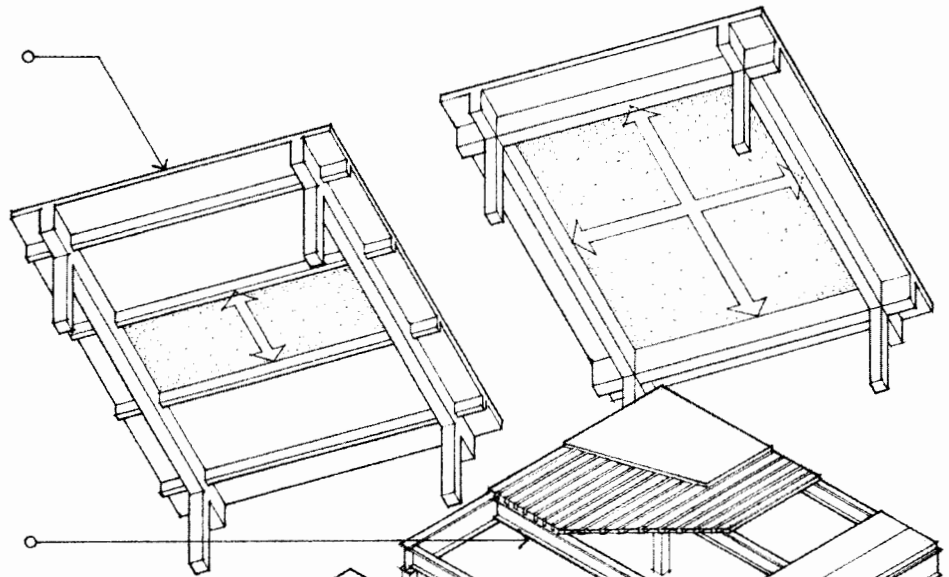


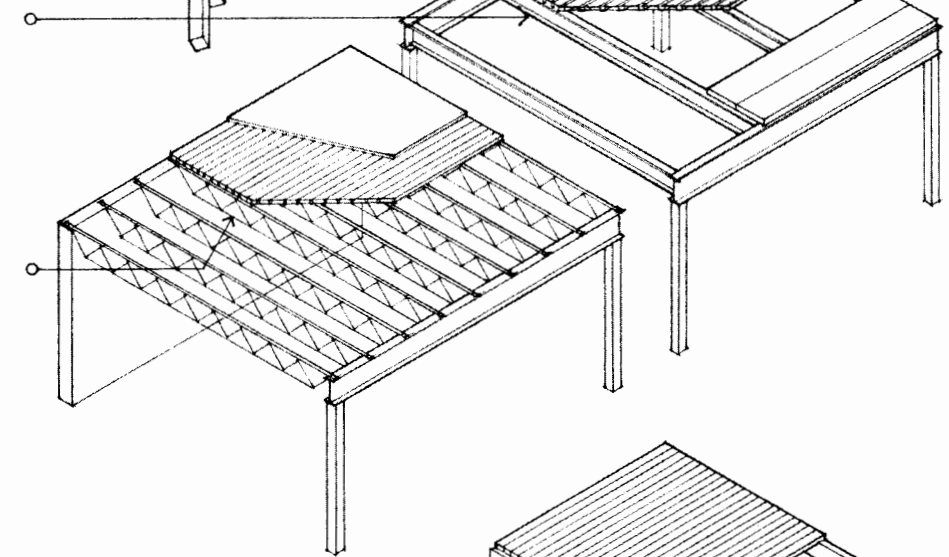
Concrete

- Cast-in-place concrete floor slabs are classified according to their span and cast form; see 4.05–4.07.
- Precast concrete planks may be supported by beams or loadbearing walls.



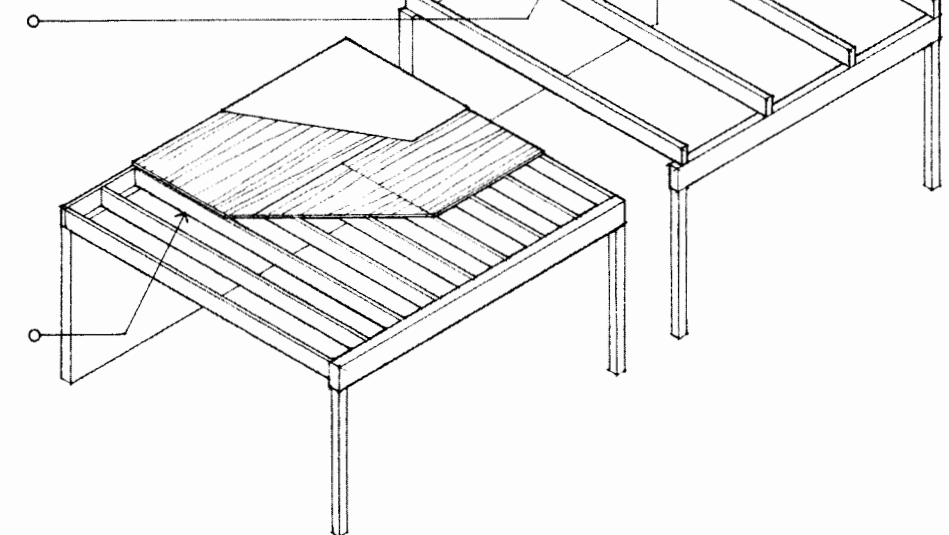
Steel

- Steel beams support steel decking or precast concrete planks.
- Beams may be supported by girders, columns, or loadbearing walls.
- Beam framing is typically an integral part of a steel skeleton frame system.
- Closely spaced light-gauge or open-web joists may be supported by beams or loadbearing walls.
- Steel decking or wood planks have relatively short spans.
- Joists have limited overhang potential.

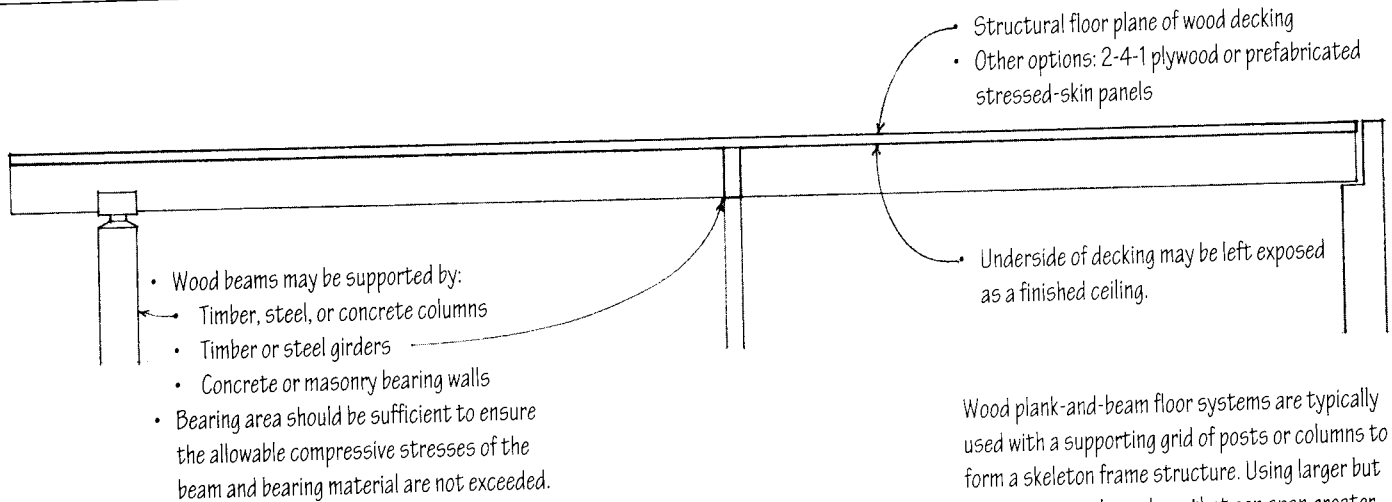


Wood

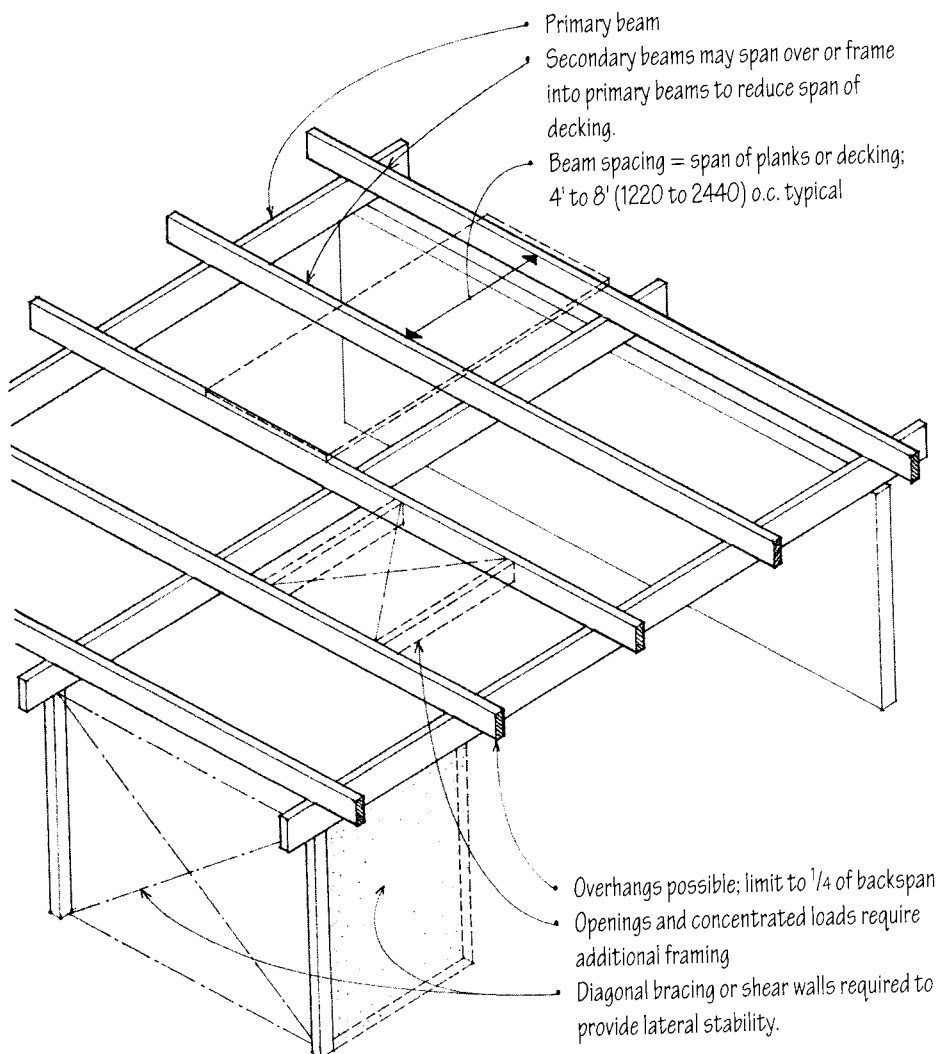
- Wood beams support structural planking or decking.
- Beams may be supported by girders, posts, or loadbearing walls.
- Concentrated loads and floor openings may require additional framing.
- Underside of floor structure may be left exposed; an applied ceiling is optional.
- Relatively small, closely spaced joists may be supported by beams or loadbearing walls.
- Subflooring, underlayment, and applied ceiling finishes have relatively short spans.
- Joist framing is flexible in shape and form.



4.38 WOOD PLANK-AND-BEAM FRAMING



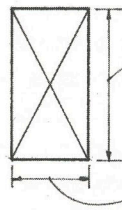
Wood plank-and-beam floor systems are typically used with a supporting grid of posts or columns to form a skeleton frame structure. Using larger but fewer structural members that can span greater distances translates into potential savings in material and labor costs.



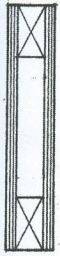
- Plank-and-beam framing is most effective when supporting moderate, evenly distributed loads; concentrated loads may require additional framing.
- When this structural system is left exposed, as is often the case, careful attention must be paid to the species and grade of wood used, the detailing of joints, especially at beam-to-beam and beam-to-post connections, and the quality of workmanship.
- Plank-and-beam framing may qualify as heavy timber construction if the structure is supported by noncombustible, fire-resistive exterior walls and the members and decking meet the minimum size requirements specified in the building code.
- Disadvantages of the plank-and-beam floor system include its susceptibility to impact sound transmission, and its inherent lack of concealed spaces for thermal insulation, piping, wiring, and ductwork.

Solid Sawn Lumber

In the selection of a wood beam the following should be considered: lumber species, structural grade, modulus of elasticity, allowable bending and shear stress values, and the minimum deflection permitted for the intended use. In addition, attention should be paid to the precise loading conditions and the types of connections used. See Bibliography for sources of more detailed span and load tables.

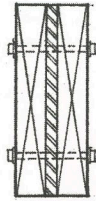


- Rule of thumb for estimating the depth of a wood beam: $\text{span}/15$
- Beam width = $1/3$ to $1/2$ of beam depth
- Limit deflection to $1/360$ th of span



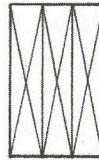
Box Beam

- Made by gluing two or more plywood or OSB webs to sawn or LVL flanges.
- Engineered to span up to 90' (27 m)



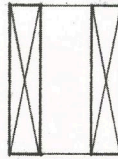
Flitch Beam

- Timbers set on edge and bolted side by side to steel plates or sections
- Engineered design



Built-Up Beam

- Equal in strength to the sum of the strengths of the individual pieces if none of the laminations are spliced
- Two members nailed w/ 10d @ 16" (405) o.c. staggered and two 10d @ each end
- Three or more members nailed w/ 20d @ 32" (815) o.c. staggered and two 20d @ each end

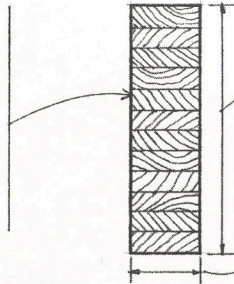


Spaced Beam

- Blocked and securely nailed at frequent intervals to enable individual member to act as an integral unit

Glue-Laminated Timber

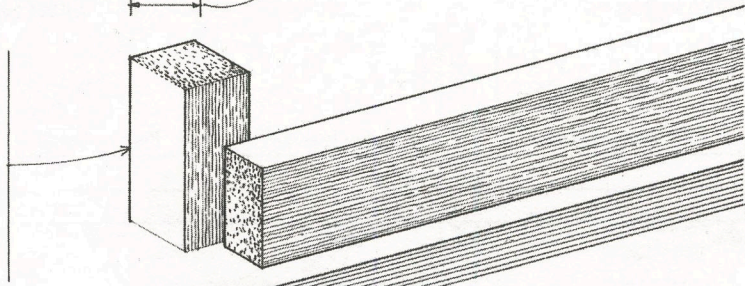
Glue-laminated timber (CSI MasterFormat 06 18 00) is made by laminating stress-grade lumber with adhesive under controlled conditions, usually with the grain of all plies being parallel. The advantages of glued-laminated timber over dimension lumber are generally higher allowable unit stresses, improved appearance, and availability of various sectional shapes. Glue-laminated timbers may be end-joined with scarf or finger joints to any desired length, or edge-glued for greater width or depth.



- Engineered to span up to 80' (24 m)
- Rule of thumb for estimating the depth of a glue-laminated beams: $\text{span}/20$
- Beam width = $1/4$ to $1/3$ of beam depth

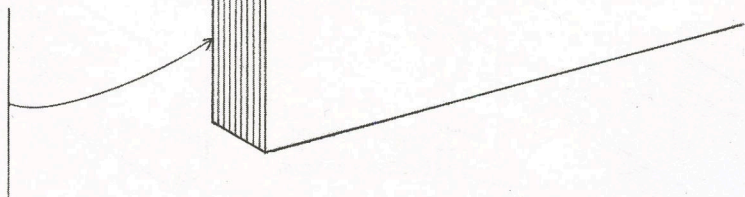
Parallel Strand Lumber

Parallel strand lumber (PSL) is a structural lumber product made by bonding long, narrow wood strands together under heat and pressure using a waterproof adhesive. Parallel strand lumber is a proprietary product marketed under the trademark Parallam, used as beams and columns in post-and-beam construction and for beams, headers, and lintels in light frame construction.



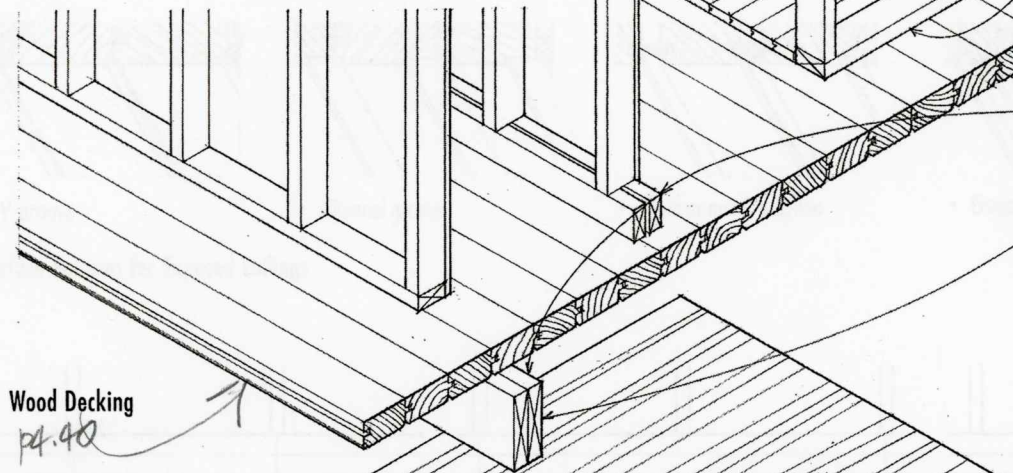
Laminated Veneer Lumber

Laminated veneer lumber (LVL) is a structural lumber product made by bonding layers of wood veneers together under heat and pressure using a waterproof adhesive. Having the grain of all veneers run in the same longitudinal direction results in a product that is strong when edge-loaded as a beam or face-loaded as a plank. Laminated veneer lumber is marketed under various brand names, such as Microlam, and used as headers and beams or as flanges for prefabricated wood I-joists.



In the plank-and-beam framing system, the supporting grid of beams should be carefully integrated with the required placement of interior partitions for both structural and visual reasons. Normally, most partitions in this system are nonloadbearing and may be placed as shown. If bearing partitions are required, however, they should continue down to a foundation wall or be placed directly over beams large enough to carry the imposed load.

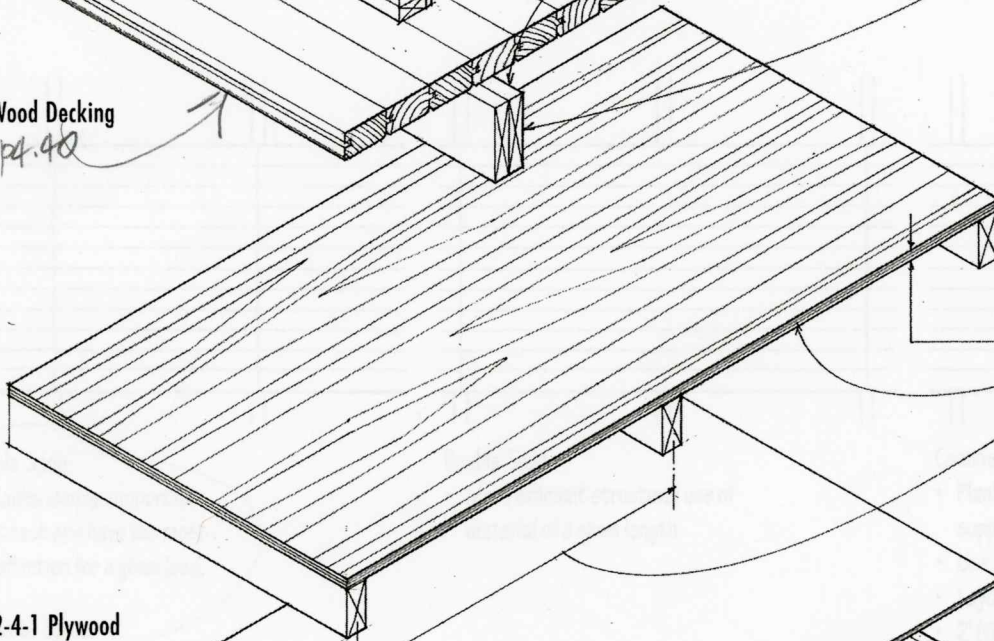
Wood Decking
p4.40



- Wood strip flooring laid at right angles to planking
- Underlayment required for resilient and thinset tile flooring
- Wood studs
- Soleplate
- The load of nonbearing partitions perpendicular to the floor decking is distributed evenly across the planks.

- Partitions parallel with the floor decking may be supported either below or above the planking.
- Beam must be framed into posts or other beams for support.
- Limited overhangs possible

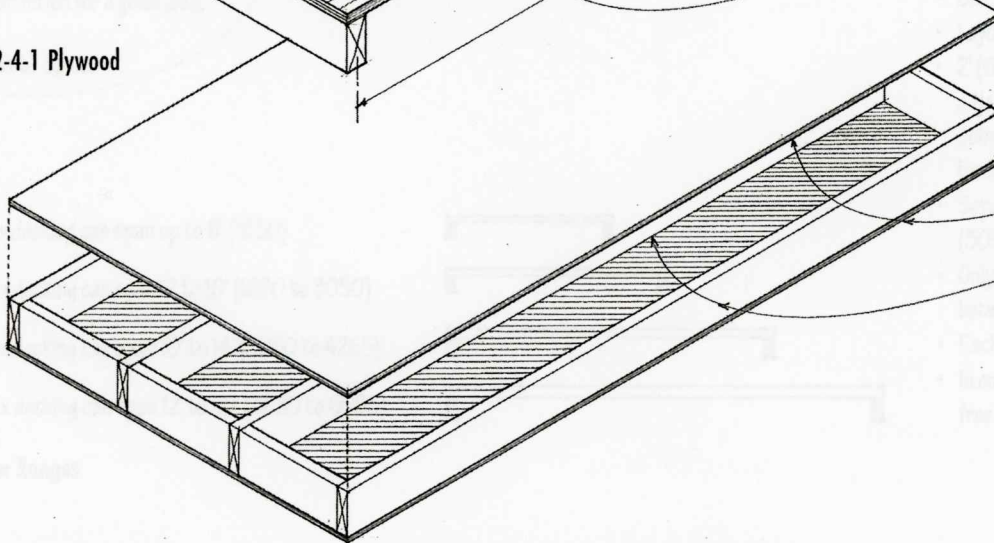
2-4-1 Plywood



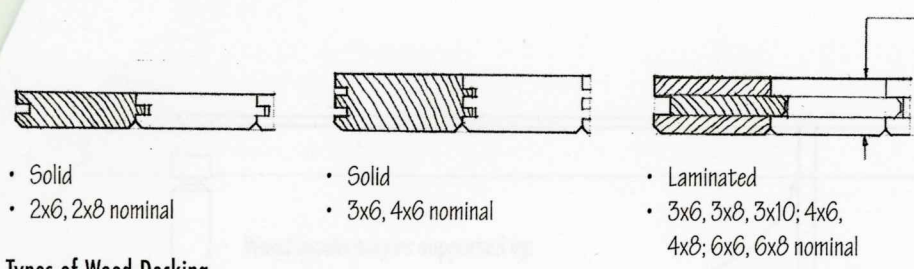
- Combined subfloor-underlayment 1-1/8" (29) thick
- Tongue-and-groove edges
- Can span up to 4' (1220)
- Laid continuously over two spans with face plies perpendicular to beams and end joints staggered
- No overhang possible

Stressed-Skin Panels

CSI MasterFormat 06 12 00 Structural Panels



- Stressed-skin panels consist of plywood facings bonded with adhesives under heat and pressure to lumber stringers and cross bracing. The plywood facings and lumber stringers act as a series of I-beams with the plywood distributing concentrated loads and resisting nearly all of the bending stresses.
- Panels integrate thermal insulation, a vapor retarder, and an interior finish into a single component.
- Limited overhangs possible



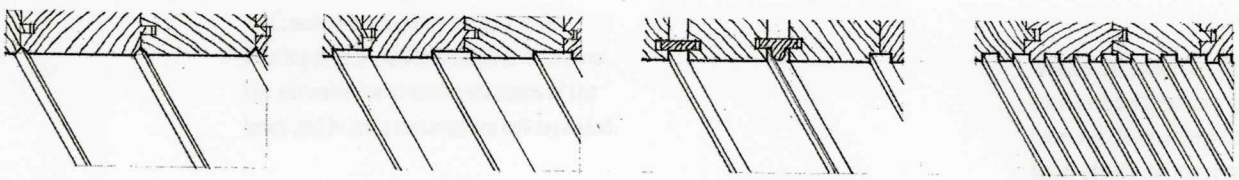
- Solid
- 2x6, 2x8 nominal

- Solid
- 3x6, 4x6 nominal

- Laminated
- 3x6, 3x8, 3x10; 4x6, 4x8; 6x6, 6x8 nominal

- Rule of thumb for estimating depth of decking: span/30
- Limit deflection to 1/240 th of decking span.
- Consult manufacturer for available sizes and allowable spans.

Types of Wood Decking



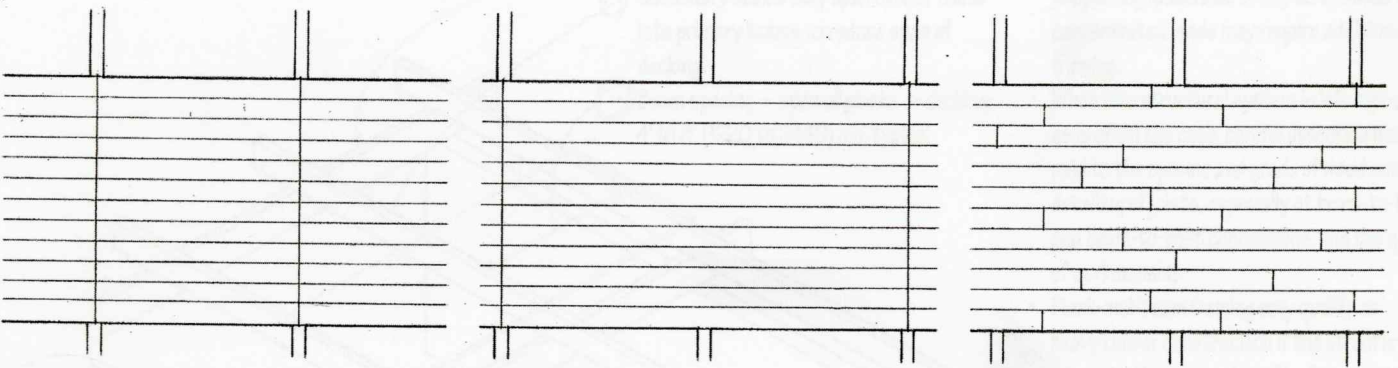
- V-groove

- Channel groove

- Plain or molded spline

- Striated

Surface Patterns for Exposed Ceilings



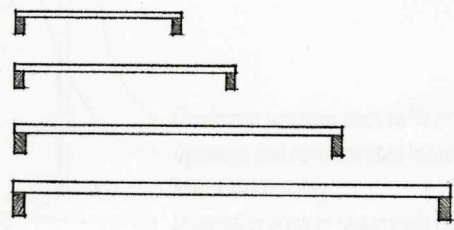
- Simple Span**
- Planks simply supported at each end have the most deflection for a given load.

- Double Span**
- Most efficient structural use of material of a given length

- Continuous Span**
- Planks span continuously over four or more supports.
 - Use of random lengths reduces waste.
 - Layout must be carefully controlled.
 - 2' (610) minimum between end joints in adjacent courses
 - Joints in the same general line must rest on at least one support.
 - Separate joints in nonadjacent rows by 12" (305) or two rows of planks.
 - Only one joint should occur in each course between supports.
 - Each plank must rest on at least one support.
 - In end spans, one-third of the planks should be free of joints.

Types of Spans

- 2x decking can span up to 6' (1830)
- 3x decking can span 6' to 10' (1830 to 3050)
- 4x decking can span 10' to 14' (3050 to 4265)
- 6x decking can span 12' to 20' (3655 to 6095)



Span Ranges