RECLAIMED MATERIALS IN ECOMOD3

Elizabeth Kahley  |  27 November 2006  |  ARCH 530

The decision to use a particular material or product in a construction project has far-reaching implications. The initial and long-term cost, durability, technical performance, aesthetics, and environmental and social impact of the product must all be evaluated against the goals of the project to ensure a successful outcome. In the case of the eco-MOD project, there is a clear priority given to selecting environmentally-responsible products that meet the requirements of affordability and occupant health and safety. The following presents a case for using reclaimed building materials as part of the environmental mission of the ecoMOD project.

Benefits of building material reuse

Reusing salvaged building materials has two primary environmental benefits: reducing the extraction of virgin materials and the energy required to process those materials, and reducing the amount of solid waste sent to landfill by diverting it from the waste stream. Figures 1 and 2 show the traditional linear life cycle of materials versus an ideal closed-loop system.

There are three ways in which materials or products can be diverted from landfill (Addis 2006):

[1] Reuse in situ. In this highest form of reuse, a component or entire building that might otherwise be demolished is reused in its existing location. This process may involve the cleaning, repair, and refurbishment of existing components or structure in order to restore it to a functional condition. Examples include structurally reinforcing an unstable foundation or wall assembly, or refinishing a wood floor.

[2] Reuse of salvaged or reconditioned products and materials. In this case, a material or product is reclaimed from a different location than its location of intended reuse. After refurbishment or reconditioning, the component is used as much as possible in its existing form and function. Examples include constructing a new building using timbers salvaged from a deconstructed barn, or using slate tiles from a demolished house for a new roof.

[3] Use of recycled content materials. This is a level of reuse a step lower than the use of salvaged components. Waste materials are reprocessed into new products, usually different than the products in which the materials were used in their previous life. Examples include concrete containing recycled aggregate, engineered wood products such as OSB, or flooring products made from recycled car tires.

While the ecoMOD3 project will certainly utilize all three of these approaches, the focus of my efforts is to advocate the second: reuse of salvaged or reconditioned products and materials. To be certain, using recycled-content products is nearly always favorable to products made from virgin sources; however, there is a great deal of energy required for the processing of these materials into new products. With this in mind, shifting the focus from recycled components to reclamation and reuse can further minimize the environmental impact of the construction process.
In addition to the environmental benefits of reusing materials, there are myriad benefits in terms of quality, cost, and community development:

**Higher quality products.** In some cases, reclaimed products are of higher quality than new products. For example, salvaged wood flooring is often from first-generation growth, large-diameter trunks, resulting in longer, mostly knot-free boards that are stable from warping and bending (Corson 2000).

**Lower cost products.** Some salvaged materials may be less expensive than purchasing new products, although this will vary depending on the architectural value of the product.

**Avoidance of disposal tipping fees.** From the perspective of the building to be demolished or disassembled, there is the benefit of reduced cost for disposal of demolition waste if a large portion of the material is salvaged for reuse or recycling. Disposal tipping fees can range between $25 and $100 per ton of debris (Deconstruction Institute 2006).

**The “local” factor.** When products are reclaimed and reused within relatively close proximity, both resources and labor are kept within the community.

**LEED and EarthCraft credit.** Using reclaimed and recycled products will earn a project credit towards both LEED for Homes and EarthCraft certification, both stated goals of the ecoMOD3 project.

### The “reuse” design process

Reusing building materials in a construction project can significantly alter the design process. In the case of recycled-content building products, there is relatively little difference in the design and procurement of materials compared to the conventional design process. In contrast, incorporating reclaimed materials into a project can require an entirely different design model (Addis 2006). Figures 3 and 4 show the traditional design process compared to the design process that incorporates reclaimed materials. In the conventional design process, teams design up to the Detail Design phase, then procure suitable new products and materials before beginning construction. In the reuse model, it may be necessary to source products much earlier in the design process, before the Detail Design phase is reached. This is due largely to the fact that reclaimed materials vary significantly in availability (i.e. quantity, proximity, timing). There is also the consideration of storage of materials after they have been reclaimed and before they are refurbished and used in the new construction.

Because this approach to design may be unfamiliar and challenging to the design team, client, and contractor, it is essential that all parties involved are committed to the use of reclaimed materials if the project is to be a success. The design team must be flexible enough to start...
thinking early in the process about incorporation of reclaimed materials so that the appropriate products may be identified and procured. The client must understand the benefits and drawbacks of using reclaimed products so that he is in full support of the initiative. Finally, the contractor would ideally be experienced in either deconstruction or the use of salvaged materials in new construction projects, so that salvageable materials are not damaged during their removal, sufficient time for deconstruction labor is accounted for in the time line, and salvaged materials are appropriately and safely reused in the new building.

Sources for reclaimed materials

Due to a growing awareness within the design and construction industries about the importance of material reuse, there are many sources for reclaimed building materials. The primary sources include existing buildings slated for renovation, deconstruction or demolition, salvaged building material retailers, and manufacturers offering reconditioned products (Addis 2006). The Material Reuse Source Guide in Appendix A of this report outlines the specific sources available to the ecoMOD3 project, including inventory and contact information.

Why this is important for ecoMOD3

There are many characteristics of the ecoMOD3 project that make the use of reclaimed materials an especially meaningful endeavor. The first and most obvious is the environmental benefit – by reducing both the extraction of virgin materials and the waste sent to landfill, we would be clearly reinforcing ecoMOD’s environmental agenda. The second – and just as significant – element of this project is the historic preservation agenda. The ecoMOD3 project has been named “The SEAM House” by the design team to express the philosophy of joining together the old and the new. The preservation of the historic house represents the highest level of building reuse; incorporating reclaimed materials into the renovation and new construction would be the logical extension in elucidating the relationship between the historic and the contemporary. Finally, the affordability agenda of the ecoMOD project is served by the potential creative reuse of inexpensive or free available materials.

Given the above reasoning, I propose that the ecoMOD3 team strives to meet the following goals:

[1] Use as many reclaimed and recycled materials as practical in ecoMOD3, while meeting the goals of affordability and modularity

[2] Earn material reuse, recycled material, and waste management credits from EarthCraft and LEED if certification is pursued:

EarthCraft:
- Recycled and Natural Content Materials
  - Reclaimed wood flooring
- Waste Management Practices
  - Donation of excess materials or re-use

LEED for Homes:
- Waste Management
  - Max 2.5 lb/sf of construction waste sent to landfill
  - (0.5 points for each additional 0.5 lb/sf reduction)
- Products
  - Select environmentally preferable products
- Innovative Design
  - Use of reclaimed materials (must provide description)

Specific issues with ecoMOD3 and reclaimed materials

Just as there are unique opportunities for material reuse in the ecoMOD3 project, there are unique challenges and constraints as a result of the multiple agendas of ecology, affordability and modularity:

Resolving the concept of mass production with the unique nature of reclaimed materials. This issue presents one of the largest challenges with respect to the incorporation of reclaimed materials. Mass production by nature requires consistency and regularity of design and material sources, whereas reclaimed materials are inherently varied in quality, appearance, and dimension, and inconsistent in availability.
Evaluating the sustainability of reclaimed materials. While we would like to assume that any reclaimed material is a more environmentally responsible choice than any new or recycled-content product, this may not be the case. A reclaimed product may have been produced using virgin materials and may have very high embodied energy, yet many argue that we should not take this into account once a product has been reclaimed. In essence, the material’s embodied energy has been “used” during its first lifetime, and should not be accounted for in its second. However, reprocessing and transportation are still relevant components of the embodied energy of the reclaimed product. We must carefully evaluate how far a reclaimed material must be transported when comparing it to an alternative product that may be available locally.

Evaluating the affordability and longevity of reclaimed materials. In some cases, reclaimed materials may be more expensive than a comparable conventional product, which may make their inclusion in the project cost-prohibitive. A potentially more significant consideration is the quality and longevity of the product. In the context of an affordable housing project, and one that must have minimal maintenance for an aging demographic, the durability of products is of utmost concern. Many reclaimed materials come with no warranty or guarantee of their structural integrity.

Labor intensity. The process of identifying, deconstructing, storing and refurbishing reclaimed materials is extremely labor-intensive. The context of the ecoMOD project may prove to be beneficial for this issue, as we have a large team of students willing to learn this process and work for no compensation. On the downside, a group inexperienced in the practices of material reuse may slow the process even more, making it impractical within the time frame of the project.

The environmental case for reclaimed materials: An analysis of reclaimed wood flooring for ecoMOD3

As mentioned above, it is good practice to do an environmental evaluation of the reuse of a building material as part of the design and material specification process. While it is often the case, one cannot universally assume that a reclaimed material is a more sustainable choice than a product from a virgin source. Because reclaimed materials frequently need to be reprocessed and transported before they can be reused, the energy required for those stages in the product’s lifecycle must be taken into account. Following is an example of this type of analysis that considers embodied energy and carbon emissions for reclaimed wood flooring as compared to virgin source wood flooring.

The Consortium for Research on Renewable Industrial Materials was organized to research and report on the impacts of producing and using renewable materials (CORRIM 2006). Among its reports is an in-depth lifecycle analysis of residential wood building materials, including a detailed breakdown of embodied energy and emissions at different stages in each product’s lifecycle. This “cradle-to-gate” analysis considers four lifecycle stages: regeneration and harvesting, product manufacturing, resin manufacturing, and transportation of the raw materials and resin to the manufacturing site (Puettmann 2005). Note that transportation from the manufacturer to the construction site is not included in this calculation.
For the Southeast region, including Virginia, the total embodied energy within these four lifecycle stages for kiln-dried lumber is 3,492 MJ/m$^3$ (Puettmann 2005). Of this total, 91% (3,175 MJ/m$^3$) is attributed to the product manufacturing stage due to the energy intensity of the kiln drying process. The remaining 9% is a result of harvesting and transportation. Total air emissions, including CO$_2$, NO$_2$, and SO$_2$ is 313.6 kg/m$^3$. Of this total, carbon dioxide emissions from fossil fuels contribute 62 kg. Carbon dioxide emissions from biomass contribute 248 kg. According to the Environmental Protection Agency, CO$_2$ emissions as a result of biomass combustion do not contribute to global warming and are therefore considered CO$_2$ neutral (Puettmann 2005).

For our analysis of reclaimed wood flooring, let us assume CORRIM’s value of embodied energy for kiln-dried lumber as a baseline for the virgin-source product. Assuming we use reclaimed wood flooring for 1000sf of interior finished floor surfaces in the renovation and the addition, we will have:

1000 ft$^2$ x ½ inch thick boards x (1 ft/12 in) = 41.7 ft$^3$ = 1.18 m$^3$ of wood flooring

Assuming 3,492 MJ/m$^3$ for the embodied energy of a virgin-source product, the total embodied energy and air emissions for 1000sf of virgin-source wood floor for ecoMOD3 would be:

3,492 MJ/m$^3$ x 1.18 m$^3$ wood flooring = 4,120 MJ total embodied energy

313.6 kg/m$^3$ x 1.18 m$^3$ wood flooring = 370 kg total air emissions

62 kg/m$^3$ x 1.18 m$^3$ wood flooring = 73.2 kg CO$_2$ emissions from fossil fuels

In order to estimate the embodied energy for the reclaimed product, we will assume that the embodied energy of its “first lifetime” - including harvesting, processing, and transportation - is not taken into account in its analysis as a reused material. We will only account for any reprocessing and transportation required after its reclamation and before its reuse in a new application.

Wood that is reclaimed from an existing structure, in most cases, requires some degree of reprocessing so that it may be reused in a new project. In the case of reclaimed wood flooring, the wood is generally sawed from salvaged structural timbers, dried to further reduce moisture content, and milled. As we have seen in the data from the CORRIM report, the process of manufacturing wood products, including sawing and kiln drying, is the most energy-intensive component of its embodied energy profile. However, based on interviews with members of the reclaimed wood industry, the energy consumed in the reprocessing of reclaimed timbers is negligible in comparison to that required for processing virgin wood. This is due primarily to the kiln-drying process: Green (virgin) wood must generally be dried from a moisture content of 100% to as low as 8% (Reeb 1997). Reclaimed wood, depending on its previous application, is already significantly dry and may require only 3-4% further reduction in moisture content. These figures suggest that approximately 5% of the original energy required for processing is necessary for reprocessing of a reclaimed material. If processing virgin wood requires 3,175 MJ/m$^3$, the reprocessing of reclaimed wood flooring in ecoMOD3 would require:

3,175 MJ/m$^3$ x 1.18 m$^3$ wood flooring x 0.05 = 187 MJ reprocessing energy
Similarly, if we assume that 91% of air emissions are associated with the processing stage, we will have the following emissions as a result of using reclaimed flooring:

313.6 kg/m² x 1.18 m³ wood flooring x 0.91 x 0.05 = 16.8 kg total air emissions

62 kg/m² x 1.18 m³ wood flooring x 0.91 x 0.05 = 3.3 kg CO₂ emissions from fossil fuels

Now that we have compared processing energy and emissions, we will consider additional transportation of the reclaimed material. If we remember that transportation from the manufacturer to the construction site was not accounted for in the CORRIM LCA data, then we can reasonably assume that if the transport distance of the reclaimed material is comparable to the transport distance of a virgin product, then we need not consider this value in the comparative analysis. However, a significant amount of reclaimed timber available in Virginia is salvaged in the Northeast United States from deconstructed industrial buildings. It is likely, therefore, that a source of reclaimed wood flooring for ecoMOD3 is from outside of our region. Because the transport distance would be significant in this case, let us consider how this would affect our analysis.

Let us assume that the source of reclaimed timber for wood flooring is in the Northeast United States (700 miles from Charlottesville, Virginia). If this is compared to a local source 100 miles from Charlottesville, the difference in transport distance is 600 miles. According to the CORRIM report, the energy required for road transport of kiln-dried lumber is 0.26 MJ/m³km (Puettmann 2005). The additional energy required for transportation of ecoMOD3’s wood flooring from the Northeast would be:

0.26 MJ/m³km x 600 mi x 1.61 km/mi x 1.18 m³ wood flooring = 296 MJ for transport

When we compare the total energy and emissions for the reclaimed material to the virgin-source material, we find that the reclaimed material has a clear environmental advantage over the virgin wood product. Assuming no additional transportation of the reclaimed material compared to the virgin-source product, there is a 95% savings in embodied energy and air emissions for the reclaimed wood floor:

4,120 MJ (virgin-source product) – 187 MJ (reclaimed product) / 4,120 MJ = 95% energy savings

370 kg (virgin-source product) – 16.8 kg (reclaimed product) / 370 kg = 95% emissions reduction

73.2 kg (virgin-source product) – 3.3 kg (reclaimed product) / 73.2 kg = 95% CO₂ reduction

If we now assume that the reclaimed material is sourced from the Northeast, the total embodied energy for the product would be:

187 MJ reprocessing energy + 296 MJ transport energy = 483 MJ total energy

4,120 MJ (virgin-source product) – 483 MJ (reclaimed product) / 4,120 MJ = 88% energy savings
It is interesting to note that even though transporting the reclaimed material from as far away as the Northeast to Virginia significantly increases the embodied energy of the reclaimed product (160%), the total embodied energy is still much lower than that of the virgin-source material.

To further emphasize the benefit of using reclaimed materials, let us assume that a very high percentage of original processing energy (25%) is required for reprocessing. Using these figures, total reprocessing and transport energy requirements would be:

\[3,175 \text{ MJ/m}^3 \times 1.18 \text{ m}^3 \times 0.25 = 937 \text{ MJ reprocessing energy}\]

\[937 \text{ MJ reprocessing energy} + 296 \text{ MJ transport energy} = 1,233 \text{ MJ total energy}\]

\[4,120 \text{ MJ (virgin-source product)} - 1,233 \text{ MJ (reclaimed product)} / 4,120 \text{ MJ} = 70\% \text{ energy savings}\]

We still realize a 70% embodied energy savings over a virgin-source material when we use a reclaimed wood flooring product, assuming 600 additional miles of transport and 25% of the original processing energy requirement.

According to a 1996 analysis by Cole and Kernan, 87% of the initial embodied energy of a building is in its materials, with the remaining in site work and construction (Measures of Sustainability 2006). If a considerable portion of the building's materials are reclaimed products, our analysis suggests that a very large decrease in embodied energy of a building is possible.

The average embodied energy of a 1000sf house ranges between 250 and 470 GJ according to various sources (Glover 2001, Deconstruction Institute 2006). While a savings of 3933 MJ for reclaimed wood flooring would only amount to approximately 1% of this figure, total energy savings would be more significant as the volume of reclaimed materials in the house increases. Note that these figures are given for a conventional wood frame house.

Because the data used for this analysis may be difficult to acquire for all potential reclaimed building materials, it may not be possible to analyze each material for embodied energy and carbon emission reduction. For a quick reference, the charts in Appendix B of this report provide a good overview of the viability of reusing various reclaimed products, and the relative environmental benefit of each application.

**Recommendations for ecoMOD3**

Following are specific recommendations for the incorporation of reclaimed building products into the ecoMOD3 project:

**Renovation and addition materials.** For the new addition, use reclaimed materials in such a way that other recycled-content or conventional materials can be substituted for the reclaimed product should the production of the design go to scale. Be specific about what the substitution product is, and ensure that it will perform in the same manner. Applications that are likely to be easily substituted include:

- Wood framing (including glulam members)
- Hardwood flooring
- Ceramic tile flooring
- Exterior cladding (wood, metal sheet, slate, stone)
- Wood doors
- Balustrades
- Metal and porcelain sinks, bathtubs
- Plumbing fixtures
- Lighting fixtures
- Hardware
- Mechanical and electrical equipment

These materials should also be considered for use in the renovation. Refurbish the original wood flooring in place if there is no need to remove it during the renovation. If the flooring must be removed, refurbish and reuse the flooring in the same capacity in either the original house or the new addition. If any part of the original structural system must be removed, showcase that material in a creative way in the ecoMOD3 house.

See Appendix B for a series of charts that outline the viability and
environmental impact of reusing various building products. Specific recommendations for using reclaimed materials in ecoMOD3 have been highlighted for reference.

Flooring material in ecoMOD3. Through my research into sources for reclaimed hardwood flooring, I recommend that we specify reclaimed wood floors for the addition, and for the historic renovation if the existing floor cannot be reused. For the bathrooms, I recommend using ceramic tile available at the Habitat Store. In evaluating the use of reclaimed wood flooring, there is a clear environmental benefit over the use of a virgin-source product. The cost of the reclaimed wood floor, however, may be substantially higher than a sustainably-harvested wood floor from Appalachian Sustainable Development, the source of the poplar flooring in the ecoMOD1 OUTin House. To keep the cost of the reclaimed floor to a minimum, I recommend selecting a lower grade of flooring that may show saw marks, nail holes, and worm holes. Selecting smaller-width boards (3,4, and 5 inches) and 1/2-inch thick boards rather than 3/4-inch thick boards will also reduce the price. Lower grades of oak, pine, and poplar appear to be the most economical choices. For an exterior application, cedar is a species that is often used as decking and is available as a reclaimed wood. Working with local retailers to identify specials or “orphaned stock” may also lead to lower prices.

Landscape. There is a great opportunity to creatively incorporate reclaimed materials into the landscape design of the project. Similar to the renovation, there is more flexibility in using unique elements in this application than in the new addition. The design of the “screen” for the space under the addition presents a perfect opportunity for a creative and unique solution, using reclaimed lumber, doors, or shutters, for example. There is an abundance of pavers available for reuse in a landscape application. Demo debris from the original house may be crushed and used as fill, or as aggregate for new concrete foundations. Other reclaimed materials that are good options in a landscape application include:

- Gabions
- Brick or stone walling
- Pavers

Product warranty. Avoid using reclaimed materials in a capacity where product longevity is critical to the affordability of the house, and where a warranty is needed. These applications include the roof system, windows, much of the mechanical system, and appliances. For exterior cladding, reclaimed materials may be used as a rainscreen with a backup system for waterproofing the structure.

Local sources. To minimize the environmental impact of long-distance transportation of materials, give priority to local sources of reclaimed materials within the state of Virginia. Refer to the Material Reuse Source Guide in Appendix A for sources of materials. It is important to remember, however, that our analysis of the environmental impact of reclaimed wood flooring shows that transporting reclaimed materials from great distances appears to be a preferred environmental option to using locally-sourced virgin materials, with respect to embodied energy and emissions.

Labor factor. Carefully consider the labor requirement when assessing the viability of using certain reclaimed materials. Ensure to build sufficient time into the construction schedule for reclaiming and refinishing materials.
APPENDICES

[Appendix A] Material Reuse Source Guide
[Appendix B] Feasibility of Reuse of Specific Products and Materials
[Appendix C] Bibliography
The following is a reference for local sources of reclaimed materials. Provided for each retailer is a data sheet with an overview of the source, location, contact information, pricing information, and inventory.

**Reclaimed building material retailers**

- Black Dog Salvage (Roanoke, VA)
- Blue Ridge Timberwrights (Christiansburg, VA)
- Cochran’s Lumber and Millwork (Berryville, VA)
- The Habitat Store (Charlottesville, VA)
- Heartwood International (Afton, VA)
- Mountain Lumber Company (Ruckersville, VA)
- Shenandoah Valley Reclaimed Lumber (Harrisonburg, VA)

**Other sources**

- ecoMOD3 historic house
- Milton Airport shed
- UVA School of Architecture
- UVA School of Engineering and Applied Science
[APPENDIX A] MATERIAL REUSE SOURCE GUIDE: BLACK DOG SALVAGE

Source
Black Dog Salvage
902 13th Street SW
Roanoke, VA 24016
T 540 343 6200
F 540 343 6295
http://www.blackdogsalvage.com
info@blackdogsalvage.com

Contact
Mike

Overview
Black Dog Salvage was created in 1999 to provide a home for Southwestern Virginia’s architectural past. The company found its beginnings with the salvage of some of Roanoke Virginia’s most notable architectural details at 21 Highland Avenue. Since that time, Black Dog has become the temporary resting place for architectural antiques, commercial salvage, and modern society’s other cast offs. Detailed list of inventory available on eBay.

Pricing
See http://www.blackdogsalvage.com for pricing on specific items.

Sourcing Location
Primarily local sources

Inventory
Reclaimed Hardwood Flooring (as of 11/20/2006)
2.5 in oak (500sf) @ $3.75/sf
3.5 in pine (100sf) @ $3.75/sf
5 in x 3/4 in face-nailed cedar ceiling decking (3000sf) @ $5.00/sf
All reclaimed wood flooring is not remilled - requires refinishing.

Pavers and stone
Decorative iron, gates
Doors and hardware
Garden and statuary
Lighting
Mantles, fireplace accessories
Stained glass
Vintage plumbing
Windows
Furniture
Miscellaneous architectural features
Source
Blue Ridge Timberwrights
P.O. Box 30
Christiansburg, VA 24068
T 540 382 1102
F 540 382 8039
http://www.blueridgetimberwrights.com

Contact
Charles

Overview
Blue Ridge Timberwrights primarily provides reclaimed timbers for reuse as structural elements. They are not currently sawing timbers into flooring except upon special request.

Inventory
Reclaimed Timbers
Reclaimed St. Lawrence Seaway douglas fir timbers were salvaged from decades old floating “sidewalks” that once helped men steer timber down rivers and across lakes. Reclaimed long leaf southern yellow pine is from Savannah Harbor, where the timbers once served as pilings dating back to the late 1600’s. This time spent submerged gave the timbers their unique color and character. In addition, we have a limited supply of reclaimed heart pine timbers taken from mills and tobacco warehouses; and a variety of reclaimed red and white oak timbers.
Source
Cochran’s Lumber and Millwork
523 Jack Enders Boulevard
Berryville, VA 22611
T 877 297 8331
T 540 955 4142
F 540 955 4135
http://www.lumberandmillwork.com

Contact
Sev

Overview
For over 25 years Cochran’s Lumber and Millwork has been providing a full line of products and services for the Historic Restoration and custom home markets. From its location at the base of the Blue Ridge Mountains, Cochran’s offers custom flooring, mouldings, and furniture. Crews deconstruct old barns for salvaged wood.

Pricing
Pricing for 3-6 in wide boards ranges between $4.62 and $12.19/sf. Quoted contractor’s price instead of retail price.

Sourcing Location
Heart pine is sourced locally and from the northeast. Tobacco wood from barns is sourced along the eastern seaboard. Locally sourced woods include oak and chestnut.

Methods
No use of renewable energy sources for processing.

Product guarantee
Prior to installation.

Inventory
Shenandoah Plank
Our line of antique reclaimed wood for wide plank flooring and timbers in species of oak, pine, and chestnut; as well as rustic grades from new woods that capture the look and feel of early American structures, at a fraction of the cost of the antique woods. Authentic, historic log cabins and hand hewn beams.

3,4,5 in Antique heart pine @ $8.61 and $10.11/sf
3,4,5 in Tobacco wood @ $5.62/sf milled, $6.00/sf distressed face
3,4,5 in Antique oak @ $7.07/sf milled, $8.85/sf distressed face
3-6 in Wormy chestnut @ $12.19/sf
4.5 in Horsecountry oak @ $4.62/sf

Custom Moulding and Other Wood Products
Wood casings, mouldings, trim, handrails, bannal, radius items, paneling, decking, corncice, custom cabinets, mantels; wainscoting for libraries, studies, kitchens, churches, schools, offices; hand-hewn beams, old heart pine, rare items; custom doors and windows made to order; lathe service for balusters, posts, newels, cornerblocks, rosettes, pickets, railings.
[APPENDIX A] MATERIAL REUSE SOURCE GUIDE: THE HABITAT STORE

Source
The Habitat Store
1221 Harris Street
Charlottesville, VA 22903
T 434 293 6331
F 434 293 4883
http://www.cvillehabitatstore.org
info@cvillehabitatstore.org

Contact
Ryan Jacoby
T 434 989 5834
ryan@cvillehabitatstore.org

Overview
The Habitat Store supports Habitat for Humanity of Greater Charlottesville by selling new and salvaged building materials to the public at discounted prices. All proceeds from the Habitat Store contribute to the construction of new Habitat homes. The Habitat Store participates in Habitat for Humanity International’s overall environmental initiative by diverting usable materials from the waste stream while promoting the responsible stewardship of natural resources.

Pricing
25% to 75% of retail price

Inventory
Interior and exterior doors
Residential electrical components
Hardwood flooring
Ceramic tile
Mantels
Kitchen and bathroom cabinetry
Door hardware
Nails and screws
Fasteners, connectors, hangers
Lighting fixtures
Lumber and sheet goods
Hardiplank
Trim, molding
Shutters
Brick, block
Paint
Stainless steel and porcelain kitchen sinks
Pedestal and drop-in bathroom sinks
Faucets, miscellaneous plumbing hardware
Complete window units
Stained glass windows
Source
Heartwood International (Big Wood)
141 Heartwood Circle
Afton, VA 22920
T 800 452 8251
T 434 361 1323
F 434 361 1873
http://www.heartwoodinternational.com
lstop@mindspring.com

Contact
Larry

Overview
Heartwood International’s mission is to promote the use of recycled, reclaimed or environmentally sensitive products. All the companies and products Heartwood represents have been carefully examined to insure consistent high quality and an impeccable environmental record. Products include reclaimed heart pine, douglas fir and oak, salvaged barn lumber, and recycled plastic fencing. Heart pine and douglas fir is shipped under the name Big Wood (www.big-wood.net), either directly from the demolition site or from their yard in Queens, New York.

Pricing
Awaiting estimate from Larry as of 11/27/2006. Prices negotiable.

Sourcing Location
Heart pine is and douglas fir is sourced from around Trenton, New Jersey, and other locations almost exclusively in the northeast United States.

Methods
Big Wood in Afton has just recently entered the reclaimed wood flooring business - previously, the company simply acted as a liaison between demolition contractors and the public. There is interest in using biomass fuel for their kiln, but there is an issue of scale when implementing this approach for a small operation. Primary energy source is electricity.

Inventory
Reclaimed Heart Pine and Douglas Fir
We travel anywhere on the east coast in search of the best lumber, but often end up in New York City - Northern New Jersey. Along with the many towns in New England, this is where the great wave of immigration brought the building boom at the turn of the 19th-20th century. Industrial buildings, warehouses, and old tenements were built with Heart Pine and Douglas Fir and as gentrification proceeds, these relics of our past are coming down. All Heart Pine is dense growth unless otherwise specified. A minimum of 8 growth rings per inch. Our Douglas Fir is also generally old growth, however it was often harvested later than the Heart Pine. For all our lumber we clean off the heavy surface metal before shipping, but we do not do any denailing.

Oak and Salvaged Barn Lumber
Heartwood International has developed an alliance with the top barn salvage company in the U.S. allowing it to offer a wide variety of salvaged barn lumber including the finest oak available, including timber, joists, and resawn lumber.
Overview
Since the early seventies, Willie Drake, the founder and president of Mountain Lumber, has been a leader in finding buildings containing outstanding Heart Pine and saving the historic wood from demolition. Mr. Drake and his scouts hand-select only the finest wood and ship it to Mountain Lumber’s mill in Virginia, where it is resawn, kiln-dried, milled, and graded based on standards originally established by the Southern Pine Inspection Bureau in 1923.

Pricing
Internet specials as low as $3.99/sf. Year end inventory will result in additional specials on “orphaned” stock. Prices negotiable.

Sourcing Location
Heart pine is sourced from east of the Rockies, with much from Georgia and South Carolina. Oak and chestnut tends to come from more local sources in Virginia, West Virginia, and Pennsylvania from old barns. Mountain Lumber also acquires reclaimed wood from China.

Methods
Mountain Lumber uses biomass fuel (sawdust) to operate its wood drying kiln, as well as to heat its plant facilities. They are very careful not to accept salvaged wood from facilities such as tanneries, to avoid toxins in their reprocessed products. Their regulatory threshold for toxins is more stringent than federal standards, and they lab test each batch of sawdust to ensure compliance.

Product Guarantee
Mountain Lumber will refund all or part of standard stock, unaltered materials for up to 30 days after its arrival and before installation.

Inventory

Hard Maple
Beautiful wood that may wear forever. Maple is among the hardest varieties found. This wood is an unusual find and is a limited opportunity for authentic aged boards with character and graceful patterning.

Historic Heart Pine
Wide range of flat and vertical grain patterns. Grades include select prime, prime, rift, crown, and naily. Sawn from the tops of sturdy timbers that originally supported flooring in warehouses or mills, our Naily grade has strength, durability, and many nail holes.

Distressed Woods
Rich color, worn spots, raised grain, original saw marks, nail holes, and hairline cracks give these distressed woods an aged appeal. Includes heart pine, yellow pine, and red and white oak.

Antique Oak, Chestnut, and Farmhouse
Antique American Oak is harder, more stable, and will develop a patina more quickly than new lumber. The nail holes and other scars are a testament to the reclaimed wood’s history, while the seasoned mix of red and white oak creates a rich blend of colors. Antique American Chestnut is also decorated with occasional knots, nail holes, and worm holes. Antique Farmhouse is planed to a smooth finish, showing bright red and yellow heartwood mixed with light blonde sapwood. Antique Farmhouse displays a collage of tight brown knots, nail holes, worm holes and trails, and beautiful grain variations.

Distressed Poplar (*Internet special as of 11/19/06)
466 Square Feet
5/8” x 1-1/2”, 2-1/2” x RL
Reg. Price $2,330.00
SALE PRICE $1,840.00

Smooth Faced “Oiled” Heart Pine (*Internet special as of 11/19/06)
In the 1800’s to early 1900’s cotton seed oil, peanut oil and other vegetable based oils were used to lubricate the machinery in cotton mills. Often times this oil would be slathered on to the machines and drip into the wood flooring and beams. When we find this “oiled” wood we segregate it from the rest of our inventory and offer it for sale at special prices.
3/4” x 2-1/2” to 9-1/4”
Reg. Price $6.50/ sq. ft.
SALE PRICE $3.99/ sq. ft.
Inventory

American Chestnut
Though at one time chestnut was very plentiful in the Shenandoah Valley, it is now virtually non-existent. Typically, chestnut is straight grained with small solid knots and a rich honey brown color that becomes more enhancing as the wood ages. The grains are highly stable and when put together with other boards offer an attractive dimensional look. The main use of chestnut is flooring, cabinets, and furniture.

Beam Cut Oak
This oak is heavy, dense, and stable. It will often have small knots, which adds color to the wood. The grain can vary from straight to circular to a marbled look. Another characteristic of oak are ray lines, which grow perpendicular to the growth rings. This adds to the stability of this species. Some sections will have nail holes and or stains from nails. Widths of the beam cut grade will vary from 5” to 9”. Just as the name implies, this grade is milled from old support beams in buildings where it is common to have lengths up to 14 feet in length. Although beam cut grade is as old as any other part of the building, it is generally protected from the environment and therefore less weathered with few or no cracks. Wormholes are often an accentuating characteristic of this grade.

Yellow Pine
This native valley wood wears extremely well and displays a rich warm reddish brown look that blends with most interior color schemes. Yellow pine is versatile, easy to manage, and stable to ensure a lifetime of warmth and character. Knots range from minute to golf ball size and are solid, stable, and dense. We mill the tongue and grooves in the middle of the edges so that either side of the board can be used according to variations in appearance.

Barn Board Oak
Barn Board Oak is a unique wood. The oak is selected from barns where it was typically used as siding. This grade is weathered gray with cracks and coloration reaching deep into the wood. Barn board is frequently used as flooring, however it can also compliment any room as door/window/base trim and a one of a kind kitchen can be created when used as cabinet stock. Although this grade is characterized by exposure cracks, it is extremely stable and versatile.
ecoMOD3 Historic House

Oak flooring in existing living room (tounge and groove)
Pine flooring in existing bedroom (face nailed)
Flooring in existing loft (unknown wood)
Structure to be demolished (bathroom addition)
Wood cladding

Shed at Milton Airport

Standing seam tin roof
Large steel doors on tracks
Wood structural elements

UVA School of Architecture

Wood stage components (9 large panels, approximately 4ft x 8ft)
4 chalkboard panels and wood chalkboard trays
2 large sheets MDF
2 projection screens (10ft and 7ft)
4 large wood slat panels (approximately 4ft x 8ft)
1 2x12 solid wood handrail (8ft)
Solid wood shelf
2 particleboard worktables (2ft x 8ft)
Assorted panels of plexiglass and steel
3 wood shipping pallets
Wood bench and support brackets
12 2x6 softwood lumber

UVA School of Engineering and Applied Science

Wood stage components (10 large panels, approximately 4ft x 8ft)
Assorted electrical and plumbing components
Key to column headings

Reuse in situ
The element, component or material will be reused in its original place in a building, or with minor relocation, but not removed from site. Its performance and/or suitability can be assessed in situ to allow designers to predict performance and durability with confidence. For example reuse of structural frame or roof truss of an old building, reuse of piles after a building has been removed, or reuse of a lift after refurbishment in situ.

There is probably some ambiguity about what constitutes ‘continued use’ and ‘reuse’ of a building. General repair and maintenance apply to the former but not to the latter. For major items such as the building structure, foundations and envelope two factors need to be considered: Is there a change of ownership? Is there a significant change of use? If the answer to either is ‘yes’, then it should be considered to be ‘reuse’.

Use of salvaged/reconditioned products/reclaimed materials
An element, component or material can be specified that has formerly been used in a different location. According to the item, it may simply have been removed from another building, stored and delivered to a new site (for example an ornamental item salvaged from a building) or it may have undergone some repair, reconditioning or minor remanufacture before being purchased for reuse, for example a window, a heating boiler, water pump or a timber beam cut to suit a new purpose and location. This category of goods includes many items that are generally found in architectural salvage yards.

RCBP
This includes all goods that have been made using some reclaimed materials. These may be post-industrial waste – the waste material from manufacturing processes such as carpet manufacture or carpentry. Or they may be post-consumer waste – material that has been used and discarded as waste, such as plastic drinks cartons or timber stripped out when a building is demolished, for example furniture made from recycled polymers (plastics), timber

Indicates a potential application for reclaimed materials in ecoMOD3 based on viability for reuse and environmental benefit

Key and charts from Addis, 2006.
## APPENDIX B FEASIBILITY OF REUSE OF SPECIFIC PRODUCTS AND MATERIALS

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<td>Cast-iron columns and beams (mainly pre-1870s)</td>
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### Appendix B: Feasibility of Reuse of Specific Products and Materials

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<td><strong>STAIRS etc.</strong></td>
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<td>H</td>
<td>H</td>
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<tr>
<td>Concrete pavings, edgings etc.</td>
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<tr>
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### APPENDIX B: FEASIBILITY OF REUSE OF SPECIFIC PRODUCTS AND MATERIALS

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<thead>
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<th>Mechanical and electrical services</th>
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<th>RCBPs</th>
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<td>Environmental benefit</td>
<td>Viability</td>
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<td>Distribution devices</td>
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<td>Distribution cable</td>
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<td>Terminal devices (sockets etc.)</td>
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<td>Terminal devices (luminaires)</td>
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<td><strong>INFORMATION AND COMMUNICATION SERVICES/PRODUCTS</strong></td>
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<tr>
<td>Communication cables</td>
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