The Timber Frame Building Process

Initially, we recommend you buy a magazine or book on timber frame homes and pick out photos that attract you. There are two primary magazines devoted to timber frame homes: Timber Homes Illustrated and Timber Home Living. You will find some of the excellent books available listed in our Recommended Reading Section.

There are many other aspects of design to consider for both interiors and exteriors. The decision about the exterior style is probably the easiest. Your timber frame will be wholly inside the walls of your house, whether you enclose it with stress skin panels or in some other manner. Consequently, you can use wood, brick, stucco, stone, or any other exterior that will fit your setting, whether urban or rural. You may want to transfer the timber frame style to the exterior in a porch or other decorative detail. The timber framed posts and trusses add a striking accent to masonry as well as to wood.

Envision your timber frame home on the site so that you can what style suits it best. Also consider the best location for various rooms in terms of the view from your windows and where the sun will be positioned throughout the day. A topographical map of your site will be helpful.

You will find many beautiful pictures of timber frame interiors and sample floor plans in the magazines and books. Choose some that particularly appeal to you and keep them nearby as you begin working on floor plan ideas for your house. Think through how much living space you will need, and how you want it organized within the structure. Allow yourself to dream at this point. This will enhance your creativity. All you need is a rough sketch of each floor. Free hand is fine.

While these ideas are perking in your mind, this is a good time to talk to the building inspector in the county where your home is to be built. You may have talked with him already about a septic permit and requirements for a building permit.

Now you’re ready to start talking with one or more timber frame companies. Most companies will confer with you based upon your floor plan sketches and the pictures you’ve selected. They can give you advice on how to accommodate the style you prefer to the structural requirements of your floor plan. In addition, they should be able to help you find ways to get the best timber frame for the style and size you require. At this
point, they also should be able to give you a ballpark estimate on the cost of the timber frame you're considering. You will also need to talk with them at this point about how you intend to enclose your timber frame.

If the timber frame company has stock home plans, it may be wise to look at them to see if any are close to what you are looking for. These timber frame home plans are already designed and engineered, potentially saving you a considerable amount of money in design fees. You'll also save time as a custom design will typically take three-to-four months. Keep in mind that the floor plan in standard timber frames can be altered to suit your needs. The only things you can't move are the posts! (Well, you can move those too, but it takes re-engineering and re-design.)

Once you have defined the frame and enclosure you want, the timber frame company should be able to give you a firm price. At that point, a sales agreement can be drawn up and signed. Then, within the time frame agreed upon with the company, the preliminary design phase, which includes floor plans and elevations, will begin. These will be revised with your input, until you are satisfied that the use of space and the style of the timber frame met your wishes. Next, the designer begins to engineer the frame, calculating loads and stresses to determine the size of timbers and kind of joinery required. This will result in your final drawings, or blue prints, which will be sent to a structural engineer, if required. This person will require any revisions he or she finds necessary, based upon the code requirements for snow and wind loads etc. in your locale. These will be presented to you, along with any costs for the change and, with your approval Goshen's designer will make the changes in the blueprints.

Congratulations!
You are now well on your way to owning the home of your dreams!

Selecting the Wood for Your Timber Frame

One of the first decisions you will make when you begin designing a timber frame home is what wood to use. The most commonly used woods are eastern white pine, douglas fir, and oak. There are many structural and aesthetic factors involved. Oak timbers are darker and heavier than pine. They also are stronger, and may be smaller in size to carry comparable loads; however, they are less stable and consequently crack and twist more than pine.

The cracks are called "checks" and will occur in all large timbers. Very rarely do they cause structural weakness if the proper grade of timbers has been chosen for each application. Many people view them as adding character to the frame, especially since checks are a feature of antique structures.

While many companies allow the timbers to season for five to six weeks, essentially they are cut green. Once locked into the frame, however, the tension prevents some of the twisting and checking. It is advisable to avoid drying out the frame too rapidly at first, especially during the winter heating season. If you make an effort to keep the heat down
your first winter and keep a humidifier going, you will be able to reduce the degree of checking.

**Timber Frame Bent/Truss Design**

The complex joinery necessary to build free-standing timber frames was developed in the so-called Dark Ages. The strength of these timber frames could carry the structural weight of a house and made the building of great cathedrals throughout Medieval Europe possible. Central to their construction is the timber frame truss. There are several basic truss designs that have literally stood the test of time. These are incorporated into “bents,” which include the posts and beams and literally make up a series of cross-sections in the frame.

<table>
<thead>
<tr>
<th>A rigid triangle is the simplest truss form and may be used for small buildings. A king post truss allows for a wider span, preventing the cross timber or tie beam from sagging.</th>
<th>Adding struts to a king post allows the builder to increase the span.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queen post trusses provide easier access to the loft area and simpler window treatment options</td>
<td>The hammer beam truss made possible broad expanses of Medieval churches and provides the roof structure for today’s most imposing timber frames.</td>
</tr>
</tbody>
</table>

**Cost Conscious Design**

Here are some the primary design considerations that will help to keep your timber frame budget in line:

1. Plan to have your frame built with timbers available regionally

2. Keep the dimensions of your floor plan simple, rectangular or square, and have a single ridgeline in your roof. Hips and valleys are difficult to timber frame, and greatly increase the cost. Corners add to the cost in any type of construction.

3. Ask your designer to keep the joinery simple and to a minimum, and to keep timber lengths as short as possible. Lengths over 18 feet usually cost a premium.
4. Design a hybrid home, using the timber frame for the great room and using structural insulated panels for the rest.

5. If you have a potential use for a loft, plan to include one. Those building a retirement home may want everything at one level to minimize stair-climbing, but be aware that one-story structures are more expensive than homes with upstairs living space, since you only have to pay for the roof once.

6. Use a plan already designed as one of the company's standard timber frames. Even if you pay to have some revisions made, you can eliminate most of the design cost this way. In addition, the company will usually charge less to cut a standard frame.

**Timber Frame Wood and Finishes**

One of the first decisions you will make when you begin designing a timber frame home is what wood to use. The most commonly used woods are eastern white pine, oak, and douglas fir. There are many structural and aesthetic factors involved.

White Pine is an excellent wood for timber frames, as it is extremely stable and does not twist, bend and crack as much as oak. It is an attractive honey color and has more knots than oak. White pine is susceptible to a fungus called Blue Stain that causes blue striations in the timbers. Whether or not this is a blemish or a character-adding feature is a matter of aesthetic choice. (See the article on Blue Stain below.) You will want to determine your own opinion.

Oak timbers are darker and heavier than pine. They have more grain and fewer knots. They also are stronger, and may be smaller in size to carry comparable loads; however, they are less stable and consequently crack and twist more than pine or fir.

The cracks are called "checks" and will occur in all large timbers. Very rarely do they cause structural weakness if the proper grade of timbers has been chosen for each application. Many people view them as adding character to the timber frame, especially since checks are a feature of antique structures.

We use cypress wood for all of our porches and exterior trim. Cypress is renowned for its durability. The heartwood in cypress trees produces oils that help resist decay when exposed to moisture. These oils also provide a natural deterrent to termites and other insects. While technically a softwood, cypress is extremely strong and is commonly used as a hardwood. The timbers have an attractive grain and a golden brown to reddish-brown hue. Cypress's excellent qualities are beginning to recommend it to our customers for the main, interior frame as well as exterior porches and trim. Its cost is comparable to douglas fir.
Using Green Timbers

With few exceptions, timber frames are cut from green timbers. This is because it takes years to air-dry timbers: oak air-dries at the rate of only about ½-inch per year, pine and fir at about 1 inch per year. Kiln drying takes several months of great care, to prevent the extreme heat from increasing checking and twisting, and consequently is expensive. A new technology of microwaving the timbers in a kiln may be preferable, but it is even more expensive.

As the moisture leaves the timbers, it causes shrinkage of the wood cells. The shrinkage is in cell diameter, not in length, and this is true in the overall timber as well. The timber will check and twist as this happens, but this doesn't affect its length or strength. Timber framers know how to compensate for the shrinkage in their design of the structure and joinery.

While recycled timbers are often extremely dry, re-sawing and cutting of new joinery, plus humidity changes, can cause movement in the timbers. In any case, people choose recycled timbers precisely for their antique look, which includes checks and hand-hewn or weathered surfaces.

Once the timbers are locked into the frame, the tension prevents some of the twisting and checking. It is advisable to avoid drying out the frame too rapidly at first, especially during the winter heating season. If you make an effort to keep the heat down your first winter and keep a humidifier going, you will be able to reduce the degree of checking.

Grading Timbers

Building departments typically require that the frame design drawings indicate the grade of timbers to be used in the frame and that the actual timbers be stamped to certify that they meet the grade specified. There is a very good reason for this requirement.

As we know, different wood species have different strengths. This is also true of specific timbers cut from one species. Various conditions, such as the number and size of knots in the timber, fungal rots that may be present in the wood, or breaks in the wood fiber may reduce the strength of the timber. For this reason, each individual timber must be inspected and graded for structural strength.

When the designer does the structural engineering for a frame, he or she selects the grade required to ensure adequate strength for the loads on that member. These design values are established in the American Society for Testing and Materials' standards. In most cases, the designer has the option of using a higher grade of timber or going to a larger timber for a specific member in the frame.
**Blue Stain**

Certain types of wood get a fungus called "Blue Stain." White pine, which is used extensively in timber framing, is one of them. The fungus that causes Blue Stain begins to grow as soon as the tree is felled and feeds on the sap when the wood is moist. Consequently it affects the sapwood, working inward through the log or timber, but stops at the heartwood.

Blue Stain is not destructive to the wood and will not cause rot or structural damage. In fact, blue-stained wood is used for cabinets because it is considered by many to be attractive. These people are willing to pay a premium for it. A high proportion of timber frame owners also enjoy the blue striations in the timber frame, as it gives it more character.

However, if you do not like the look of Blue Stain, talk with your timber framer about ways to control or eliminate it. They include using winter-cut timbers, which are not as susceptible because the sap is down; or dipping the timbers in a fungus-killing chemical, which will retard it for a while. Keeping them well-aired while stacked will also help. Scrubbing the timbers with a bleach mixture can reduce the visibility of the Blue Stain. Once the timber frame is erected and the timbers are in a lower humidity indoor environment, the Blue Stain will stop spreading.

**Finishing a Timber Frame**

*by R. Michael Baugh*

Although a timber framed structure is often compared to a fine piece of furniture, the finishing requirements and objectives for heavy timbers and quality furniture are quite different. The finish itself should be different as well.

Varnishes, lacquers, and urethanes work well on kiln-dried, dimensionally stable furniture-grade lumber, but these same finishes would be impractical on timbers, whose fibers and cells must "breathe" and move, due to varying moisture content and stresses within the wood. Green timbers seek moisture equilibrium, and the escape of moisture along with the chemistry of green wood will break down or oxidize a finish that seals the wood completely. With re-sawn material the same factors occur in reverse: the dry fibers need moisture and suppleness from the finishing oils to reduce further checking and brittleness, as new stresses and movement from re-sawing and re-joining come into play.

For either green or re-cycled material, there are three goals in the finishing process. The first is to reduce the checking, drying, and shrinking process in both the timbers and joinery. The second is to enhance the beauty of the particular species of wood that is used. At the same time, the finish must be easy to apply, and simple to maintain and re-finish over the years. Last, but certainly not least, the finish should be relatively safe to both the users and the environment.
Most commercially available finishes cannot adequately accomplish all of these objectives for several reasons. Nearly all of these finishes contain metallic driers which speed up the drying time of the finish, necessitating the application of many thin coats that only serve to seal the surface of the timber. The wood simply cannot stay wet long enough to allow the oils to be absorbed into the cells, fibers, and checks of the timber. These driers, although used in small quantities, are quite toxic. Also, most available finishes are 70-80% solvent, leaving very little protective material on or in the timber. Re-application only serves to seal the timber further because of the rapid polymerization due to the driers. And the higher the solvent ratio, the higher the VOC (volatile organic content) level in the shop. Some (but not all) finishes out-gas aldehydes as they dry, although water-based finishes are much safer in this respect. Typically, touch-up work, reapplication, and periodic maintenance is a time-consuming process.

A good finish for timbers must be drier-free in order to allow time for penetration and absorption, and to prevent rapid breakdown of a finish that merely seals the surface. (On timbers, finishes that seal the surface only are more prone to UV degradation, as well to oxidation for the previously mentioned reasons.) Without driers in the finish, if properly applied, the finish will definitely reduce checking and shrinking, even in green oak.

Secondly, a good finish for timbers must be able to be easily and rapidly applied due to the large surface area of the frame. The excess should be easy to wipe off without leaving lap marks and a gummy build-up on the surface. The optimum solvent-to-solids (oils, waxes, resins) ratio is about 50/50. The ingredients should be the purest grades in order to discolor as little as possible over time. Such a finish is flexible, "living" in and not on the timber, and is easily replenished through the years as needed without a lot of surface preparation. I recommend application of one good heavy coat, filling all surface checks and coating all joinery, prior to raising; and touch-up and cleaning after drying in the frame, using more finish and a rough pad where necessary to remove scuffs and abrasions, dirt, dust, and paint, and of course, the inevitable footprints. Over the years, as the timbers appear dry and "thirsty," more finish can be applied as needed to keep the timbers in the best possible condition for generations to come.

**Exterior Timber Frame Finishes**

Timber framed porches and exterior details are extremely attractive and bring the timber frame outside, unifying the interior and exterior of your home. However, the wood needs special attention, since it is exposed to insects and the elements. There are some woods that will hold up better than others, such as cedar, cypress or redwood. Cedar and redwood are prohibitively expensive for most folks. Cypress, as mentioned above, is an excellent wood for exterior use, and is available at a reasonable price.

With the proper finish, white pine, douglas fir and oak may all be used for the exterior. The exterior finish should protect the wood against mildew, termites, and ultra-violet rays, which will discolor the timber, "graying" it out. One way to do this is to spray on an insecticide, a borax product of some kind, for example, and then top coat it with a penetrating oil finish. The oil finish will need to be reapplied at regular intervals.
An attractive way to finish a porch or exterior trim is to use a tinted oil stain for the penetrating oil finish—for example, a gray tint. This can be applied and then wiped off, like a white wash. The result is a "pickled" look, as the grain of the wood still shows through under the gray tint. This method also has the advantage of reducing the visibility of any graying of the timbers from UV rays.

Goshen Timber Frames' Raisings

Raising a Traditional Timber Frame

A traditional timber frame uses a bent system—in part, specifically to facilitate raising the frame. The bent assembly represents a cross section of the structure, including posts, tie beam, and rafters. The bents are trial assembled in the shop, to ensure an exact fit. Then they are taken apart, coded, and stacked to await shipment.

At the time of the raising, the timbers are first assembled on the ground. The bent that will go up last is assembled first, followed by the next in order of placement, with the first bent to be raised on the top of the pile. The crane lifts the first bent up and places it on the floor deck. It is braced to hold it steady while the connecting girts are fitted into the bent. They too are braced. The next bent is flown in by the crane and connected up with the girts. Once the two bents are tied together by the connecting girts, we have a more stable structure to work on.

After the bents are secured with connecting girts, the loft floor joists are flown in and installed in the loft area. Finally, the ridge beam and roof purlins are flown in and dropped into their housings on the rafters. The area defined by two bents and these horizontal members (connecting girts, purlins, and joists) is called a bay.

We find that it generally takes the Goshen crew approximately two days to assemble and raise a 3- to 4-bent frame, such as standard frames Blackberry Cove and Walnut Creek. A larger frame, with side sheds (such as Sugar Fork) may take up to three days. The conditions of the site have a bearing, of course, since it is a very different proposition to raise a frame on a steep slope which limits crane access compared to raising a frame on level ground.

Raising a Common Rafter Frame

Common rafter frames are constructed with horizontal plates running through the structure. The rafters are set on the plates, usually on 2' to 4' centers. There are no purlins in a common rafter frame.

This system, too, serves a purpose in terms of the raising, especially of very large frames, since the bents might become so large that they would be dangerously heavy. When
raising a common rafter frame, the bent posts are raised in sections and topped with the plates, which tie them together. Then loft floor joists are seated. Finally, the rafters are flown in and seated on the plates.

In general, common rafter frames are quickly and easily raised. However, a large common rafter frame, such as Goshen's Gentry's Mill, can take a considerable amount of time, because there are so many separate timbers to be installed piece by piece with the crane. Consequently, we plan on 3 to 4 days to raise this frame.

**Advantages of Structural Insulated Panel Systems**

*by Bob Murray*

Timber framers -- and homeowners buying their frames -- have made structural insulated panel systems the preferred method of closing in timber frame homes. There are plenty of good reasons for their choice. Timber framers pour their hearts and souls into producing a frame that will be a work of craftsmanship and beauty. They and the new owners want to protect that frame as quickly as possible. With the use of insulated panels, the average-sized home can be enclosed in a couple of days with a protective envelope that will keep all the elements off the frame.

Structural insulated panels are placed on the outside of the timber frame, so the entire frame is exposed to view in the interior of the home--unlike stick-framing, which is filled in between the timbers. And because the timbers are fully inside the insulated wall system, they are also protected from moisture damage. With stick-framed walls, on the other hand, moisture can penetrate into the wall cavities and cause rotting of both timbers and intermediate studs.

Another advantage over stick-framed in-fill is that panels are manufactured using OSB on the inside skin, which normally has sheetrock applied to it with screws and/or nails. As the panels are manufactured using engineered materials, they are very stable and will not shift. Because of this the owner will not have a nail-popping problem in the future.

<table>
<thead>
<tr>
<th>Foam Core Thickness</th>
<th>EPS (Expanded Polystyrene)</th>
<th>Polyurethane</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-9/16ths-inch</td>
<td>R-17</td>
<td>R-24</td>
</tr>
<tr>
<td>5-9/16ths-inch</td>
<td>R-24 .5</td>
<td>R-40</td>
</tr>
</tbody>
</table>

*(As a general rule of thumb, polyurethane foam has a 60% higher R-value than EPS of the same thickness.)*

As a result, homeowners can begin saving money immediately by buying smaller HVAC systems. And of course they continue to enjoy savings on energy costs,
anywhere from 40%-60%, depending on the size and type of panels they select, for as long as they own the home.

I can't fail to mention the increased strength to be gained by the use of panels. Both timber framers and their frame owners aim to build homes that will stand the test of time. The use of panels provides significant additional strength to the home. But first, a clarification needs to be made: two types of panels are generally produced: structural insulated panels, which are used to build homes that do not have any other structural component; and insulated panels, which enclose the timber frames that provide the structure. The former are called SIP's (Structural Insulated Panels) while the latter are simply called insulated panels or stress skins, although sometimes they are all referred to (inaccurately) as SIP's. True SIP's are structural, and since their loads are carried evenly throughout, they are stronger than stick-built walls in compressive strength and resistance to racking. In fact, according to a report from the US Department of Energy (November, 2001) "Testing has shown that a wall panel with two half-inch-thick OSB skins is nearly three times stronger than a conventional 4-inch stud wall." This can make a big difference, especially in parts of the country that experience severe weather. Houses built of SIP's have stood up to windstorms, tornadoes and earthquakes that have knocked neighboring stick frames flat.

**Basic Panel Information**

Now that I've described the basic advantages of insulated panel systems for use in building timber frame homes, let me list some of the aspects of polyurethane panels that make them better than all the others.

1. Most urethane panels are produced using a Computerized Drafting System to design the panel system to extremely close tolerances. The panels are produced and fabricated from the design in quality controlled plant conditions. This means they arrive at your building site already pre-fabricated and ready to go up without a hitch.
2. Urethane foam insulation generates the highest R rating for panels. We generally recommend our R-26 wall panels and R-40 roof panels for home construction. This will reduce your energy costs by a minimum of 50% over stick framing.
3. As the Urethane is injected into the panels, it seals itself to both OSB skins and completely fills the panel. This provides an automatic air and vapor barrier. And, as the panels are entirely filled, there are no air spaces for moisture to build up, thus greatly reducing any opportunity for mold to grow in your wall system.
4. In most urethane panels, your electrical plan is fabricated into the panels for you, some include chases lined with conduit and wiring boxes. You or your electrician need only fish the wires through once the panels are up.
5. In some panels, your electrical plan is fabricated into the panels for you, with chases lined with conduit and wiring boxes. You or your electrician need only fish the wires through once the panels are up. These wiring boxes are installed prior to
the foaming operation, furthermore, effectively sealing them and eliminating any drafts through the boxes.

6. Polyurethane panels are manufactured using environmentally friendly products. Insulated panels are relatively new in the centuries-old building industry. But while they have been in use only for the past 50 years or so, these "newcomers" are already tried and true. In fact, they have proven to be the strongest, most energy efficient and most durable method of high quality home construction. Polyurethane panels make the most of these advantages.

**Panel Basics**

**Panel Design**

Panel design gives you the exact measurements for cutting and fitting the panels. Panel producers provide the design to the builder if the panels are going to be fabricated on site. Those companies that offer complete pre-fabrication generally design and engineer the panels to much closer tolerances. Many of the latter will also include your plans for electrical into the design and put in the chases and/or conduit and wiring boxes during pre-fabrication. The panel design generally does not include plans for plumbing or heating and cooling, since these are generally worked into interior space, as in conventional construction.

**Accessories**

These are the various fasteners required to connect the panels. Some panel companies provide the accessories with the panels while others do not. The cost of the accessories is generally 10-15% of the panel cost.

**Panel Interior Treatments**

If you are planning to use Tongue & Groove Decking on your ceiling, the proper procedure is to install it first and attach the panels over it.

If you are going to use sheet rock on ceilings or walls, a furring strip should be nailed on the exterior of the frame members before installation of the insulated panels. This leaves spacing that will simplify installation of sheet rock. The dry wall installers simply slip the sheet rock behind the timber frame braces and posts in the space provided by the furring strip. The same method can be used to make it easier to install wood paneling on the walls. Be sure to tell your designer what material you plan to use, and which dimension (both sheet rock and wood paneling come in different thicknesses) so the proper size furring strip will be indicated in the drawings.

**Exterior Finishes**
Panels allow for the whole range of exterior finishes on roof and walls. This versatility is just one more of the advantages of enclosure with panels, as it allows you to build a home that fits into any setting. Neither EPS nor polyurethane foam contains formaldehyde or CFC's.

On Roofs: You can use metal, shingle or shake roofs over the panels. Shingles come in a wide range of quality. If you are using shingles, therefore, it is best to choose a company that will warranty their product over panels. It is also wise to avoid a dark-colored shingle in a hot climate.

At this point no studies have been completed to indicate that a cold roof will increase the life span of composition shingles over panels. The typical panel roof is simply covered with felt and shingles. Although this is theoretically a hot roof, in fact, because of the extremely high R-Value of panel roofs, it is more accurately defined as neutral. The insulation prevents heat from building up in the interior and over-heating the roofing material.

On Walls: The panel walls can be covered with any kind of wood, vinyl, stucco, stone or brick. Your siding manufacturer will provide specifications for attaching the siding to the wall panels.

**Dry-In**

Enclosing a frame with insulated panels is faster than stick-framing, but of course the type of panel used will make a big difference as well. The pre-fabricated panels can be installed very quickly and offer almost immediate protection for the timber frame.

Once the panels are installed, you have only to get the roof covering over the panels and your home is dried-in and safe from the elements. At this point, you have much more leeway in scheduling the work to complete your home.

**Finishing Your Home**

In general, finishing a timber frame enclosed with insulated panels is not significantly different from finishing a stick-framed home. However if the contractor is not familiar with panel construction, he can consult with the timber frame company on questions concerning finishing the house.

Again, the more sophisticated pre-fabricated panels make finishing your home easier. Since they are pre-fabricated, you will not have the time-consuming and messy process of cutting the panels on site. The best panels have chases lined with conduit and wiring boxes installed in the panels for your electrical. The rough openings for windows, skylights and doors are cut and framed in with wood. The subfacia is already installed on the roof edge. All of these features provide significant time savings and make the contractor's job easier.
Moisture

While panels protect the timber frame from moisture, they themselves require protection from moisture. There are three key preventative measures. The most important is that the panels must be properly sealed with foam during installation. As a second measure, you should wrap the home in a vapor barrier. This step is not required by all panel manufacturers, but is good building practice. The third measure—one the homeowner can take—is to install an air exchange system to exhaust the moisture-laden air that builds up in any tightly sealed structure. Some state energy codes require air exchange systems in all new construction, now. More will adopt that requirement in the future.

Indoor Air Quality

An air exchange system will also bring fresh air into your home and exhaust the stale air. This is recommended in all tight houses, including those enclosed with insulated panels, because there are no drafts or leaks to allow air exchange with the outdoors. Many products found in the home, such as furniture, curtains, carpet, and cleaning products, emit gasses that can build up and pollute the air inside the home unless there is a mechanical air exchange system.

You can get an air exchange system with a whole house air purifier, if you want to take that next step.

Off-Gassing

Insulated panels do not contribute to the pollution of air with formaldehyde or other gasses. Neither EPS nor polyurethane foam contains formaldehyde or CFC’s. While trace amounts of formaldehyde are found in fresh OSB, it is well below the limits established by the U. S. Department of Housing and Urban Development. In addition, they diminish to undetectable levels within the first few months. (HUD's limit is 0.2ppm for plywood and 0.3ppm for particle board. Fresh OSB is below 0.1ppm and for this reason has been exempted from testing and certification.)

Fire

SIP's pass all the standard fire tests required of wood-based construction. They contain no air within their foam core, so the crucial element required for a fire to burn, oxygen, is absent. This means that the fire will not run up the wall cavity. The sheetrock usually used as the interior wall finish adds another 15 minute thermal barrier to protect the SIP's and any other underlying structure. Urethane panels typically have a Class 1 fire rating. Urethane does not burn.
Insects

Insulated panel systems have no insect problems that are unique to them. The same insects that can infiltrate a stick framed home may get into a panel enclosed house. It is advisable to take the same precautions that one would take in building any home.

Keeping out carpenter ants and/or other insect pests such as termites, may require a multi-pronged approach, which includes treating the soil, putting in the metal shields between the foundation and sub-floor, keeping flower beds away from the foundation and removing overhanging limbs. It is advisable to talk with your local pest control professional and your builder about which steps are most effective in your area.

Cost

The panel materials cost more than stick framing with fiber glass batting, but less waste, cheaper labor costs and the savings on heating and cooling systems often allow SIP's to stay competitive in the long run. Prices vary region by region, so the best procedure is to get competitive bids locally, figuring in the long term factors as well as short term.

Wiring and Mechanical

Wiring Timber Frame Homes Enclosed with Insulated Panels

With the proper information and adequate planning, wiring a home enclosed with insulated panels can be simpler and quicker than wiring a stick frame house.

The most common method used in wiring insulated panels is for the manufacturer to create horizontal chases (at two levels that are chosen by the homeowner) through the foam insulation. The electrician then fishes the wires through the chases. These chases save the time normally spent drilling through the 2 X studs of a stick frame house in order to create pathways for the wiring.

An improvement in this method of wiring is offered by certain panel manufacturers. In this option the electrical boxes for the switches and outlets are pre-installed during fabrication. This saves the electrician time (and therefore the homeowner money) and also provides a tighter, better-insulated fit at each electrical box. The fabricator also lines the chases with PVC pipe, which simplifies the wiring process. The wires will not get caught on the foam insulation so they can be pushed, not fished, through the chases. This, once again, saves on the electrician's time.

If it is not possible to make use of the existing chases, alternative methods of wiring can be employed. These methods include running the wiring behind baseboards, chair rails or wainscoting. However, these are options of last resort due to the question of meeting local building codes and the additional costs of material and labor.
The basic method for wiring ceiling fixtures and ceiling fans is to rout out the tops of ceiling beams to create a channel in which to run the wires. This procedure is done in the shop while your frame is being cut or on site after the raising.

The lighting choices available to the timber frame homeowner are the same as those used in conventionally built stick frame houses. There is, however, one important difference to keep in mind when laying out your lighting plan. The posts and beams that give timber frame homes their distinctive character can also cast some big shadows. It is therefore important to decide where you want to accentuate those shadows and where you want to eliminate them. The various lighting fixtures -- surface mount, recessed, track lighting, hanging fixtures, etc. - can be used alone or in conjunction with one another to produce the desired lighting patterns.

Once the wiring method has been chosen it is necessary to develop a detailed wiring plan that includes the path of the wires and the exact location of all switches, outlets and light fixtures. The diagram can be marked on the home plans by the electrical contractor or by the homeowner.

**Basic Plumbing Procedures**

Since it is never advisable to run plumbing in exterior walls (due to the reduction of insulation values and the danger of the pipes freezing) the utilization of insulated panels does not impact a timber frame's plumbing scheme.

Because of their customary open design, however, timber frame homes do present specific difficulties in concealing the pipes. Keeping in mind a few basic rules while laying out your floor plan and plumbing design will eliminate most of these hurdles.

"Wet walls" typically must be constructed of 2 X 6 studs in order to accommodate four and a half inch vent stacks and four inch drains. If, for some reason, the partition walls will not accommodate the required pipes, or the plumbing has to be run on an exterior wall, then a separate plumbing chase (a false wall) can be built to enclose the pipes.

Upper level floors in timber frame homes often consist of 2 X Tongue and Groove (T&G) decking. This method of construction saves money in both material and labor and has the added advantage of creating an aesthetically pleasing finished appearance. However, because the 2 X T&G forms both the flooring of the upper rooms and the ceiling of the lower living spaces it leaves no cavity in which to run horizontal pipe chases. To overcome this issue 1 X Tongue and Groove is placed on top of the beams and a floor system is built up with 2 X material to create a void for wiring, ductwork, and insulation.

Finally, a word of warning. It can not be stressed enough that, under no circumstances, should any timber be cut or drilled through to accommodate the plumbing. To do so would compromise the structural integrity of your timber frame.
**Heating And Cooling**

The first order of business in assuring year-round comfort in your new timber frame home is to make certain that it is as energy efficient as it is beautiful.

Energy efficiency means savings for the homeowner not only in the long run with lower fuel bills, but also in the purchase and installation of heating and cooling systems. In many locations, a cooling system needs to be nothing more than strategically placed ceiling fans. As for heating the structure, many homeowners will utilize solar energy (active or passive) while others may want to install a wood burning, or pellet, stove. These are excellent options that can save money and be environmentally friendly; however, local building codes (as well as the homeowner's lending institution) will almost certainly require a back up heat source.

A forced air furnace, located in the lowest level, with properly placed registers let into the floor of the main level, should handle the heating requirements for the entire house. The heat simply rises to the upper levels of the timber frame home.

If heat has to be delivered directly to specific areas in the upper levels, a forced air furnace would not be a desirable option. In this case either a whole house hot water system or electric baseboard heaters are better suited for the task. As opposed to the space requirements for forced air ductwork, the pipes used in hydronic systems are generally ¾" and therefore can be easily concealed in partition walls. And finally, while the cost of electric heat per BTU is the highest of any available system, the relative low cost and ease of installation make this an acceptable choice if the heaters are only infrequently needed.

Radiant floor heating is a popular system for heating timber frames. Radiant floor heat provides heat by convection, heating the floor and furniture first. This is a very efficient way to heat a timber frame home.

**Ventilation**

As mentioned above, stress skin panel enclosure provides an extremely tight and draft-free interior. While optimal in terms of comfort and economy, it may reduce air exchange more than is desirable. For this reason, it is recommended that you have an air exchange system installed along with your heating system.

**Financing Your Timber Frame**

**Owner/Builder Loans Made Easy**

*By: Dean Beety, First Federal Bank*

As housing prices go up, more people are choosing to put their skills to work. Building your own home allows you to get competitive bids and manage your own project. Acting
as your own builder saves borrowers an average of 15% off the appraised value. The savings can increase if you are willing to roll up your sleeves and do the actual labor.

Many lending institutions specialize in working with owner builders and offer the following benefits:
* No application fee.
* Construction to Permanent financing reduces your closing costs compared to a two close program.
* Based on credit qualifications, financing can be up to 90% LTV of the appraised value. Many owner builders are able to finance with no money down. Sweat equity is treated as cash.
* More end loan options make it easier to qualify. Some of the loan programs offered by lending institutions are called "Conventional", "Jumbo", "Risk Level" to name a few. Financing is available to owner builders with lower credit scores.
* Low construction interest rate.
* Monthly construction interest payments can be financed in to your end loan. This allows you to stay in your current housing situation until your home is completed.
* 100% lot financing.
* Personalized lending. Ask to work with a team that will fully communicate with you every step of the way. Talking to the same party that is familiar with your building process and needs will make this transaction much easier.

GENERAL CONTRACTOR LOANS MADE EASY

Ask your lending institution if they offer a "one close" loan program. They will work with you and your General Contractor to provide you with a turn key ready home. The following benefits apply to this program:
* In some cases, no application fee.
* Construction to Permanent financing, ("one close" loan) reducing your closing costs compared to a "two close" program.
* Financing of up to 95% of the actual costs.
* More end loans making it easier to qualify. Conventional, Jumbo, Risk Level and other loan programs are available. Financing is available to borrowers with lower credit scores.
* Low construction interest rate.
* Monthly construction interest payments can be financed in to your end loan. This allows you to stay in your current housing situation until your home is completed.
* Personalized lending. Ask to work with a team that will fully communicate with you every step of the way. Talking to the same party that is familiar with your building process and needs will make this transaction much easier.
Financing Your Timber Frame Home in 3 Easy Steps

By Robin C. Urban

Congratulations on taking the first step toward realizing your dream of building a new timber frame home – educating yourself on the financing available. When building a new home, the best program available today is the construction-perm mortgage. When you are approved for a construction-perm mortgage you are approved for both the construction loan financing, plus the end loan mortgage. Benefits of a construction-perm mortgage include single settlement, low construction interest rate, the possibility of using equity in land as down payment, extended rate locks, wide variety of end loan mortgages available, and much more.

STEP 1: WHAT DO I DO?
Determing what financing best fits your needs early in the process will help guide you through the design and pricing process.

Since not everyone has the same financial needs, your first step should be a call to your lender to determine the maximum mortgage amount you qualify for and the mortgage program that is best for you. A pre-qualification can be done in a matter of minutes over the telephone. At this time the lender will determine with you if you should make a full application or apply for pre-approval. Both the application and pre-approval are done over the telephone.

A pre-approval gives you a commitment letter that is good for 120 days, allowing you time to finalize your design and pricing. The commitment letter will give you the confidence of knowing exactly how much house you can afford and the opportunity to take advantage of an interest rate you are comfortable with. When you finalize your design and pricing, your financing is ready.

The documentation we will need from you for application include:

- Application fee and lock deposit (if applicable)
- 1 month of current paystubs
- 2 years most recent W-2’s
- 3 months of bank statements
- 12 month’s mortgage history
- Sales agreement or deed for land
- Complete set of plans, specs and a fully executed builders contract
- Record of any deposit paid to builder/contractor

STEP 2: WHAT LENDER DOES!

Once your application has been taken over the telephone, the application is sent to you for your signatures and to obtain the required documents listed previously. Once your loan officer has received the application package back from you, it is sent for the
processing of documents and for underwriting approval. After all documents are reviewed and all guidelines are met, the underwriter issues an approval.

Upon approval of your loan, an appraisal will be ordered. The appraised value of your home will be based on the value of your land, plus the construction costs.

A customized construction disbursement schedule is developed. Your builder will help to determine at what phase the construction will be complete. During construction of your home, inspections are ordered after receiving written or verbal requests from you or your builder/contractor. A variety of payment options are available depending on your situation.

Locking your interest rate can be confusing. Talking with your lender through this process will help you. Some points to remember:

- The construction loan interest rate is automatically locked at application
- The permanent mortgage rate can either be locked at application or you may elect to float your rate.
- If you locked your permanent rate at application, your lock is good for 30 – 270 days depending on the option you choose. You will need to know when your home is expected to be completed to select the best rate lock option.
- If you wish to float your permanent rate, it will float until you call to lock or it will automatically be locked 5 days prior to modification.

STEP 3: HOW IT ENDS!

After the appraisal is received and all documentation for the construction and permanent mortgage are complete, a settlement will be scheduled near you for your signatures. Some closing costs are paid at this time, any liens against the land are paid off, and the construction phase of your home starts.

You are required to make interest-only payments to your mortgager on the funds that have been disbursed to the Builder/Contractor during construction. Once a final home inspection is completed and a certificate of occupancy is issued, your construction loan is ready to modify into your permanent mortgage.

A modification package is sent to you for signatures on final documents and to pay the balance of your closing costs. After modification, your interest-only payments will no longer be required; instead you will start making your regular monthly mortgage payments.

Now it is time to enjoy your new home. Thank you for taking the time to learn how easy financing your new Timber Frame home can be.

NOTE: The above was prepared by Robin C. Urban, or M & T Mortgage Corporation.
Options for Financing your Timber Frame Home

by: Andy Schell

The best possible financing for a home is, of course, a Conventional Mortgage*, in other words, a mortgage with a loan balance of less than $333,700. A *conventional mortgage offers the lowest interest rates and the broadest range of mortgage programs and products.

In the case of a timber frame purchase with a turnkey contract, application may be made with certain banks for Construction Permanent Financing with a One-Time Closing.* This is not an option offered by all banks, but with some research it can be found. To prepare for this application, you should have all parties lined up, with estimates from each: in other words, your timber frame company, contractor, and any others, such as a foundation builder, if separate from the contractor.

In the case of an owner/builder, obtaining a conventional mortgage is possible but will require more effort. I have three suggestions that may help you in this case.

1) Obtain an equity loan on one or more of your current properties. This will provide cash for building. Although the terms are less favorable than those for a conventional mortgage, upon completion of building, a conventional mortgage can be obtained and the temporary financing paid off.

2) Short-Term Construction-Only Financing can be obtained with a local bank, in which case a conventional mortgage is required upon completion. This short-term loan provides the necessary funds for building; then the conventional mortgage replaces the original loan and provides more favorable long-term financing.

3) Explore consumer loan options -- a conventional mortgage would be desired upon completion. The conventional mortgage can be applied for ahead of time and await completion of building.

Andy Schell is a Mortgage Loan Officer for Southtrust Mortgage Corporation.

Disclaimer Note: The above articles, provided by lenders, are to be used as information only. Every customer brings different criteria to the loan process. Goshen Timber Frames does not endorse or recommend any specific lender, customers will use their own judgment and resources in making financing arrangements.