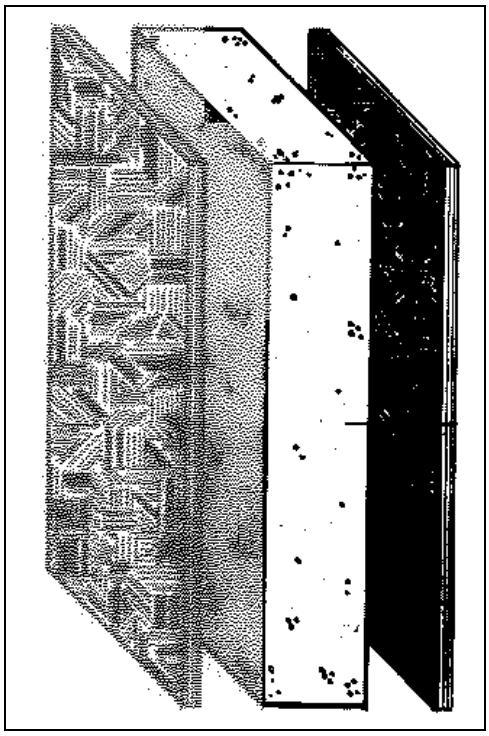
Floor, Wall and Roof Systems

It takes about ten mature trees to frame a conventional house. This provides an excellent opportunity for improvement. Engineered wood products make use of 95% of the tree as compared to 60% for solid lumber construction.

Structural Insulated Panels (SIPs)

- Typically two "skins" of structural wood sheathing with a foam core



Structural Insulated Panel [1]

- Provides energy efficiency, material efficiency, and construction efficiency
- Skins provide tensile and compressive strength while the foam core provides the rigidity
- Skins are most commonly oriented strand board (OSB), waferboard, plywood, sheet metal, cementitious fiberboard, and gypsum board
- Typical foam cores are expanded polystyrene (EPS), extruded polystyrene (XPS), polyurethane, and polyisocyanurates
- Panels have high insulation and low infiltration values
- Wall panels can provide R14 to R24 and roof panels can provide R41 or more [2]
- Fasteners for railings, brackets, etc. may be placed anywhere along the panel, not just at stud locations
- Virtually impervious to shrinking and warping
- Fewer cavities in the insulation to allow for air convection
- Provides superior noise reduction
- Urethane foam and XPS are subject to "thermal drift", decreasing the R value until the drifting stops whereas EPS does not experience thermal drift
- Unlike Fiberglass, the insulation is resistant to moisture absorption, eliminating the need for a vapour barrier (although most building codes would still require one)
- Extremely tight against air infiltration
- OSB can be made from new growth wood, such as aspen and jack pine, which can be regenerated in five to ten years
- Uses only 25% of the wood used in conventional wood frame construction
- EPS is manufactured without the use of CFCs or HCFCs
- XPS is made with HCFC-142b, which is 90% less destructive to the ozone layer as its predecessor CFC-12
- Panels come with prerouted electrical wiring chases

List of manufacturers:

Fast and Epp Partners Consulting Structural Engineers
fastepp@uniserve.com
http://users.uniserve.com/~fastepp/welcome.htm

Residential Steel Framing: Light-Gauge Steel

- Steel studs are channel components, roll-formed from corrosion resistant zinc-coated steel
- Load bearing steel studs can be 14, 16, 18, or 20 gauge
- Non-load bearing steel studs are available in 20, 22, and 25 gauge steel
- Provides greater flexibility in design due to increased strength

- Will not warp, crack, swell, shrink, split, or bow
- Zinc coating provides a galvanized coating that inhibits rust
- Potential for rotting and intrusion by termites and vermin is eliminated
- Greater fire protection than conventional wood framing
- 100% recyclable
- Inert and stable: will not compromise indoor air quality
- Note: conducts close to ten times more heat than wood

Precast Concrete Panels

- Autoclaved aerated concrete units are lightweight, structural, and uniform
- Millions of microscopic air bubbles create a cellular structure that provides the lightweight characteristics as well as the thermal and acoustical properties
- Load bearing walls include steel reinforcement

EPS and Tubular Steel

- Exterior walls can be made with expanded polystyrene foam and tubular steel

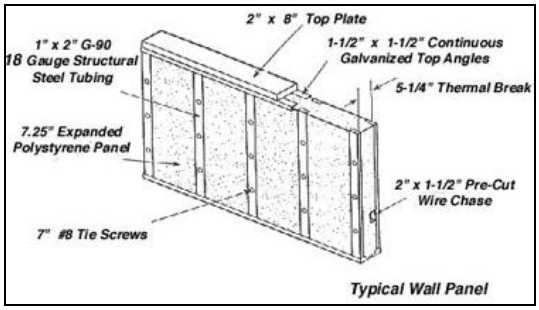


Illustration of EPS and Tubular Steel Panel [3]

- This system provides increased insulation compared to conventional wood framing
- The galvanized steel tubes provide three times the strength of wood frame construction
- The steel tubes can easily be recycled if the building is ever demolished
- The system is impervious to rust, rot, and insects
- Eliminates on-site waste since the panels are constructed in the factory
- Window and door openings are factory built, improving the accuracy and thermal integrity
- Reduces on-site labour costs due to ease and quickness of construction
- Building shell provides most of the structural support for the building, allowing for greater freedom in placing interior walls
- No vapour barrier is required (although vapour resistant paint is recommended for areas of high humidity)

Wood I Joists

- Upper and lower flanges are made from solid high-quality 2x4s
- The 2x4s are smaller pieces than conventionally used, saving trees and allowing for lumber to be cut from younger, second generation trees
- Web is made from oriented strand board (OSB) or plywood
- Can be used for floor joists or roof rafters
- Can span greater distances than conventional joists or rafters
- The joists are placed 24” apart instead of the usual 16”
- Floor is less prone to squeaking and bouncing
- Ductwork, wiring, and piping may penetrate the web, although depending on the hole size, the location of the cut may be restricted
- Weigh less than solid lumber joists
- Require more delicate handling than solid lumber
- Glues may off gas, a concern for indoor air quality
- May require web stiffeners if the applied load is large or the span is long

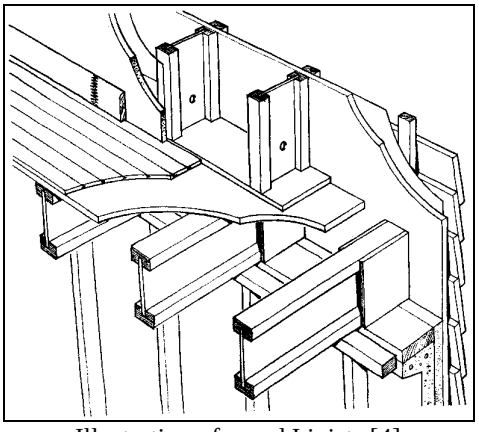


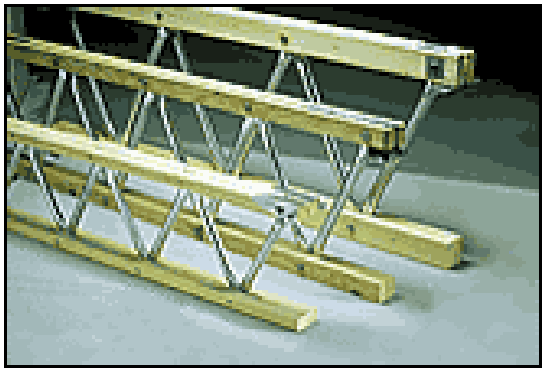
Illustration of wood I joists [4]

Manufactures/Suppliers

Trus Joist MacMillan
http://www.tjm.com/

Open Web Trusses

- Most common design consists of 2x4 chords and webs with steel plate connectors
- Often lifted into place by cranes, but can easily be lifted into place without mechanical assistance
- Tubular steel forms the web



Picture of Open Web Trusses [5]

- The open web design allows for easy installation of ducts, wiring, plumbing, etc.
- Most common design for residential construction is 1.5" by 3.5" chords connected by 1" diameter tubular steel
- Can cover a range of spans
- The steel web can easily be recycled in the future

Laminated Beams

- Highest strength lumber is placed at the top and bottom to ensure efficient use of lumber. The top and bottom will experience the greatest compressive and tensile stresses.
- Will not distort

References

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2. Bynum, Richard T. Jr. and Daniel L Rubino. Handbook of Alternative Building Materials in Residential Construction. McGraw-Hill, Toronto, ON, 1999. pg. 4-6.
3. Creative Energy Technologies website: http://www.cetsolar.com/ecospec.htm
4. Grady, Wayne. Green Home: Planning and Building the Environmentally Advanced House. Camden House, Camden East, ON, 1993. pg.102
5. Trus Joist MacMillan website: http://www.tjm.com/products/aboutcust/custow/custow.html