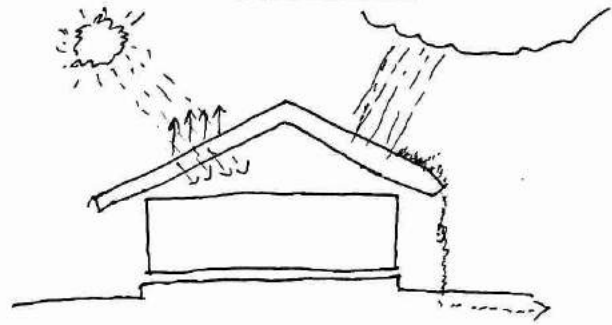


Structure Envelop: Roof + Spanning Elements

6.02 - 6.30

Roof Systems

- control of moisture vapor
- control of heat, solar radiation
- resist spread of fire

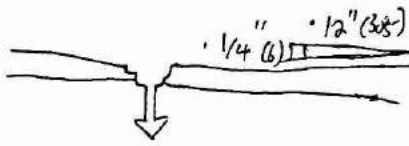


①

Gravity load - resist lateral wind and seismic forces, uplifting wind forces

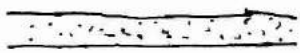
Roof Slopes

- Minimum slope: 1/4" per foot



Flat roofs

structures of



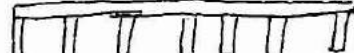
Reinforced concrete slabs



Flat timber or steel trusses



Timber or ~~steel~~ steel beams



wood or steel joist

- low slope roofs 3:12

- Medium to high-slope roofs 4:12 to 12:12

Relate to ^{the decision of} roofing materials and design wind loads.

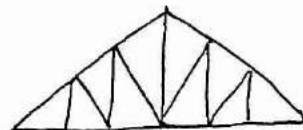
Sloping roof may have structure of



wood or steel rafters



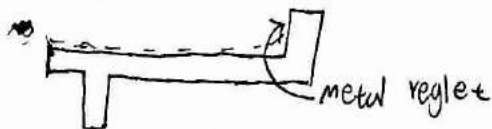
Timber or steel beams



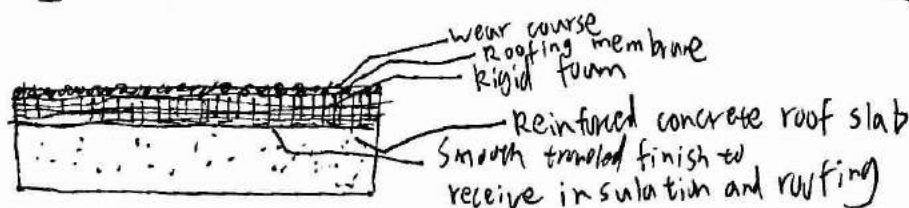
Timber or steel trusses

Reinforced Concrete Roof Slabs

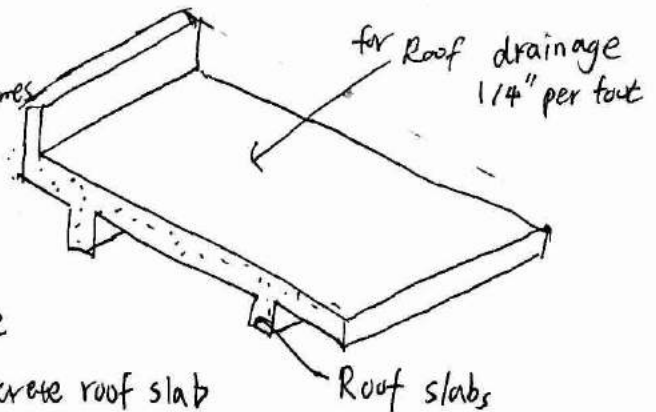
- cover membrane roofing
- support by reinforced concrete columns, concrete frames



metal reglet

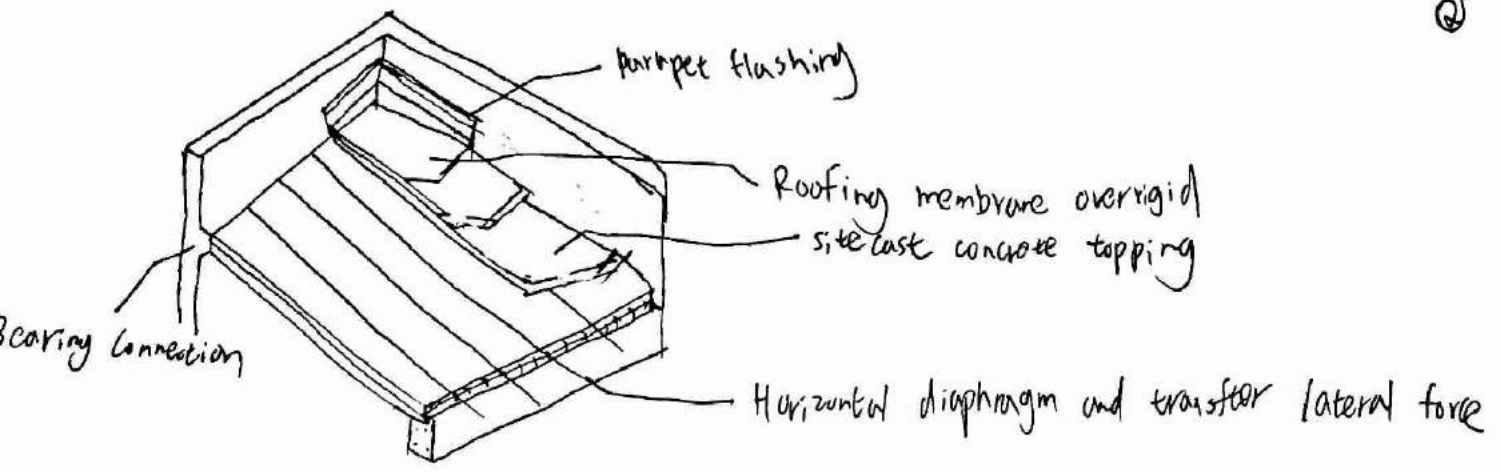


wear course
roofing membrane
rigid foam
Reinforced concrete roof slab
Smooth troweled finish to receive insulation and roofing

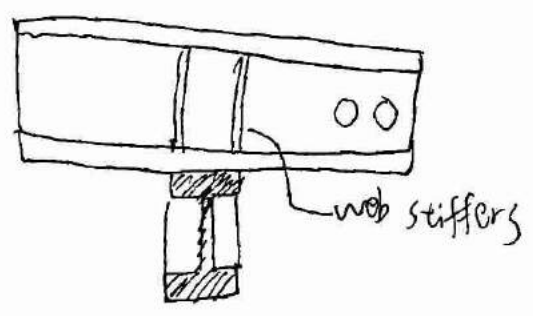
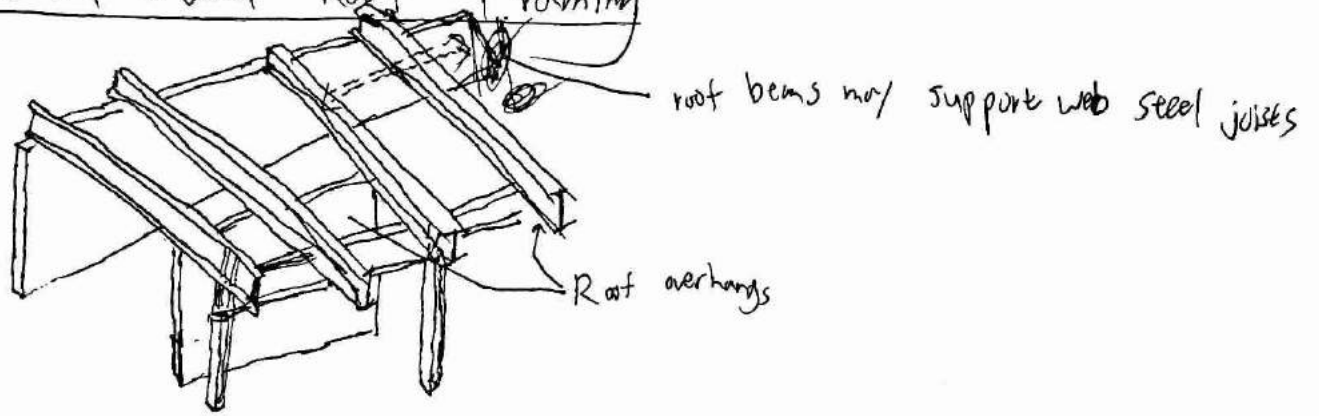


Roof slabs

Precast Concrete Roof systems

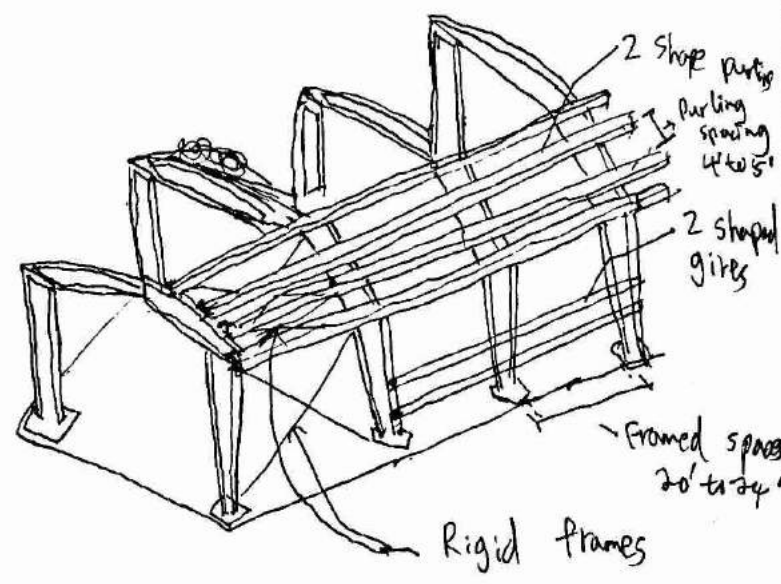


Structural steel Roof Framing



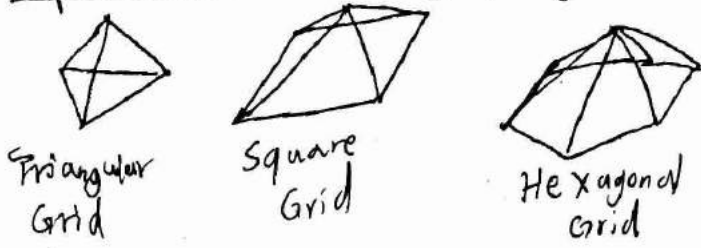
Steel Rigid Frames

- Rigid frames of steel span 30' to 120'



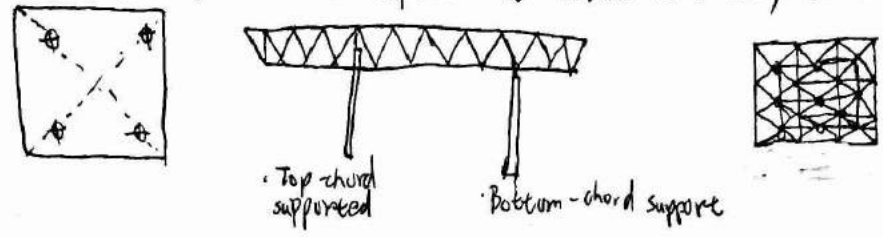
Space Frames - long-spanning three dimensional plate structure

(3)

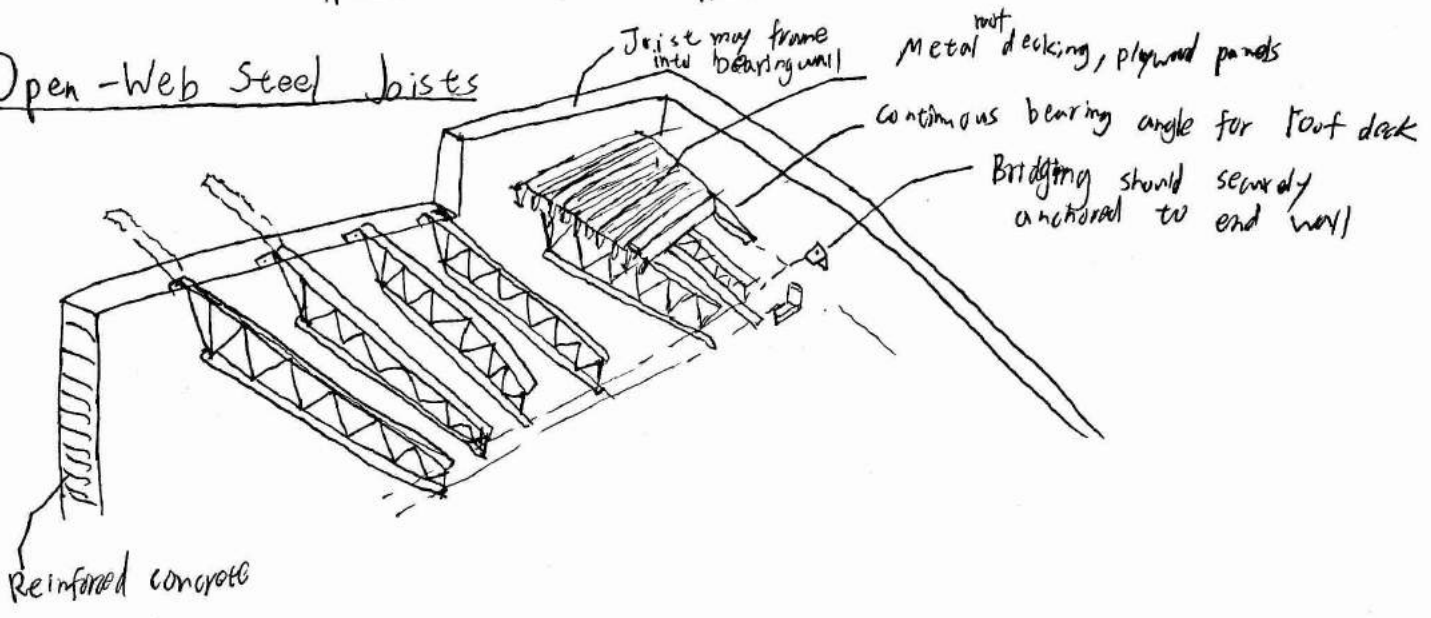


- Can be constructed of structural steel pipe, tubing, channels, tees, or w-shapes

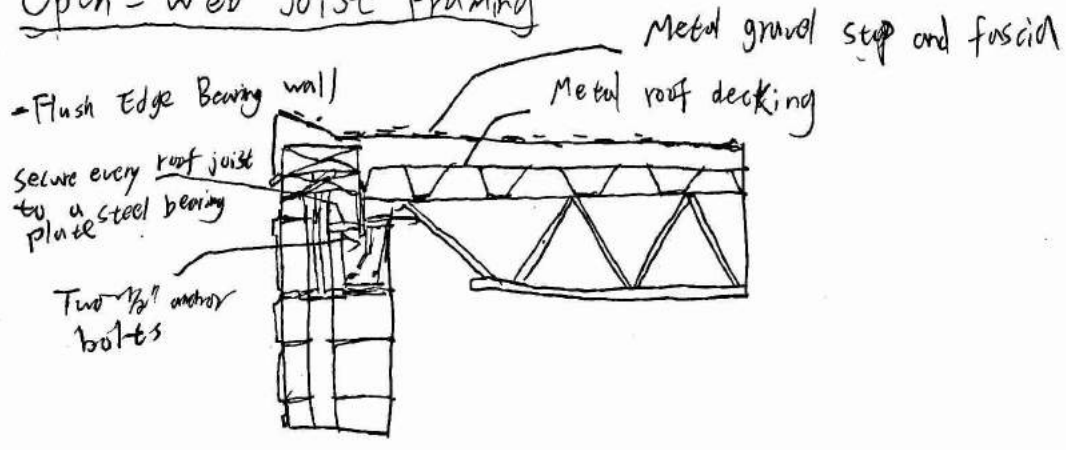
- supporting bay should be square to ensure two-way structure



Open-Web Steel Joists

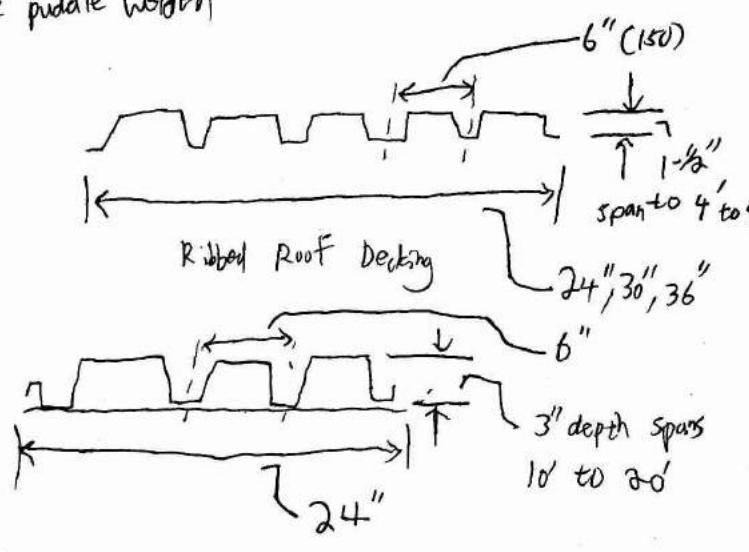
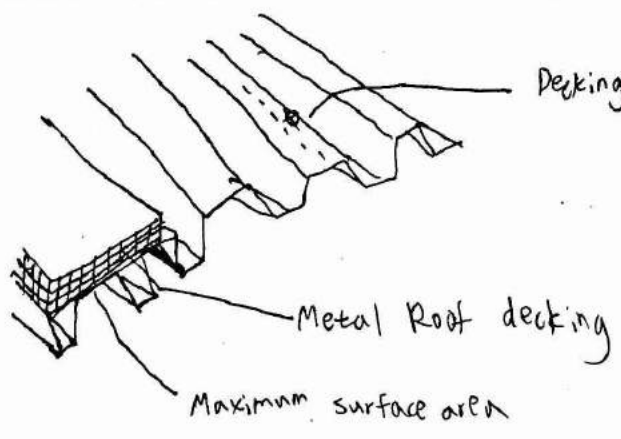


Open-Web Joist Framing



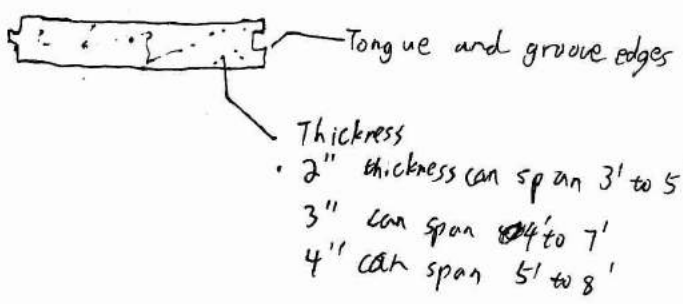
Metal Roof Decking

(f)

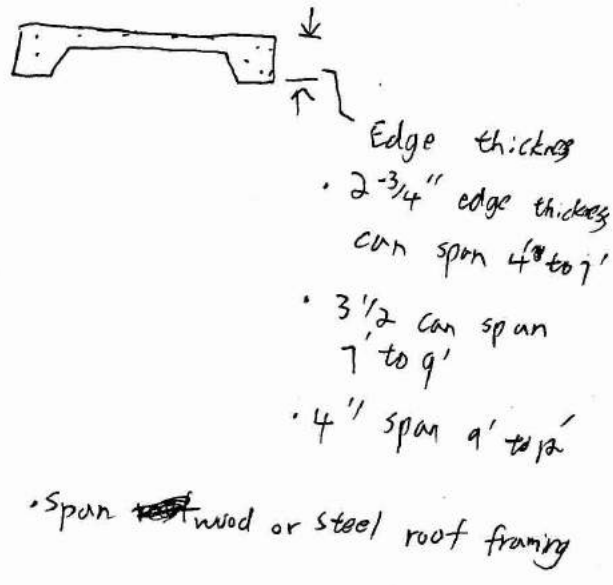


Cementitious Roof Planks

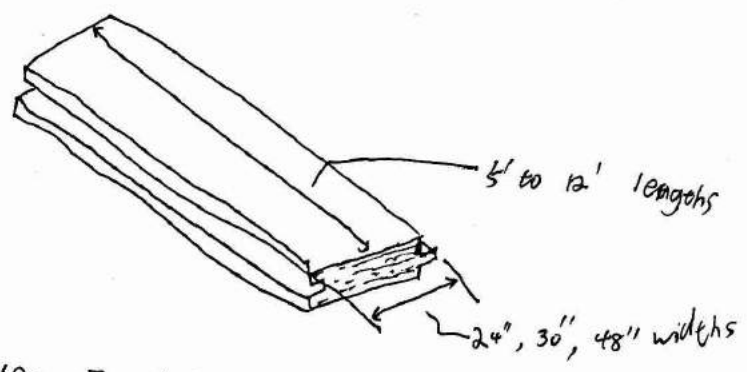
- made with portland cement, light weight aggregate, aerating compound



- Thickness
- 2" thickness can span 3' to 5'
 - 3" can span 4' to 7'
 - 4" can span 5' to 8'



- Edge thickness
- 2 3/4" edge thickness can span 4' to 7'
 - 3 1/2" can span 7' to 9'
 - 4" span 9' to 12'

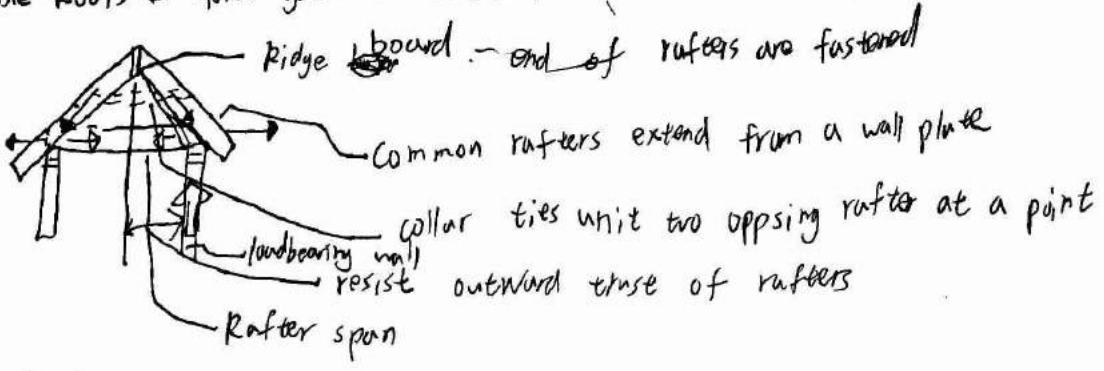


• Span ~~not~~ wood or steel roof framing

Rafter Framing

- Ridge - horizontal line of intersection at the top between two sloping planes of a roof
- Shed - roof with single slope
- Eave - overhanging lower edge of roof
- Soffit - underside of an overhanging roof eave

Gable Roofs - form gable at each end

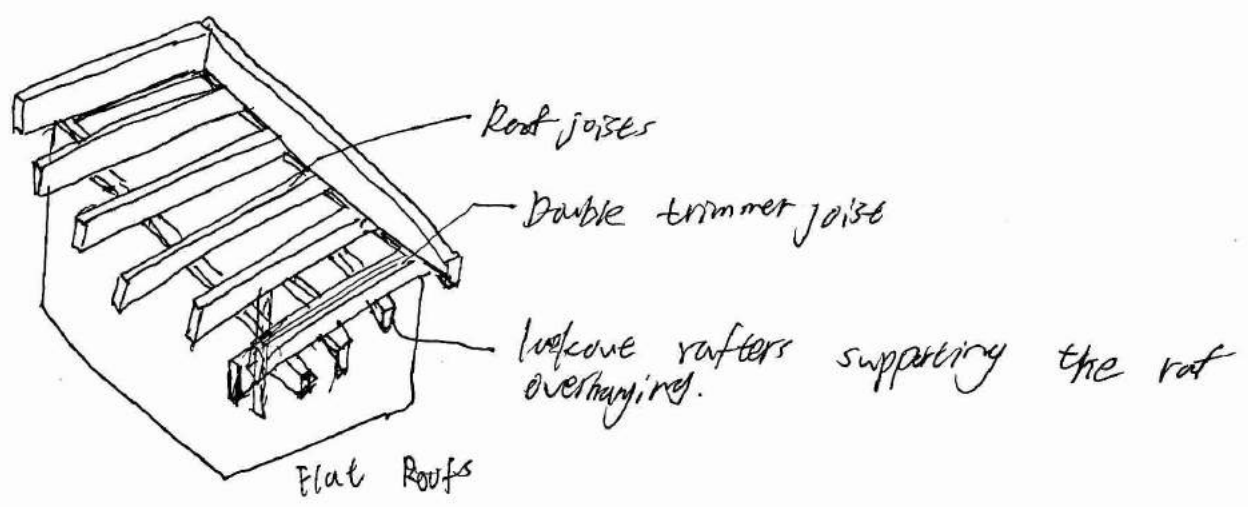


Hip Roofs

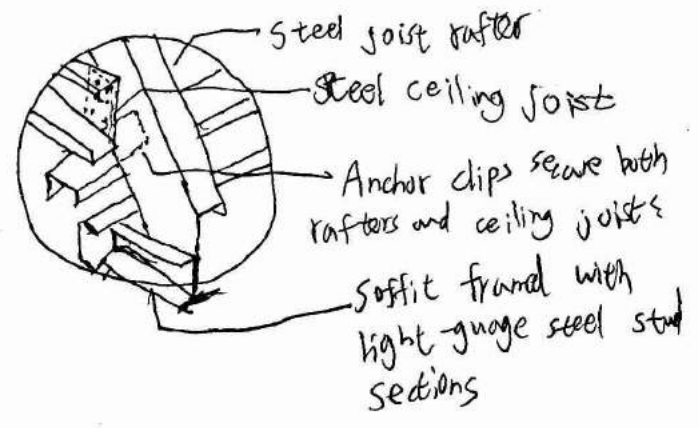
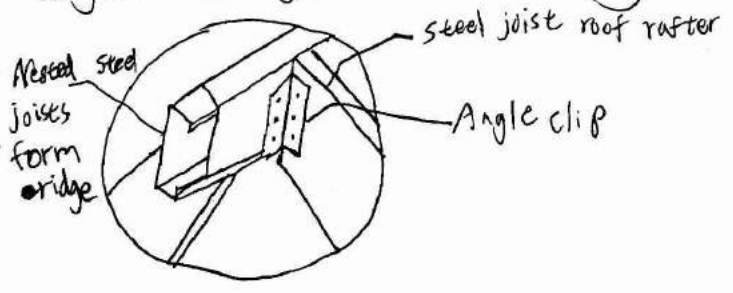
- having sloping ends and side meeting at an inclined projecting angle

Gambrel Roofs - divided on each side into a shallower slope above a steeper one

Flat roofs - framed in a manner similar to floor joist framing



Light-Gauge Roof Framing

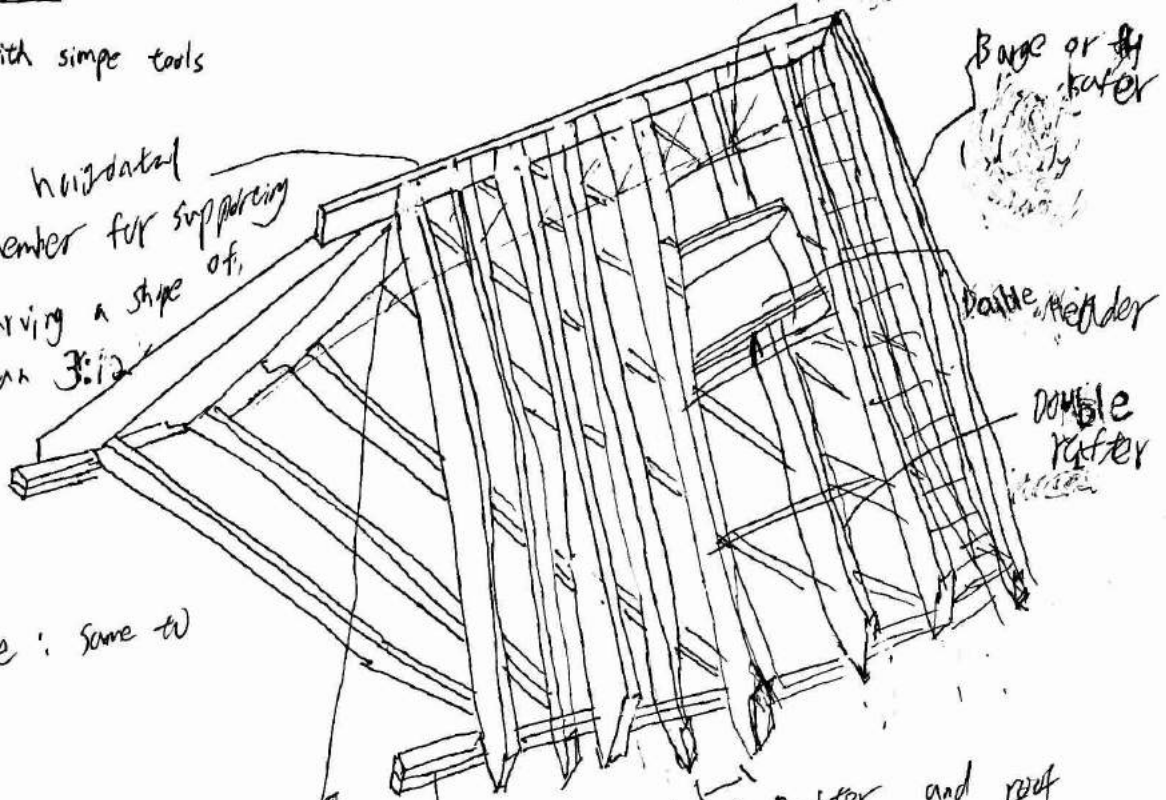


Wood Rafters

- quickly assembled with simple tools

⑥

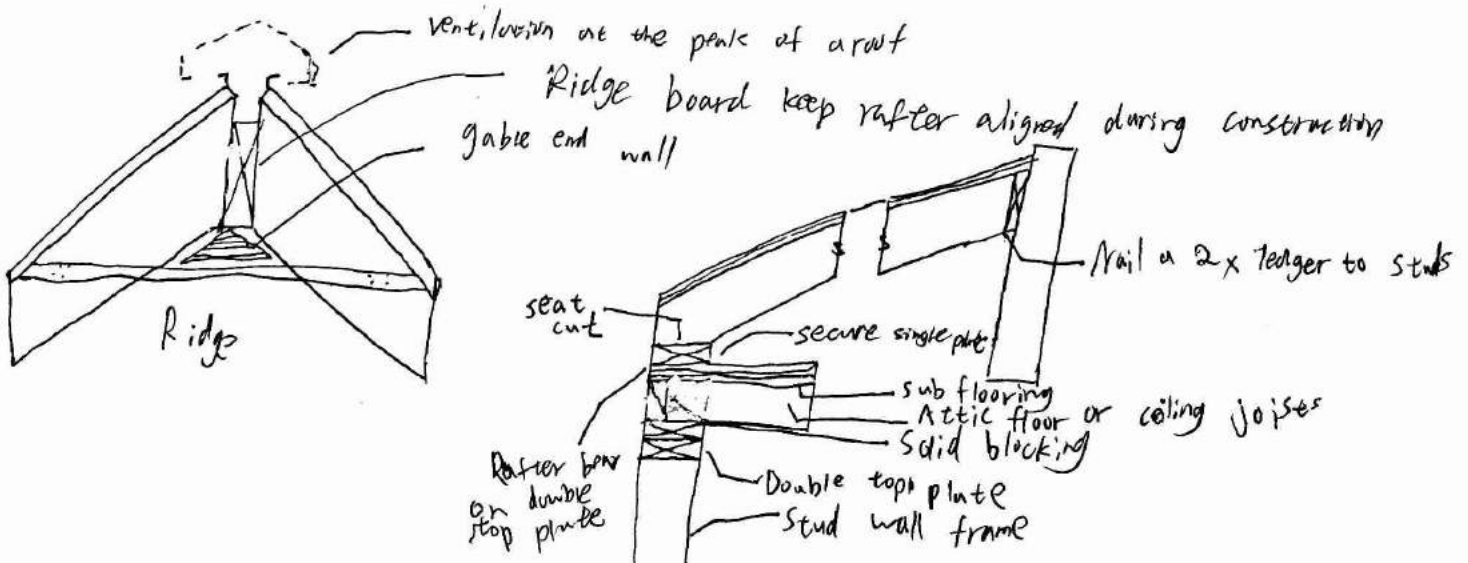
horizontal member for supporting a rafter having a slope of, less than 3:12

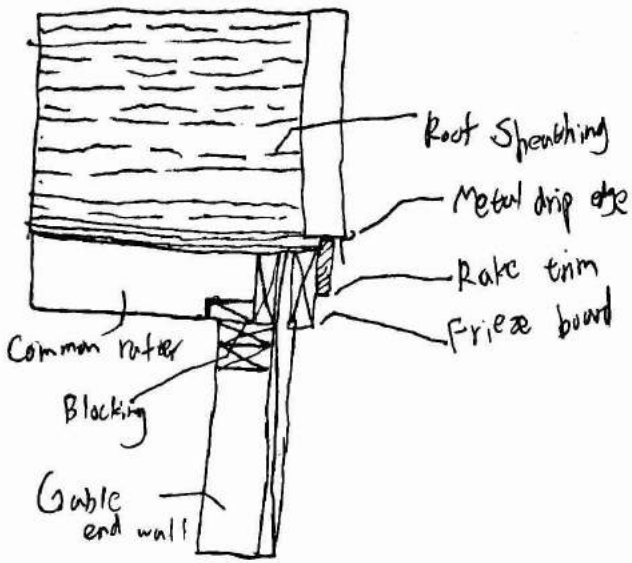


Roof mirage: same to gable wall

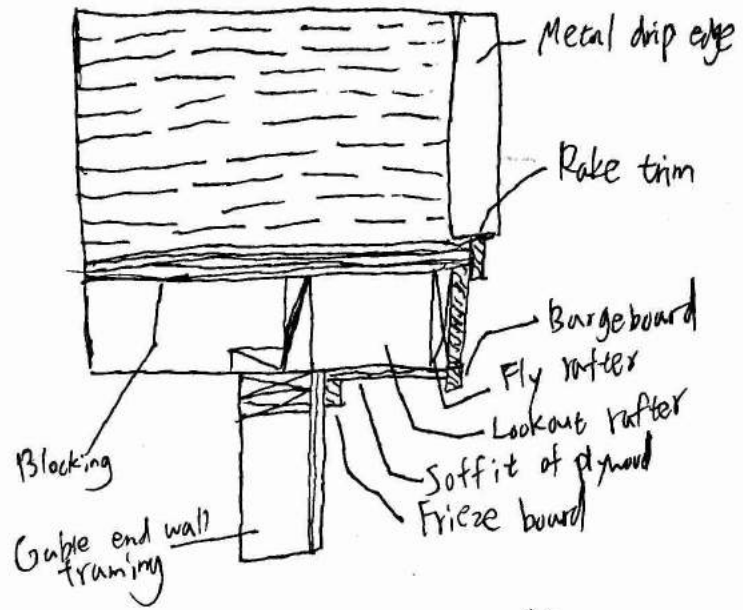
Rafter span 2x6 span up to 10'

Wood Rafter Framing



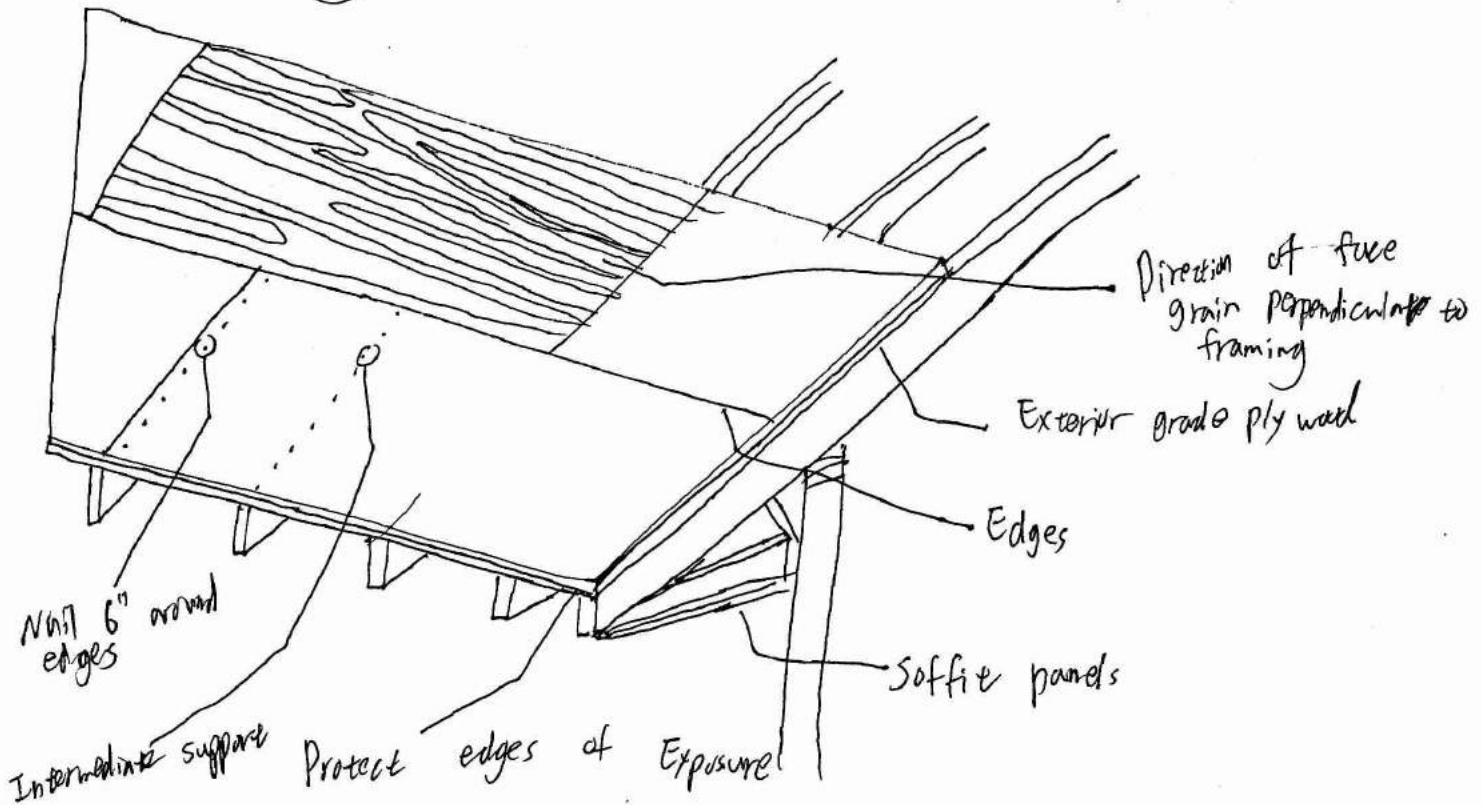


Rake Overhang



(1)

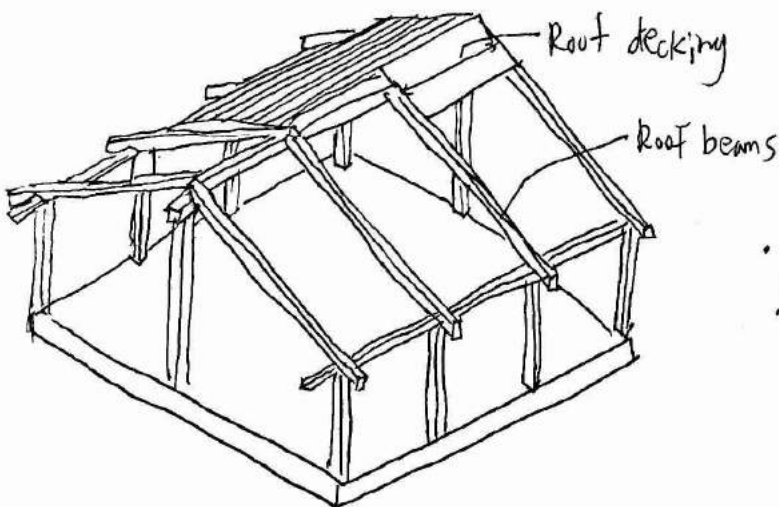
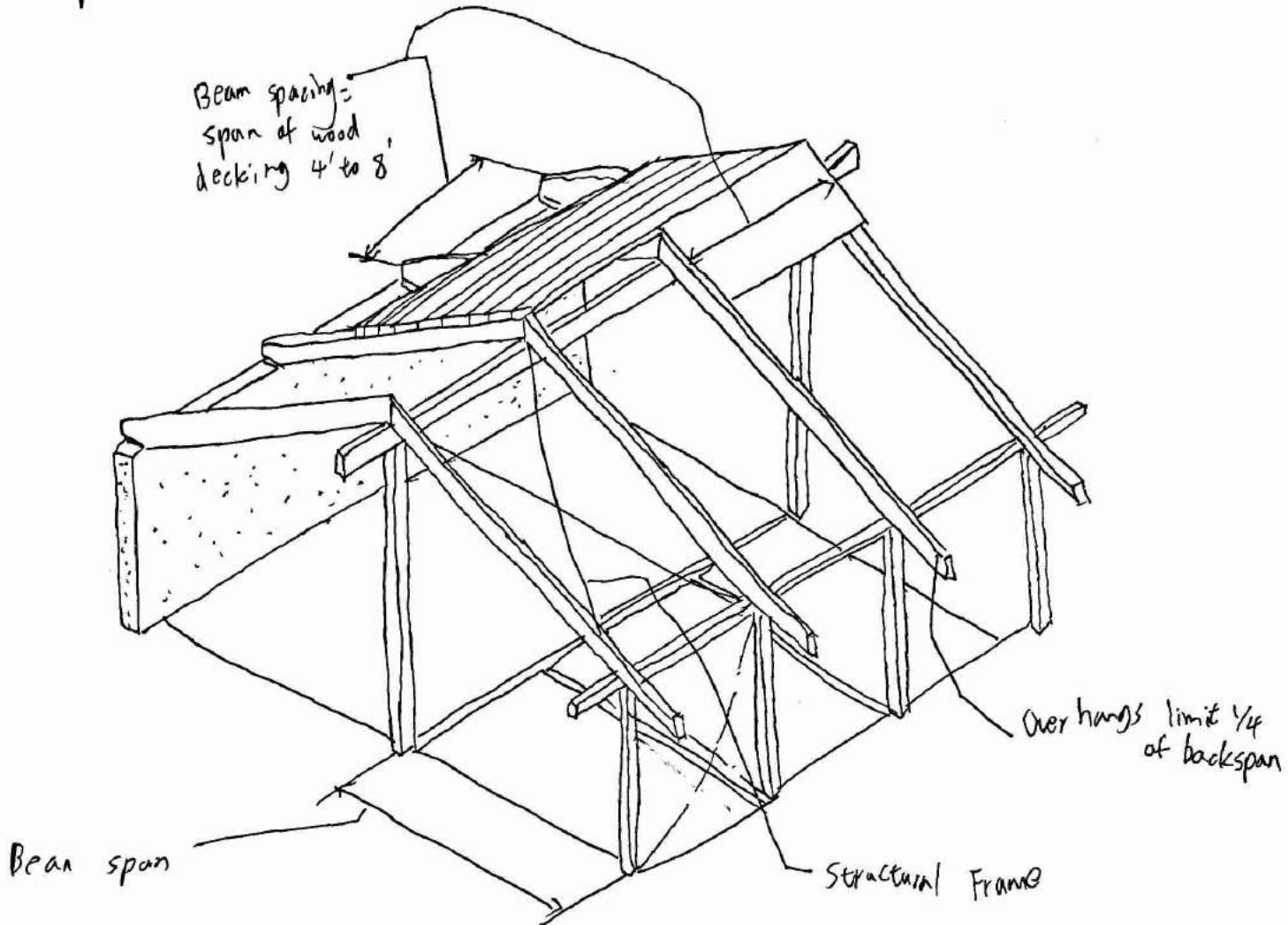
Roof Sheathing



Wood-Plank-And-Beam Framing

- Same supporting grid of posts or columns
- left exposed to interior

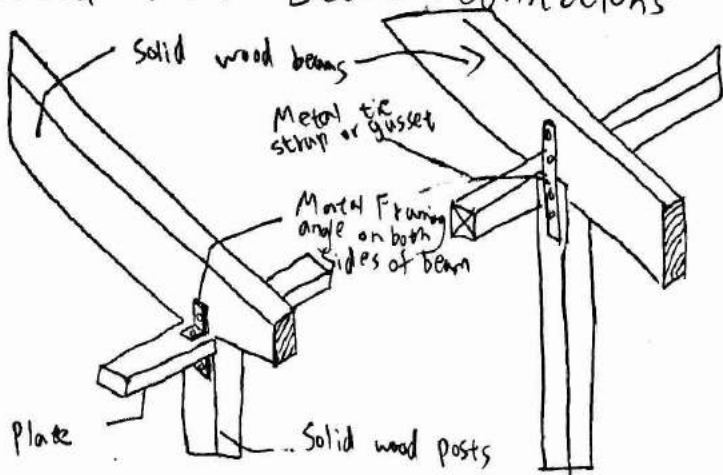
②



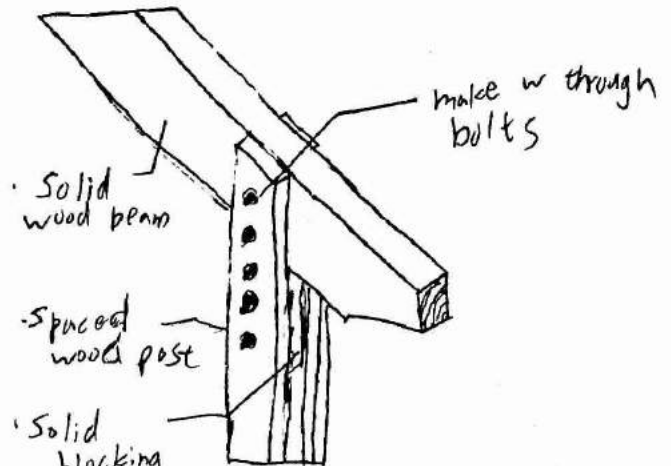
- Roof beams spaced 4' to 8'
- ^{beam} supported by girders, columns, reinforced concrete or masonry bearing wall

Roof parallel with slope

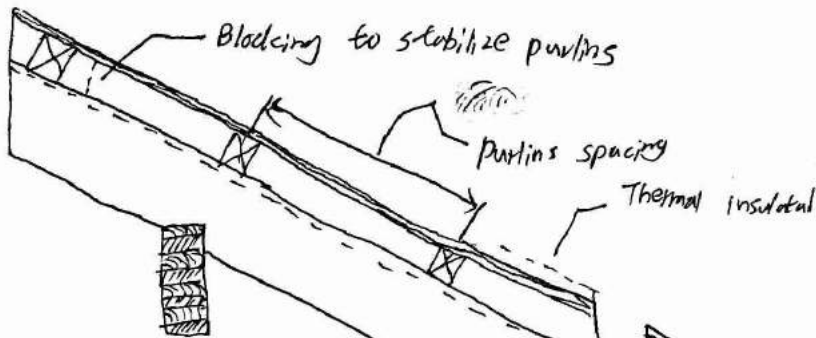
Wood Post-Beam Connections



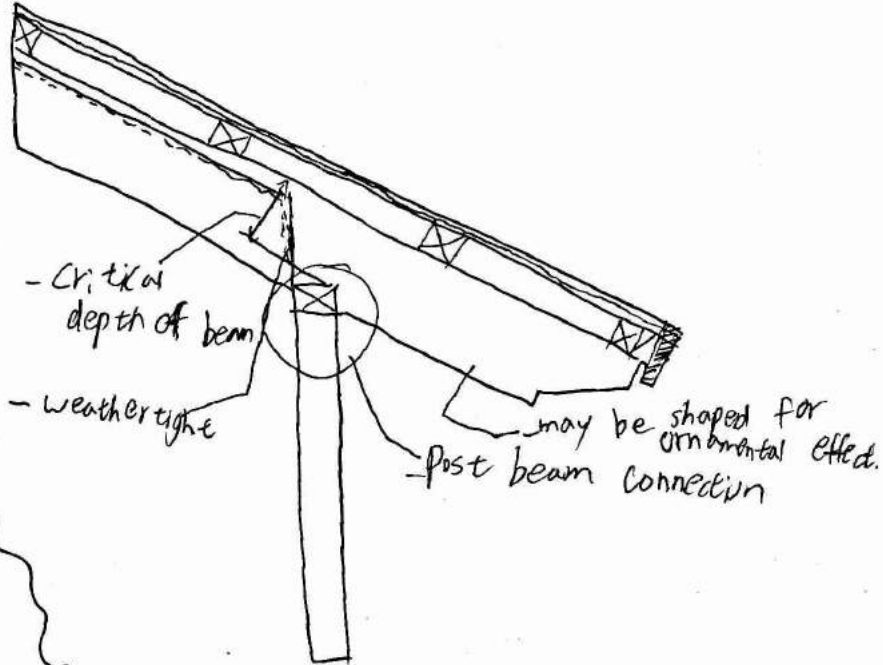
Post Beam Connection



Post Beam Connection

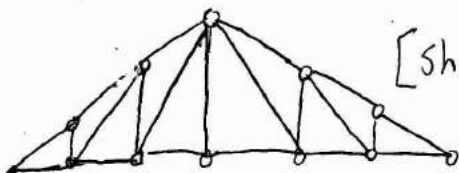


Roof sect @ Interior Support

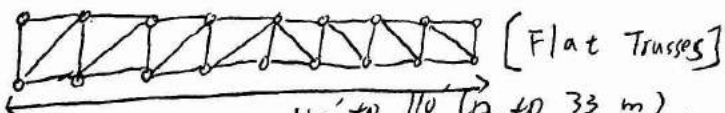


Wood Trusses

- carrying greater loads
- Spaced further apart

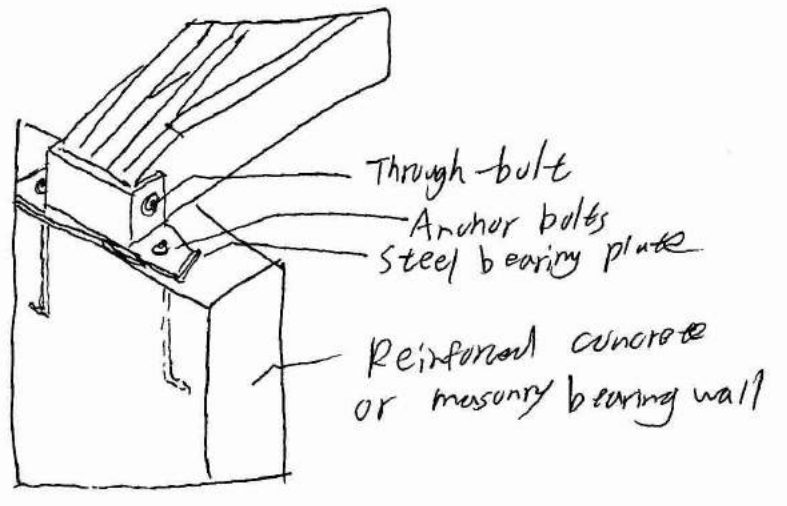
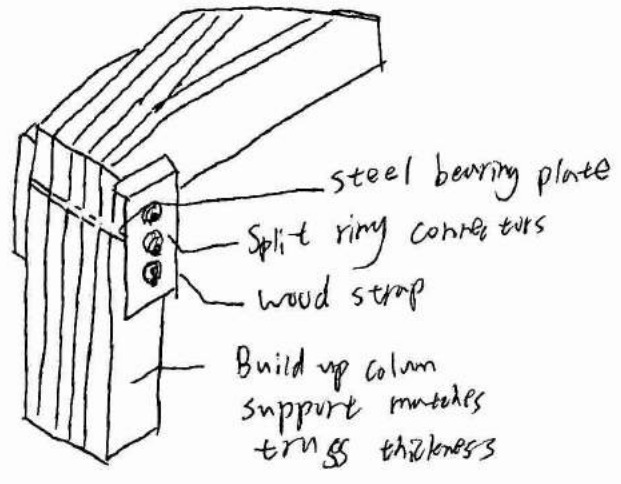
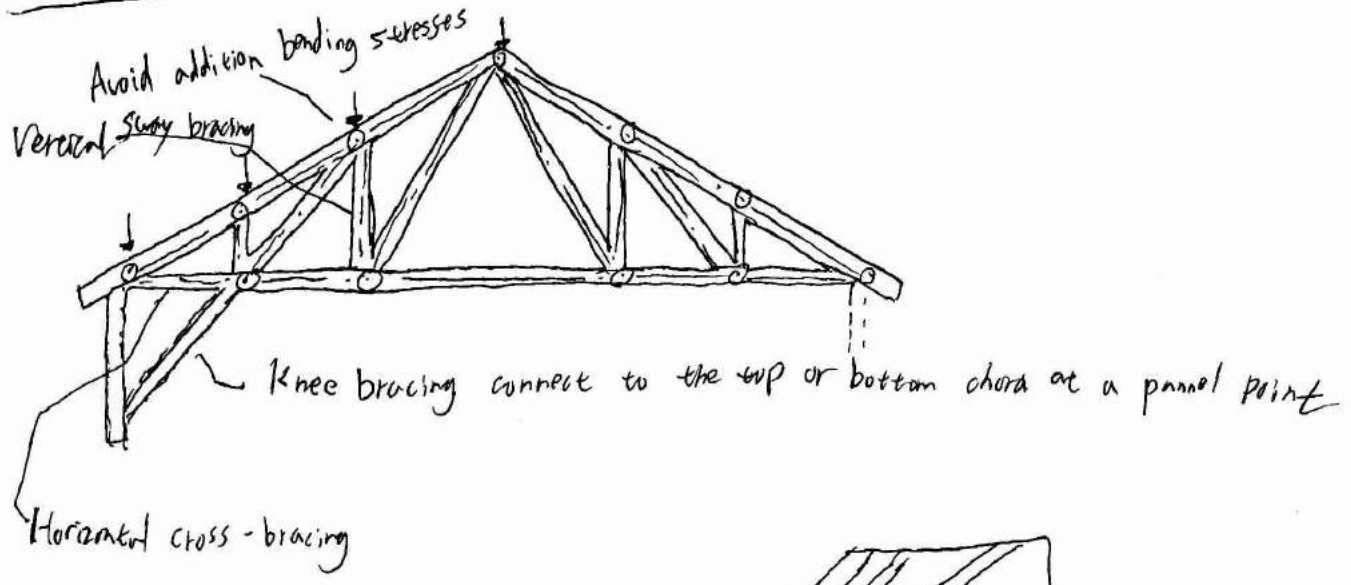


span range for shaped trusses
40' to 150' (12 to 45 m)
depth range span/2 to span/6
for shaped trusses



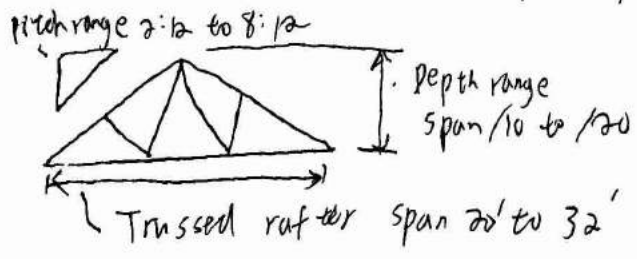
40' to 110' (12 to 33 m)
Depth range for flat trusses span/10 to 1/5

Wood Trusses



Wood Trussed Rafter

- 2x4s; 2x6s top chord
- effective when a rectangular plan requires a quantity of a single truss type



- 2' maximum extension of top chord for overhang
- ceiling applied to bottom chord truss space more than 2'

