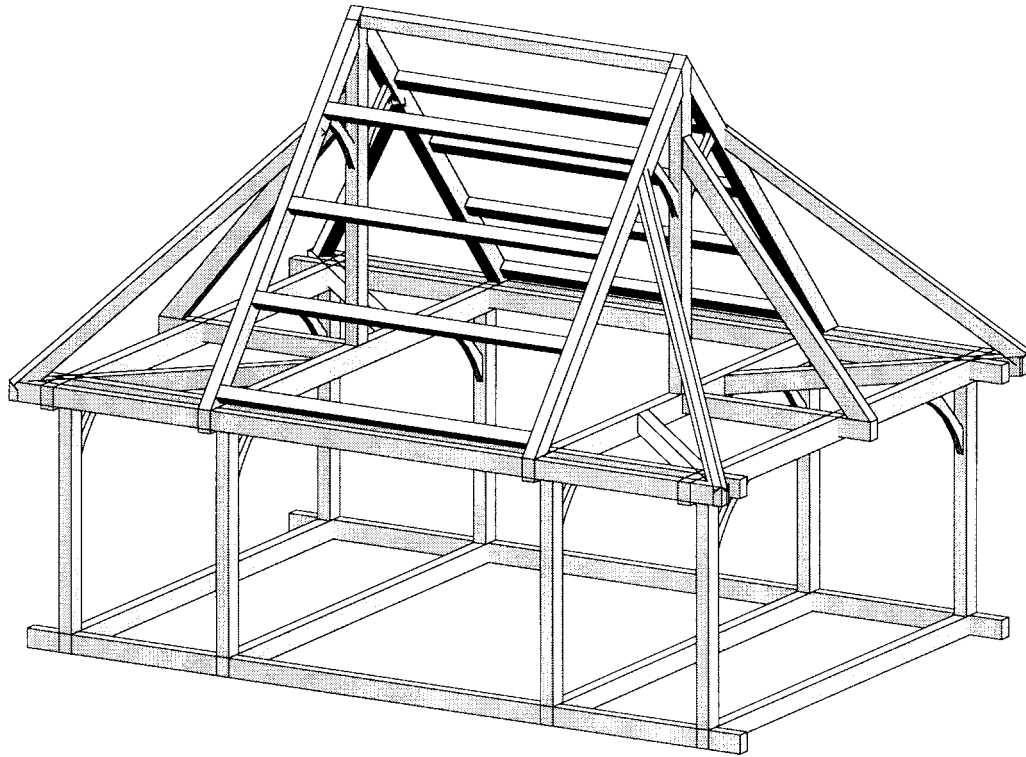


The Library

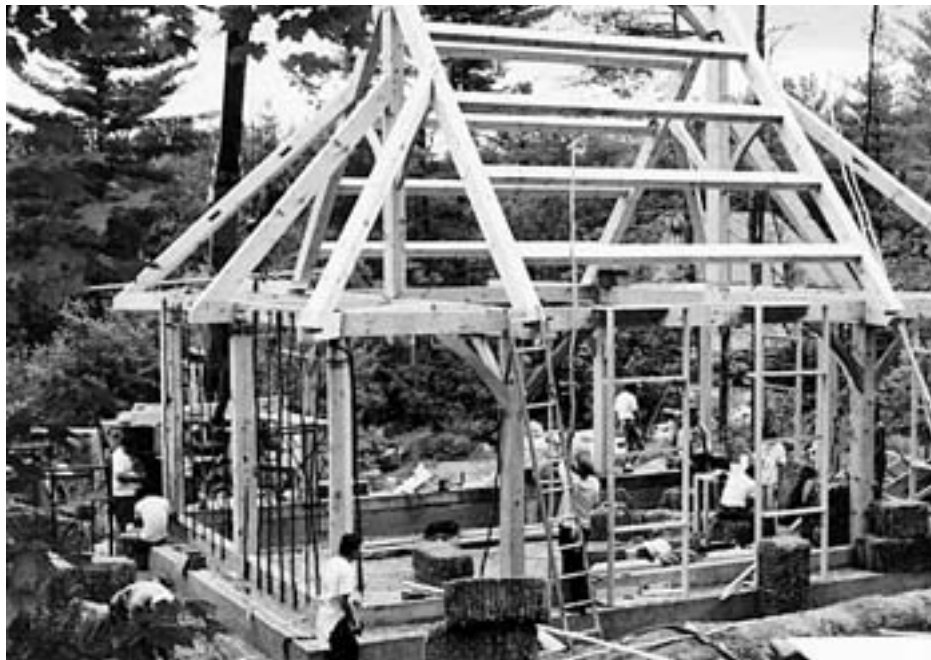
The library incorporates a number of traditional and alternative building systems. The frame, cut and raised in the June 1996 workshop, was designed to provide both introductory and advanced framing details for course instruction, and is modeled after the Japanese Minka. This was followed up with a straw bale workshop instructed by Athena and Bill Steen.

The foundation is a rubble trench, the walls are straw bales. For lateral reinforcing, maple saplings, harvested from the site, were lashed together with hemp twine, inside and out. The roof is thatch. Clay plaster is used on both the interior and exterior walls.

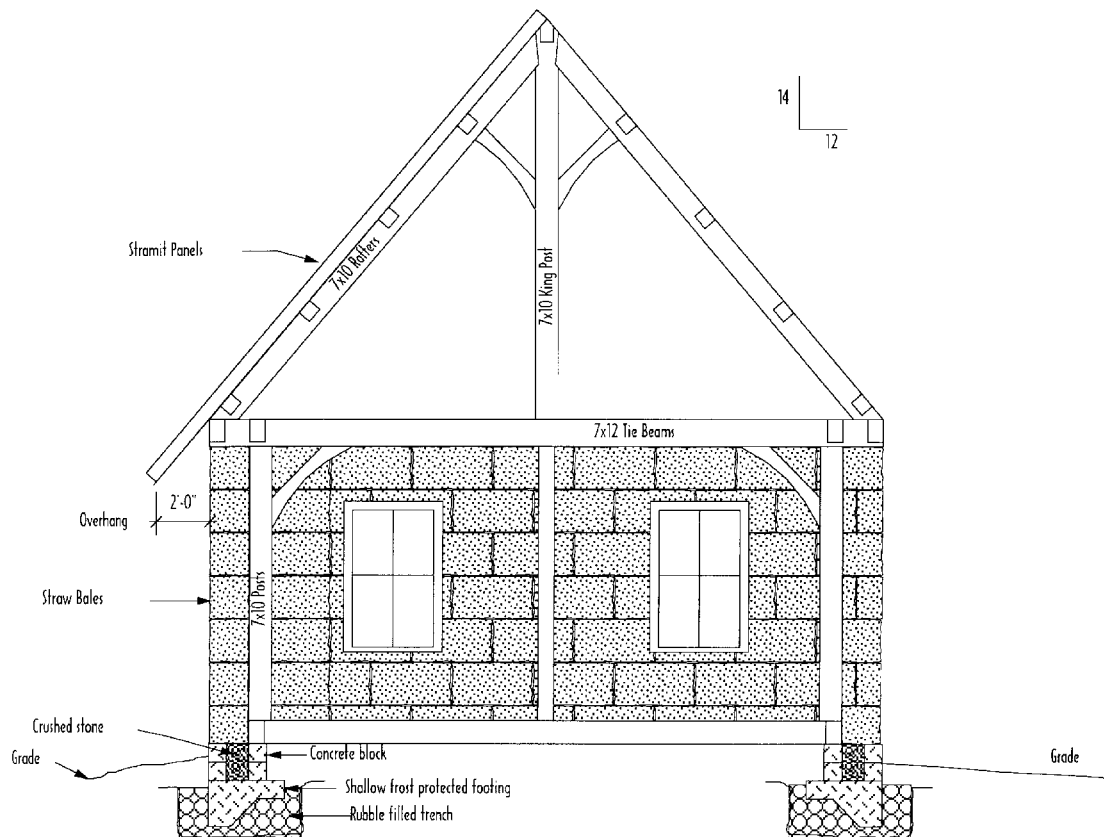




Library Plan / Isometric View



This workshop incorporated the full spectrum of building in a comprehensive 2 week course. Students built the rubble trench foundation, the timber frame, the straw bale enclosure and a portion of the base coat of earth plaster on the interior walls.



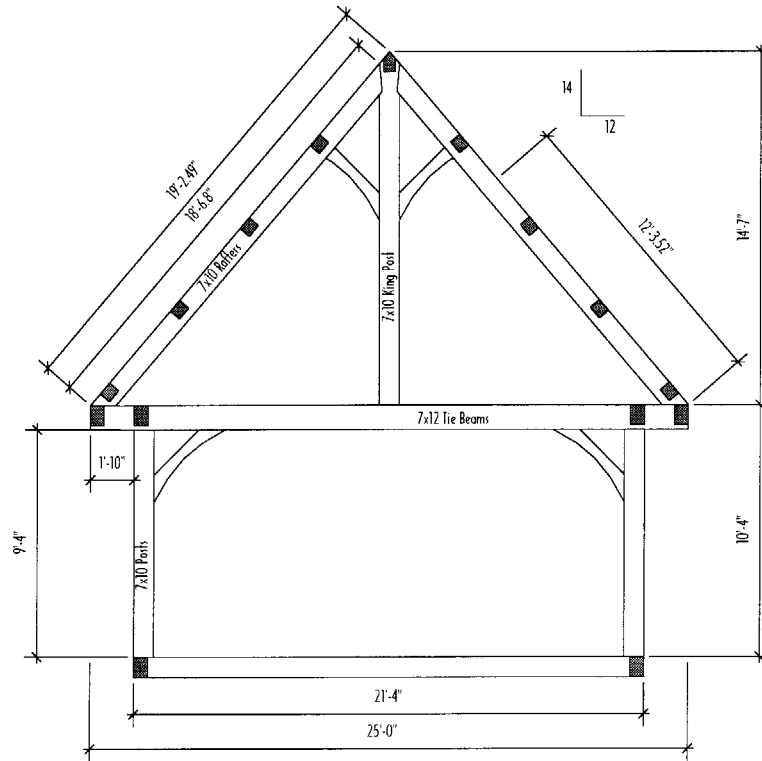
Framing Section



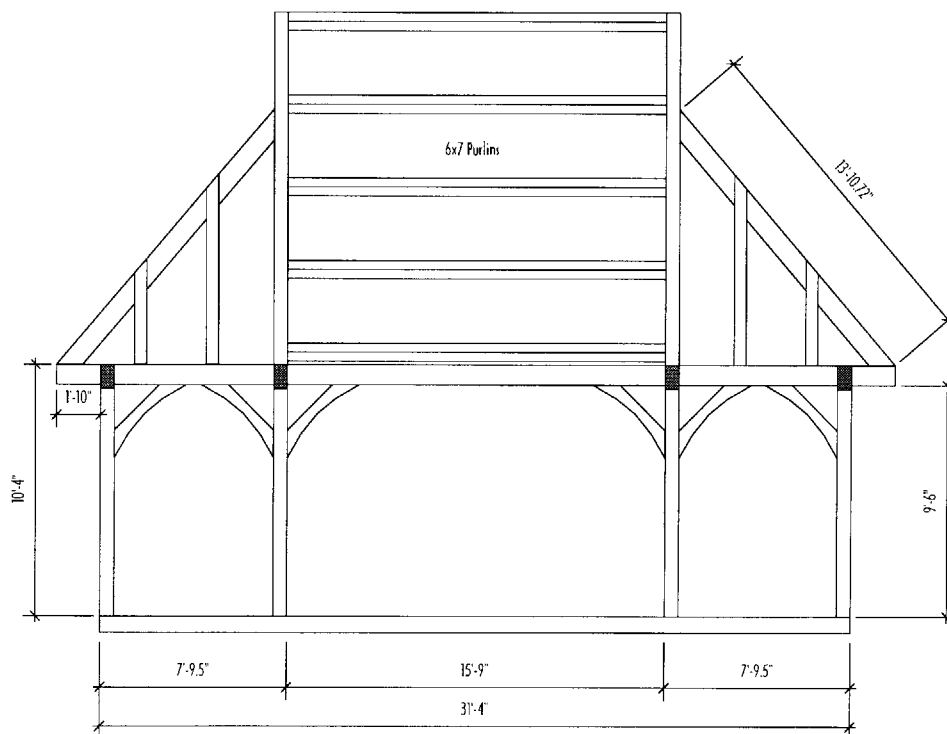
Preparing the frame for bales with maple saplings for lateral support.



Bale installation nearing completion on day 10 of the workshop. Both frame and bales were completed in the two week workshop.



Bent Framing Plan



Framing Elevation

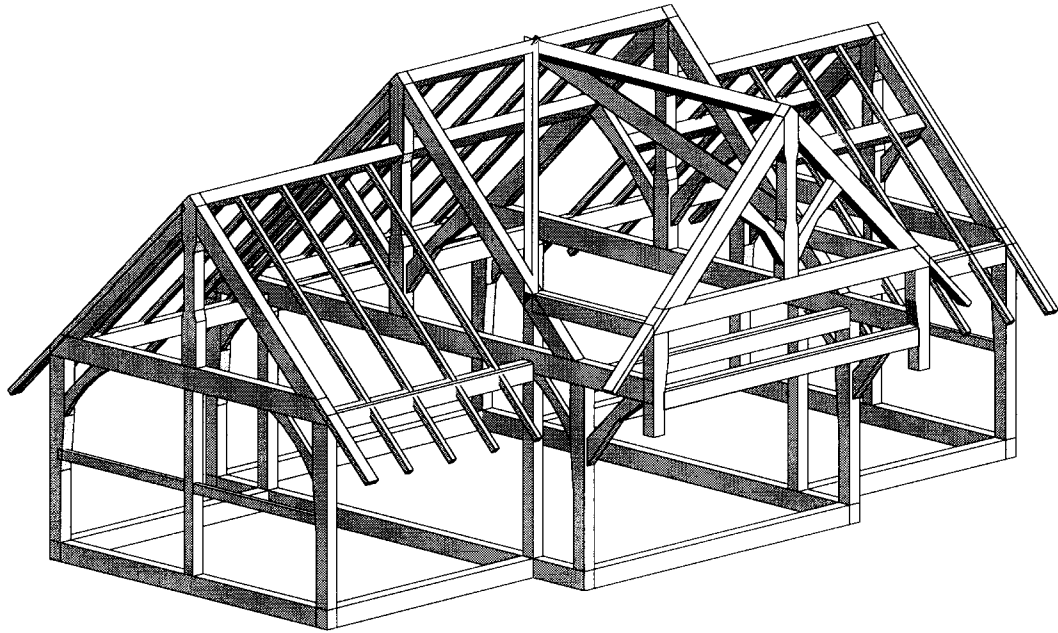


The Dining Hall

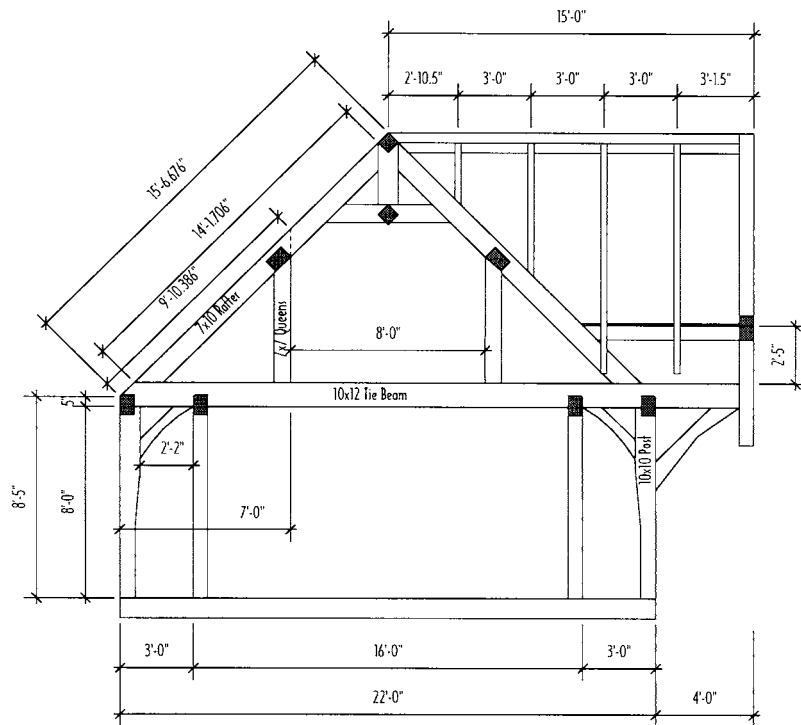
The dining hall is designed in the style of a medieval English cottage, and is intended to be the building that experiments with a variety of clay/fiber enclosure systems. Wattle & daub, woodchip-light clay, straw-light clay and straw clay blocks will make up the wall enclosure. It will be half-timbered, with a lime putty exterior plaster finish. The roof will be covered with compressed straw panels, applied over pine boards.



The design goal of the dining hall is to experiment with methods to efficiently produce the materials and application of both traditional methods, and some of the more recent innovations in natural clay-based infill systems. These will be monitored to evaluate long term results. The frame was cut and erected by students in the June 1997 workshop class and combined both introductory and advanced joinery systems.



Dining Hall / Isometric View



Bent Framing Plan



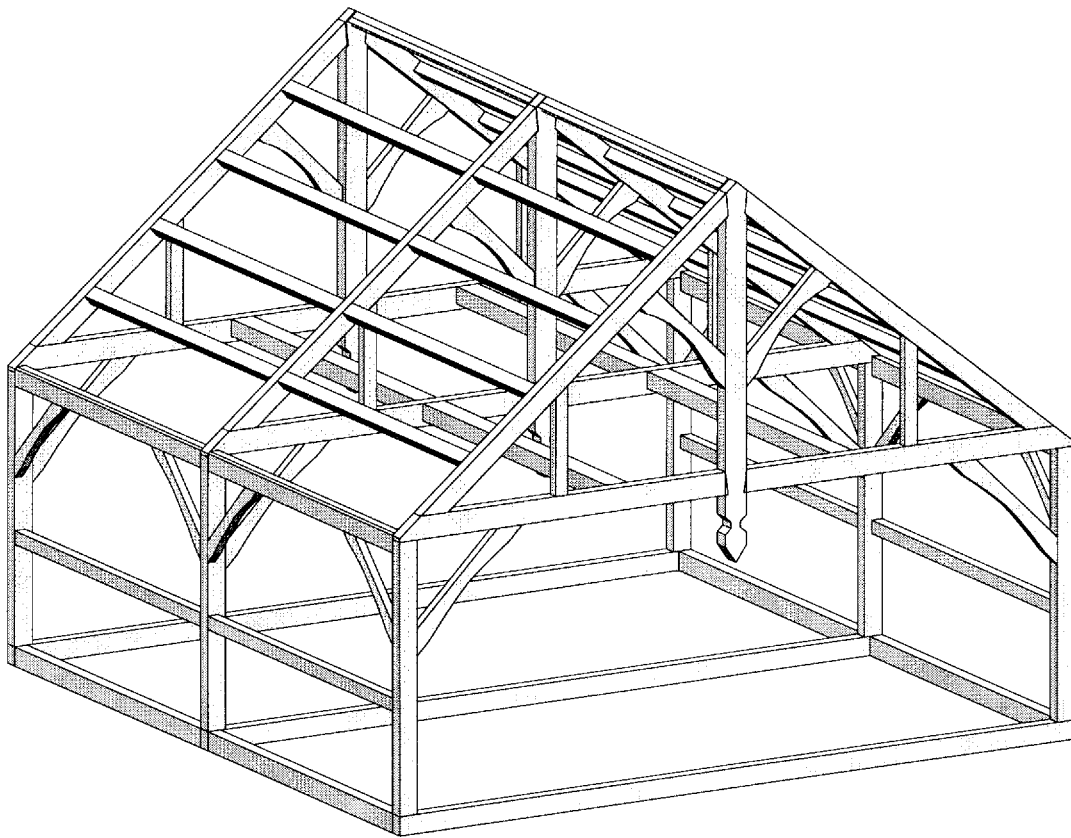
The Workshop

The Workshop frame was designed to provide the greatest amount of open space, with the least amount of timber and labor. To achieve this, king-post trusses, spanning 32 feet, were used. The rafters are 20 feet, but all of the remaining timbers are 16 feet and under.

The frame was cut in the June 1995 workshop. The roof and walls are covered with compressed wheat straw panels with local pine covering the walls with steel roofing.



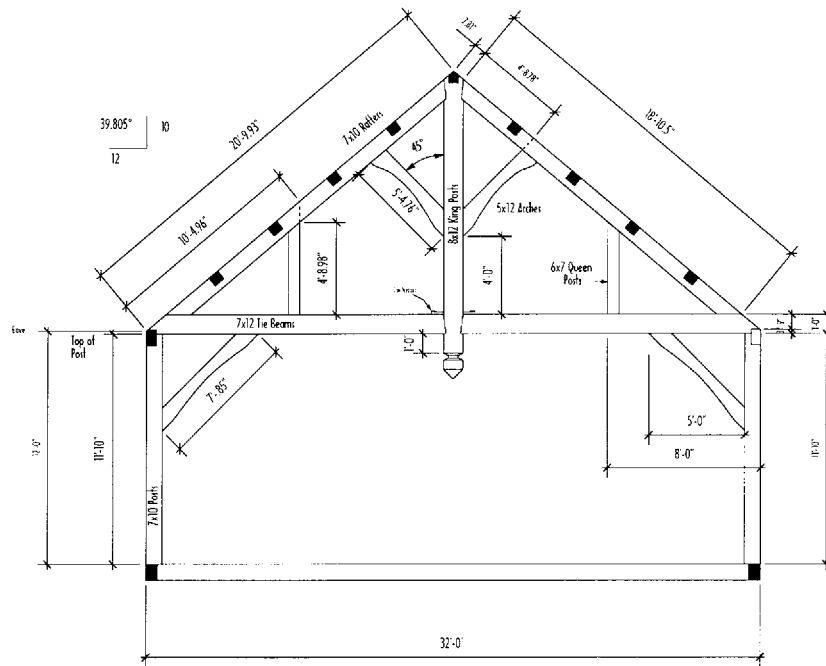
Shop at the end of the summer of 1997.



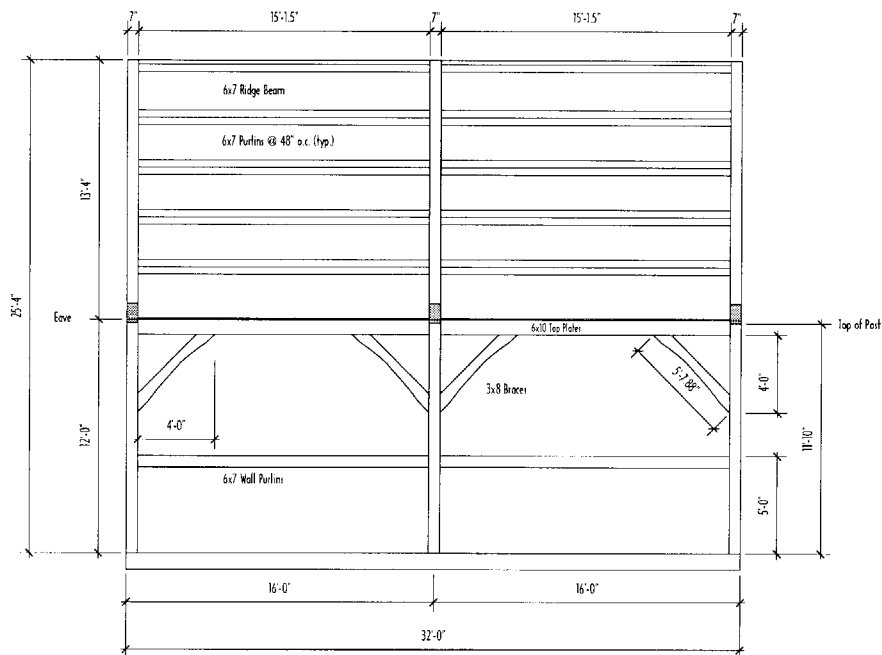
Workshop Frame / Isometric View



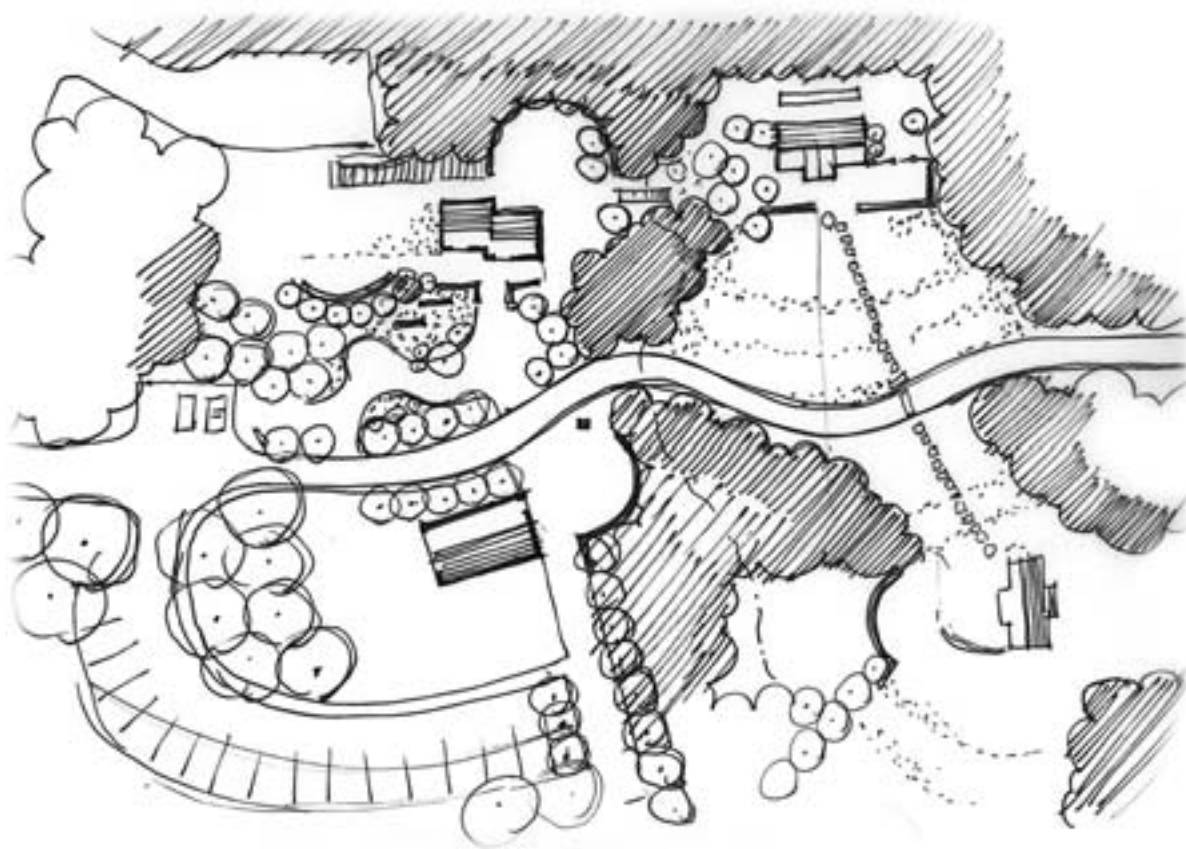
The king-post trusses of the shop span 32 feet. Compressed wheat straw panels cover the roof and walls. The frame was designed to maximize the use of materials to provide the greatest space for the least amount of timber and labor.



Bent Framing Plan



Framing Elevation Plan



The Site Plan

The FMSTB campus is situated on 40 acres on the Corn Hill Road, in West Brownfield, Maine. Five acres have been designated for the campus dwellings and structures. The remaining 35 acres will remain in tree growth, managed to create a sustainable, long-term supply of timber for future workshop projects. In addition to timber management, plans to cultivate a 6 acre meadow for farming, gardening and agricultural crops that can be used for both food, and construction materials are underway.

The work that has taken place since the ground breaking in April of 1996 has been exciting, if not miraculous, in its unfolding. There is still much to do before the long-term goals are fully realized and the work complete. Perhaps it will never be completed, for at every turn there appears another new and exciting building concept to explore.

Timber Framing Courses

In the spring of 1983, guided by little more than a burning desire to expand the awareness of timber framing, we initiated our first timber framing workshop at our shop in Brownfield, Maine. It was a simple cape frame, small in size, based on the traditional design and joinery of the early 19th century frames common to New England. Our goal at the time was to share the knowledge we had gained over the previous ten years of building this type of frame to what we found to be an eager student body. Though we entered this first workshop with a little fear and trepidation, we found it to be something much greater than we had ever imagined—for both student and teacher. To this day, the workshops have remained as rewarding as this first one.



"When I arrived, I wasn't sure what I was going to learn, but I have come away with exactly what I needed; the confidence and knowledge which create the ability to tackle large projects in wood. (ABSOLUTELY SUPER!!!)"
—J.I.G. Grand Rapids, MI

Workshops bring together small groups of people from various backgrounds and experiences, bound only by enthusiasm and a common goal to learn traditional building techniques. Through the process, they become united into a cohesive working unit, bound by common experience. Each workshop produces a complete frame, cut entirely by the students and raised on the final day of the workshop. Celebration ensues.

The process unfolds step-by-step, in a structured and focused manner with the primary emphasis on the systems, approach and techniques that will allow the student to gain the knowl-

edge and confidence to tackle a framing project on their own.

For the architect and engineer, the workshop is an opportunity to work with the components of a joined frame, while applying the structural and mechanical principles. For the builder it is an opportunity to expand their talents to include traditional timber frame joinery into their repertoire. For the novice or aspiring owner-builder, it is a chance to walk through the process of building; to develop practical woodworking skills, to communicate with others of like mind, and to develop relationships with people who may help to make their own building plans a reality.

Above all, the timber framing experience is unique in allowing a person to join others in a common task, while developing practical hands-on skills. The *process* is perhaps the most important aspect of the workshop, but the frame raising provides immediate and tangible proof of achievement, as well as cause for celebration.

A Workshop Primer

What to bring & What to Expect



Did We really cut that timber 18 inches too short?

So You Want to be a Timber Framer?

“What tools do I need to build a timber frame?” This is the most common question asked by workshop students. My first response is usually, “A chisel and a mallet.” This may not be the whole truth, but I believe that tools should be purchased only after they’ve proven to be absolutely essential to the work at hand. With a chisel and mallet, a brace & bit, and a hand saw, an experienced carpenter can build anything—given the time. When learning a new trade, it’s best to start out with only the few essential tools of that trade. The first priority is to learn how to use these few tools really well; to execute your work accurately and efficiently, and to understand the nature of the work before you go out and spend a bundle on a cache of tools that may spend most of their time in the tool box. Tools can be an addiction, I will admit that, but owning a hoard of tools will not necessarily make a person a better craftsman. A craftsman, however, can expand the capabilities of just about any tool he or she touches.

Timber framing is demanding work, both on the tools, and on the body using them. More than any other type of housebuilding, it demands a level of intimacy and dedication that tends to make people extend the limits of their abilities. When people extend their limits, tools will be asked to do the same. This is why it’s so important to buy professional quality tools. We have a ritual at the beginning of every workshop in which we check all of the tools before we begin. The framing squares are checked for square, the tape measures checked for accuracy, the chisels are checked for trueness. Inevitably, about half of the tools fail to pass the test and end up in the cull pile. In the workshop you’ll have an opportunity to use a variety of tools, hand and power. This will give you an insight into the full range of the tools of the trade, and the experience to make wise tool purchases.



Raising the Maine Public Broadcasting House. Cut in the Spring 1992 Workshop and donated to MPBN as a fundraiser.

“So...can I expect to learn enough in the workshop to actually build my own timber frame home?” A tough question, perhaps, but I only need to look back to our past students to find the answer.

Over the last fifteen years roughly 30% of our graduates have gone on to actually build their own timber frame, or have made timber framing their profession. Many have started their own timber framing company. Essen-

tially, you can expect to receive as much from the experience in a measure equal to what you're willing to give. Our goal is to instill confidence by organizing systems and techniques which can be followed and applied to any number of framing situations. There is a mystery to timber framing, but it does not lie in the physical or mechanical act of laying out and cutting joints.

Past woodworking or building experience has little to do with your ability to be a successful timber framer. In fact, it's often those with no building experience who excel at timber framing. If fine joinery is to be the result, it's imperative that the pressures of time and speed of production be removed from the equation. Professional builders often have a more difficult time adjusting to the slower pace required to do fine work than novices who have never been subjected to the wrath of an irate project foreman. Our approach is to first develop a visual image of what it is we're building. Once this mental image is developed, we begin to unfold the frame, timber by timber, joint by joint, in a systematic way so that each timber can visually be seen and placed in the frame. Progress begins slowly and systematically, making sure that the concept and approach is fully understood on an individual and group basis. As the group congeals into cohesive teams, confidence rises and talents increase. With this, speed naturally picks up. It's common for more work to be produced on the last work day before the raising, than in all the preceding days.

The mystery of timber framing? This is difficult to describe in words, but you'll catch a glimmer of it as you stand back after the raising and begin to realize what just happened.

Timber Framing Tools

The following is a quick review of the tools you'll need to bring to the workshop. If you own a set of carpentry tools, you may already own many of these tools. Aside from the framing chisel, these are all common tools and available in most neighborhood hardware stores. Purchased new, the tools making up the basic tools set should cost under \$150. The primary emphasis in the workshop is on working with hand tools, however, power tools are used as well.

A Beginner's Tool Box

Framing Square - Framing squares were developed by timber framers in the middle ages and remain today as one of the most useful layout tools available to a carpenter. To the timber framer, it's an essential tool of the trade. As with many tools, the best framing squares are the most expensive, and it is absolutely imperative that the square is *square*. All squares should be checked off the rack before purchasing by measuring the diagonal from 15" to 20". This should read *exactly* 25". Approximately 30% of all new squares on the rack will be out of square. The aluminum, Stanley Professional model is the best American made square available. It also comes with an extremely informative booklet which clearly explains how to use it. This booklet in itself is almost worth the \$30 to \$40 price tag of the square. A line of stainless steel Japanese squares are also available in many tool catalogs. These will last longer than aluminum squares, take a little more abuse, and they are less flexible, which means they won't tend to bend when scoring layout lines. Lee Valley Tools sells these for \$35-\$45, with a guarantee that they're square.

Framing chisels, 1-1/2 & 2" —If any tool is synonymous with timber framing, it's the framing chisel. Framing chisels come in two basic types; tang chisels and socket chisels. For timber work, the socket version is much preferred because it can take considerably more abuse, and there is less shock and vibration transferred to the hand from repeated mallet blows. Broken handles can also be replaced quickly with just about any piece of hardwood laying around. A tang chisel on the other hand will transfer more vibration to your hand which creates more fatigue. Replacing handles also proves to be a little more difficult—and their handles are always breaking.

A chisel should be judged by the quality of its steel, its weight, balance, and most importantly, its *feel*. The *feel* of a chisel may seem



A good framing chisel can be used to chop deep mortises with a mallet, and as a slick to pare thin shavings. The chisel above is a 2" Barr, the mallet a 32 oz. lignum vitae carvers mallet.



Mortises will be drilled and chopped with a chisel and mallet prior to using mortising machines. Note the mallet design above. This is our preferred style as described.

a somewhat nebulous term, but it can be quickly understood by chopping a few joints with one that has *it*, and then chopping a few joints with one that *doesn't*. Most mortises are either 1-1/2 or 2 inches wide, therefore, one chisel of each size is ideal.

Used chisels can be found in antique stores and yard sales, but you must know what you're looking for. Chisels with a thin cross section are usually a sign of a finer grade steel, and most often worth buying. Chisels with a heavier cross section are usually older, and made by laminating high carbon steel between softer low carbon steel. If the hardened steel can clearly be distinguished along the edge of the blade, it is most likely a sign that the hardened steel is of high quality. Most of these have a slight sweep to their back, which is a design element, and not necessarily a sign of abuse. Any chisels stamped with the names Swan, Buck or

Wetherby should be bought without a second thought. If a chisel only has the imprint "cast steel", it was most likely made by an individual craftsman prior to 1870. These vary dramatically in quality, depending on the metallurgy skills of the craftsman. Some of these early cast steel chisels are the best chisels ever made.

The selection of new chisels on the market is limited as well. The best chisels I've found, by far, are made by Barr Quarton, of **Barr Specialty Tools**, in McCall, Idaho. Barr, who is an apprenticed Japanese sword maker, hand forges a line of socket timber framing and log building tools that really have no equal in any mass produced line. I'd recommend his tools as a first choice to any serious timber framer, or woodworker.

Henry Taylor (a corporation), of Sheffield, England, also makes a line of socket framing chisels which can be purchased through Woodcraft supply under the Woodcraft name. These look great, however the quality varies as they are made of a lower grade steel which is over-hardened to compensate. Subsequently, they can be difficult to sharpen and to maintain a good edge.

For tang chisels, **Sorby**, also of Sheffield, makes a great line of quality tools, including a set of tang framing chisels. While the tang is not preferred, the quality of the steel in the Sorby chisels is superb. Coupled with the feel that they've managed to capture, they are the best alternative if a quality socket chisel cannot be found.

Framing Mallet, 32 to 48 ounce - My preference in a framing mallet is a one piece, turned hornbeam,



16 to 18 inches long, with a head about 3 to 3-1/2 inches in diameter. These, of course, you have to turn yourself. Beech, hickory, and rock (hard) maple also make great mallets. A line of *lignum vitae* mallets, marketed as *carvers mallets*, are available through most mail order catalogs. If you don't have the wood, or the lathe, these are your best bet. Order the heaviest version (approx. 32 ounces). Dead blow hammers can also be used, however they produce more fatigue, create more heat through friction, and have less feel than a solid wooden mallet. When pounding a chisel with a mallet, you should be able to feel the edge of the chisel cutting the wood. I find anything other than a turned wooden mallet (with a pounding face parallel to the grain of the wood) creates too much shock and vibration, and this *feel* is lost.

Combination Squares—These are used primarily for gauging the depth of mortises, length of tenons and laying out the end of tenons and repetitive layouts, such as dovetails. As such, it's not essential that they be absolutely true, however, as with all tools, one should buy the best quality available if possible. It's useful to have two combo squares which can be set to different depths for multiple layout.

Hand Saws—For timber work, both crosscut and rip saws are required. The Japanese *Ryoba* saws are a good choice because they have both rip and crosscut teeth. Another great all-around saw is the Stanley Shark saw. These have a tooth pattern similar to Japanese saws, but they cut on the push stroke. Essentially a crosscut saw, they also make rip cuts reasonably well. They can be found in most neighborhood hardware stores for under \$20. Disston and Sandvik also make fine saws for professionals at a cost range from \$25-\$55.

Planes—For smoothing and flattening the faces of timbers in the immediate area around joinery prior to layout, cleaning up tenons, and removing the bumps and ridges from the edges of timbers, a block plane is one of the handiest tools. The standard #9 1/2 is good for general work, and the #60 1/2 low angle version is great for planing end grain. If only one is to be purchased, make it the low angle #60 1/2. Stanley still makes one of the best block planes on the market. Stick with Stanley's Professional line of planes and you can't go wrong. The top-of-the-line Stanley's go for about \$45. In addition to the block plane, a rabbet plane is also a handy tool for shaving tight up to the shoulders of tenons.

Protractor & Bevel Square—If you are taking an advanced workshop, a protractor (or compass) square is essential. The rotating protractor head is necessary for gauging compound angles for layout and checking angles after cutting. Bevel squares are an inexpensive alternative to a protractor square and should be part of every



Chain mortisers provide an efficient way to remove lots of material, but are only used in workshops only after the student has learned the traditional drill and chop method.

woodworkers tool box. Woodcraft Supply and Lee Valley both carry two or three models of Protractor and Bevel squares at reasonable prices.

Scientific Calculator—For determining compound roof angles, a calculator with Trig functions is required. Sharp, Texas Instruments, Casio and Radio Shack all make inexpensive models for under \$15. Construction Master calculators, manufactured by Calculated Industries, are useful only if they have Trig Functions (Construction Master III model). If you own another version of these calculators, please bring a regular scientific calculator as well.

Additional Supplies

In addition to the tools listed above, all participants should bring the following: 25' tape measure, carpenters pencils, blue and red builders crayons, razor knife (common retractable blade utility knife), tool pouch, note paper and a clipboard.

Safety equipment

In addition to tools, appropriate clothing and safety equipment is required. Ear protection and safety goggles of good quality is essential. Tools are sharp, and timbers are heavy, so rugged clothing, sturdy boots (steel toed is recommended, however workboots are sufficient) and work gloves are recommended.

The tools listed above are only the basics that you'll need to bring. You can bring additional tools if you have them. If you have a favorite circular saw, 1/2" drill, or any other power tools you feel comfortable working with, by all means, bring them along too. All tools will be inspected prior to the workshop. Only safe and properly operating tools will be allowed to be used in the workshop.

Tool Check List

- 2" Framing chisel (1-1/2" optional)
- Framing Mallet
- Framing Square, Combination Square & Bevel Square
- Scoring knife, 25' tape measure
- Safety goggles, ear protection
- Carpenters pencils, red & blue builders crayons, clipboard
- Scientific calculator (trig functions required)



Tool Suppliers

Woodcraft Supply, Parkersburg, WV. 1-800-542-9115

Planes, squares, mallets, marking and layout tools.

Lee Valley Tools, Ogdensburg, NY. 1-800-871-8158

Planes, squares, mallets, marking and layout tools.

Japan Woodworker, Alameda, CA. 1-800-537-7820

Planes, squares, mallets, marking and layout tools.

Barr Specialty Tools, McCall, Idaho. 1-800-235-4452

Quality hand forged framing chisels and edge tools.

Timber Framing Workshop Overview

Design Seminars

One day design seminars precede all of our multi-day Introductory workshops held at the school in Maine. Design seminars offer a great opportunity to gain a working understanding of all aspects of building a timber frame house, from basic design and joinery, to the completion of the home. With the help of slides, chalkboard and CAD drawings, we'll walk through all of the steps of building a timber frame home, and along the way, unravel the myths and solve many mysteries.



The design seminar explores the history and development of timber framing in addition to addressing problems which are likely to confront a contractor unfamiliar with contemporary timber framing. From foundation through completion, our focus is on assisting aspiring owner-builders in solving their own design problems, and allowing experienced builders to expand their expertise.

Historical overview

The process begins with an overview of the history of traditional timber framing from Europe to America. A discussion on the evolution of timber framing systems, from early post & lintel structures to the medieval cottage will be covered.

Bent framing

This segment covers the different bent designs and systems. The makeup of a bent, terminology, function of the principal members and the basic engineering principles of a properly designed bent. This will include a discussion on the bent and bay system to create functional and efficient living areas.

Joinery

Developing a basic vocabulary of joinery details is the first order of business. Common details, their variations, design criteria, tension and compression joinery, structural and engineering considerations, and rule-of-thumb guidelines will all be covered.

Floor systems

This segment covers the design and requirements of floor systems. Joist and summer beam placement, aesthetic and balance of layout, planning for plumbing and mechanical systems, first floor framing—true timber frame, principal sill and girts, and conventional framing to accommodate the frame.

Foundations

The structural considerations and design criteria for a number of foundation systems suitable for timber framing is covered in this session: poured concrete, concrete block, concrete piers and rubble trenches will be covered. The focus will be on specific requirements unique to timber framing.

Enclosure systems

An overview of a variety of enclosure options will be discussed. Foam core stress skin panels, installation techniques, wiring, cost to R-Factor ratio, and types available will be covered. In addition, a number of alternatives including site-built panels, stud in-fill, compressed straw panels and traditional straw/woodchip clay infill systems will be covered.

Mechanical systems

Choosing and integrating mechanical systems in a timber frame requires careful consideration in the design and planning stage. Design considerations and helpful tips will be discussed in this segment.



Introductory Timber Framing

The best way to learn how to build a timber frame is to do it. In hands-on workshops, we do just that. The primary focus is on appropriate joinery design and layout, with particular attention paid to *perfect execution*. Each joint will be systematically laid out and cut by the students, allowing the opportunity to gain firsthand

experience of joinery design, and the feel of cutting a timber frame in the traditional manner.

The workshop frame is designed specifically for instruction, combining a broad variety of joinery details in hopes of expanding the students vocabulary of joinery details. Close attention is paid to setting up systems and approaches that will result in perfect joinery, every time.

The process begins by reviewing the frame plan, identifying each member, and then creating a visual image that must be shared by everyone in the class. Teams are created—one for each bent, and the setup of the timbers on cribbing begins. This initiates the timber surveying process. The timbers are surveyed for visual and mechanical properties, grade and physical defects. A thorough discussion of the physical and mechanical properties of wood are discussed in this process. Preliminary labeling for placement in the frame is made.

Layout of joinery and cutting usually begin on the second day. The process begins slowly to assure that everyone understands each step

prior to moving onto the next. As the first few joints are completed, confidence and technique is gained and momentum builds. This momentum culminates in the raising of the frame on the final day.

What began as a fractured group of individuals has become a cohesive work force, unified and directed toward the final goal of raising and dedicating the frame. Celebration ensues with just cause.

*Frame raising, June 1998
workshop at FMSTB.*



Advanced Timber Framing

For those who have some basic timber frame experience, our advanced workshop is the place to hone your joinery skills and expand your repertoire to include compound hip & valley roof framing. As with our introductory course, we pay special attention to creating systems and techniques which may be applied to any framing situation, with the same results every time. Perfection!



Valley foot to principal rafter detail.

Compound roof framing is nothing more than a combination of simple right triangles. By first creating a visual image, then translating this mental image to paper using simple sketches, each triangle can be isolated, allowing the builder to determine its physical dimensions and angles through trigonometry. This approach allows even the most complex roof frames to be understood.

In the hands-on workshops we apply systems and theory to the construction of a hip & valley roof frame designed specifically for instruction.



The theory, mechanics and mathematics of compound roof framing is covered through the systematic unfolding of the frame plan. This begins with the footprint and elevation, which provides the initial known elements. With this information, all other angles and intersecting planes can be determined through trigonometry by isolating each right triangle.

Natural Building Workshops

Using Traditional Models for our Modern Needs



The building workshops at FMSTB have a primary focus on the joinery, design and construction of traditional timber framed homes built in New England from the mid 17th to the mid 19th centuries. The common house and barn frames built in this period were the result of hundreds of years of European experience and traditions, adapted to the resources, economy and climate of the New World.

Early settlers quickly adapted to the environment and its resources. The vernacular dwellings in Europe used timber as a structural framework and infilled the walls with wattle & daub, a mixture of straw and clay worked into a wickerwork of oak and willow. The roofs were covered with stone or thatch. The earliest settlers brought these traditions with them. The use of wattle & daub and thatch was common in the Massachusetts Bay area into the latter part of the 1600s. As the settlements grew, industry and sawmills soon followed. The plentiful supply of timber provided new options— wood sheathing and siding, split shake and sawn shingle roofs. Wattle & daub and thatch soon disappeared.

Our resource supply is once again changing, and our sensitivities to the ecological impact we have on our environment has become an issue of great importance. By studying the building traditions of the past, we may find solutions to our building needs of the future. Traditional building, by its nature—using only the materials that come directly from the building site, or in close proximity—is by all definitions *natural building*.

In an attempt to develop practical and professional ways to integrate traditional *whole house* systems into our modern building environment, experimentation is ongoing at FMSTB. Straw, clay, stone and timber have been the common building materials for ages. The natural building workshops at FMSTB begin with traditional methods, but go beyond to explore new ways to use these materials that will fulfill the requirements of our modern needs. Strawbale, woodchip and clay, natural earth plasters and thatch workshops are designed to include the best of the old-world techniques, with the latest in engineering and manufacturing processes to provide viable natural alternatives. The timber frame provides the core structural element, thereby reducing the structural requirements of these systems, making them practical as building alternatives that will meet the requirements of our modern building codes and lifestyle needs.



Stacking and lashing bales on the Library in the Strawbale workshop instructed by Atheena and Bill Steen, summer 1996.



Frank Andresen, clay builder from Dusseldorf, Germany, demonstrates the traditional method of preparing straw light clay. Clay slip, left, is poured onto straw and then mixed with a pitch fork. The ratio of clay slip to straw will dictate insulation qualities and application requirements.



Clay plaster applied over straw bale walls in the Library at FMSTB.

Clay Building Systems

Wattle & Daub

Mixtures of straw and clay have been used to enclose timber frames for a millennia or more. One of the more common methods is known as wattle & daub. In this system, a dense mixture of straw and clay (daub) is worked into a wickerwork (wattle) made up of oak staves wedged into grooves in the timbers. Staves are spaced approx. 16 inches apart and usually no more than 3 feet long. Split willow saplings are then woven through the staves to create a tight, solid mesh. Willow was traditionally used because it is flexible and easy to weave. Maple, hazel and ash saplings may also be used, and the staves can be made from most hardwoods. The finished wall thickness can range from 4 to 8 inches.

This system is fun, easy to accomplish, provides a solid wall surface, and has a long and well proven history of success. However, to create a solid wall a dense mixture of clay slip

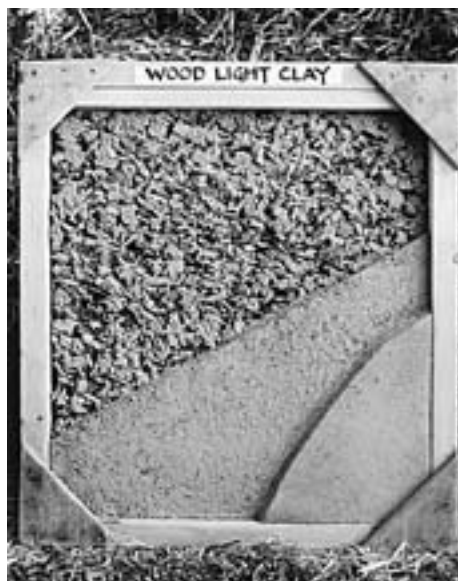
to straw is required. This reduces its insulating qualities, making it less suitable to cold northern climates. It is ideal for interior partitions, and can be used as the interior form for a straw light clay or woodchip light clay infill.

Straw Light Clay

A more recent adaptation developed in Germany in the 1970s, straw light clay provides the same benefits as wattle & daub, uses the same materials, but has increased resistance to thermal conductivity. In this

system, clay slip is mixed with the straw to lightly coat the straw fiber. After allowing 24 hours to cure, the mixture is then lightly packed into slip-forms or a cage made up of reed matting or wood laths. The more lightly it is packed, the higher the insulating qualities. Walls are commonly made 12 thick, but can range from 8 to 16 inches. However, the thicker the wall, the longer the drying time, and it must be protected from freezing until it is fully dried. A 12 inch wall will take from 6 to 10 weeks to fully dry.

Insulation values of up to R-24



Woodchip light clay sample panel with clay plaster base and finish coats.

in a twelve inch wall can be achieved, however it is misleading to apply standard R-values to this, or most other clay/fiber systems. To achieve a suitable comfort level 12 inches is appropriate for northern climates.

This system can also be used to make blocks which can be laid up as bricks or adobe. This is advantageous if the construction is to be carried out in the winter months. In this case, the blocks can be produced in the summer months, or in controlled conditions.

Woodchip Light Clay

Woodchip light clay is produced and installed in the same manner as straw light clay, only replacing woodchips for straw. It has advantages over straw light clay in that it is: 1) faster to produce (requiring no curing time); 2) it can be mixed in a cement mixer (requiring little or no hand work); 3) it can be easily poured into the wall forms or cage, and; 4) it does not require the careful tamping to achieve the correct density. Simply pour and spread lightly to fill all of the voids. The mixture compresses to the appropriate density under its own weight.

As with straw light clay, the mixture can be formed into blocks and laid up in a clay mortar as with bricks or adobe.



Slip form used form woodchip light clay wall section.

Cob

Cob is a traditional clay/fiber based building system that has been in use for thousands of years. Cob achieved widespread use in England from the 13th through the 19th centuries. The term 'cob' comes from the Old English root which means "a lump". This suitably describes the material as it is often made by forming a mixture of clay based soil and straw into rounded lumps (the size of a large loaf of bread). These lumps were then laid up into free standing structural walls, and occasionally used as an infill for timber frames. Structural in nature, cob walls can support a joined timber framed roof system.

Applying finish coat of clay plaster to the Library at FMSTB.

Clay Plasters

The clay wall systems described above all share a number of similar unique characteristics. One of the most important being that they create breathable wall systems. In this nature, the wall acts as a filter, creating a healthy indoor environment by actually filtering the contaminants from the outdoor air. It is important to maintain this breathability. This can be assured by using a natural clay plaster finish.

The recipes for clay plasters vary, but a common base coat plaster can be made by mixing 1 part clay to 3 parts sand and 1 part finely chopped straw. This mixture may vary depending on the quality of the clay, climate or environment, or the particular application specifications.





Top) Scottish Thatcher, Colin McGhee, on the roof of the Library. McGhee has instructed courses at FM since 1999. Left) British thatcher, Jason Morley, on the roof in the July 1997 thatching workshop at FMSTB.



Harvesting reeds in a coastal marsh in Scarborough, Maine.



A rubble trench foundation was used in the Library at FMSTB.

Thatch

The thatchers trade may be one of the oldest building trades in the world, and its modern approach has changed very little throughout the ages. It is adaptable to a wide variety of materials; water reeds, straw, grasses and palm fronds. A suitable thatch can be obtained in nearly every region of the world. As a natural roofing material it is used in its raw form, requiring no manufacturing. However, harvesting can be time consuming if done by hand, and reed beds need to be developed to produce quality material. The aesthetic beauty of thatch is unmatched. Coupled with its low tech requirements and its use of an annually renewable resource, it deserves to be considered as a viable natural roofing option.

Thatching in this country is costly because there is no traditional infrastructure to build upon. There is a small and growing industry evolving, and it is indeed experiencing a revival in Europe. Our efforts to thatch our own Library roof has opened new and exciting doorways, created relationships with professional thatchers, both in the U.S. and Europe, and has helped to spawn a small infrastructure in the states.

Whole System Building

Building in a traditional, natural, way goes beyond the framing and enclosure if a *whole system approach* is to be envisioned and implemented. Reducing the impact on the land during the construction phase, addressing the issue of waste and sewage—at all levels—and considering long-term energy requirements must all be addressed.

Rubble trench foundations have proven to create less impact on the building site, and cost less than traditional foundations. Their design and construction are promoted and covered in all of our design seminars. Two of the four buildings at FMSTB have been built on this type of foundation.

Constructed wetlands offer an ecologically sound way to treat sewage and waste water. Plans for such a system on site are underway. Future workshops and seminars are also in the planning stage.

Hosting a Traveling Workshop

Traveling workshops can be sponsored by just about anyone interested in timber framing. However, to fully understand the process and expectations, a previous FMSTB workshop is required to be eligible to host a workshop. For the individual, it offers the opportunity to learn about timber framing, meet new friends, and as a result, end up with a small house, barn, or shop frame at a very economical price. For a timber framing shop, it's a great way to train employees and potential clients in the finer aspects of introductory, and or, advanced framing techniques. Due to the logistics, we have created two programs; one for the individual, and one for the professional timber framing shop.



McKelvey Barn, October 1998 Workshop project in Stow, Massachusetts.

Frame Design Parameters

The primary goal of our workshops is to educate students in the approach to designing, laying out, cutting and raising a timber frame. As such, frame projects are designed to incorporate a broad variety of joinery details—those that we feel will give students the greatest amount of knowledge and flexibility in designing and building their own frame. We will work with the sponsor to create a design which will serve their ultimate needs, but, we will not compromise on the essential elements we feel are important to the educational experience.

The size of the workshop frame project is dictated primarily by the number of students participating. We have found that it takes from 3 to 4 students in a workshop setting to comfortably cut each bent in the frame. By expanding the bent and bay spans to their maximum, 9 to 12 students can cut a 24' x 32' three bent frame without pushing too hard (remember, this is a learning experience, not a work marathon). Introductory and Advanced workshop frame projects can be designed to accommodate the needs of both the intended course instruction, as well as the ultimate use of the frame by the sponsor with surprising flexibility.

Individual Sponsors

We have found that six day courses work best for traveling workshops sponsored by individuals not associated with a professional shop. As in all of our workshops, education is the primary focus and we view the frame as a by-product of the instruction. Requests to host a workshop will be accepted only from those who have previously completed a FMSTB workshop. Frame design and working plans are provided by FMSTB based on design terms and parameters described in our Traveling Workshop Worksheet. FMSTB will supply all instructional material, including *A Timber Framer's Workshop*, and a site-specific T-shirt to all students.

The sponsor will provide all of the framing materials (as specified by FMSTB) and a suitable work space. In addition, we ask that the sponsor supply a light continental breakfast and lunch for all participants.

All of the necessary power tools and specialized equipment will be provided by FMSTB, however, we will supply a list of tools and supplies which may be provided by the sponsor if available.

Past Traveling Workshops

Bodega, CA
Chicago, IL
Ijamsville, MD
West Falmouth, MA
Middleboro, MA
Medway, MA
Stow, MA
Waldoboro, ME
Kansas City, MO
High Rolls, NM
York, PA
Sylvatus, VA
Cambridge, VT
Bowdoinham, ME
Syracuse, NY
Stuart Island, WA
Airville, PA
Oskaloosa, KS
Corbett, OR
Kauai, Hawaii

Canada
Head-of-Jeddore, NS
Dufresne, Manitoba
Hillsdale, Ontario

Costa Rica
San Luis
Monteverde
Tamarindo



Professional Timber Frame Company Workshops

For professional timber framing shops we have developed special programs in both Introductory and Advanced timber framing. These are 5-day workshops, and are intended to train in-house shop employees. Requests to host the professional shop workshops will be accepted by any organized timber frame company. Specific frame design and working plans will be formulated to meet the educational needs of the companies employees and staff. Workshop manuals and all instructional materials will be provided. The sponsor will provide all of the materials, tools, shop and or work space. In addition, we ask that the sponsor supply a light continental breakfast and lunch for all participants.



*Advanced Workshop
frame project hosted by
Pride Builders, Winnipeg,
Canada, 1995*

Site Preparation and General Requirements

In all workshops the site preparation, foundation and first floor framing must be completed prior to the workshop. All of the necessary plans and technical information (stock details) required to carry this out will be supplied by FMSTB once the final plan is determined. The sponsor is required to provide all materials and supplies. Hand-raisings are appropriate for many workshop frames, however, if the size or design of the frame prohibits this, the sponsor is required to provide a crane.

Scheduling

We attempt to schedule all traveling workshops at least six months in advance. This allows ample time for the design process, site preparation and promotion of the workshop.

How to Get Started

If you would like to begin the process of organizing a workshop, send us a proposal explaining why you would like to sponsor a workshop, the intended use of the frame project, the site location, preferred dates of the workshop, and a rough drawing of the type, style and size of the frame you would like to construct. Upon reviewing this, we will respond with comments and questions, and attempt to refine the frame project and schedule an appropriate date. Sponsorship is available only to those who have previously completed a FMSTB workshop.

Design Seminars

In addition to the hands-on workshops, we also offer one and two day design seminars which cover the essentials of timber framing, from joinery design, framing systems, developing a floor plan, foundation and site preparation, enclosure systems, mechanical and electrical system design and installation. This is accompanied with slide shows of the various processes, providing a thorough overview of all aspects of constructing a timber frame home. Design seminars can be arranged to precede hands-on courses, or stand alone.

Please contact us for more information concerning course outline, fees and scheduling.

Letters from Past Students

"Thanks for the wonderful experience this past week. Nicki and I had a great time taking the workshop and being in Maine.

Our trip home to Virginia was long, but we had a lot to talk about over our 800 mile long trek. We're still amazed by the overall effect the workshop had, and just how beautiful the process is for cutting and erecting a frame. As we drove home we knew we accomplished a lot! We made new friends, we learned how to use new tools, and we especially learned how to say "Jean-Claude.""

Nick and Nicki Salido, Alexandria, Virginia

"I just wanted to drop you a note to let you know what an excellent time I had at your workshop. I really feel like I learned how to use the tools, and got a good overall understanding of what goes into a timber frame... You can read all you want, but for me there's no substitute for hands-on experience! I can't wait to take another workshop.

Of course the real highlight of the workshop was meeting you. I thought you were going to be just another builder. I had no idea you'd be an artist, and a visionary. You have such a contagious passion for your craft! I found it very inspiring. I also like the way you kept the group focused on the philosophical/spiritual as well as practical aspects of Timberframing."

David Parchen, Irving, Texas

"I wanted to send along my regards and a few words about my experience at the High Rolls, New Mexico workshop.

I feel that I received the full value of the workshop fee on the first day. I gained valuable insight into the "quality" of the raw timbers as we chose the right timber for the various frame members. It was helpful and useful to begin each day with the 'skull session' and then have the opportunity to immediately apply the learning. Over the week my understanding of the principles of timber framing deepened as my skills with the tools increased. Your passion for the craft inspired us all and your enthusiasm for the project quickly transformed a group of strangers into a cooperative, productive work team. The environment of the workshop was made very special by the warmth of the Robinson family and the beautiful setting. So, for anyone considering your coursework, I say, "Do it! It will be one of those life learning experiences you will not soon forget.""

Kenneth Snyder, Seattle, Washington.

"This is a good opportunity to let you know that the timber framing course was excellent. I also value the information presented by Frank Andresen on clay building systems. I would definitely take another workshop with you guys, and may do it in the next year or two."

Henry Gorczycki, Johnstown, PA

"How do I begin to thank you for this experience which has been life changing? ...I have always been a carpenter; you have helped to awaken the master who lives within me in spirit.

In this uncertain world, know that you indeed make a difference. Your kind and beautiful family, your attitude and philosophy, the country surroundings all serve as an example of the way life should be. You have brought brothers closer together and made friendships between others which will last almost as long as the frame which we created. Those who truly embrace the experience will craft with a new respect for the materials and the people whom they will serve. Although we are miles apart once more, we stand together, champagne held high in the air, a tribute to our combined efforts and experience at Fox Maple. Vive Jean-Claude."

Rich Ahrens, Basking Ridge, NJ

"Hello! I'm finally writing with a long overdue Thank-you, for putting on such a great workshop. It truly was a wonderful experience. I feel like I learned a great deal and it has given me more confidence in my work at school."

Amy Kiessling, Wheeling, West Virginia.

Lodging & Accommodations

There are a number of local bed & breakfast's within a 5 minute ride from our school, and some a brisk hike. Most of the lodging establishments listed below offer a reduced rate for workshop participants, so be sure to tell them you are taking a workshop at Fox Maple. Camping is available on-site with bathing facilities. The campus is located on a secluded 40 acre parcel, with streams, mountains, and bridle paths. Campers should bring tents and all camping supplies and utensils. Ponds and rivers are nearby for soap-free bathing and the local Health Club has shower and bathing facilities which can be used for a small fee.

Workshops run from 9AM to 5PM, daily. Breakfast and a hearty lunch are included in the workshop tuition. Shopping and numerous restaurants are located within a 15 minute drive. Friends and family members are welcome to accompany workshop participants, and meals can be provided them for a nominal fee. We are located in the foothills of the White Mountains of western Maine, and many natural and commercial recreational facilities are close by which family and friends not enrolled in the class can enjoy. Children are welcome, but they must be attended by an adult not enrolled in the workshop.

Foothills Farm B&B

Brownfield, Maine
Kevin Early, Theresa Rovere
207-935-3799
1 Mile from Fox Maple
Rates: \$32 single, \$42 double

Burnt Meadow B&B

Brownfield, Maine
Cullen Carpenter, 207-935-4014
5 miles from Fox Maple
Rates: \$50 dbl occupancy.

Purity Spring Resort

E. Madison, NH
603-367-8896, 1-800-373-3754
10 miles from Fox Maple
Rates: \$42-\$123 single.
PSR's health club & pool is available to campers for bathing facilities. Call for special weekly rates.

The Inn at Crystal Lake

Eaton, NH
Ken Oceau
603-447-2120, 1-800-343-7336
5 miles from Fox Maple
Rates: \$50 single, \$60 double

River-Run Campground

Brownfield, Maine
207-452-2500
5 Miles from Fox Maple

Woodland Acres Campground

Brownfield, Maine
207-935-2529
5 Miles from Fox Maple
Weekly rate:
\$19 per night
w/ water & elec.

Camping at Fox Maple

Camping at Fox Maple is free. We have a tipi and a few spaces that offer cover. Bathing facilities are available but with large groups, there may be a line. Additional bathing facilities with full health spa are available at **Purity Spring Resort**, a short 10 minute drive from the campus for a \$5 fee (though they seldom charge FM students). Call Purity Springs at 1-800-373-3754 for info about daily or weekly rates.

For more information about additional lodging, local recreational and historic sites, call the North Conway, New Hampshire Chamber of Commerce at: 603-356-3171

Directions to Fox Maple

From **Portland**, take route 25 west to route 113 (about 3 miles past Standish Village). Follow 113 west approx. 25 miles to intersection of Rts. 160 & 113 in Brownfield (Grant's market), and turn left onto 160. At the church you'll come to a Y with a monument on the left. Go straight at the monument (160 takes a hard left; don't take it). This is the Snowville Road. Bear right at the Y after a small bridge, and continue straight past a four corners and a T intersection. Follow signs to Snowville and W. Brownfield. Corn Hill Road (marked Fire Lane 21) is 3.5 miles from the monument, where you'll see the thatched Fox Maple sign. Turn right onto Corn Hill. We're on the right at the next Y. (1 hour drive.)

From **Boston**, take route 95 north to the Spaulding Turnpike (Rt. 16 No.) to Conway N.H. Turn right at the light in town onto Rt 153. Go five miles to Crystal Lake in Eaton, N.H. Turn left at the town beach (this is Snowville Rd). It is about 6 miles to the Fox Maple sign. at the Corn Hill Road (Fire Lane 21). Turn left to our school at the end of the lane. (2-1/2 hour drive.)

You can't miss it. Any questions call 207-935-3720.

