

## Timber Frames and Log Structures



## Modern Timber Frame

Contemporary examples by Riverbend



# Modern Timber Frame

Traditional structural framing usually with Douglas Fir or White Pine



Peter von Buelow

University of Michigan, TCAUP

Slide 3 of 45

# Timber Framing

John Pariseau barn 2015



Peter von Buelow

University of Michigan, TCAUP

Slide 4 of 45

# Timber Framing

John Pariseau barn



Peter von Buelow

University of Michigan, TCAUP

Slide 5 of 45

# Timber Framing

John Pariseau barn



Peter von Buelow

University of Michigan, TCAUP

Slide 6 of 45

# Timber Framing

John Pariseau barn



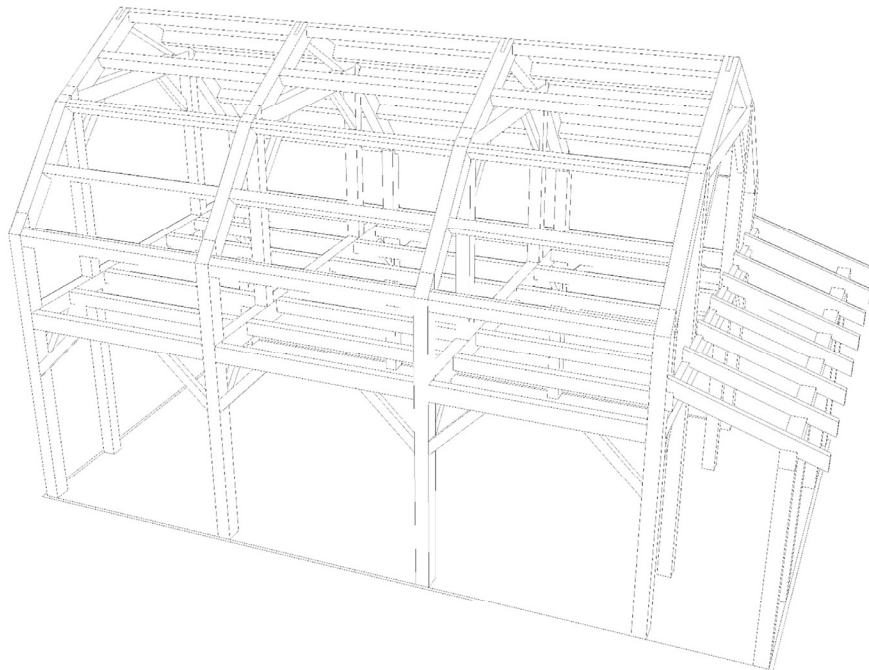
Peter von Buelow

University of Michigan, TCAUP

Slide 7 of 45

# Timber Framing

John Pariseau barn



Wanderlust Design  
1115 W. Main St.  
Plymouth, MI 48170

Pariseau Barn  
Plymouth MI

ISSUE  
7/23/15

DESIGNED BY  
D.H.

**a**

**02**

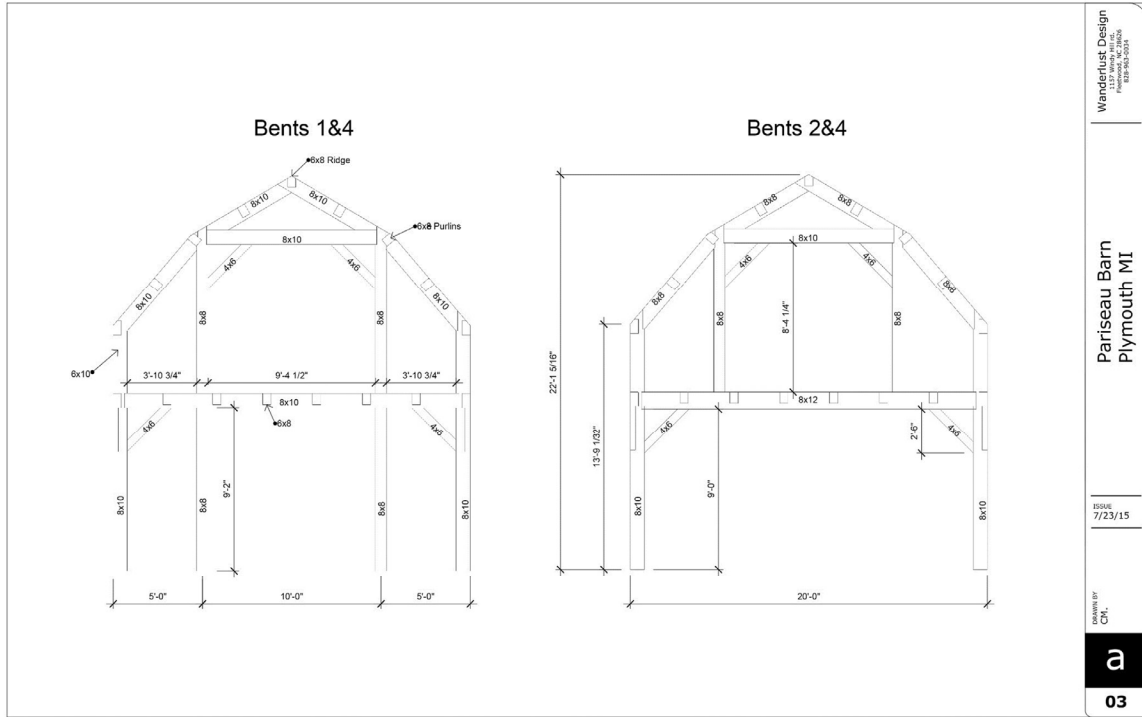
Peter von Buelow

University of Michigan, TCAUP

Slide 8 of 45

# Timber Framing

John Pariseau barn



Wanderlust Design  
 10000 N. 24th St.  
 49706-1024

Pariseau Barn  
 Plymouth MI

ISSUE  
 7/23/15

DESIGNED BY  
 CH

**a**

**03**

Peter von Buelow

University of Michigan, TCAUP

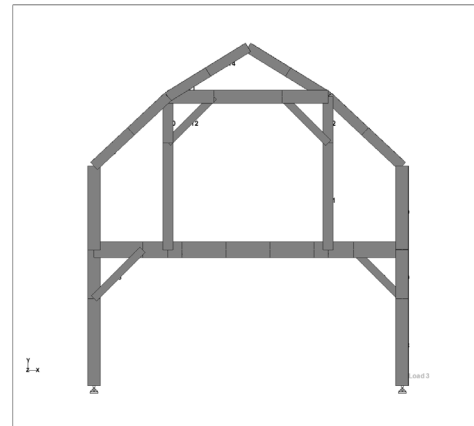
Slide 9 of 45

# Timber Framing

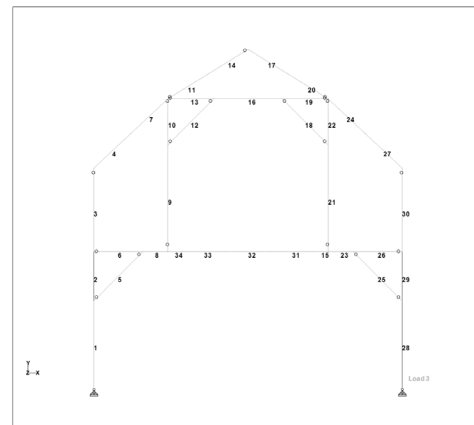
John Pariseau barn

## Combination Load Cases

- 7 D
- 8 D+L
- 9 D+LR
- 10 D+S
- 11  $D+0.75L+0.75LR$
- 12  $D+0.75L+0.75S$
- 13  $D+0.6W$
- 14  $D+0.75L+0.75(0.6W)+0.75LR$
- 15  $D+0.75L+0.75(0.6W)+0.75S$
- 16  $0.6D+0.6W$



Sections



Utilization

Peter von Buelow

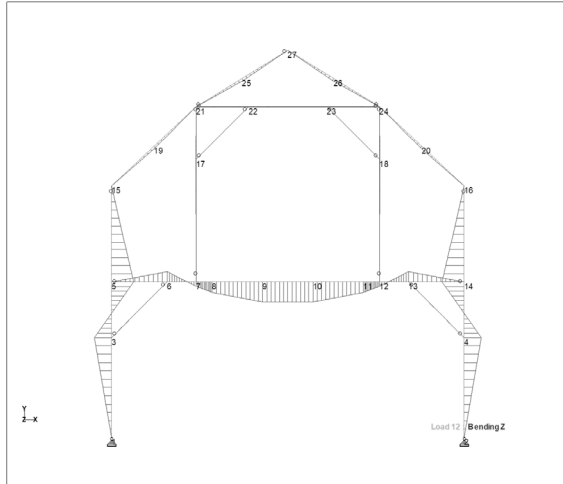
University of Michigan, TCAUP

Slide 10 of 45

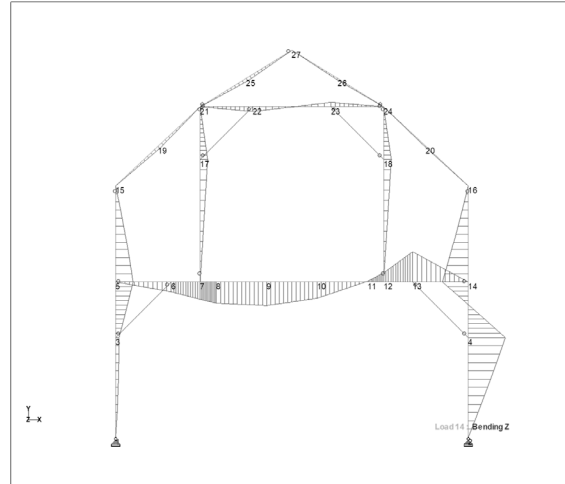
# Timber Framing

John Pariseau barn

Moment:



$D+0.75L+0.75S$

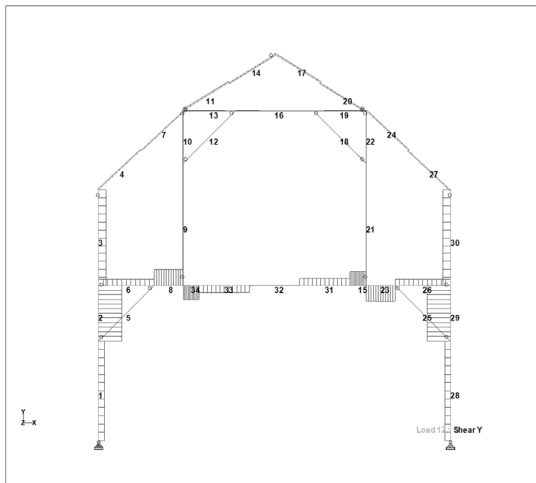


$D+0.75L+0.75(0.6W)+0.75LR$

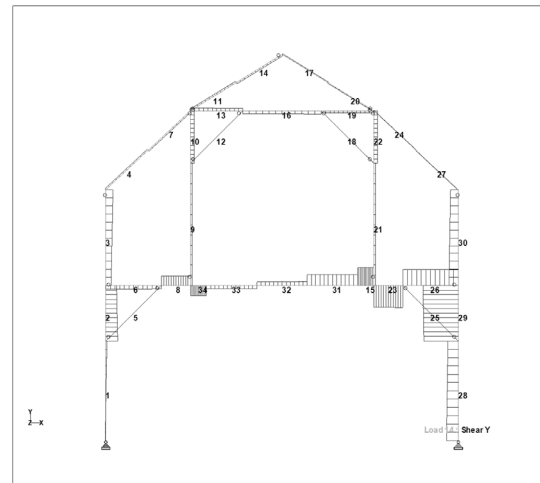
# Timber Framing

John Pariseau barn

Shear



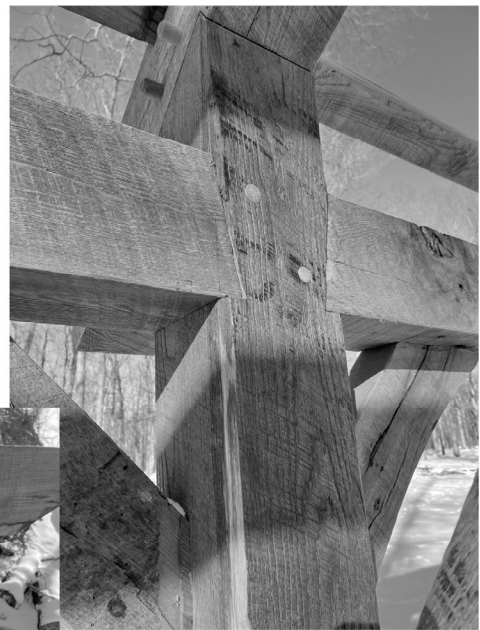
$D+0.75L+0.75S$



$D+0.75L+0.75(0.6W)+0.75LR$

# Timber Framing

Charlie Carter barn



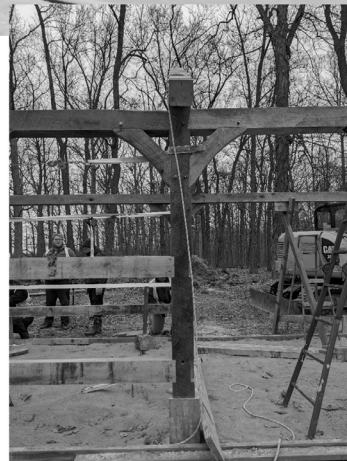
Peter von Buelow

University of Michigan, TCAUP

Slide 13 of 45

# Timber Framing

Charlie Carter barn



Peter von Buelow

University of Michigan, TCAUP

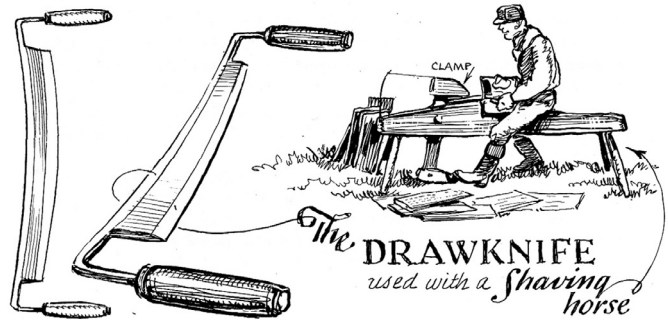
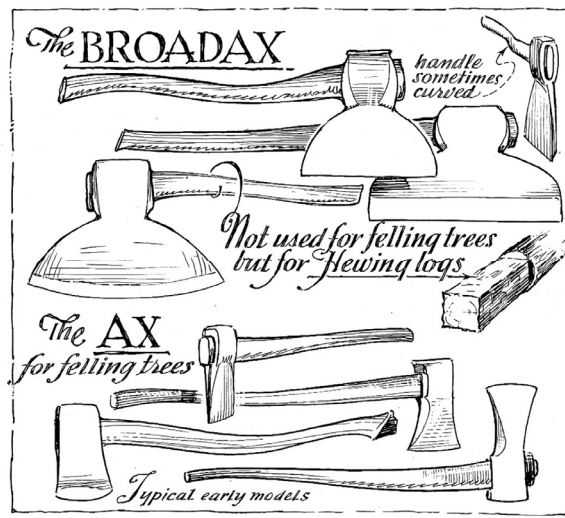
Slide 14 of 45

# Timber Framing

## Tools



Peter von Buelow



University of Michigan, TCAUP

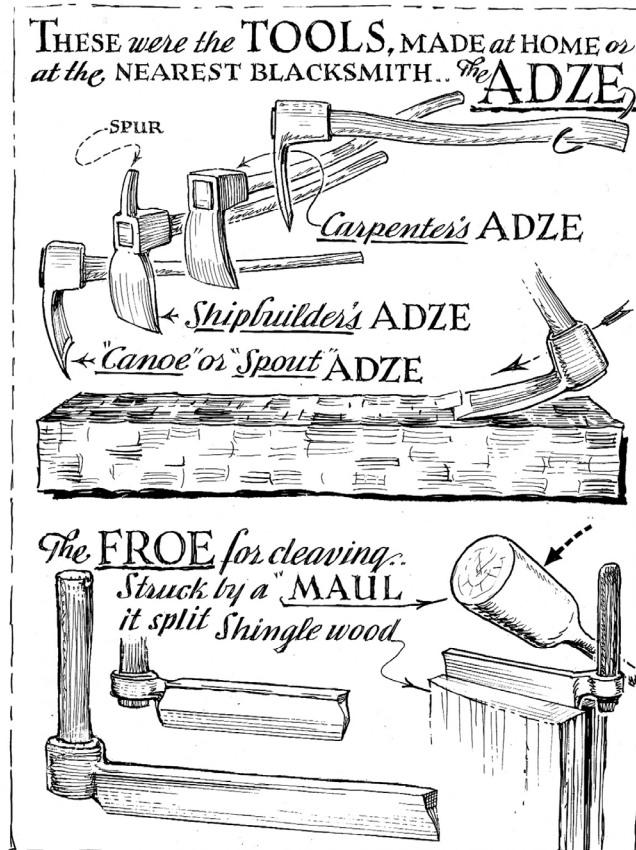
Slide 15 of 45

# Timber Framing

## Tools



Peter von Buelow



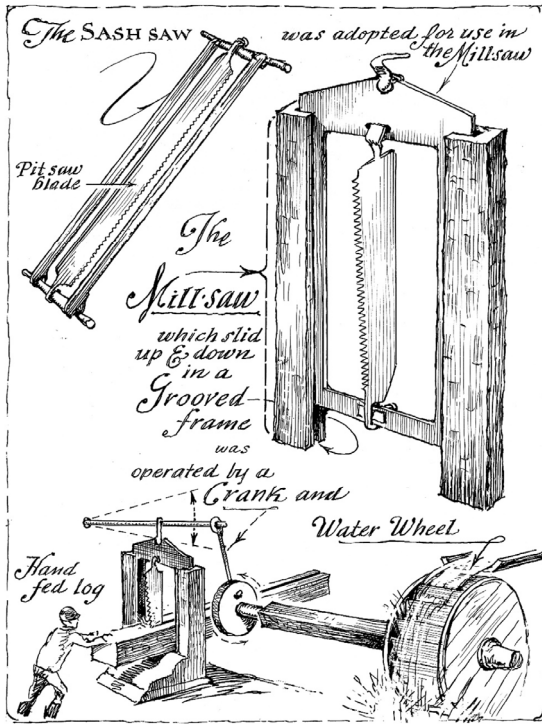
University of Michigan, TCAUP

Slide 16 of 45



# Timber Framing

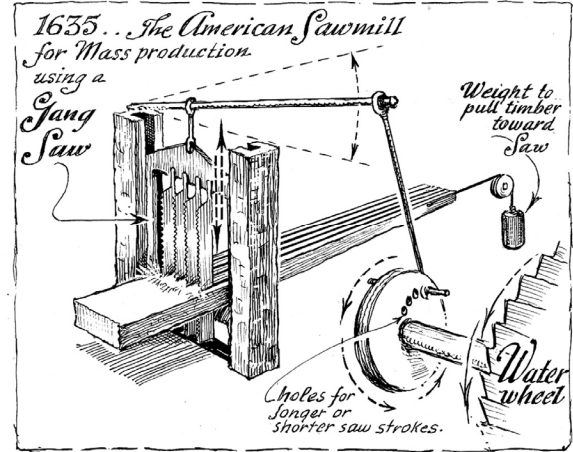
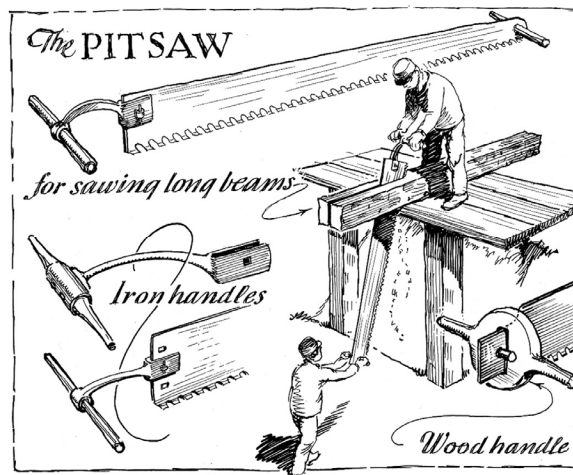
## Tools



Peter von Buelow

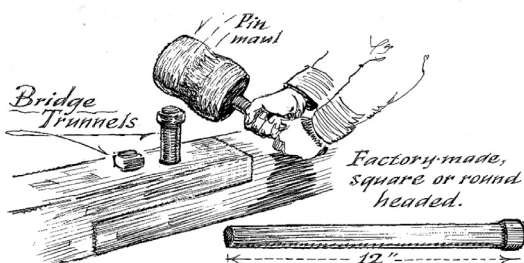
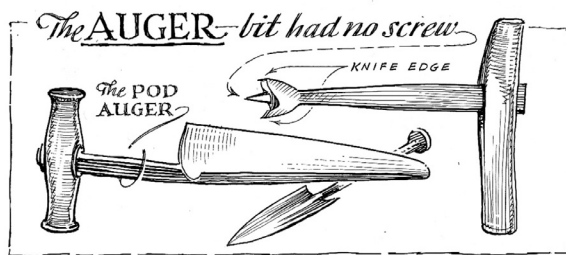
University of Michigan, TCAUP

Slide 17 of 45

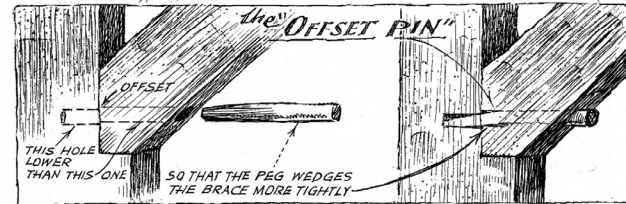
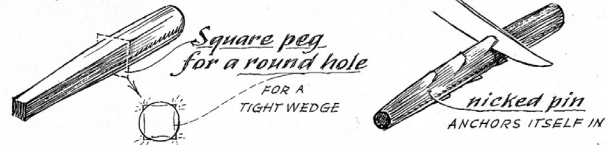


# Timber Framing

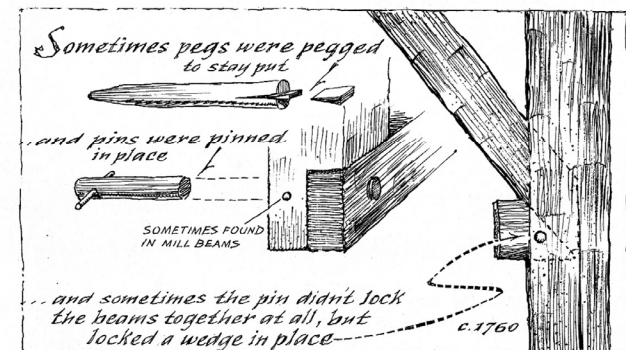
## joinery



## Ways of making a wooden pin stay put. (1700s)



Hammered while green, it stayed put tightly



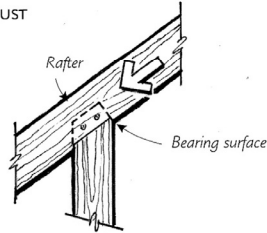
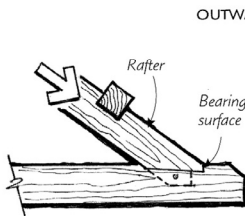
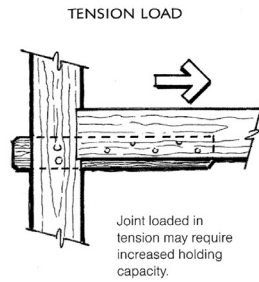
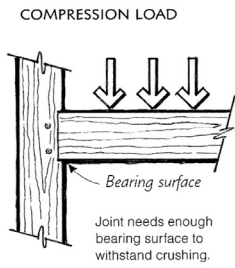
Peter von Buelow

University of Michigan, TCAUP

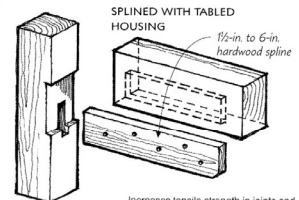
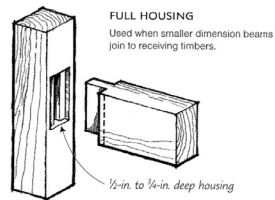
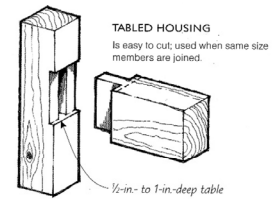
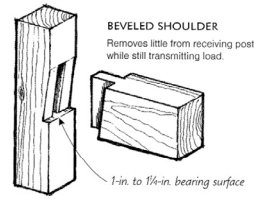
Slide 18 of 45

# Timber Framing

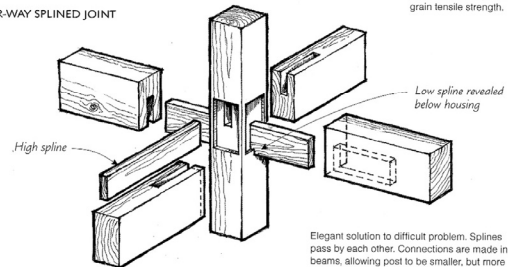
## joinery



## STRENGTHENING MORTISE-AND-TENON JOINTS



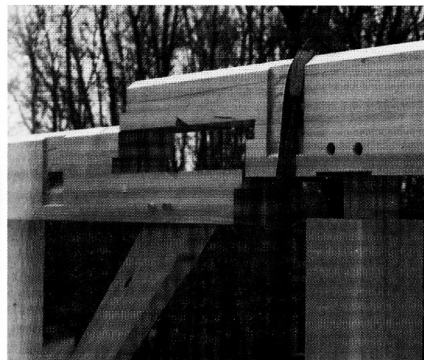
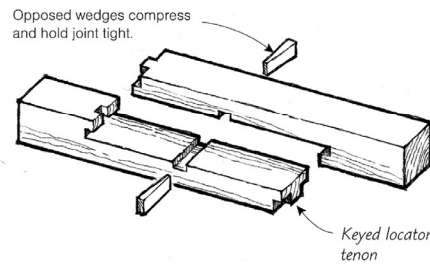
## FOUR-WAY SPLINED JOINT



# Timber Framing

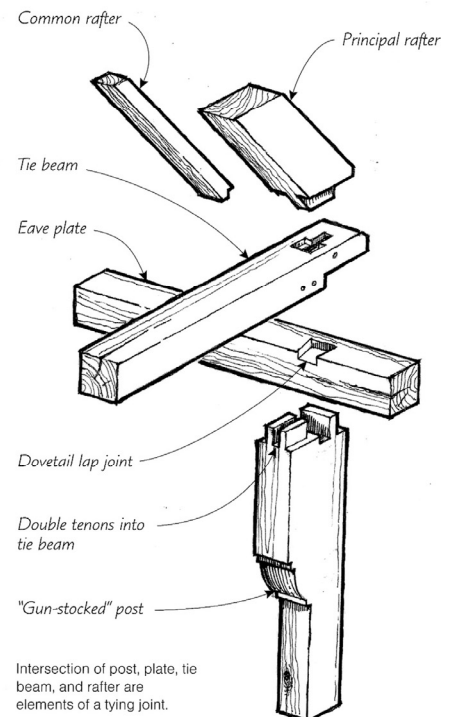
## joinery

## SCARF JOINT



The scarf joint can be very strong and beautiful. This example is keyed in two directions and will be locked with wedges. Note that the brace is positioned to help support the scarf. The wood is Sitka spruce.

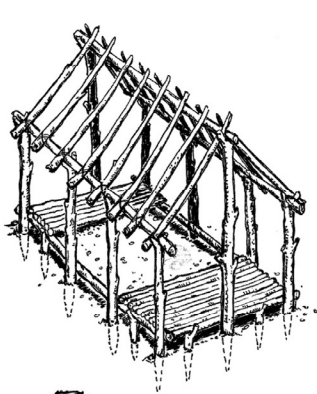
## TYING JOINT



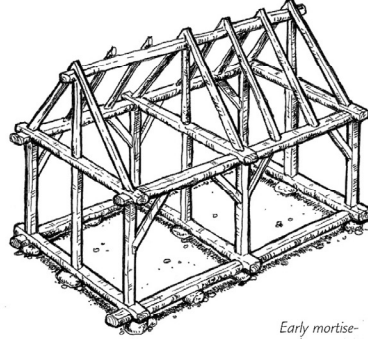
# Timber Framing

## timber frame development

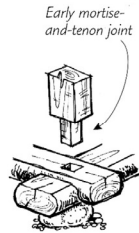
### EARLY TIMBER-FRAME STRUCTURES



Early wood structure with pieces lashed together and earthbound posts. Rigidity arises from ground anchoring of the frame.

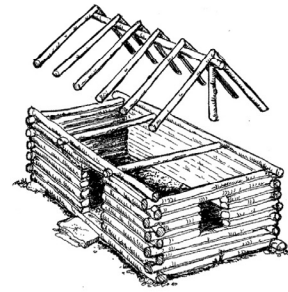


Bringing frame out of ground gave structure a longer life. It also required early builders to make stronger joints and develop structural resistance to loads.



Early mortise-and-tenon joint

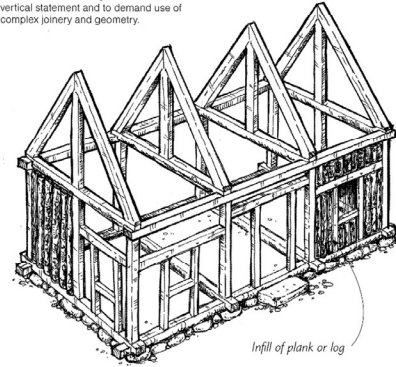
### LOG HOME



Stacking logs is a more basic means of creating a structure, yielding a massive and earthbound look.

### TIMBER-FRAME HOME

Timbered buildings in heavily wooded areas seemed to rise out of ground with more of a vertical statement and to demand use of complex joinery and geometry.



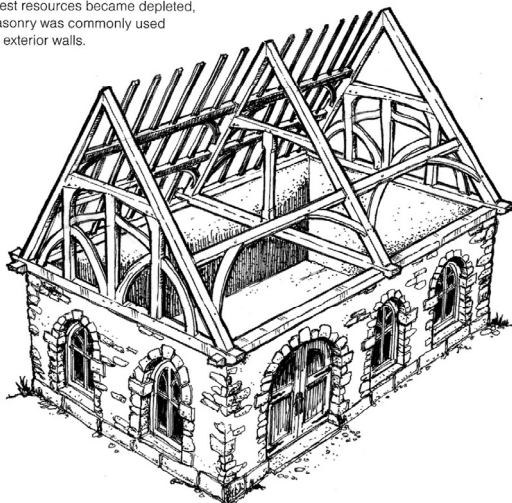
Infill of plank or log

# Timber Framing

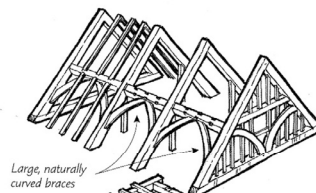
## timber frame development

### TIMBER-FRAME STRUCTURE OF THE MIDDLE AGES

Some of the greatest carpentry of all times is evident in timber-framed roofs of Middle Ages. As European forest resources became depleted, masonry was commonly used for exterior walls.

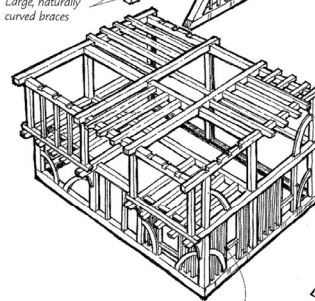


### OLD ENGLISH-STYLE FRAME



Large, naturally curved braces

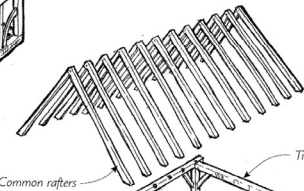
English framing made use of shorter length of timber, curved bracing, and many studs (some removed for clarity).



Close studding

Colonial Americans developed style that featured long timbers for posts, plates, rafters, and tie beams. Frame design was pragmatic and spare in relation to English archetype.

### EARLY AMERICAN FRAME



Common rafters

Tie beam

Long, continuous plate

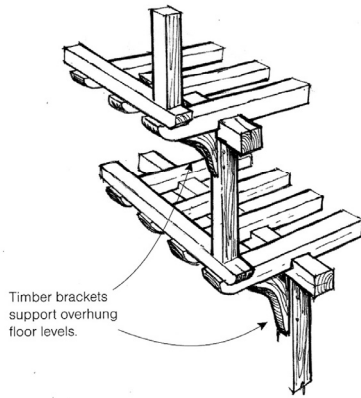
Simple bracing

Continuous posts

# Timber Framing

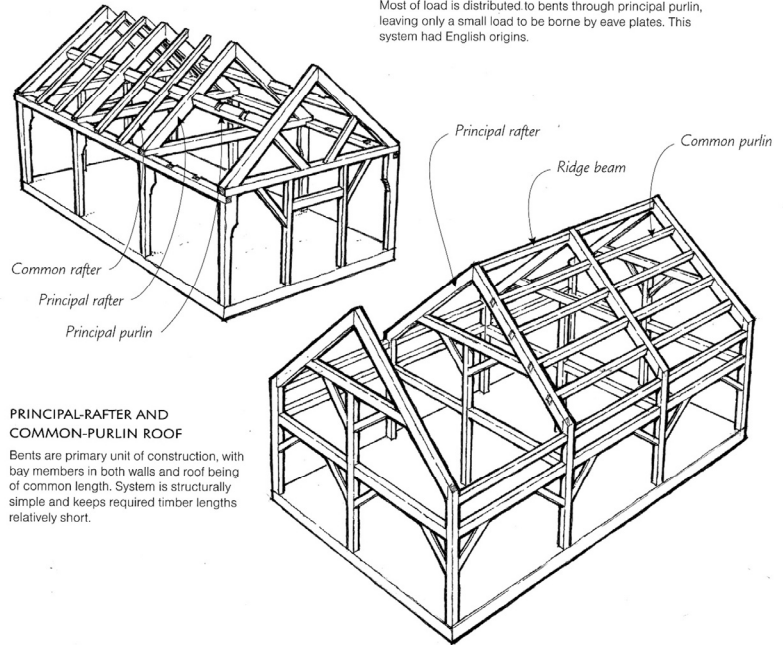
## timber frame development

### BRACING THE STRUCTURE



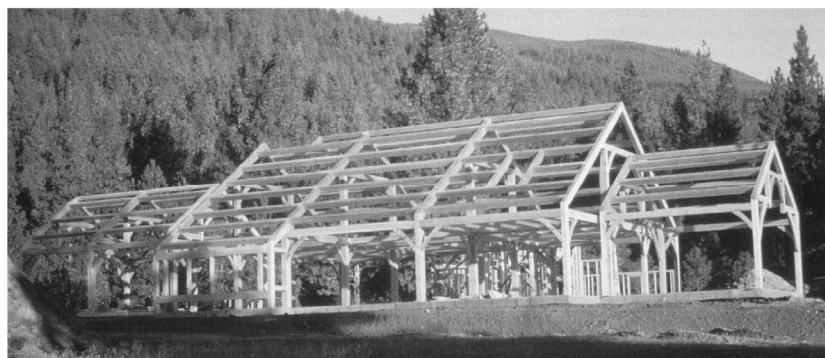
### PRINCIPAL-RAFTER ROOF SYSTEMS

**PRINCIPAL-RAFTER AND PRINCIPAL-PURLIN ROOF**  
Most of load is distributed to bents through principal purlin, leaving only a small load to be borne by eave plates. This system had English origins.



# Timber Framing

## timber frame development

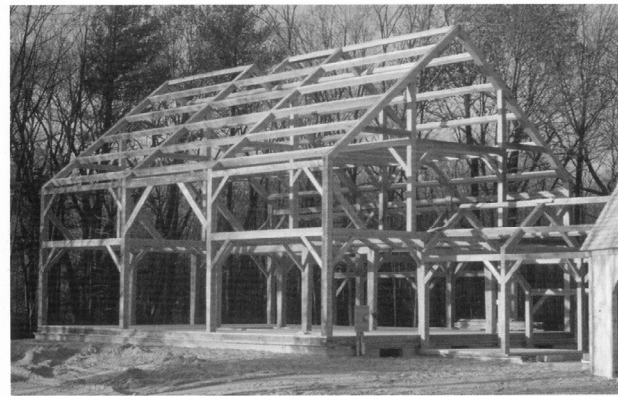


# Timber Framing

timber frame development



Peter von Buelow



In the principal-rafter and common-purlin system, the frame is segmented into distinct bays, which reduces the need for excessively long timbers and the making of scarf joints. This frame has three 16-ft. bays.

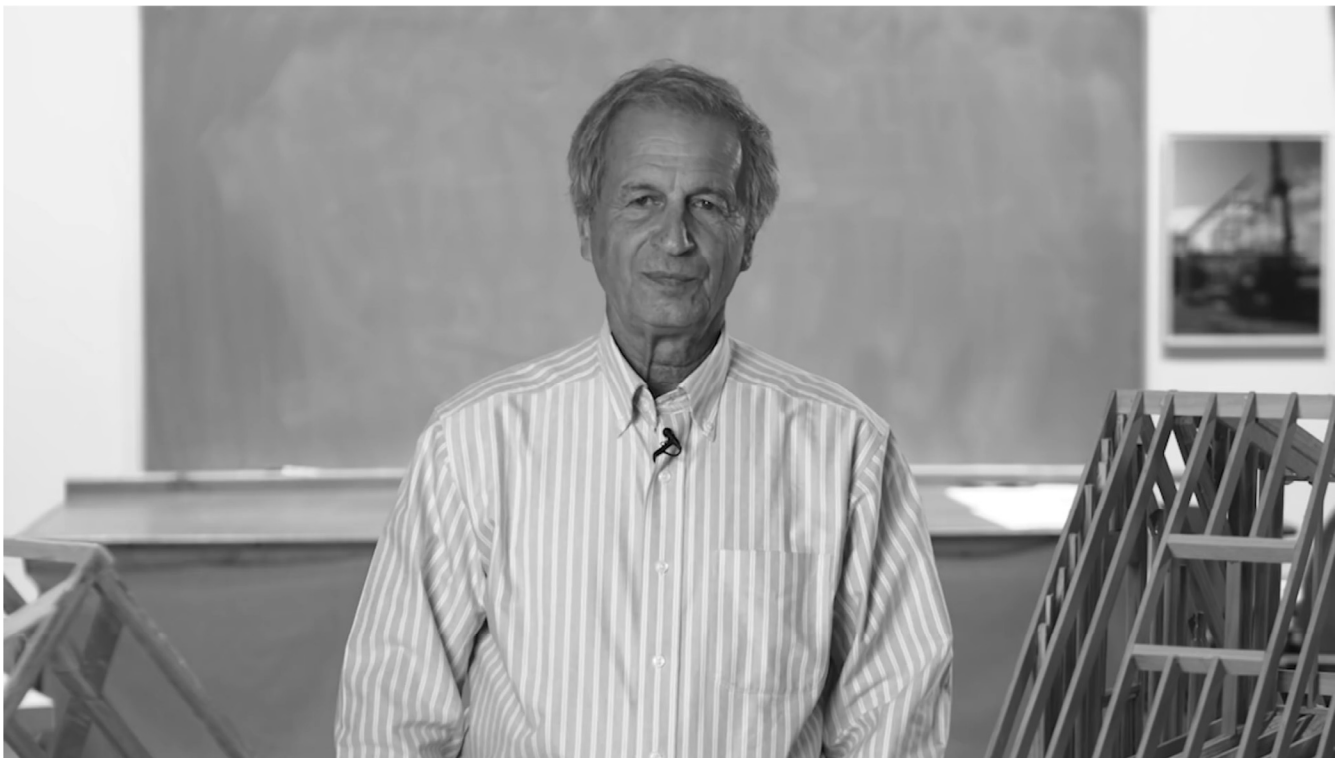


In this frame, of recycled fir, we were fortunate to have very long timbers available for the plates. Had that not been the case, scarf joints would have been required.

University of Michigan, TCAUP

Slide 25 of 45

# Timber Framing timber frame vs. stick built



Peter von Buelow

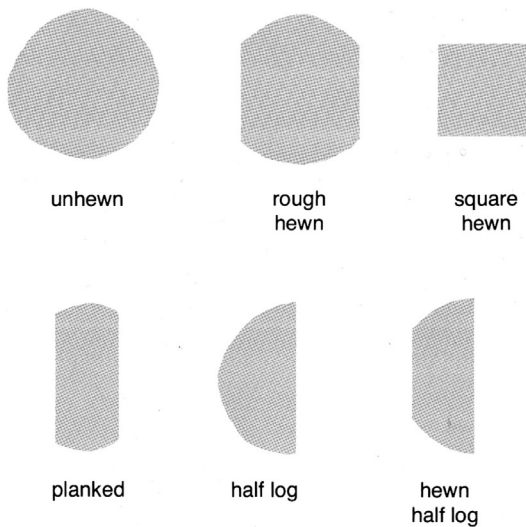
University of Michigan, TCAUP

Slide 26 of 45

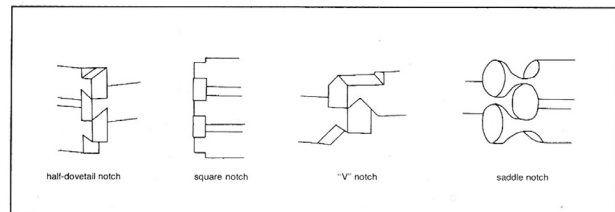


## Timber Framing

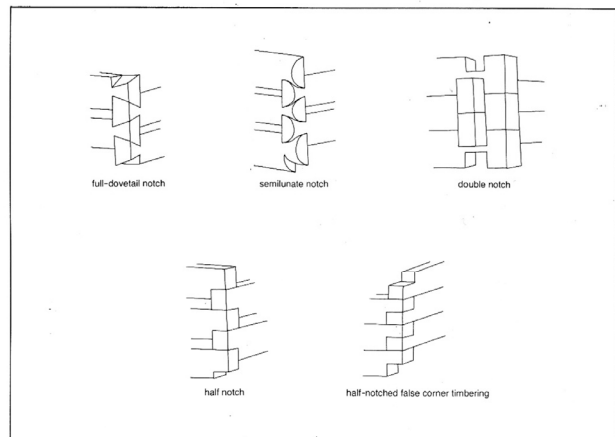
### Log construction



### 50 Corner Notching



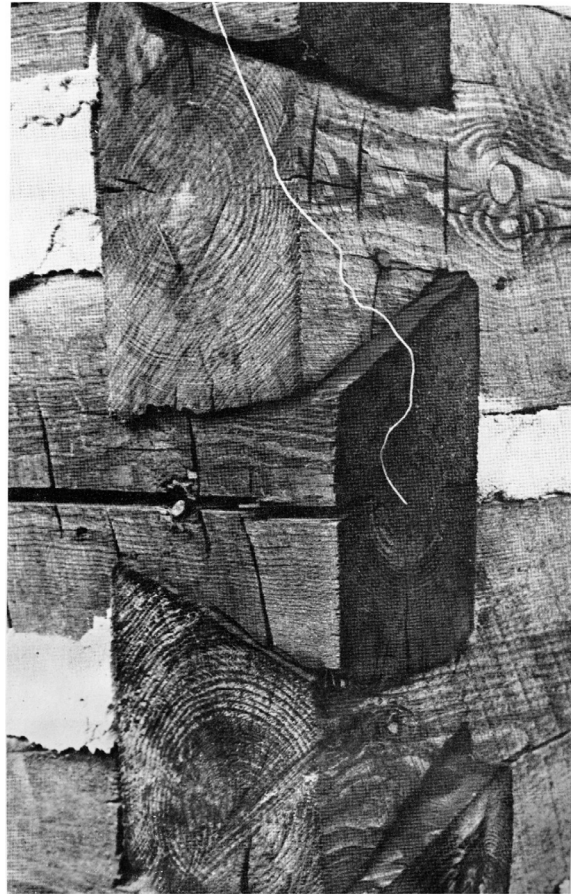
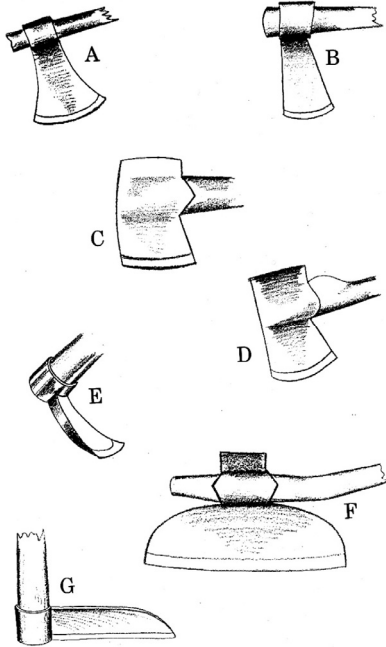
4-1. Most common types of log corner notching in Texas.



4-2. Minor notch types found in Texas.

# Timber Framing

## Log construction



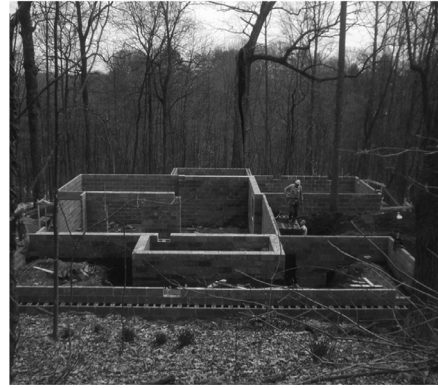
# Timber Framing

## von Buelow log home



# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 31 of 45

# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 32 of 45



# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 33 of 45

# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 34 of 45

# Timber Framing

von Buelow log home



Peter von Buelow

# Timber Framing

von Buelow log home



Peter von Buelow

# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 37 of 45

# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 38 of 45

# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 39 of 45

# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 40 of 45

# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 41 of 45

# Timber Framing

von Buelow log home



Peter von Buelow

University of Michigan, TCAUP

Slide 42 of 45

# Timber Framing

von Buelow log home



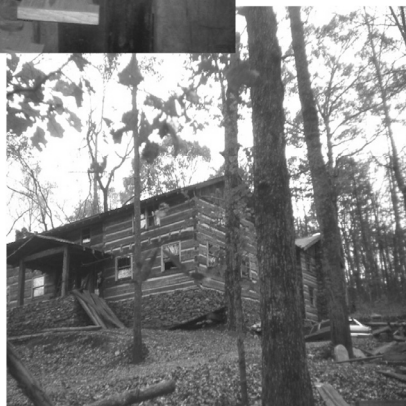
Peter von Buelow

University of Michigan, TCAUP

Slide 43 of 45

# Timber Framing

von Buelow log home



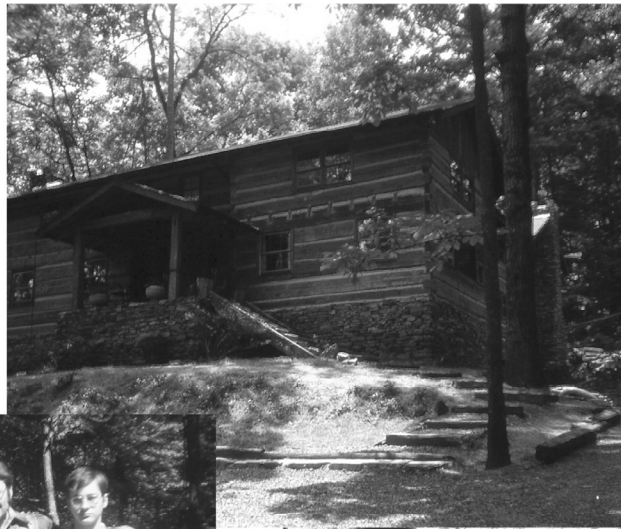
Peter von Buelow

University of Michigan, TCAUP

Slide 44 of 45

# Timber Framing

von Buelow log home



Peter von Buelow