



FACT SHEET

ASSEMBLIES: FLOOR

Description

This section addresses floors over crawl spaces and basements as well as intermediate floors between levels. Floor structure varies widely based on requirements for square footage, building heights, clear spans, loadings, and material availability. Floor structure also contributes to the overall strength and structural integrity of the building system. Noise and vibration transmission through floor systems can affect human comfort and equipment performance. The type of floor system can impact the choice of mechanical distribution systems and other systems integration. For example, there are limitations of solid joists versus open web truss. The overall environmental impacts associated with floor structure components are related to requirements for durability and flexibility within flooring structure design. The following comparative analysis identifies the relative economic, energy, and environmental implications of three floor system options: 2 x 12 solid wood joist construction with OSB decking, wood truss floor system with OSB decking, and wood I-joist floor system with oriented strand board (OSB) decking.

Recommendations

Each floor system option has distinct economic, environmental, and construction advantages and disadvantages. Priorities and trade-offs will need to be considered in order to select the most appropriate system for a given project. Manufactured wood I-joist are recommended considering both cost and environmental impacts. They provide the lowest first cost across a variety of joist depth and floor span, and use a minimum amount of low quality and potentially recycled material.

Floor Alternatives

alternatives	cost/sf-habitable	material/sf-habitable		IAQ	LCT	practice
2x12 joist 16" o.c.	\$7.33	lumber (bf)	0.13	typical	typical	standard
		subfloor (s.f.)	1.00			
truss joist 16" o.c.	\$6.68	lumber (bf)	0.06	typical	good	standard
		subfloor (s.f.)	1.00			
11-1/4" I-joist 16" o.c.	\$5.95	lumber (bf)	0.05	typical	better	standard
		sheathing web (s.f.)	0.86			
		subfloor (s.f.)	1.00			

Criteria Summaries

Cost: The manufactured wood I-joist system has the lowest cost of the floors compared. It is 19% less expensive than solid 2x12 constructions, a difference of \$1.38 per square foot. I-joists are \$0.73 per square foot less expensive than truss joists. The systems compared have similar spanning capabilities; 2 x12 construction on the low end at 17' to 19' depending on wood species; and open web joist on the high end at 21'. If a clear span is desired and cost savings can be gained through the reduction of supporting structure, a truss joist in this or a slightly deeper configuration may be more cost effective.

Energy: In most cases, intermediate floors are not insulated. Where insulation is required, all three systems can be insulated in the cavities between the joists or trusses. Encapsulated cavities provide the greatest flexibility for types and amounts of insulation. Exposed floor systems have greater limitations since the cavity is left open, which may limit the types, thickness, and location of insulation. However, each floor system can be sufficiently insulated to ensure thermal and acoustic performance.

Material: The systems compared have similar spanning capabilities although manufactured products (trusses and I-joists) can be used over greater spans than solid wood joists today. The material used in I-joists and trusses is smaller in dimension and often from a rapidly renewable source. Solid wood construction uses twice the lumber of either manufactured system. This impact can be magnified if the wood is not harvested from certified forests. Manufactured wood products do not rely on high grade lumber and can contain post industrial waste wood, which can further reduce the impact of the system. Material use for the truss joist system could be reduced by extending the spacing to 24 inches and increasing the decking to a full 3/4-inch depth.

Life Cycle Thinking:

- Energy consumption (especially non-renewable, fossil fuel energy): Reduced use of materials or selection of products made from underutilized or waste products are perceived as more environmentally sound choices. However it is essential to take into consideration the entire life cycle of those products, ensuring they do not contribute more negative impacts because of increased energy to produce or ship, or more toxins or pollutants created throughout their extraction/harvesting, manufacturing or disposal phases.
- Pollutants generated in production: Production of OSB generates considerable pollutants that can affect workers in production facilities.
- Potential for out-gassing in the building: If left exposed and unsealed, OSB could be a possible source of volatile organic compounds (VOCs). Some types of OSB can cause decreased indoor air quality due to off-gassing.
- Durability of the product: There are no significant differences in durability between flooring systems.
- Potential for future recycling:

IAQ: Since intermediate floors are typically on the interior and uninsulated, condensation and mold issues are not critical as they are for exterior walls and roofs. Potential health issues associated with moisture and mold in building cavities can still occur within wood floor systems which are insulated or enclosed with plumbing systems.

Practice: All systems considered are common practice