

# Materials for a Sustainable Building Industry

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## ABSTRACT

*This presentation discusses the need for the home building industry to adopt resource-efficient building materials and designs. Manufacturing conventional materials requires resources that are becoming more economically scarce and ecologically damaging to extract, while current building designs encourage wasteful building construction. The Center for Resourceful Building Technology is currently building its first demonstration project, which combines resource-efficient designs and materials in a 2,400-square-foot house. The center will publicize the project as part of its ongoing educational effort.*

## INTRODUCTION

The home building industry is facing a decline in the availability and quality of dimensional wood and other wood-based products. At the same time, society is attempting to deal with increasing amounts of waste resources, markets for which fluctuate greatly depending on demand. Combined with ever-increasing disposal costs for construction debris and municipal industrial wastes, these conditions are stimulating the development of secondary issues for waste resources, as well as a more efficient use of primary resources.

In the United States, of 438 million hectares of original forest cover, 65 million (15%) remain. In total, including secondary growth, 296 million hectares of forest remain (Ryan 1991). Lumber use is not diminishing—currently the world uses approximately 1.7 billion cubic meters of lumber per year, and the United States uses 417 million cubic meters per year, 25% of the world's total (Ryan 1991). According to U.S. Forest Service economists, lumber use will increase nationwide; according to one study, the nation's use will exceed 21 billion board feet in 1990.

## MATERIALS

The following partial list includes brief discussions of some of the home building industry's conventional materials.

**Dimensional Wood** Builders use on the average 11,000 board feet per house of dimensional wood, with the wood coming traditionally from the heartwood of large-

diameter, mature trees. Aside from the environmental effects of harvesting old growth, the large old monarchs are now less than 3% of the existing timberbase; the smaller growth trees today have proportionally more sapwood, which is subject to knots, defects, and severe crowing. The two main uses of dimensional lumber are framing and floor joists. "Framing accounts for about 70% of lumber uses in single-family houses" (Marcin 1987), including two-by-fours and two-by-sixes used for plates, corners, headers, and partitions. Builders use dimensional wood floor joists (two-by-tens, two-by-twelves) for virtually all basement and crawlspace floor assemblies (i.e., nonslab).

**Plywood Sheathing** Builders use this material for floors and roofs. "In 1982, plywood was used for subflooring in 94 percent of nonslab foundation houses..." (Marcin 1987). Plywood is made of veneers from large-diameter trees.

**Wood Trim** Many builders use clear wood trim for doors and windows because it is stable, low in moisture, and easy to mill and tool. To make wood trim, manufacturers use the heartwood from mature trees, especially white and yellow pine, hemlock, and hardwoods such as oak.

**Wood Siding** Builders use wood siding for 30% of exteriors because it looks good and is relatively inexpensive. Wood siding requires stable, dry heartwood from mature trees if it is to be durable, and old-growth timber is a commodity no longer in large supply.

**Cedar Shakes and Shingles** Home builders are still using cedar shakes and shingles because of their durability and rustic appearance. The mature cedar trees from which shakes and shingles are cut are rapidly diminishing, and the Forest Service no longer manages cedar for sustained yield because it is a climax species and because of its slow growth and rotation (Marita 1990).

**Exposed Beams** Some homebuyers like the look of exposed beams, but, unfortunately, these beams come from large, mature trees that are dimensionally more stable than sapwood.

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**Solid Fir Doors** These interior fir doors, which many homebuilders use, are popular for their durability and pleasant look but also require mature trees that have had time to develop clear vertical grain in their heartwood.

## DESIGNS

Currently used designs encourage using resources at rates faster than we, as a society, can afford or that the environment can sustain. The following conventional design features overuse wood: Timber frame houses require clear timber cut from mature trees. In standard frame housing, overusing interior walls to create rooms wastes materials and requires relatively more nonsolar lighting as well as windows for improved daylighting. Single-dwelling houses require more materials—especially exterior products and insulation—than multi-family or cluster development, which, because they are clustered, can be less expensive to heat and cool. Many conventional designs have sitings that neglect sun and wind conditions and thus ignore the potential for passive solar heating and natural cooling conditions.

## ALTERNATIVE BUILDING DESIGN AND MATERIALS

The Center for Resourceful Building Technology (CRBT), based in Missoula, Montana, is committed to finding specific ways to decrease the ecological effects of residential building construction and maintenance. Specifically, CRBT is interested in improving the use and manufacture of building materials by encouraging builders to use resource-efficient designs and sustainable building materials. CRBT has three general tasks: researching alternative building materials and design, demonstrating these materials and designs, and circulating the information the center derives from this work. ReCRAFT 90, CRBT's first demonstration project, combines all these tasks and is currently the center's main focus. In addition, CRBT has published a guide to resource-efficient materials, with brief descriptions and information useful to builders and architects. The guide also includes a directory to manufacturers, with references to the resource base from which their products are made.

## REFERENCES

- Marcin, T.C. 1987. The outlook for the use of wood products in new housing in the 21st century. *Forest Products Journal* 37:78, 55-61.
- Ryan, J.C., and S Postel. 1991. Reforming forestry. In Lester Brown (ed.), *State of the world*, 1st ed. New York: W.W. Norton and Co., 74-92.