The Use of Wood in Architecture

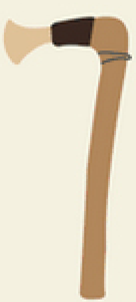
From Historic Precedents to Modern Methods of Construction

The History of Wood Construction

Wood is pretty good in tension and bending
Resiliant under repeated loads

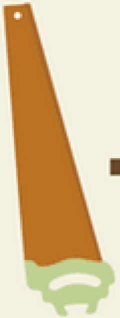
https://www.logcabinhub.com/living-with-wood-from-the-beginning-of-time/

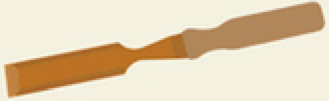
BRONZE AGE



The copper and bronze age allowed man to make tools more durable and less brittle.

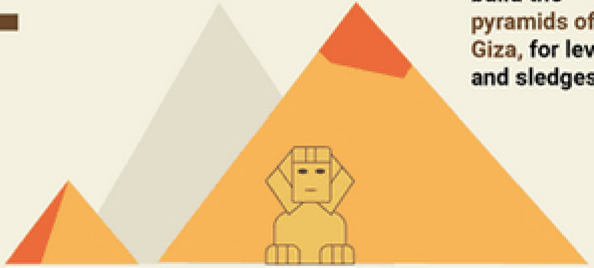
The copper age also brought about the metal saw which brought on advancements when working with wood.





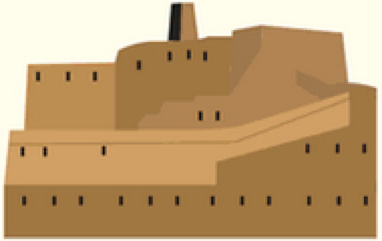
Wattle and daub, a combination of woven wooden strips and other adhesive material has been used to build walls for at least 6,000 years.

In 2560BC Egypt had to strip every bit of forest and wood they could to build the pyramids of Giza, for levers and sledges.



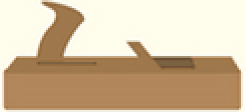
IRON AGE

During the Iron Age the main building material was the mud-brick which still required the use of wood- the bricks were formed in wooden moulds.

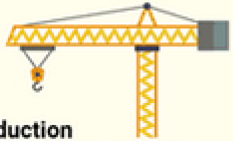


Largest structure ever made from Adobe

of woodland had been cleared



The Iron Age saw more advancement in wood work, steel improved all the existing tools, and introduced the hand-plane.



The introduction of the timber crane during the Roman Empire allowed men to lift much larger weights to higher heights and create more impressive structures.

MIDDLE AGE

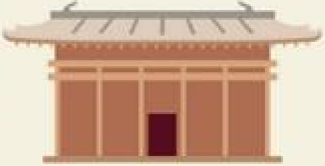
In the Middle Ages, Carpenters were considered to be among the most skilled craftsmen and were in high demand; the construction of every building required wood.

THE WATER MILL,
invented during the Renaissance (14th-17th century) had a hugely positive impact on carpenters work and was used to saw timber and convert trees into planks.

The technique we now use today, known as 'Timber Framing' was first developed by the Romans in 50AD.

By the Middle Ages (476 – 1500 AD) timber framing was reaching its heights with impressive structures such as the hammer-beam roof of Westminster Hall.

In China, Temples are usually built with a timber frame on top of a stone base; the oldest wooden building in China is the Nanchan Temple (Wutai) which dates back to 782 AD.



21ST CENTURY

One of the most popular uses for wood in construction now is the rustic log cabin.

The Granot Loma is the largest and most expensive log home in the world.

Wood is still a hugely popular material to build with and it will stay that way for a long time! It is aesthetically pleasing, provides us with a construction method which is renewable and sustainable as the world moves to greener way of living, the log cabin is bound to only increase in popularity.

Whilst North America's forest acreage is stabilizing, more work must be done to ensure they survive for future generations.

Historic Wood Architecture of Japan

Kōfukuji Five Storied Pagoda
Nara, Japan
730 CE

Itsukushima Shrine
Miyajima, Japan
593 CE

Fushimi Inari Shrine
Kyoto, Japan
711 CE


納
奉


株式会社
樋屋
関連会社
平成二十四年八月吉日建之

Kinkaku-ji (Golden Pavilion)
Kyoto, Japan
1398 CE

Heian Shrine
Kyoto, Japan
1895

Tōdai-ji
Nara, Japan
750 CE


makita

Historic Traditional House
Nichinan, Japan

More contemporary Japanese house
Using the same style of building

Historic Residence
Kitakyushu, Japan


室内立入禁止
順路
Route
顺路
순로

Historic Wood Architecture of China

Various buildings
Summer Palace
Beijing, China


氣象昭回
雲外天香

Early American Wood Houses
Salem, Massachusetts

Houses in the Swiss Alps
More solid construction
than in North America


Wood Framing Techniques

Two kinds of "wood":

Natural:
- Logged and cut and can have defects
- Limited in size

Engineered:
- Select parts of the wood are "assembled" usually with a binder material (glue) into shapes that are more regular and stronger
- More environmentally responsible
- Very large sizes are available

Advantages of Wood:

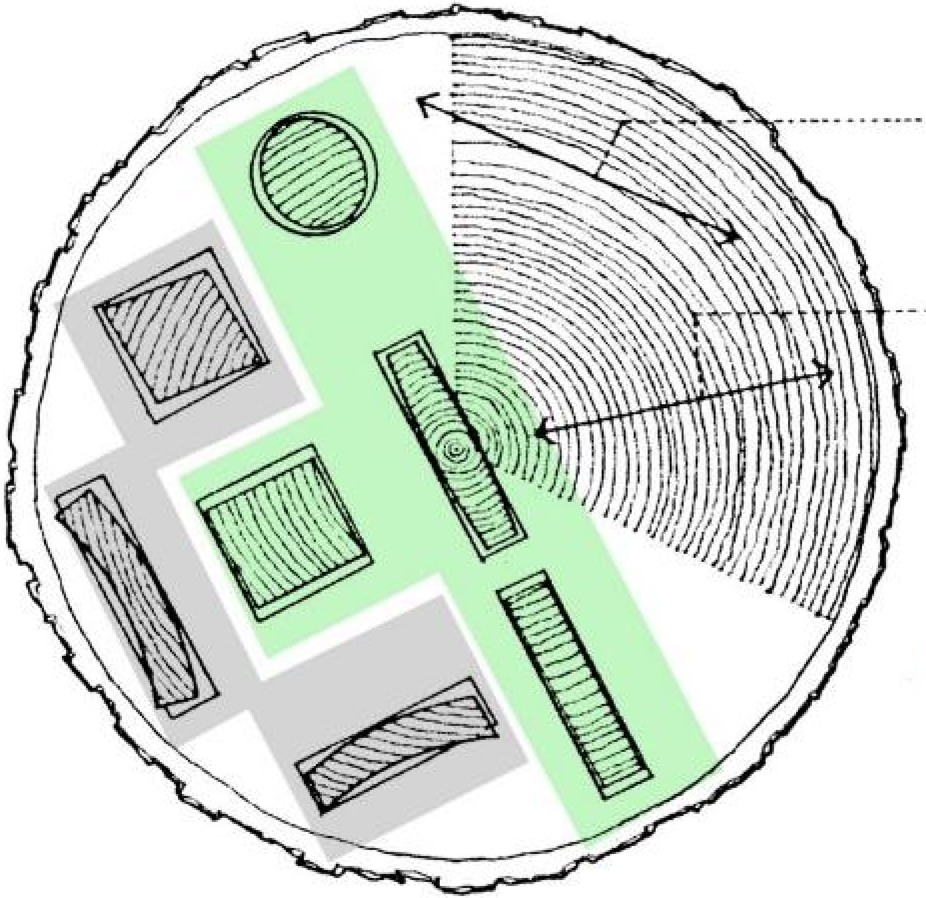
- Natural material
- Renewable (if forests carefully managed)
- Sequesters carbon
- Easily worked with hand tools on site

Disadvantages of Wood:

- Burns
- Rots
- Foot for termites and carpenter ants
- Not available everywhere in the world
- Height limited
- Natural insulator so cannot store heat

Wood Construction Structural Types:

- Heavy bearing wall (solid)
  - Contemporary uses CLT panels
- Post and Beam
  - Larger members spaced usually 2.4m apart or more
- Light Framing
  - Smaller members (38mm x ??mm) placed at 400 mm o.c.



tangential shrinkage
Wood shrinkage in a direction tangent to the growth rings, about double that of radial shrinkage.

radial shrinkage
Wood shrinkage perpendicular to the grain, across the growth rings.

longitudinal shrinkage
Wood shrinkage parallel to the grain, about 2% of radial shrinkage.

Quartersaw cutting
Plainsaw cutting

Platform framing

Balloon framing

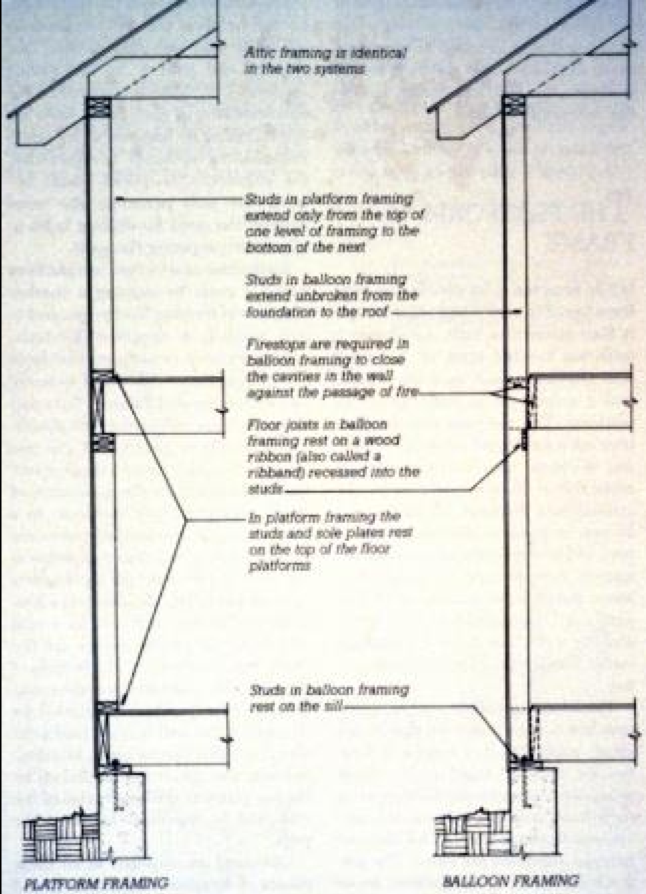
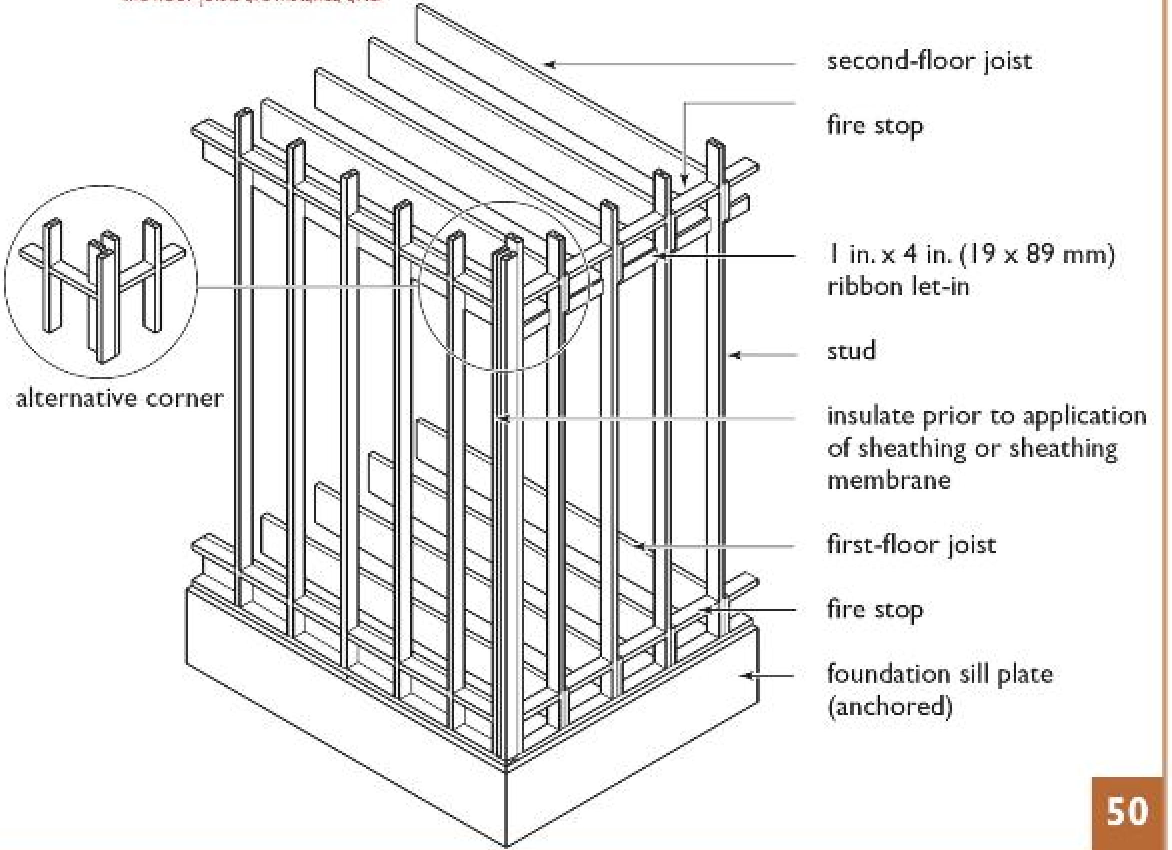


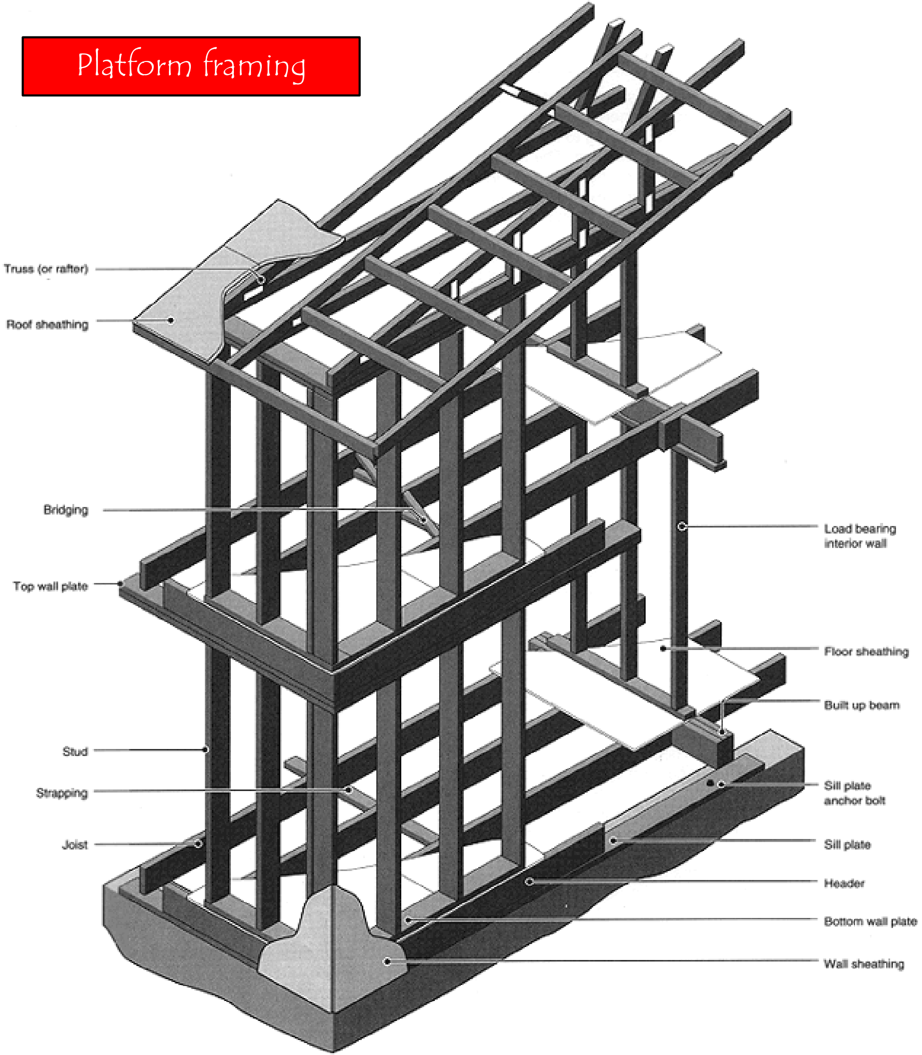
FIGURE 5.2
Comparative framing details for platform framing (left) and balloon framing (right). Platform framing is easier to erect but settles considerably as the wood dries and shrinks. If nominal 12-inch (300-mm) joists are used to frame the floors in these examples, the total amount of loadbearing cross-grain wood between the foundation and the attic joists is 33 inches (838 mm) for the platform frame, and only 4½ inches (114 mm) for the balloon frame. Interior partitions in a balloon frame building are essentially platform framed, however, which can result in tilting of floors.

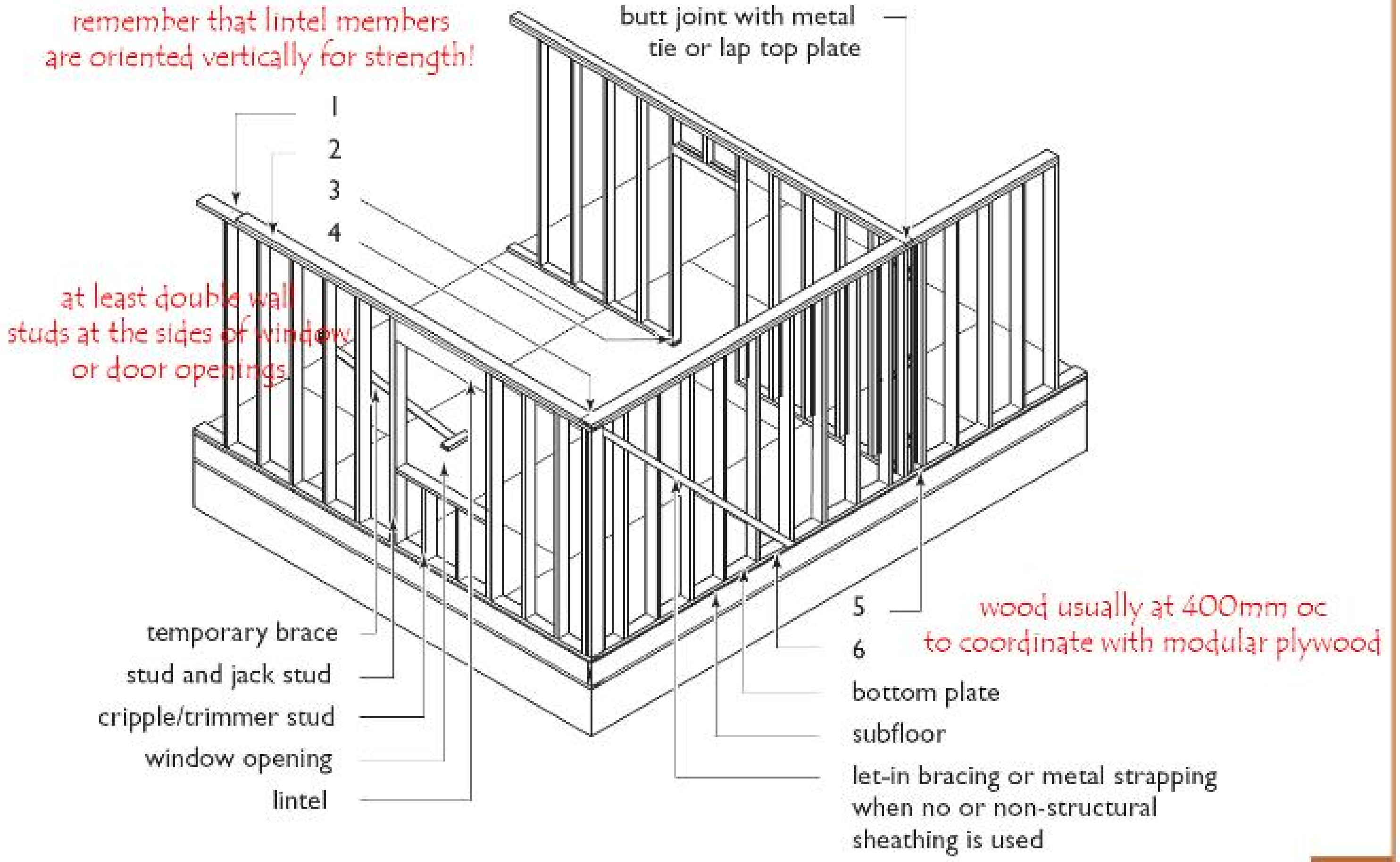
Wall framing using balloon construction method

in balloon framing the studs are continuous to the underside of the roof
the floor joists are installed after



Platform framing





Note: Where the lintel exceeds 10 ft. (3 m), the jack stud needs to be doubled on both sides of the opening.

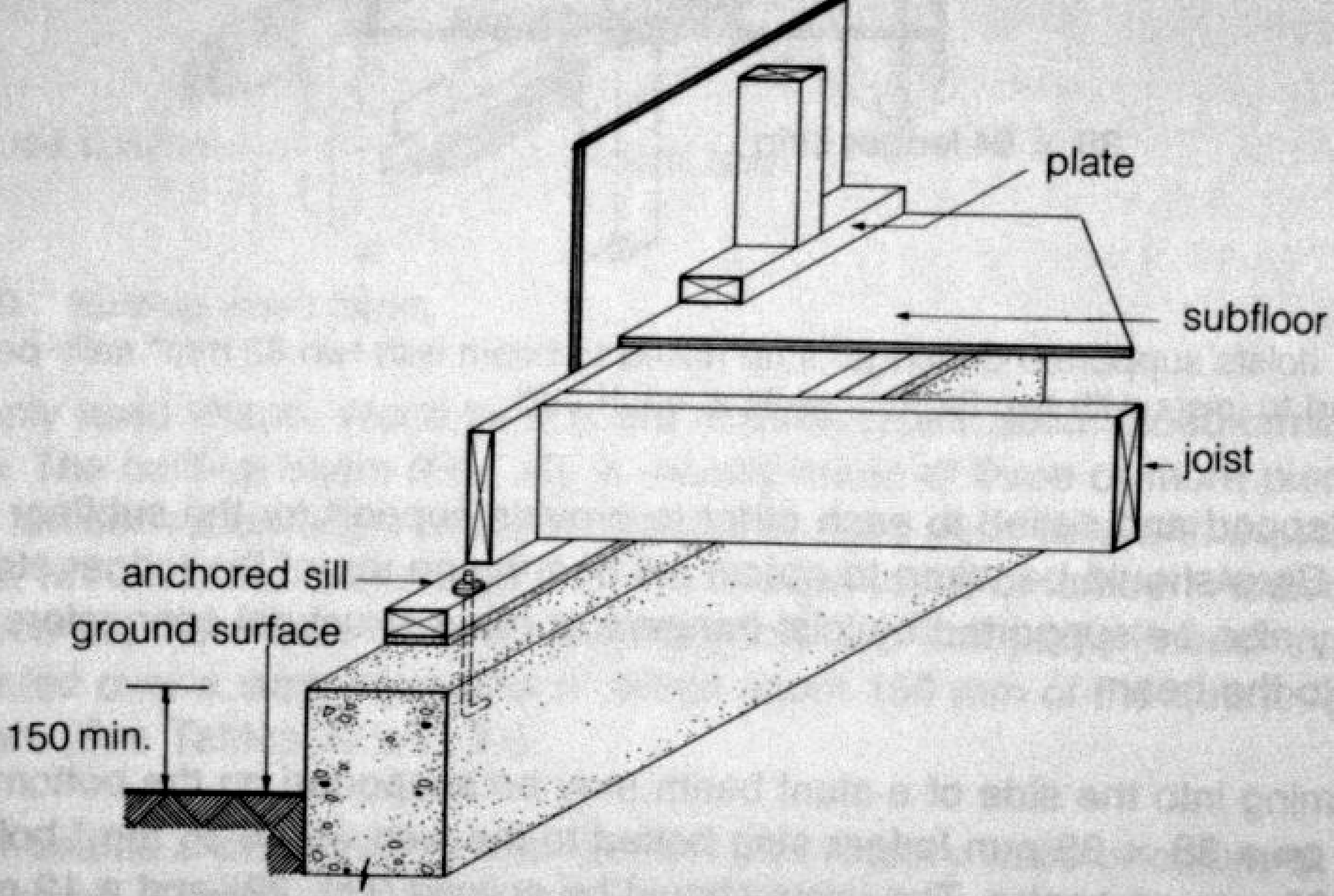


Figure 24. Box-sill method used in platform construction.

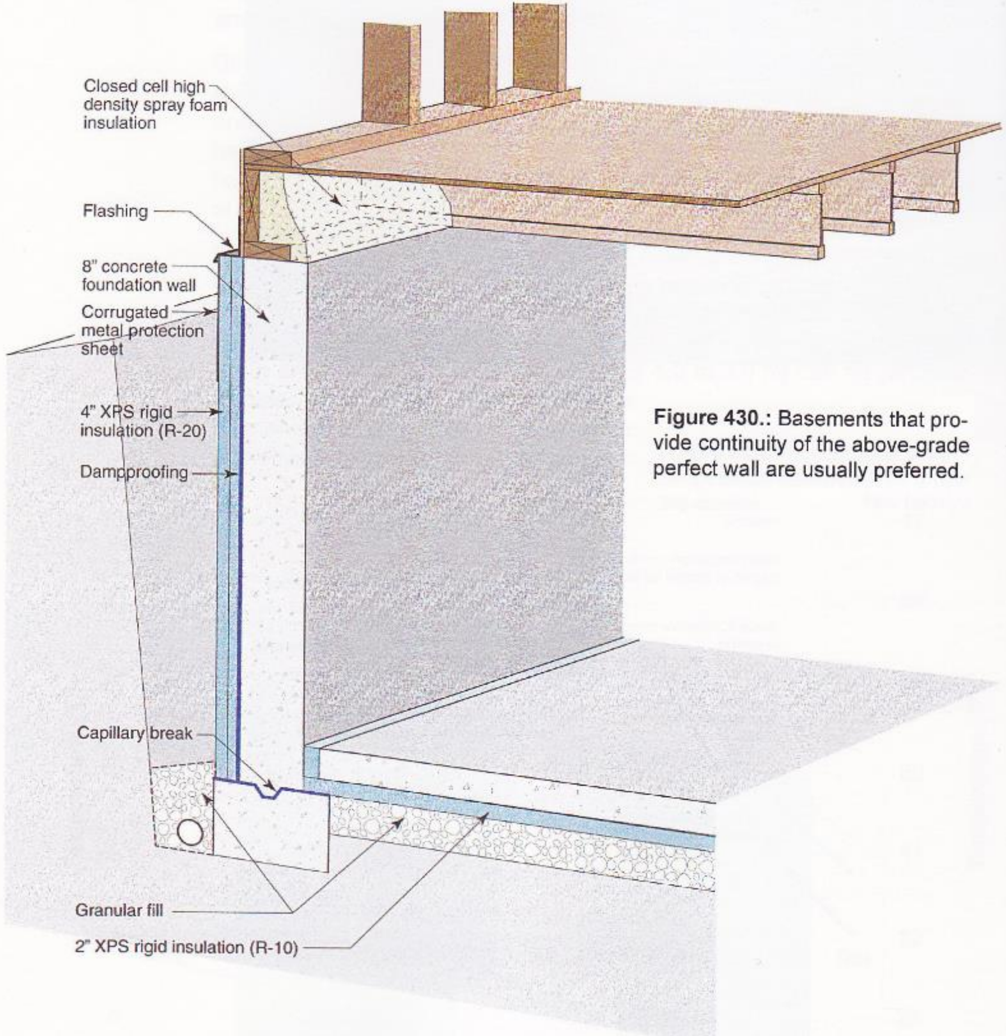
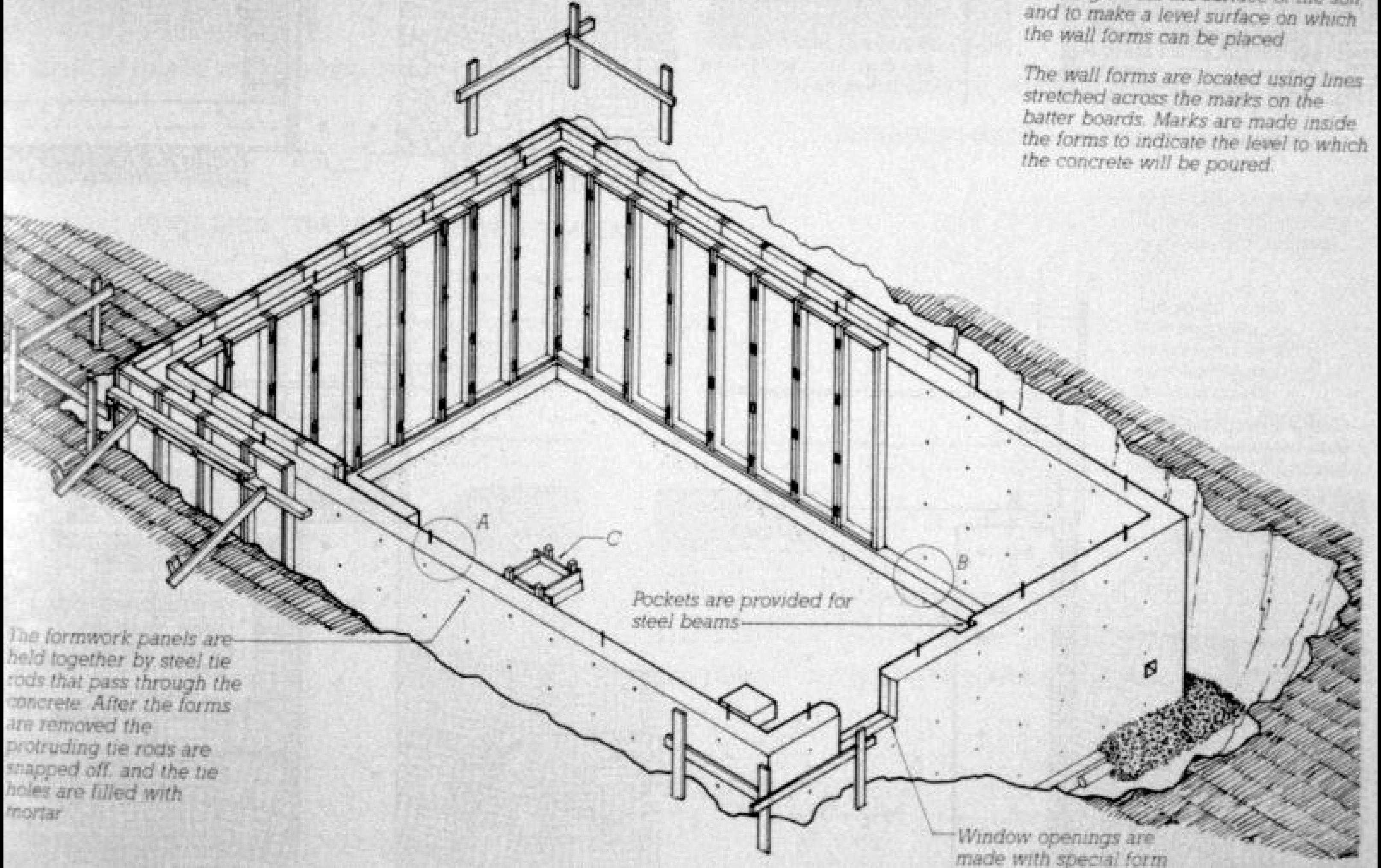


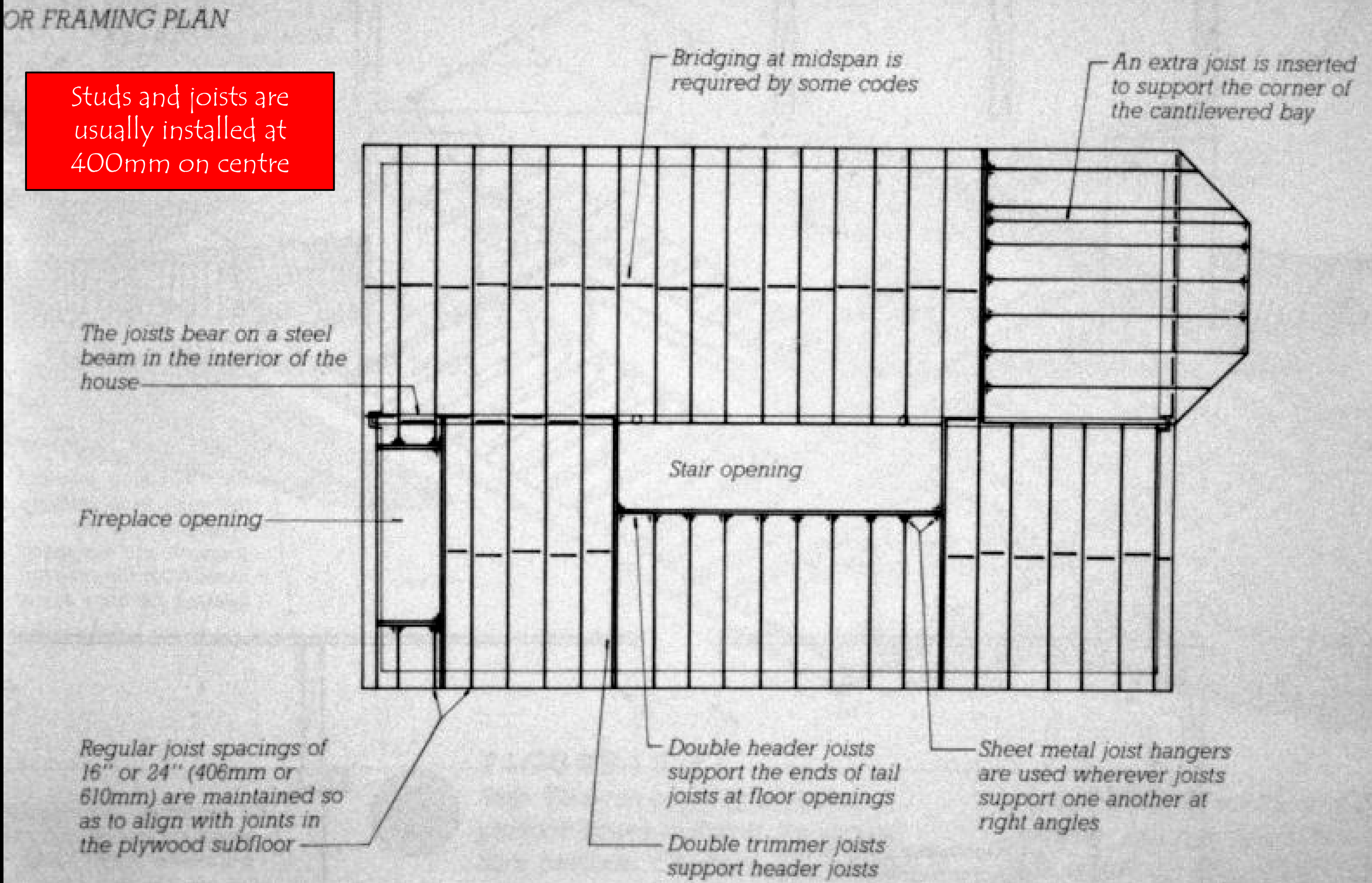
Figure 430.: Basements that provide continuity of the above-grade perfect wall are usually preferred.

After excavation, concrete footings are poured to spread the load of the building across the surface of the soil, and to make a level surface on which the wall forms can be placed

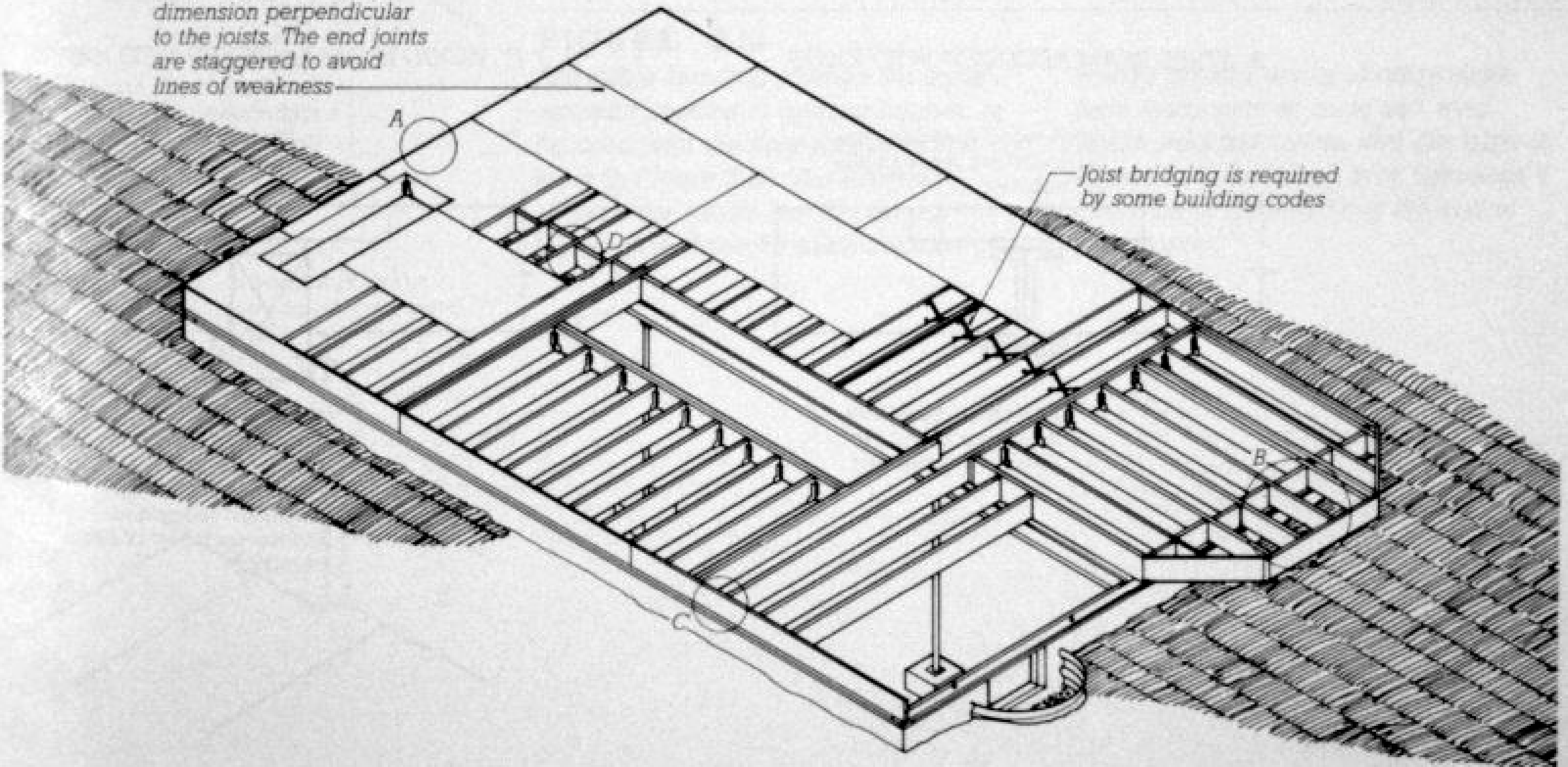
The wall forms are located using lines stretched across the marks on the batter boards. Marks are made inside the forms to indicate the level to which the concrete will be poured.

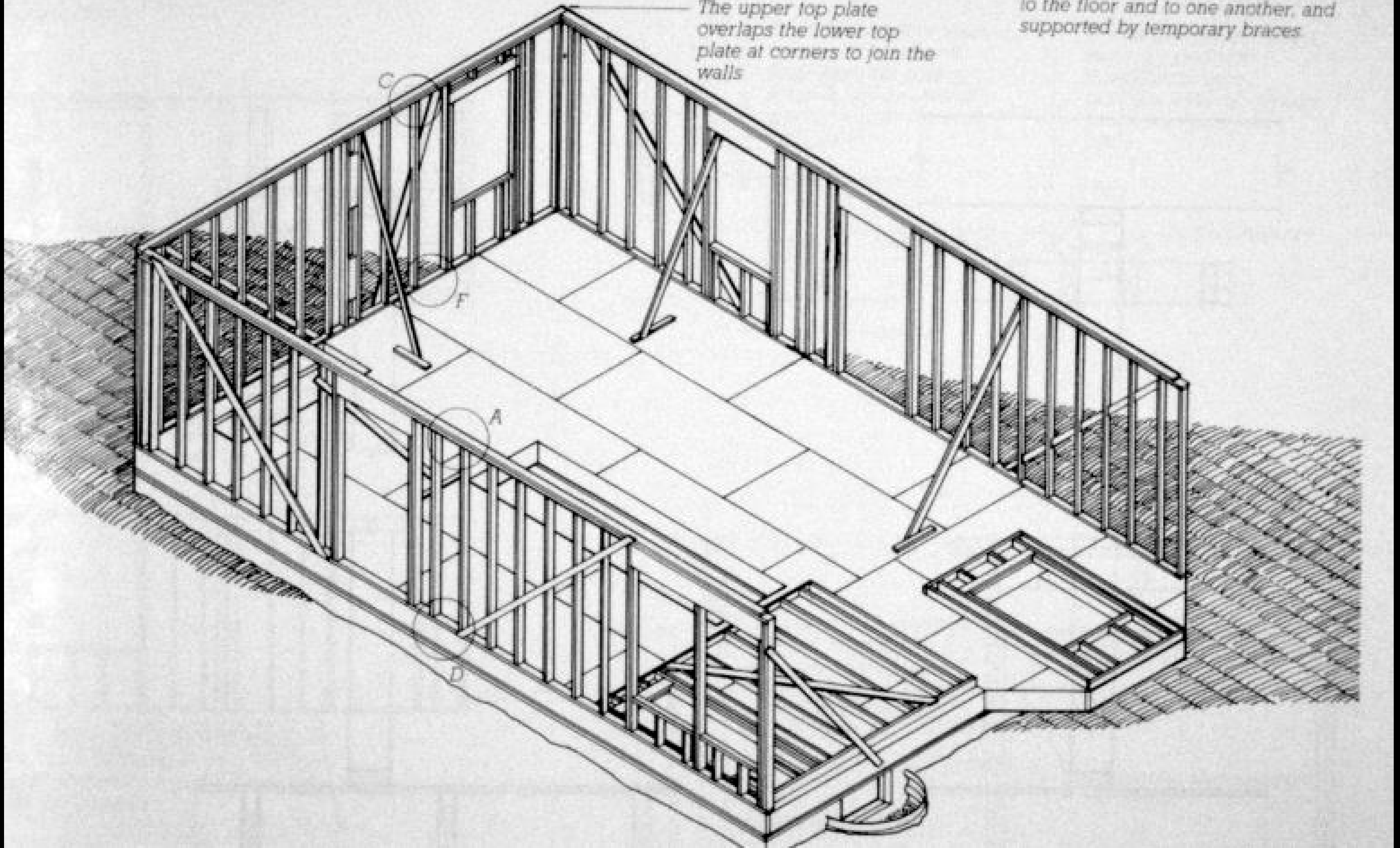


Studs and joists are usually installed at 400mm on centre

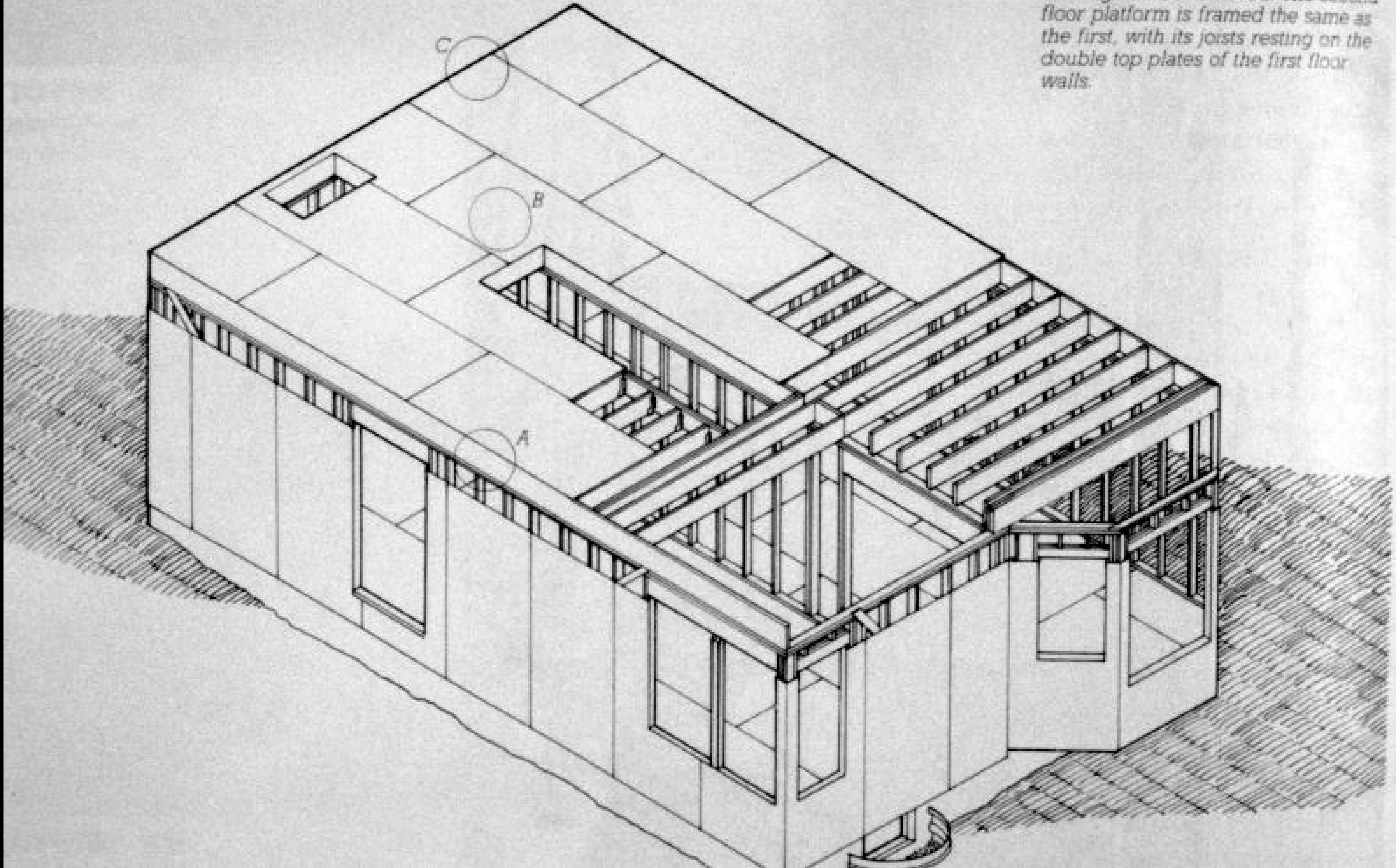


When the foundation is complete basement beams are placed, sills are bolted to the foundation, and the first floor joists and subfloor are installed.



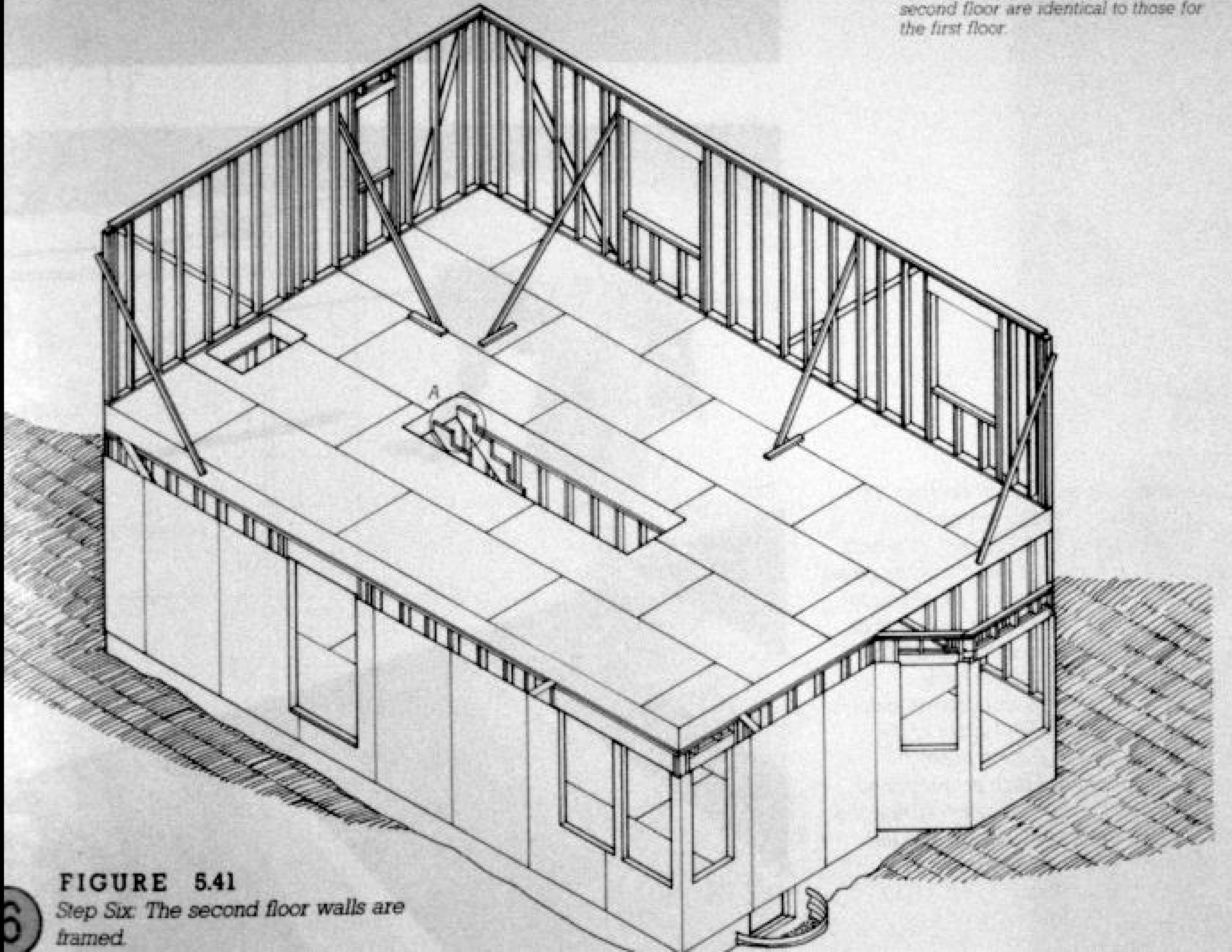


The subfloor makes a convenient platform on which to assemble the first floor wall frames. The assembled frames are tilted up into place, nailed to the floor and to one another, and supported by temporary braces.



When the first floor walls are complete and sheathed, much of the temporary bracing can be removed. The second floor platform is framed the same as the first, with its joists resting on the double top plates of the first floor walls.

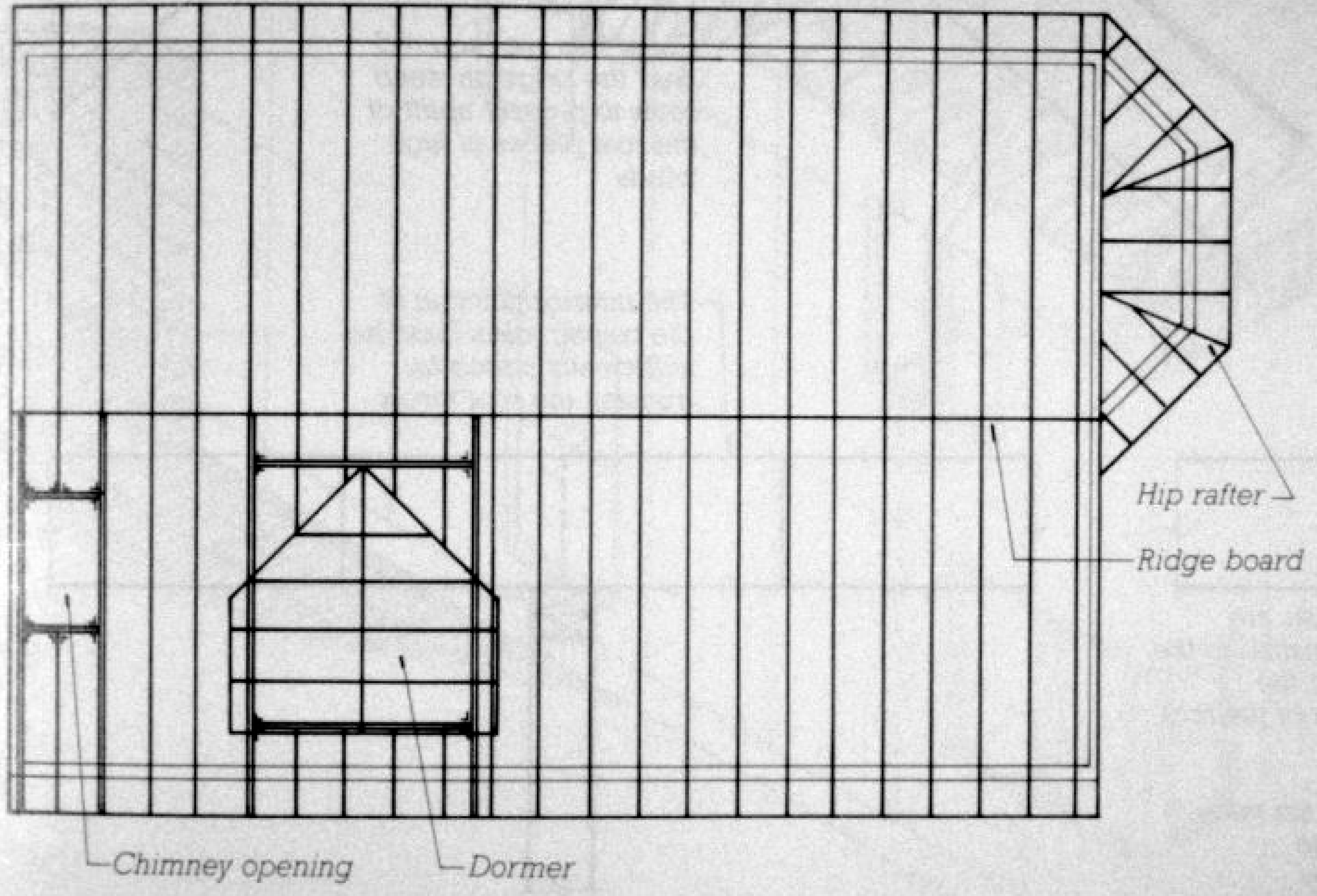
Wall framing procedures for the second floor are identical to those for the first floor.



6

FIGURE 5.41

Step Six: The second floor walls are framed.



ROOF FRAMING PLAN

The ceiling joists above the second floor (which also serve as attic floor joists) are toenailed to the tops of the second floor walls. A few rafters are then erected to support the ridge board, and the remainder of the rafters are put up. Double headers and trimmers are used around openings in the roof.

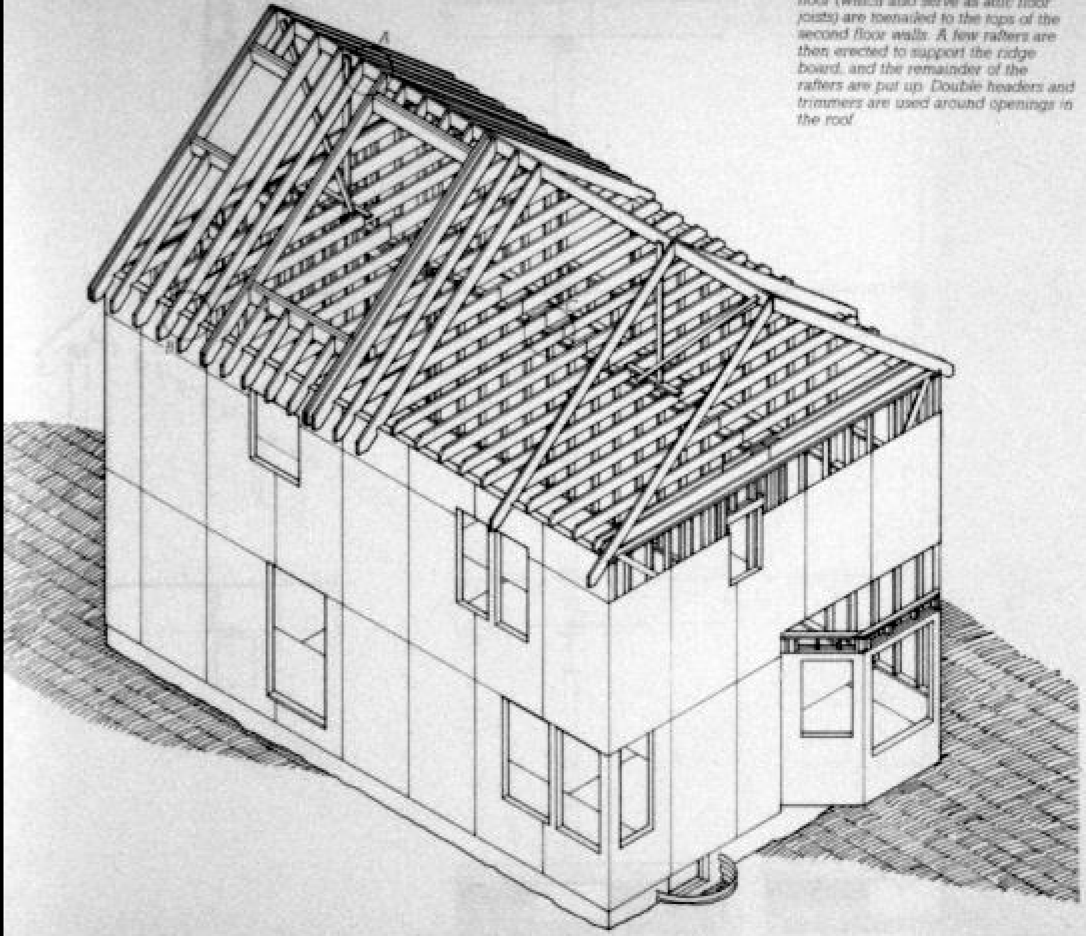
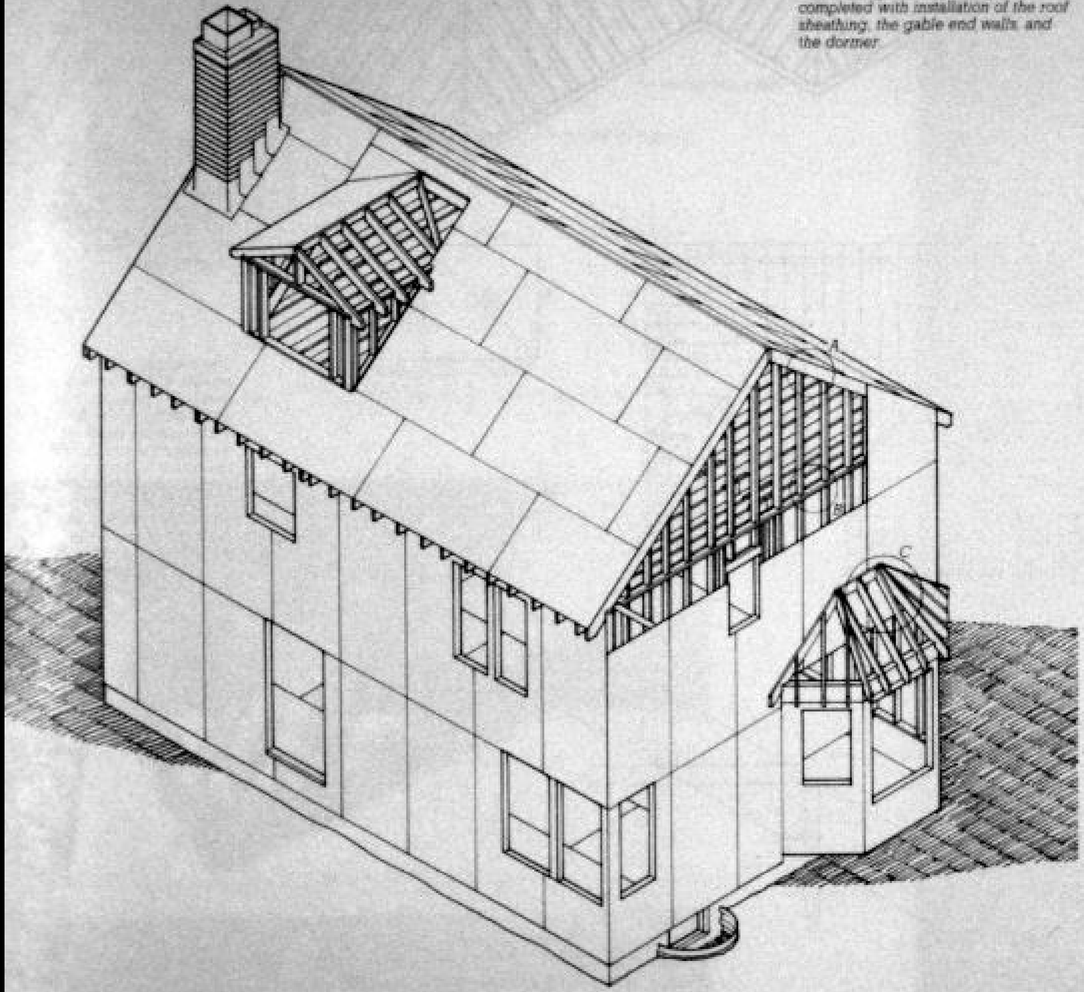


FIGURE 5.48

7 *Step Seven: Framing the attic floor and roof.*



The framing of the building is completed with installation of the roof sheathing, the gable end walls, and the dormer.

FIGURE 5.50

8 *Step Eight: The frame is completed.*

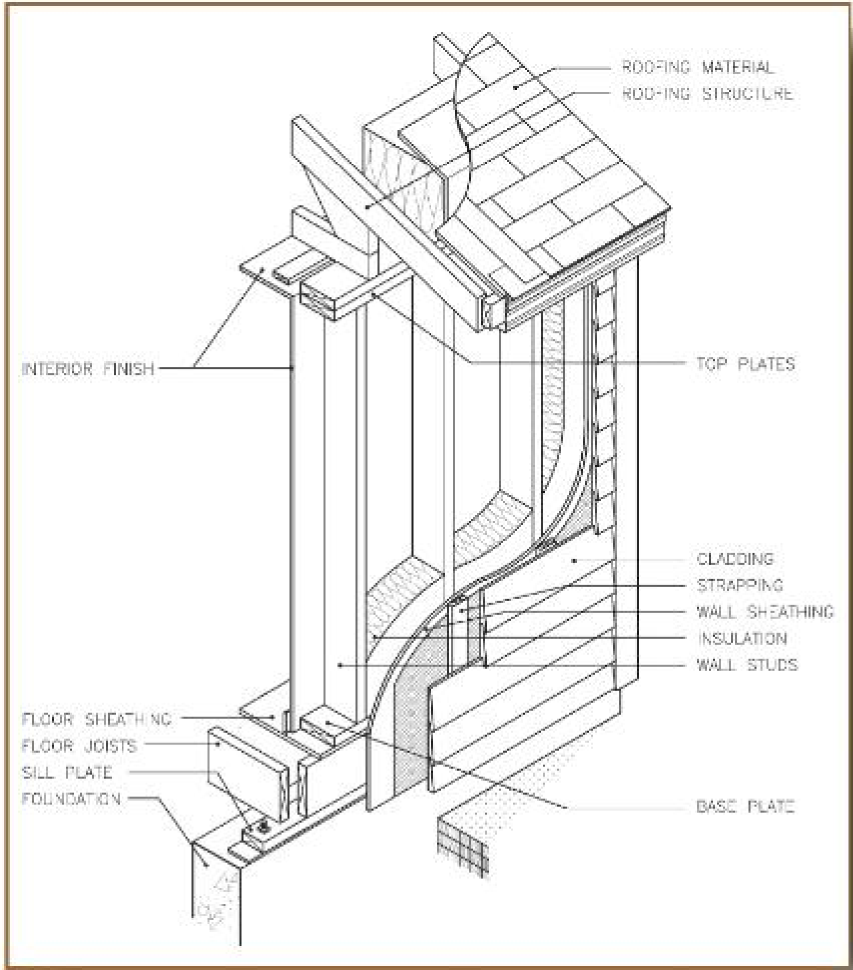
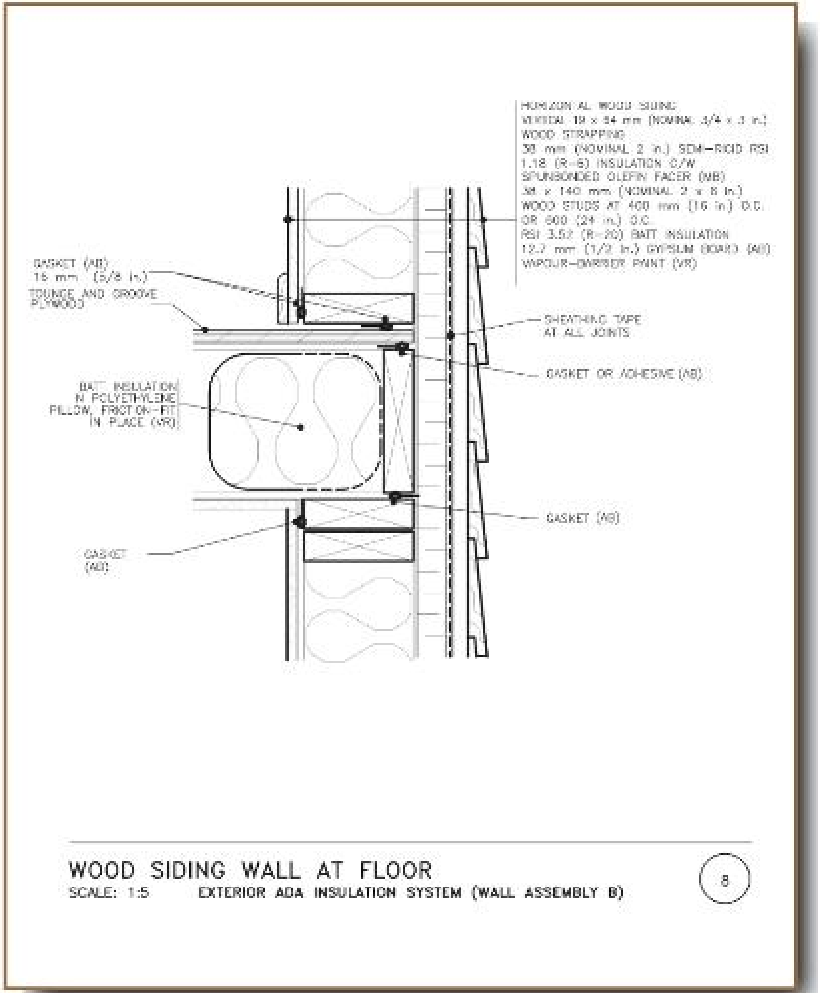
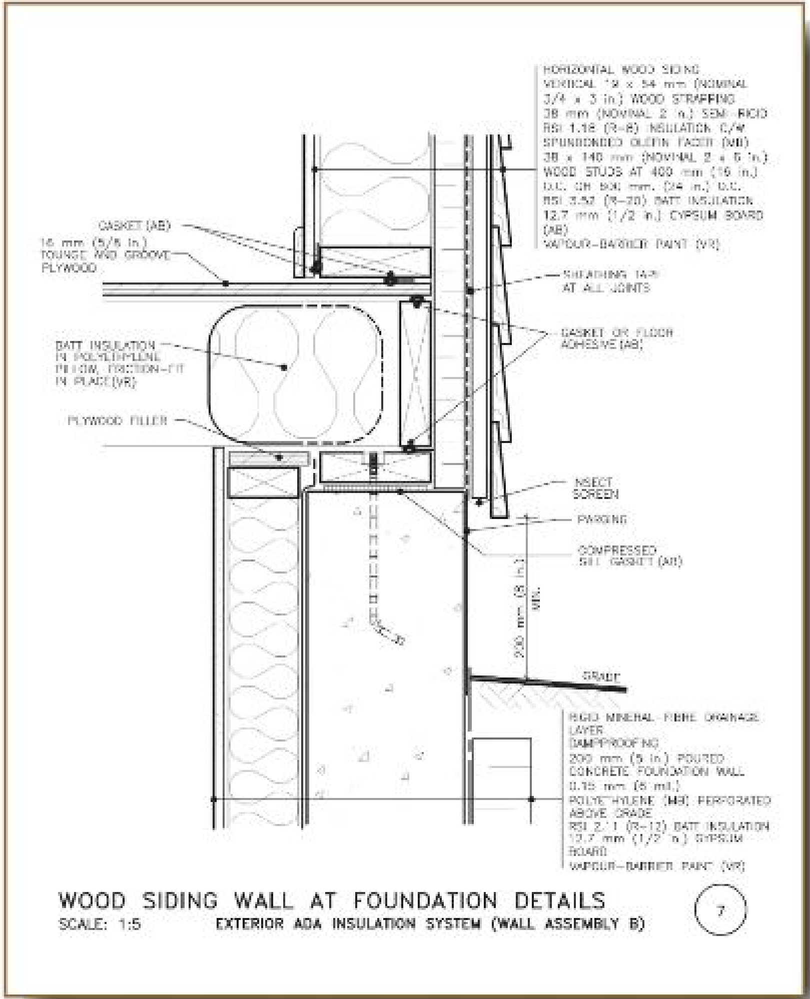


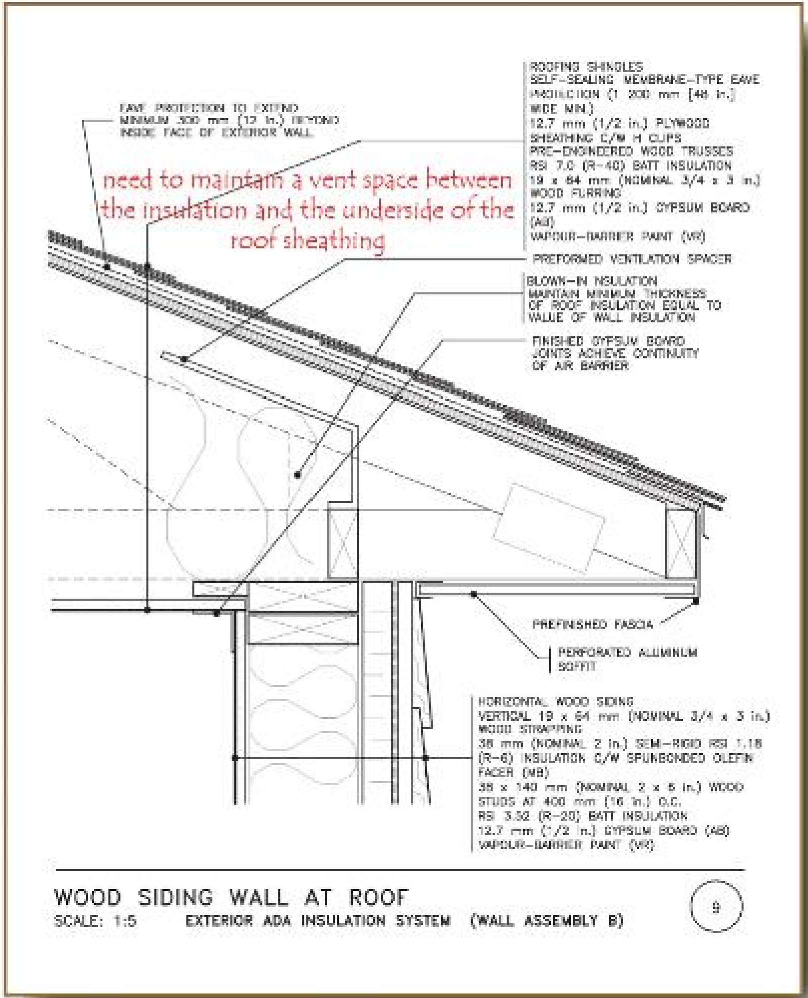
Figure 2.6: Components of a wood frame structure



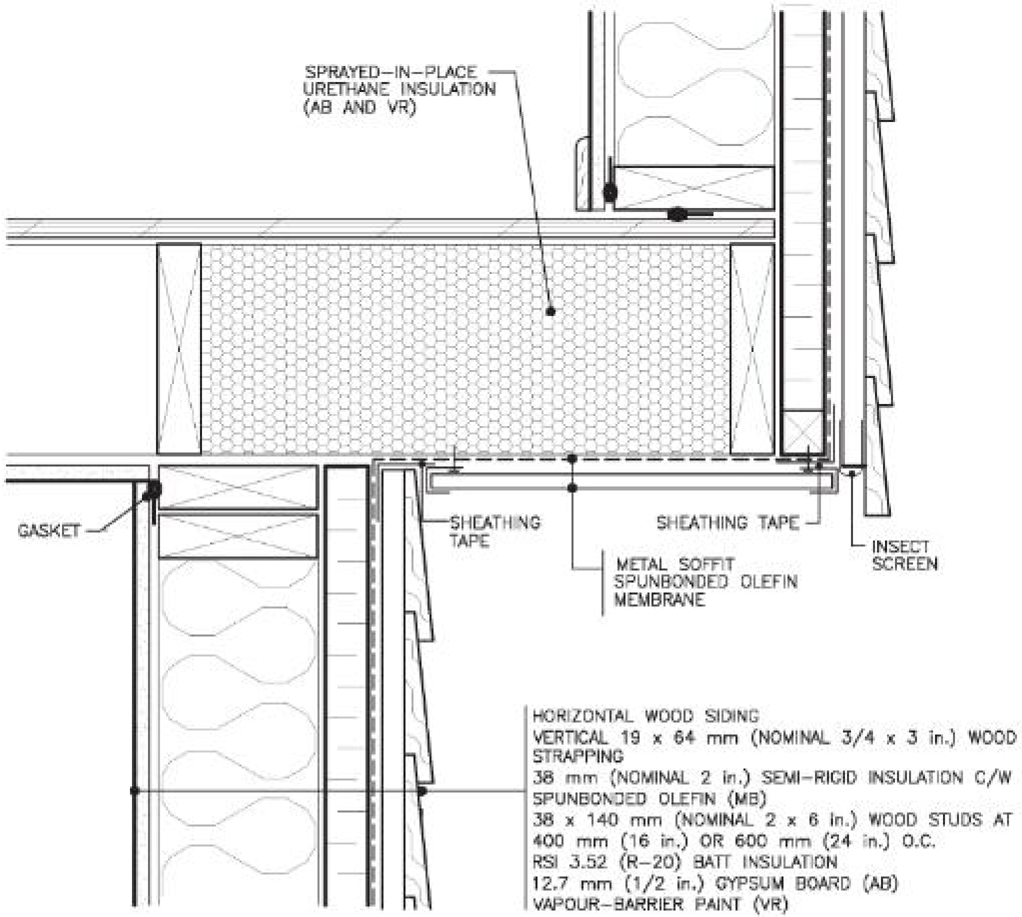
Detail 8: Wood Siding Wall at Floor



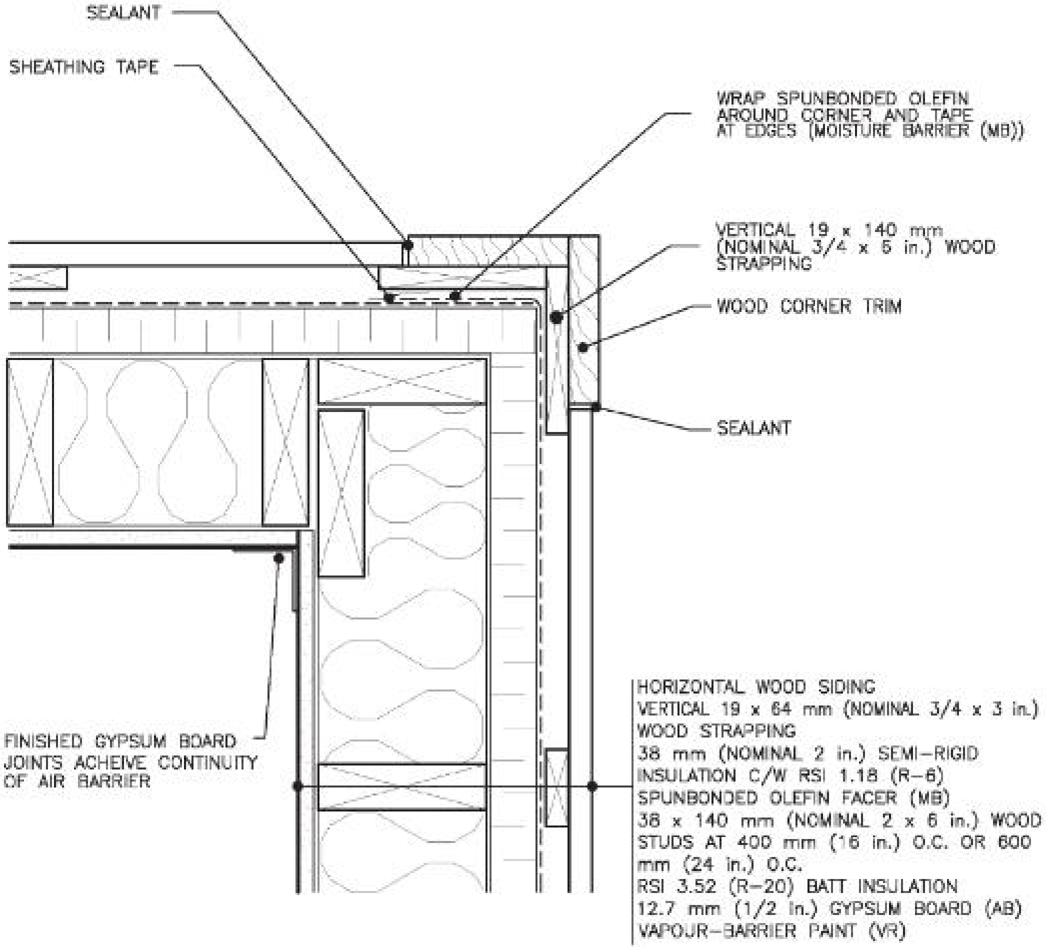
Detail 7: Wood Siding Wall at Foundation

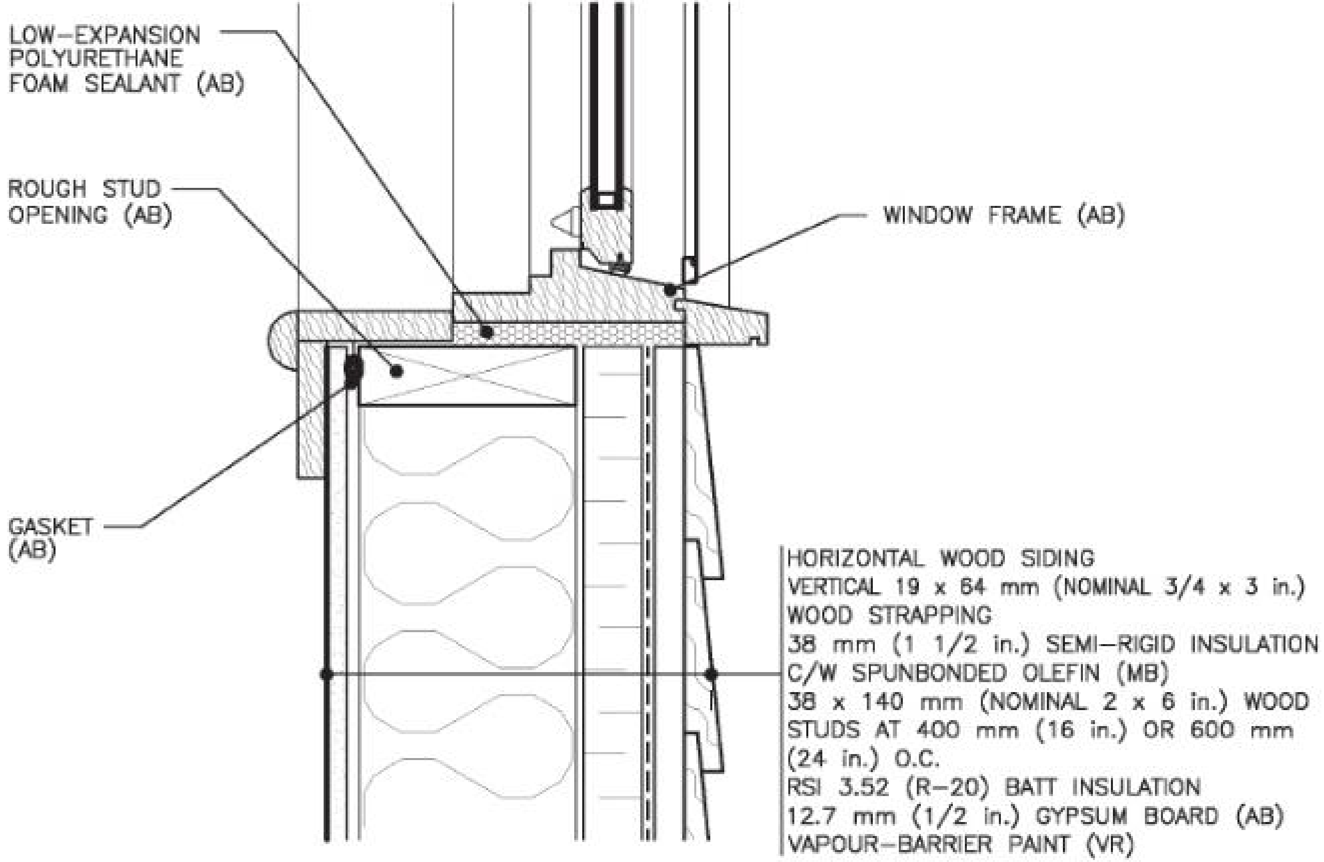


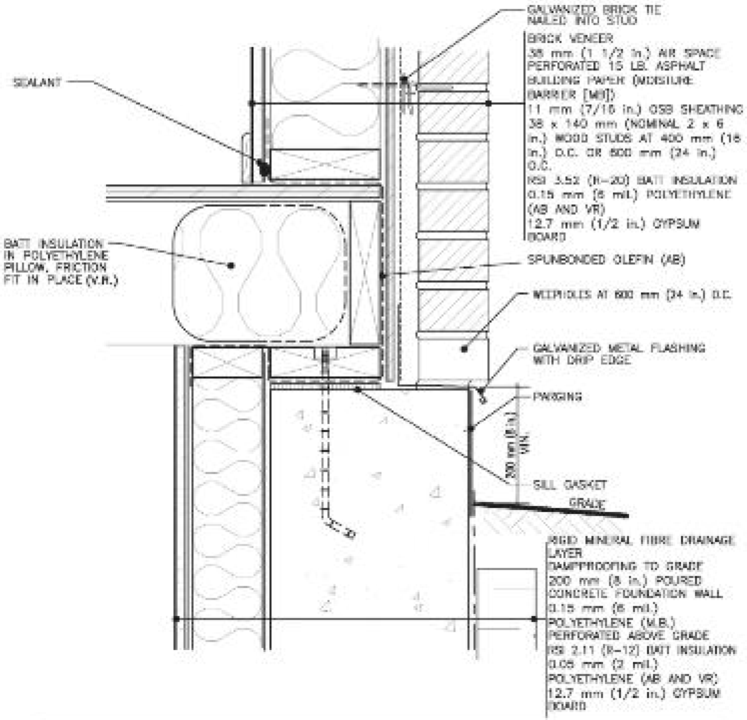
Detail 9: Wood Siding Wall at Roof



SPRAYED-IN-PLACE
URETHANE INSULATION
(AB AND VR)
GASKET
SHEATHING
TAPE
SHEATHING TAPE
METAL SOFFIT
SPUNBONDED OLEFIN
MEMBRANE
INSECT
SCREEN
HORIZONTAL WOOD SIDING
VERTICAL 19 x 64 mm (NOMINAL 3/4 x 3 in.) WOOD
STRAPPING
38 mm (NOMINAL 2 in.) SEMI-RIGID INSULATION C/W
SPUNBONDED OLEFIN (MB)
38 x 140 mm (NOMINAL 2 x 6 in.) WOOD STUDS AT
400 mm (16 in.) OR 600 mm (24 in.) O.C.
RSI 3.52 (R-20) BATT INSULATION
12.7 mm (1/2 in.) GYPSUM BOARD (AB)
VAPOUR-BARRIER PAINT (VR)


SEALANT
SHEATHING TAPE
WRAP SPUNBONDED OLEFIN AROUND CORNER AND TAPE AT EDGES (MOISTURE BARRIER (MB))
VERTICAL 19 x 140 mm (NOMINAL 3/4 x 6 in.) WOOD STRAPPING
WOOD CORNER TRIM
SEALANT
FINISHED GYPSUM BOARD JOINTS ACHEIVE CONTINUITY OF AIR BARRIER
HORIZONTAL WOOD SIDING
VERTICAL 19 x 64 mm (NOMINAL 3/4 x 3 in.) WOOD STRAPPING
38 mm (NOMINAL 2 in.) SEMI-RIGID INSULATION C/W RSI 1.18 (R-6) SPUNBONDED OLEFIN FACER (MB)
38 x 140 mm (NOMINAL 2 x 6 in.) WOOD STUDS AT 400 mm (16 in.) O.C. OR 600 mm (24 in.) O.C.
RSI 3.52 (R-20) BATT INSULATION
12.7 mm (1/2 in.) GYPSUM BOARD (AB)
VAPOUR-BARRIER PAINT (VR)


LOW-EXPANSION POLYURETHANE FOAM SEALANT (AB)
ROUGH STUD OPENING (AB)
WINDOW FRAME (AB)
GASKET (AB)
HORIZONTAL WOOD SIDING
VERTICAL 19 x 64 mm (NOMINAL 3/4 x 3 in.) WOOD STRAPPING
38 mm (1 1/2 in.) SEMI-RIGID INSULATION C/W SPUNBONDED OLEFIN (MB)
38 x 140 mm (NOMINAL 2 x 6 in.) WOOD STUDS AT 400 mm (16 in.) OR 600 mm (24 in.) O.C.
RSI 3.52 (R-20) BATT INSULATION
12.7 mm (1/2 in.) GYPSUM BOARD (AB)
VAPOUR-BARRIER PAINT (VR)

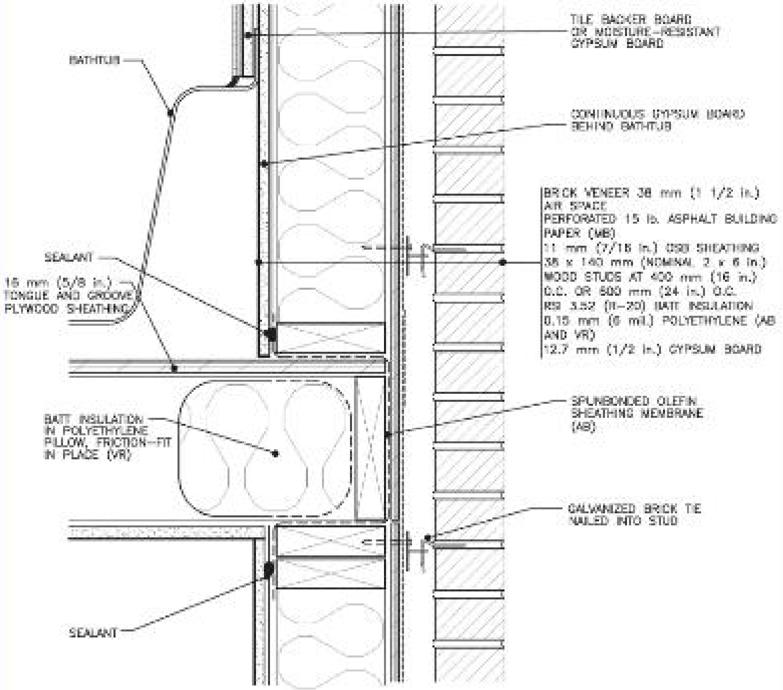


BRICK VENEER WALL AT FOUNDATION

SCALE: 1:5 BASIC POLYETHYLENE STUD WALL (WALL ASSEMBLY A) 1

issue with this wall is lack of cavity insulation
adding requires alteration to foundation wall
width in order to also support the brick veneer

Detail 1: Brick Veneer Wall at Foundation

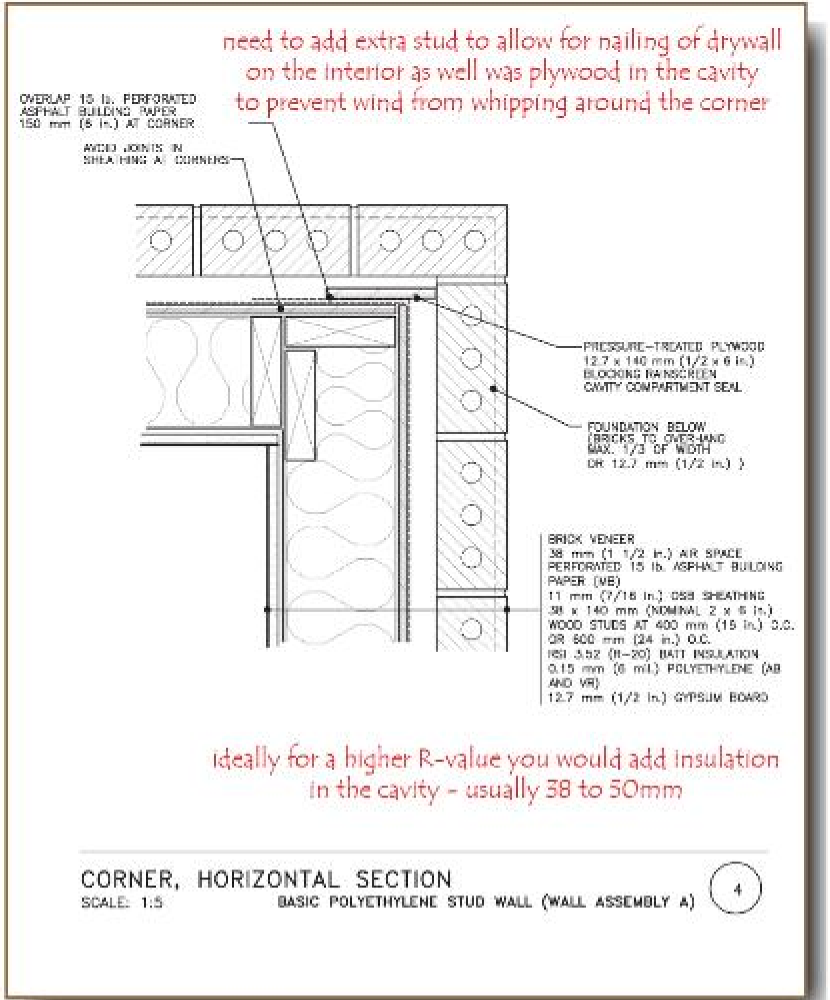


BRICK VENEER WALL AT HEADER

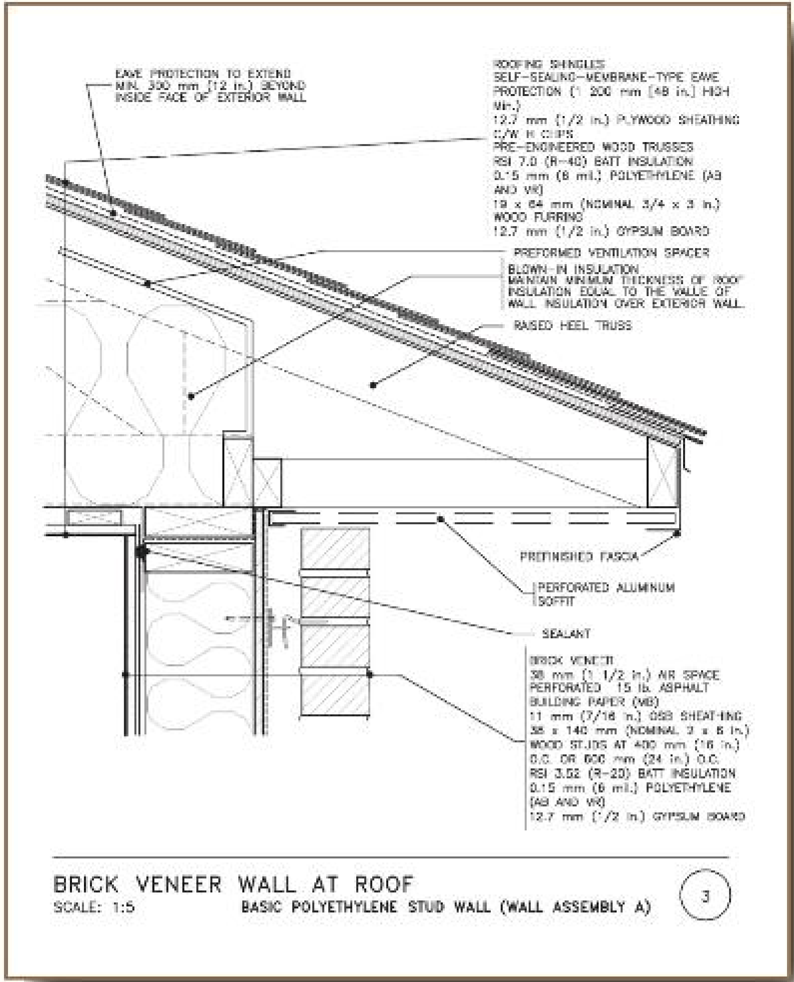
SCALE: 1:5 BASIC POLYETHYLENE STUD WALL (WALL ASSEMBLY A) 2

issue with this wall is lack of cavity insulation

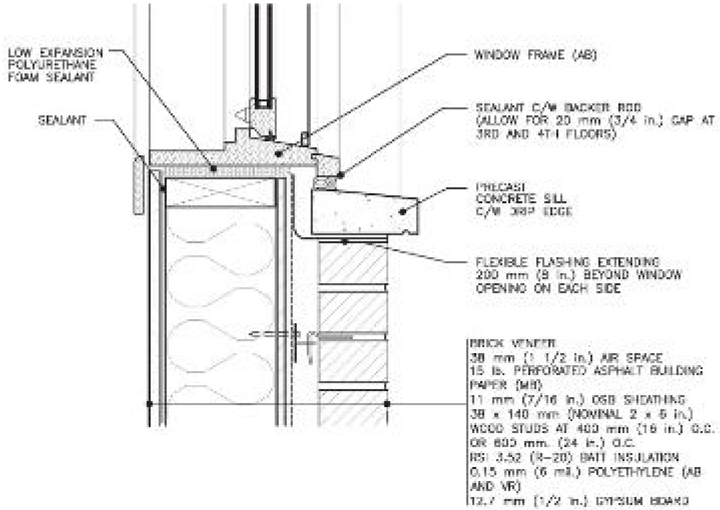
Detail 2: Brick Veneer Wall at Header



Detail 4: *Corner, Horizontal Section*



Detail 3: *Brick Veneer Wall at Roof*



the rough framed opening is always larger than the window
in order to allow the placement of shims that allow the carpenters
to ensure that the windows are plumb and square

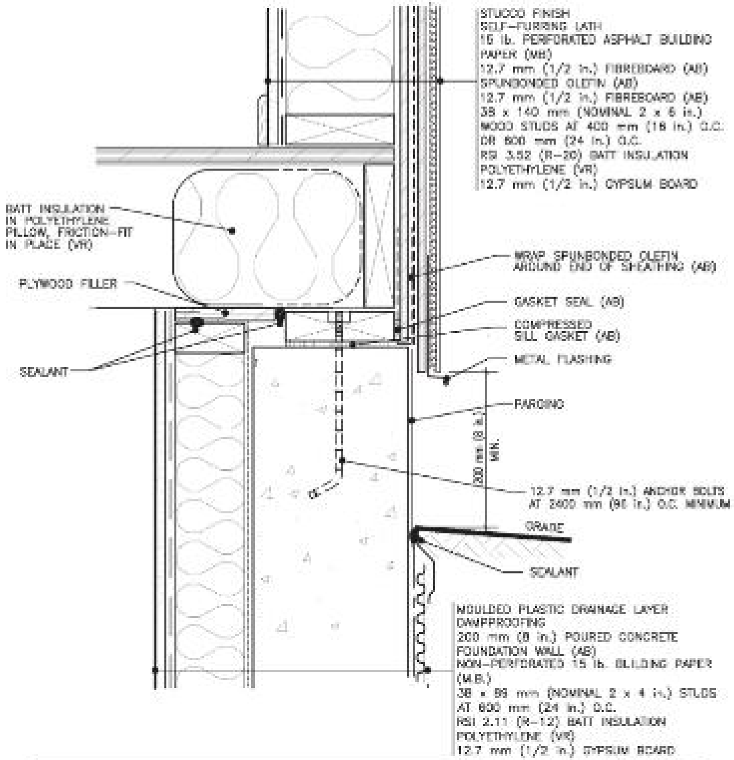
WINDOW OPENING
SCALE: 1:5

(WALL ASSEMBLY A)

17

Detail 17: Window Opening, A

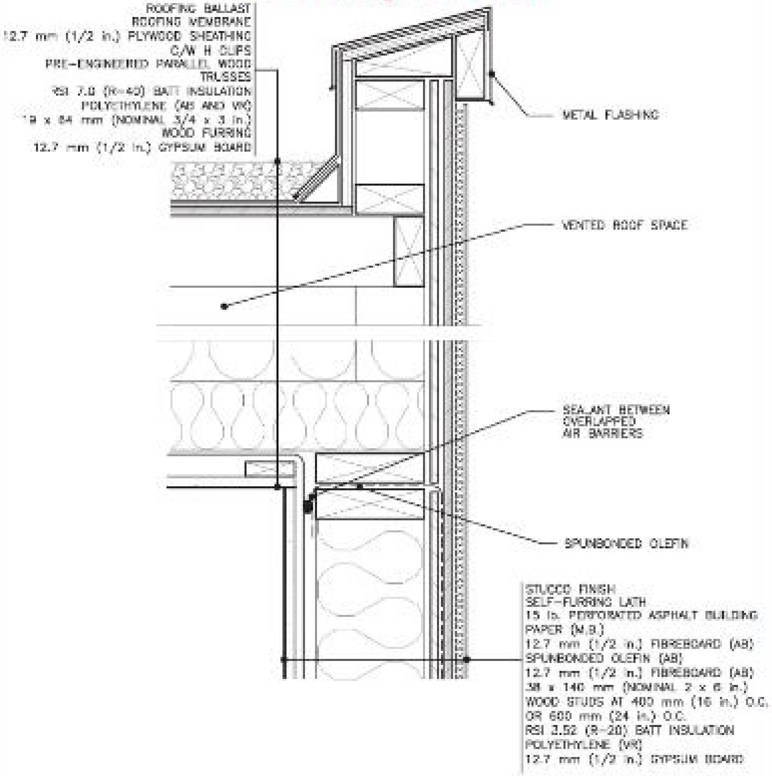
this detail would be better if you added 38-50mm
of rigid insulation between the sheathing and the stucco



STUCCO CLAD WALL AT FOUNDATION
SCALE: 1:5
EASE SYSTEM (WALL ASSEMBLY C)
11

Detail 11: Stucco Clad Wall at Foundation

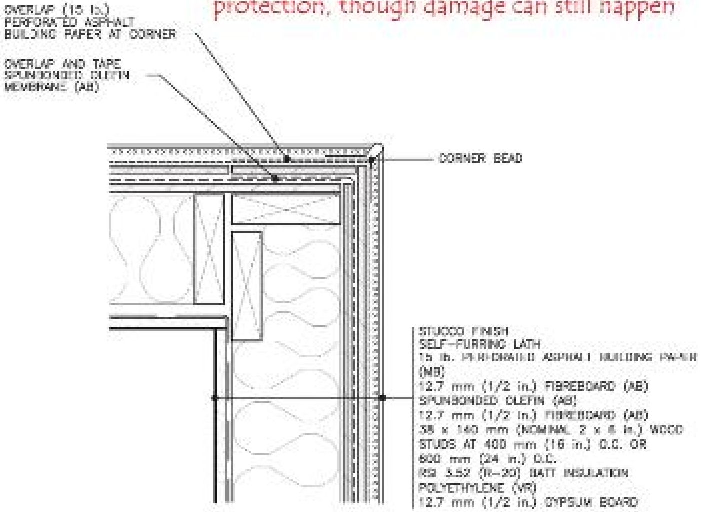
the parapet flashing always drains into the roof to
avoid staining on the facade



STUCCO CLAD WALL AT ROOF
SCALE: 1:5
EASE SYSTEM (WALL ASSEMBLY C)
13

Detail 13: Stucco Clad Wall at Roof

stucco is fairly vulnerable to damage so they use a metal bead up the corner to provide better protection, though damage can still happen



CORNER, HORIZONTAL SECTION

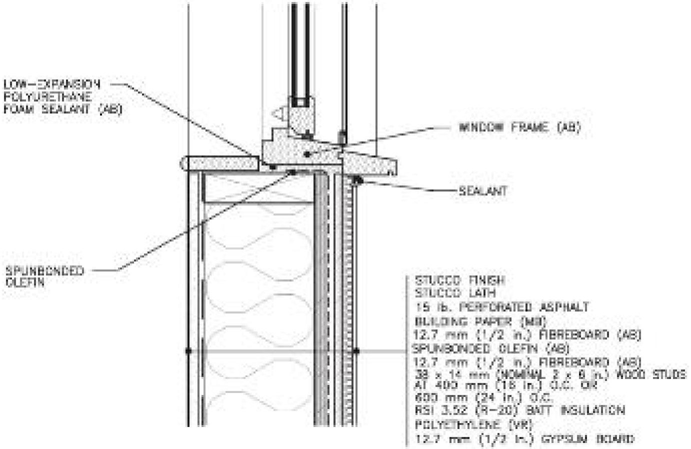
SCALE: 1:5

EASE SYSTEM (WALL ASSEMBLY C)

14

Detail 14: Corner, Horizontal Section

the window placement in a stucco wall is similar to a wood clad wall



WINDOW OPENING

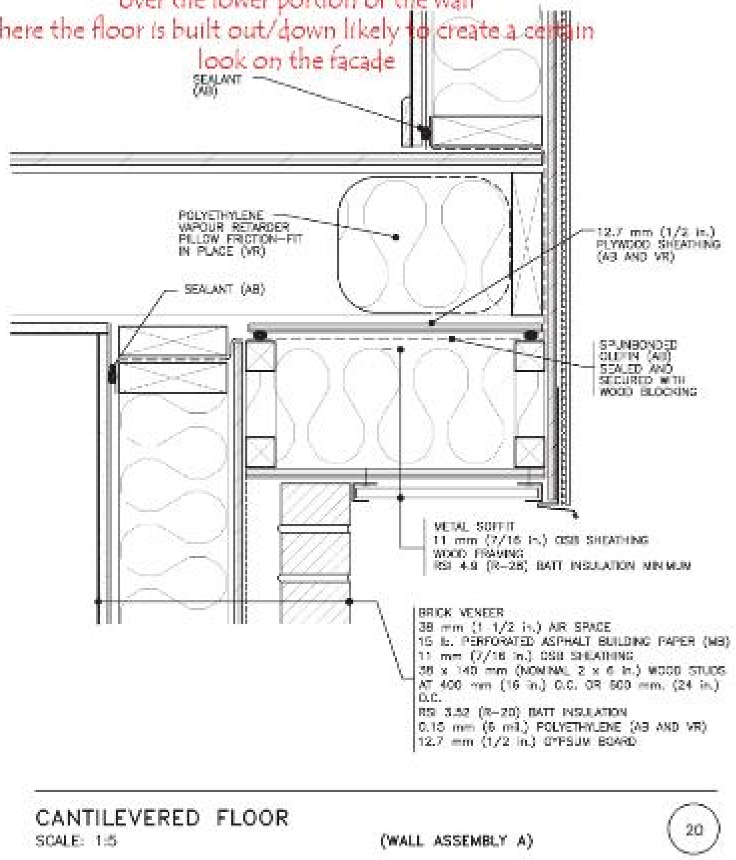
SCALE: 1:5

(WALL ASSEMBLY C)

19

Detail 19: Window Opening, C

for floor extensions the joists are cantilevered out
over the lower portion of the wall
here the floor is built out/down likely to create a certain
look on the facade

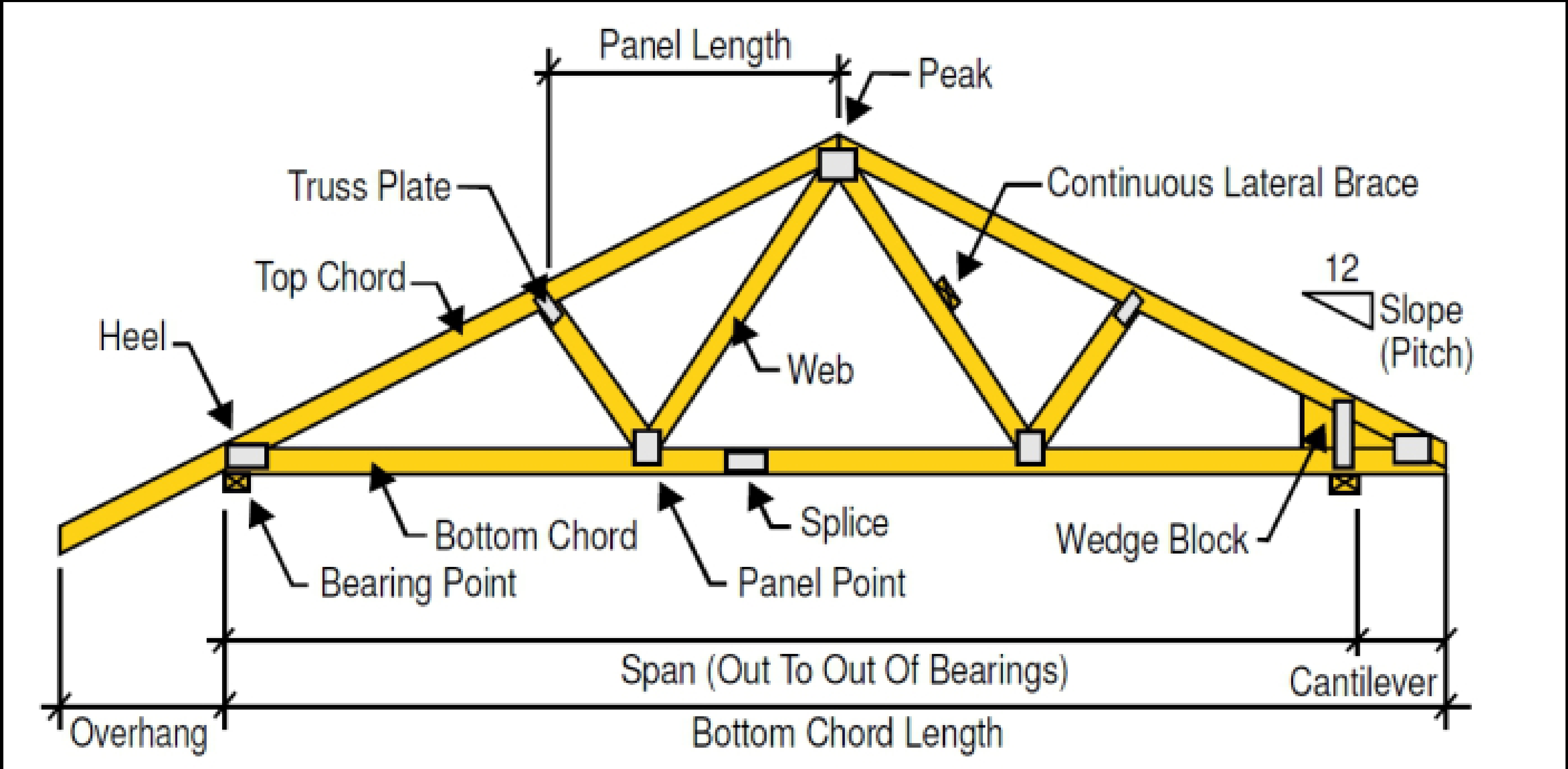


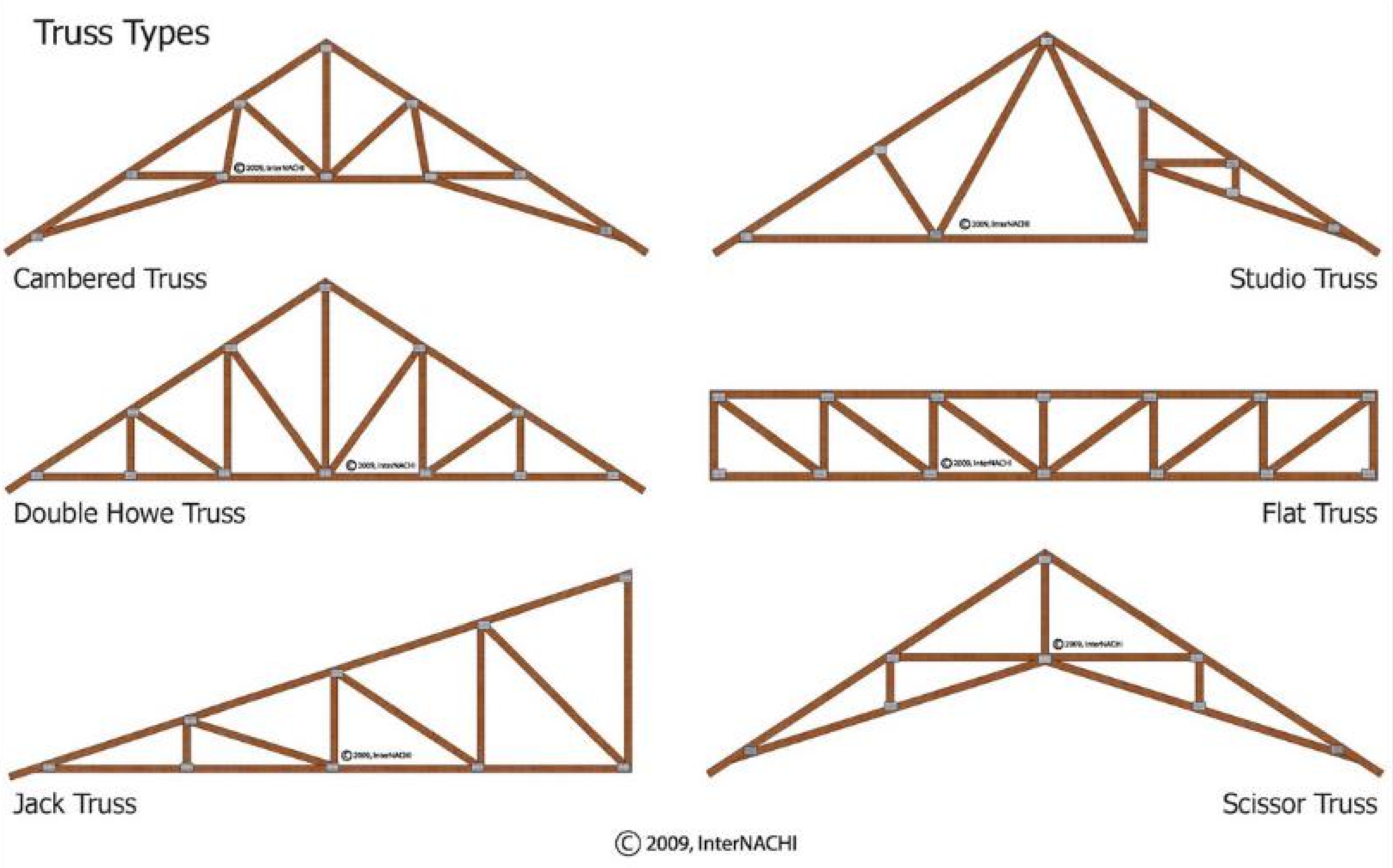
Detail 20: Cantilevered Floor, A

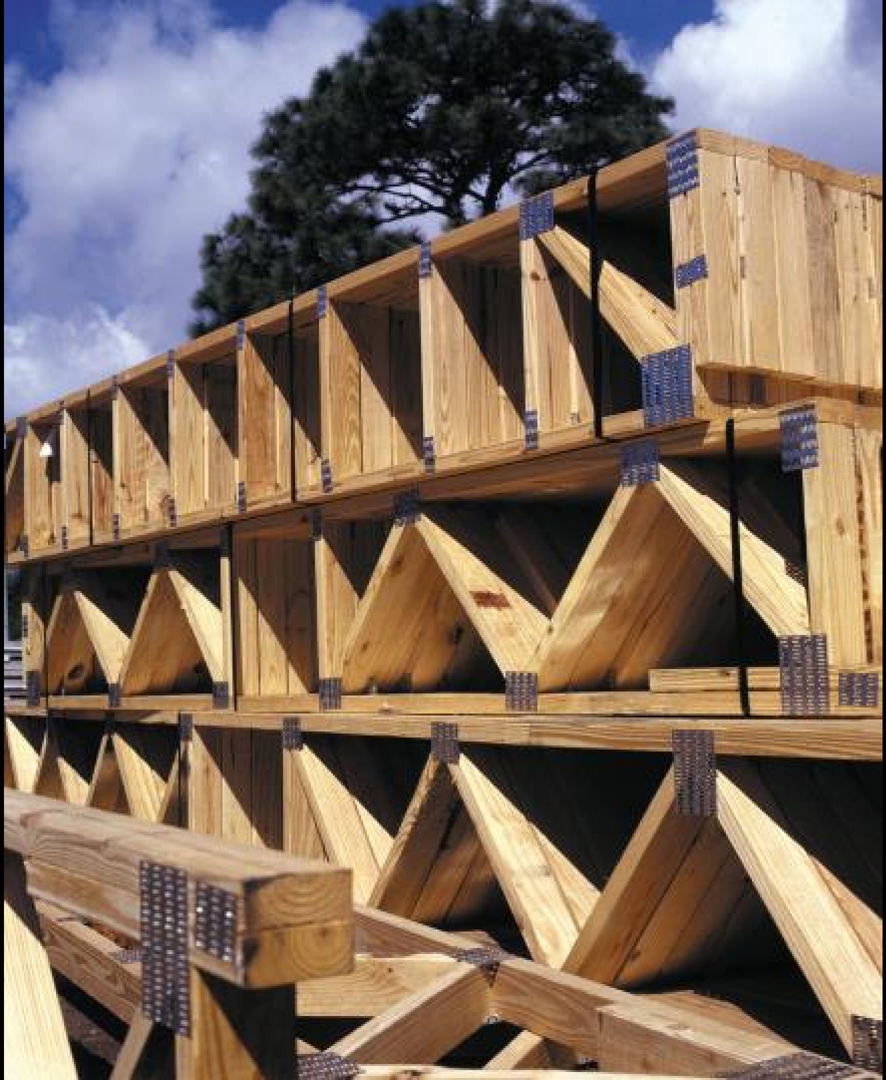
Two ways of framing a residential roof:

1. Traditional uses rafters and collar ties for stability
- Can inhabit the space below the roof

1. Contemporary uses prefab trusses for speed of construction
- Cannot inhabit the space below the roof


Panel Length
Peak
Truss Plate
Continuous Lateral Brace
Top Chord
12
Slope
(Pitch)
Heel
Web
Splice
Bottom Chord
Wedge Block
Bearing Point
Panel Point
Span (Out To Out Of Bearings)
Cantilever
Overhang
Bottom Chord Length


Truss Types
Cambered Truss
Studio Truss
Double Howe Truss
Flat Truss
Jack Truss
Scissor Truss
© 2009, InterNACHI



Framing Sizes

Table 16
Maximum spans for floor joists – general cases[1,2]

Commercial Designation	Grade	Joist Size in. (mm)	Maximum Span, ft-in. (m) – Joist Spacing in. (mm) – With Strapping 12 (300)	With Strapping 16 (400)	With Strapping 24 (600)	With Bridging 12 (300)	With Bridging 16 (400)	With Bridging 24 (600)	With Strapping and Bridging 12 (300)	With Strapping and Bridging 16 (400)	With Strapping and Bridging 24 (600)
Douglas fir	No. 1	2x6	10–2	9–7	8–7	10–10	9–10	8–7	10–10	9–10	8–7
– larch	and	(38x140)	(3.09)	(2.91)	(2.62)	(3.29)	(2.99)	(2.62)	(3.29)	(2.99)	(2.62)
(includes	No. 2	2x8	12–2	11–7	11–0	13–1	12–4	11–3	13–9	12–10	11–3
Douglas fir		(38x184)	(3.71)	(3.53)	(3.35)	(4.00)	(3.76)	(3.44)	(4.19)	(3.90)	(3.44)
and western		2x10	14–4	13–8	13–0	15–3	14–4	13–6	15–10	14–10	
13–10											
larch)		(38x235)	(4.38)	(4.16)	(3.96)	(4.66)	(4.38)	(4.11)	(4.84)	(4.51)	(4.20)
		2x12	16–5	15–7	14–10	17–2	16–2	15–3	17–10	16–7	15–6
		(38x286)	(4.99)	(4.75)	(4.52)	(5.26)	(4.94)	(4.65)	(5.43)	(5.06)	(4.72)
Hem – fir	No. 1	2x6	10–2	9–7	8–7	10–10	9–10	8–7	10–10	9–10	8–7
(includes	and	(38x140)	(3.09)	(2.91)	(2.62)	(3.29)	(2.99)	(2.62)	(3.29)	(2.99)	(2.62)
western	No. 2	2x8	12–2	11–7	11–0	13–1	12–4	11–3	13–9	12–10	11–3
hemlock		(38x184)	(3.71)	(3.53)	(3.36)	(4.00)	(3.76)	(3.44)	(4.19)	(3.90)	(3.44)
and		2x10	14–4	13–8	13–0	15–3	14–4	13–6	15–10	14–10	
13–10											
amabilis fir)		(38x235)	(4.38)	(4.16)	(3.96)	(4.66)	(4.38)	(4.11)	(4.84)	(4.51)	(4.20)
		2x12	16–5	15–7	14–10	17–2	16–2	15–3	17–10	16–7	15–6
		(38x286)	(4.99)	(4.75)	(4.52)	(5.26)	(4.94)	(4.65)	(5.43)	(5.06)	(4.72)
Spruce –	No. 1	2x6	9–7	8–11	8–2	10–4	9–4	8–2	10–4	9–4	8–2
pine – fir	and	(38x140)	(2.92)	(2.71)	(2.49)	(3.14)	(2.85)	(2.49)	(3.14)	(2.85)	(2.49)
(includes	No. 2	2x8	11–7	11–0	10–6	12–5	11–9	10–9	13–1	12–2	10–9
spruce		(38x184)	(3.54)	(3.36)	(3.20)	(3.80)	(3.58)	(3.27)	(3.99)	(3.72)	(3.27)
[all species		2x10	13–8	13–0	12–4	14–6	13–8	12–10	15–1	14–1	13–2
except		(38x235)	(4.17)	(3.96)	(3.77)	(4.44)	(4.17)	(3.92)	(4.60)	(4.29)	(4.00)
coast sitka		2x12	15–7	14–10	14–1	16–4	15–5	14–6	17–0	15–10	14–9
spruce],		(38x286)	(4.75)	(4.52)	(4.30)	(5.00)	(4.71)	(4.42)	(5.17)	(4.82)	(4.49)
jack pine,											
lodgepole pine,											
balsam fir and											
alpine fir)											
Northern	No. 1	2x6	8–3	7–8	7–1	9–3	8–5	7–5	9–4	8–5	7–5
species	and	(38x140)	(2.51)	(2.33)	(2.16)	(2.81)	(2.57)	(2.25)	(2.83)	(2.57)	(2.25)
(includes	No. 2	2x8	10–6	10–0	9–4	11–3	10–7	9–8	11–10	11–0	9–8
any		(38x184)	(3.19)	(3.04)	(2.84)	(3.44)	(3.23)	(2.96)	(3.60)	(3.36)	(2.96)
Canadian		2x10	12–4	11–9	11–2	13–1	12–4	11–7	13–8	12–9	
11–10											
species		(38x235)	(3.76)	(3.58)	(3.41)	(4.01)	(3.77)	(3.54)	(4.16)	(3.88)	(3.62)
covered by		2x12	14–1	13–5	12–9	14–9	13–11	13–1	15–4	14–4	13–4
the NLGA		(38x286)	(4.29)	(4.08)	(3.88)	(4.51)	(4.25)	(4.00)	(4.67)	(4.35)	(4.06)
Standard											
Grading Rules)											

Note to Table 16

1. Spans apply only where the floors serve residential areas.
2. Subfloor must comply with minimum requirements from tables 18 and 15.

These tables can be found in the CMHC Handbook you can download on the course page

Table 22
Maximum spans for spruce – pine – fir lintels – No. 1 or No. 2 grade – non-structural sheathing[7]

Lintel Supporting	Lintel Size, in. (mm)[1], 2-ply	Maximum Span, ft.–in. (m)[2,3] — Exterior Walls — Specified Snow Load, psf (kPa)[4]: 20.9 / 1.0	31.3 / 1.5	41.8 / 2.0	52.2 / 2.5	62.7 / 3.0	Interior Walls
Limited attic storage and ceiling	2–2 x 4	This area intentionally left blank					4–2
	2–38 x 89						1.27
	2–2 x 6						6–4
	2–38 x 140						1.93
	2–2 x 8						7–9
	2–38 x 184						2.35
	2–2 x 10						9–5
	2–38 x 235						2.88
	2–2 x 12						11–0
	2–38 x 286						3.34
Lintel Supporting Roof and ceiling only (tributary width 2 ft. (0.6 m))[6]	2-2x4	8-4	7-4	6-8	6-2	5-10	6-2
	2-38x89	2.55	2.23	2.03	1.88	1.77	1.88
	2-2x6	13-2	11-6	10-5	9-8	9-2	9-8
	2-38x140	4.01	3.50	3.18	2.96	2.78	2.96
	2-2x8	17-4	15-1	13-9	12-9	12-0	12-9
	2-38x184	5.27	4.61	4.18	3.88	3.66	3.88
	2-2x10	20-11	18-11	17-6	16-3	15-4	16-3
	2-38x235	6.37	5.76	5.34	4.96	4.67	4.96
	2-2x12	24-3	21-11	20-4	19-3	18-5	19-3
	2-38x286	7.38	6.67	6.21	5.87	5.61	5.87
Lintel Supporting Roof and ceiling only tributary width 16 ft. 0 in. (4.9 m)[1]	2-2x4	4-2	3-8	3-4	3-1	2-10	3-1
	2-38x89	1.27	1.11	1.01	0.93	0.87	0.93
	2-2x6	6-4	5-5	4-10	4-5	4-1	4-5
	2-38x140	1.93	1.66	1.48	1.35	1.25	1.35
	2-2x8	7-9	6-8	5-11	5-5	5-0	5-5
	2-38x184	2.35	2.03	1.80	1.64	1.53	1.64
	2-2x10	9-5	8-1	7-3	6-7	6-1	6-7
	2-38x235	2.88	2.47	2.20	2.01	1.84	2.01
	2-2x12	11-0	9-5	8-5	7-8	6-10	7-8
	2-38x286	3.34	2.87	2.56	2.33	2.09	2.33
Lintel Supporting Roof ceiling and 1 storey[1,2,5]	2-2x4	3-5	3-2	2-11	2-9	2-7	2-5
	2-38x89	1.05	0.96	0.89	0.84	0.79	0.74
	2-2x6	4-11	4-6	4-2	3-11	3-8	3-4
	2-38x140	1.49	1.37	1.27	1.19	1.13	1.02
	2-2x8	6-0	5-6	5-1	4-9	4-4	3-11
	2-38x184	1.82	1.67	1.55	1.44	1.33	1.20
	2-2x10	7-3	6-8	6-2	5-8	5-3	4-9
	2-38x235	2.22	2.04	1.89	1.73	1.59	1.45
	2-2x12	8-5	7-9	7-1	6-5	5-11	5-5
	2-38x286	2.58	2.36	2.15	1.96	1.81	1.66

Continued on p. 381

Table 26
Maximum spans for roof joists – specified roof snow loads 52.2 and 62.7 psf (2.5 and 3.0 kPa)

			Maximum Span, ft–in. (m)					
			Specified Snow Load, psf (kPa)[1]					
			52.2 (2.5)			62.7 (3.0)		
			Joist Spacing, in. (mm)			Joist Spacing, in. (mm)		
Commercial Designation	Grade	Joist Size, in. (mm)	12 (300)	16 (400)	24 (600)	12 (300)	16 (400)	24 (600)
Douglas fir – larch (includes Douglas fir and western larch)	No. 1 and No. 2	2x4 (38x89)	6–3 (1.91)	5–8 (1.74)	5–0 (1.52)	5–11 (1.80)	5–4 (1.63)	4–8 (1.43)
		2x6 (38x140)	9–10 (3.01)	9–0 (2.73)	7–10 (2.39)	9–3 (2.83)	8–5 (2.57)	7–4 (2.25)
		2x8 (38x184)	13–0 (3.95)	11–9 (3.59)	10–3 (3.11)	12–2 (3.72)	11–1 (3.38)	9–6 (2.90)
		2x10 (38x235)	16–7 (5.05)	15–1 (4.59)	12–7 (3.84)	15–7 (4.75)	14–2 (4.32)	11–8 (3.55)
		2x12 (38x286)	20–2 (6.14)	17–11 (5.46)	14–8 (4.46)	19–0 (5.78)	16–7 (5.05)	13–6 (4.12)
Hem – fir (includes western hemlock and amabilis fir)	No. 1 and No. 2	2x4 (38x89)	6–3 (1.91)	5–8 (1.74)	5–0 (1.52)	5–11 (1.80)	5–4 (1.63)	4–8 (1.43)
		2x6 (38x140)	9–10 (3.01)	9–0 (2.73)	7–10 (2.39)	9–3 (2.83)	8–5 (2.57)	7–4 (2.25)
		2x8 (38x184)	13–0 (3.95)	11–9 (3.59)	10–3 (3.14)	12–2 (3.72)	11–1 (3.38)	9–8 (2.95)
		2x10 (38x235)	16–7 (5.05)	15–1 (4.59)	13–2 (4.01)	15–7 (4.75)	14–2 (4.32)	12–3 (3.72)
		2x12 (38x286)	20–2 (6.14)	18–4 (5.58)	15–4 (4.68)	19–0 (5.78)	17–3 (5.25)	14–2 (4.32)
Spruce – pine – fir (includes spruce [all species except coast sitka spruce], jack pine, lodgepole pine, balsam fir and alpine fir)	No. 1 and No. 2	2x4 (38x89)	6–0 (1.82)	5–5 (1.65)	4–9 (1.44)	5–7 (1.71)	5–1 (1.56)	4–6 (1.36)
		2x6 (38x140)	9–5 (2.86)	8–6 (2.60)	7–5 (2.27)	8–10 (2.69)	8–0 (2.45)	7–0 (2.14)
		2x8 (38x184)	12–4 (3.76)	11–3 (3.42)	9–10 (2.99)	11–7 (3.54)	10–7 (3.22)	9–3 (2.81)
		2x10 (38x235)	15–9 (4.81)	14–4 (4.37)	12–6 (3.82)	14–10 (4.52)	13–6 (4.11)	11–9 (3.59)
		2x12 (38x286)	19–2 (5.85)	17–5 (5.31)	15–3 (4.64)	18–1 (5.50)	16–5 (5.00)	14–4 (4.37)
Northern species (includes any Canadian species covered by the NLGA Standard Grading Rules)	No. 1 and No. 2	2x4 (38x89)	5–5 (1.64)	4–11 (1.49)	4–3 (1.31)	5–1 (1.55)	4–7 (1.41)	4–0 (1.23)
		2x6 (38x140)	8–6 (2.59)	7–9 (2.35)	6–9 (2.05)	8–0 (2.43)	7–3 (2.21)	6–4 (1.93)
		2x8 (38x184)	11–2 (3.40)	10–2 (3.09)	8–10 (2.70)	10–6 (3.20)	9–6 (2.91)	8–4 (2.53)
		2x10 (38x235)	14–3 (4.34)	12–11 (3.94)	11–0 (3.35)	13–5 (4.09)	12–2 (3.71)	10–2 (3.10)
		2x12 (38x286)	17–4 (5.28)	15–7 (4.76)	12–9 (3.89)	16–4 (4.97)	14–5 (4.40)	11–9 (3.59)

Note to Table 26

1. To determine the specified snow load in your location contact your municipal building department.

Putting it all together

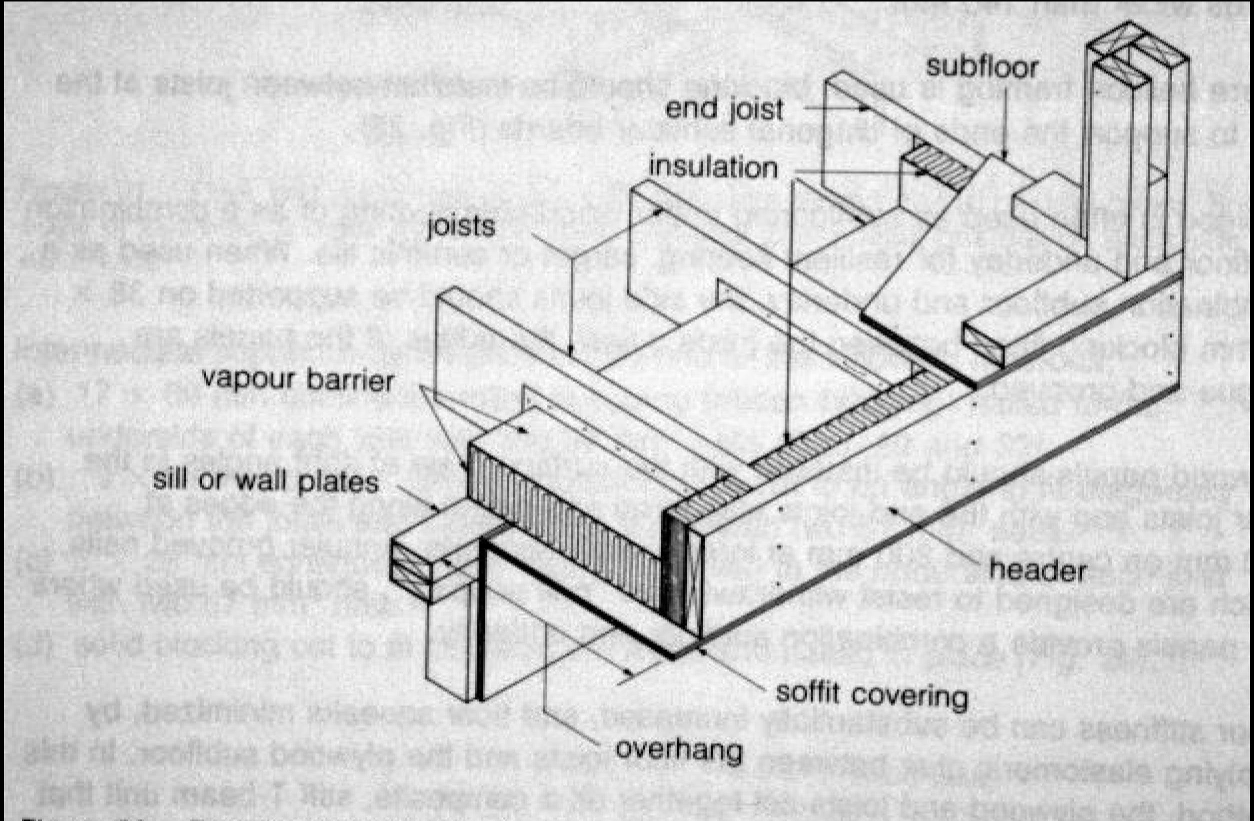



Figure 33. Floor framing at projections.


KAYCAN


unik


PEACHTREE


PEACHTREE

Heavy Timber Construction

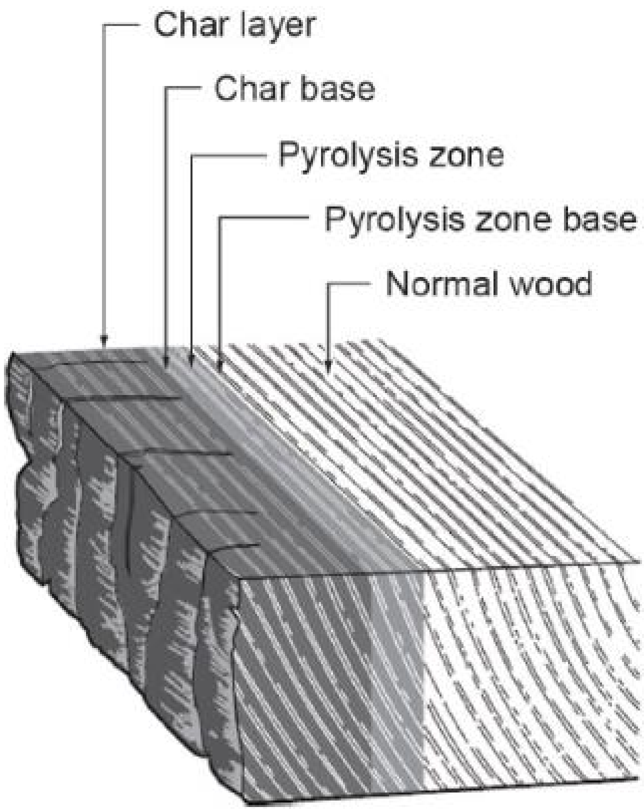


Figure 3.1. Formation of Char layer and pyrolysis zone in wood (one-dimensional) when exposed to high temperatures (CSA, 2011).

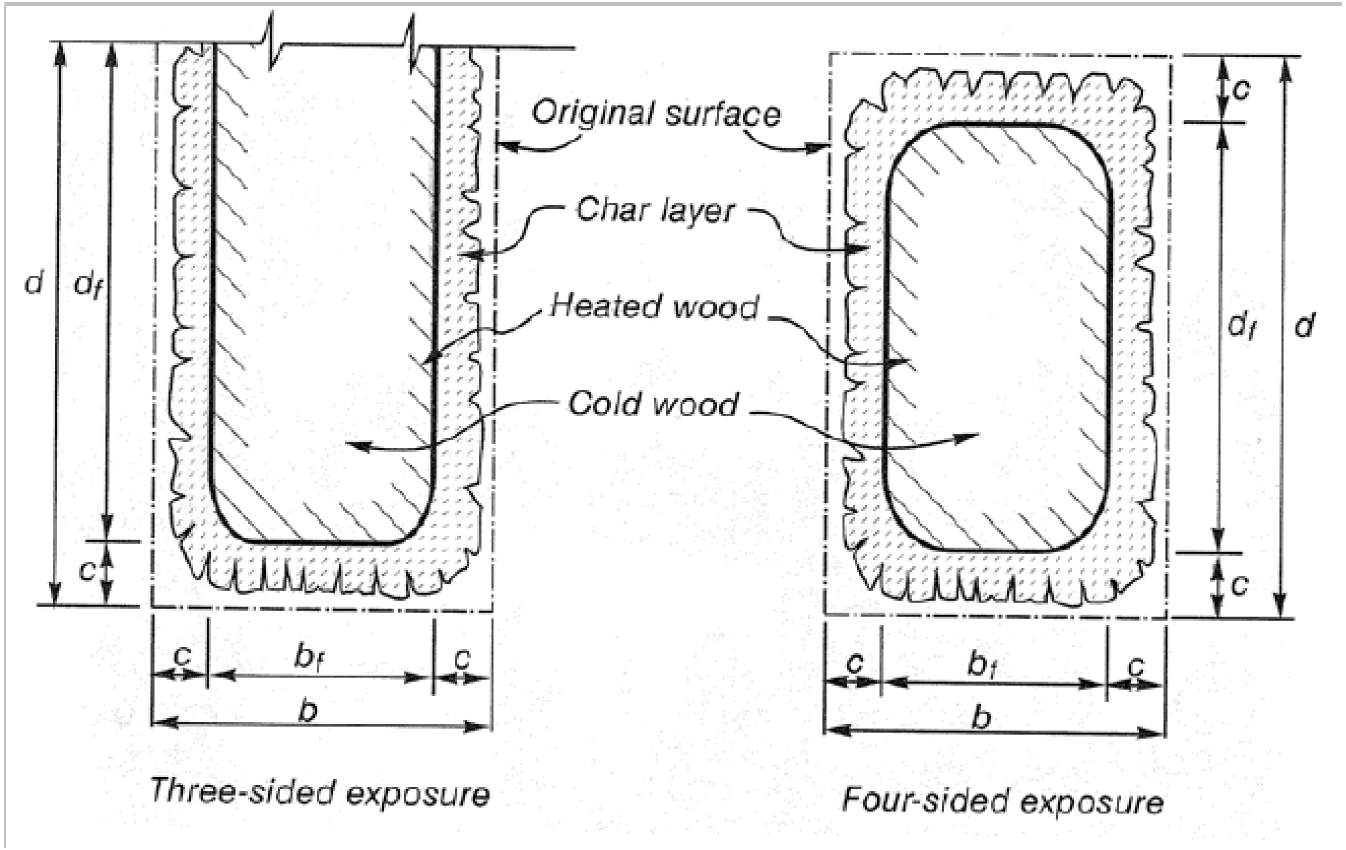


Figure 3.5. Illustration of wood beam or column exposed to fire with the char layer, heated wood layer and cool interior section indicated (Buchanan, 2001).

Glue-laminated timber (glulam) is fabricated by gluing individual pieces of dimensional lumber together to form columns, beams and headers.

Glue-laminated timber panels have the appearance of glulam beams laid flat. These panels provide a strong and economical flooring option with one-way spanning capability.

Laminated veneer lumber (LVL) is fabricated by laminating and gluing multiple veneers together in the same orientation. This enables long elements to be produced that have high strength in one direction.

Laminated strand lumber (LSL) is fabricated from flaked wood strands glued together in large billets. The length is limited only by standard shipping and trucking dimensions. LSL can be used for floors, walls and vertical members where large floor-to-floor heights are required.

Visitor Centre, Stanley Park, Vancouver


Our Communities Toda

Hult Center for the Performing Arts
Eugene, Oregon, USA
Hardy Holzman Pfeiffer Associates
1982


KeyBank


Gene H. Kruger Pavilion
Laval University
Quebec City, Quebec
Paul Gauthier + Gallienne Moisan Architects
2005

Jackson-Triggs Niagara Estate Winery
Niagara-on-the-Lake, Ontario
KPMB Architects
2001

The Core, Eden Project
St. Austell, England
Nicholas Grimshaw Architects
2005


WATER

Scarborough Civic Centre Library
LGA Architectural Partners & Philip H. Carter Architects



Scarborough
Civic Centre
Branch



TEENS



LIBRARY

Richmond City Hall
Richmond, BC
KPMB Architects


Transit Terminal
Yufuin, Japan

Retail Store
Yufuin, Japan


Visitor Centre
Soo, Japan

The Nest – UBC Campus Centre
Dialog (HBBH) + BH Architects
Vancouver, BC


Welcome
to the Nest!

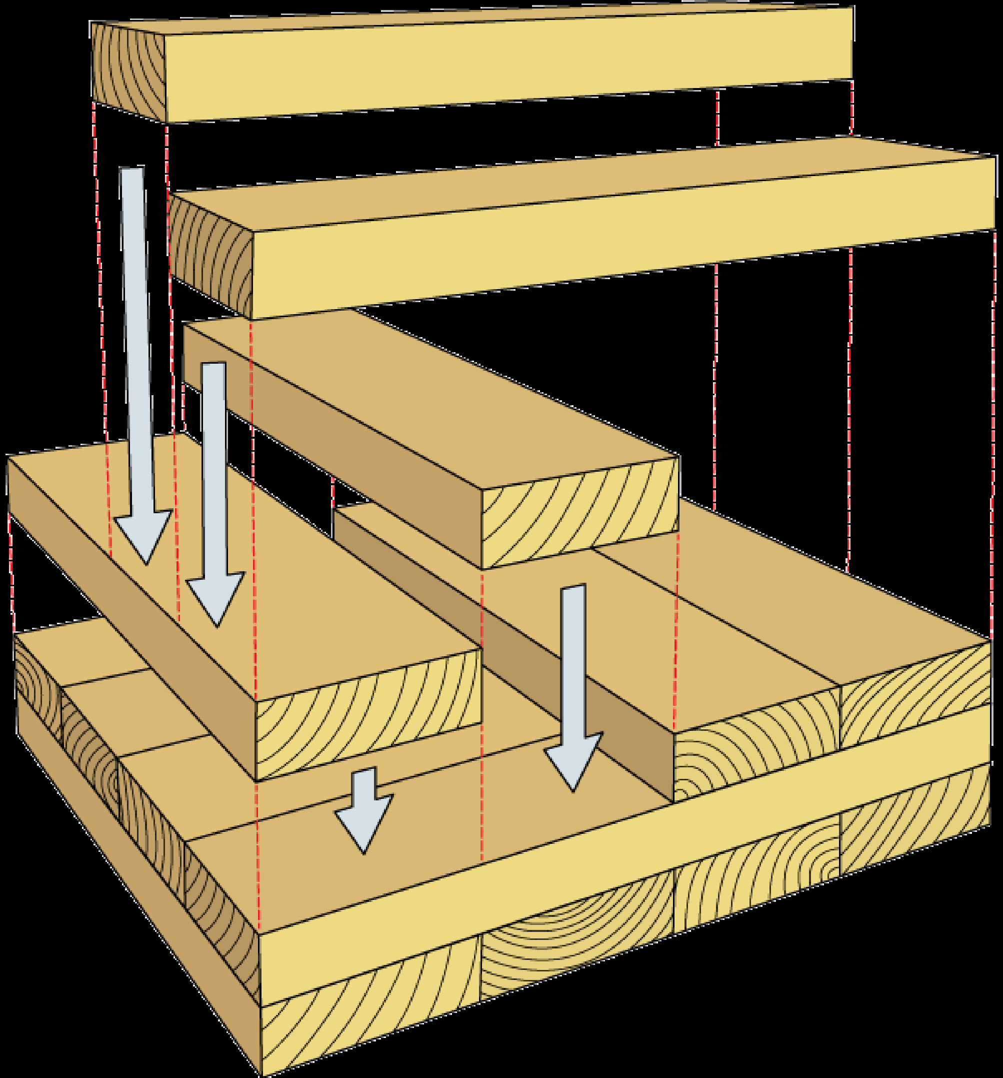

Welcome
to the Nest!


Centre for Interactive Research on Sustainability (CIRS)
Vancouver, BC
Perkins + Will


CLT – Cross Laminated Timber
(often used in conjunction with Glue Laminated Timber)

Comes in 3, 5 and 7 ply thickness

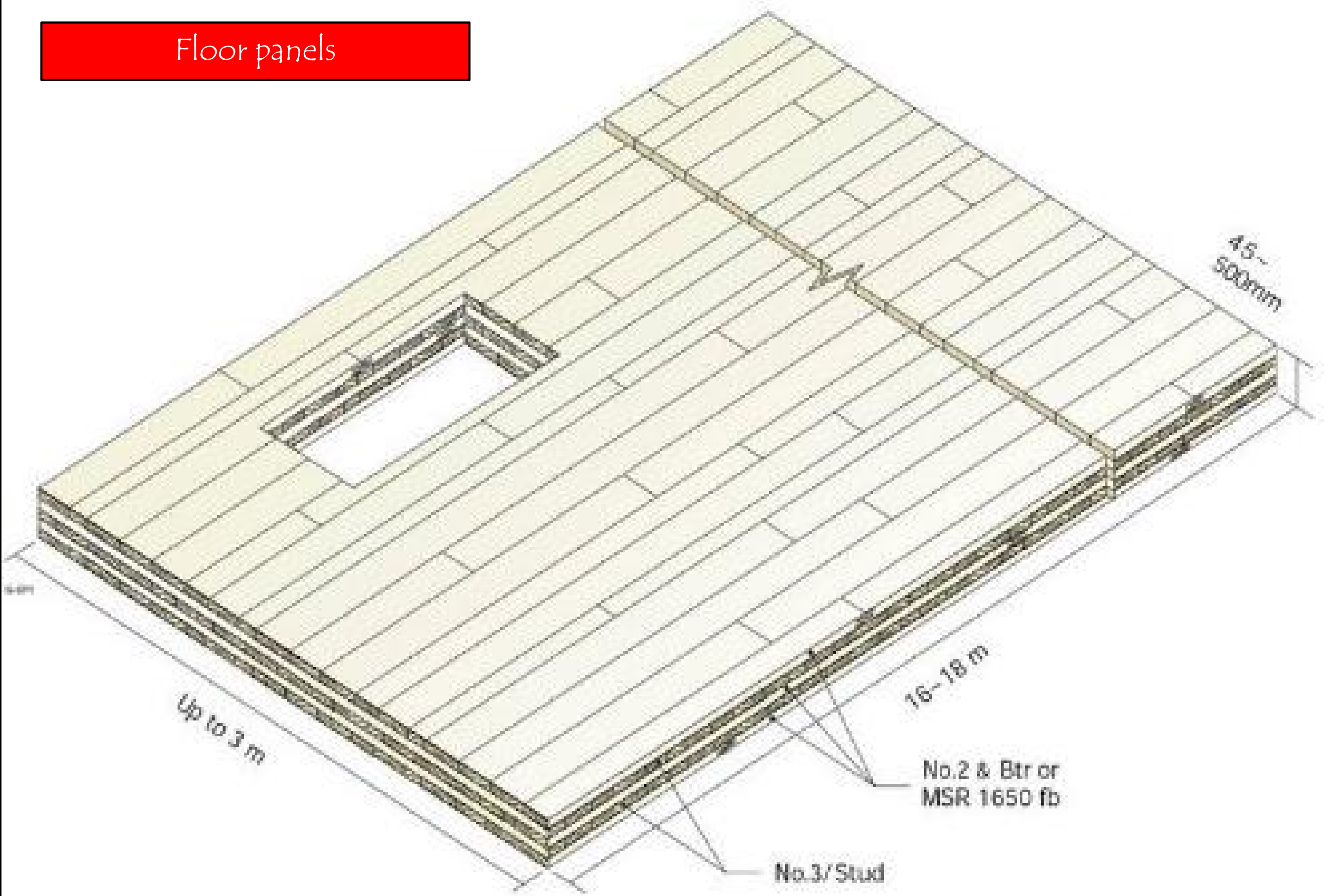
Each layer is about 38mm thick but varies by manufacturer, so check

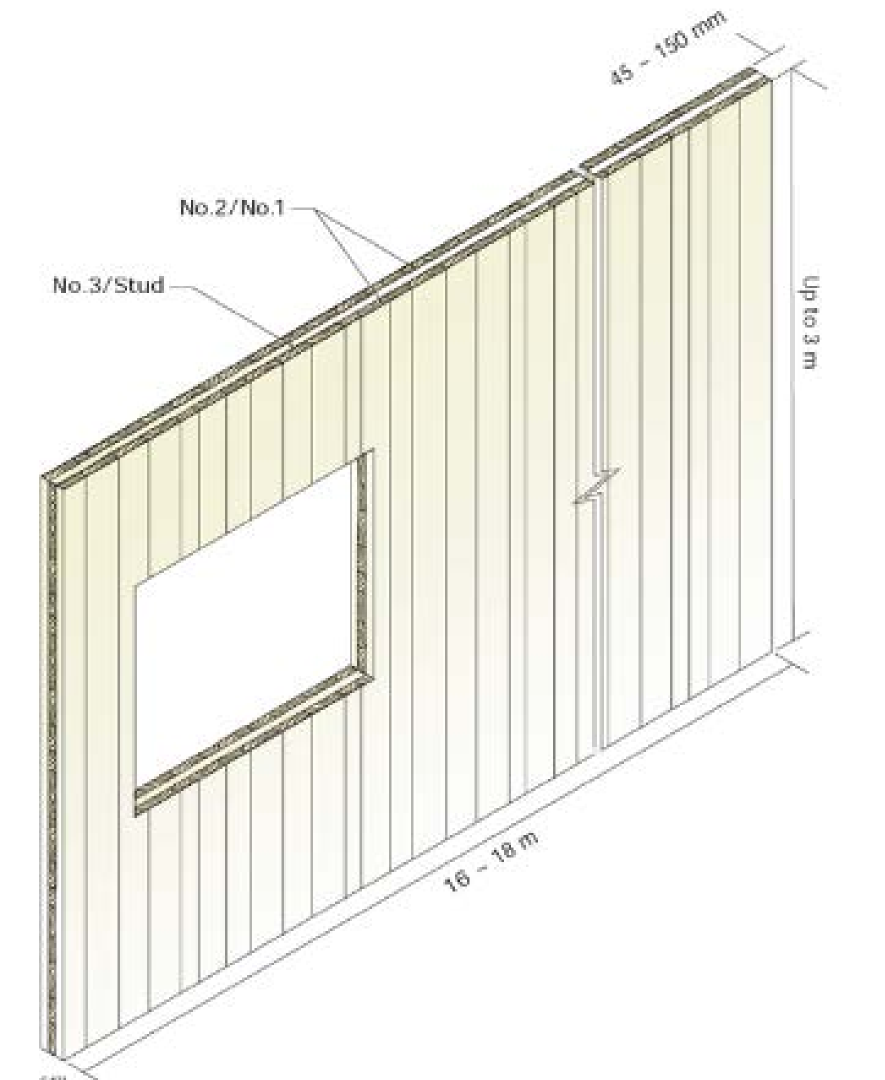


Called cross laminated as each layer is set perpendicular to the previous

Must have an odd number of layers so the outside faces are in the same orientation

Floor panels

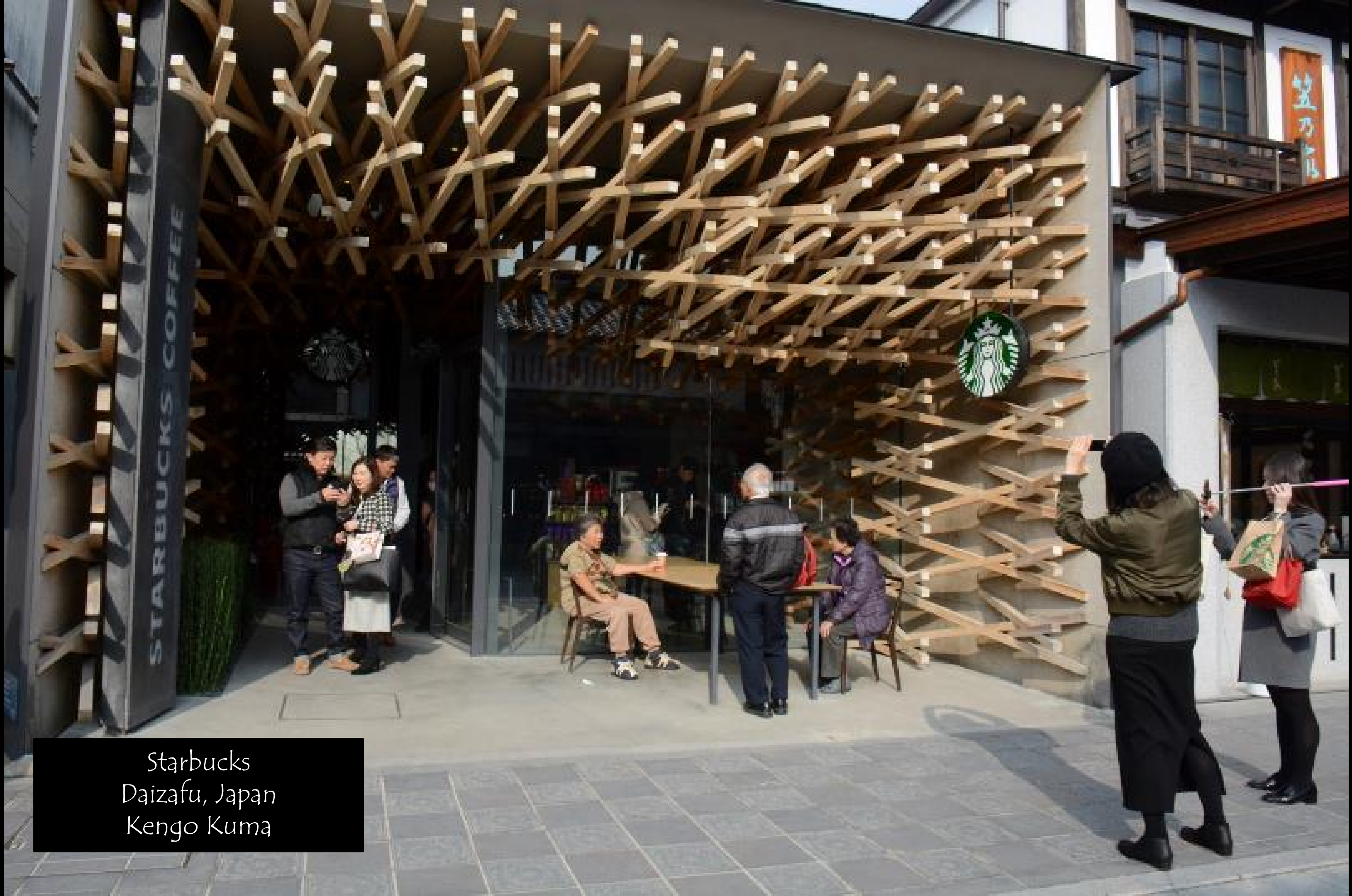




Wall panels


The John W Olver Design Building
UMASS Amherst
Massachusetts, USA
Leers Weinzapfel Associates


UCAN
FASTENING PRODUCTS



Starbucks
Daizafu, Japan
Kengo Kuma