

INSPIRATION REPORT

ARROW
TIMBER FRAMING

A Timber Framing Magazine

Fall 2022

STRUCTURAL LESSONS FROM 500-YEAR-OLD GERMAN TIMBER FRAMING

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STRUCTURAL LESSONS FROM 500-YEAR-OLD GERMAN TIMBER FRAMING

Why do I only notice the windshield of my vehicle if it has a big ugly chip or is cracked? Or why do the few airplane crashes that happen end up on the news? The reason I pose these questions, which reveal how we as people learn and process information, is because SOME of the info I'm going to share with you will be 500-YEAR-OLD FAILS. But I want to focus on the learning lessons and in no way disrespect the early builders who did the best they could with the info and tools they had. Overall, I was incredibly impressed with what I witnessed on my short tour of old timber framing in Germany.



*Figure 1
Dovetail nail-less ladder construction*

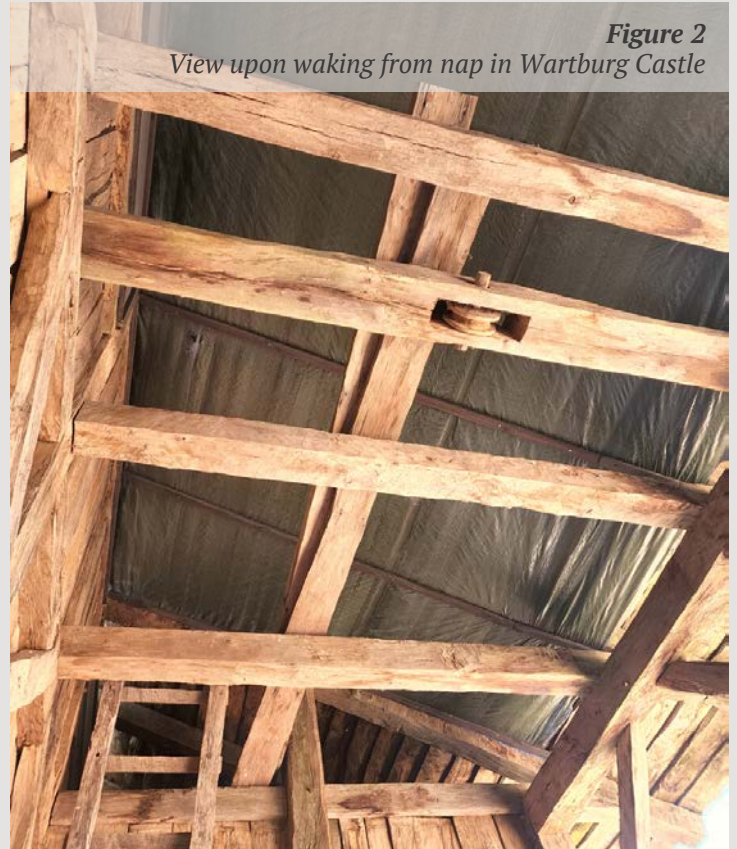
WHAT DID I MISS?

While I was able to see and learn a lot, I'm afraid I missed way more than I was able to take in. For example, the no-nail ladder construction pictured here (Fig 1) would have gone unnoticed if I had not

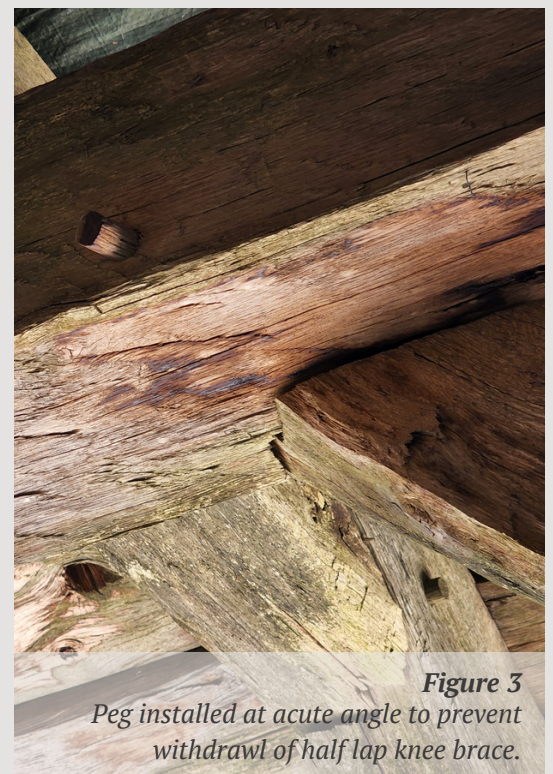
snuck in a 20-minute nap while touring the Wartburg castle where Martin Luther translated the New Testament disguised under the pseudo name of Junker Jorg. (Just an FYI, travel and tourism put a substantial cognitive load on one's mind! In order to take in more, I had to charge the batteries with a power nap.) The ladder was located in a low shed a little ways off the beaten path. And there happened to be a pile of old oak boards stacked up to the perfect bed height... hmm...

pause... a furtive glance around, backpack under my head, and lights out! People generally do not notice inert mass tucked away in a corner- I slept undisturbed. Upon awakening, (Fig 2) I saw a unique ceiling beam modified to accept a wooden pulley. To this day, I'm not sure what it was used for. It definitely wasn't an engine hoist! Then I thought, slaughtering hoist, but the shed was next to the blacksmith building; the question is still unanswered in my head!

I also noticed that pegs were installed through the half-lap knee braces at an angle to prevent the withdrawal of the knee brace. Next, I noticed the angle cut on the bottom of each ladder rung. This partial dovetail joint made it impossible for the rungs to work loose.



*Figure 2
View upon waking from nap in Wartburg Castle*



*Figure 3
Peg installed at acute angle to prevent withdrawal of half lap knee brace.*

CANTILEVER LOVE AFFAIR

The last construction detail I noticed on this shed which was also duplicated on the blacksmith shed, was the cantilevered ceiling joists supporting the rafters. Why would the early builders choose to build that way? Generally rafters rest on the wall plate beam. Upon reflection, three possible reasons came to mind: 1) To get bigger overhangs. 2) To spread out the joinery. If too many joints occur at the same place, wood removal can become excessive. 3) To increase the load-bearing capacity of the ceiling joists. The roof load on the cantilevered joist shortens the actual interior span of the ceiling joists. I've noticed a lot of the "Pit Peter against Paul," to neutralize or minimize structural loading in old timber framing- the epitome of a win-win solution, right?



Figure 5
3 1/2 story apartment flank both sides of bridge
above river with heavy timber supports.



Figure 4
Labor intensive old time influence

STRAIGHT TALK TIME!

"Pitting Peter against Paul" reminds me of one of the drawbacks with traditional timber framing- as opposed to modern Post and Beam construction, which utilizes metal connectors.

Maybe I should keep this a "secret," but I prefer to be straight forward... just like timber framing itself! The drawback I'm speaking of is the inefficient use of wood because the joinery is forced to "Rob Peter to Pay Paul." The removal of wood required to craft traditional joinery, such as the mortise and tenon, reduces structural capacity. Both timber pieces sacrifice wood in a dance to optimize structural strength... Do you find this drawback disappointing? Perhaps the following factoid will cheer you up.

Nine times out of ten, timber frame beams are sized by artistic eye. To look right, bigger sizes are required which means the inefficiency drawback is often a moot point. There are times when a longer span dictates the timber size. And when timbers are too small to use traditional timber frame joinery, we usually opt to use hidden metal connectors to address tension loading. So in practice, we don't really see a lot of inefficient use of timber. Knowing the whole picture makes me feel good!

But I firmly believe it is impossible to achieve a win-win using traditional joinery for ladders. There is a reason we don't see traditionally hand crafted ladders in use today. A handy rule of thumb says it's silly if your ladder weighs more than a beam you have to lift!



Figure 6
One post is tasked with supporting a cantilevered beam system for a large apartment building.

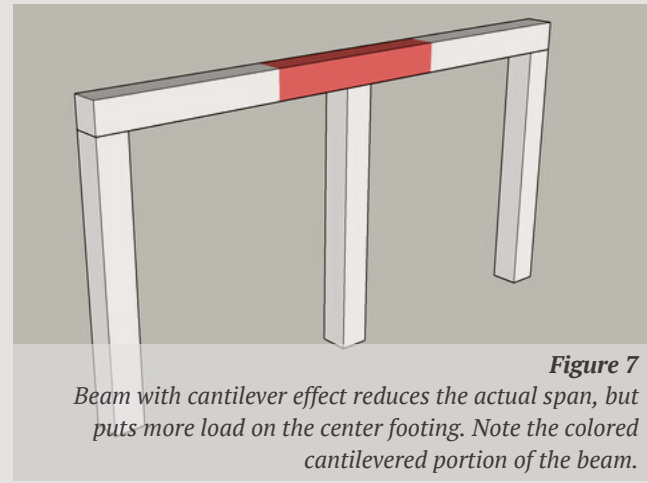


Figure 7
Beam with cantilever effect reduces the actual span, but puts more load on the center footing. Note the colored cantilevered portion of the beam.

BIGGER CANTILEVERS

I just mentioned early builders love affair with cantilevers. It is a handy pragmatic principle to use in building. But it can be a little risky! Consider the picture in fig 4. With a single post supporting beams which get progressively longer to support the cantilevered floor of an old 3½ story apartment building, the load leverage was too great. The use of the cantilever backfired for these early builders! But I have true empathy- This modern day builder (me) has been bitten in the rear with glue-lams used in a cantilever situation.

The building pictured is over a river in Erfurt Germany. The stone arched tunnels support a narrow roadway flanked by the two tall apartment buildings. Both sides of the tunnels have been built out to support the a portion of the apartment buildings above. Was this a planning oversight? (Fig 6) As in, "Say, boss, don'cha think these apartments should be a bit wider?" Maybe that was the case. But I'm guessing this was intentional value engineering, as the stone arches consume a lot of labor and material. With this buildout, even the big beams in the simple span here sag with the multiple story load during the passage of time. I've come to understand that the wood molecules actually creep and change orientation when under a big load. Some of these big beams have sagged even though the spans have been broken into thirds with heavy angle posts. Why? I'm guessing that the thrust generated by the angular post can cause settling or

movement at the bottom and top of the angle posts. This translates to magnified vertical movement at the top, allowing the main beam to sag.

Another important detail regarding the cantilever effect is the extra loading on the concrete footings. As a young carpenter I mistakenly ordered long beams to span multiple posts believing I was making things stronger. But, then loading deviated from the engineers intended loading because of the cantilevered effect. (Fig 7)!

BOWLING A STRUCTURAL 300

In the 1500's, consistently using a favorite ball would be advantageous because of the oblong shapes of the obviously imperfect stone bowling balls! They also appear to only have thumb holes! (Fig 9) But for bowling a structural 300, I want to shine our awareness on the gazebo roof construction at the head of the bowling lane. (Fig 8) Is this roof is supported by a beam and a post? Or is it a tension ring? Or are the bottom beams in tension like a

truss? Here are my thoughts. We can pretty easily eliminate the possibility of tension ring. If it were a tension ring, there would be no need for the ceiling beams at all. Looking at the other two options, the ceiling timbers seem too small to function as simple beam spans and way bigger than needed if functioning in tension, like a truss bottom chord. But upon closer inspection I believe the bigger beam girth was required to accommodate mortise and tenon joinery where the other ceiling beams joined the continuous/unbroken beam in the center. I also suspect suspect the tenons were not robust enough to handle the tension loads over time. I'm judging by the two big iron "staples" added to prevent the "broken" adjoining beams from spreading apart.

This picture also showcases a unique lateral bracing method. The lower beams abutting the posts function as small knee braces. Not unlike plywood nailed to a wall. Even though the plywood is square, tension and compression traverse from corner to corner just like a knee brace. Speaking of knee braces why do you suppose the big knee braces were added to the panel on the left?



Figure 8
Is this bowling gazebo roof a tension ring, post and beam, or truss structure?

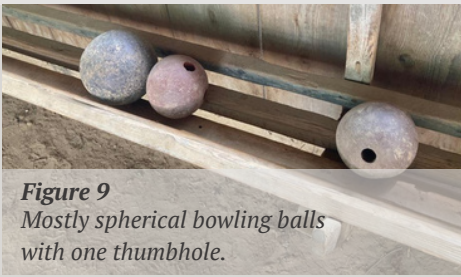


Figure 9
Mostly spherical bowling balls with one thumbhole.



Figure 10
The truss that almost was! A central post was needed to make the span.

TRUSS EXAMPLES

Now let's talk about a couple of truss examples. The first example has all the hallmarks of a truss, but a central post is used to support the bottom chord/beam. (Fig 10) Why? Because it is too big of span for the floor of the attic area above. But you can see the bracing and heavy timbers above, which support the entire roof span without any central post. In one place, you can see how the lower center post was removed, and a tension post was added in the attic area- making it an actual clear-span truss.

The next truss example is similar in how it showcases human ingenuity to use tension to increase load capacity. (Fig 11) This building was basically a post and beam stacked roof. But in later years, some of the ceiling beams were removed to create space for an early construction exhibit over a stairwell down to an archeological dig display. No extra timber members were required to make these retrofit trusses- only the three pieces of metal tie rods to create a big scissor truss! I have to say creative building solutions really turn my crank.

RISKY STAIRWAYS?

When I see what early builders have done, I find it even more impressive. And speaking of creative building, check out the photo of this old stairway! Instead of using what today are called stair stringers, triangular chunks of beam form both tread and riser, supported by two stair beams. I noticed this was one place old square nails were frequently used to attach the triangular steps to the stair beams. (Fig 12) Overall a great solution! In general, stairways in Europe are closer to the narrow, steeper stairway construction shown here. I've seen winding staircases using various construction methods for both commercial and residential buildings. I have always appreciated the beauty, math, and efficiency of winding staircases. Here in America, building codes have us safely encased in "bubble wrap." So the elegant staircase solutions one might see in Europe are illegal here. Harumph!

Now don't mistake my pictorial use of the "bubble-wrap-safety" concept as scorn. It is just that it touches a sensitive libertarian

nerve within me. Rules and regulations have a purpose- at least during conception. But looking back at the freedom builders of old had, I wonder how far we should go in our quest to eradicate risk. But now I'm getting a little off track. By and large, we have it good! Perhaps your final takeaway might sound something like this:

Learning opportunities, structural lessons and creative building solutions surround us. It is entertaining and inspirational to learn from builders from long ago!

Hopefully, you can apply some of the thinking and practical mindset bygone builders have shared with us to your timber frame journey! As always, stay loose. Define what you want. And enjoy the process.

On behalf of the ATF Team,

Bow

Bert Sarkkinen



Figure 11
Old and new collide! Cables were added to existing rafters to create trusses.

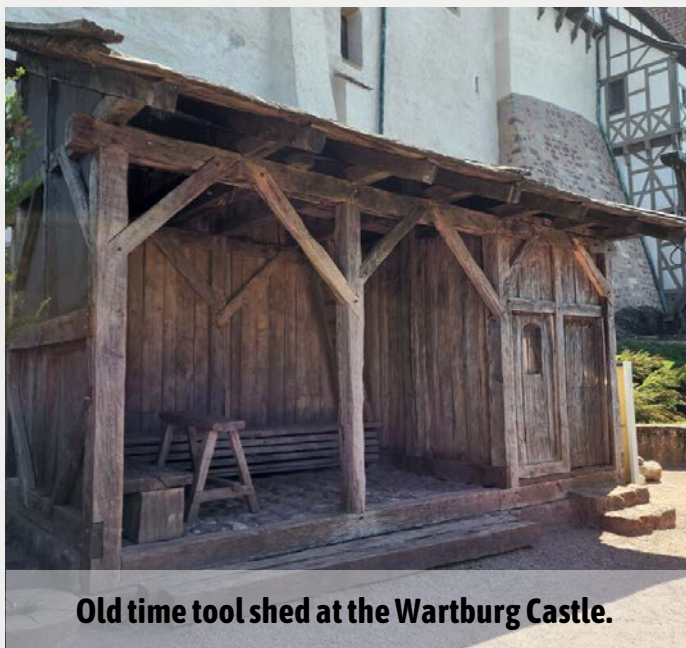


Figure 12
Large, triangular slabs of timber were used to create this old, steep stairway.

German Timber Frame Field Trip



Old Fachwerk(half-timbered) city apartments in Erfurt with exposed lateral bracing.



Old time tool shed at the Wartburg Castle.



**How do these timbers
age so well?**





Well worn spiral staircase with unique support structure.



Was time money in the old days? Ornate roofs and time consuming attic living abound!



Reminiscent of an old time festival with spectators above.



Extra old fachwerk protected by large overhangs.



Check in massive beam makes scarf joint look ornamental.



Interesting cantilever and pop out support.



Bavarian style timber framing makes enjoyable pit stop for mountain hikers.

getting to know



DONNA WIRKKALA

Getting to know Donna is getting to know the quintessential Finn - reserved, quiet, loyal, smart, competent, and industrious. Having lived in Finland, I understand and appreciate these traits which Donna exhibits. As an employer, I obviously love it! But just like everything in life, there is no free lunch. When I eventually goof up enough to get on her bad side, I'll have to work like a dog to straighten things out! That is just how it is with Finns, but it is an easy trade-off to accept! Now just maaaaybe, with the passage of time, I've accumulated enough hard-won wisdom to avoid goofing up, but I wouldn't advise placing any heavy bets on it! Should you happen by our operations in Kalama, you will likely meet Donna. As our bookkeeper and receptionist, her desk is positioned by the front door. She won't talk your ear off or entertain you by clowning around but will efficiently help you get whatever you came for. Just. Like. Always. Thanks, Donna! We all appreciate your steady, reliable service.

What would you like people to know about your past?

ELEVEN SIBLINGS, AND WE ALL GET ALONG! ALSO, I WON THE JUMP ROPE CONTEST IN 5TH GRADE WITH 1037 JUMPS.

Where is a place you would like to visit?

I HOPE TO VISIT GUATEMALA SOON TO SEE MY SISTER AND HER FAMILY WHO LIVE THERE.

How do you like to spend your free time?

WITH MY FAMILY, READING A GOOD BOOK OR SITTING NEXT TO WATER IN THE SUN.

What would have to happen in the next 3 years to make you feel like you are moving forward?

GETTING MY YOUNGEST THROUGH MIDDLE SCHOOL, I FEEL THEY ARE SOME OF THE MOST CHALLENGING YEARS! BUT, ONCE WE ARE THROUGH THAT, IT WILL FEEL LIKE WE ARE MOVING FORWARD.

Memory Lane

As a young framer working on a volunteer project, my uncle accused me of being a suit-and-tie framer. My uncle and his employees had heavy rubber muck boots, while I had opted for wearing some sort of grippy tennis shoes. The reason I mention this good-spirited chest thumping is that this German timber frame tour basically accused me of being a big fat wuss too! Consider a kitchen of old. They are small and dark. Black smoke stains are everywhere, even darkening the small glass window panes. Heavy tools are not only in the kitchen but on the farms and artisan shops. You users! Heavy objects and the traces of long hard labor stare at one from every corner! Today, we experience a genuine hardship when the power goes out. Or perish the thought, we lose our precious cell phone!



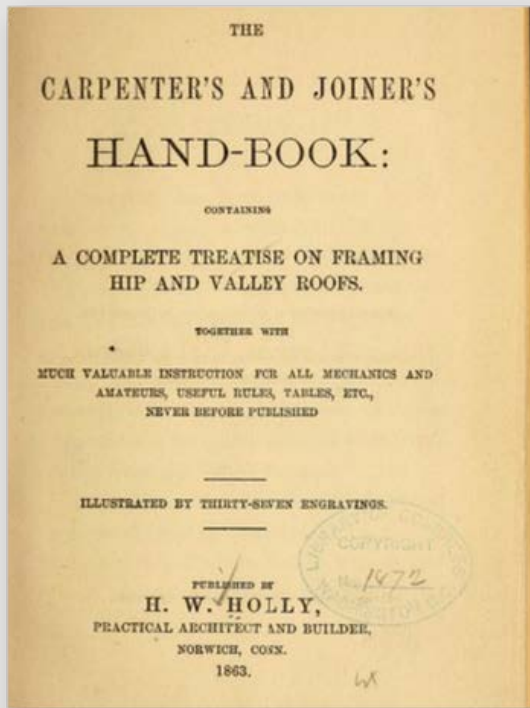
Callous city - here we come!

Happiness is...

As I write this, Martin Luther is on my mind. Kristine and I visited Wittenburg the day before and toured his home, church, and the church door where the 95 theses were nailed. From time to time, God uses remarkable people to further his cause. An old saying I picked up years ago from Luther is something to the effect of: "There are three things to know about preaching. When to speak. What to say. And when to stop." I believe this applies to practically any endeavor we attempt in life. However, the last item strikes me as the most important because it is the most overlooked.

Tell me, have you ever had the moral high ground in a relationship dispute and botched the chance to move in a positive direction because you overplayed your hand? Me too. Knowing when to stop is trickier than it sounds. I caution clients to avoid the overly tricked-out teenage truck syndrome with timber design. When I was a young framing apprentice with my brother, our father made sure we quit while we still wanted to work. Left to our own devices, we would have continued to put in long days until it wasn't enjoyable anymore. Too much of a hobby backfires in the same way - just as a new favorite snack or new favorite restaurant. It may be easier to ask- "What kind of pursuits don't require restraints to stay on track?". Pause... I couldn't come up with anything, either. Recognizing when to pump the brakes is no small thing!

...Knowing
When to
Stop



THE CARPENTER'S AND JOINER'S HAND-BOOK

B⁺

By Henry Wells Holly

If I were recommending this book, printed in 1863, solely on the immediate practicality of the content, it would not make the cut. Nowadays, there are simply too many easier, quicker methods to accomplish the carpentry calculation and layout needs contained in this book. So why the recommendation? Aaah, well, ahem! I'm glad you asked! For starters, it is keeping with the old theme of this I-report. Reading, learning, and applying knowledge from this poorly printed guide is a challenge, just like the builders of old-faced! Accepting this challenge will expand your creative thinking. Secondly, the old methods, tips, and tricks do not require a calculator, and many are downright brilliant in their simplicity. Someday you may find yourself in a situation without your handy-dandy construction master calculator- one of these tricks just might save your bacon! Bottom line: If you have a working knowledge of applied math and enjoy a challenge, this book is for you.

Learn & Do



PIMSLEUR LANGUAGE COURSES

A⁺

By Pimsleur Team

I've had languages and culture as a hobby for quite a few years. I think it has an abysmal practical return on investment, yet I still enjoy it. I don't know why. *Immersion is the very best* way to learn a language, but is not practical for most people. But, I highly recommend Pimsleur's methodology for those who still think it would be cool to speak a foreign language.

I like how it skips the rote memorization of numbers, ABC's and mind-numbing, awkward grammar rules. Also, I like how it is audio focused. You can use it with your phone app while driving, going to sleep, or whenever it is handy - learning primarily with audio mimics how children and babies learn, preventing heavy accents from letter pronunciation carry-over. For example, a "P" in Finnish is pronounced closer to the English "B" sound. It is an excellent program, BUT you will need more than just this program to enjoy speaking another language. For what it is worth, I've documented my top 5 easy-peasy-lemon-squeezy rules for learning a language here.

THE ARROW TIMBER PHILOSOPHY

People want things which reflect their personality.

People want an enjoyable process with a mutual exchange.

People want teamwork, transparency, and creative solutions.

I experience this over and over in the course of a year, not only when clients view albums or 3-D models in my office, but especially so immediately after the completion of their timber structure. **Appreciative head nods and slow smiles have almost become a trademark!** I fell in love with the timber framing craft in 2002 and I still feel just as privileged and enthused. Many, many, personalized structures have been created since then. In fact, my **passion, artistry, and repertoire of creative solutions** have all grown dramatically... I sometimes wonder if it is simply something to do with rising to challenges and building upon success. You probably agree that exposed beams provide geometric beauty and resonate deep within our psyche... The style brings to mind **durability, longevity, safety, laughter, smiles, and home to many warm feelings.**



THE QUESTION

What is the best way for you to acquire your personalized timber living?

Not too much, not too little. Not too high, not too low. Just the right mix of timber presence and style... How to find that sweet spot which you can enjoy for years and pass on to your heirs. It's really about enriching the lives of those around you and sharing your unique personality and viewpoints with them. **How do you intend to achieve this? How will you determine a good fit with service providers?**

Seek out and choose, therefore, things that will evoke head nods and slow smiles. Things which resonate with your personality. Things that do not grow old or boring with the passage of time. You will not regret it.

To your goals, momentum, and happiness

Bert Sarkkinen, Owner



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Timber Frame Seminar

IDEAS TO EXPAND YOUR OUTDOOR LIVING

Who among us couldn't use more space to move, relax and get more fresh air outdoors? Since this inspiration report is about old timber framing, let's pretend you are the story character Bilbo and I am Gandalf. With this seminar, I am knocking on your door, compelling you to embark on a fun rewarding adventure. Except you won't have to leave home to face hardships like Bilbo. (Or like the people living 500 years ago!) **Done right, your biggest hardship will be choosing the most comfortable outdoor furniture to complete your three seasons outdoor expanded living room!**

SAVE THE DATE

January 12, 2023 at 6:00 PM

Live attendees limited to 30. Online attendees will be unable to participate in the shop tour, coffee, and snacks. But, they can start their own adventure from their actual home, just like Bilbo! We hope to see you there- welcome!

**Call 1-833-212-0202 or go to
arrowtimber.com/seminar to
reserve your complimentary spot!**