Timber Frame Practices Manual

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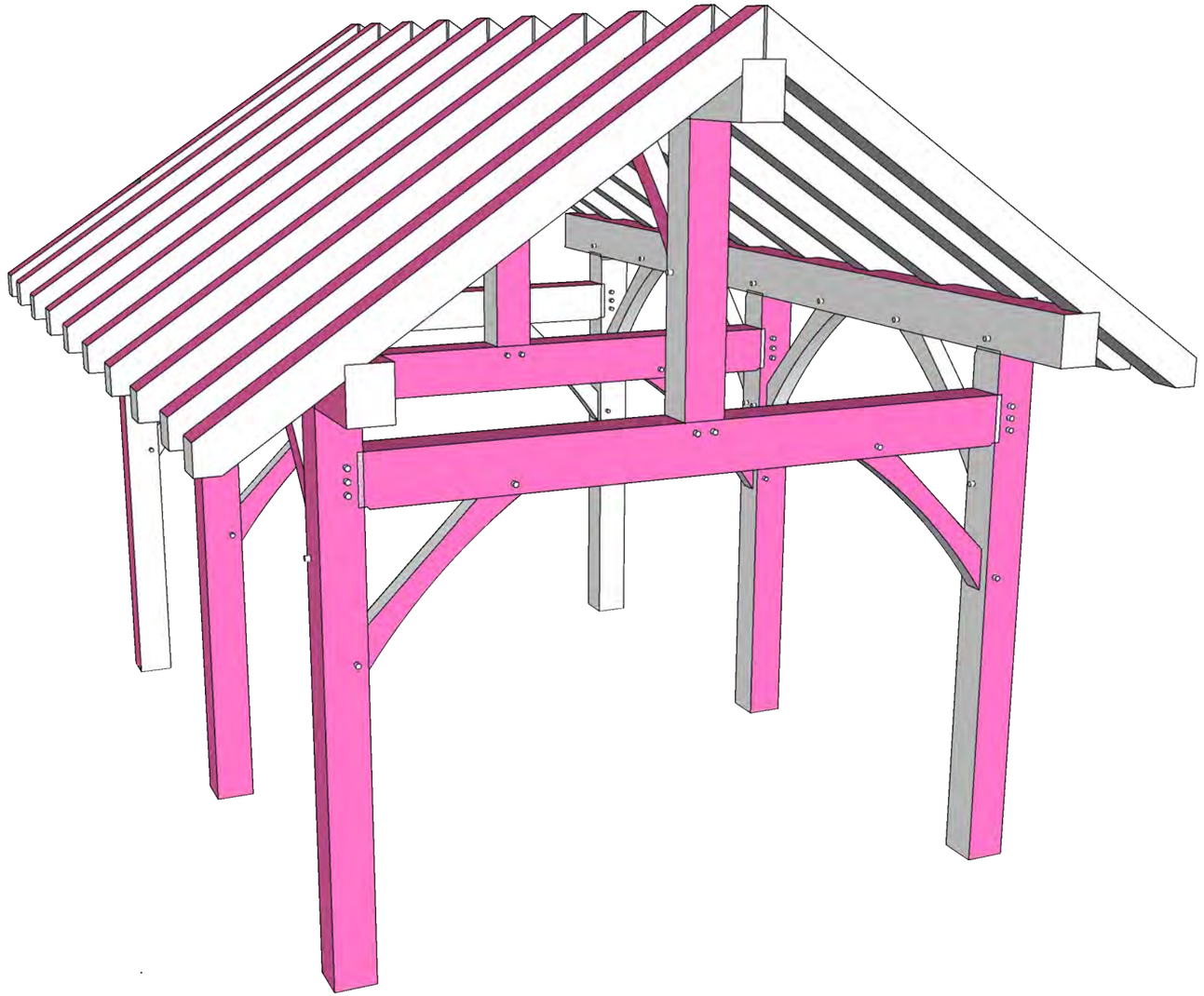
Learn timber framing with this easy-to-follow beginner's guide.



STAR HILL TIMBERWORKS

New Framer's Road Map

Revision 1 (4.8.25)

Liability Statement

The information contained in this manual is intended for educational and informational purposes only. While every effort has been made to ensure accuracy and safety, timber framing is an inherently physical and potentially hazardous activity that involves the use of sharp tools, heavy materials, and specialized techniques.

Users of this manual are solely responsible for their own safety and for exercising sound judgment when applying the information contained herein. Star Hill Timberworks, its instructors, authors, and affiliates assume no responsibility or liability for any injuries, damages, losses, or claims arising from the use or misuse of the methods, tools, or materials described in this manual.

It is strongly recommended that readers seek hands-on training from experienced professionals and follow all applicable safety codes, building regulations, and best practices. Always wear appropriate safety gear, use tools as intended, and work within your skill level.

By using this manual, you acknowledge and accept full responsibility for your own safety and the outcomes of any timber framing projects you undertake.

Revision 1 (4.8.25)

Introduction

Welcome to the Star Hill Timberworks Timber Framing Practices Manual—a comprehensive, beginner-friendly guide designed to help you confidently step into the world of timber framing.

This manual was created with the first-time framer in mind. Whether you're a student who recently completed one of our in-person classes, or someone learning from home, this resource offers clear, step-by-step instructions, helpful visuals, and even animations to walk you through each part of the process.

We know that getting started with timber framing can feel overwhelming—there's a lot to learn, and sometimes the hardest part is knowing where to begin. That's why we've made this manual approachable and practical. It's meant to be your go-to reference at the workbench, in the shop, or on-site—something you can return to again and again as you build your skills.

For our students, it serves as a take-home guide to reinforce what you learned in class. And for those who can't make it to an in-person course due to time, distance, or budget, this manual is a stand-alone introduction to essential tools, techniques, and best practices used in traditional timber framing.

We hope this manual empowers you to pick up your tools with confidence and take the first steps toward crafting strong, beautiful, and lasting timber structures.

Let's get started.

A Few Notes Before You Begin

This manual is formatted for printing on 11 x 17 paper for easy reading and layout reference. However, you can shrink to fit and print it on standard 8½ x 11 paper if needed.

The processes and techniques described here are based on our own experience at Star Hill Timberworks. Timber framing is a versatile craft, and there are many valid approaches—feel free to explore and experiment with what works best for you.

The roadmap included in this manual offers a clear, step-by-step method we believe is an excellent way to begin your timber framing journey.

Throughout the manual, layout operations are demonstrated using our exclusive Star Hill Layout System, which includes the Framer's Friend, Mortise and Tenon Master, and EZ Brace. That said, you can achieve the same results using other tools like a framing square, combination square, speed square, or your preferred timber framing layout tools.

Animations can be accessed via links in the left margin. Additional helpful links are found throughout the body of the manual. All links are indicated by a solid black box with white lettering for easy identification.

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Take the Guesswork Out of Layout with the Star Hill Timberworks Exclusive Layout System

Timber framing demands precision—and the right tools can make all the difference.

The **Star Hill Timberworks Exclusive Layout System** is designed to simplify and streamline the layout process, helping you work faster and more accurately, whether you're just starting out or refining your craft.

This powerful set includes:

Framer's Friend – Your go-to tool for laying out consistent shoulder lines, tenon cheeks, and reference marks. Engineered for accuracy and efficiency, it keeps your layout clean and repeatable from timber to timber.

Mortise and Tenon Master – Make complex joinery approachable. This tool helps you quickly mark mortise locations and tenon dimensions with precision, taking the stress out of critical joinery layout and keeping your work tight and aligned.

EZ Brace – Laying out braces just got easier. The EZ Brace ensures your layout is square, symmetrical, and repeatable—no more fiddling with angles or worrying about inconsistent brace lengths.

Hand-Forged Marking Knife (Double Bevel) – Crafted for clean, accurate lines, this double-bevel knife is perfect for both left- and right-handed users. Its fine edge bites into wood fibers with ease, giving you crisp layout lines that won't get lost in the sawdust. Includes a custom belt sheath for safe, convenient carry on the job site.

Each tool is handcrafted with care and tested in our classes and workshops to ensure reliability in real-world timber framing projects.

Whether you're building a frame in your backyard or on a job site, the Star Hill Layout System gives you the confidence to cut clean, accurate joinery every time.

Trusted by students. Loved by pros. Made for real work.

Available now with **free U.S. shipping**.

Hand-Forged Marking Knife with Holstex Sheath

Star Hill Timberworks Layout System

General Notes

Square Rule Format: These plans use Square Rule layout, a method that compensates for timber irregularities. Tenon and mortise sizes are standardized, ensuring uniformity. All measurements are referenced from one specific face (highlighted in pink) and are provided once per shop drawing. Dimensions for similar components are inferred from the initial measurements, keeping drawings streamlined and easy to read.

X-Ray View Drawings: Shop drawings are presented in an "X-ray" style, showing internal joinery details for clarity.

Mortise and Tenon Specifications: For 8" and 10" timbers: Mortises and tenons are 2" thick and positioned 2" from the reference face. For 6" timbers: Mortises and tenons are 1 1/2" thick and positioned 1 1/2" from the reference face.

Rafter Attachment: Rafters are fastened to the plates with timber screws, and rafter clips can be added if desired.

Knee Brace Pockets: Shown at a 45-degree angle. Mortises are drilled to the full depth, so there's no need to angle the pockets themselves.

Mortise Drilling Depth: Mortises should be drilled and finished before cutting the housings. Drill depth is calculated as the depth of the mortise plus the housing depth plus 3/8". Depth adjustments may be needed depending on drilling technique, so check the first mortise and adjust as required.

Pegging: For 6" timbers use 3/4" hardwood pegs. For 8" and 10" timbers use 1" hardwood pegs. Peg holes are pre-marked and drilled in the mortised timbers, while tenon hole locations are determined during a test fit. For draw boring, mark the tenon hole in the test fit, disassemble, and adjust the mark slightly closer to the shoulder before drilling. This offset ensures that the draw bore peg pulls the joint tight when assembled.

Footings: Footings should extend below the frost line. Post brackets can be set in concrete or secured to footings with cement anchors.

End Grain Sealing: Apply Anchor Seal or similar to all cut joints' end grain to slow drying and reduce checking. For logs or timbers stored before use, seal the ends to prevent premature drying.

Road Map

- ① ☐ Read Will Beemer's "Learn to Timber Frame"
- ② ☐ Read Steve Chappell's "A Timber Framer's Workshop
- ③ ☐ Review Star Hill Timberworks Timber Frame Practices Manual
- ④ ☐ Review Star Hill Timberworks animations and videos
- ⑤ ☐ Acquire base timber framing tools*
- ⑥ ☐ Take a timber framing class, see StarHillTimberworks.com for offerings
- ⑦ ☐ Build a set of ponies
- ⑧ ☐ Cut a set of sawhorses
- ⑨ ☐ Cut a mail box or Wedding Arch
- ⑩ ☐ Cut a small structure: i.e. Outhouse
- ⑪ ☐ Cut a wedged 1/2 dovetail joint
- ⑫ ☐ Cut a scarf joint
- ⑬ ☐ Acquire a plan for your project frame **
- ⑭ ☐ Order timbers for your project **
- ⑮ ☐ Order pegs for your project
- ⑯ ☐ Cut your Timber Frame

* The exclusive Star Hill Layout System (Mortise and Tenon Master, Framer's Friend and EZ Brace) may be purchased at a Star Hill Class. Occasionally, there are extra units for sale at StarHillTimberworks.com. You can also purchase sharpening jigs/stones, chisels, marking knives, sheaths, and plans.

** Star Hill Timberworks can help you with custom timber framing plans generated in square rule format. We can also source timbers in MN/WI if needed.

Cutting a mortise using a boring machine

Checking a mortise pocket with a knee brace

Lifting a plate by hand on raising day

Cutting a tenon by hand, using a Japanese Boat Saw

New Framer's Road Map

Tools

Ⓔ =Tools we consider essential

Hand Tools

Layout and Measuring Tools

- Ⓔ Framing Square
- Ⓔ 25' Measuring Tape
- Ⓔ Combination Square
- 12" or 24" Ruler
- Plumb Bob
- Chalk Line
- Compass/Divider
- Ⓔ Marking Knife
- Ⓔ Pencils and Fine-Tip Markers

Fast Cap makes a "Burn One" tape measure that eliminates the need to burn 1", 10", or 12" on a standard tape

Chisels and Accessories

- Ⓔ Timber Framing Chisels (1 1/2" and 2")
- Corner Chisel
- Slick
- Ⓔ Mallet (wooden or urethane)

Cutting Tools

- Ⓔ Rip Saw
- Ⓔ Crosscut Saw
- Ⓔ Japanese Ryoba (cross cut & rip)

Shaping Tools

- Drawknife
- Spokeshave
- Ⓔ Block Plane
- Adze (for shaping)

Drilling and Boring Tools

- Brace and Bit
- Ⓔ Auger Bits (1", 1 1/2", and 2")
- Ⓔ Wood Owl Drill Bits (1" and 1 1/2")
- Ⓔ Boring Machine
- Ⓔ Drill Guide (Rockler)

Marking and Layout Templates

- Ⓔ Star Hill Layout System (Mortise and Tenon Master, Framer's Friend, EZ Brace)

Power Tools

Saws/Mortiser

- Ⓔ Circular Saw (7 1/4")
- 10 1/4" Worm Drive Saw
- Circular Saw 16-5/16" beam saw
- Chain Mortiser (e.g., Makita or Mafell)
- Reciprocating Saw
- Band Saw

Mafel Chain Mortieser

Drills and Augers

- Ⓔ Cordless Drill (high-torque)
- Drill Press (for precise holes)
- Drill Stand

Makita Chain Mortieser

Planers and Joiners

- Handheld Power Planer
- Joiner/Thickness Planer

Sanders and Polishers

- Belt Sander
- Orbital Sander
- 4" Grinder with Sanding Discs

Routers and Specialty Cutters

- Router with Jig for Housings

Other Power Tools

- Portable Sawmill (if preparing timbers yourself)

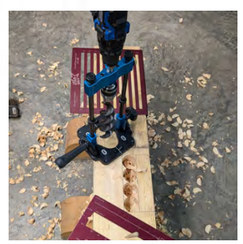
Personal Protective Equipment (PPE)

- Ⓔ Safety Glasses
- Ⓔ Ear Protection
- Ⓔ Work Gloves
- Ⓔ Steel-Toed Boots

Tool Maintenance Supplies

- Ⓔ Sharpening Stones
- Ⓔ Honing Guide
- Ⓔ Lubricant

Drill Guide
1 1/2" mortise material removal with Wood Owl bit



Boring machine for mortise material removal (1 1/2" or 2") with auger bits

Staging

- Ⓔ Ponies
- Ⓔ Testle Sawhorses
- Jawhorses - Rockwell
- Ⓔ Rachet Straps
- Timber Cart or Carpet Dolly

Tool Brand Recomendations:

Big Foot Saw 10 1/4
Skill Saw or Makita 16 5/16"
Makita Chain Mortiser
Mafel Chain Mortiser
Mafel Drill Guide
Makita 4" Sander (4 x 24)
Star Hill Layout Tools
- Star Hill Framer's Friend
- Star Hill Mortise and Tenon Master
- Star Hill EZ Brace
- Double Bevel Marking Knife

Wood Owl Ultra Smooth Bits
Rockwell Drill Guide

Chisel Brand Recomendation:

All timber framing operations can be performed with 1 1/2" chisel, as a framer expands their tool box, they will likely purchase the following:

1. 1 1/2" Chisel
2. 2" Chisel
3. Corner Chisel
4. Slick

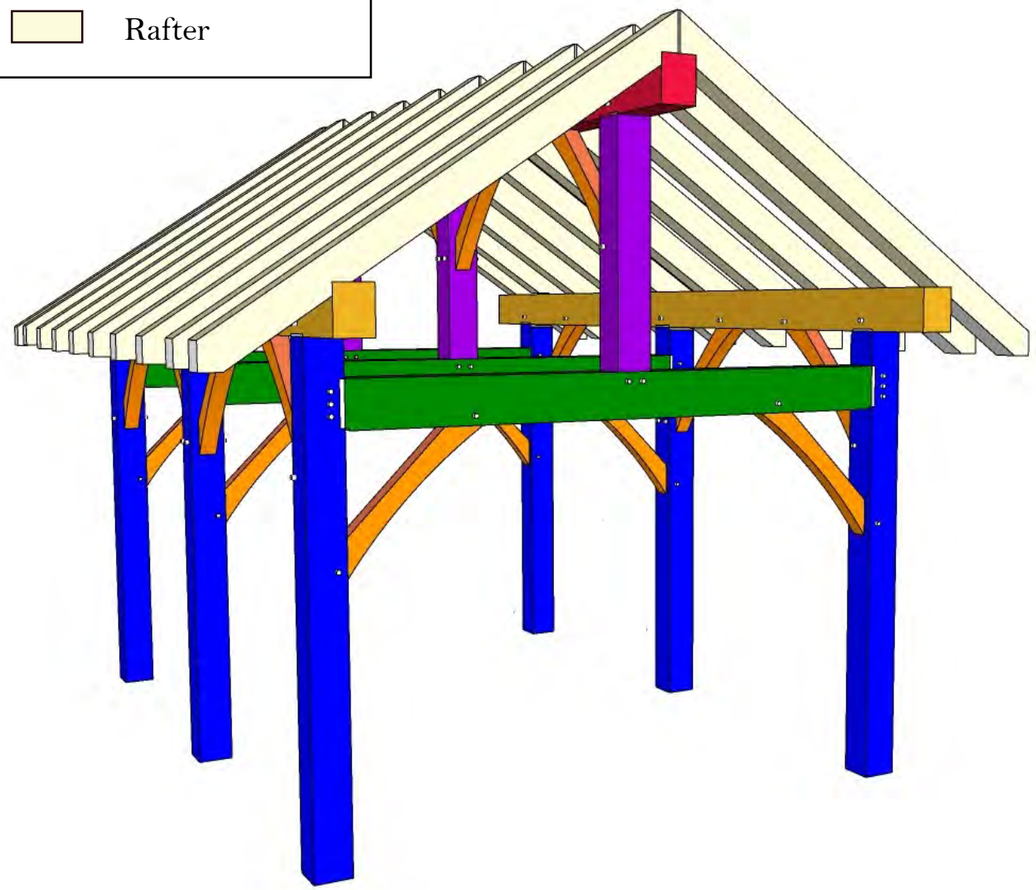
We like the following brands:

1. Star Hill
2. Barr
3. Arno
4. Sorby

https://www.starhilltimberworks.com/tools/

Anatomy

- Tie Beam
- Post
- Knee Brace
- King Post
- Plate
- Ridge
- Rafter



White Pine; 10" x 10" Posts, Plates, and Ridge; 10" x 12" Tie Beam; 6" x 10" Rafters ; 4" x 6" Knee Braces; 1 1/2" Tongue & Groove Decking

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Timber List

TIMBER	PG#	W	D	L(ft)	BF	ASSIGNED	LAYOUT	CHECKED	CUT
PLATE A	A.14	8	10	20	133	JSA	JSA	CA	JSA
PLATE B	A.15	8	10	20	133	JSA	JSA	CA	AW
RIDGE	A.16	8	10	20	133	JSA	JSA	AW	AW
TIE 1	A.17	8	10	14	93	CA	CA	JSA	
TIE 2	A.18	8	10	14	93	CA	CA		
TIE 3	A.19	8	10	14	93	CA			
POST 1A	A.20	8	8	10	53				
POST 1B	A.21	8	8	10	53				
POST 2A	A.22	8	8	10	53				
POST 2B	A.23	8	8	10	53				
POST 3A	A.24	8	8	10	53				
POST 3B	A.25	8	8	10	53				
KING 1	A.26	8	8	6	32				
KING 2	A.27	8	8	6	32				
KING 3	A.28	8	8	6	32				
RAFTER (CUT 20)	A.29	6	7	12	840				
KB30 (CUT 18)	A.30	4	6	6	216				

Cleaning up a housing

Test fitting

Mortise cutting demo

Timber Tracking and Ordering Guidelines

Use a timber list or an equivalent method to track each piece of timber in the frame, along with its current status. Timbers are typically ordered 1–2 feet longer than their final dimensions. This extra length allows for adjustments during layout, ensuring that knots or other imperfections do not interfere with the joinery.

Knee braces should be ordered slightly oversized, with an additional 1/4" to 1/2" in width and depth. This allows the braces to be planed to precise dimensions just before cutting the frame, reducing the risk of gaps in the knee brace pockets caused by timber shrinkage.

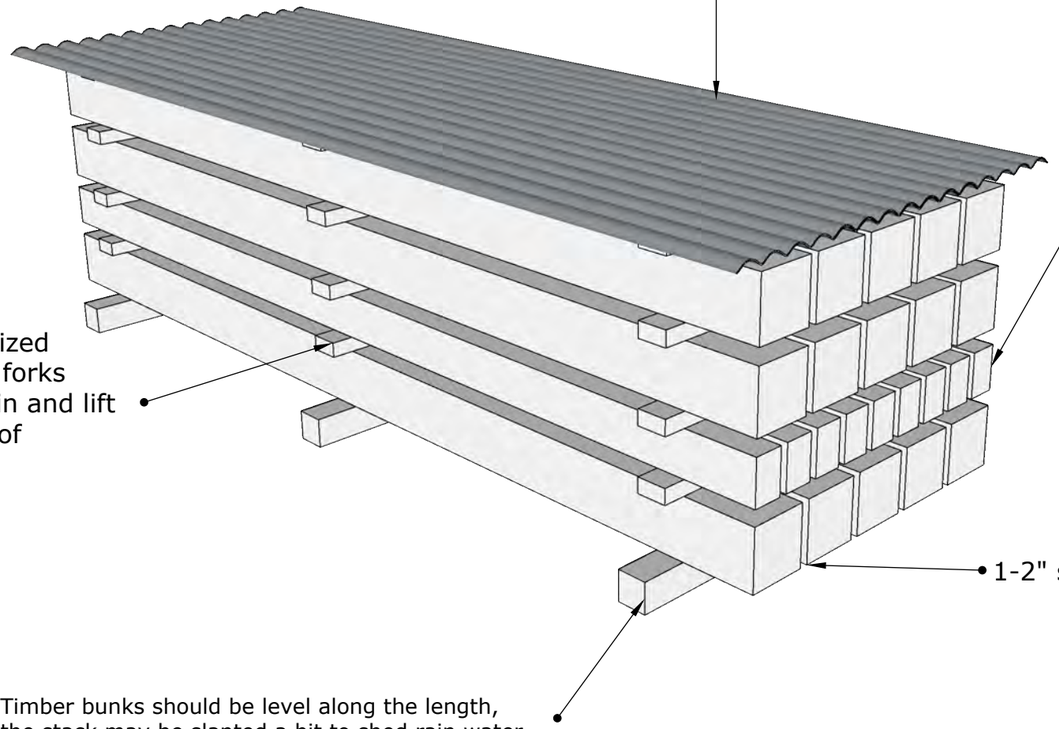
The timber list can be used to discuss your project needs with a sawyer.

Before ordering your timbers, we suggest that you have a final plan with drawings

Plan changes can have a material impact on the timbers required for your project

Timber Storage

Old Timer's Recipe
Timbers should be winter cut when the sap is low
Store timbers outside in the snow
Bring timbers one at time into the shop to cut
After cutting, store out in the snow
In the spring, raise the frame



Rafters staged for assembly

Sauna timbers ready for raising day

Timbers need to be stacked and stickered. Ensure that there is a cover over the top and adequate air-flow around each timber. Both ends of the timbers should be sealed with AnchorSeal or similar product. This will minimize checking of green timbers. Timbers are normally worked green. If you are able to let your timbers dry for 3-4 months after milling, the timbers will be considerably lighter and easier to work with.

Timber Selection

1. Understanding Timber Species

Timber species vary in strength, appearance, and workability. When selecting a species for your project, consider the following factors:

- **Structural Properties:** Hardwoods such as oak or softwoods like White Pine and Douglas fir are commonly used in timber framing due to their strength and durability.
- **Aesthetics:** The grain, color, and texture of the timber can impact the overall appearance of your frame.
- **Availability:** Local species may be more cost-effective and sustainable.
- **Workability:** Some species are easier to cut and shape than others.

2. Sourcing Timbers

Where and how you source your timbers can significantly affect the quality and cost of your project:

- **Local Sawmills:** Partnering with local sawmills can reduce transportation costs and support local businesses. Custom cutting services are often available for specific dimensions and lengths.
- **Salvaged Timbers:** Reclaimed wood can add character and sustainability to your project. Ensure that salvaged timbers are properly inspected for defects or previous damage.

3. Timber Grading Practices

Grading is essential for ensuring that your timbers meet the necessary structural requirements. There are two primary grading systems:

- **Visual Grading:** A trained grader inspects each timber for knots, grain slope, checks, and other defects that could affect strength. This method is often sufficient for smaller projects.
- **Machine Stress-Rated (MSR) Grading:** For large-scale or heavily loaded structures, timbers may require machine grading to confirm their strength properties.

Defects to look for include:

- Excessive knots or knot clusters.
- Severe checking or splitting.
- Grain runout exceeding acceptable limits.
- Rot, insect damage, or other forms of decay.
- Timber wane

Organizations in the U.S. that grade timbers include the **Timber Products Inspection, Inc.**, **NELMA (Northeastern Lumber Manufacturers Association)**, and **Southern Pine Inspection Bureau**. These groups provide standards and certifications to ensure the quality and reliability of structural timbers.

4. Obtaining an Engineering Review

An engineering review may be required, especially for larger or more complex structures. A licensed structural engineer will: **Evaluate Load Paths, Verify Connections, and Check Building Codes.** For engineering evaluations, consider reaching out to organizations like **Fire Tower Engineered Timber** or the **Timber Framers Guild Engineering Council**, both of which specialize in timber frame structures and can provide expert guidance and reviews tailored to your project.

5. Moisture Content

Timbers must have an appropriate moisture content to minimize shrinking, twisting, or checking over time. Typically, green wood (20-30% moisture) is used in timber framing, but air-dried or kiln-dried wood may be preferred for some applications.

6. Planning for Dimensional Changes

All wood moves with changes in moisture. When selecting and designing with timbers:

- Account for shrinkage and expansion, especially across the grain.
- Use proper joinery techniques to accommodate movement without compromising the frame's strength or stability.

7. Documentation and Traceability

Maintain records of your timber purchases, including species, grade, moisture content, and supplier information. This documentation will be useful for inspections and potential resale.

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Inspection/Shrinkage

1. General Inspection

- **Check for Species and Grade:** Ensure you have the correct wood species and quality for your project. Hardwoods and softwoods have different properties affecting workability and strength.
- **Confirm Dimensions:** Measure the timber to verify it meets the required size for your frame layout.

2. Content

- **Timber Framing and Green Wood:** In general, timber framing is designed to use green wood, as traditional joinery allows for natural shrinkage and tightening over time.
- **Ideal Moisture Levels:** Timbers should be at an appropriate moisture content to minimize shrinkage. Green timbers typically have a high moisture content, while air-dried and kiln-dried timbers are more stable.

3. Structural Soundness

- **Check for Checks and Splits:** Small checks (cracks) are normal and often occur as wood dries, but large or deep splits can compromise strength.
- **Look for Shakes:** A shake is a separation along the growth rings. Too many shakes can weaken the timber.
- **Inspect for Knots:** Sound knots are acceptable, but loose or excessive knots near joinery locations can weaken the timber.
- **Assess Grain Orientation:** Straight grain is preferred. Grain that runs diagonally or has excessive runout can lead to weakness in critical joinery areas.

4. End Grain and Ring Orientation

- **Look at End Grain for Stability:** A tighter growth ring pattern generally indicates stronger wood.
- **Ring Orientation:** Ideally, timbers should oriented so that shrinkage occurs in a predictable direction, reducing movement in joints.

5. Final Marking and Sorting

- **Identify Prime Timbers:** Reserve the best timbers for key load-bearing areas.
- **Mark Joinery Locations:** Once inspected, mark layout lines based on the best face and edge of each timber.
- **Store Properly:** Keep timbers stacked with stickers (spacers) for airflow and cover them to prevent excessive moisture absorption.

1. How Wood Shrinks

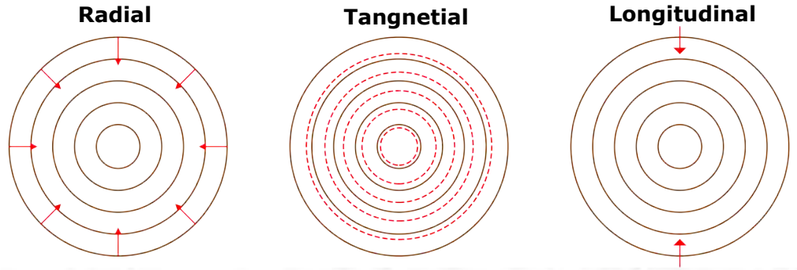
Wood shrinks unevenly depending on the grain orientation:

- **Radial Shrinkage (Across Growth Rings):** Minimal, about 3-5%.
- **Tangential Shrinkage (Along Growth Rings):** More significant, around 6-10%.
- **Longitudinal Shrinkage (Along the Grain):** Negligible, typically less than 0.1%.

Because wood shrinks more in the tangential direction than in the radial direction, timbers tend to develop **checks** (surface cracks) as they dry. These are normal and rarely affect strength.

2. Shrinkage Rates for Green Timbers

Green (freshly cut) timbers have a moisture content of **30-60%** and will shrink as they dry to **15-20%** in



Species	Tangential Shrinkage (%)	Radial Shrinkage (%)
White Oak	10.5%	5.6%
Douglas Fir	7.6%	4.8%
Eastern White Pine	6.1%	2.1%
Western Red Cedar	5.0%	2.3%
Southern Yellow Pine	7.4%	4.8%

3. Effects of Shrinkage in Timber Framing

Timber framing is designed to accommodate shrinkage:

- **Joinery Tightening:** Traditional mortise and tenon joints tighten as the timber dries.
- **Gaps in Pegged Joints:** Some shrinkage can cause slight movement in pegged joints, but properly placed pegs maintain structural integrity.
- **Checks and Cracks:** Surface checks are expected and typically do not affect the strength of the frame.
- **Wall and Floor Movement:** In post-and-beam structures, shrinkage can cause walls to settle slightly over time, requiring consideration in finishing details.

4. Managing Shrinkage

- **Use Proper Joinery:** Traditional joinery methods account for shrinkage, ensuring tight and secure connections over time.
- **Orient Growth Rings Thoughtfully:** Positioning timbers with the heart side out reduces warping.
- **Allow for Drying Time:** If possible, air-dry timbers for 2-3 months before use (timbers are lighter).
- **Use Drying Techniques:** Some builders kerf larger timbers to relieve stress or apply end-grain sealers to slow drying.

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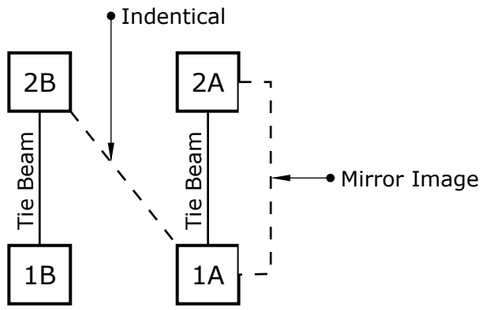
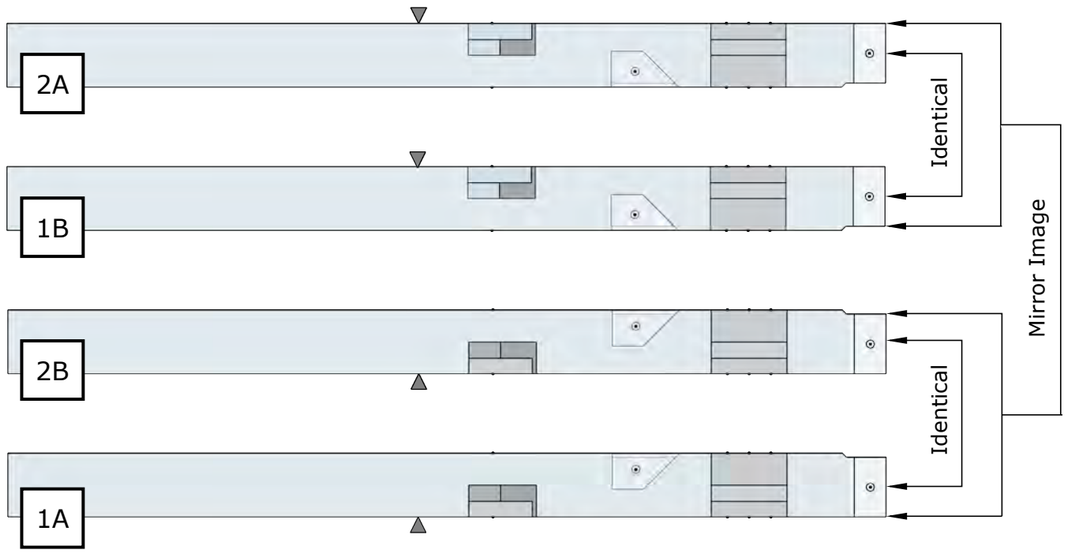
Working Timbers in Groups

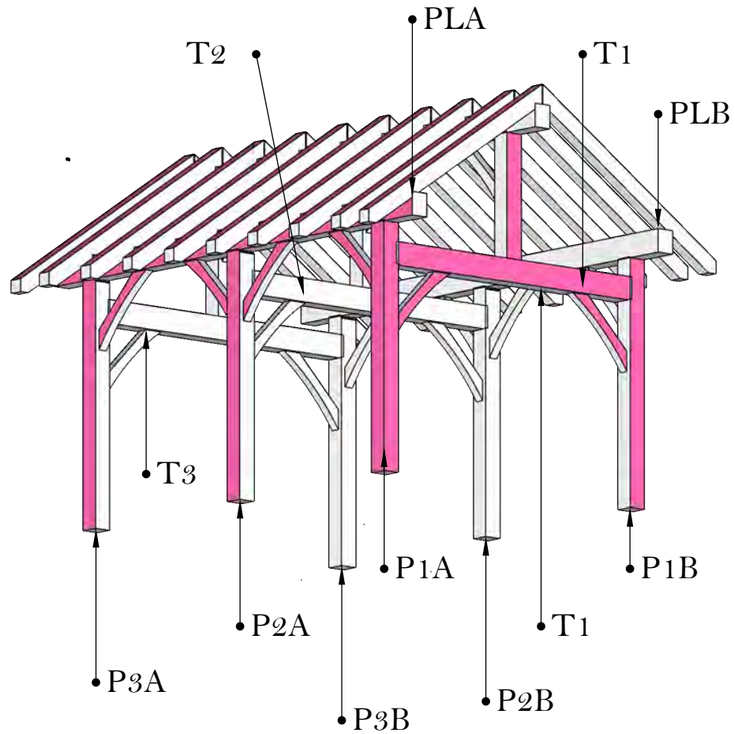
Placing timbers side by side on skids is an effective way to catch layout errors before cutting. Once the layout for each timber is complete and double-checked, align the timbers on skids with their tenons at the same end and their like faces facing up. This setup allows you to visually confirm that the timbers are either identical or mirror images, as required. If discrepancies are found, the layout must be corrected before proceeding.



Simple Structure
In a simple symmetrical timber frame, the diagonal posts will be identical. Posts that share a common tie beam will be mirror images.



Timber Check
Arranging your timbers in this manner during the layout process easily reveals any issues that require correction.



P1A is identical to P3B
P3A is identical to P1B

P1A is a mirror image of P1B
P3A is a mirror image P3B
P2A is a mirror image of P2B

T2 and T3 are indentical
T1 is a mirror image of T2 & T3

PLB is a mirror image of PLA

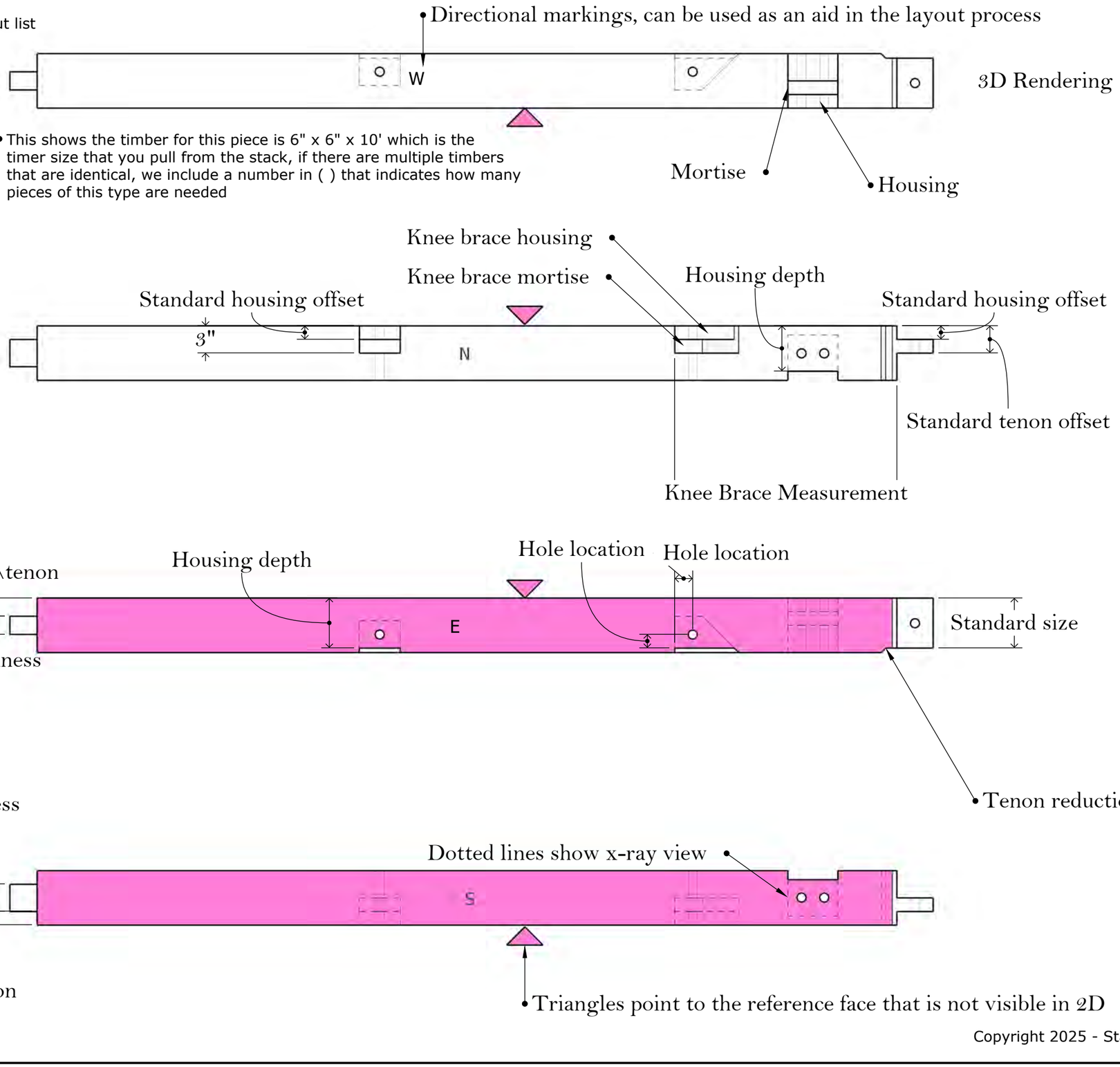
Drawing Conventions

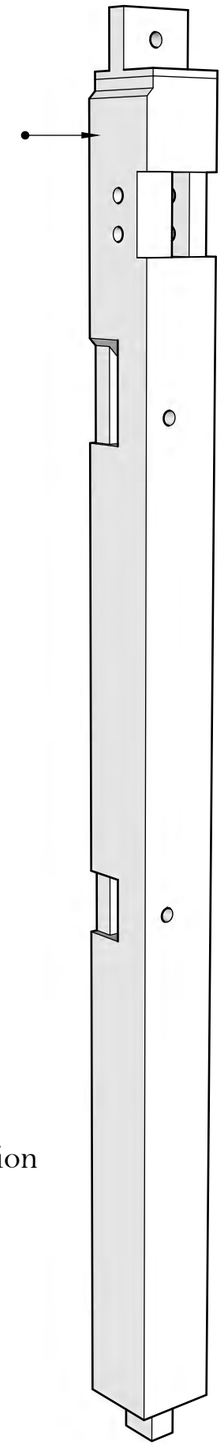
6 x 6 x 10 ← Matches cut list

This shows the timber for this piece is 6" x 6" x 10' which is the timer size that you pull from the stack, if there are multiple timbers that are identical, we include a number in ( ) that indicates how many pieces of this type are needed

To keep the drawings free of clutter, in general, measurements will appear one time

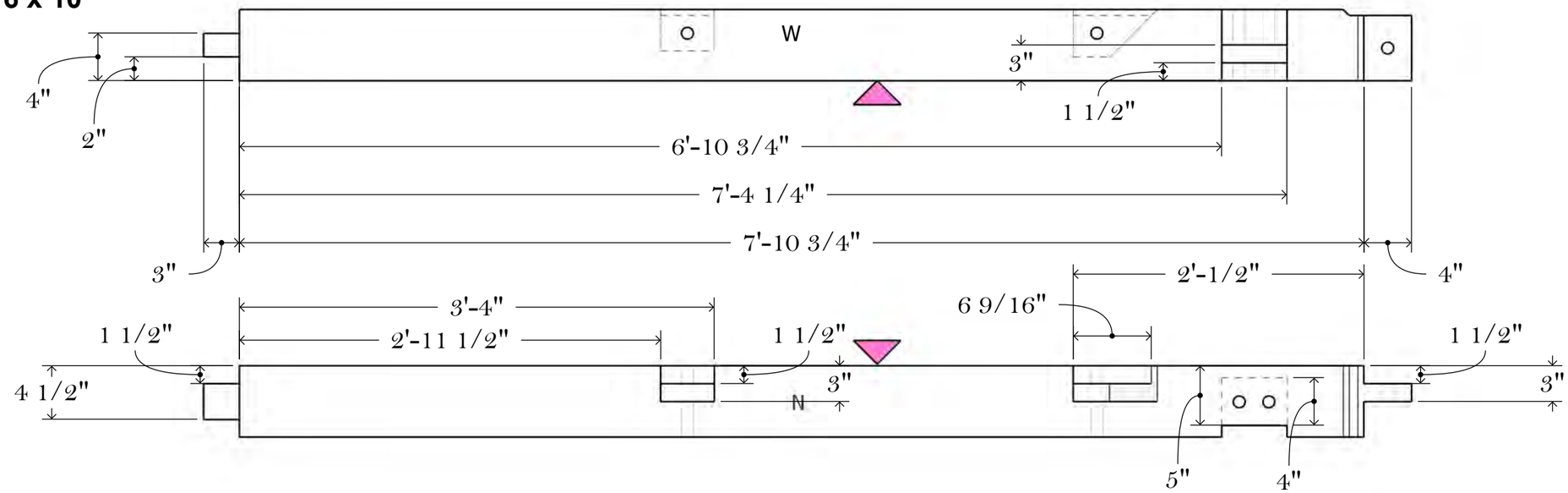
Like measurements are inferred from those on the plan

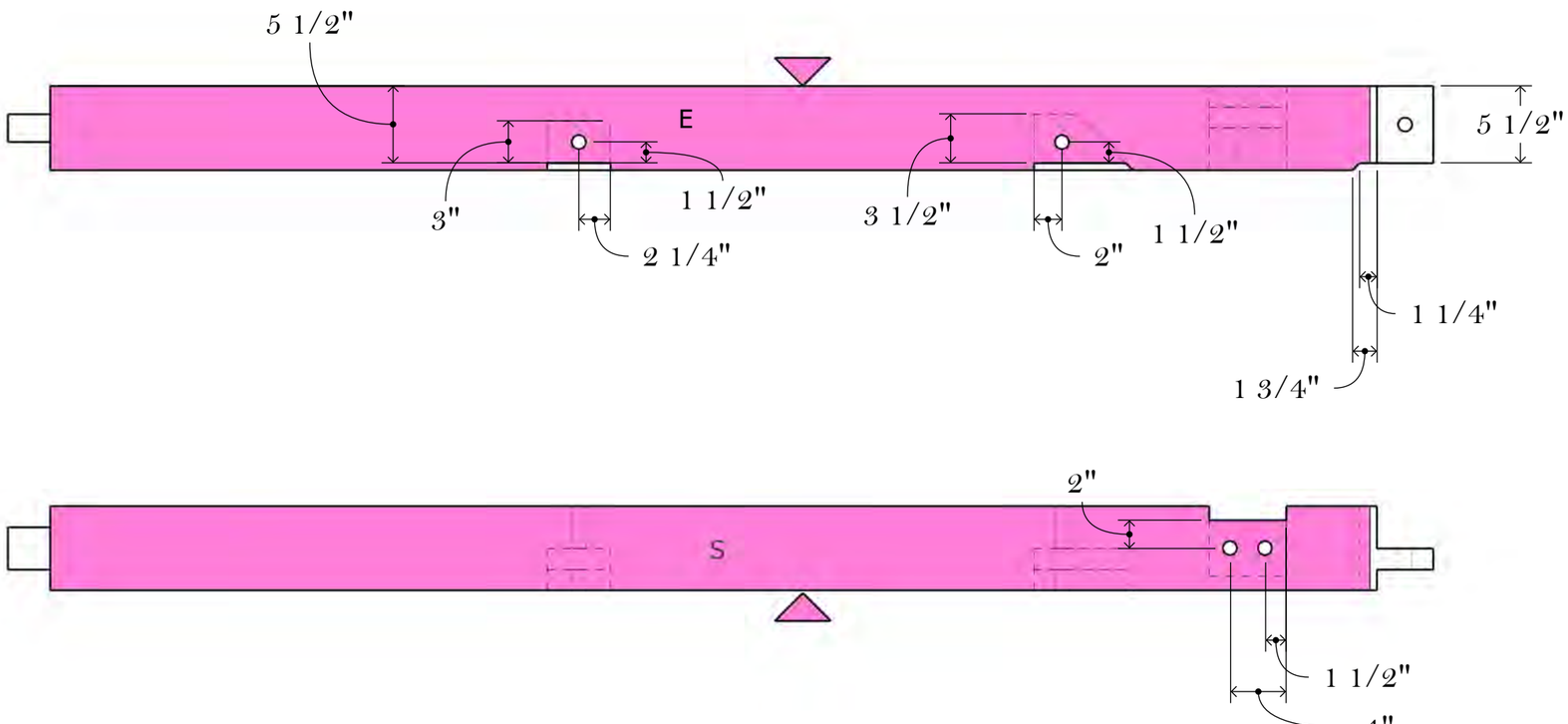


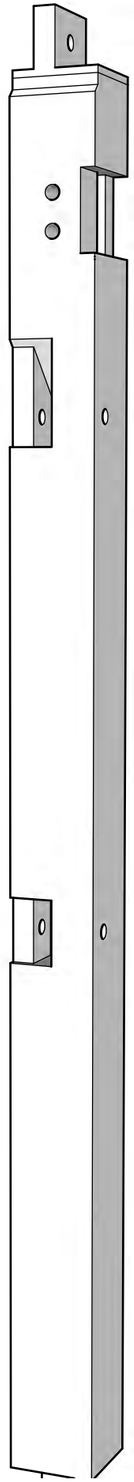


Example 2D Drawing

6 x 6 x 10







- Star Hill Timberworks LLC

How to Use a Timber Framing Chisel

A timber framing chisel is a robust tool designed for cutting and shaping large joinery in heavy timbers. Proper technique and care ensure precision and longevity of both the tool and your work. Below is a step-by-step guide on how to use a timber framing chisel effectively.

1. Choosing the Right Chisel

Timber framing chisels come in various widths, typically ranging from 1 1/2" to 2". A well-honed edge and a durable handle, often reinforced with a metal hoop, are essential for heavy-duty use. Selecting the right chisel size for your joinery ensures clean and accurate cuts.

2. Sharpening and Maintenance

A sharp chisel is crucial for effective cutting. Use a sharpening stone or honing guide to maintain a razor-sharp edge. Regular stropping helps keep the edge keen. Store your chisel in a protective sheath to prevent damage and maintain sharpness.

3. Proper Grip and Handling

Hold the chisel with a firm but controlled grip. Your dominant hand should guide the chisel's motion, while the other hand steadies it. For paring cuts, push the chisel with controlled force; for chopping cuts, use a wooden or mallet-style hammer to drive the tool.

4. Cutting Techniques

- **Paring**: For removing thin shavings and refining surfaces, hold the chisel at a shallow angle and push with even pressure.
- **Chopping**: To remove bulk material, position the chisel vertically and strike the handle with a mallet, creating a clean, precise cut.
- **Mortising**: When cutting deep mortises, begin by scoring the outline and progressively chisel deeper while ensuring vertical alignment.
- **Bevel Control**: Keep the bevel facing downward for controlled paring, and use the flat side for precise, perpendicular cuts.

5. Safety Considerations

- Always cut away from your body to prevent injury.
- Use a firm work surface or clamp the timber to ensure stability.
- Wear safety glasses and gloves when necessary to protect against flying wood chips and accidental slips.

Note: Normally, a timber framing chisel is used with the flat side down, ensuring it stays horizontal or plumb. Occasionally, flipping the chisel over helps control depth and prevent excessive biting, especially when working around knots or cleaning out the bottom of a mortise. Taking small, controlled cuts with the chisel yields better results.

6. Storage and Care

After use, clean the chisel blade with a dry cloth and apply a light coat of oil to prevent rust. Store the chisel in a sheath or toolbox to maintain its sharpness and longevity.

By following these guidelines, you'll achieve precise, clean cuts and extend the life of your timber framing chisel. With practice and proper technique, this essential tool becomes an invaluable part of your timber framing work.

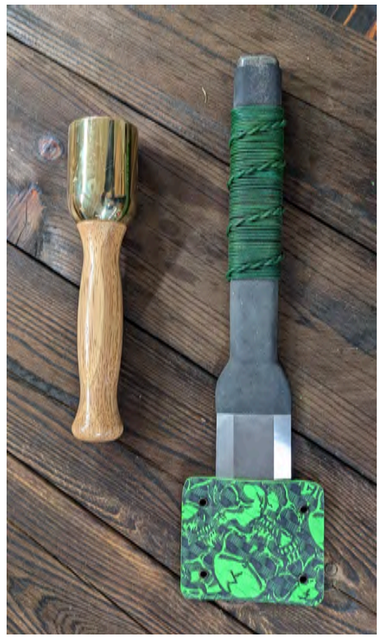
Homemade 1" chisel, shaped an old file using a 2 x 72 sander, burn fit the handle, added a shouldered cutting edge, tang style chisel secured with epoxy, wrapped with 3 mm cord (1/2 hitch pattern), and a Holstex sheath

For a hollow grind, you can take your chisels to a saw shop, or purchase the WEN sharpening system, which is substantially less expensive than the Tormak System

Star Hill chisels 1 1/2" and 2", shouldered edge, 100% tool steel

Sharpening a chisel using a Star Hill stone and guide jig

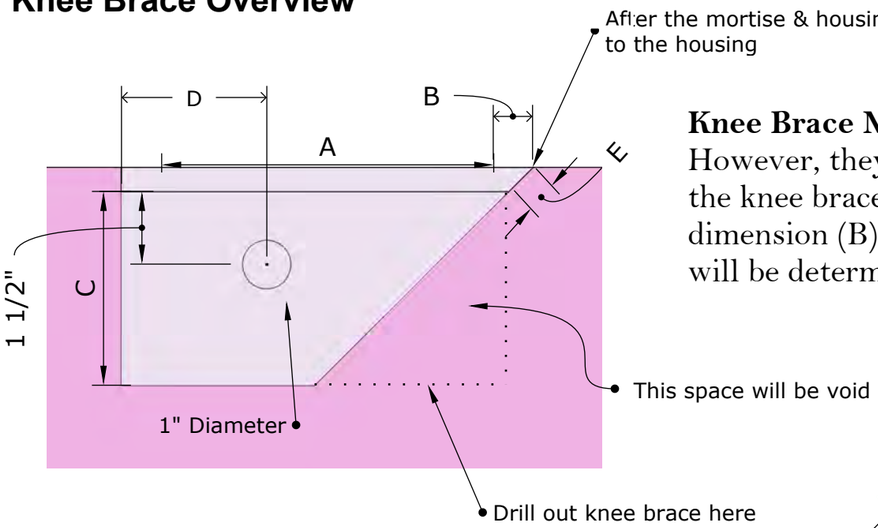
Occasionally, we need to fine-tune a chisel angle or restore its edge using a sander (belt sander or 2" x 72"). It's crucial to work slowly and keep the metal cool by frequently dipping it in water or snow. Excessive heat can compromise the edge by reducing its hardness



Arno chisel, available on Amazon, great option for those on budget, we added a hollow grind, 3 mm leather cord wrap, and custom Star Hill sheath

Revision 1 (4.8.25)

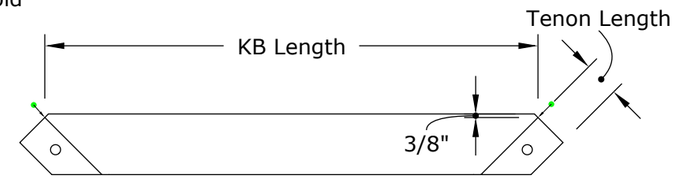
Knee Brace Overview

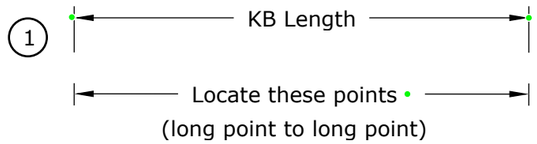


Knee Brace Mortises are show at a 45 degree angle. However, they can be drilled square as the angled portion of the knee brace does not provide any structural support. The dimension (B) of the angle cut at the top of the knee brace will be determined by the depth of the timber.

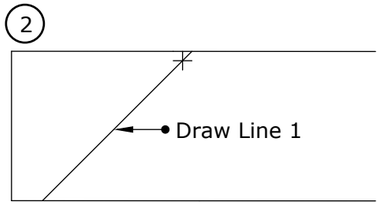
Knee Brace Fit
To improve the fit of your knee braces with square rule methods, consider ordering the timbers slightly oversized (+1/4" to 1/2") and plane them exactly to the specified dimensions.

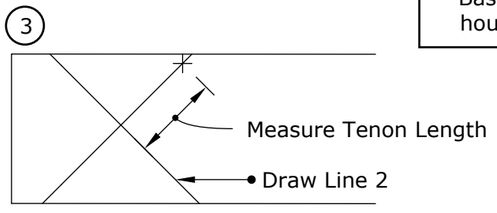
Knee Brace Layout



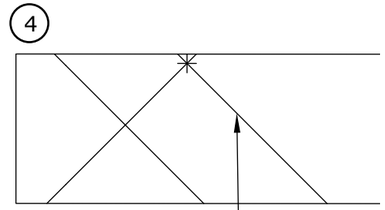


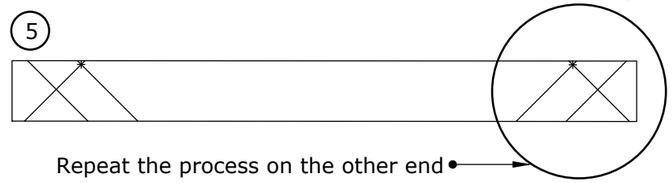
The remaining layout is based on **marking 45 degree lines** from the top of the timber referenced off these points

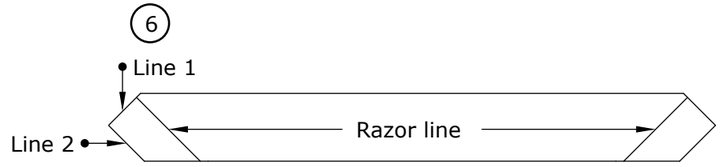




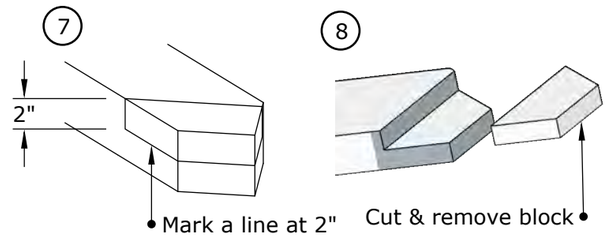
KB Length*
30 x 30 = 3' 7 1/8"
32 x 32 = 3' 9 15/16"
36 x 36 = 4' 3 5/8"
48 x 48 = 5' 8 9/16"
54 x 54 = 6' 5 1/16"
60 x 60 = 7' 1 3/4"
* Based on 1/2" housing

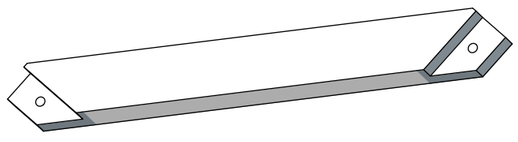






Make sure the sawblade is square to the guide
Cut the Knee Brace along Line 1 & Line 2





A Length of the knee brace mortise pocket is determined by the depth of the knee brace timber.

Timber	Length
4"	5 3/16"
5"	6 9/16"
6"	8"
8"	10 13/16"

B This dimension will vary with the depth of the timber to maintain a 45 degree angle at slope E.

Timber Depth	B
+/- 0"	1/2"
+ 1/8"	5/8"
+ 1/4"	3/4"
-1/8"	3/8"
-1/4"	1/4"

C Depth of the mortise is normally 3" to 4 1/2". 3" is about the minimum depth that allows room to install a peg.

D The peg hole is located 1 1/2" below the housing. Dimension D is defined to place the peg about in the center of the knee brace tenon.

Hole Drilling

Rockler drill guide, available on Amazon works great for drilling mortises

https://a.co/d/0VPvyDO

This method works well with a 1" or 1 1/2" Wood Owl bit

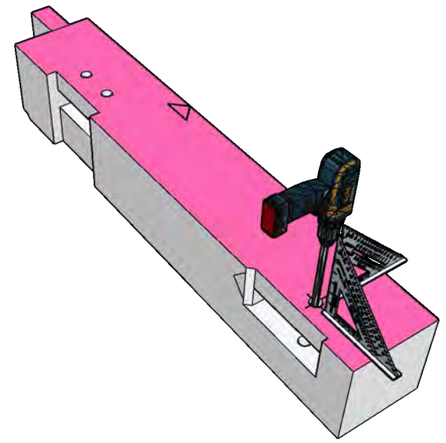
If drilling 2" holes and auger bit, use a boring machine

Boring machine for drilling mortises

1. **Marking Holes**
   - Tenon holes are marked during the test-fitting process
   - After test fitting, disassemble the frame and drill the holes
   - Always mark hole locations on the reference side of the timber
2. **Drawbore Technique**
   - If using drawbore pegs, mark the tenon hole during test fitting
   - Drill the tenon hole approximately 3/16" toward the shoulder to create an offset
   - This offset ensures the pointed drawbore peg pulls the joint tight during assembly
3. **Drilling in Relation to Mortises**
   - **With a Chain Mortiser:** Drill holes before cutting the mortise
   - **With a Drill Jig:** Drill holes after cutting the mortise
4. **Drilling Technique**
   - Drill through the timber from one side
   - Use a speed square, guide, or mirror to maintain proper drill bit alignment
   - Apply minimal downward pressure—let the lead screw pull the bit through
   - When the lead screw emerges from the bottom, the bit will strip out, and the drill speed will increase, remove bit from hole (do not punch through the timber)
5. **Maintaining Clean Hole Edges**
   - Flip the timber over, brace the drill securely, and complete the hole from the opposite side

Wood Owl, Ultra Smooth bits (available on Amazon) work well for drilling peg holes.

https://a.co/d/g95BBoS



Mafel BST drilling station works well for peg holes

https://www.timberwolftools.com/mafell-bst-drilling-stations

Test Fitting

1. Prepare the Work Area

- Choose a flat, stable surface for test fitting.
- Organize all timbers by their corresponding layout.
- Ensure tools such as mallets, chisels, and measuring tapes are on hand.

2. Dry-Fit the Frame in Sections

- Begin with one bent (wall section) at a time.
- Assemble posts, beams, and braces without glue or pegs.
- Use temporary fasteners or clamps to hold pieces together if necessary.

3. Check for Proper Joinery Fit

- Inspect each joint for gaps; they should be snug but not forced.
- If a joint is too tight, carefully pare down with a chisel.
- If too loose, consider shimming or adjusting the tenon.

4. Verify Frame Squareness and Alignment

- Use a tape measure diagonally across the frame to check for squareness
- Adjust as needed by tapping timbers with a mallet.

5. Assemble the Full Structure (If Space Allows)

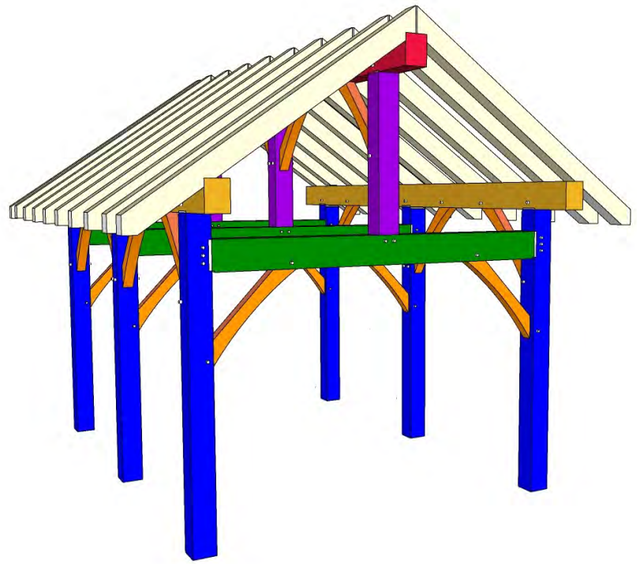
- Erect all bents and connect tie beams and plates.
- Confirm overall alignment before pegging or final adjustments.

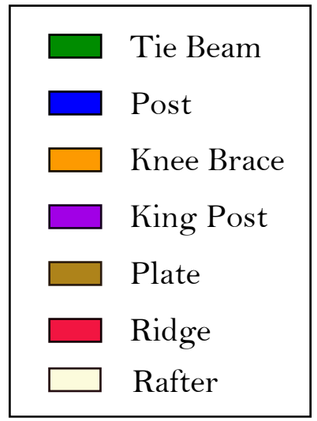
6. Address Any Issues Before Final Assembly

- Mark and correct misaligned joints.
- Re-test fit if major adjustments were made.
- Disassemble carefully to prepare for transport or final assembly.

Test fitting a door header on a wall

When making changes because a joint doesn't fit, in general, we change one item at a time. This allows us to determine the direct impact of the change we made





Test Fit Process

Ensure you have a level area with adequate ponies, cribbing, or sawhorses to support the structure that will be fitted

1. Test fit posts to plates with knee braces
2. Test fit king posts to ridge with knee braces
3. Test fit king posts to tie beams
4. Test fit ties to posts with knee braces

For step number 4, if the frame will be raised soon, validate the orientation of each bent, test fit the bent in place to raise the structure

Do the final pegging after fitting. in this case, tenon holes are drilled in place to prevent additional disassembly

Note: During the test fitting process, when assembled for fitting, mark or drill peg holes for tenons

Test fitting a sauna bent

Test fitting a wall, bent, or ridge is conducted with the structure horizontal supported on cribbing, ponies, or sawhorses

Test fitting 2 posts, 1 tie beam, and 2 knee braces

Truck Straps are your friend for the test fitting process, it is not unusual to use 3 or 4 truck straps on one section

To prevent marring, blocking is placed under the hook/rachet and on the corners (under the strap)

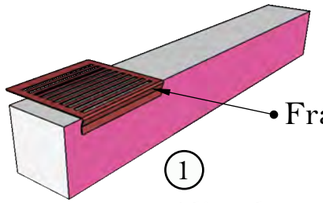
Tenon holes are marked (or drilled) during the test fit process

If a joint doesn't go together properly, adjust as needed

Revision 1 (4.8.25)

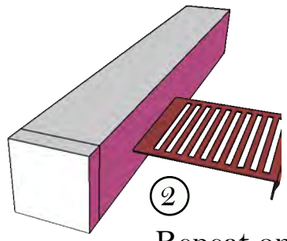
Square Up Timber

Note: prior to squaring up a post, validate your sawblade is square to the guide



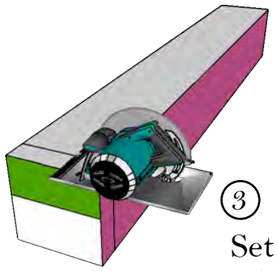
1

Align layout tool with the reference face, knife the post bottom



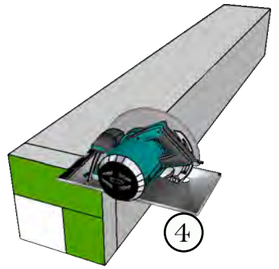
2

Repeat on all 4 sides



3

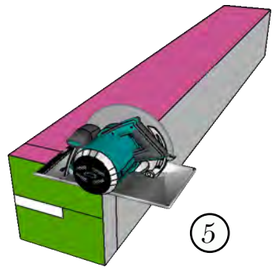
Set saw to 3 1/2", make 1st cut



4

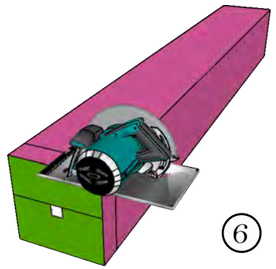
Rotate timber, make 2nd cut

Warning: This saw position (heavy side out) allows you to see the line better. However, it can only be used in this manner, when the end block will not drop off.



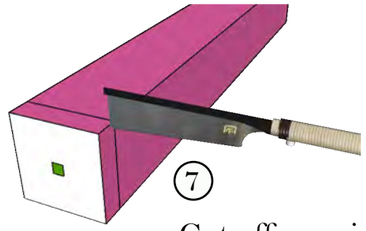
5

Rotate timber, make 3rd cut



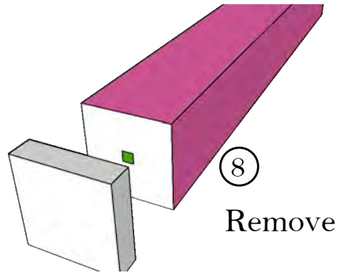
6

Rotate timber, make 4th cut



7

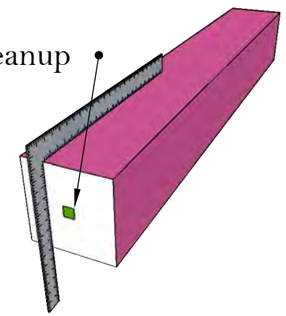
Cut off remainder (1" x 1") with a handsaw



8

Remove the block

This area needs cleanup



9

Clean up with a chisel, check for square

Learning layout

Mortise cutting demonstration

Revision 1 (4.8.25)

Layout Considerations

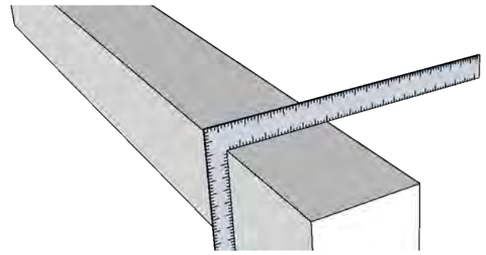
Timber Layout Using the Square Rule Process

1. **Select and Prepare Your Timber**
   Ensure your timbers are straight and square up any rough surfaces as needed. Identify reference faces and mark them clearly with a carpenter's pencil or chalk.
2. **Establish Reference Edge and Face**
   Choose one edge and one adjacent face as your primary reference surfaces. These will serve as the basis for all layout measurements. Mark them with a carpenter's triangle to maintain consistency.
3. **Measure and Mark Joinery Locations**
   Using a framing square and tape measure, lay out all mortises, tenons, and other joinery based on your framing plans. Always measure from the same reference edge to maintain accuracy.
4. **Apply the Square Rule**
   - Check the timber's dimensions at key points along its length.
   - If irregularities exist, use a consistent "perfect" dimension (e.g., 7½" for an 8" timber).
   - Lay out joinery based on this idealized size, ensuring uniformity across all timbers.
5. **Use Star Hill Layout Tools for Accuracy and Efficiency**
   The **Framer's Friend, Mortise and Tenon Master, and EZ Brace** were designed to ensure your layout is accurate, precise, and efficient. These tools help streamline marking mortises, tenons, and braces, reducing errors and improving workflow.
6. **Mark Joinery Details**
   Clearly mark mortise depths, tenon shoulders, and housing cuts using a marking gauge, combination square, and framing chisels for reference. Use a marking knife for precision where necessary.
7. **Double-Check Layout**
   Verify all measurements and markings before cutting. Cross-check against other timbers to ensure alignment and consistency in the frame.
8. **Label and Organize**
   Mark each timber with its designated location (e.g., "Post A1") and note joinery details for assembly. Keep your layout organized to streamline cutting and fitting.

By following the Square Rule process and using Star Hill Timberworks' specialized layout tools, you ensure precise, repeatable joinery, even when working with slightly irregular timbers.

When you start your layout process, compare the piece drawing to your timber, check dimensions and adjust your layout to keep joinery out of the knots (if you can).
We order timbers 1'-2' long in order to have some wiggle room when it comes to layout

Prior to starting your project, determine your best trees or timbers, set these aside to be used as plates and ridge



For Posts: Check all 4 corners with a framing square; identify the best edge, the reference faces will be the two faces adjacent to the best edge

The best edge should be square

For Plates, Ridges, & Ties: Sight the timber; find the crown (bow), place the timber with the crown up. In this case the reference edge must be selected from the top two edges, this ensures the crown will be up on horizontal members

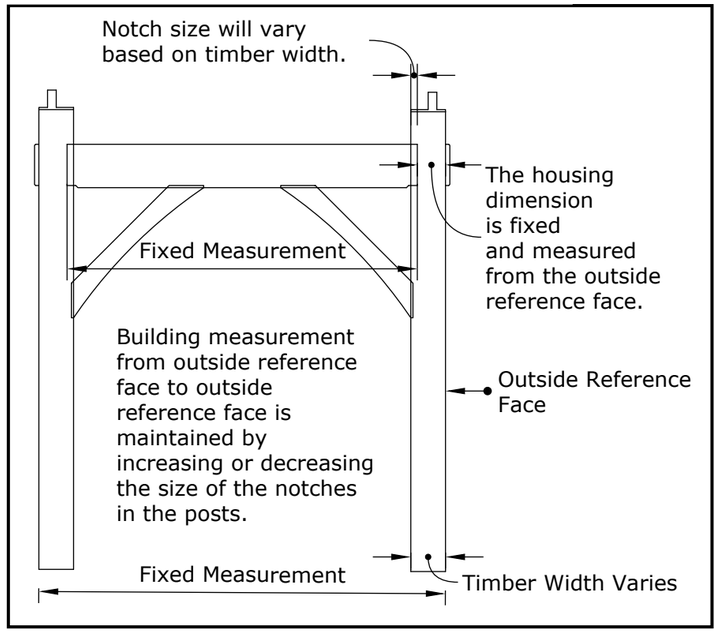
During the layout process we don't rely on the moveable tab on the end of your tape. Instead we burn an inch, 10 inches, or a foot.

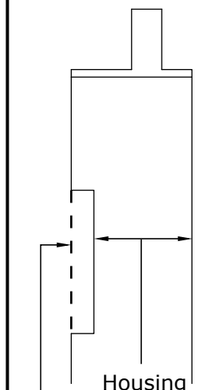
For example: To burn 1 foot, place the 12" mark from your tape where you want the zero. Then, add a foot to each measurement (so if you want 2' you mark the tape at 3'

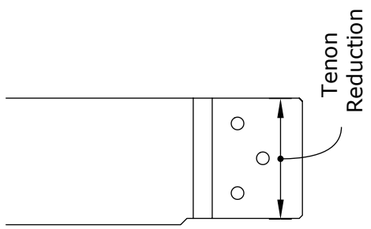
Not all tapes are created equal, you can find inconsistency in the printing among tapes, the tapes can be 1/8" off

Prior to starting your project, check all the tapes in your toolbox and validate that they are printed the same

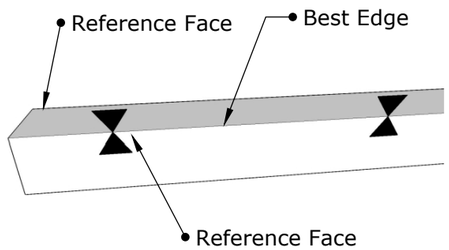
Square Rule

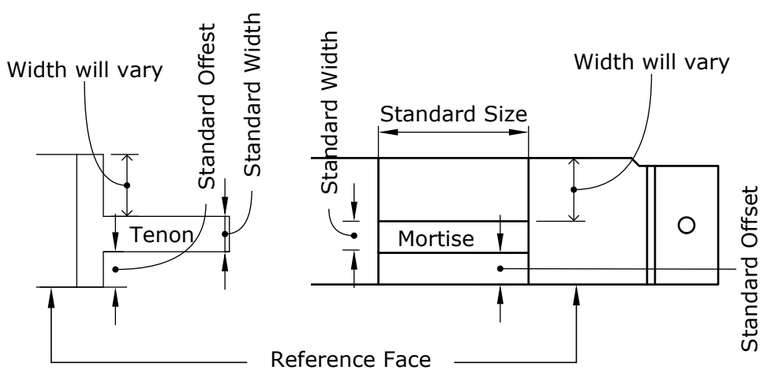




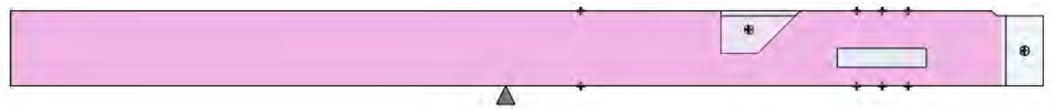


Tenons are reduced to a standard size. Generally, 1/2" less than the nominal timber dimension. Mortises are sized to match.

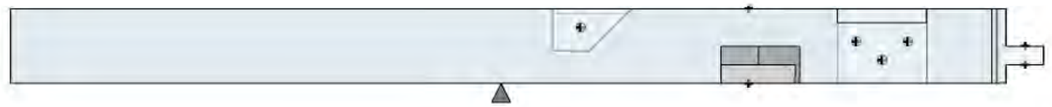




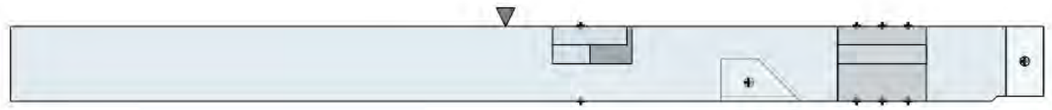
Shop drawings are produced in a roll format. Each drawing shows all four faces. When you look at our shop drawings, you will see a shaded face (Hot Pink) and diamonds. If the shading is showing, that indicates a reference is up, the diamonds point to the reference face that is not visible.



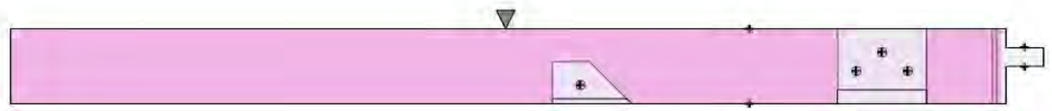
If you start with this face up



Roll the timber toward you; this face will be up



Roll the timber toward you a second time; this face will be up



Roll the timber toward you a third time; this face will be up

Determining the Reference Faces
The reference faces are the two best adjacent faces of the timber, located next to the best edge. To identify them, inspect all four edges with a square at multiple points along their length to find the straightest and most consistent edge. Once the best edge is selected, mark the two adjacent faces as reference faces using clear triangular marks. These marks help ensure the reference faces are easily recognizable during the layout process. From this point forward, all measurements are taken from the edge of the timber will reference one of these marked faces. All measurements are taken from the across the timber will originate at one of the reference faces

Ties, Plates, and Ridge
Orient the timber with the crown up. Select one of the two top edges as the best edge and mark the adjacent faces as reference faces. Layout the timber such that the crown is on the top of the timber.

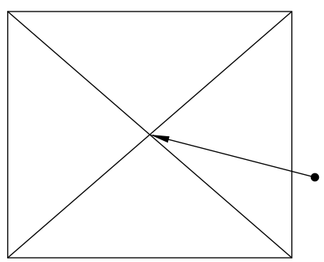
Revision 1 (4.8.25)

Centerline Layout

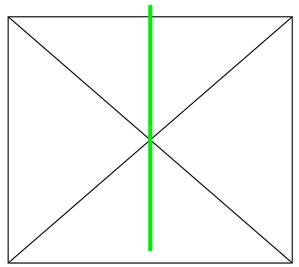
Centerline layout methods may be used on all timbers (in lieu of Square Rule). However, this method is ALSO useful when using Square Rule and you encounter a twisted, bowed, or curved timber and you don't have a replacement.Laying out this piece using the centerline method will ensure joinery lines up. You may need to clean up the outside (reference side) of the joint with a 4" grinder and 24-36 grit disc as the reference faces may not line up.

Cut the timber to working length (~1"- 2" more than needed), this ensures the tenons will be near the center of the timber

Ensure you have shims, level the timber side to side, obtain the best fit, bubbles may be offset, if so, ensure bubbles are equally spaced in opposite directions. Secure the timber so it does not move.

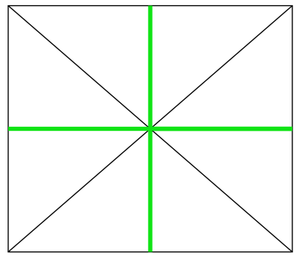


Locate the center of the timber on both ends



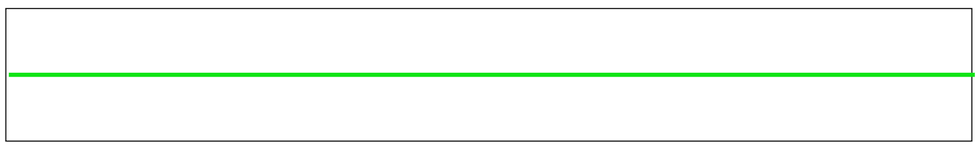
Use a level, draw a plumb line thru the center on both endes

There is no need to level the timber along its length



Use a level, draw a level line thru the center on both ends

Note: once this step is complete, there is no need to keep the timber level side to side any longer

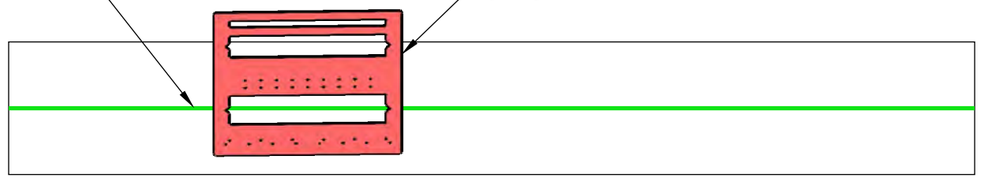


Use the marks on the end, snap a chalk line down the length of the timber, rotate the timber, repeat on all 4 sides

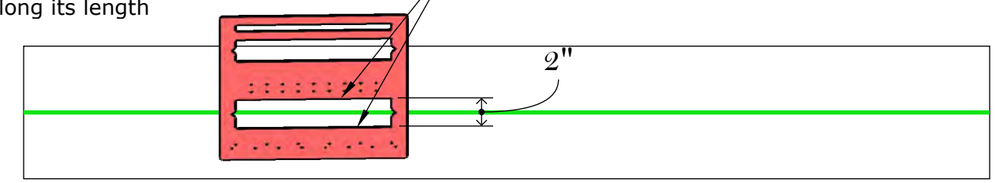
For centerline layout, all measurements are pulled form the centerline rather than from the reference edge, this ensures the joinery will line up

Line up v-notches

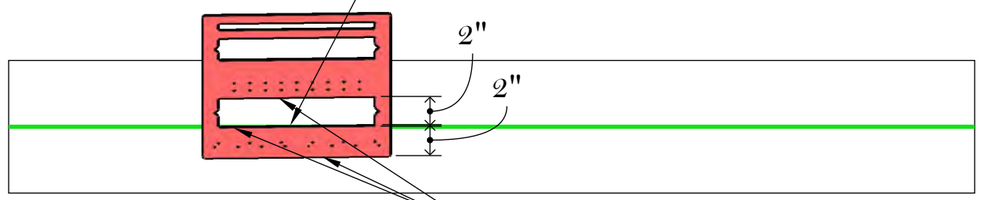
Use an edge to make lines perpendicular to the centerline



For a centered mortise, draw these lines



For a mortise and housing line up the centerline with this edge



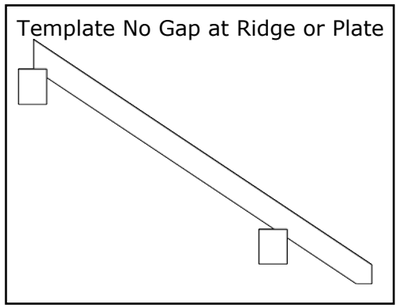
Draw these lines

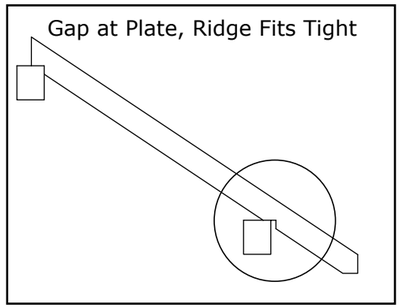
Mortise and Tenon Master

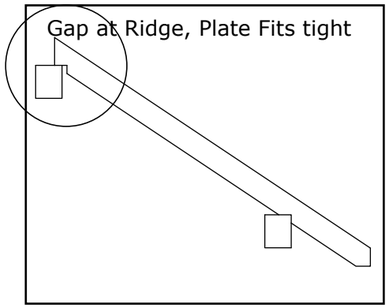
Rafter Fitting

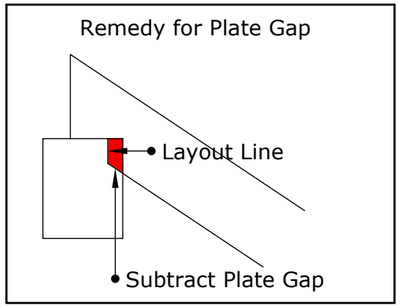
Method 1

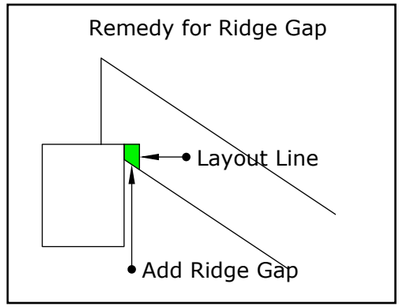
Rafter Mapping: To address inconsistencies in ridge dimensions, create a rafter map. Start by making a rafter template, either by scribing the first rafter or by creating a dedicated template. Position the rafter template at each designated rafter location on the building and check for gaps at the ridge or the plate. Note the size and location of any gaps on the rafter map. Use the template to lay out each rafter, and for areas with gaps, adjust the ridge bird's mouth as needed to correct the issue based on the recorded gap locations.

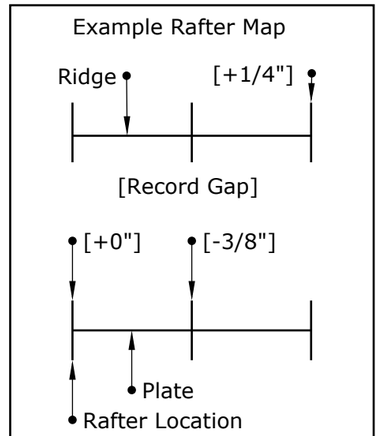












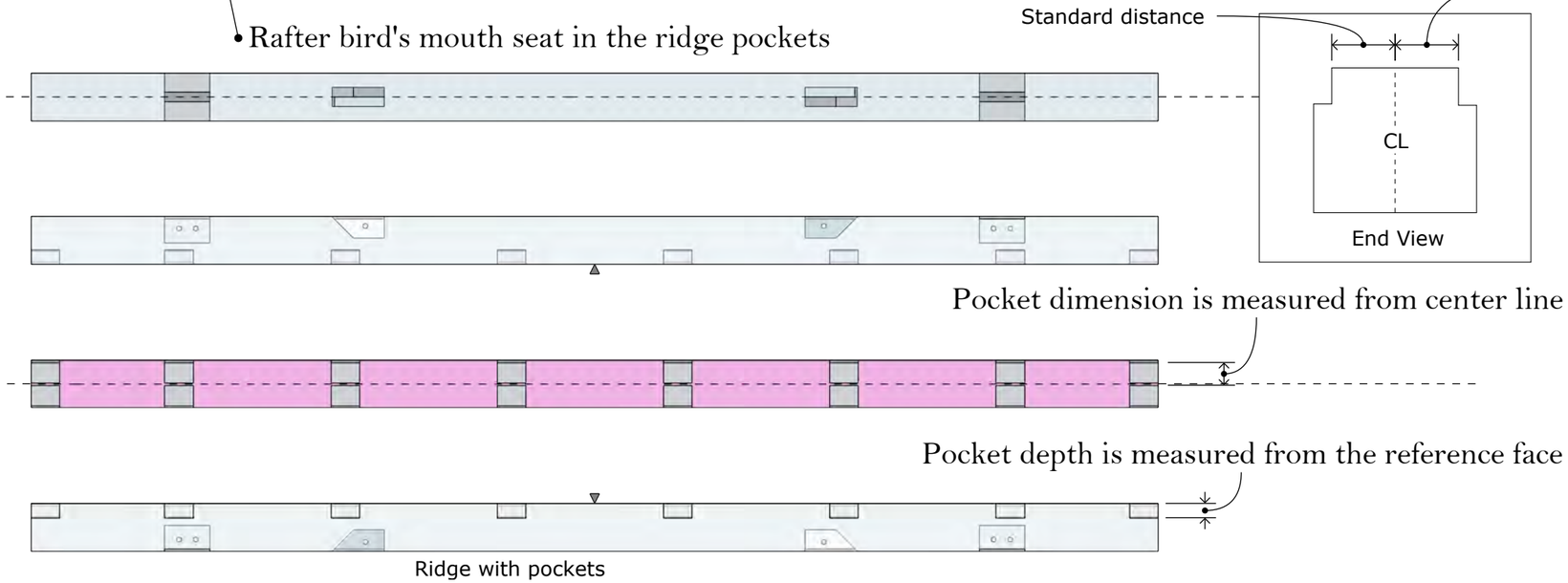
Remedy for either the ridge or plate gap is applied to the ridge birdsmouth. Rafters are sized such that there is a 1/2" gap at the peak to allow for adjustment. Roofing materials will cover and conceal this gap.

Method 2

Ridge Notches: Another option to ensure your rafters fit properly on the frame is to lay out the ridge using the centerline method. Cut pockets into the ridge to seat the rafter bird's mouths. This approach ensures a consistent measurement between the outside edge of the plate and the pockets, allowing the rafters to be precut to uniform dimensions.

Ridge notching ensures the corner where the bird's mouth will sit is a know distance from the centerline, on the plate the 2nd bird's mouth will sit on the reference edge, allowing rafter length to be calculated so rafters can be precut

Rafter bird's mouth seat in the ridge pockets



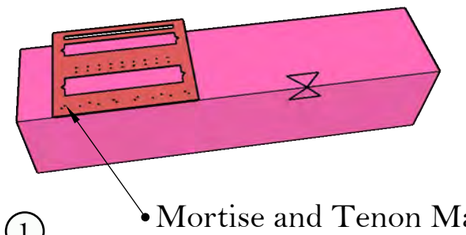
Ridge with pockets

The Mortise and Tenon Master works very well for centerline layout, used for ridges to accept rafters

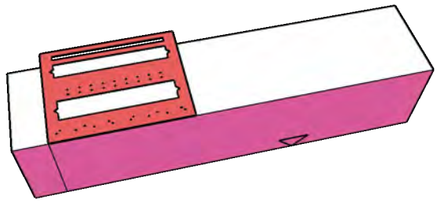
Revision 1 (4.8.25)

Tenon Layout

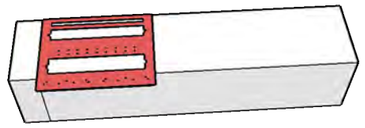
Note: We don't use the end cut off by the sawyer. We square up the timber perpendicular to the reference faces before starting the layout process.



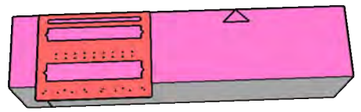
① Align tool to reference edge; mark line



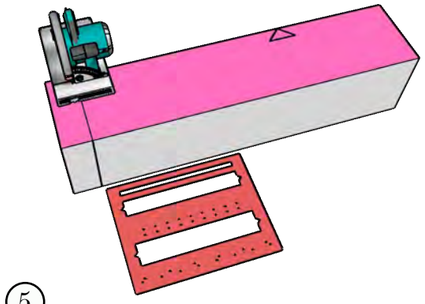
② Rotate timber, align tool to reference edge, mark line



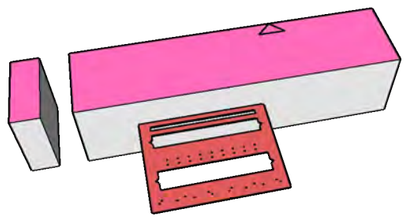
③ Rotate timber, align tool to reference edge, mark line



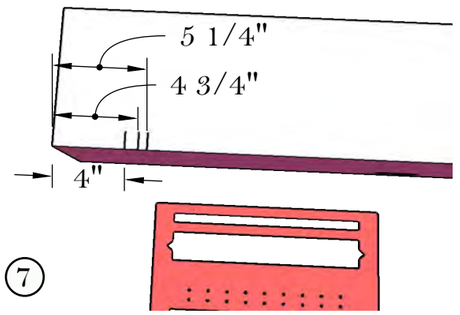
④ Rotate timber, align tool to reference edge, mark line



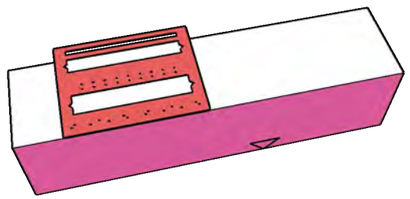
⑤ Cut off timber



⑥ Squared up timber end

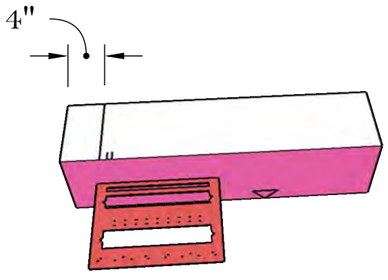


⑦ Mark reduction @ 4", 4 3/4", and 5 1/4"

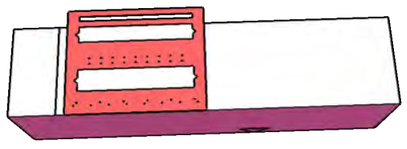


⑧ Align tool to reference edge, knife shoulder line

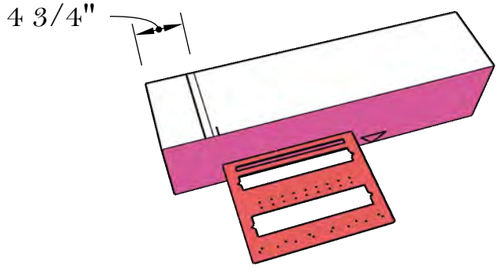
Note: For a clean cut, set the saw to about 1/4" shy of 1/2" timber width/depth. Cut all 4 sides; finish with a handsaw.



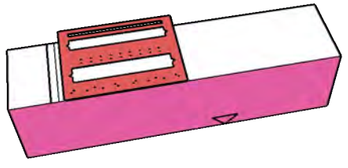
⑨ Shoulder knife line



⑩ Align tool to reference edge, mark 1st reduction line

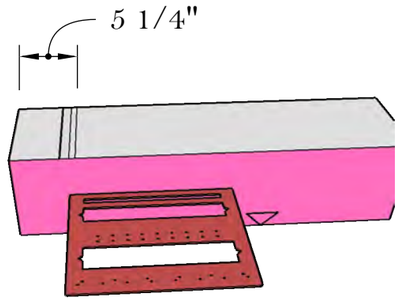


⑪ 1st reduction line



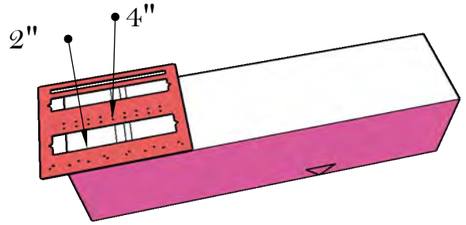
⑫ Align tool to reference edge, mark 2nd reduction line

Tenon Layout 2



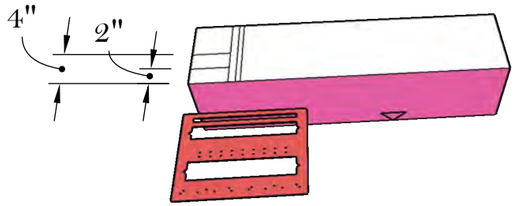
13

2nd reduction line



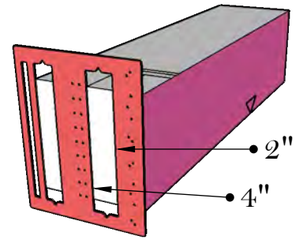
14

Align tool to reference edge, draw tenon at 2" and 4"



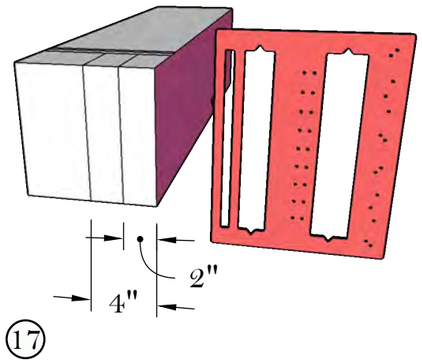
15

Tenon line



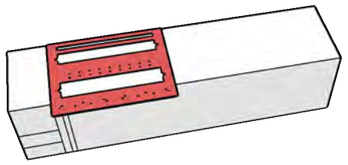
16

Align tool to reference edge, draw tenon at 2" and 4"



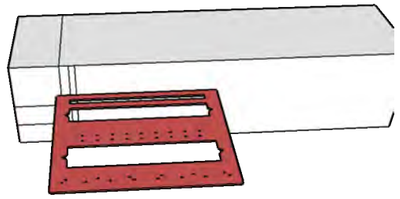
17

Tenon line



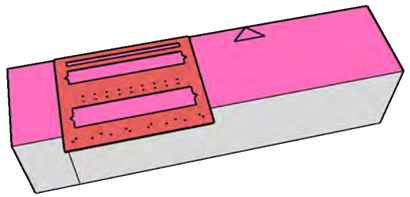
18

Align tool to reference edge, knife shoulder line



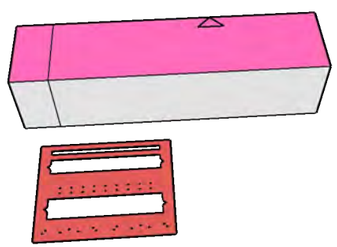
19

Shoulder line



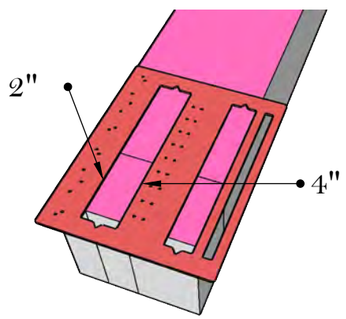
20

Rotate timber, align tool to reference edge, knife shoulder line



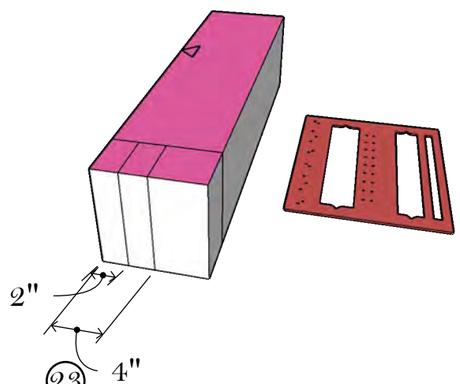
21

Shoulder line



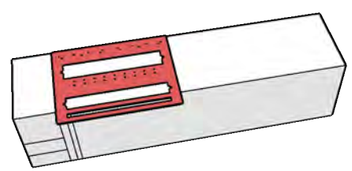
22

Rotate timber, align tool to reference edge, draw tenon at 2" and 4"



23

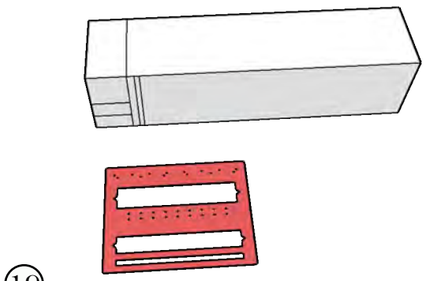
Tenon lines



24

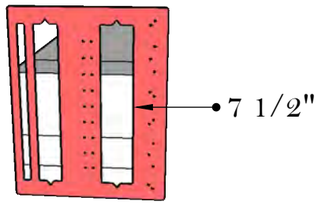
Rotate timber, align tool to reference edge, knife shoulder line

Revision 1 (4.8.25)



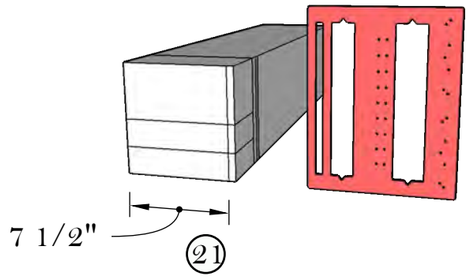
19

Shoulder line



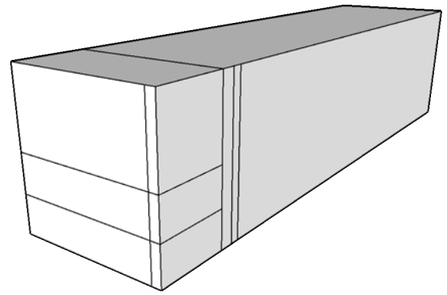
20

Align tool on reference face, draw 7 1/2" reduction



21

Reduction line



22

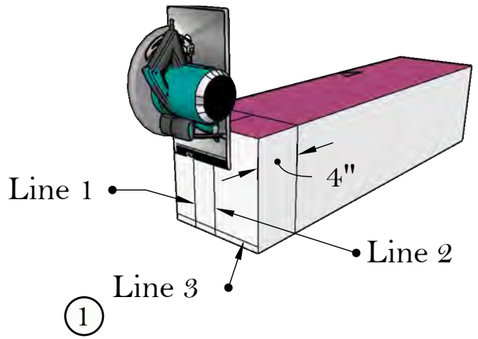
Tenon layout complete; ready to cut

Checking timber after layout with Mortise and Tenon Master

Layout tools

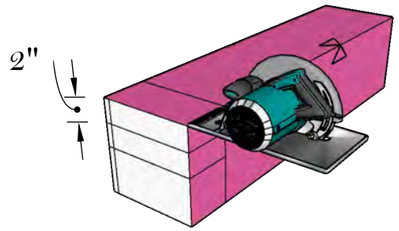
Timber layout using a Star Hill plan

Tenon Cutting



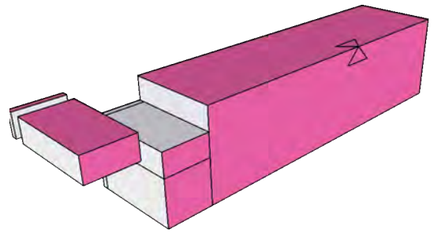
1

Set saw to 4", cut Lines 1, 2 , & 3 (tenon cheeks and reduction)



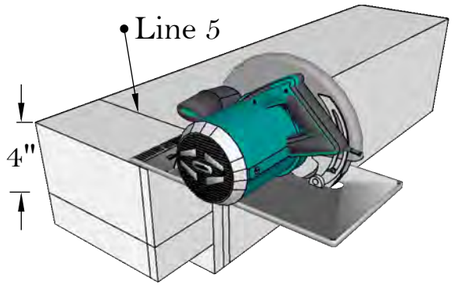
2

Set saw to 2"; cut shoulder (Line 4)



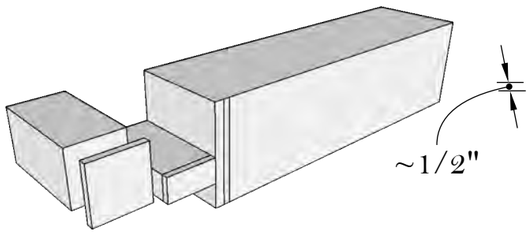
3

Remove these blocks



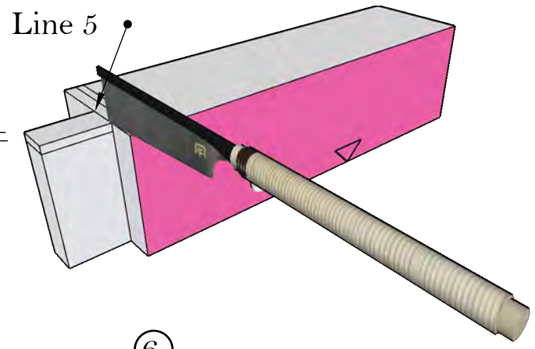
4

Rotate timber 180 degrees; set saw to ~4" and cut shoulder line (Line 5)



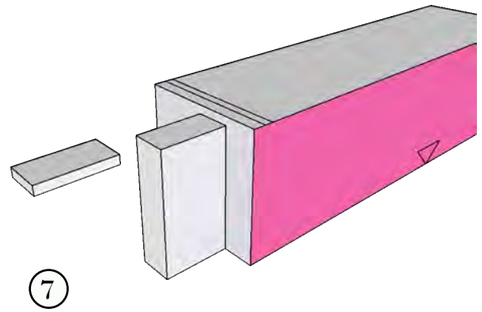
5

Remove these blocks



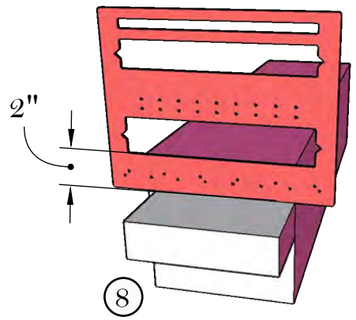
6

Use a handsaw; cut line 5 @ ~ 1/2"



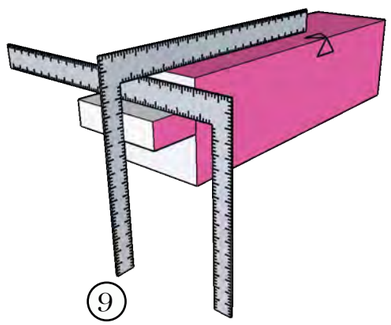
7

Remove this block



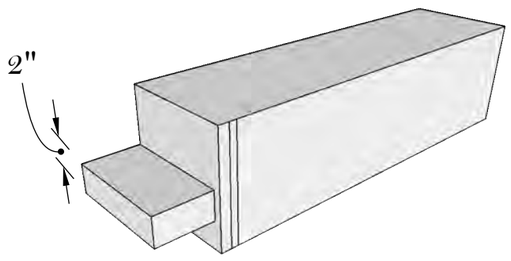
8

Validate reference side is right on 2", adjust cheek as needed



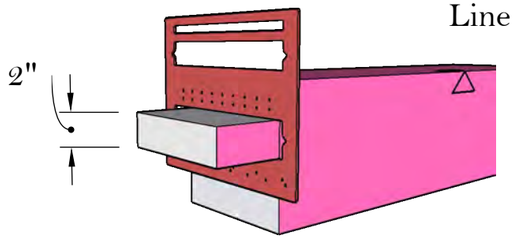
9

Use two framing squares; validate that the tenon is plumb to post



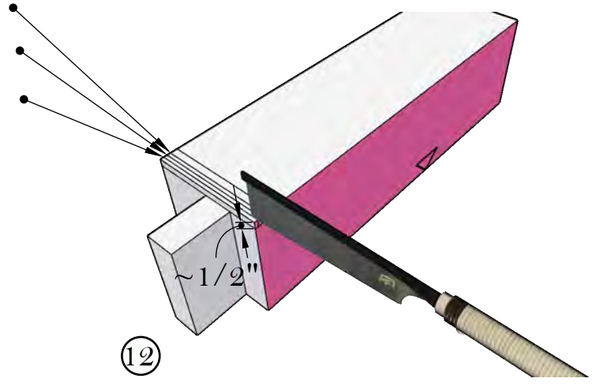
10

Adjust the non reference side so that the tenon is 2"



11

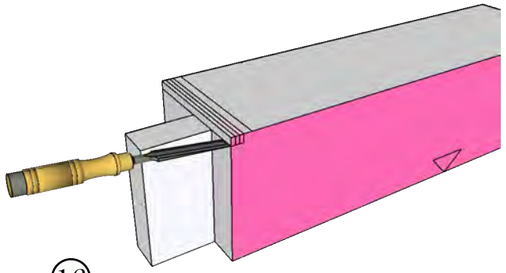
Validate the tenon is 2"



12

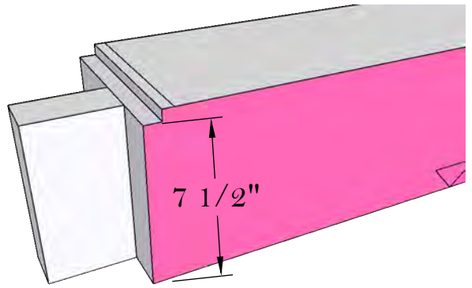
Use a handsaw or small circular saw; cut kerf lines 7, 8, & 9 (~1/2")

Tenon Cutting 2



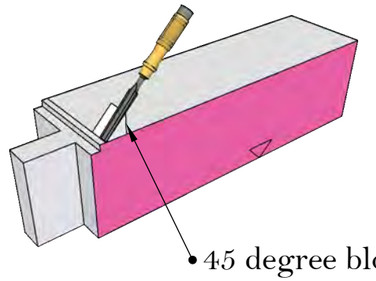
13

Use a chisel, remove shoulder for housing



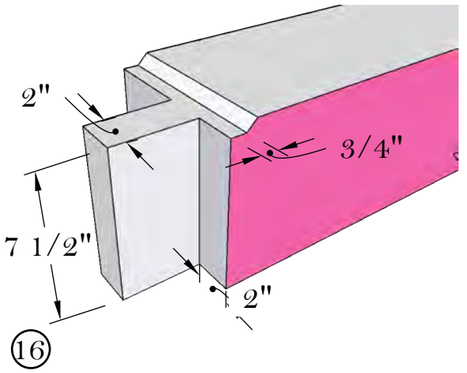
14

Shoulder set at 7 1/2"



15

Use a chisel and a 45 degree block to chisel out a 45 degree angle

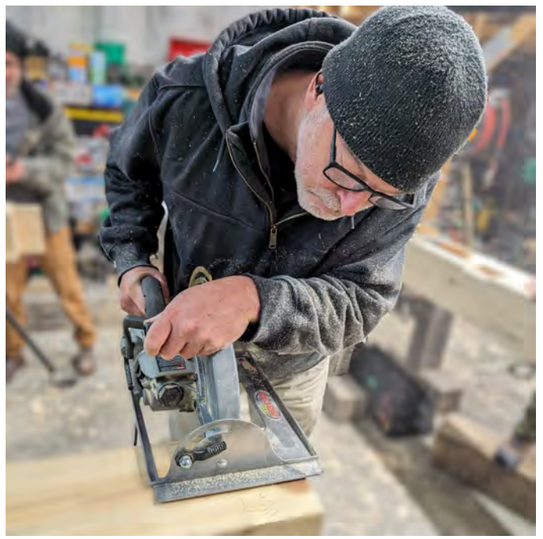


16

Tenon is complete

Cutting reference shoulder

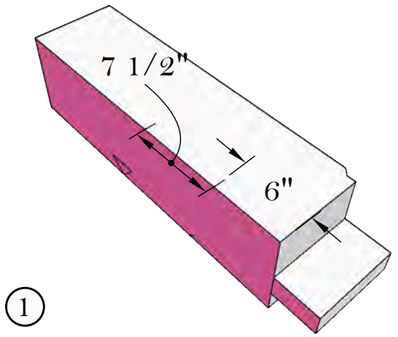
Drop cutting a tenon



Big Foot 10 1/4" saw with 75 degree swing base

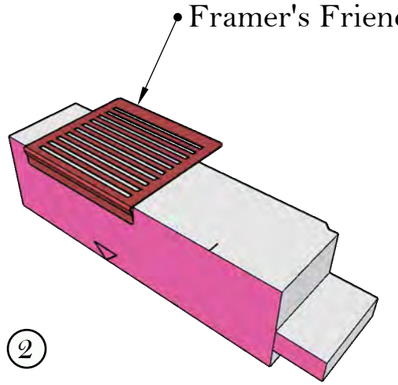
Animation Link: https://youtu.be/aeTZCabPYJE

Mortise Layout



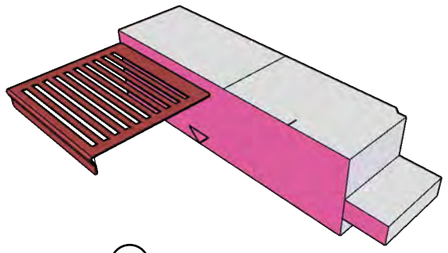
1

Layout mortise start and stop



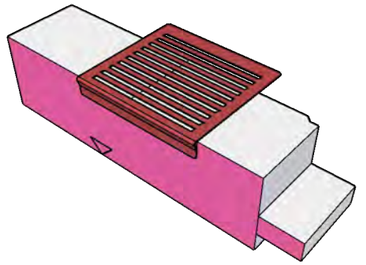
2

Align tool with reference face; knife housing



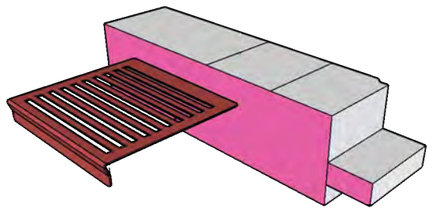
3

Bottom housing line



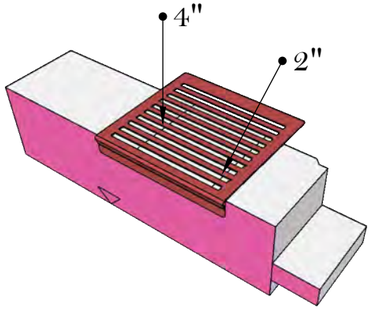
4

Align tool with reference face; knife housing



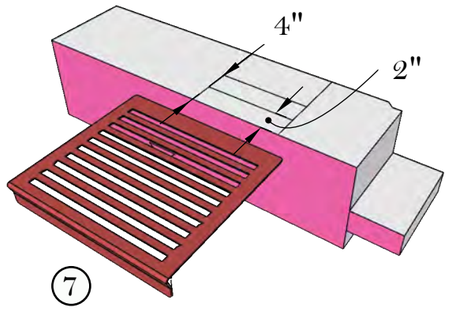
5

Top housing line



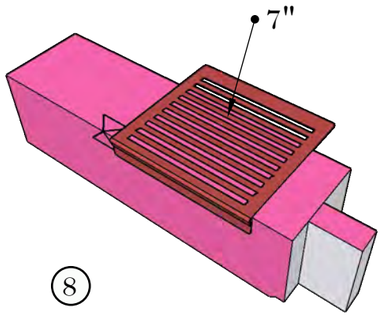
6

Align tool with reference face; knife lines at 2" and 4"



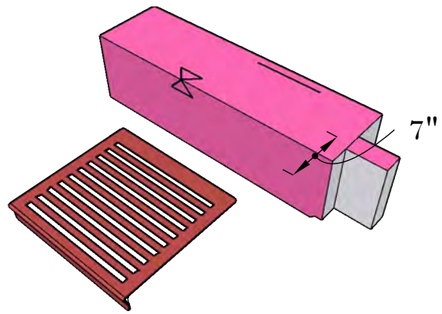
7

Mortise is 2" thick and 2" off the reference face



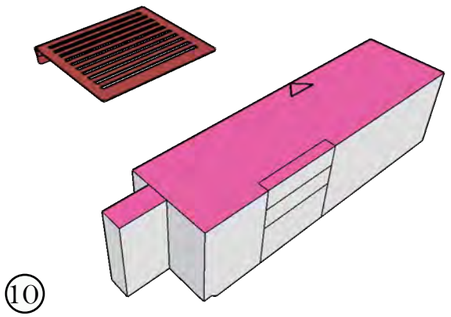
8

Align tool with reference face; knife housing at 7"



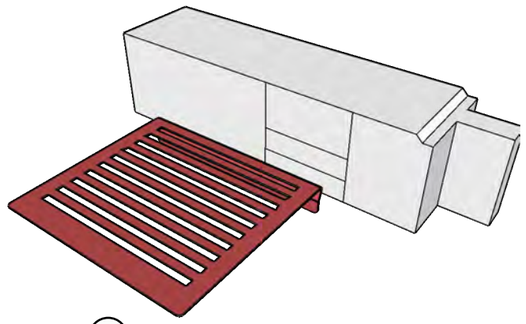
9

Housing line



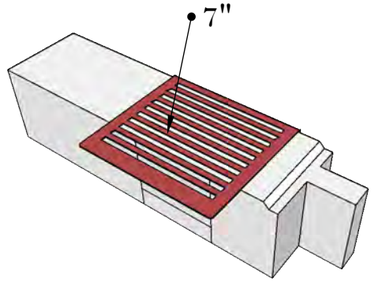
10

Connect lines



11

Rotate timber



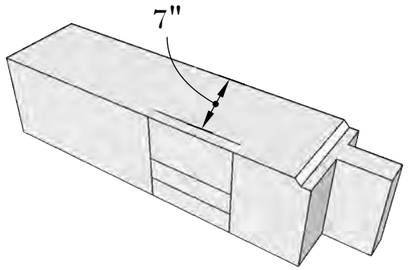
12

Align tool with reference face; knife the other housing line at 7"

Revision 1 (4.8.25)

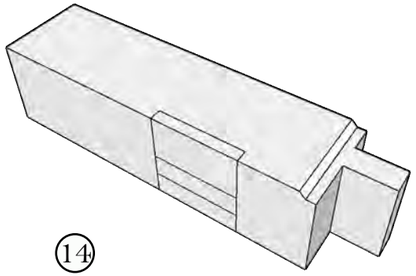
STAR HILL

Timber Frame Practices



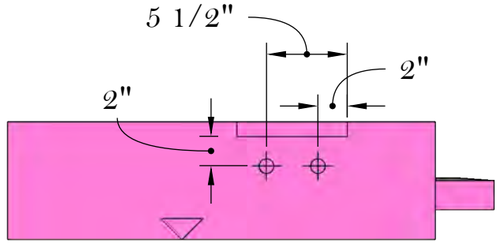
13

Housing line



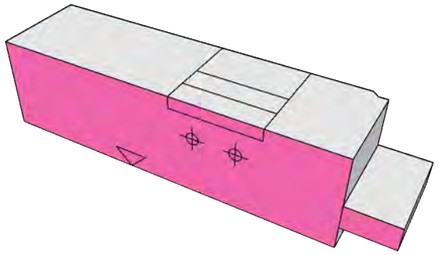
14

Connect lines



15

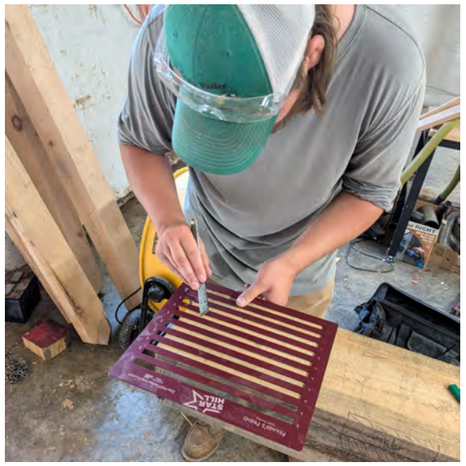
Layout peg holes on the reference face



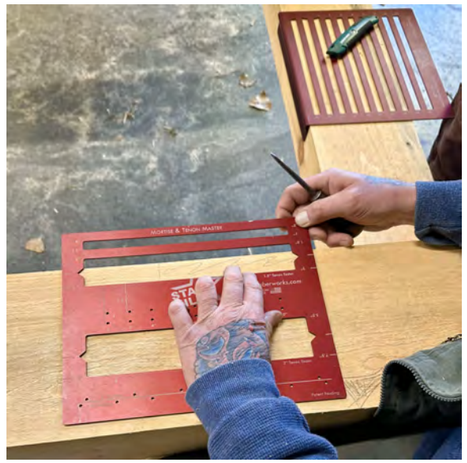
16

Layout complete; ready to cut

Star Hill Framer's Friend



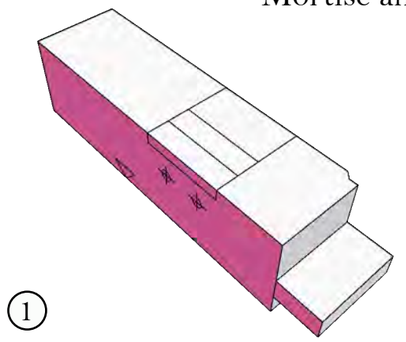
Layout using the Framer's Friend



Layout drill holes with the Mortise and Tenon Master

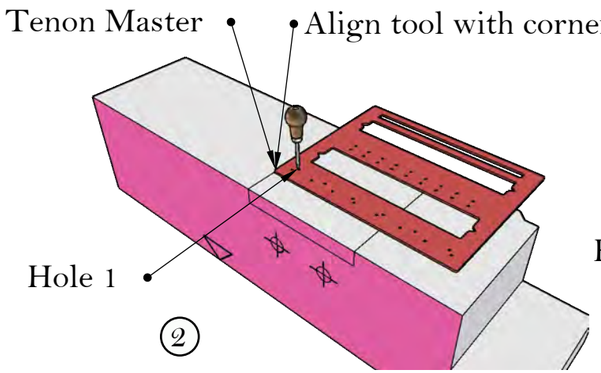
Cutting beams

Mortise Cutting



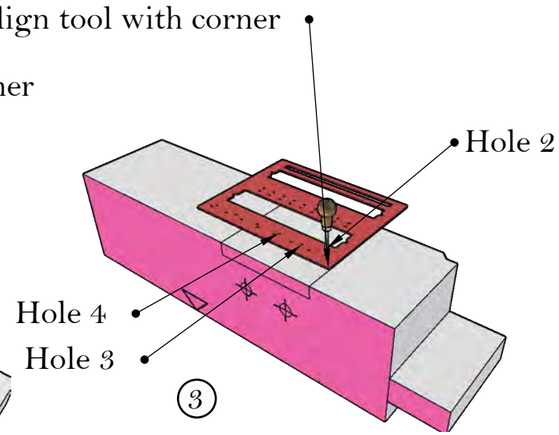
1

Mortise ready to cut



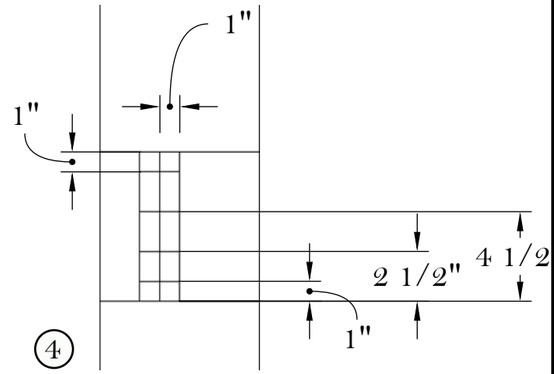
2

Align tool with corner, use 2" scale, mark 1st hole



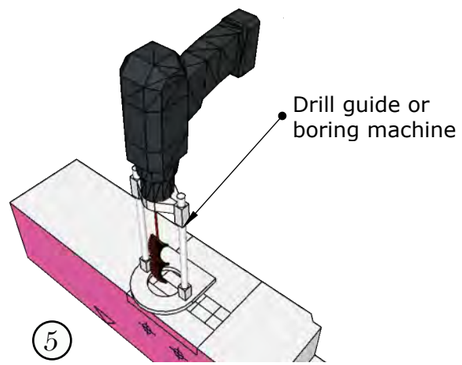
3

Shift tool to the other end of the mortise, align tool with corner, use the 2" scale, mark holes 2, 3, and 4



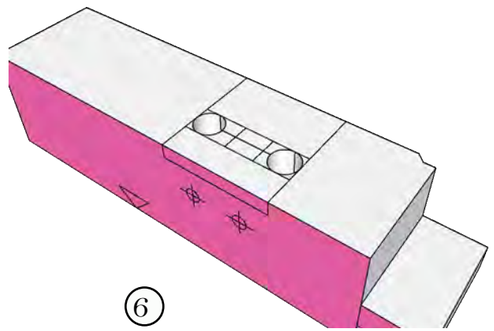
4

Starter hole layout complete



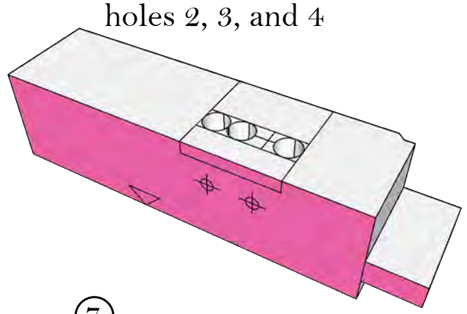
5

Set depth (tenon length + housing depth + 3/8"), drill 1st hole



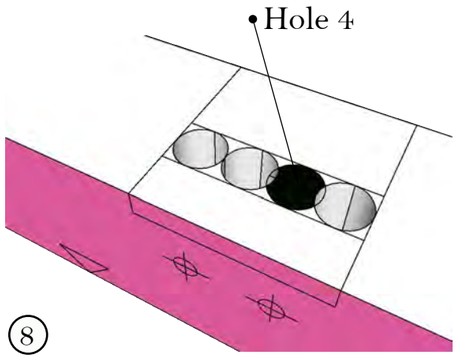
6

Drill the other end of the mortise



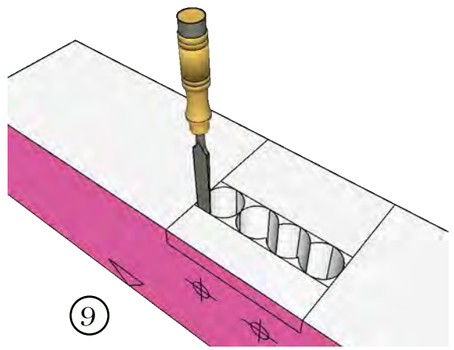
7

Drill 3rd hole



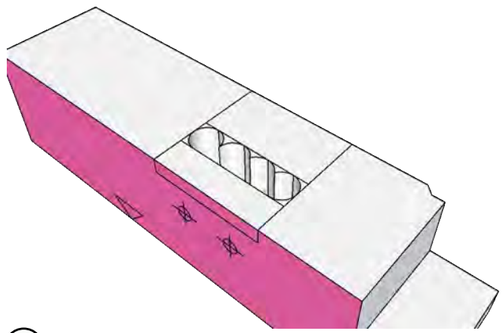
8

The 4th hole will not line up, split the difference and drill hole number 4. If the bit doesn't bite, use a smaller bit



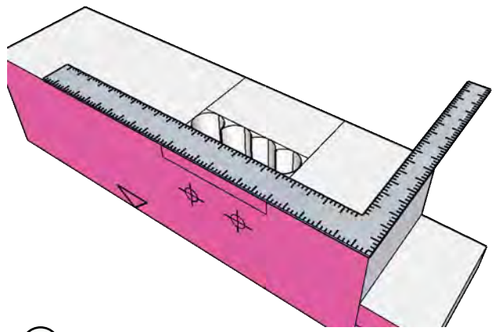
9

Start on the reference side, use a chisel to cleanup the mortise



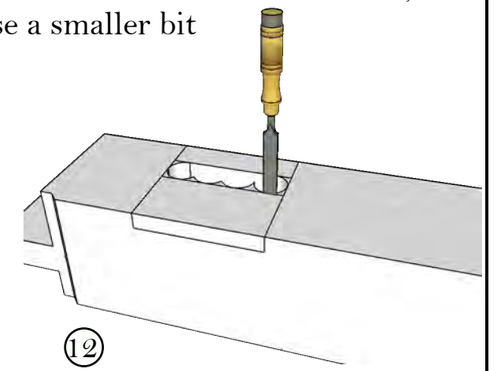
10

Remove material, ensure the sides of the mortise stay plumb



11

Check the reference side, validate the edge is right on 2"

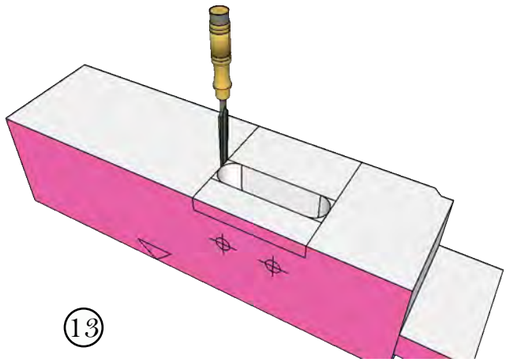


12

Use a chisel to remove material from the non reference side

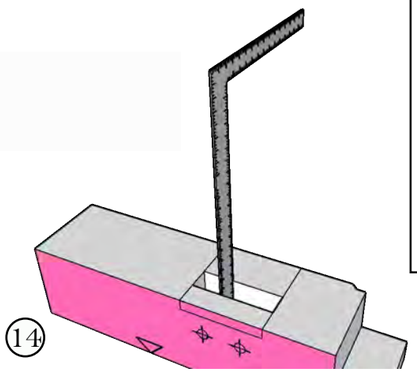
Revision 1 (4.8.25)

Mortise Cutting 2



13

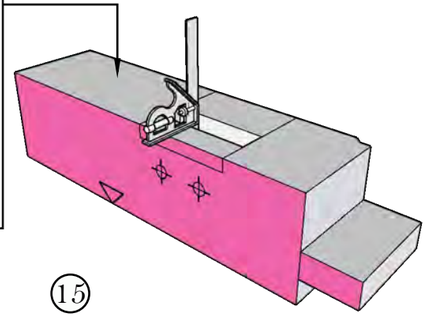
Use a chisel or corner chisel to clean up the corners



14

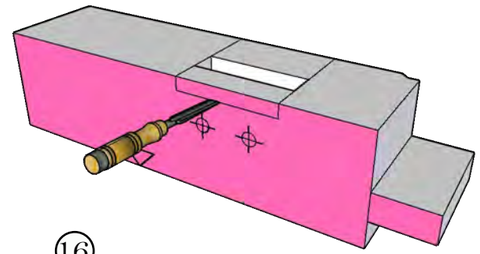
Use a framing square to verify the mortise is right on 2"

If this surface is not square to the reference face, register a framing square on the reference face and set the combo square on top of the framing square



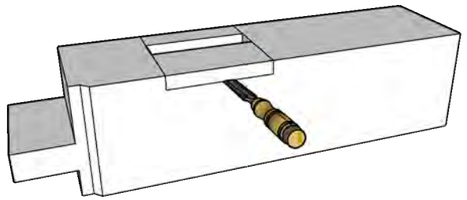
15

Use a combo square to check the depth (mortise depth + housing depth + 3/8", validate sides of mortise are plumb



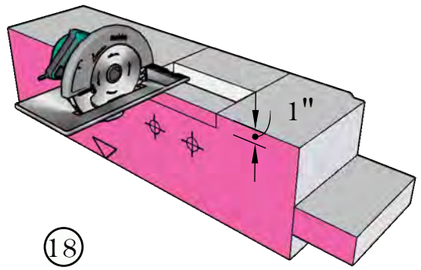
16

Set housing line with a chisel



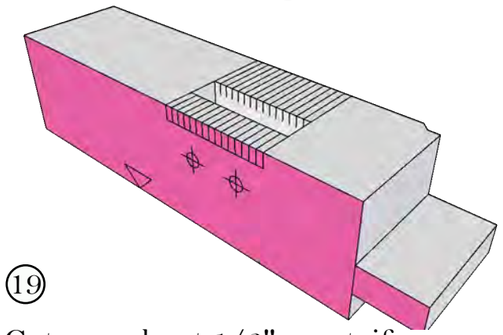
17

Use a chisel, set the housing line on the other side of the timber



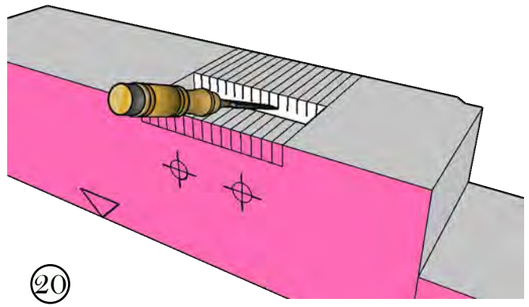
18

Set the saw at ~1" make material removal cuts



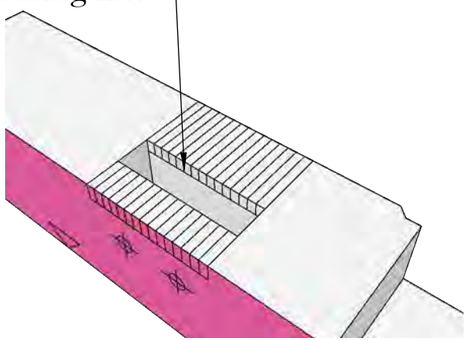
19

Cuts are about 1/2" apart, if there are knots, decrease the distance between cuts



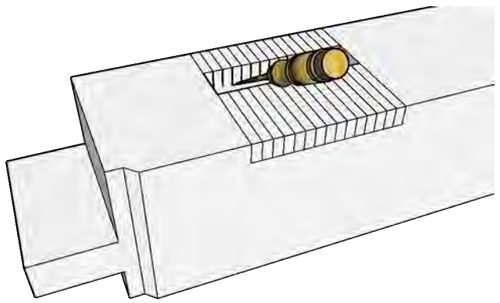
20

Use a chisel, set the housing line inside the mortise at bottom of the cuts



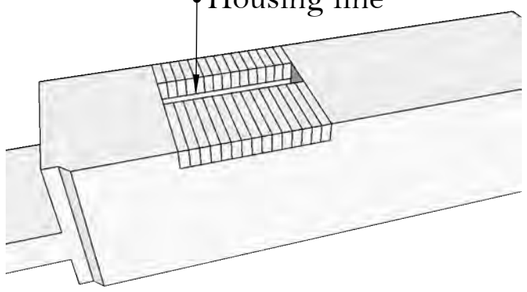
21

Score line



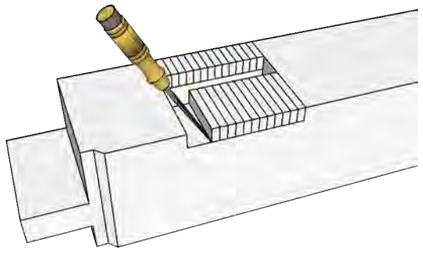
22

Set the other inside housing line with a chisel



23

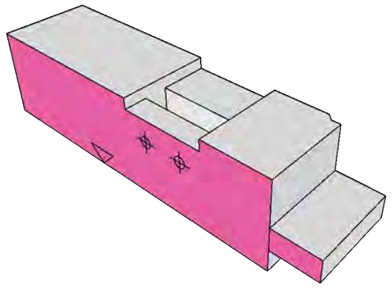
Score line



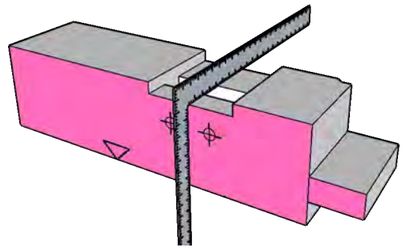
24

Remove blocks to make room for chisel

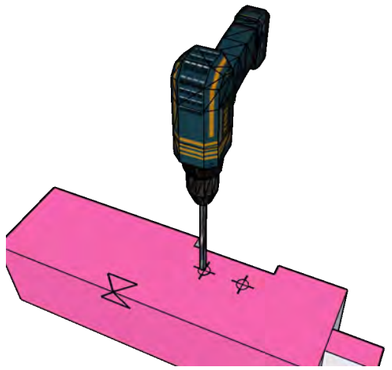
Revision 1 (4.8.25)



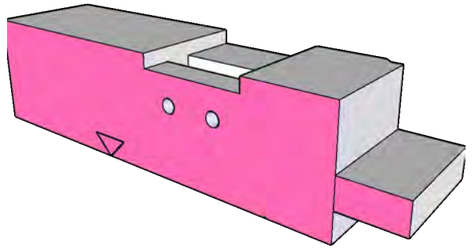
25
Remove waste wood from both sides of housing



26
Use a framing square, validate it touches on the edges with a touch of daylight under the square and the faces are perpendicular to the reference face

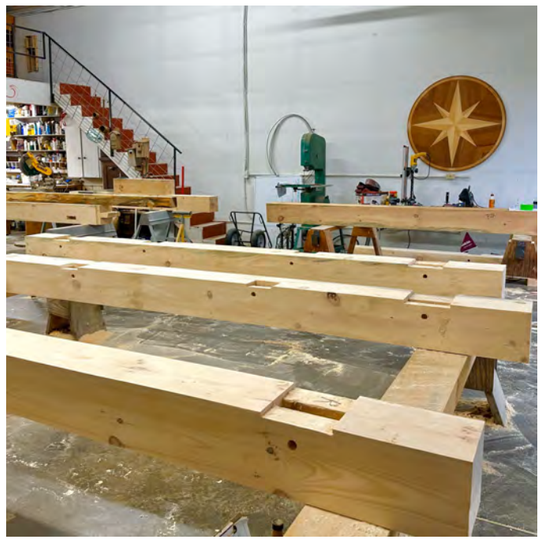


27
Drill peg holes



28
Mortise is ready

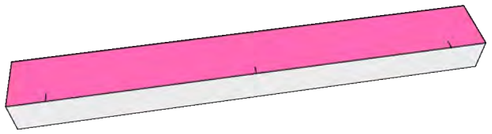
Chisel sharpening



Timbers staged for work

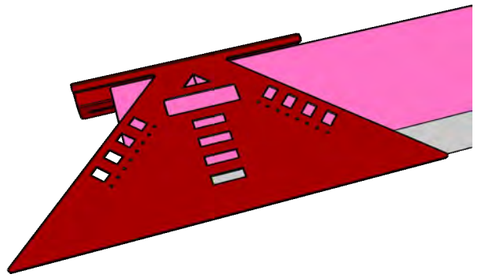
Raising sauna with a lifting shear

Knee Brace Layout



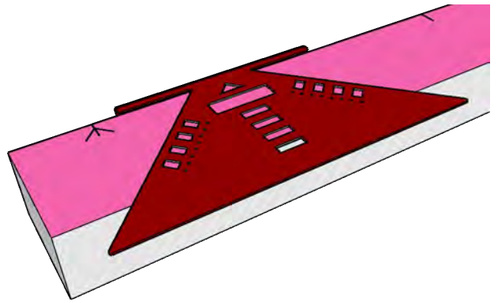
1

Layout knee brace long point to long point, mark center if a curved brace is desired



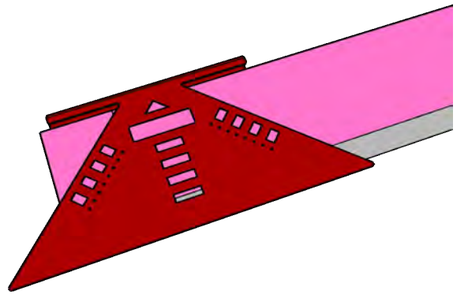
2

Use a sharp pencil, mark a chevron at the long point mark



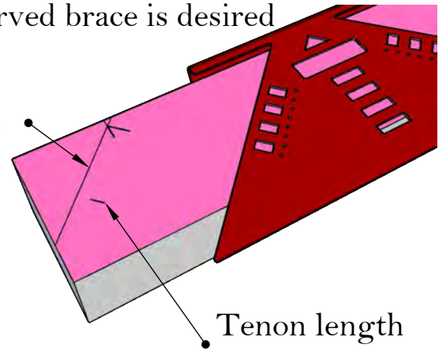
3

Long point chevron



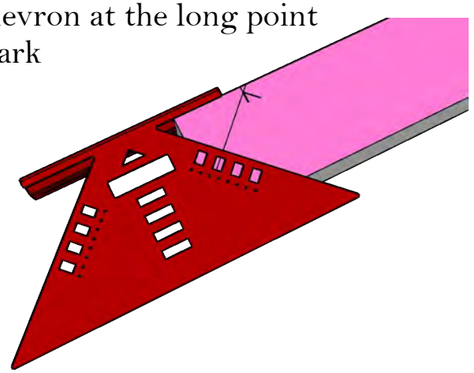
4

Align tool with reference face and chevron, draw line and mark tenon length



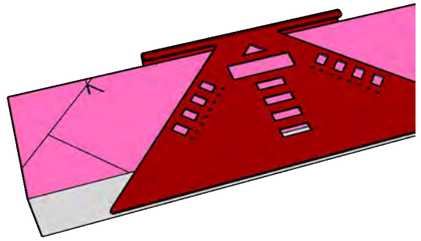
5

Top housing line



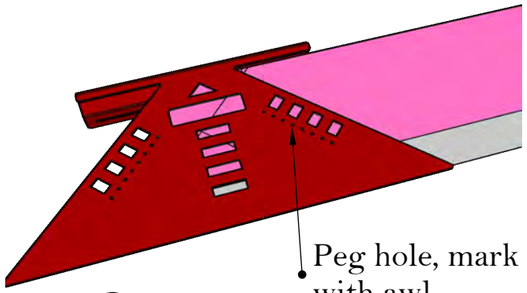
6

Align tool with reference face and tenon length mark, draw bottom of tenon



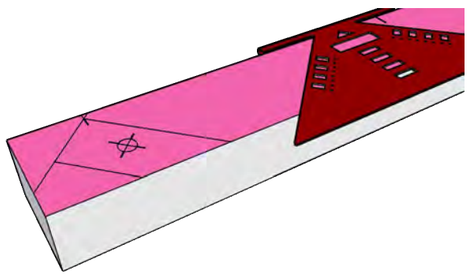
7

Bottom of tenon



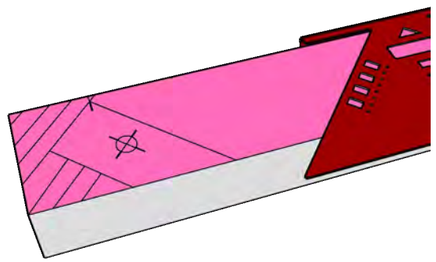
8

Align tool with reference edge and chevron, knife the shoulder line, mark peg hole (if desired)



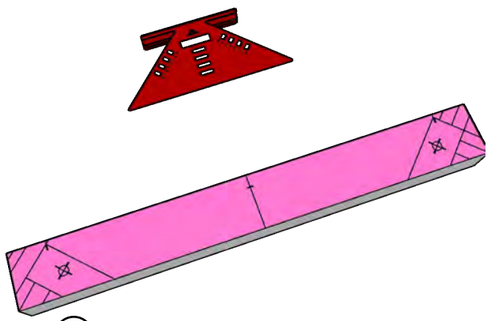
9

Tenon layout



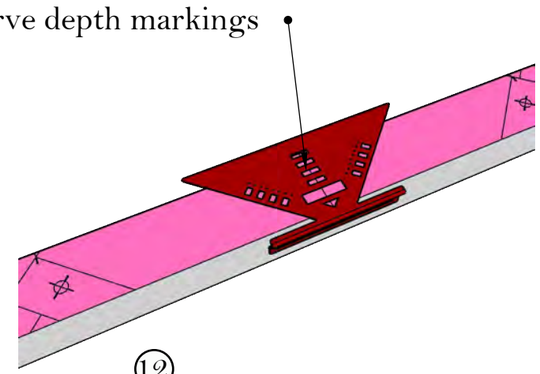
10

Mark waste wood



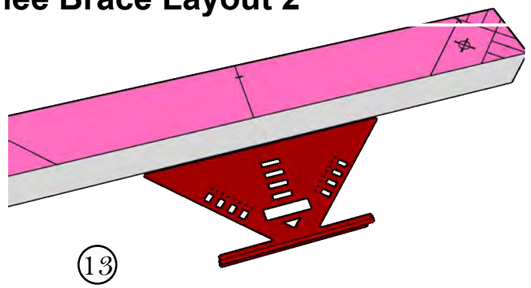
11

Reverse the knee brace, repeat the process on the other end



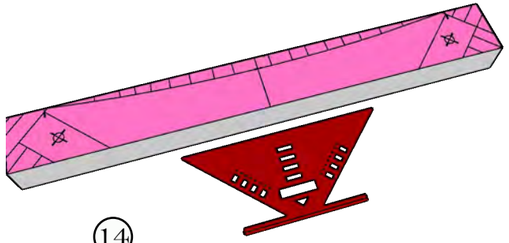
12

Reverse the layout tool, align with center mark chevron, mark the curve depth



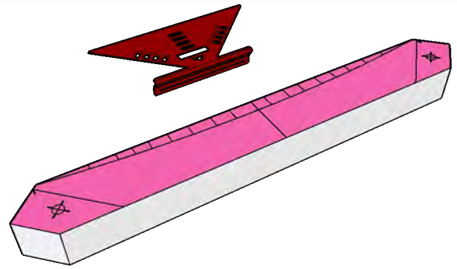
13

Tenon curve mark



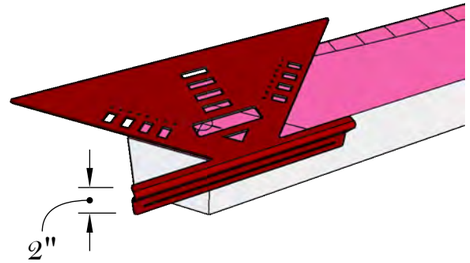
14

Use a flexible piece of scrap, mark the knee brace curve (if desired)



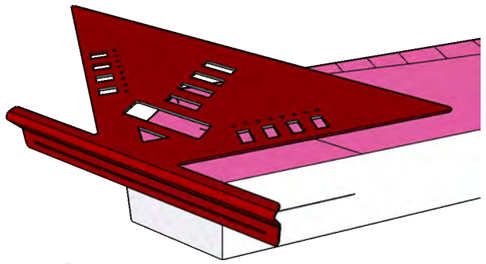
15

Cut out knee brace blank



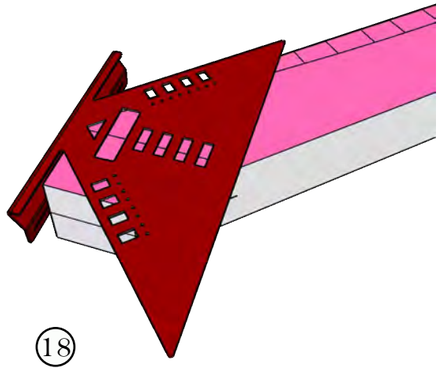
16

Use the side of the tool, mark depth at 2"



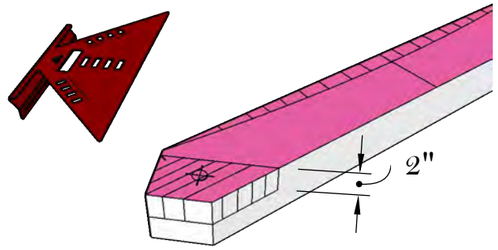
17

Rotate the tool, mark depth at 2"



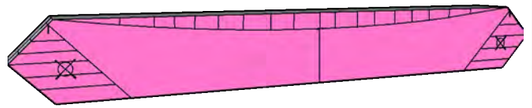
18

Rotate the took\l, mark depth at 2"



19

Tenon layout complete



20

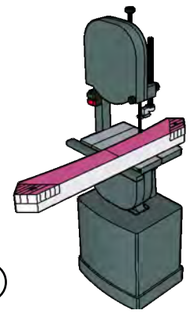
Repeat the process on the other end

Cutting a housing with an axe

10' x 10' Pergola

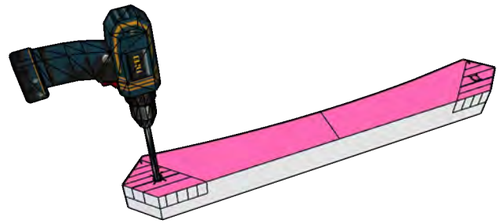
Knee brace layout with EZ Brace Revision 1 (4.8.25)

Knee Brace Cutting



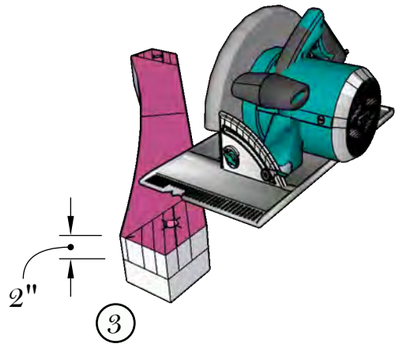
1

Use band saw or chainsaw and chisel to cut knee brace curve (if desired)



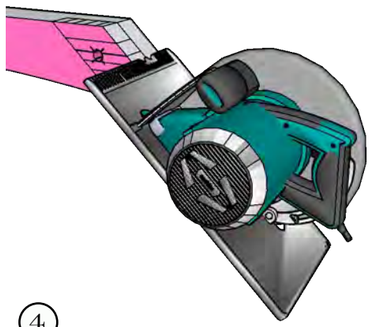
2

Drill peg hole, repeat on the other end



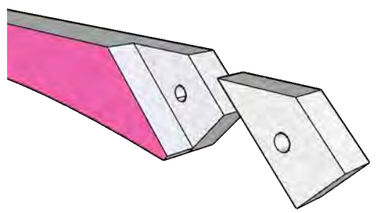
3

Set saw to 2", cut shoulder



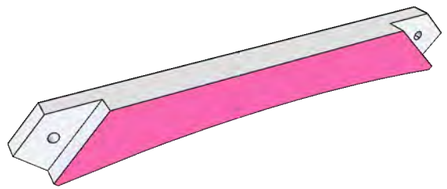
4

Set saw to tenon depth, cut tenon cheek



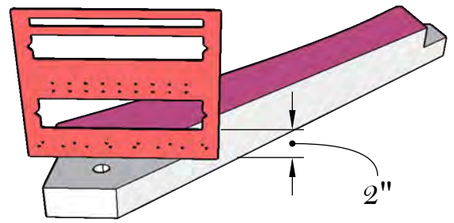
5

Remove this block



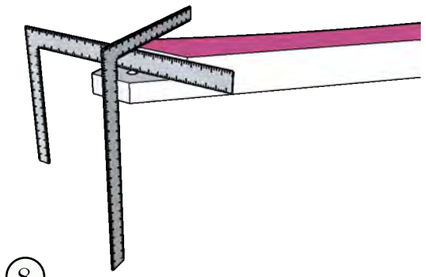
6

Repeat process on the other end



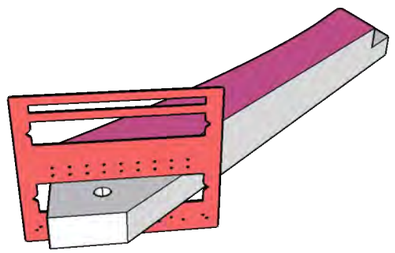
7

Validate shoulder is at 2" adjust tenon cheek with a chisel as needed



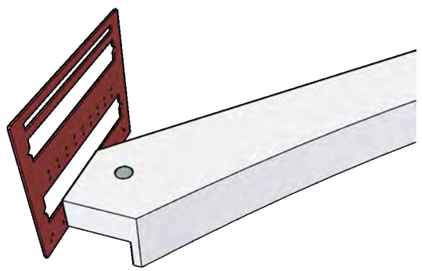
8

Use 2 framing squares, validate tenon is plumb



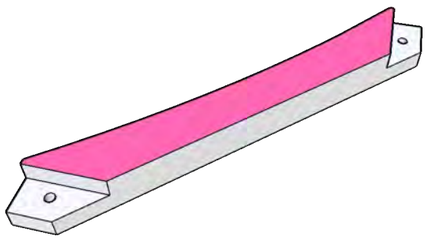
9

Check the tenon is at 2"



10

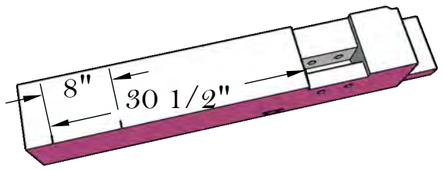
If the tenon is >2", flip over the knee brace and sand the backside



11

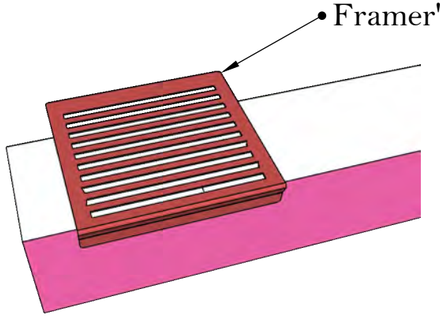
Knee brace ready for installation

KB Mortise Layout



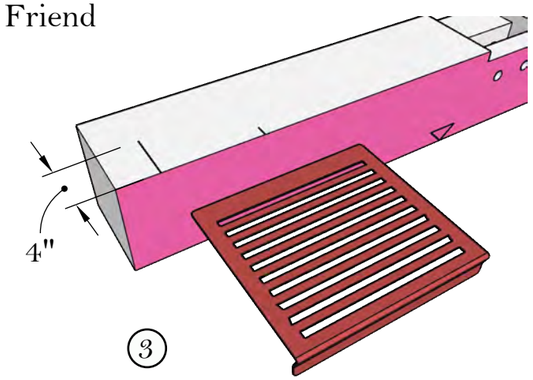
1

Mark top and bottom of mortise, measure for bottom of mortise 1st (30 1/2"), then, measure to top (8")



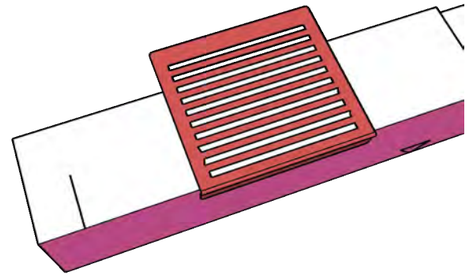
2

Align tool to reference face, knife mortise bottom (4" across timber)



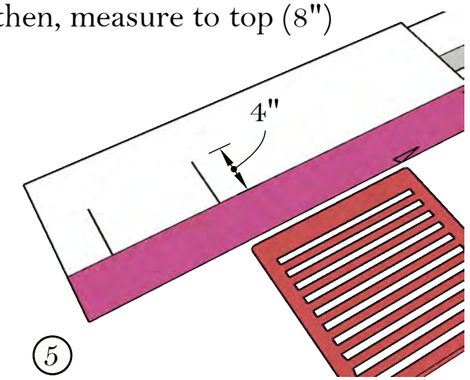
3

Bottom knife line



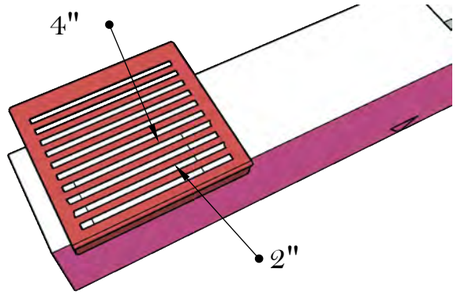
4

Align tool with reference face, knife mortise top (4" across timber)



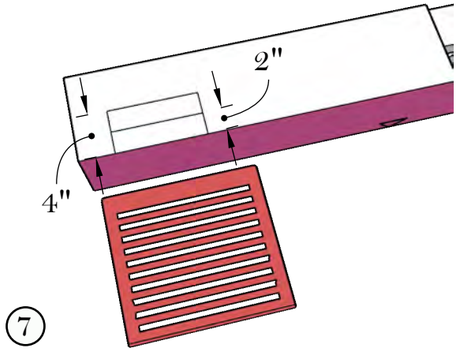
5

Top housing line



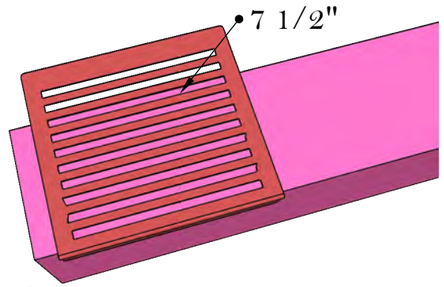
6

Align tool with reference face, knife 2" and 4"



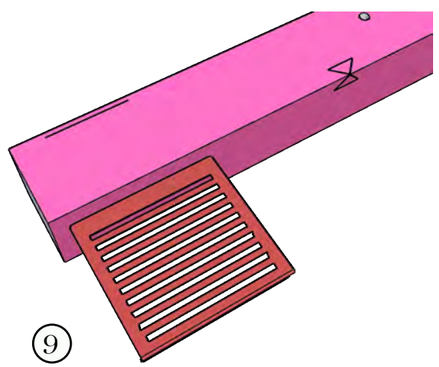
7

Mortise is 2" thick and located 2" off the reference face



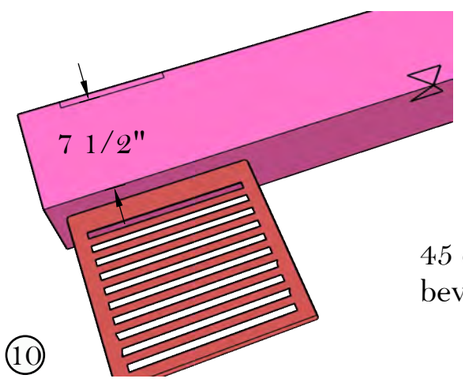
8

Rotate timber, align tool to reference face, knife housing line (7 1/2" from reference face)



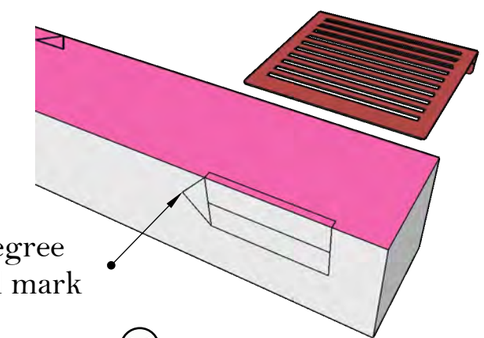
9

Housing line



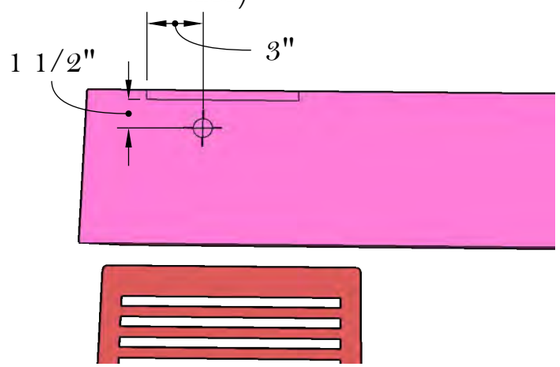
10

Connect the housing line



11

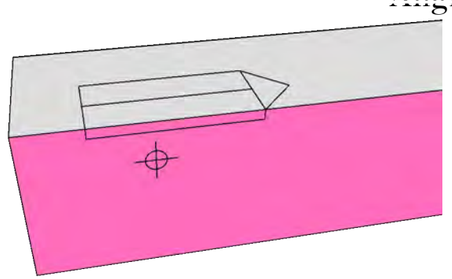
Add a mark that shows which way the bevel points, the bevel points toward the connecting member



12

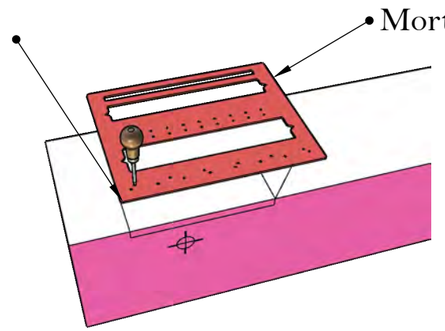
Layout peg hole on the reference face, 1 1/2" below housing, 3" from bottom

KB Mortise Cutting



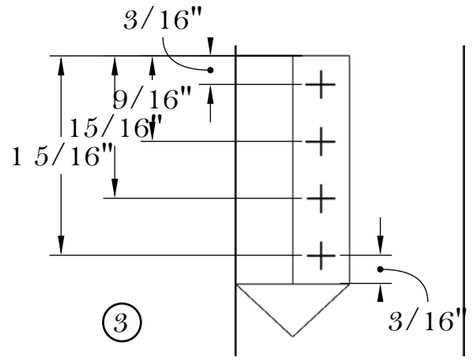
①

Knee brace layout complete, ready to cut



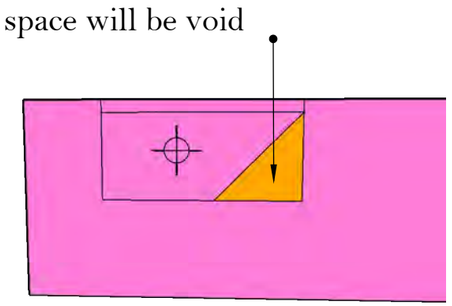
②

Align tool to corner, select the 2" scale, mark starter holes



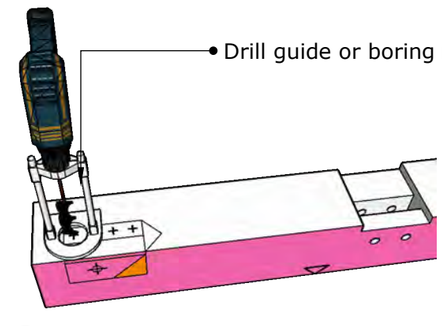
③

Starter hole layout



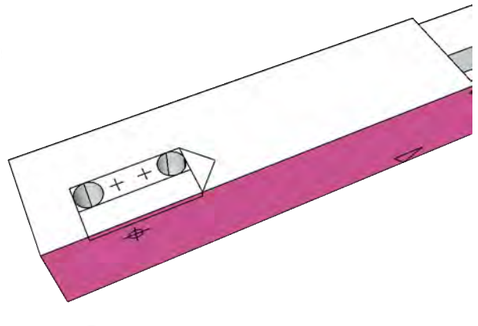
④

Knee brace tenons are cut at 45 degrees; however, we drill retangular holes for the mortises



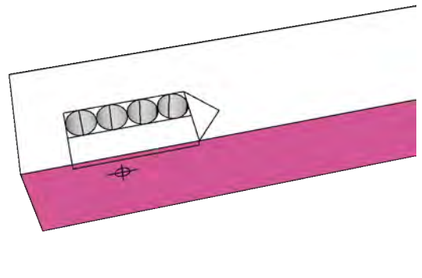
⑤

Set depth (mortise depth + housing depth + 3/8"), align the drill stand and bit screw to the starter holes



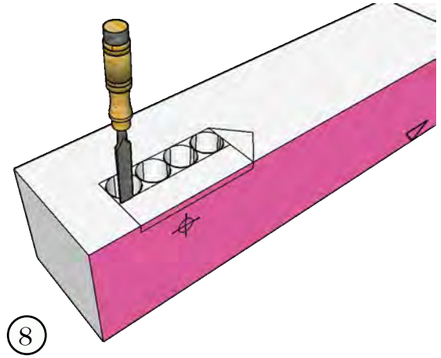
⑥

Drill both ends



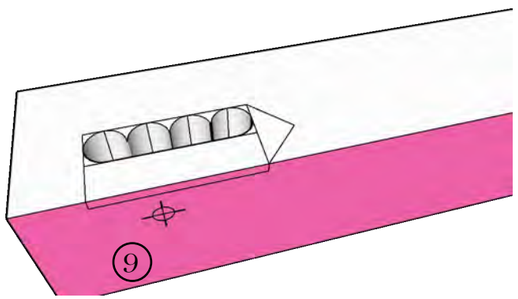
⑦

Drill center 2 holes



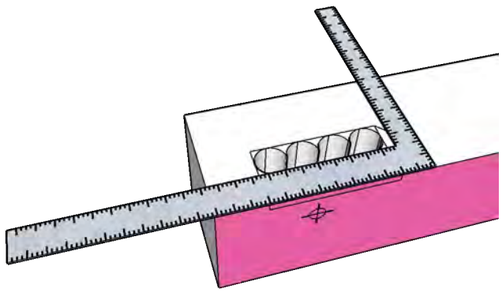
⑧

Use a chisel, remove waste wood from the referene side



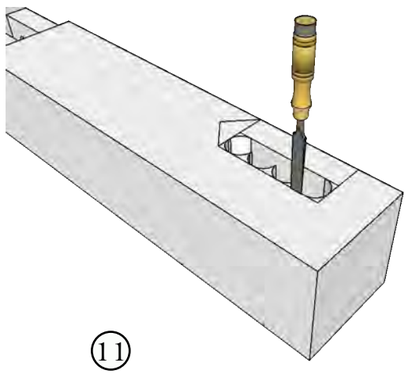
⑨

Material removed



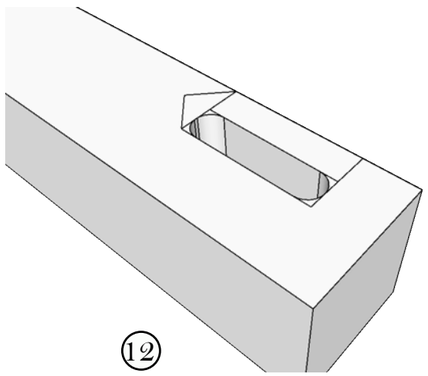
⑩

Check the reference side with a framing square, make sure the housing is right on 2"



⑪

Use a chisel, remove waste wood from the non reference side

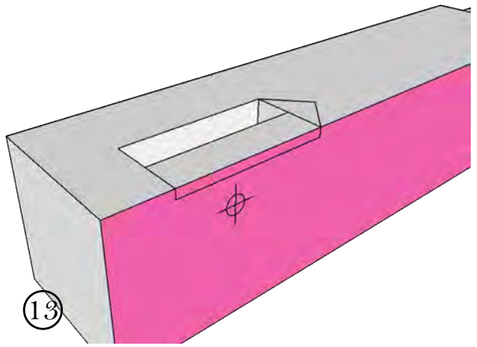


⑫

Use a chisel or corner chisel to clean up the ends of the mortise

Revision 1 (4.8.25)

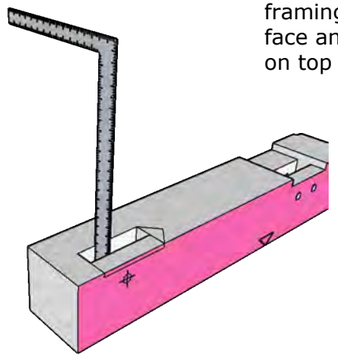
KB Mortise Cutting 2



13

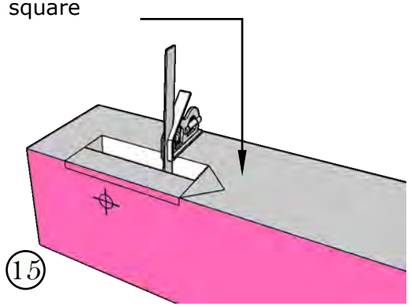
Mortise is squared up

If this surface is not square to the reference face, register a framing square on the reference face and set the combo square on top of the framing square



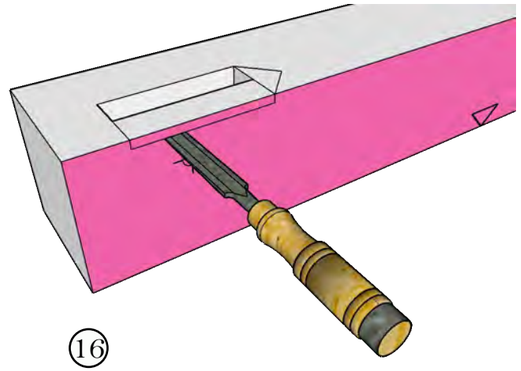
14

Check the mortise with a framing square, validate it is 2"



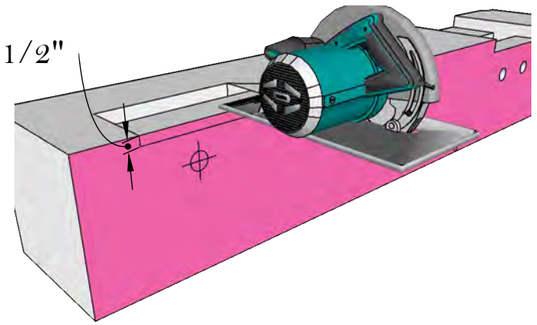
15

Check the depth (mortise depth + housing depth + 3/8"), validate mortise is plumb



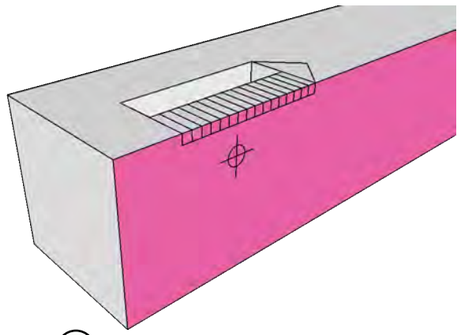
16

Check the reference side with a framing chisel, make sure the housing is right on 2"



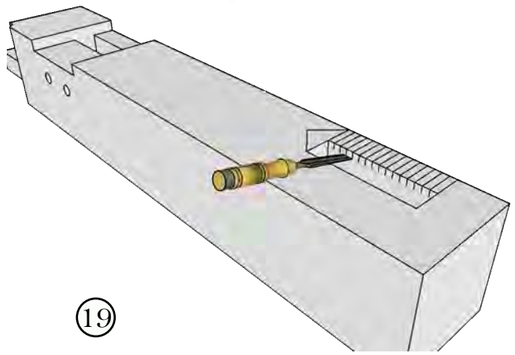
17

Use a chisel, remove waste wood from the non reference side



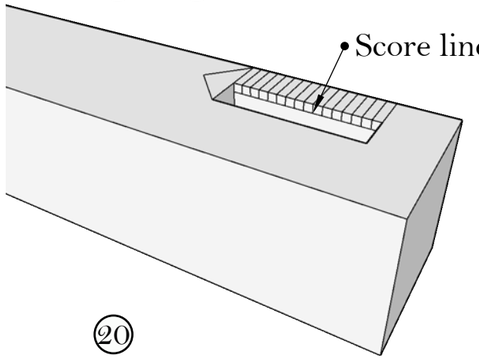
18

Use a chisel or corner chisel to clean up the ends of the mortise



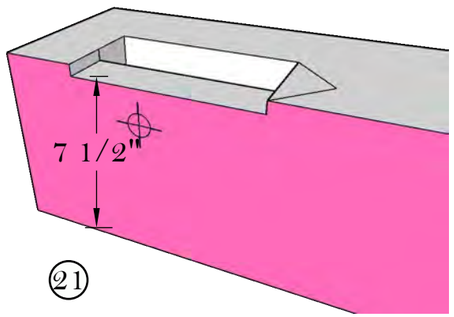
19

Use a chisel, set inside housing line



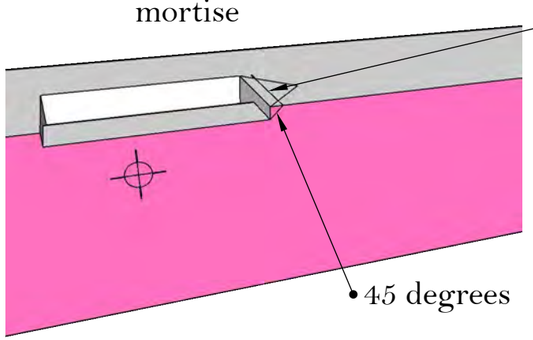
20

Housing line



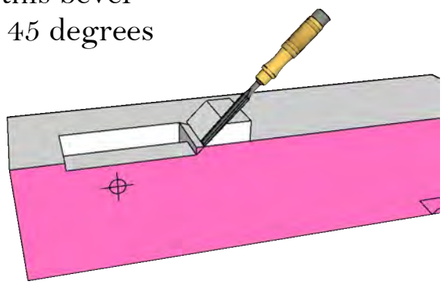
21

Remove housing material, validate housing is at 7 1/2"



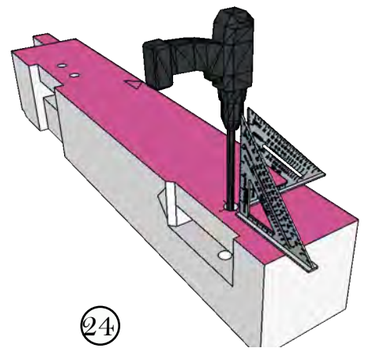
22

Measure housing distance, draw bevel line at 45 degrees



23

Use a 45 degree block to register chisel, remove waste wood from bevel

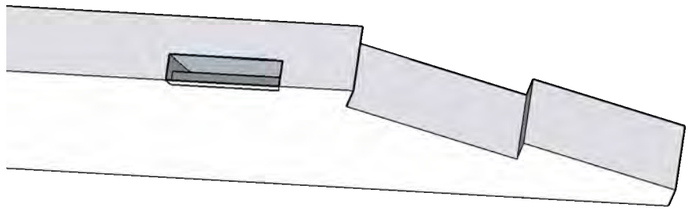


24

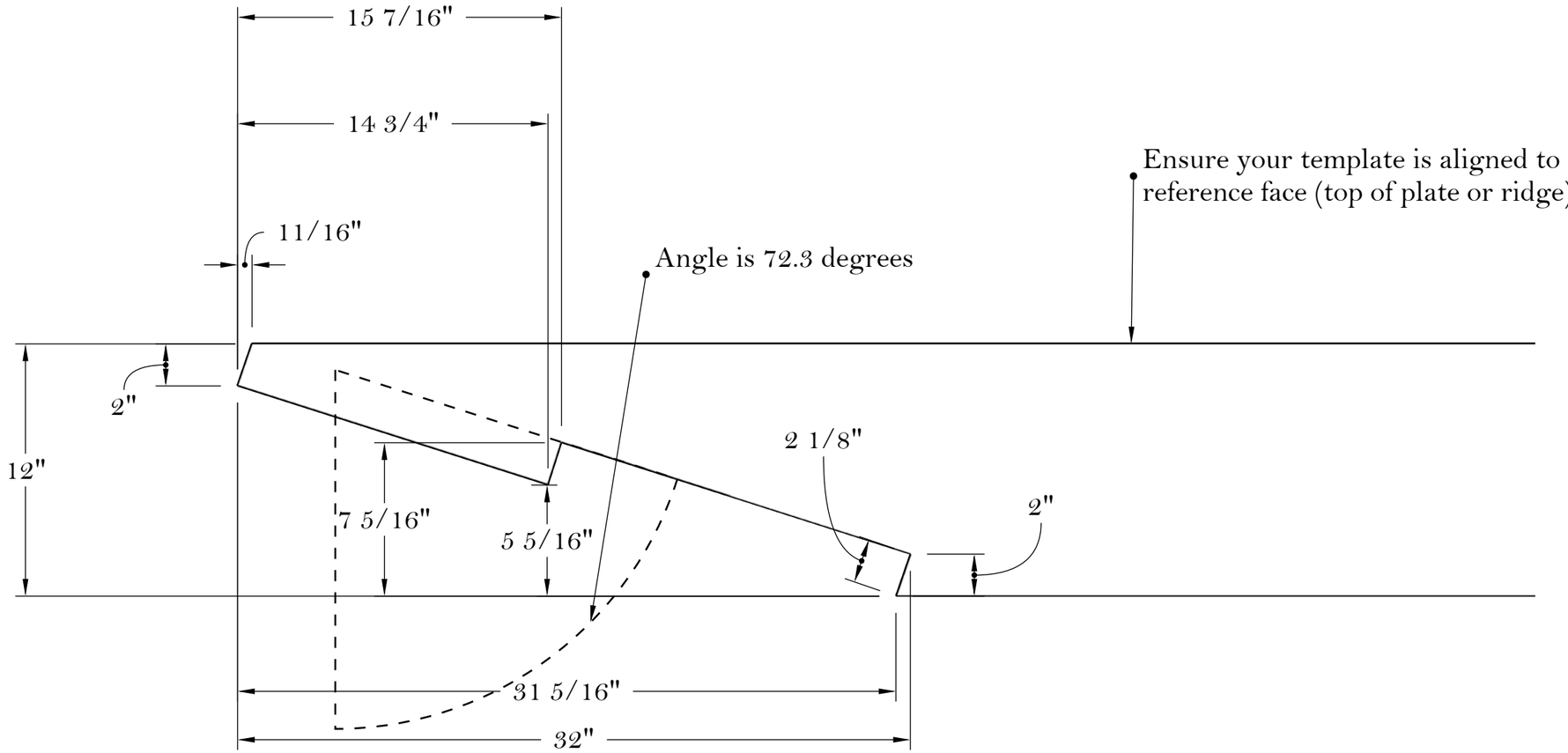
Use two speed squares for reference, drill peg hole

Revision 1 (4.8.25)

Scarf Joint



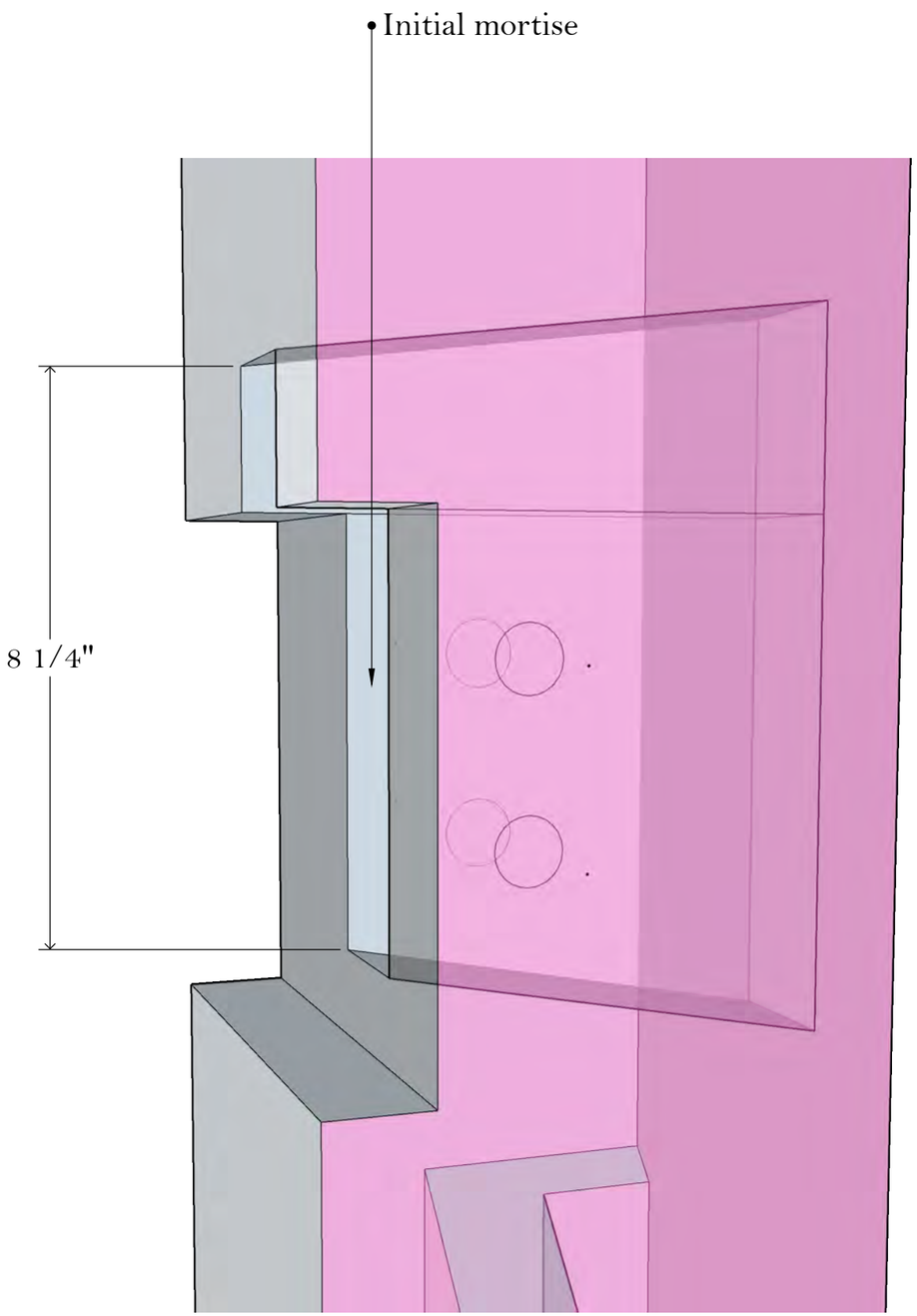
This particular under-squinted scarf design is secured with
Timberlok or Spax structural screws. There are many variations for a scarf joint.
Download our free reference, "Historic American Timber Joinery" for additional examples
https://www.starhilltimberworks.com/product/historic-american-timber-joinery/

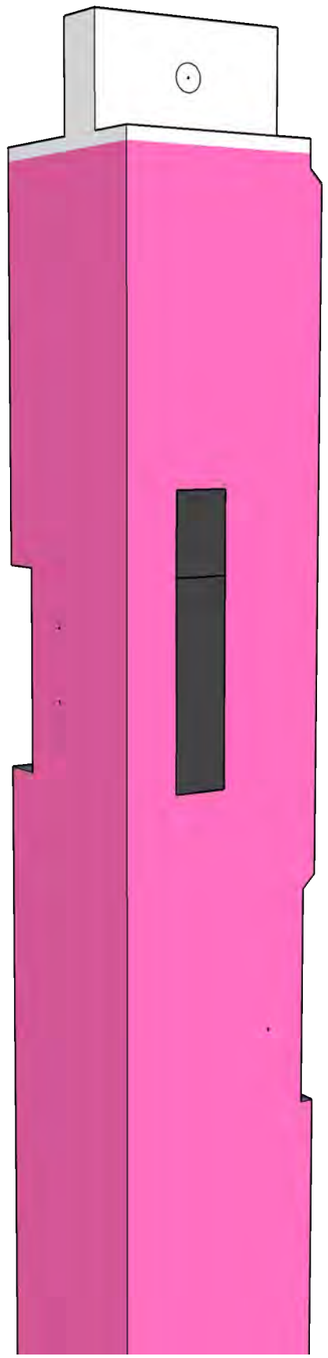


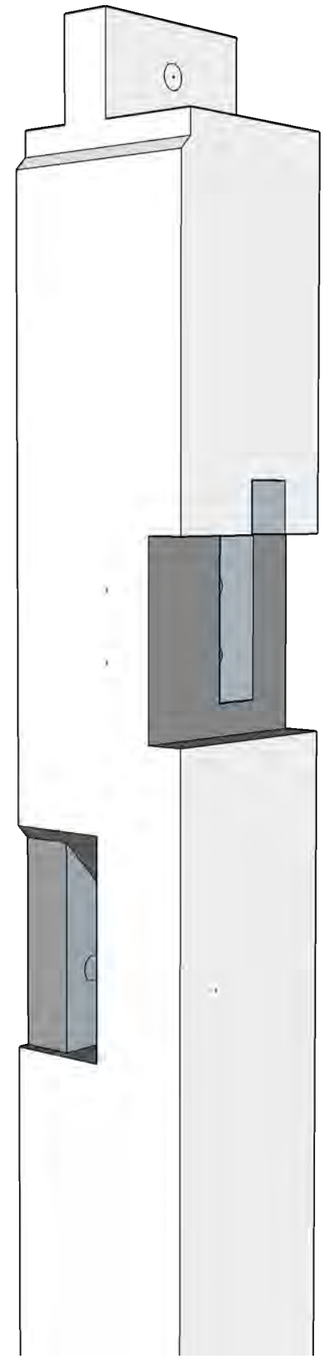
Make a template that is both precise and accurate out of MDF or similar material, template may be used for both top and bottom sections of the layout. Make sure the template is exactly the depth of your timber (in this case 12").

When template is ready, draw out the scarf, reverse the template; validate that other 1/2 lines up properly

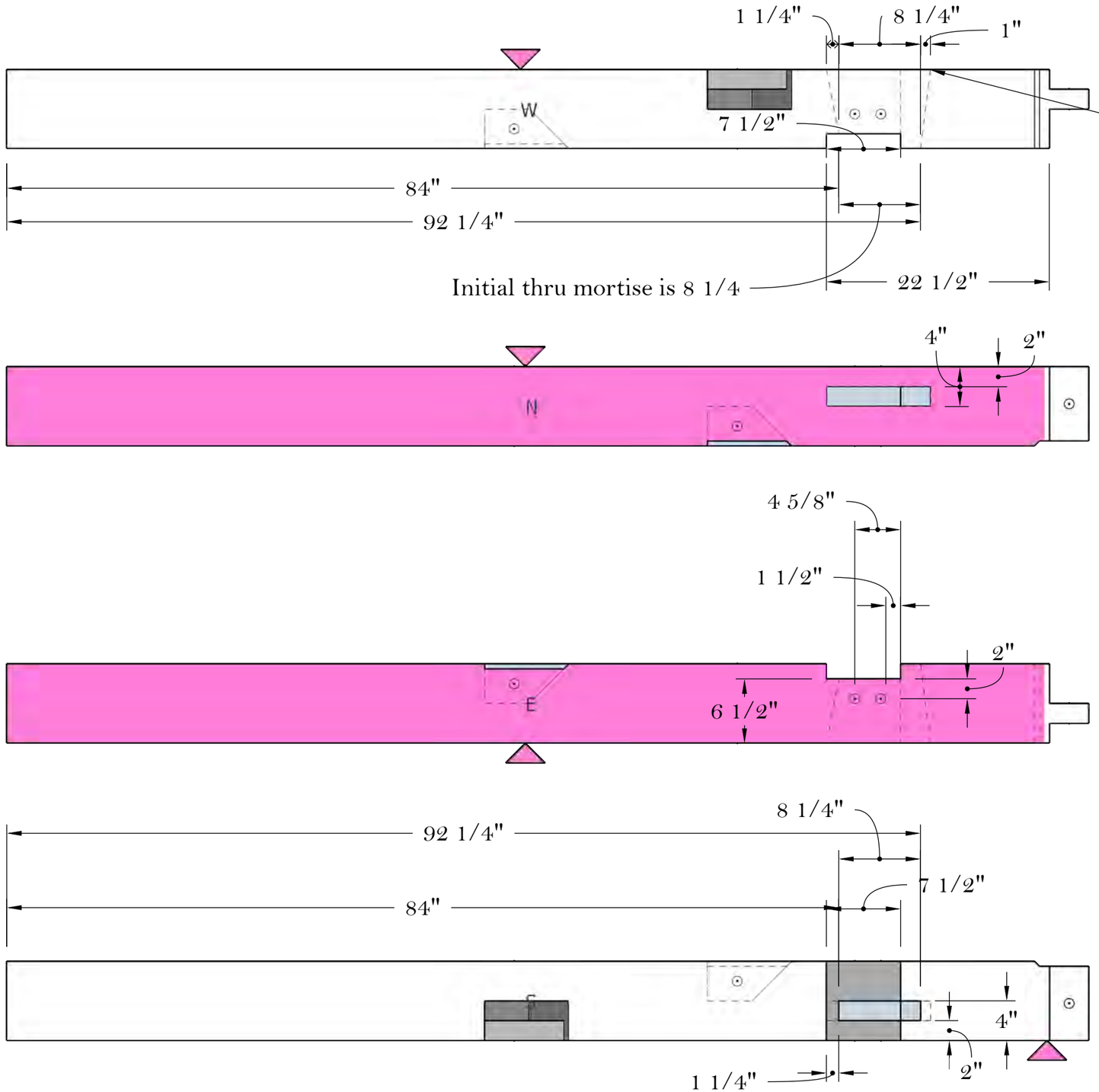
1/2 Dovetail Mortise





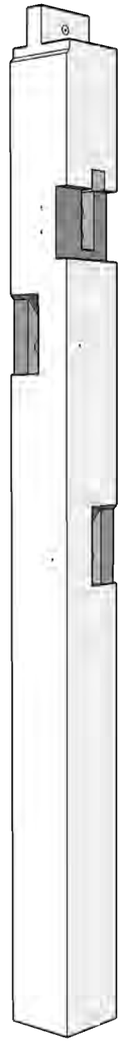


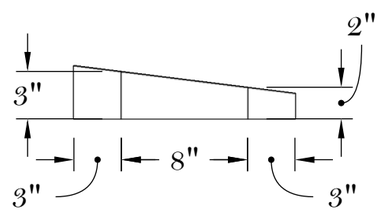
1/2 Dovetail Mortise 2



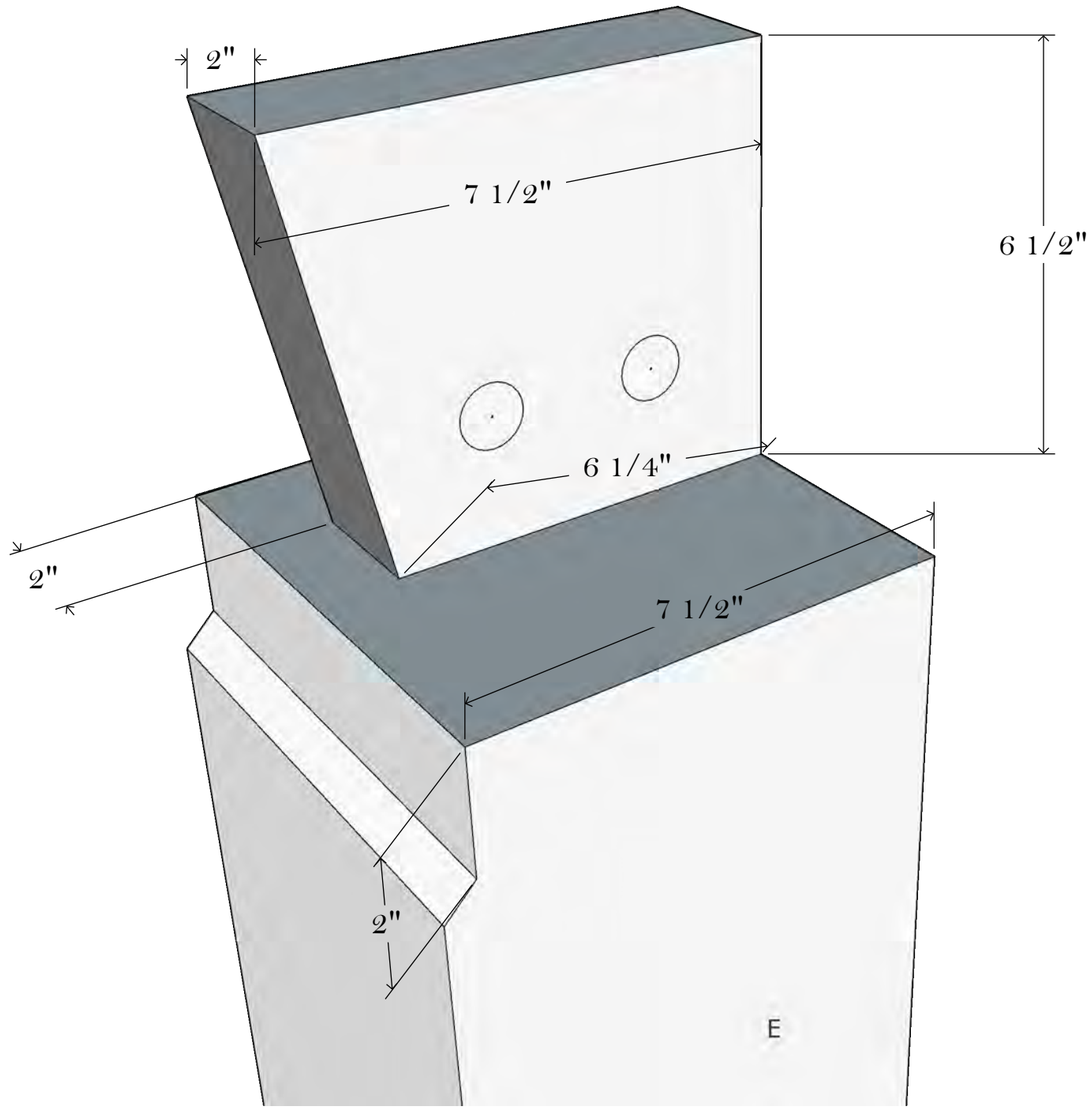
1. Cut through mortise
2. Cut housing
3. Use a saw to kerf dovetail
4. Chisel out dovetail waste
5. Check joint with a template

Note: Through mortise is cut a bit over 1/2 way through the timber. Flip timber, finish the through mortise from the other side.



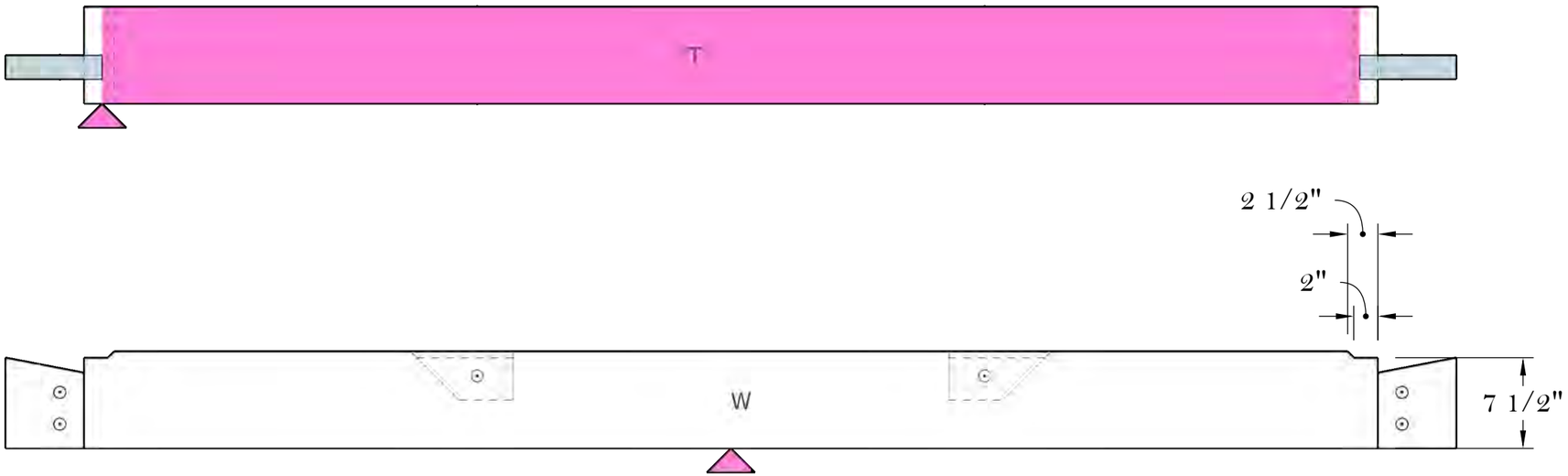


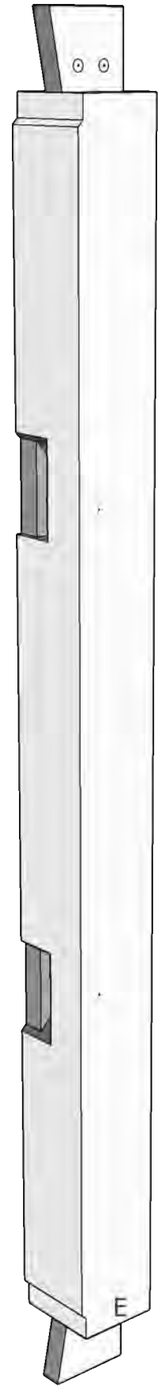
Hardwood wedge is 2" thick

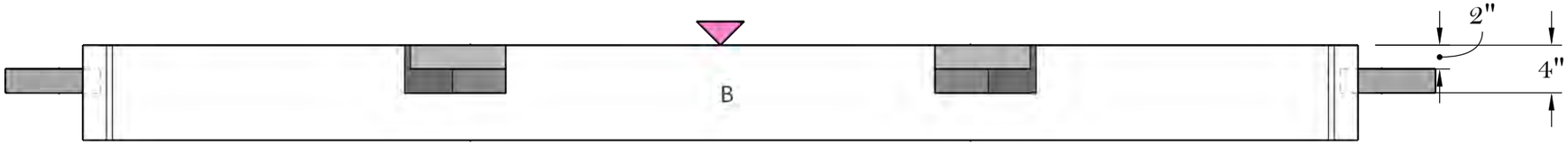


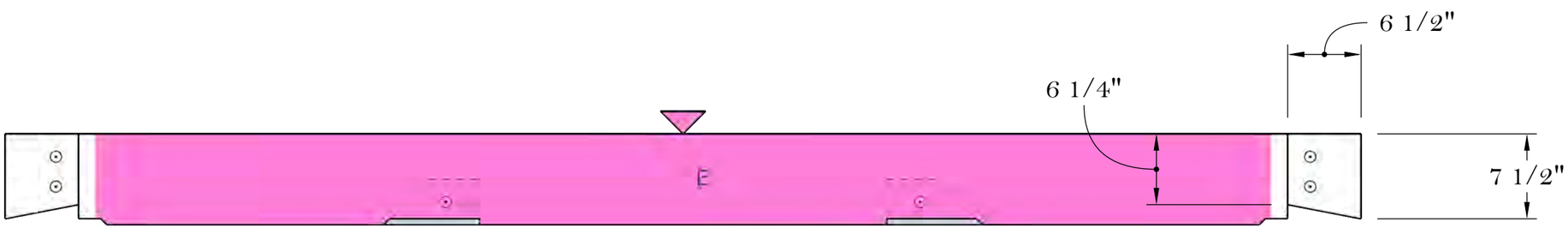
Note: Prior to cutting the 1/2" Dovetail mortise, cut a tenon template that can be used to check the fit.

1/2 Dovetail Tenon 2

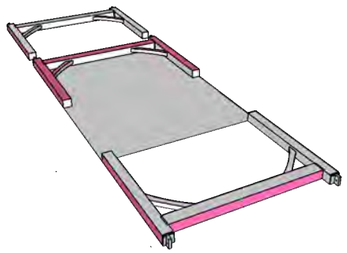




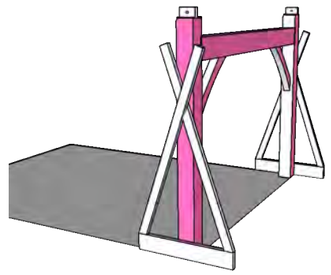




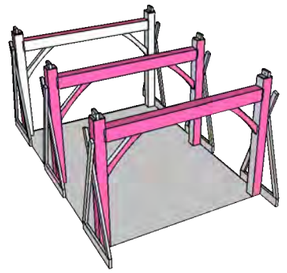
Frame Raising



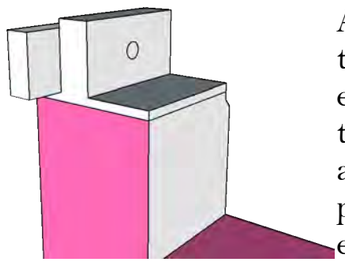
1
Assemble and place bents, make sure reference faces align with plan



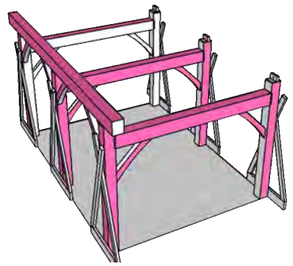
2
Stand up and brace 1st bent using manpower, crane, or lifting shear



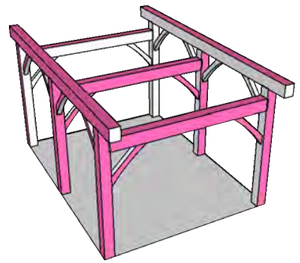
3
Stand up and brace the 2nd and 3rd bent, check plumb, square, and spacing



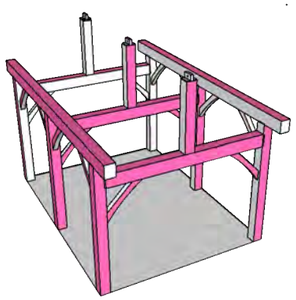
4
Add a 2 x 4 to the top of each post, this will allow the post to set evenly



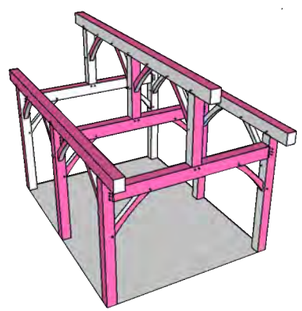
5
Start knee braces, lift plate onto posts, rotate 2x4, lower plate, and remove 2x4



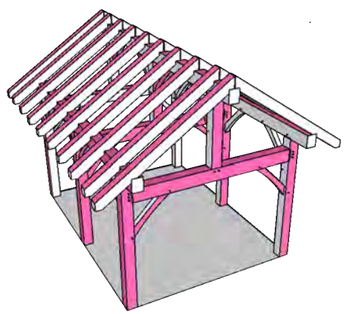
6
Repeat the process on the 2nd plate, remove bracing



7
Using scaffold or decking, set the king posts into positions



8
Install ridge and knee braces using the same process used on plates, peg frame



9
Install rafters using Spax or Timberlok screws

Over the years we have taught many new framers how to approach the trade. We developed a New Framer Roadmap (Page 4) that is a suggested methodology for learning timber frame practices. This method suggest that we start small and develop the skills and confidence to tackle our project. The roadmap recommends taking a framing class if you are able. However, some individuals do not have the time or means to attend a class. This manual was developed such that an interested framer could follow the instruction and methods provided to learn timber framing.

The following complete plans are included with this manual:

Ponies

Sawhorses

Mailbox

Wedding Arch or Sign Holder

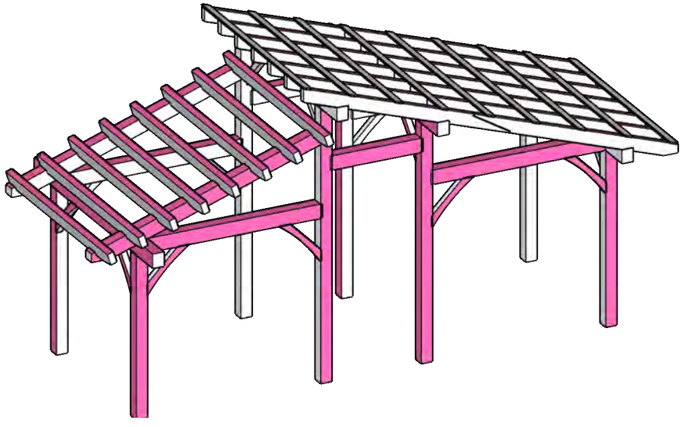
Outhouse

Plans are generated in Square Rule format; they show all reductions and measurements

Need a Custom Plan?

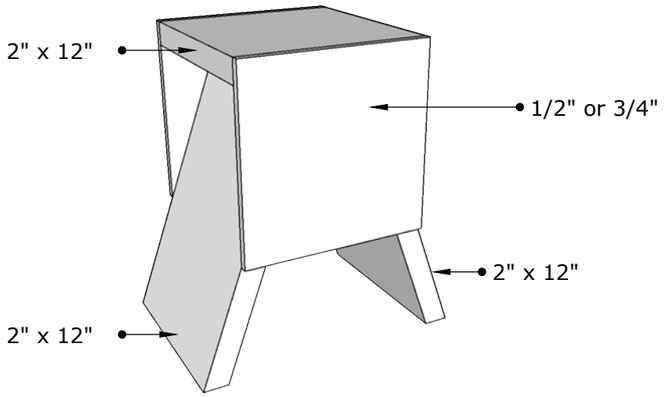
At Star Hill Timberworks, our custom plan process begins with understanding your vision and project goals. We work closely with you to develop a detailed timber frame design tailored to your needs, whether it's a small cabin, workshop, or full-scale home. Using traditional joinery methods and practical layout techniques, we create precise, buildable plans that align with your skill level and construction approach. Whether you're a DIY builder or working with a crew, our plans provide clear guidance to bring your timber frame project to life.

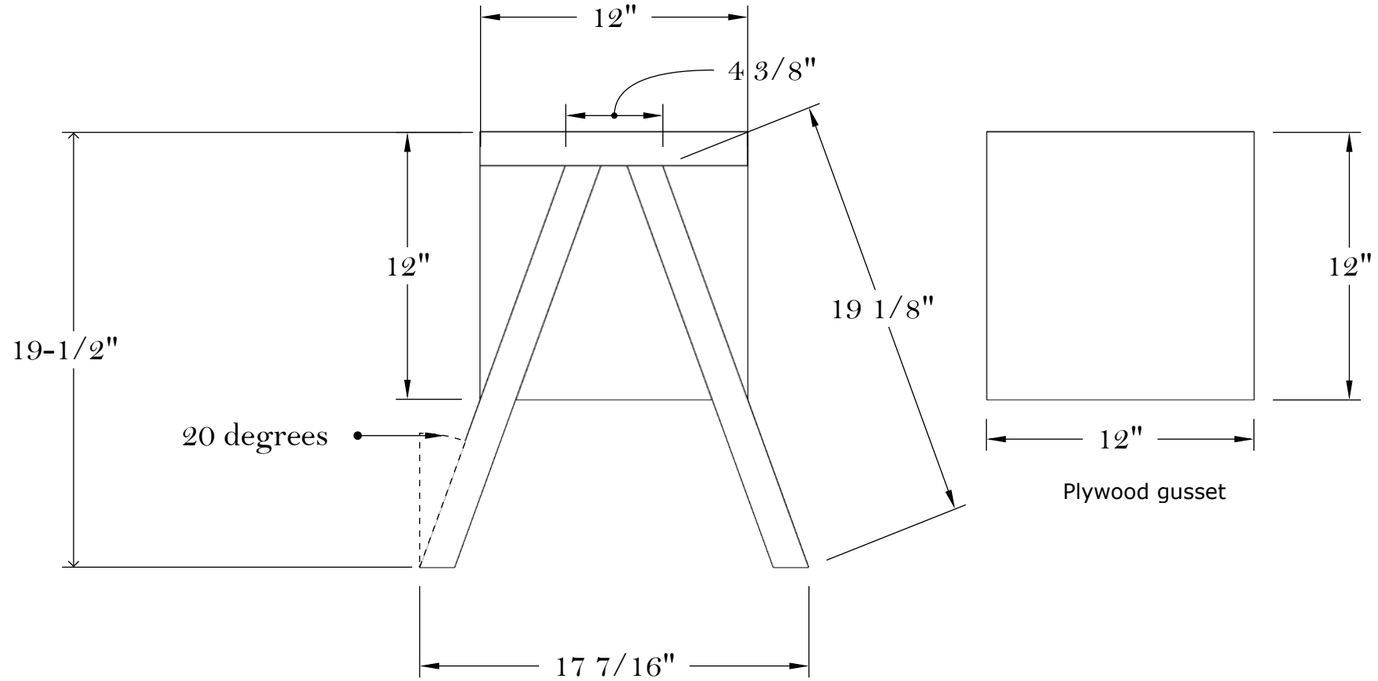
Contact Jon@StarHillTimberworks.com



Star Hill Timberwork's Split Ridge Custom Plan
Anchorage, AK

Timber Frame Ponies





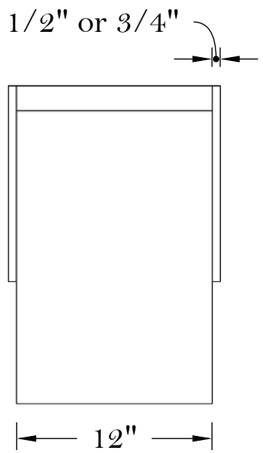
Front

Plywood gusset

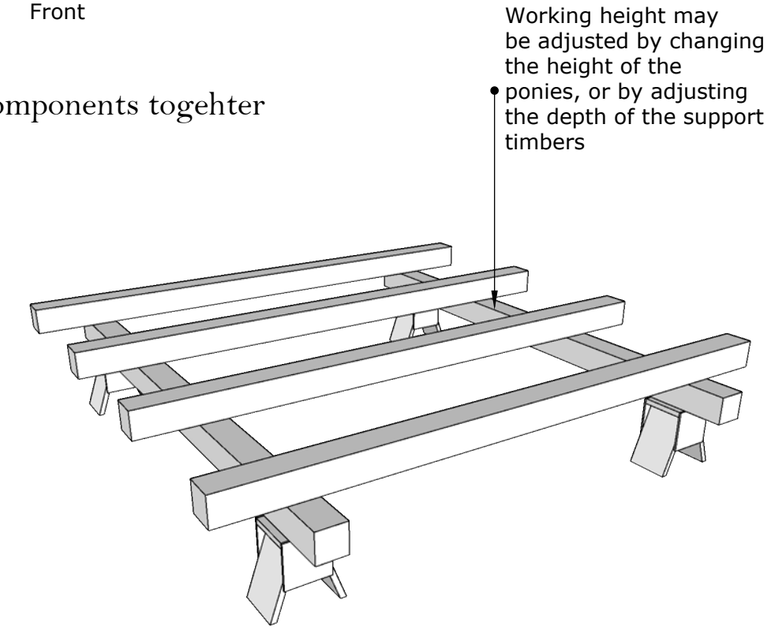
Materials [4 Ponies]
(2) 2" x 12" x 10'
48" x 12" Plywood (1/2" or 3/4")
2 1/2" Structural Screws
Glue

Timber ponies are simple to build and offer a lightweight yet sturdy solution for setting up timber skids. They allow similar-sized timbers to be positioned side by side on skids, enabling an efficient assembly-line workflow for working on multiple pieces simultaneously.

Glue & screw components togehter

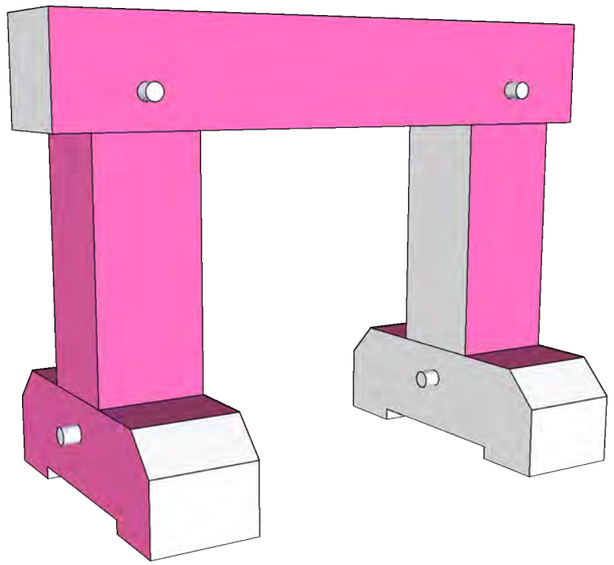


Side



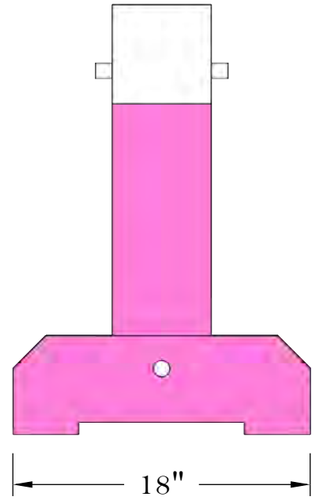
Ponies set up as timber skid

With this design and 8" timbers, working height will be 35 1/2"



This sawhorse plan is designed to use 6" x 6" timbers; there are no housings on this project, so you want ensure that at the joinery locations the timbers are right on 6". Consider ordering your timbers 1/4" oversized and plane them to 6" x 6" before cutting this project.

Materials (2 Sawhorses)	QTY
6" x 6" x 10' Timber	2
1" x 8" Hardwood Peg	8



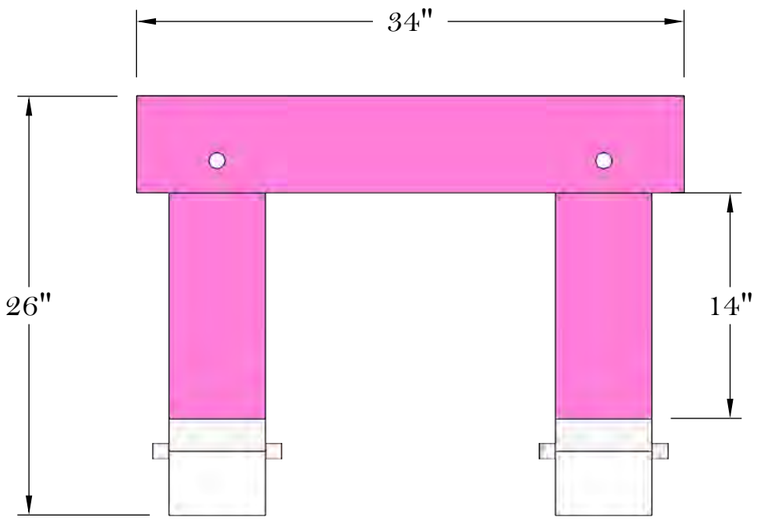
The sawhorses are designed to provide a working height of 34" when supporting an 8" timber and have a span of 34". Both dimensions can be customized to suit your needs. The working height can be adjusted by modifying the length of the posts, while the width can be expanded by increasing the length of the top beam.

Sawhorse 1

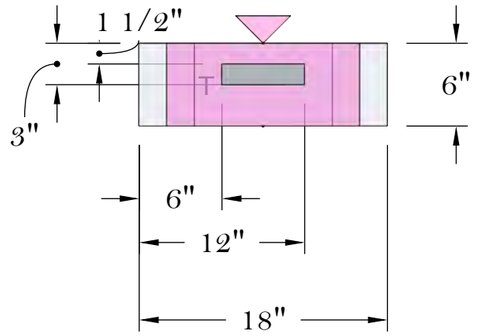
Timber	Layout	Checked	Cut
Top			
Post 1			
Post 2			
Foot 1			
Foot 2			

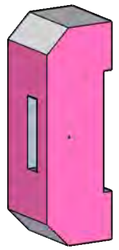
Sawhorse 2

Timber	Layout	Checked	Cut
Top			
Post 1			
Post 2			
Foot 1			
Foot 2			

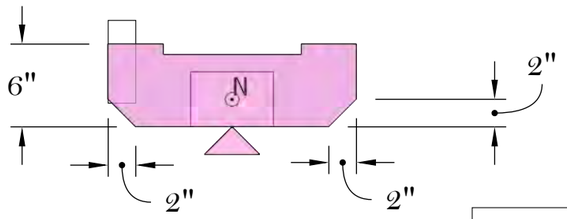


Sawhorse Plan 2

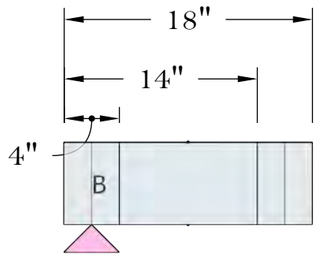


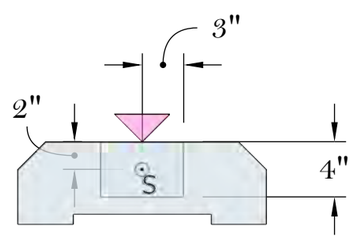


Foot 1

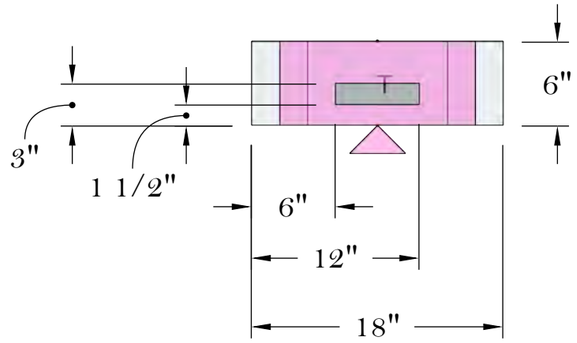


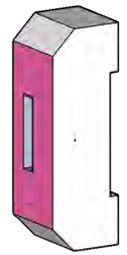
Another option for the foot is to leave the timber full depth and screw on pressure treated pieces. This extends the life of the sawhorses. Using this method results in the sawhorse working height increased by the depth of the pressure treated lumber used.



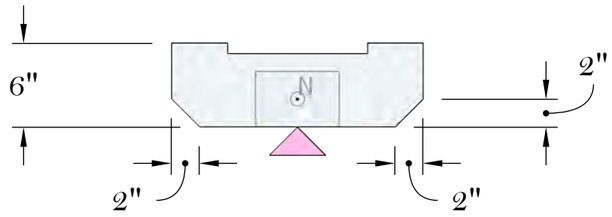


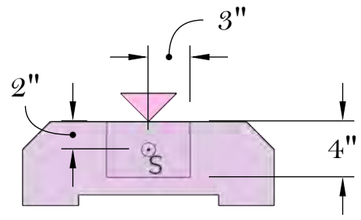
These components are mirror images



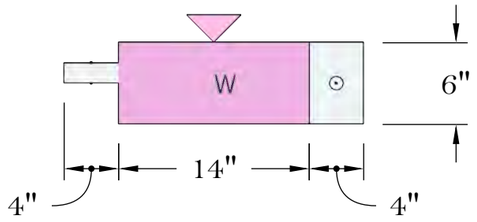


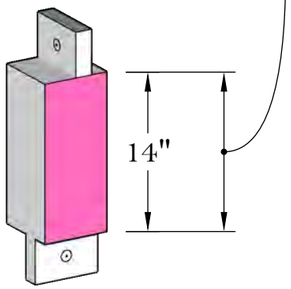
Foot 2



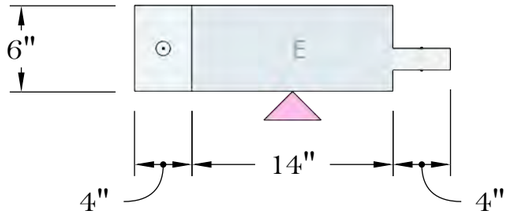


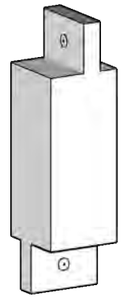
Sawhorse Plan 3



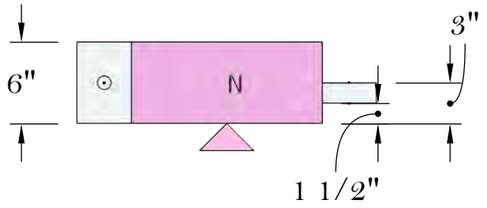


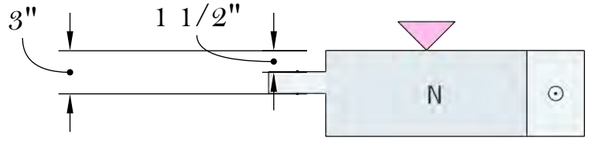
Post 1

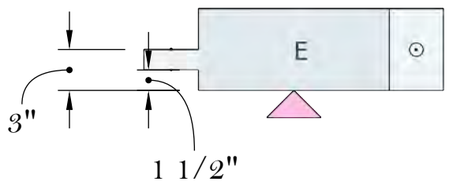




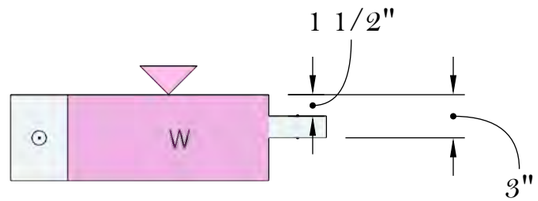
Post 2

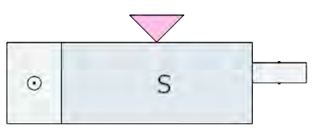


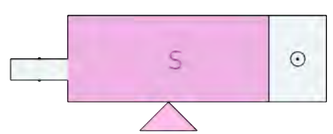




These components are mirror images

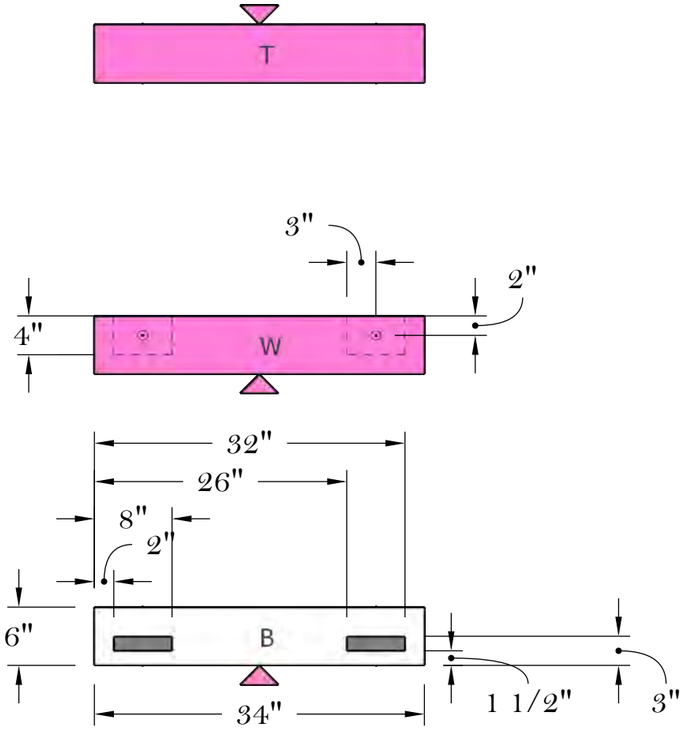


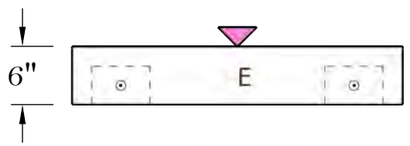


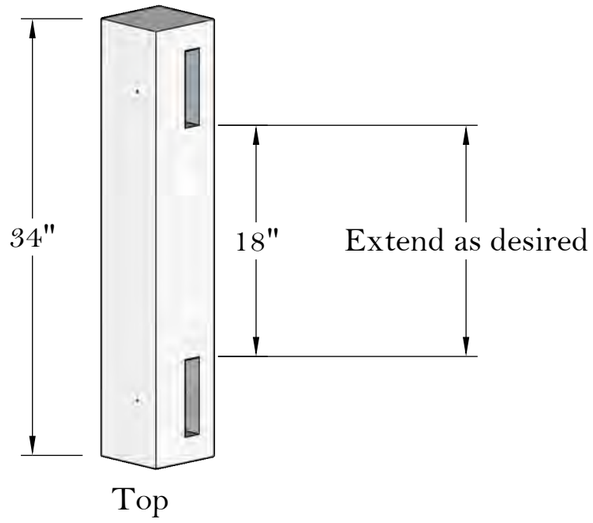


Revision 1 (4.8.25)

Sawhorse Plan 4







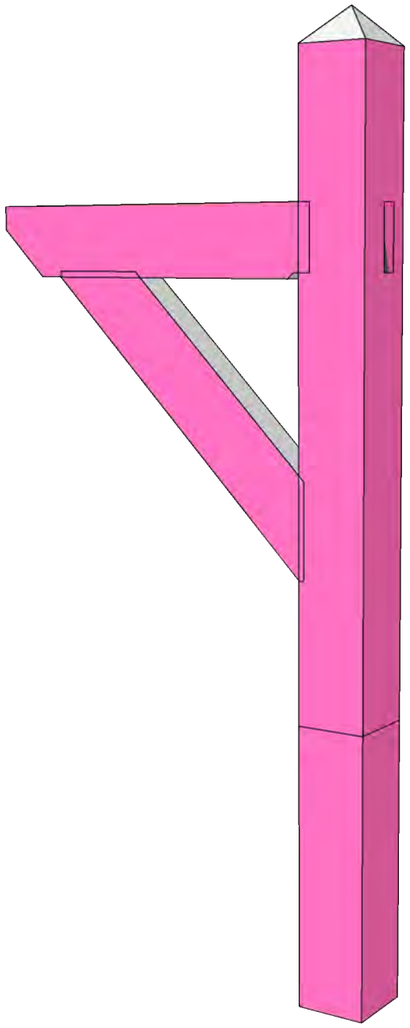
This top is designed to be 34"; however, if more working space is desired, extend the top

Sawhorse with "Let In" braces, the small set of horses is used for chain mortising and drilling

Sawhorses used to support work for layout

Sawhorses used to support work for AnchorSeal and final finishing

Mailbox Plan



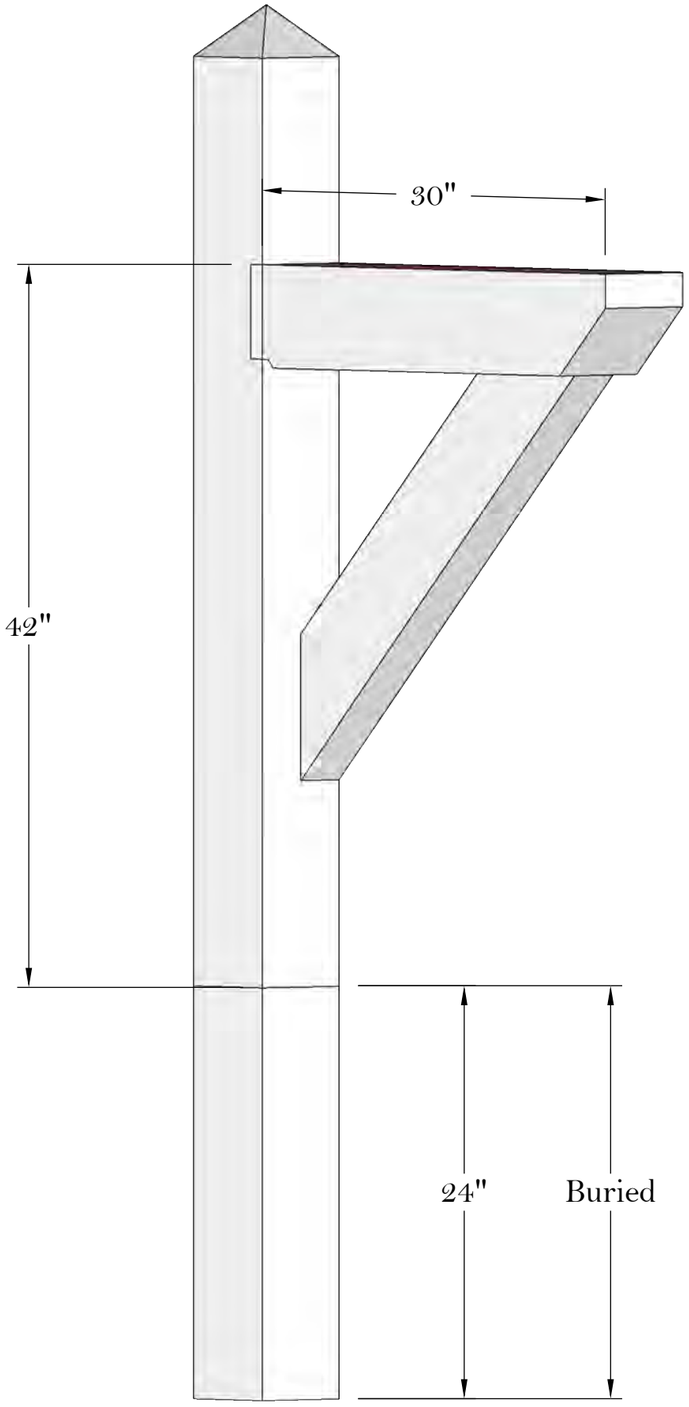
This mailbox plan is an excellent 1st timber framing project as it contains mortises, tenons, and a knee brace. Techniques which are needed to construct a small building. For the knee brace, consider ordering your timbers 1/4" oversized and plane them to 4" x 6" before cutting this project to improve knee brace fit.

Materials (2 Sawhorses)	QTY
6" x 6" x 10' Timber	1
4" x 6" x 4'	1
1" x 8" Hardwood Peg	3

Timber	Layout	Checked	Cut
Post			
Beam			
KB 24			

Mortise and Tenon Master can be used for all layout systems, including Mill Rule, Square Rule, Snap Line, and Center LLine

The mailbox is designed to provide a mailbox height of 42" with 24" of the post buried. Consider burning the section of post that will go into the ground and coating with some type of preservative.



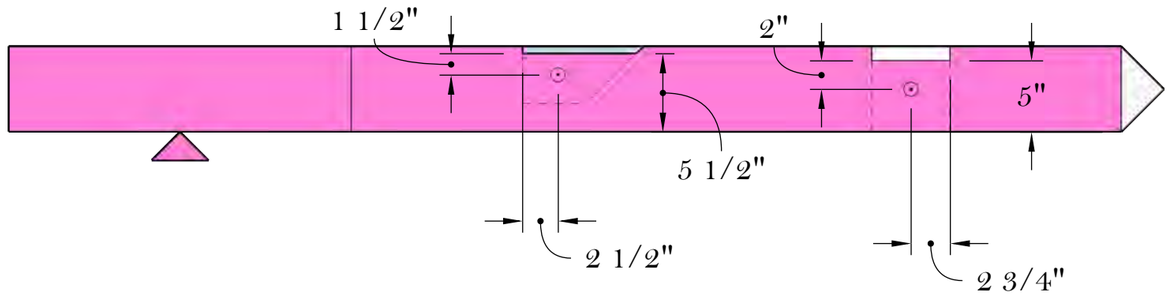
Revision 1 (4.8.25)

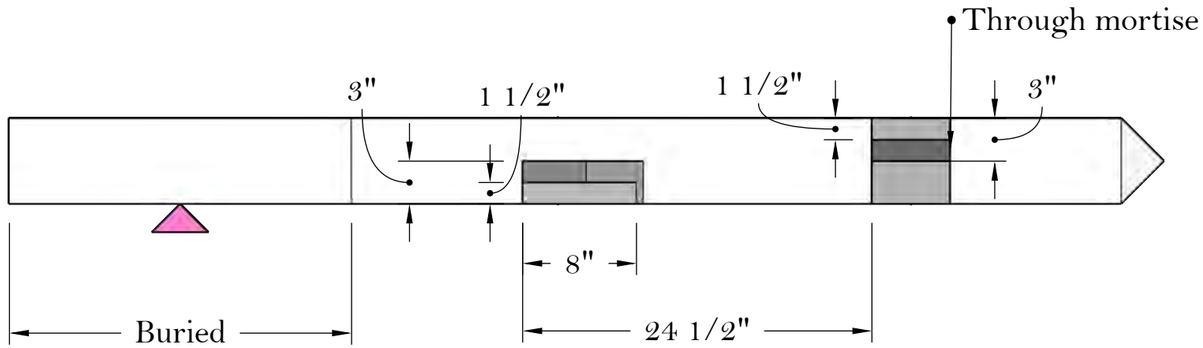
Mailbox Plan

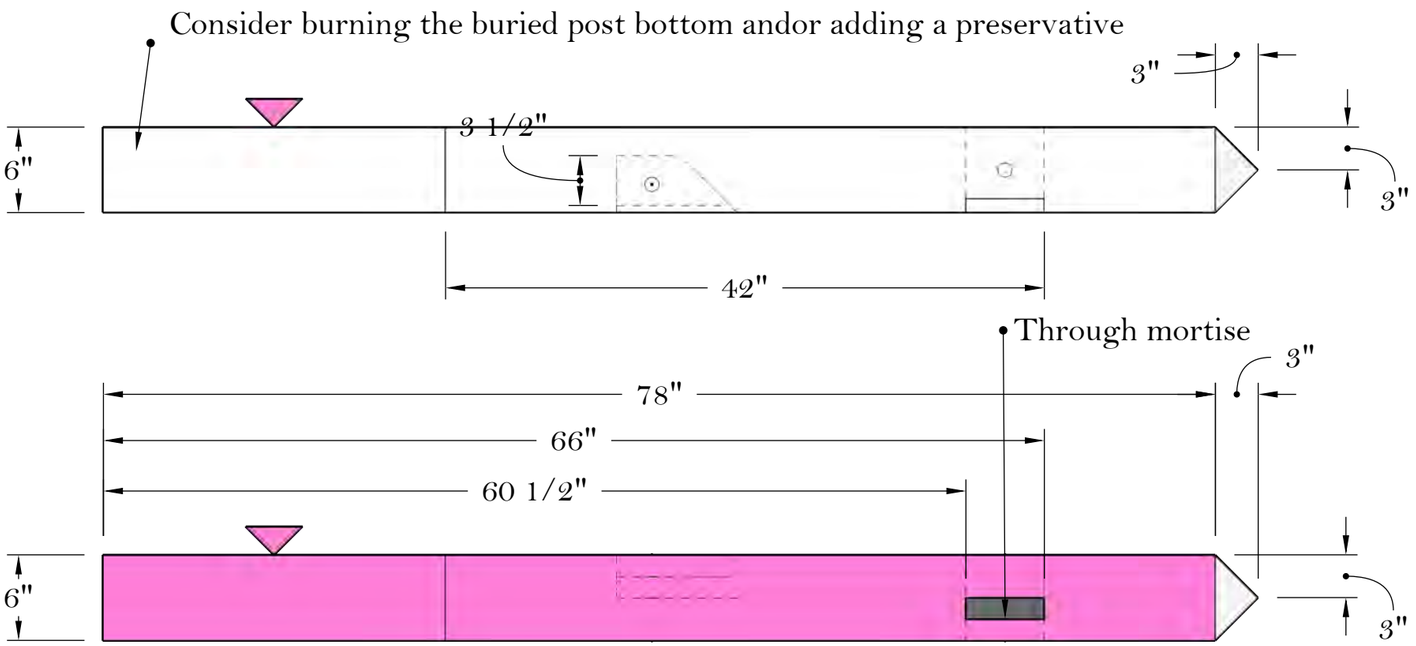
STAR HILL

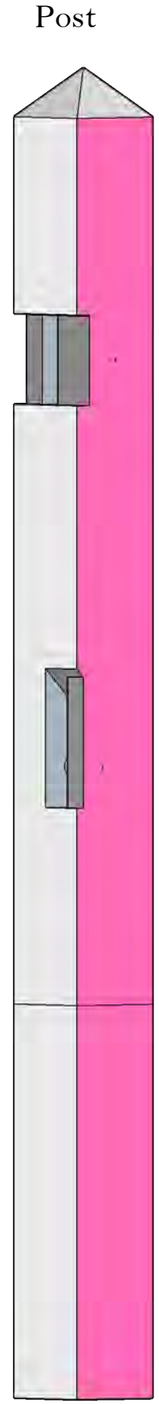
Timber Frame Practices

Mailbox Plan 2



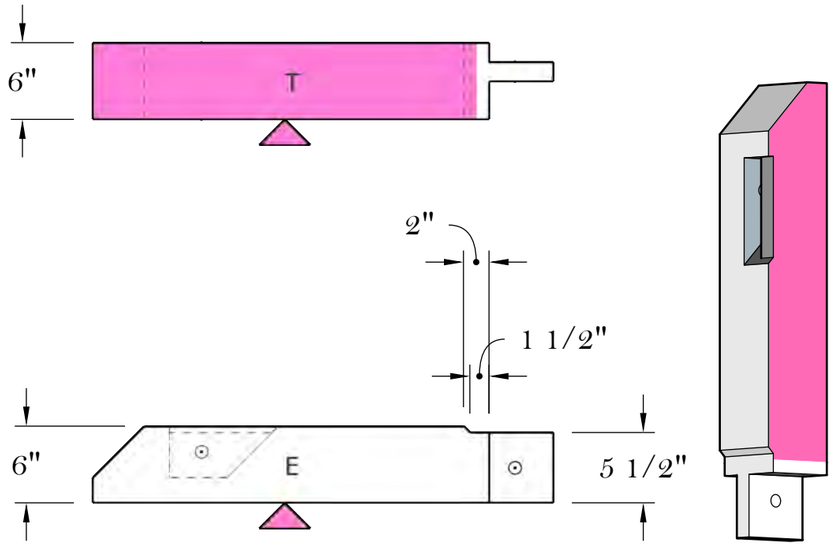




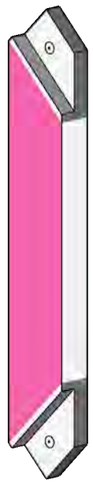


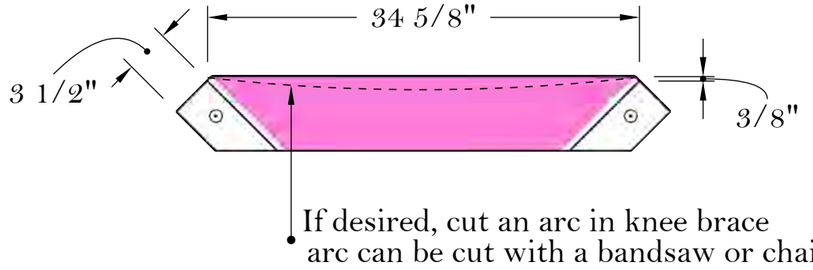
Mailbox Plan 3

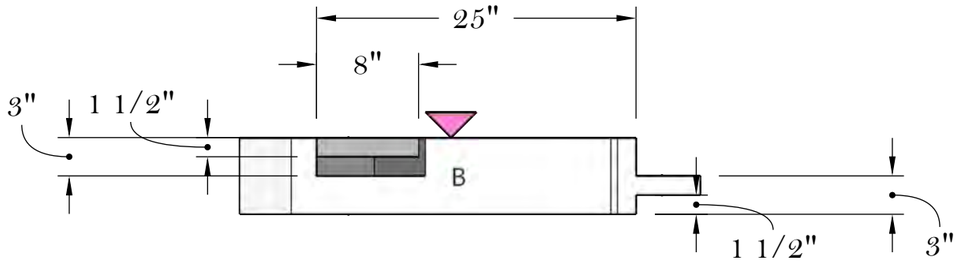
Beam

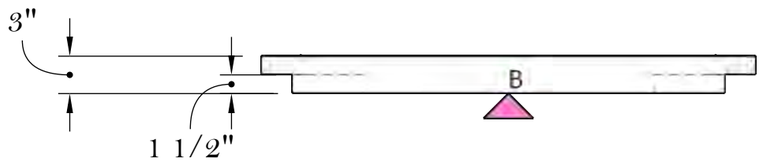


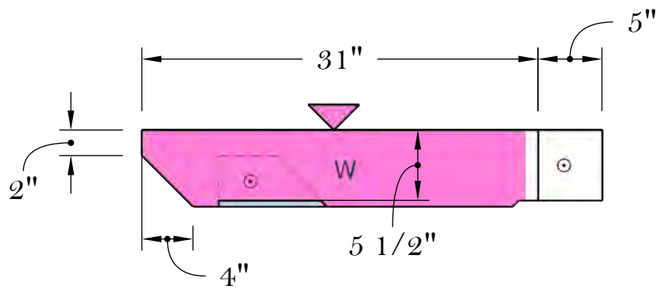
Knee Brace 24

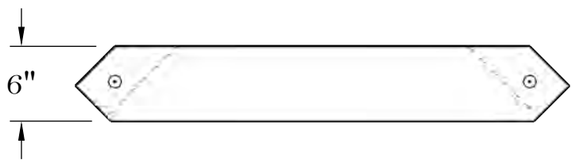












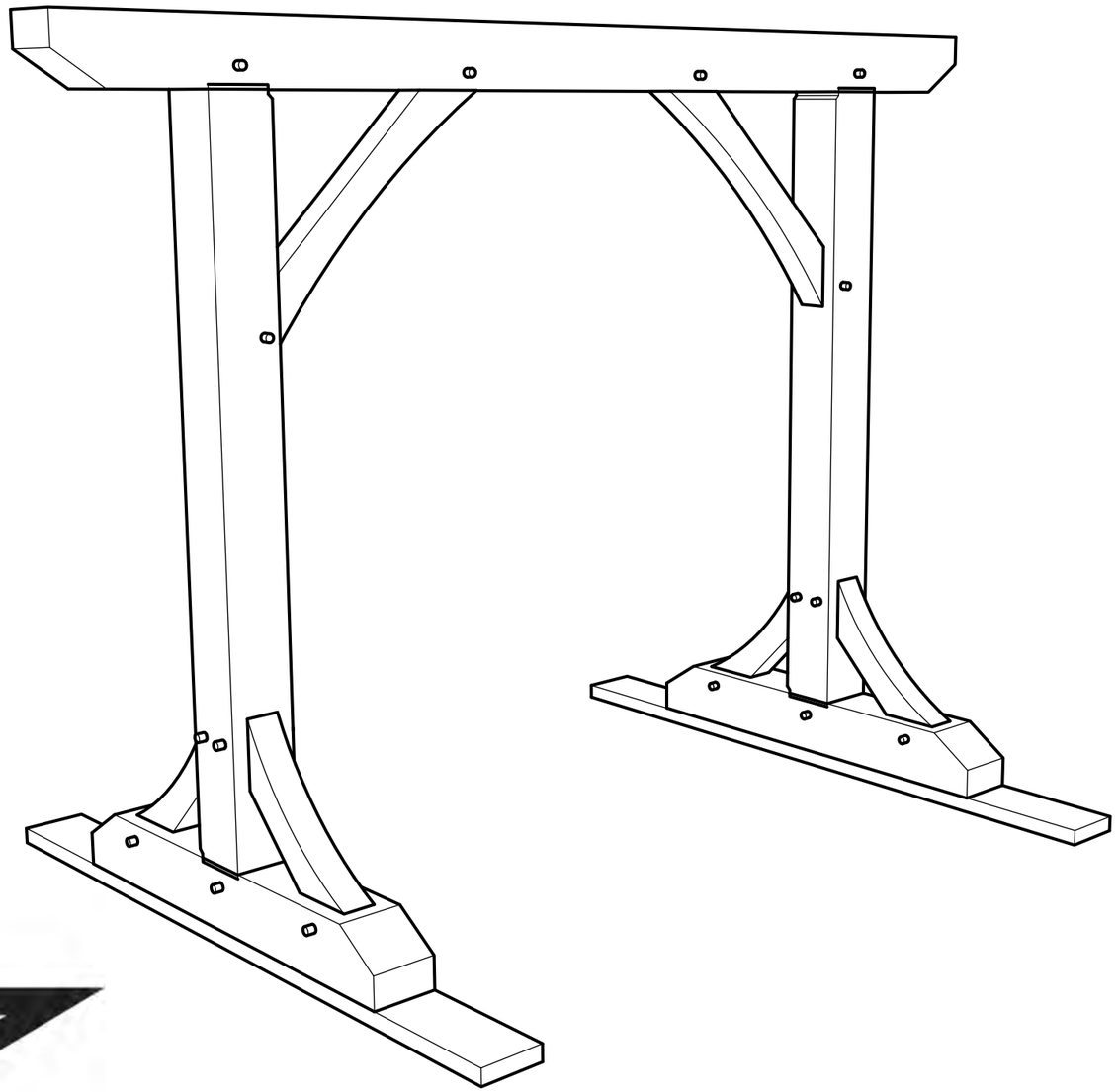
Project: TF Practices 1

Client: Star Hill Customer

Revision: 00

Number: 20241216P

Star Hill Timberworks LLC
N3901 690th Street
Ellsworth, WI 54011

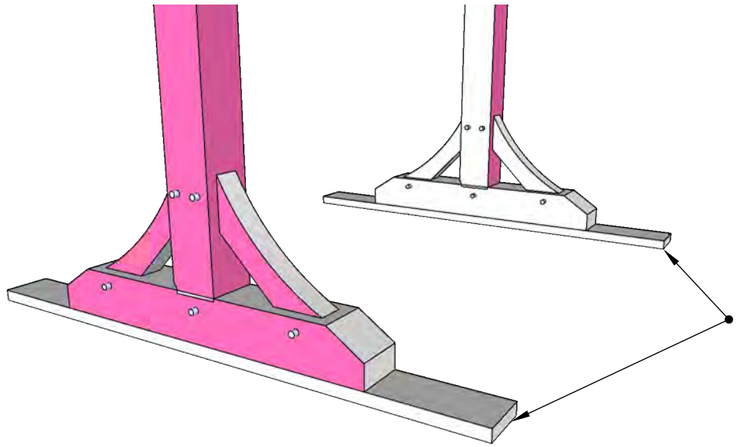


Timbers
Post: 8 x 8
Plate: 8 x 8
Knee Brace: 4 x 6

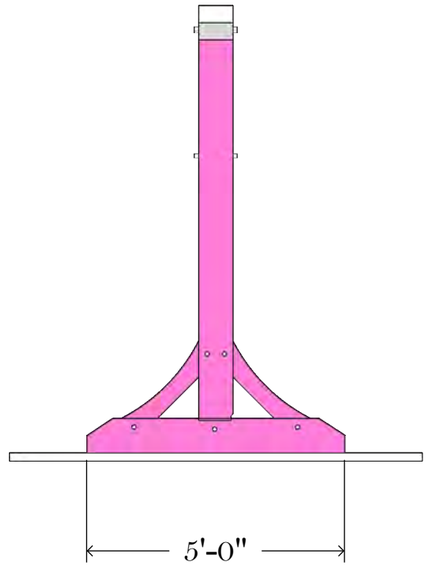
Optional
Stabilizers 2 x 6 x 10'

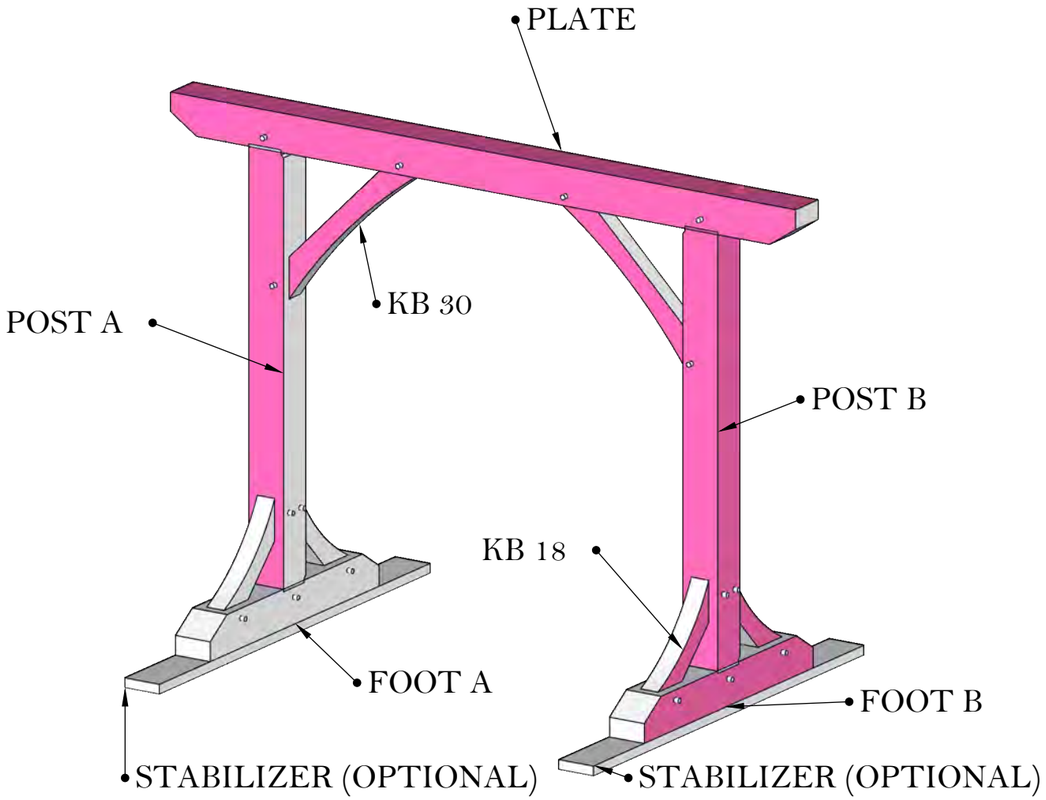
Wedding Arch Shop Drawings

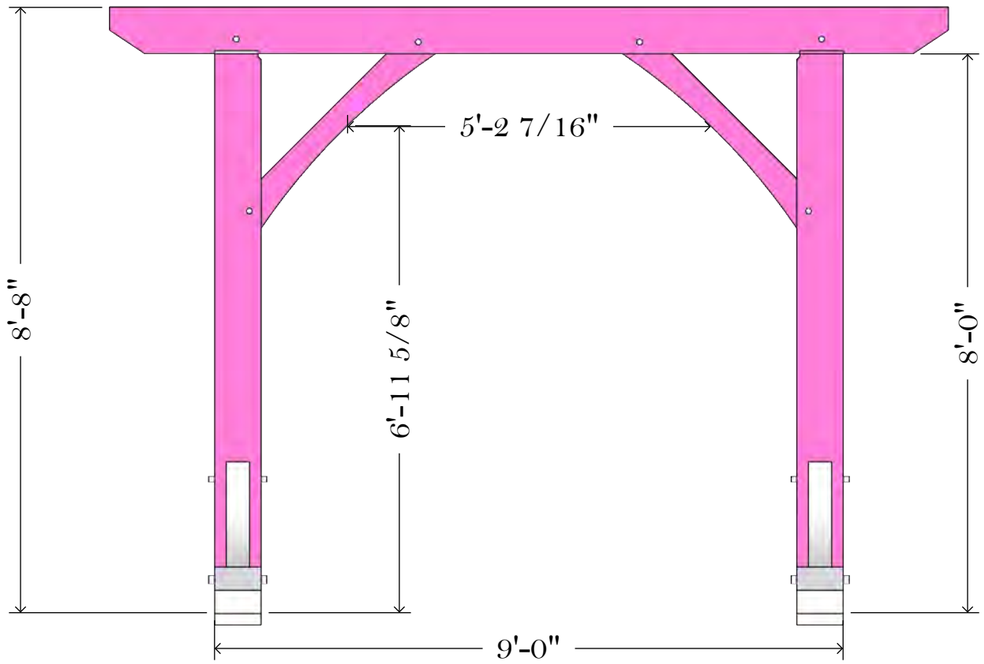
Revision 1 (4.8.25)

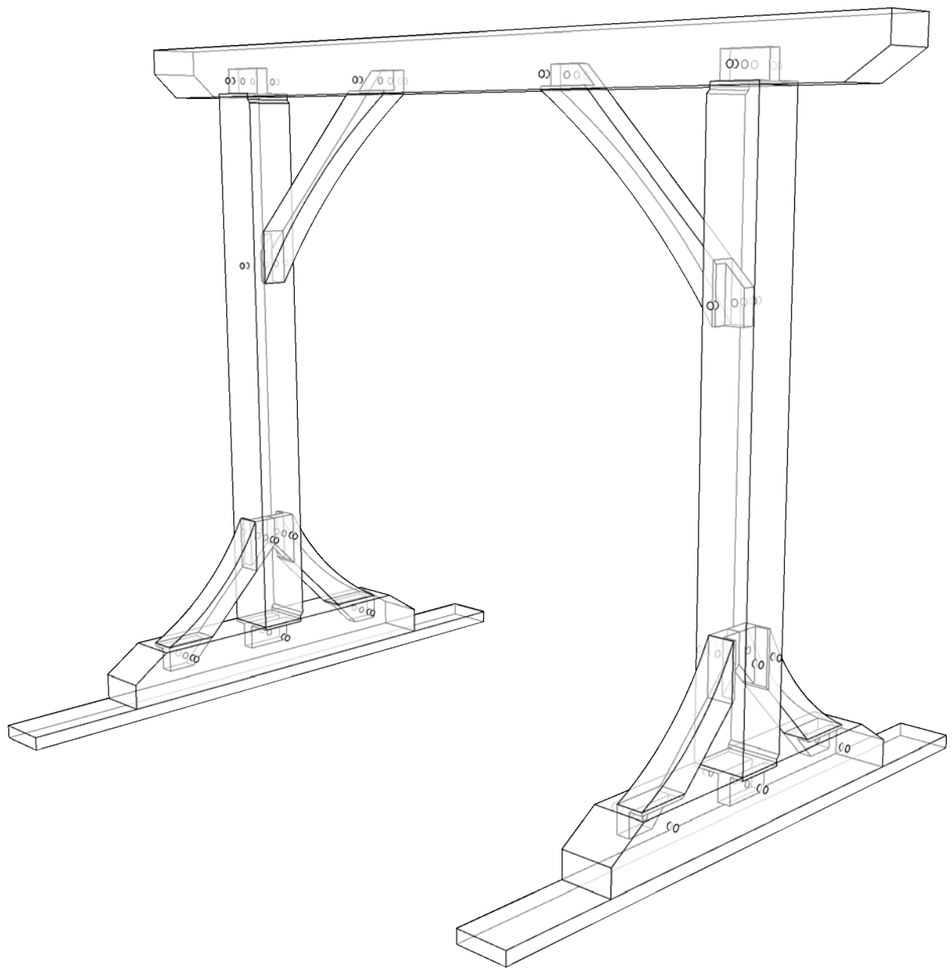


Optional stabilizers. Cut 2x material; screw to the bottom of the foot. Drill and stake the stabilizers.









Timbers						
Name		W	D	L(ft)	L(in)	BF
PLATE		8	8	14	144	75
POST A		8	8	10	97	53
POST B		8	8	10	97	53
FOOT A		8	8	6	61	32
FOOT B		8	8	6	61	32
						245

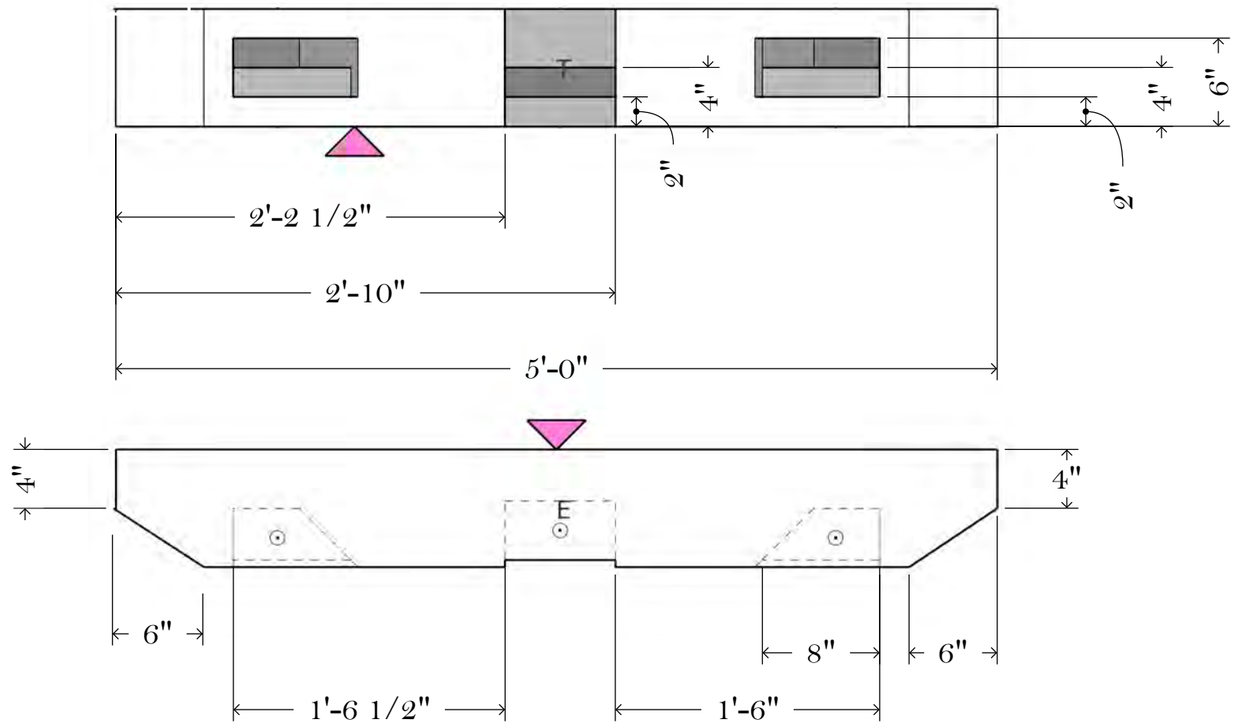
Scantlings						
Name	Qty	W	D	L(ft)	L(in)	BF
KB 30 (4 X 6)	2	4	6	6	48	24
KB 18 (4 X 6)	4	4	6	4	32	32
						56

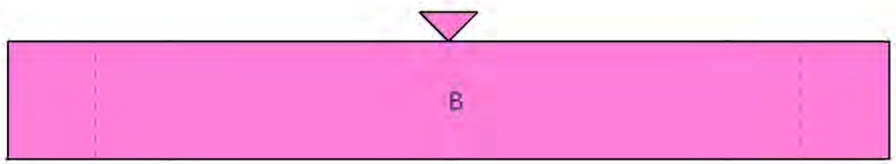
(16) 1" x 10" hardwood pegs.

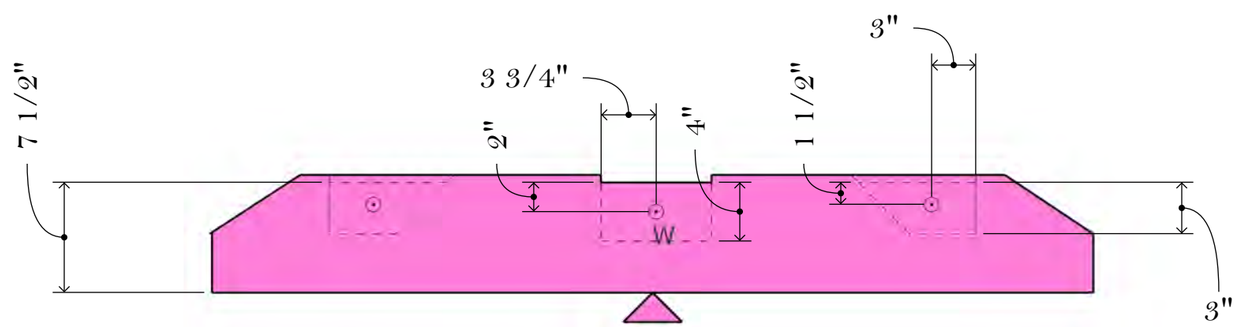
Cut List				
Qty	W	D	L(ft)	BF
1	8	8	14	75
2	8	8	10	107
2	8	8	6	64
2	4	6	6	24
4	4	6	4	32
				301

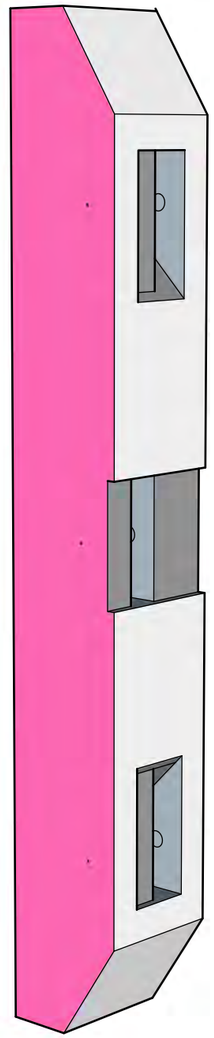
A/S Foot A

8 x 8 x 6







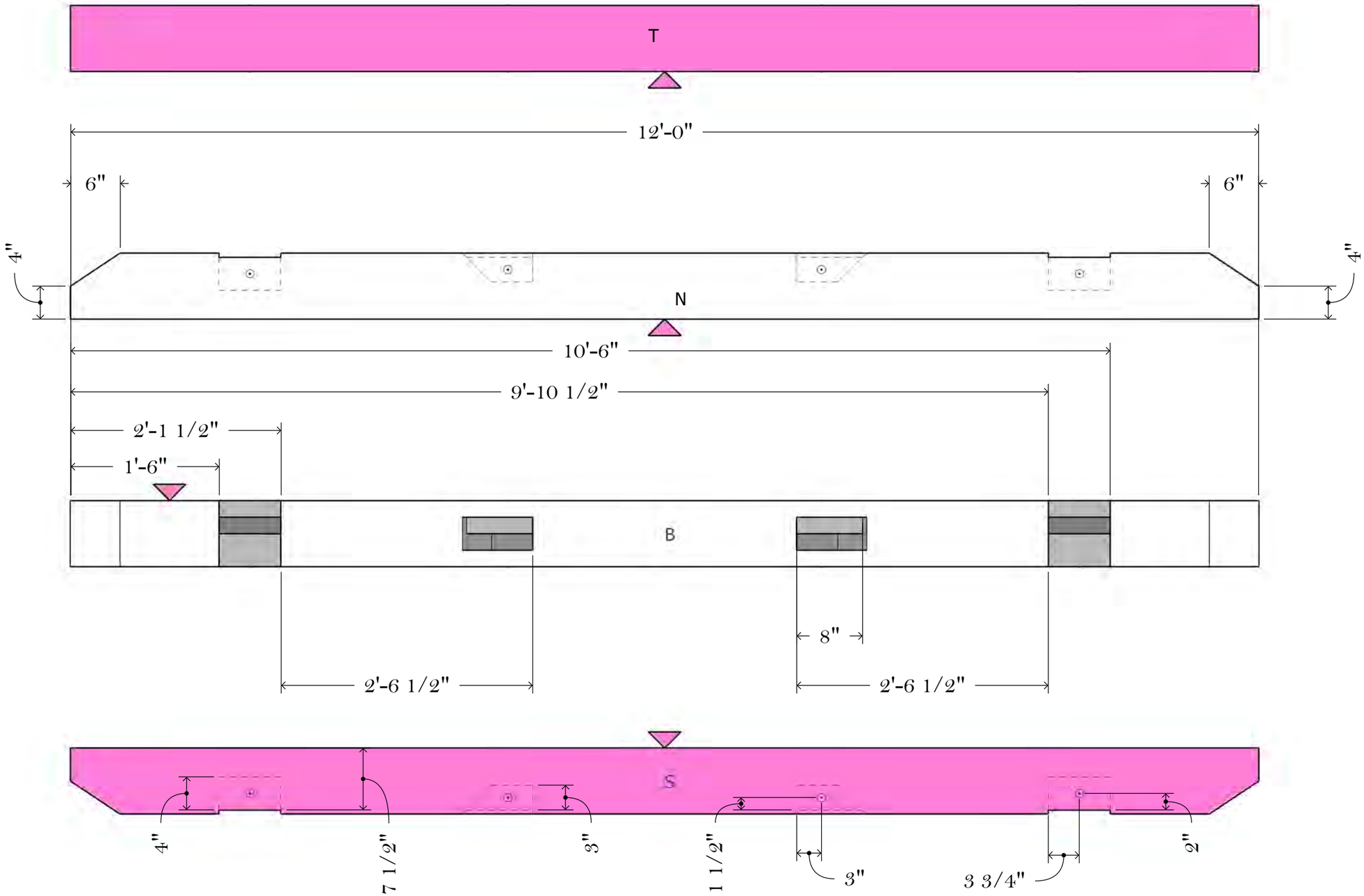


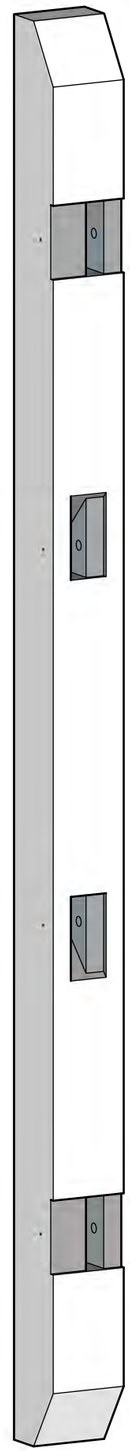
A/S Foot A

STAR HILL

Timber Frame Practices

A/S Plate
8 x 8 x 14



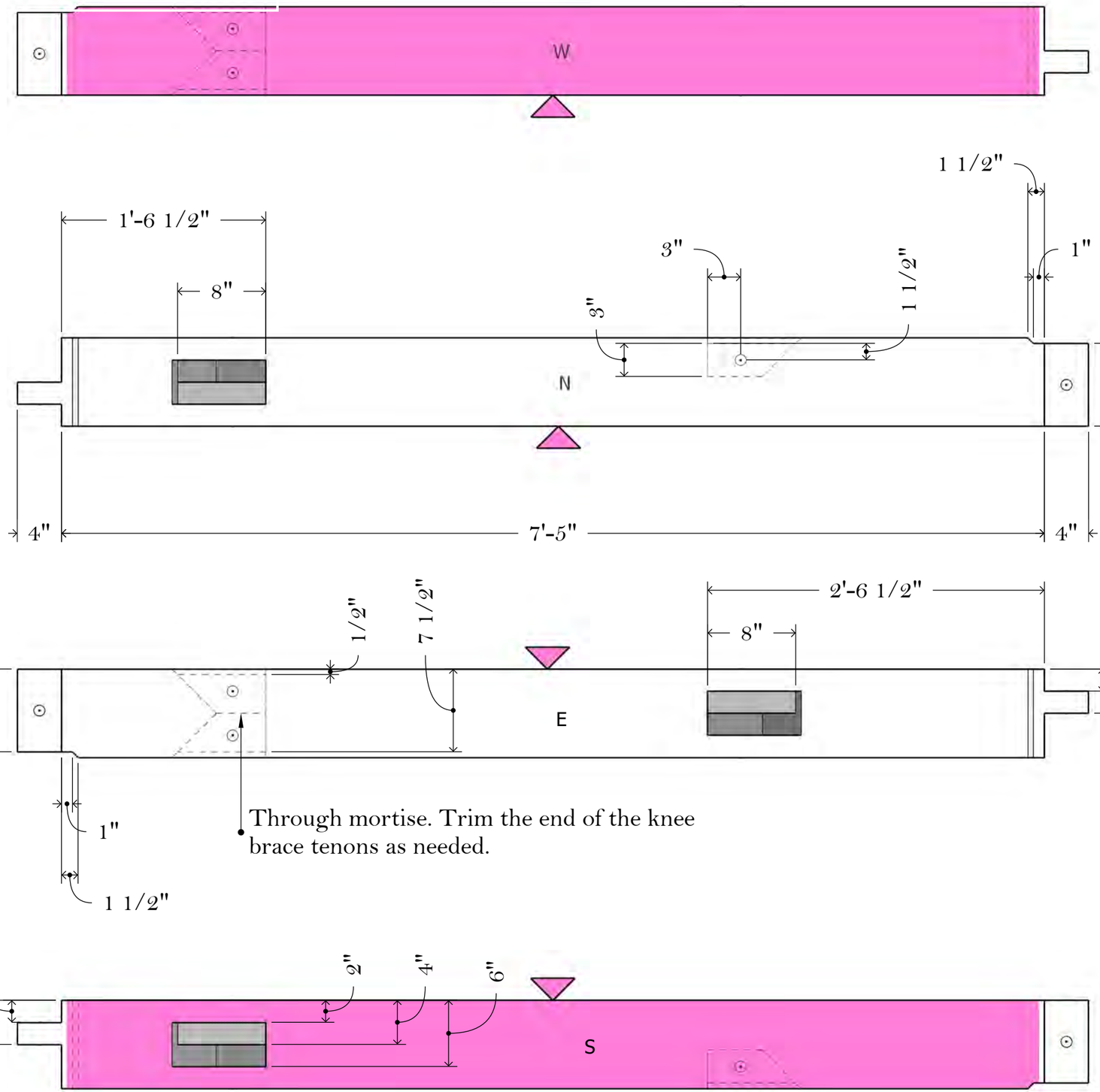


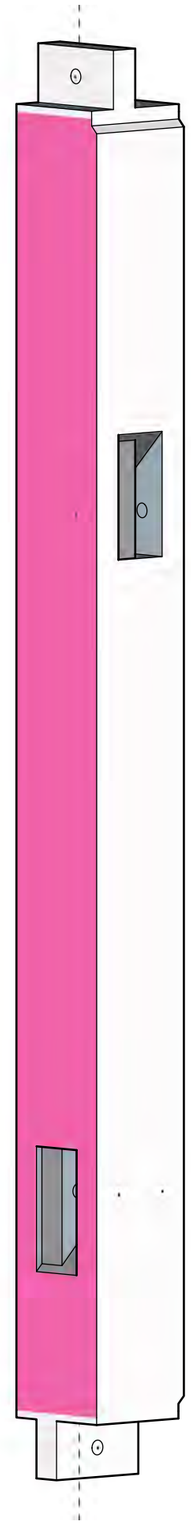
A/S Plate

STAR HILL

Timber Frame Practices

A/S Post A
8 x 8 x 10



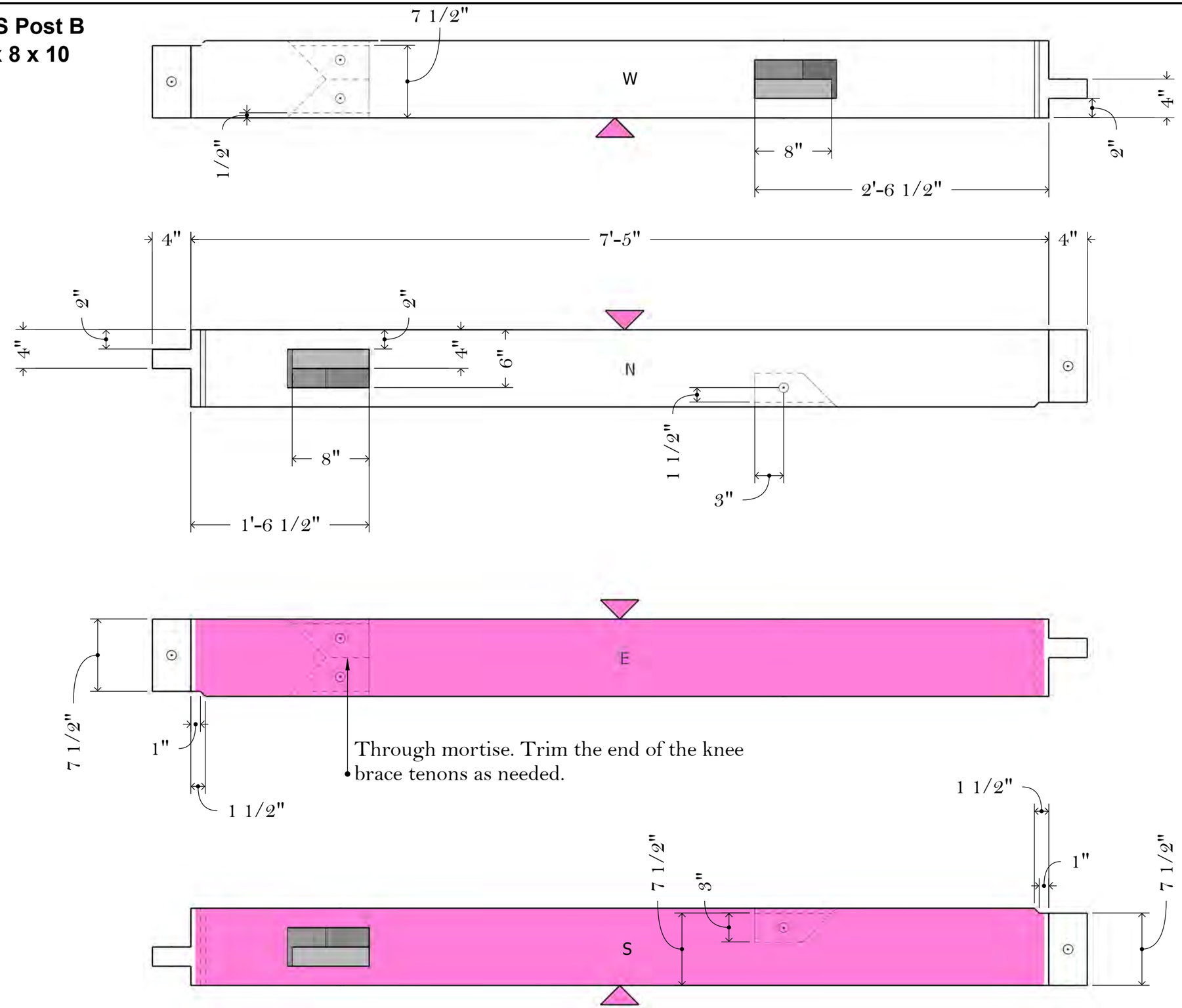


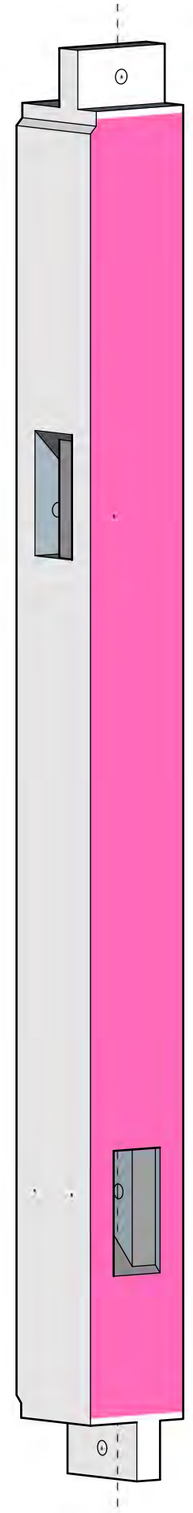
A/S Post A

STAR HILL

Timber Frame Practices

A/S Post B
8 x 8 x 10



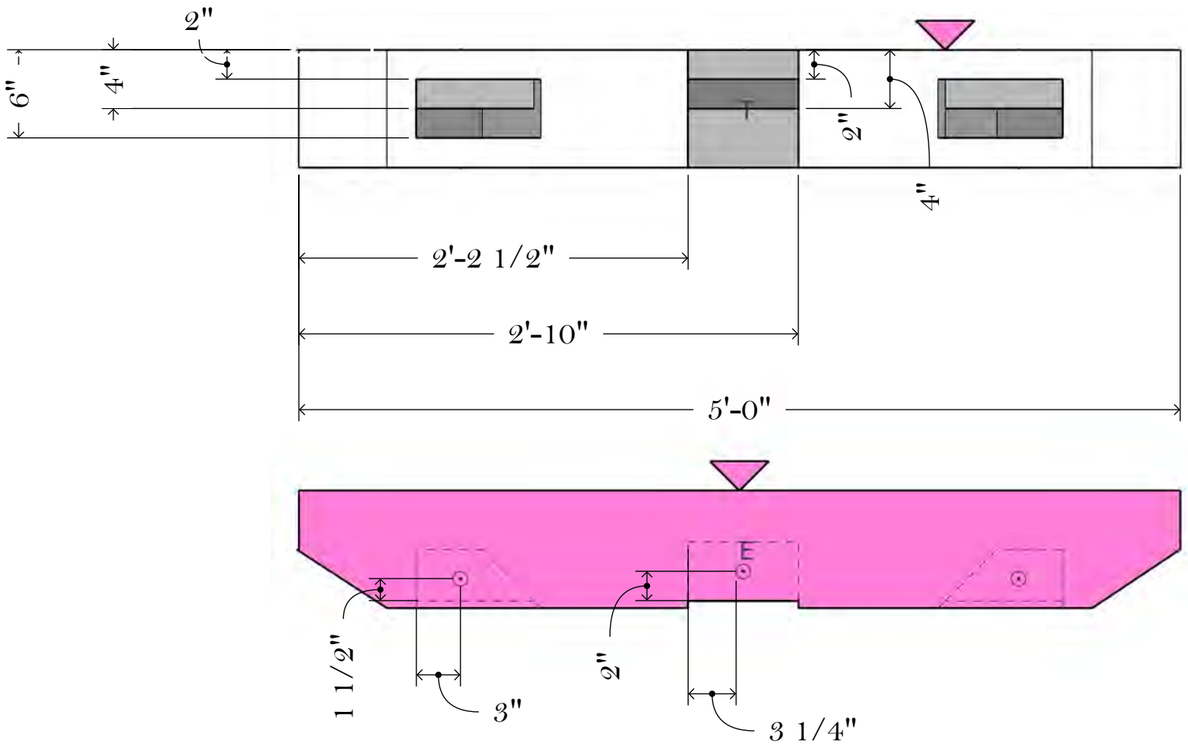


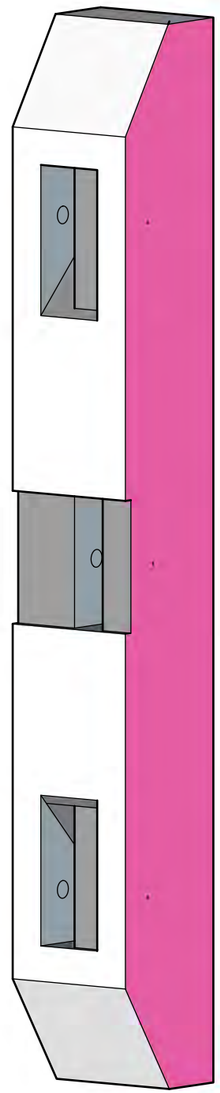
A/S Post B

STAR HILL

Timber Frame Practices

A/S Foot B
8 x 8 x 6



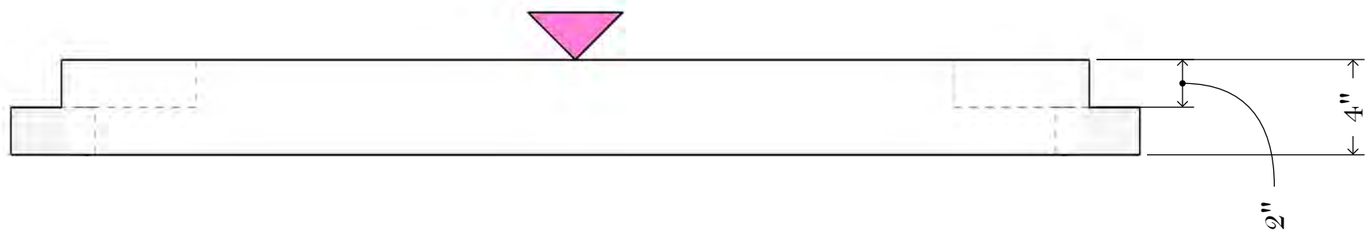


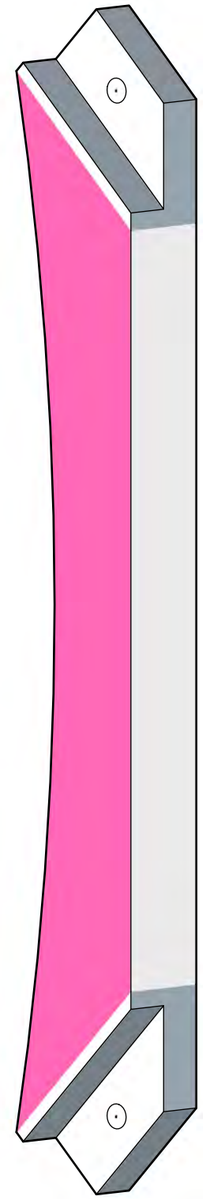
A/S Foot B

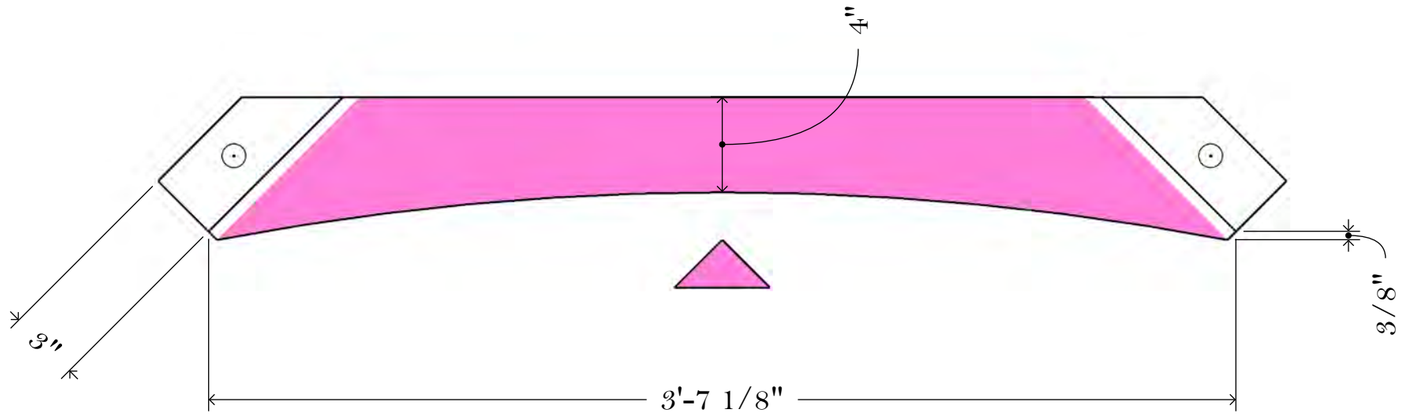
STAR HILL

Timber Frame Practices

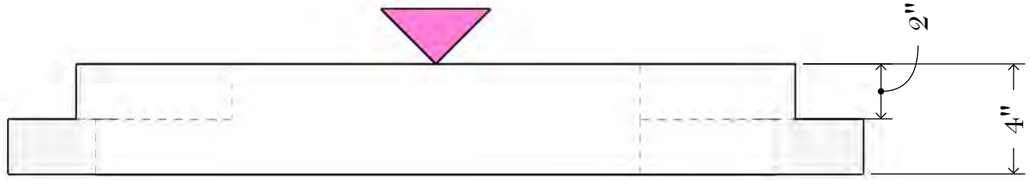
A/S KB30
4 x 6 x 6 (2)

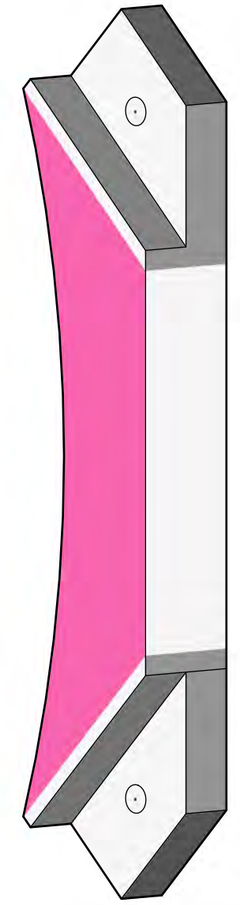


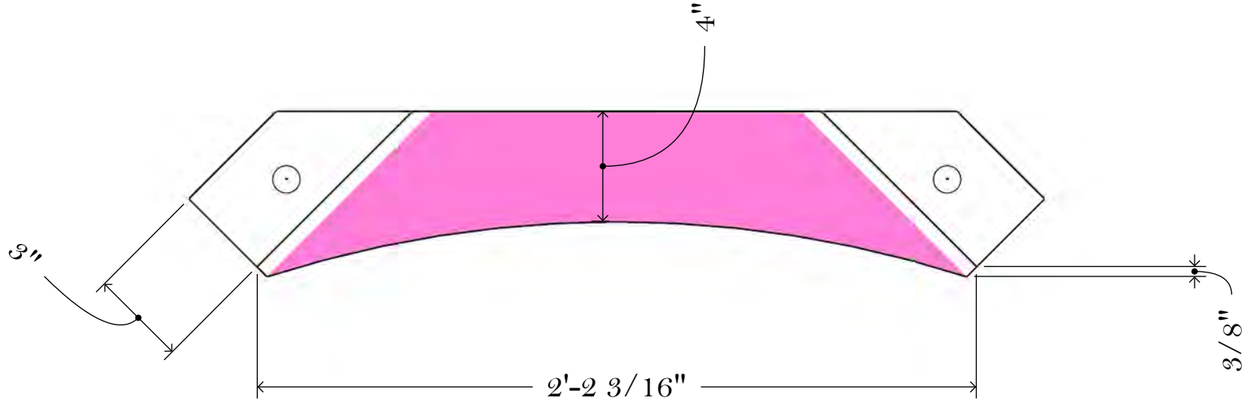




A/S KB18
4 x 6 x 4 (4)



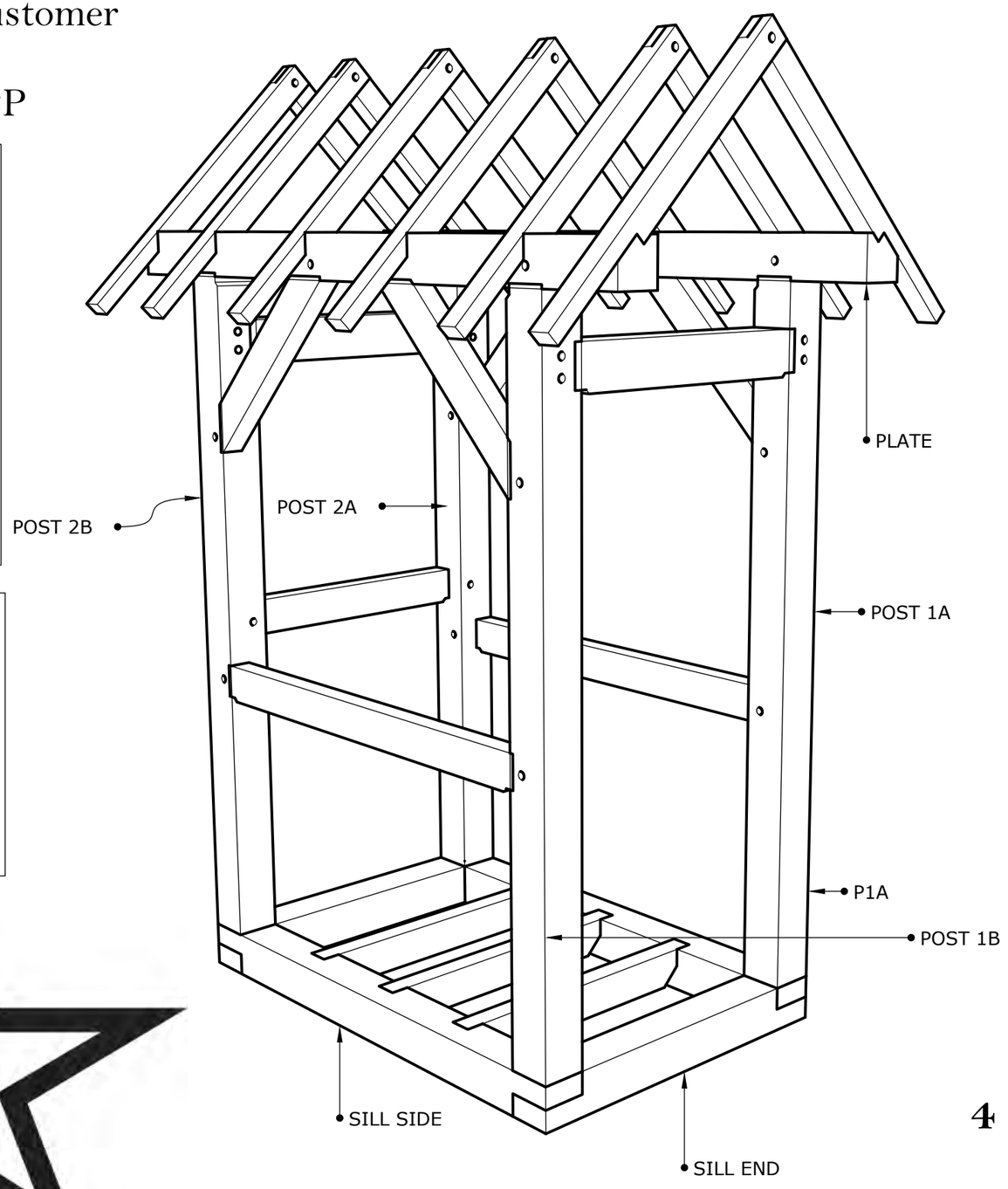




Project: TF Practices 1
Client: Star Hill Customer
Revision: 00
Number: 20241216P

6 x 6 Posts
6 x 6 Ties
6 x 6 Plates
6 x 6 Sills
3 x 5 Braces
3 x 5 Girts
3 x 3 1/2 Rafters
3/4" Pegs
419 Board Feet

Plans are designed to print out on 11" x 17" paper or shrink to fit on 8 1/2" x 11"



Star Hill Timberworks LLC
N3901 690th Street
Ellsworth, WI 54011

Cut List				
Qty	W	D	L(ft)	BF
6	6	6	10	180
2	6	6	8	48
4	6	6	6	72
2	3	5	6	15
8	3	5	4	40
12	3	4	6	64
			Total Board Feet	419
(26) ¾" Hardwood Pegs				

Square Rule Format

Star Hill Timberworks plans are designed using standard timber framing practices. The client is accountable for ensuring compliance with engineering standards, construction practices, and obtaining any required permits and/or stamps.

4 x 6 Outhouse Shop Drawings

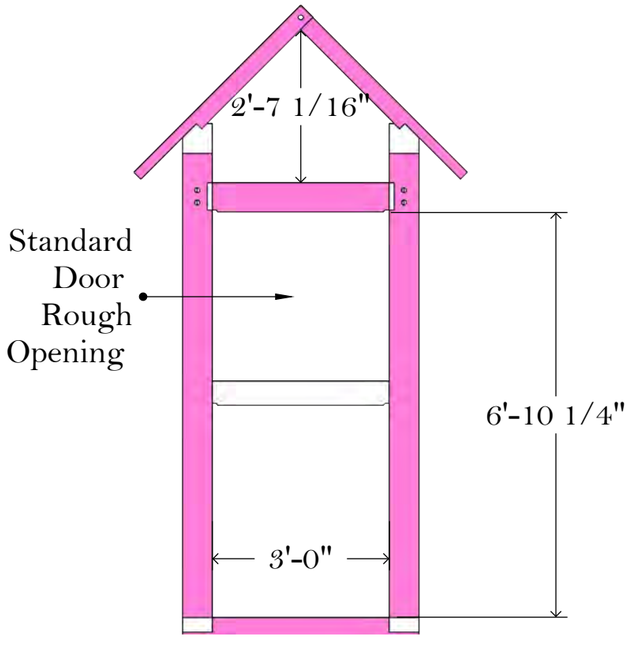
[12/12 Roof Pitch]

Revision 1 (4.8.25)

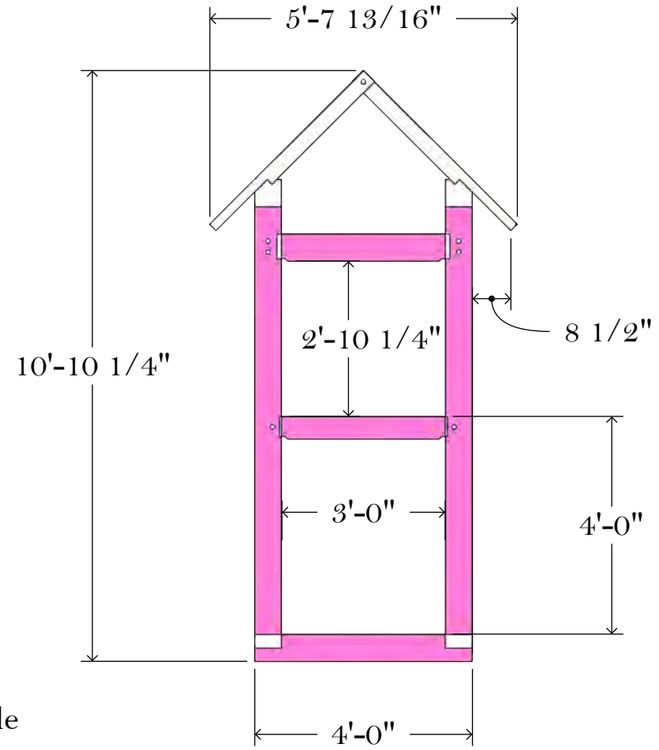
Outhouse Plan 2

Pink faces are Reference Faces

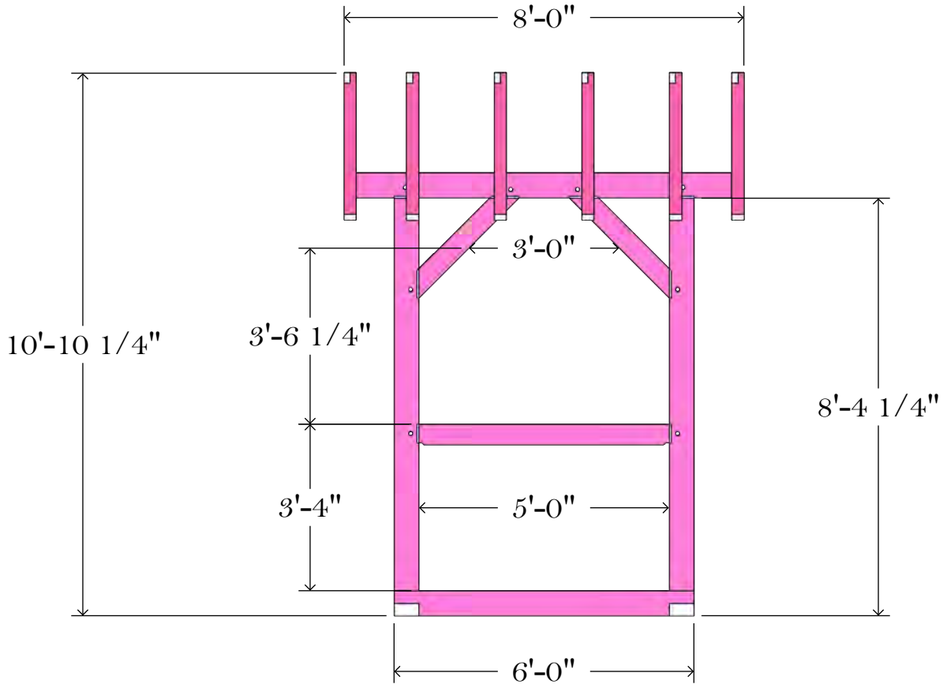
Front



Back



Side



Revision 1 (4.8.25)

Outhouse Plan 2

STAR HILL

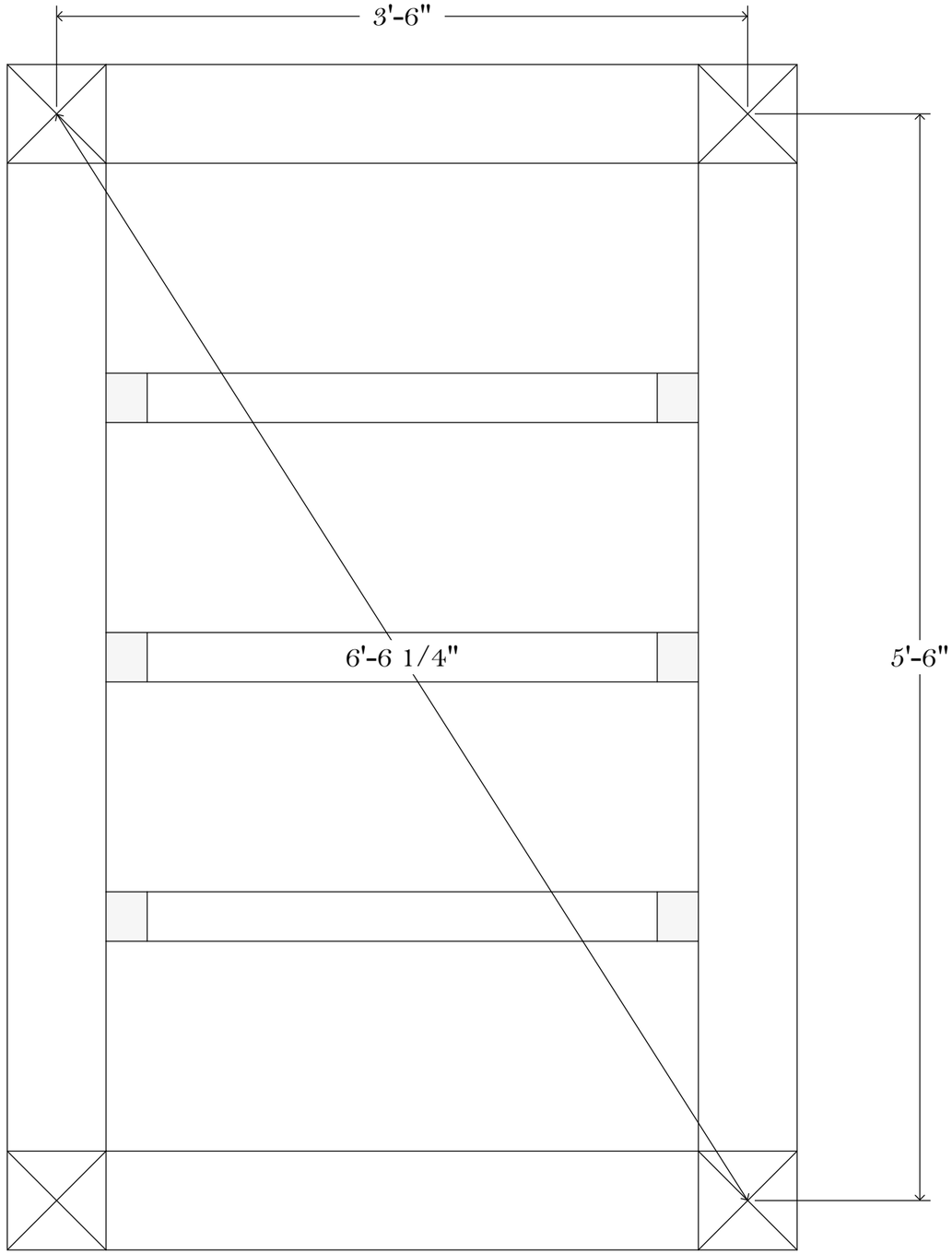
Timber Frame Practices

Timbers:									
Name		W	D	L(ft)	BF	Assigned	Layout	Checked	Cut
POST 1A		6	6	10	30				
POST 1B		6	6	10	30				
POST 2A		6	6	10	30				
POST 2B		6	6	10	30				
TIE 1		6	6	6	18				
TIE 2		6	6	6	18				
				Board Feet	156				

Multiples/Scantlings:									
Name	Qty	W	D	L(ft)	BF	Assigned	Layout	Checked	Cut
PLATE	2	6	6	10	60				
SILL SIDE	2	6	6	8	48				
SILL END	2	6	6	6	36				
GIRT SIDE	2	3	5	6	15				
GIRT END	1	3	5	4	5				
JOIST	3	3	5	4	15				
KB30	4	3	5	4	20				
RAFTER A	6	3	3.5	6	32				
RAFTER B	6	3	3.5	6	32				
				Board Feet	263				

Outhouse Plan 4

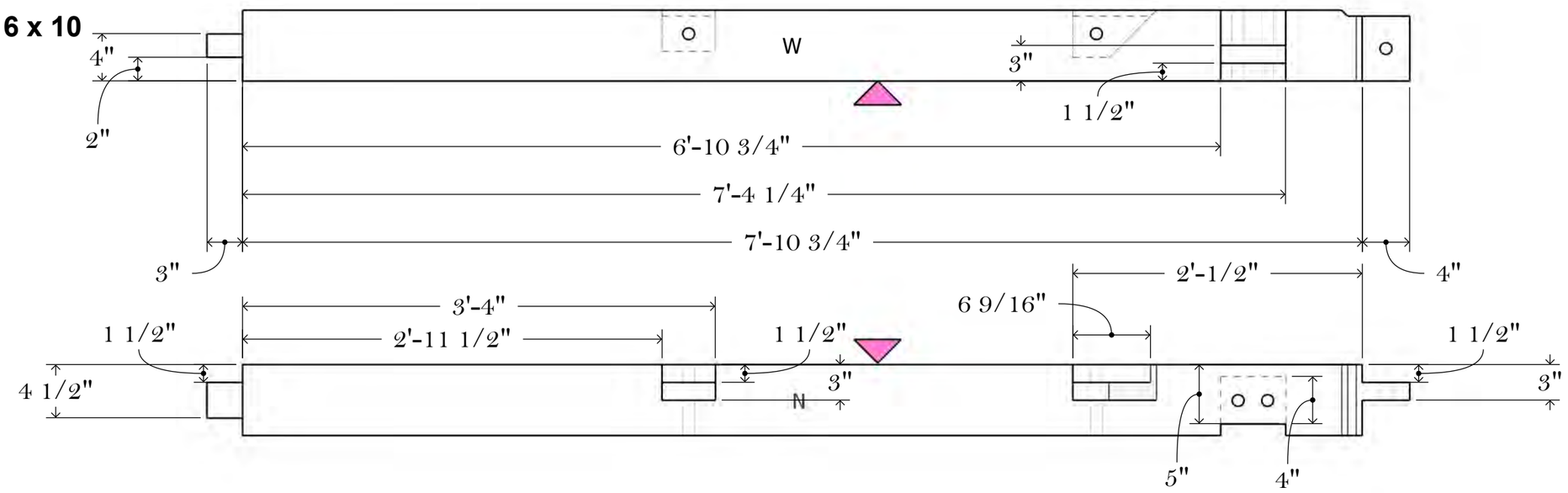
Footing Layout

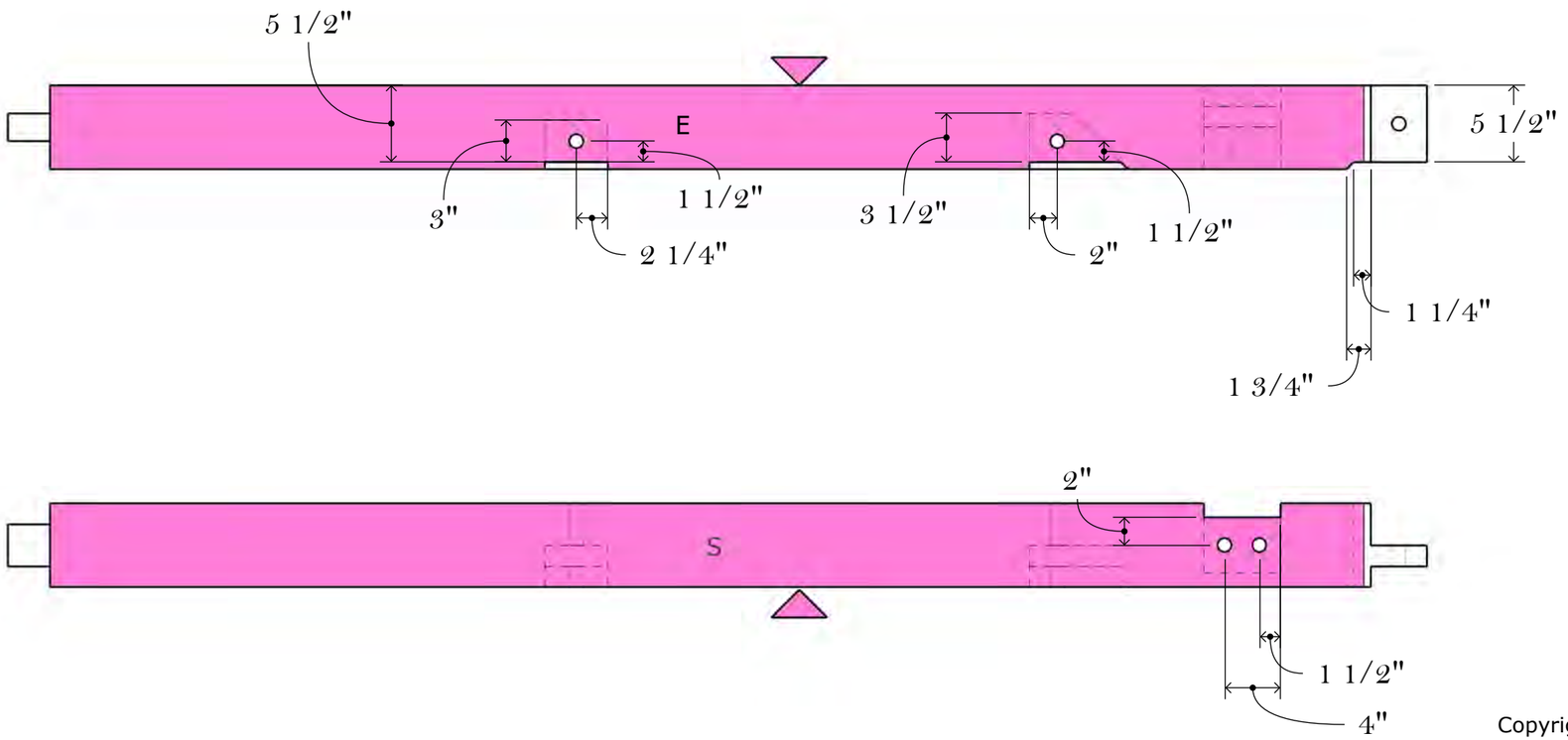


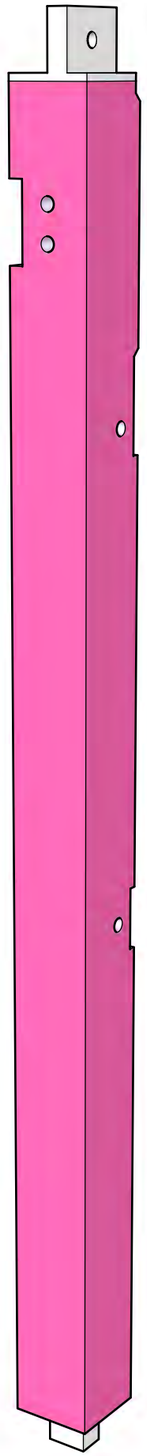
Footings should extend below the frostline

OH P1A

6 x 6 x 10





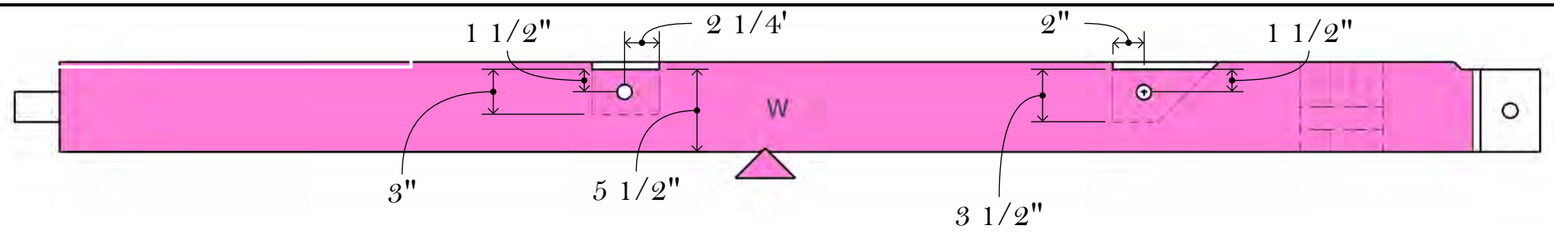


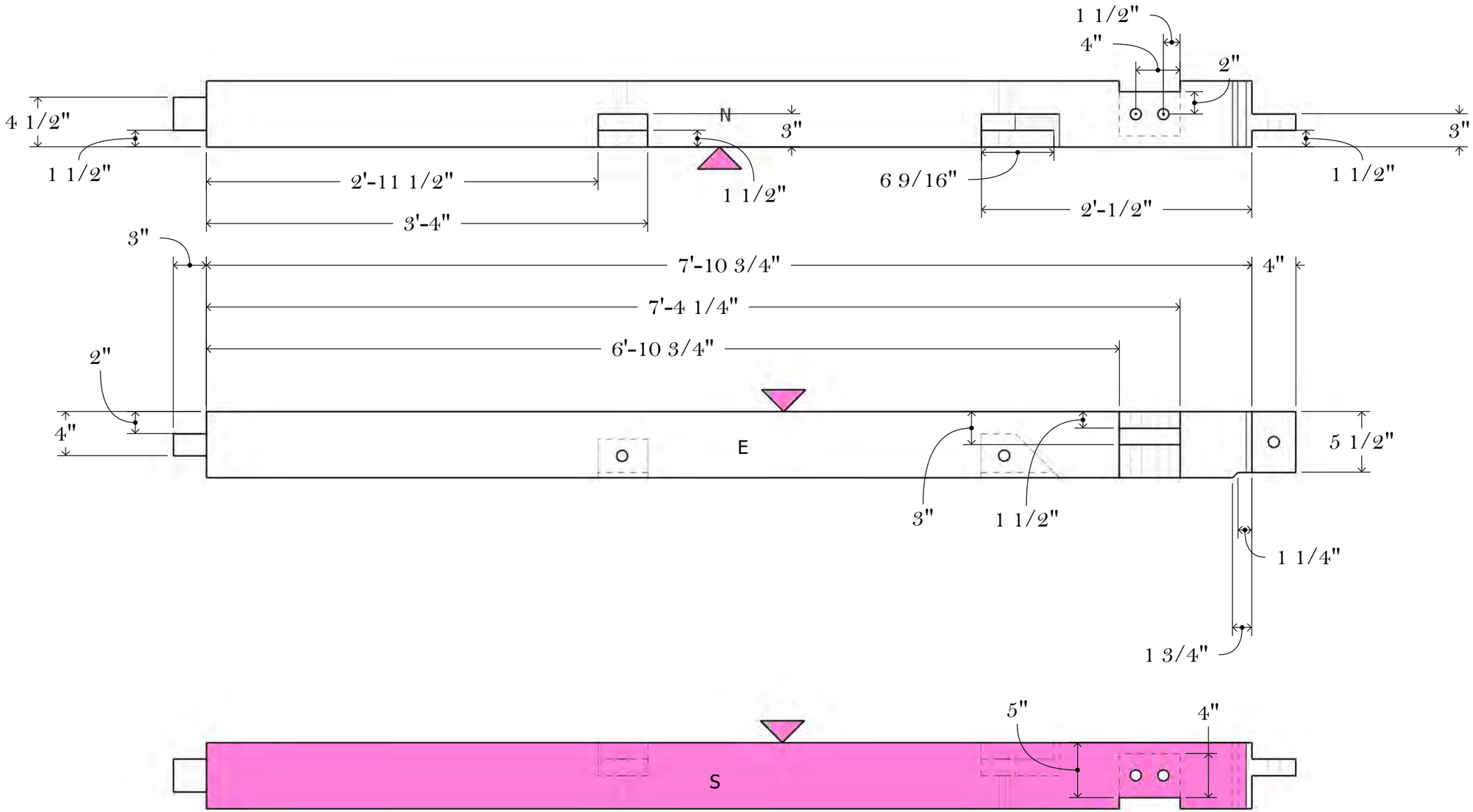
OH P1A

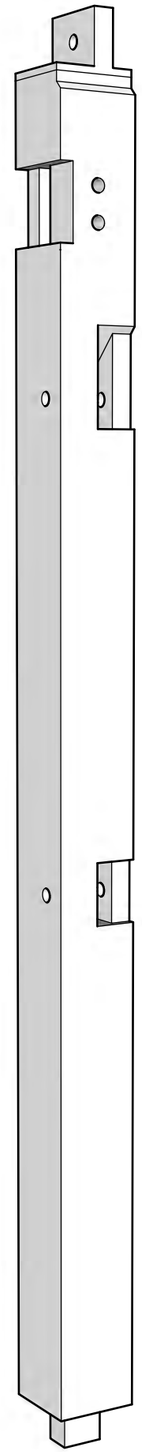
STAR HILL

Timber Frame Practices

0H P1B
6 x 6 x 10





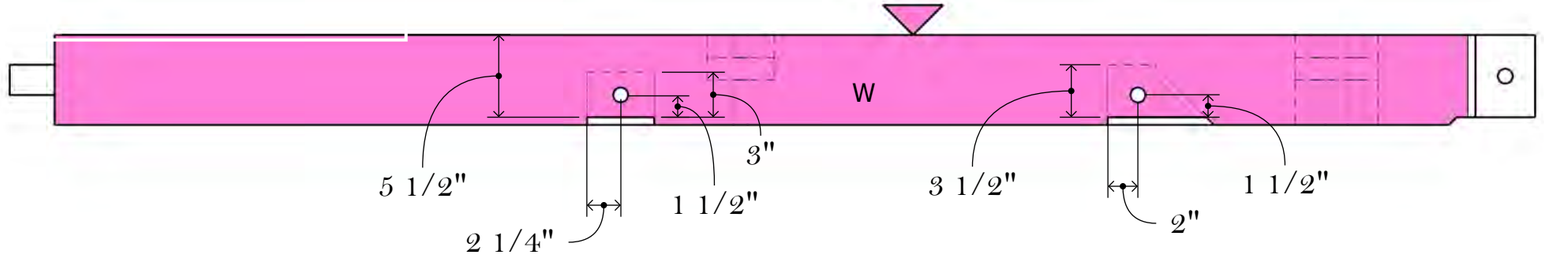


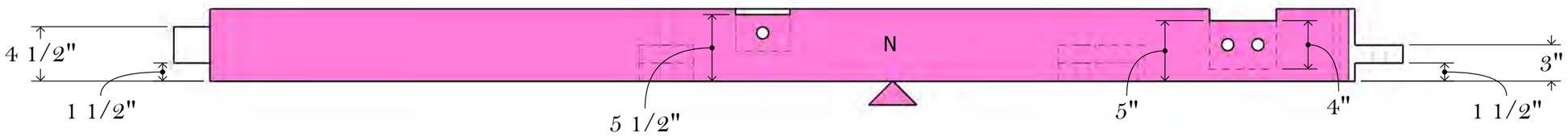
0H P1B

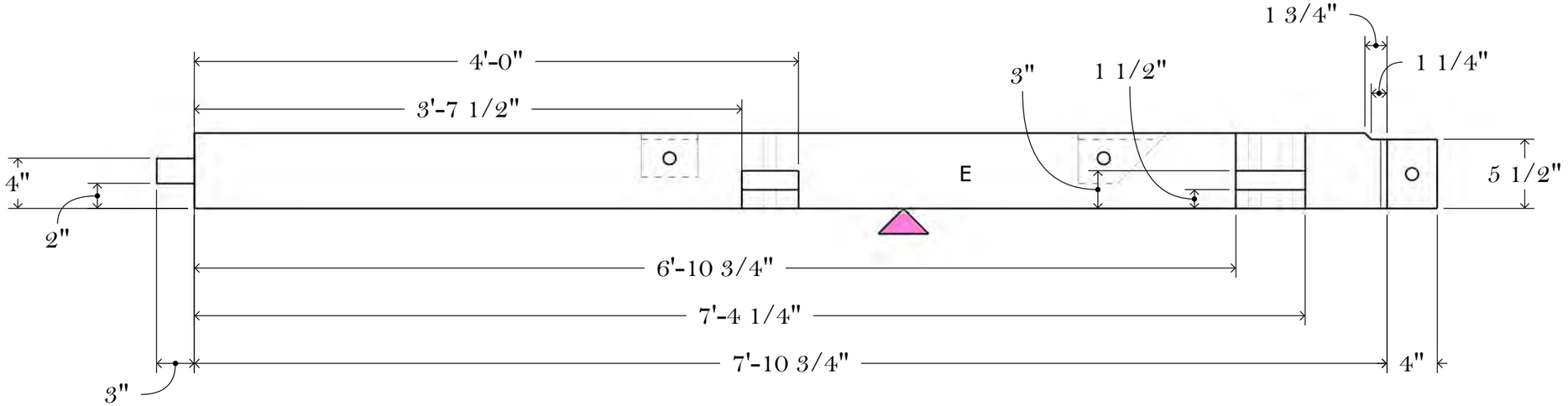
STAR HILL

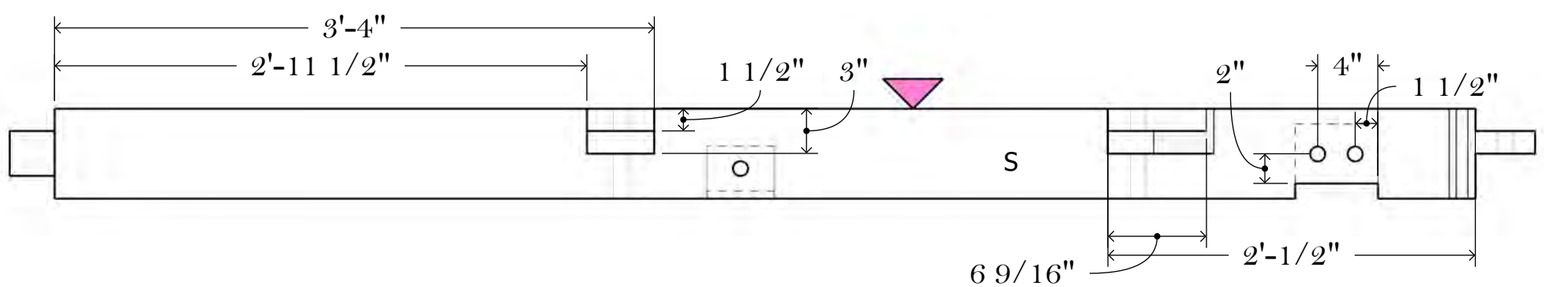
Timber Frame Practices

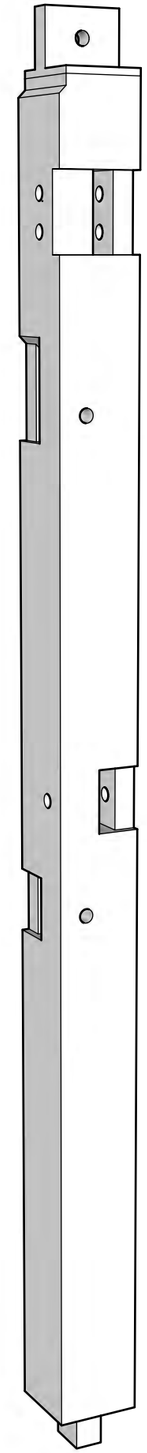
OH P2B
6 x 6 x 10









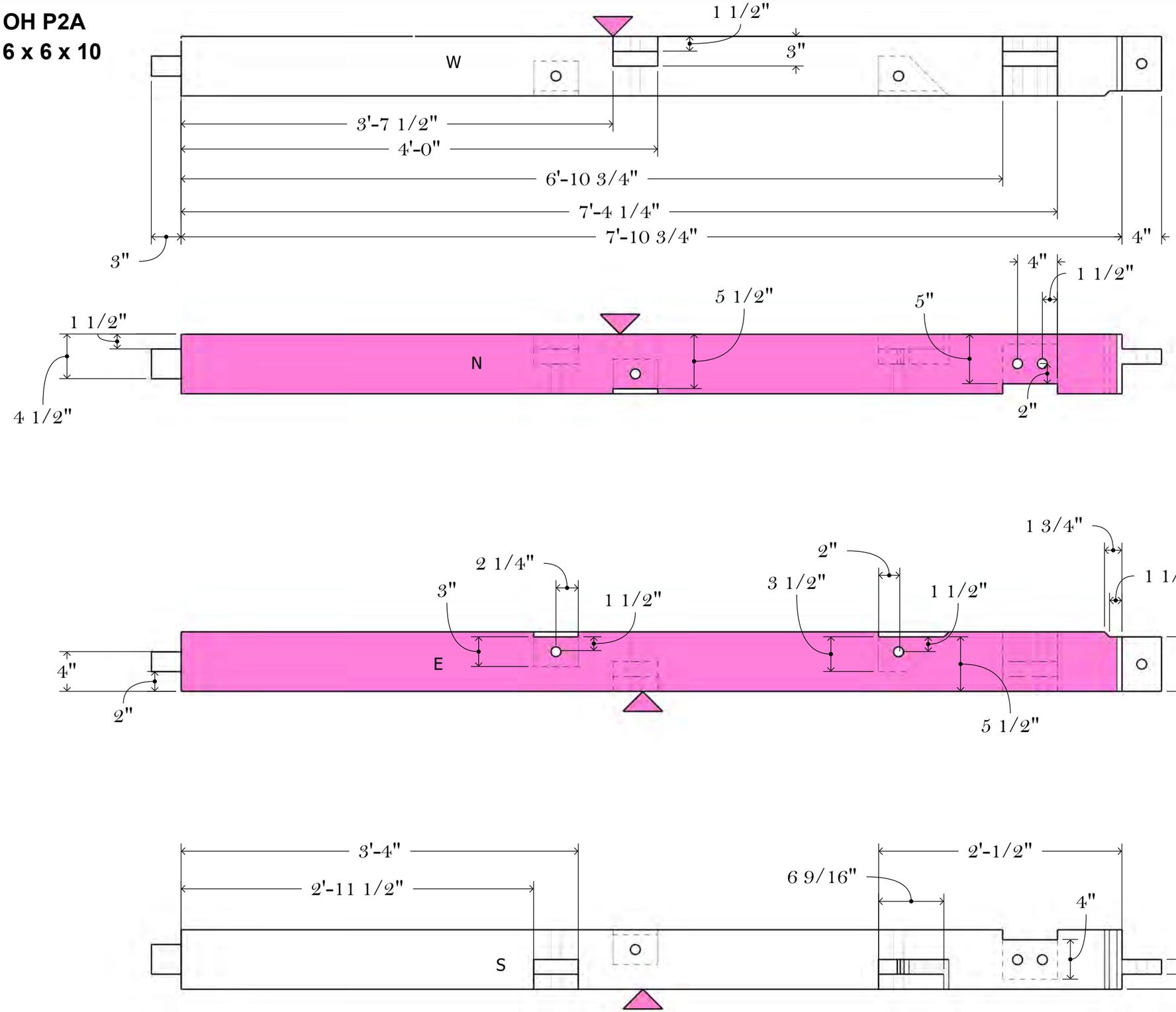


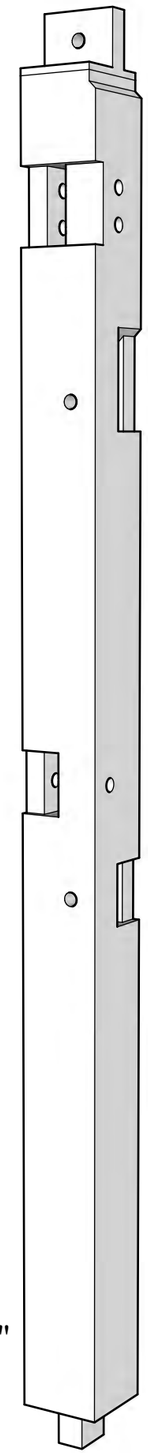
OH P2B

STAR HILL

Timber Frame Practices

OH P2A
6 x 6 x 10



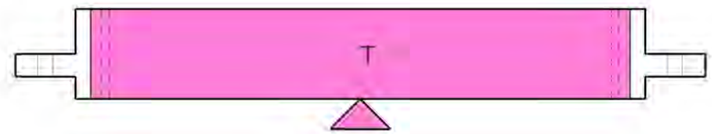


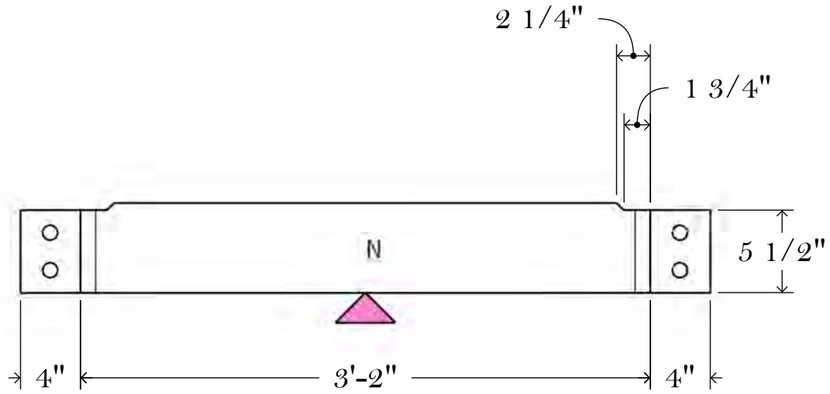
OH P2A

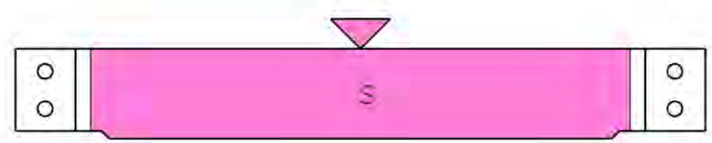
STAR HILL

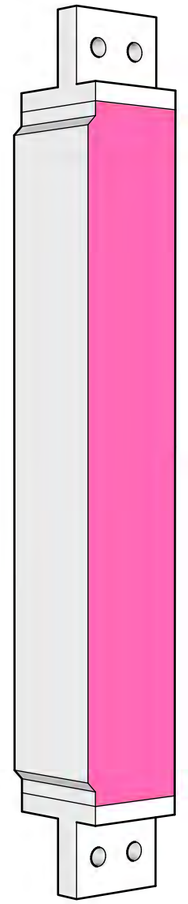
Timber Frame Practices

OH Tie 1
6 x 6 x 6







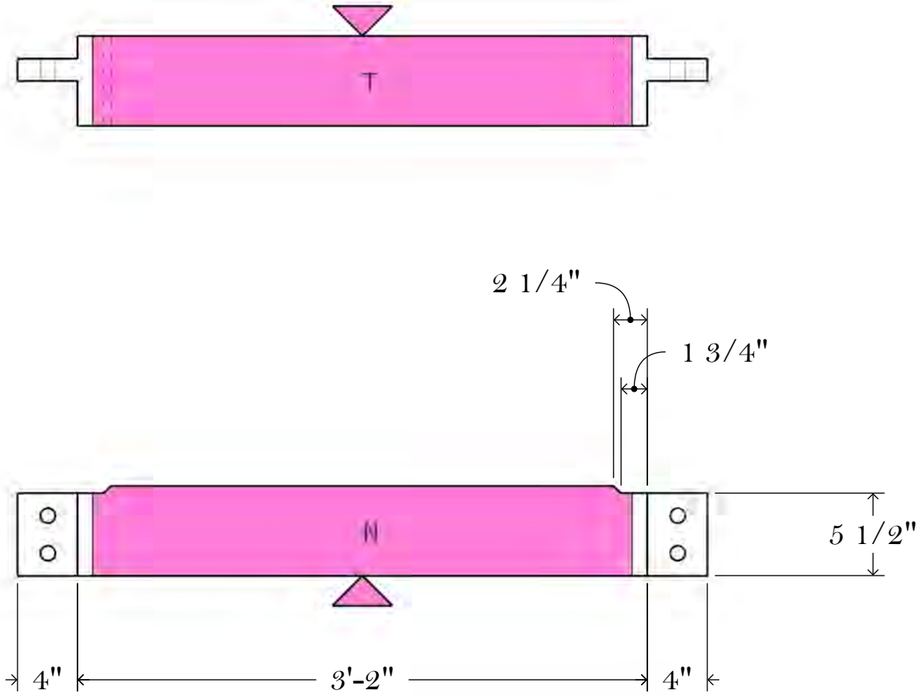


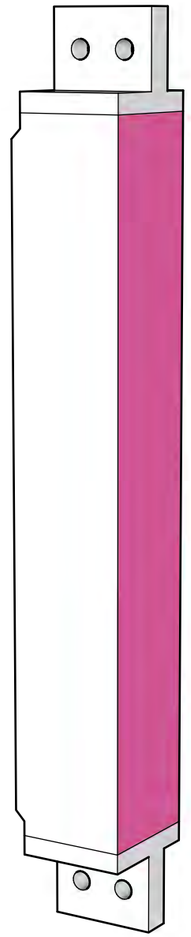
OH Tie 1

STAR HILL

Timber Frame Practices

OH Tie 2
6 x 6 x 6



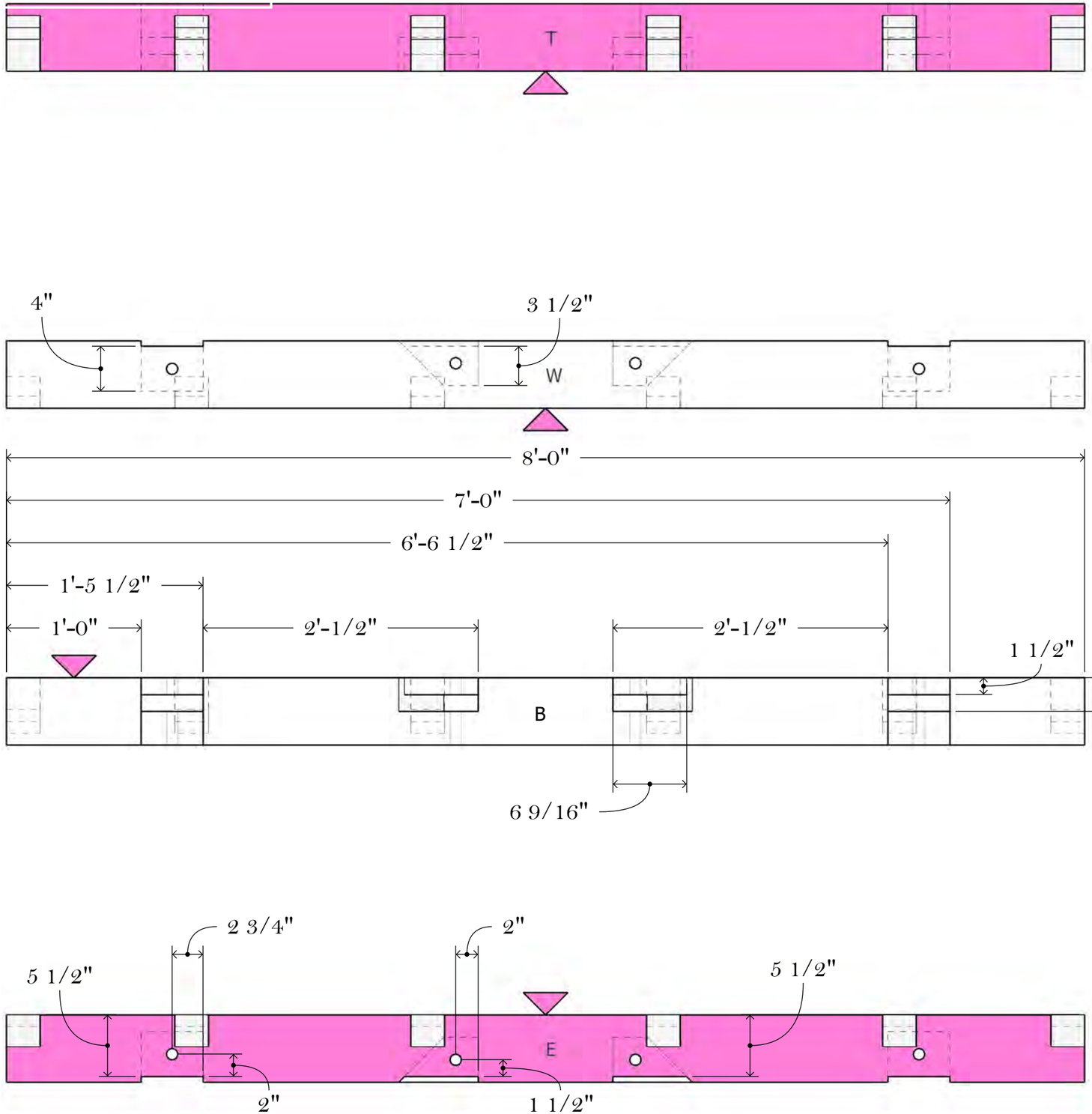


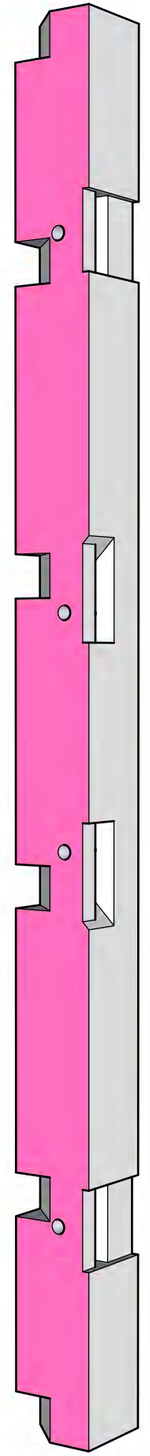
OH Tie 2

STAR HILL

Timber Frame Practices

OH Plate
6 x 6 x 10 (2)



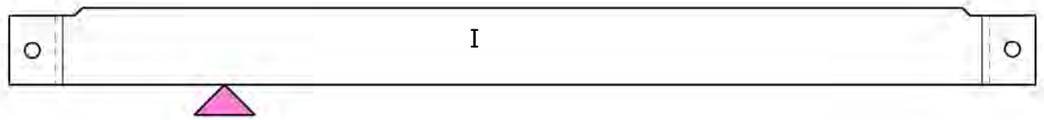


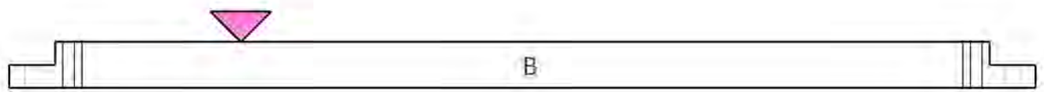
OH Plate

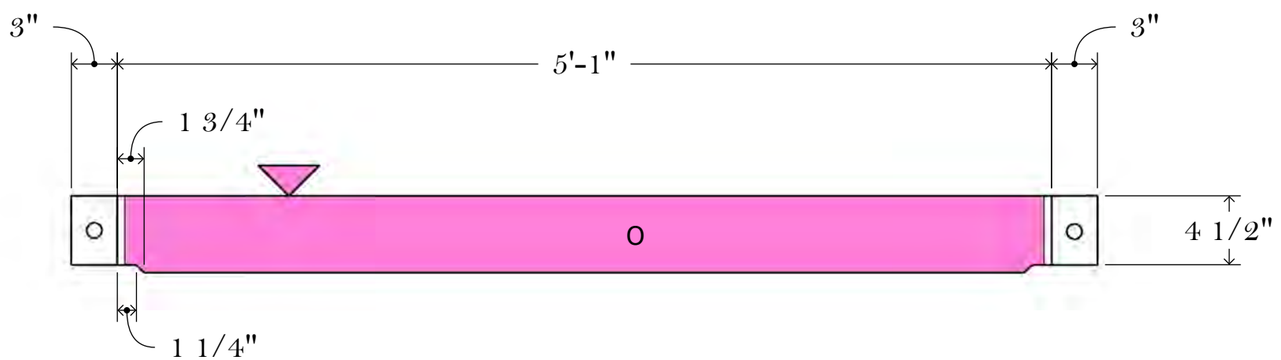
STAR HILL

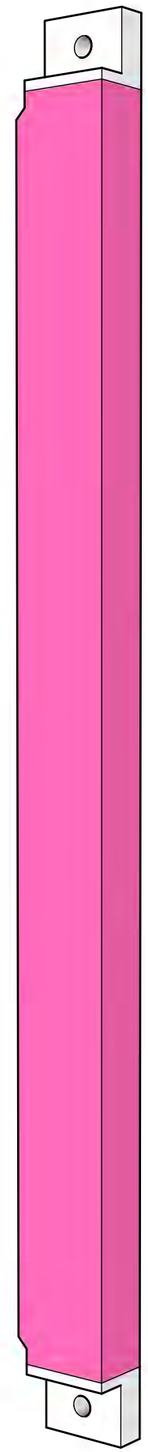
Timber Frame Practices

OH Girt - Side
3 x 5 x 6 (2)







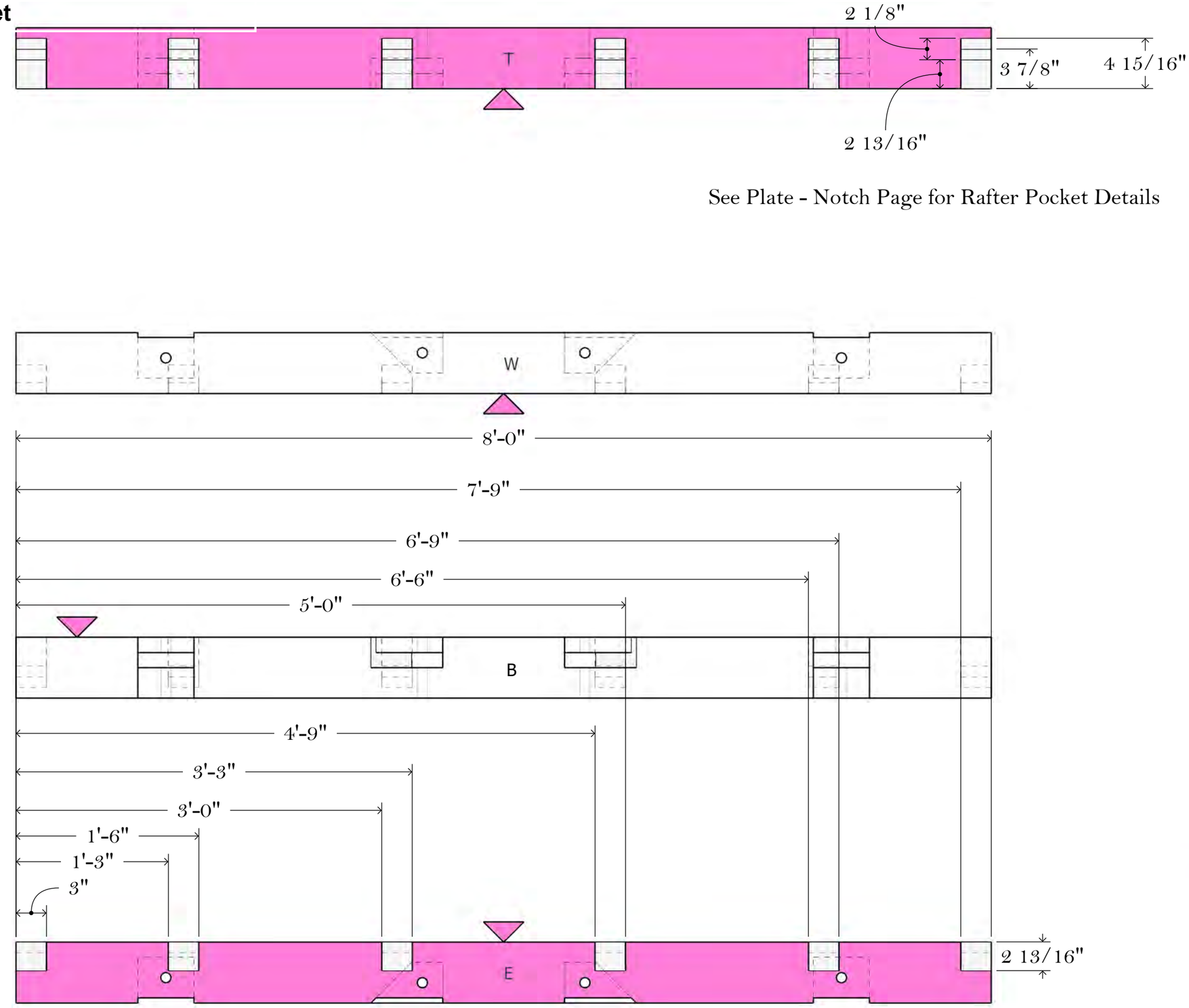


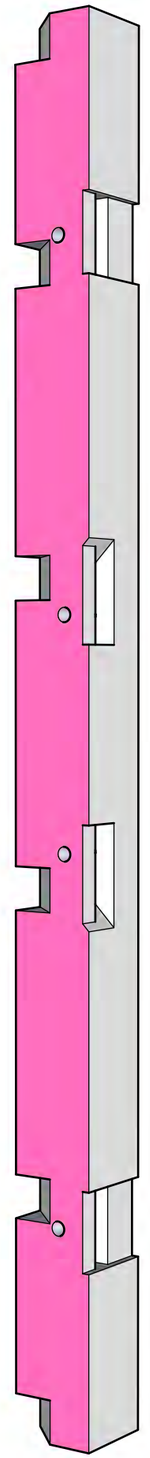
OH Girt - Side

STAR HILL

Timber Frame Practices

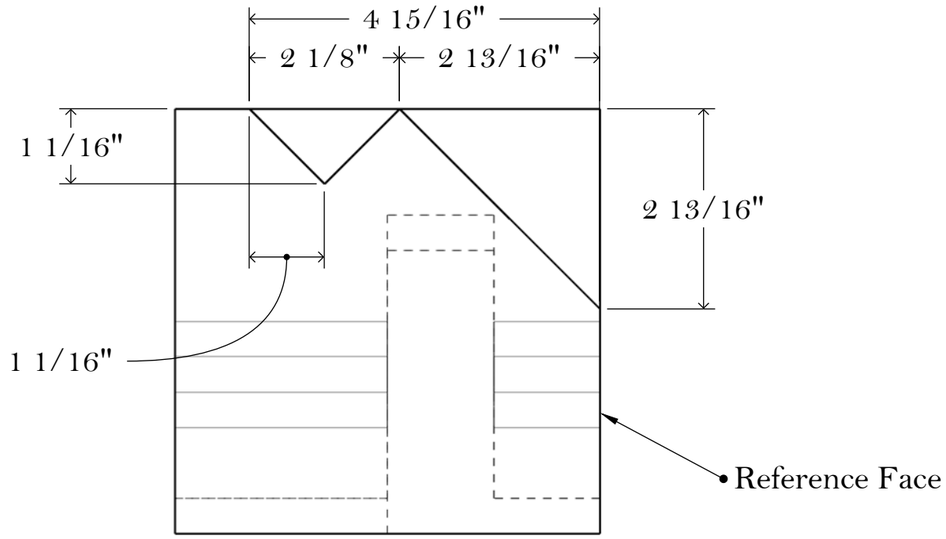
OH Plate Pocket
6 x 6 x 10 (2)

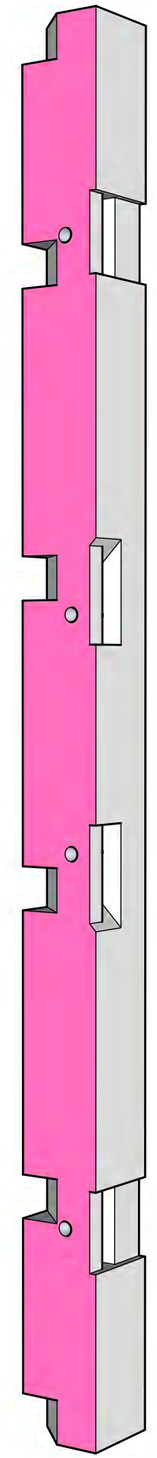




See Plate - Notch Page for Rafter Pocket Details

OH Plate Notch



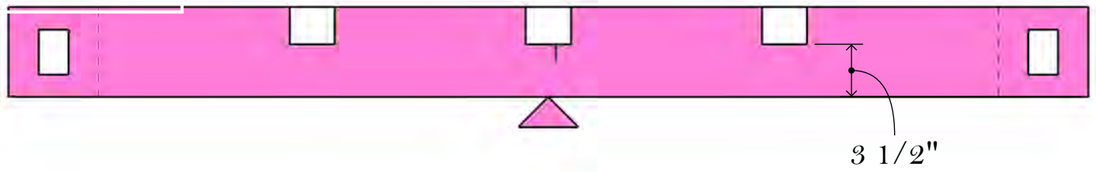


OH Plate Notch

STAR HILL

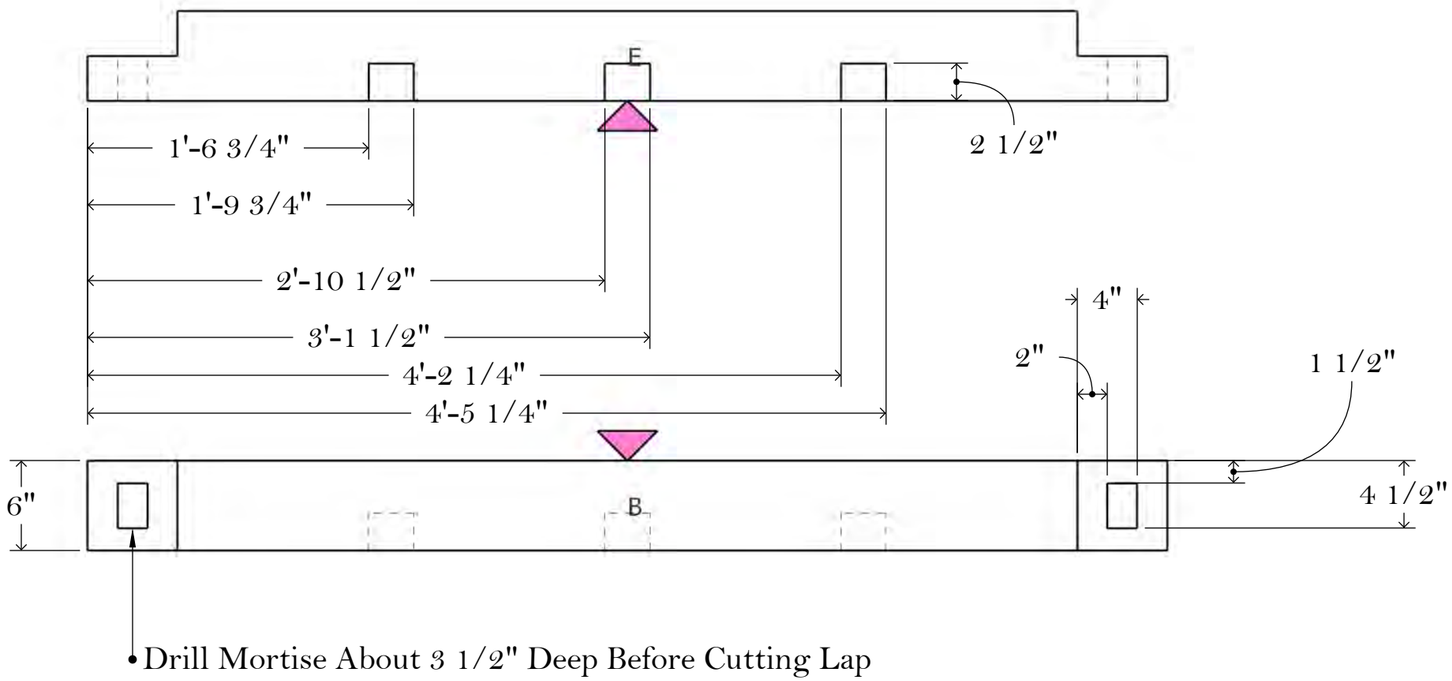
Timber Frame Practices

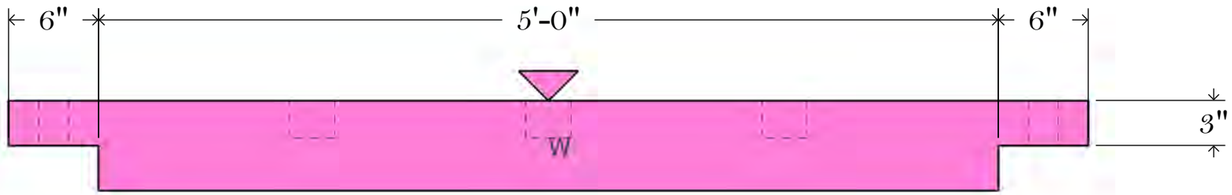
OH Sill - Side
6 x 6 x 8 (2)

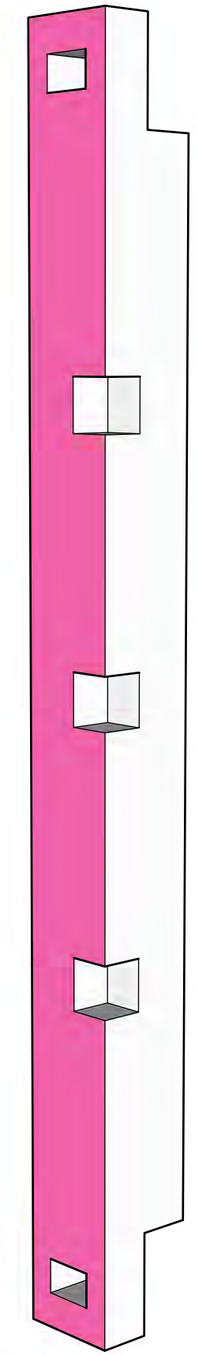


Secure sills with Timberlok or Spax structural screws

Connect Post to Sills with Hurricane Straps





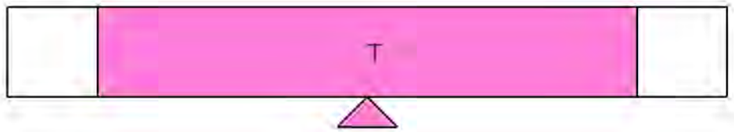


OH Sill - Side

STAR HILL

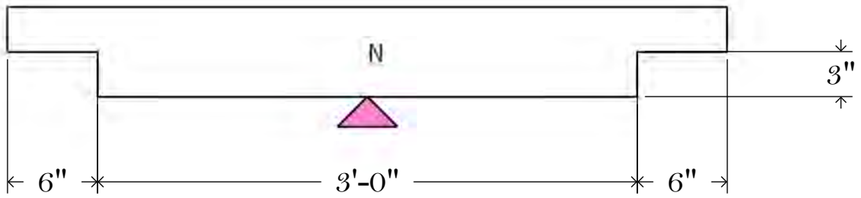
Timber Frame Practices

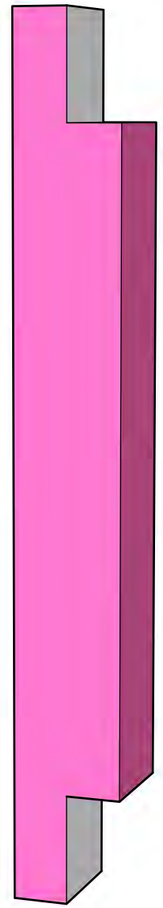
OH Sill - End
6 x 6 x 6 (2)



Secure sills with Timberlok or Spax structural screws

Connect Post to Sills with Hurricane Straps



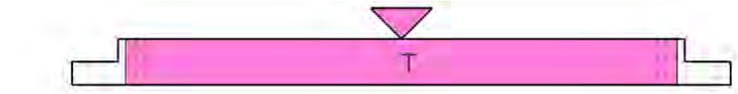


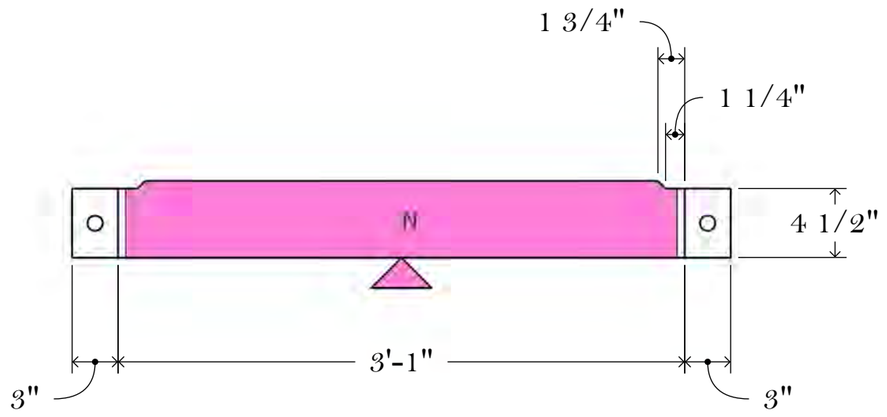
OH Sill - End

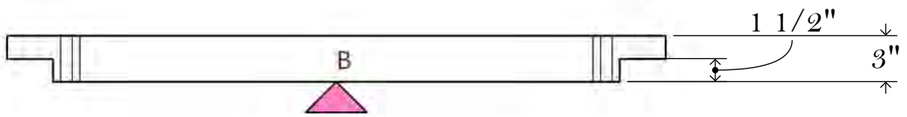
STAR HILL

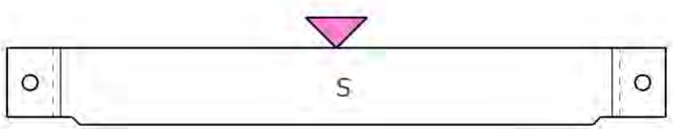
Timber Frame Practices

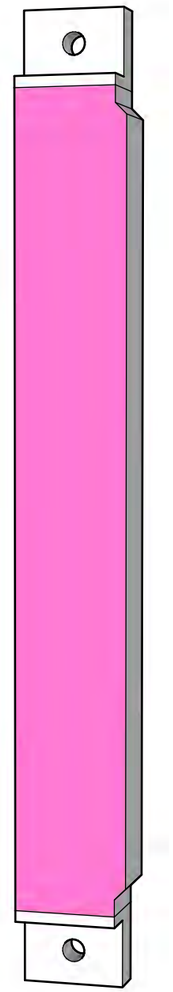
OH Girt - End
3 x 5 x 4









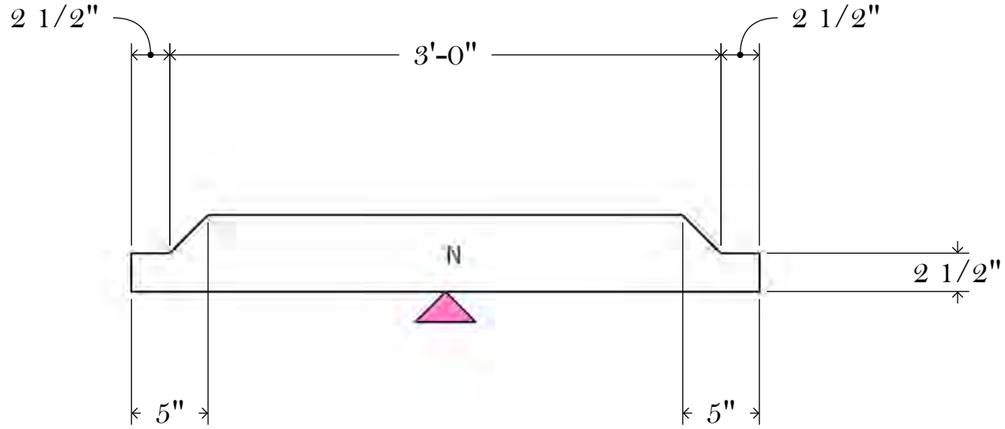


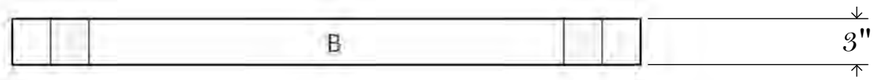
OH Girt - End

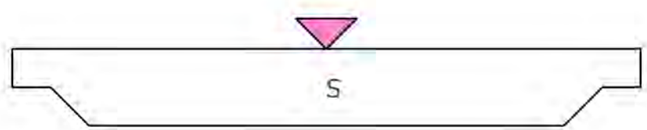
STAR HILL

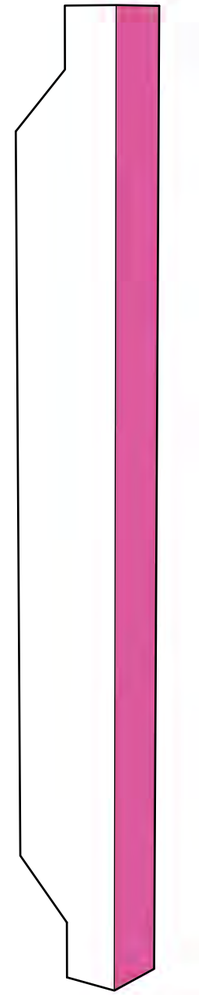
Timber Frame Practices

OH Joist
3 x 5 x 4 (3)







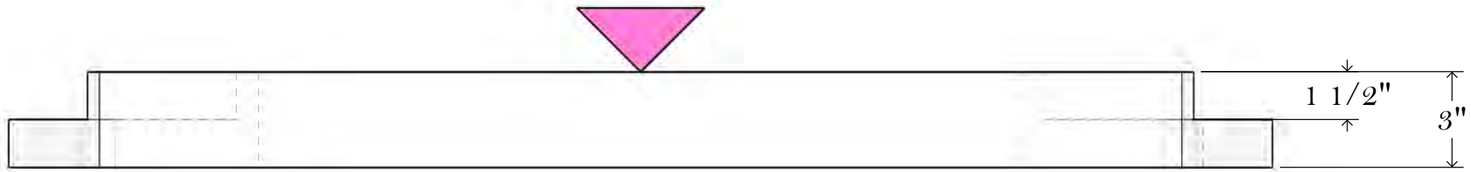


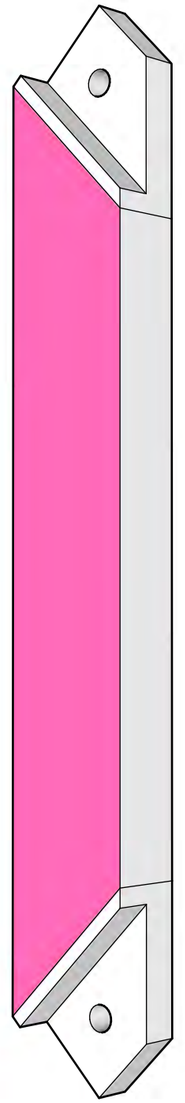
OH Joist

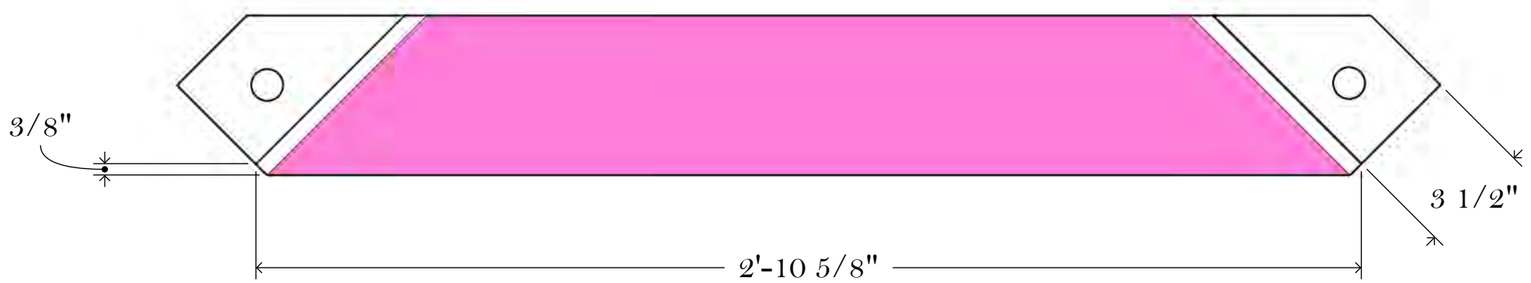
STAR HILL

Timber Frame Practices

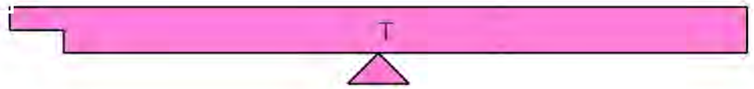
OH KB 30
3 x 5 x 4 (4)



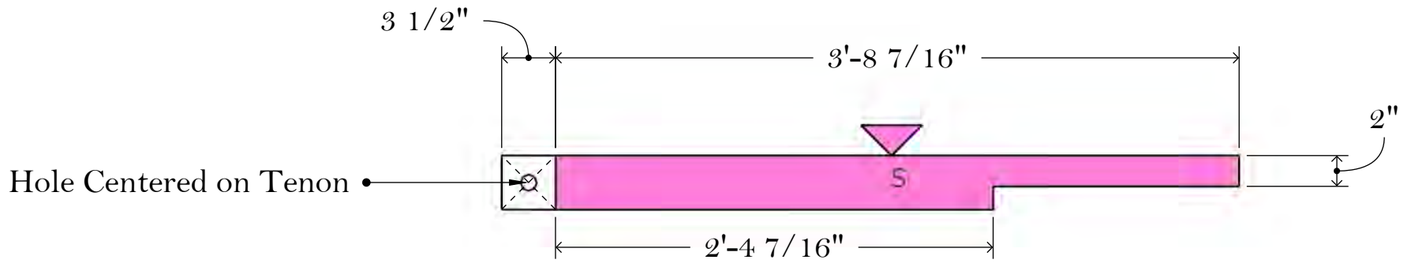


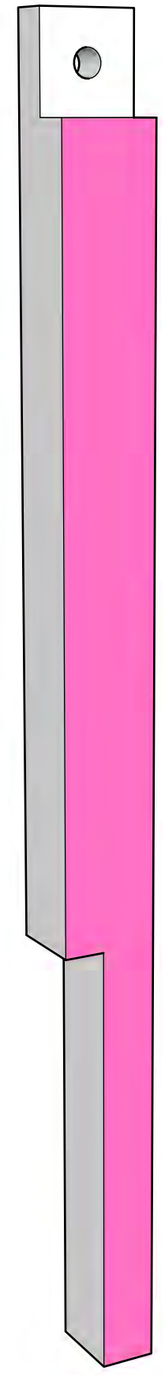


OH Rafter A
3 x 3 1/2 x 6 (6)



Secure rafter to plate with Timberlok or Spax structural screws





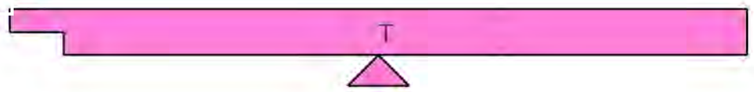
OH Rafter A

STAR HILL

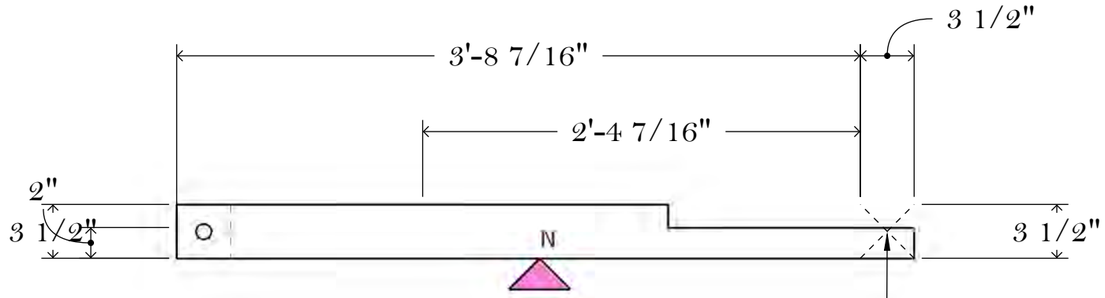
Timber Frame Practices

OH Rafter B

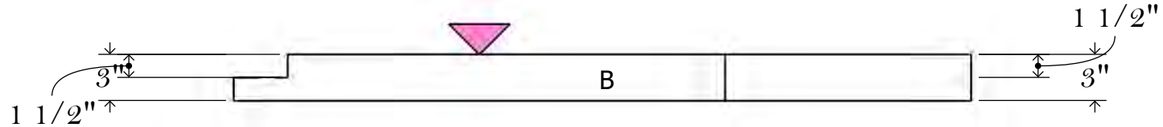
3 x 3 1/2 x 6 (6)

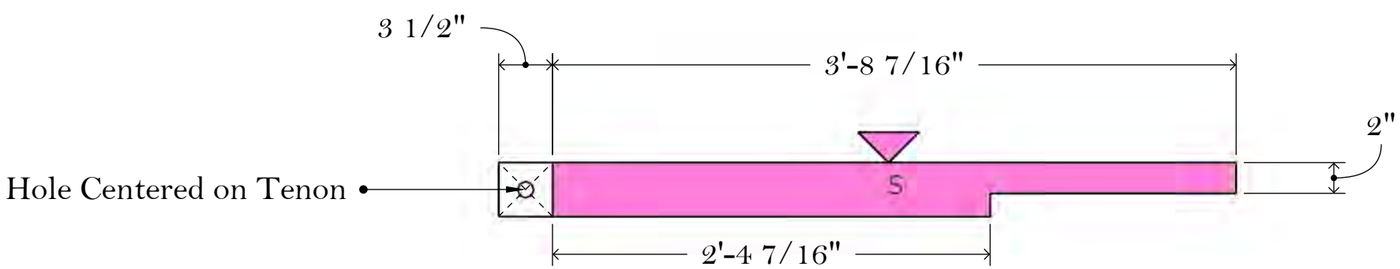


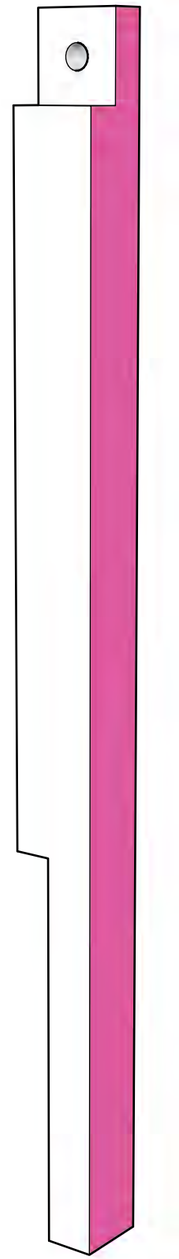
Secure rafter to plate with Timberlok or Spax structural screws



Center the Hole on the Tenon







OH Rafter B

STAR HILL

Timber Frame Practices