DESIGN FOR REUSE PRIMER

15 SUCCESSFUL REUSE PROJECTS WITHIN DIFFERENT SECTORS EXPLORED IN-DEPTH. RESEARCHED AND EDITED BY PUBLIC ARCHITECTURE

VERSION 1.1
PUBLIC ARCHITECTURE

© 2010 Public Architecture. All rights reserved.
The photographs in this book are used with permission and their authors retain all rights in their possession.
Designed by Studio Lin www.studiolin.org

ACKNOWLEDGEMENTS

This publication would not have been possible without the great many people who generously contributed time and energy or lent support. This includes current and past members of the Public Architecture staff: Brad Leibin, Cali Pfaff, John Peterson, Nick McClintock, Amy Ress, Mia Scharphie, Evelyn Lee, Milton Marks, and John Cary.

A team of dedicated volunteers were instrumental to doing the research, developing the case studies, and facilitating outreach. Grant Alexander, Virginia Alexander, Mary Casper, Roselle Curwen, Barbara Franzoia, Trudy Garber, Taj Hanson, Julia Howe, Annie Koo, Shanti Levy, Nicole Melas, Tammy Ng, Ashley Turner, and Liz Westbrook have contributed many long hours throughout the two-year development of this project.

A knowledgeable team of advisors have also provided their invaluable expertise to this research. That team includes co-Principal Investigator Brad Guy, now of Catholic University, as well as advisory team members Gregory Dick of the California Integrated Waste Management Board, Timonie Hood of US EPA Region 9, Mark Palmer of San Francisco Department of the Environment, and Meri Soll and Wes Sullens, both of StopWaste.Org.

Editor Jennifer Roberts provided invaluable assistance in helping to bring an engaging tone to the case studies. We are grateful to the graphic vision of Alex Lin/Studio Lin, for adding a visual richness to the stories.

The U.S. Green Building Council (USGBC) provided the generous funding that made the *Design for Reuse Primer* possible. We also thank the USGBC research program staff for providing additional resources and support over the course of the project. Thanks as well to the research grant's technical review team; they have been a great sounding board throughout.

Finally, we would like to extend our deepest gratitude to all the individuals and organizations involved with the case study projects who generously took the time to talk or work with our research team. Your stories and insights are the foundation of this publication. We feel honored to be able to share these signature examples of reuse with a wider public.

Thank you.

Liz Ogbu
Co-Principal Investigator and Project Director
Design for Reuse Primer

INTRO-DUCTION

Liz Ogbu

WASTE NOT

What does it mean to build green? As the concept of sustainable building has gained greater traction within and outside of the design and construction industry, "building green" has often been linked with achieving higher levels of energy efficiency or improved air quality. Materials have often played a secondary role. Even when considered, the sustainable materials market tends to focus on new rapidly renewable materials, sustainably harvested materials and materials with recycled content such as bamboo flooring, certified wood and recycled glass finishes. Yet, as the 15 projects profiled in the *Design for Reuse Primer* show, material reuse represents one of most creative, exciting and effective approaches to building green.

Reused, or reclaimed, materials are materials extracted from the waste stream and repurposed without further processing or with only minor processing that does not alter the material's nature. Old bricks cleaned of their mortar and used to create a new facade, wood beams remilled into flooring, and wood from packing crates fashioned into window trim are all examples of reuse. Reuse is not to be confused with recycling. Recycling also involves removal

The Jewish Reconstructionist Congregation used reclaimed materials extensively as part of the first LEED Platinum house of worship.

of materials from the waste stream, but those materials undergo significant processing to convert them into new products. Waste paper reduced to pulp and then combined with pulp from new wood to produce new paper is a form of recycling.

By not undertaking extensive reprocessing, material reuse provides buildings with features difficult to retain in the recycling process. From reclaimed cypress that recalls 19th-century Eastern European Jewish culture to 100-year-old brick from the deconstruction of an Army warehouse, reclaimed materials infuse the buildings profiled here with a beauty, texture and history that inspired creativity in the designers and brings richness to the experience of the users.

The potential of material reuse to impact the building industry's environmental footprint is significant. *Environmental Building News* reports that building construction accounts for nearly 30% of all raw material consumption. Unfortunately, much of that material winds up trashed. Nearly one-third of the waste in U.S. landfills comes from building construction and demolition debris, according to the U.S. Environmental Protection Agency. If, as *Environmental Building News* reports, over 25% of the buildings existing in 2000 will be replaced by 2030, we'll have a staggering amount of discarded material on our hands over the next two decades.

This is alarming not only because we're filling up landfills and wasting valuable materials, but because of the harm it is doing to our atmosphere. Organic materials such as wood, which represent a significant amount of overall construction and demolition debris, eventually break down and produce methane. A greenhouse gas, methane has a global warming impact many times worse than carbon dioxide. Reusing wood

A living building, the Omega Center incorporates reclaimed Cypress as part of its commitment to tread lightly on the earth.

reduces methane emissions from landfills. What's more, according to the Deconstruction Institute, every ton of reused wood avoids the emission of 60 pounds of greenhouse gases created when new lumber is harvested and milled.

The projects profiled here are part of a movement among certain designers, builders and clients to turn these statistics around. By reducing the need for raw material consumption, the energy associated with manufacturing and transporting raw materials, and the amount of waste sent to landfills, reclaimed materials provide a prime opportunity to follow the sustainability mantra of "Do more with less."

SEE ONE, DO ONE, TEACH ONE

Despite the potential of material reuse, it has been a largely untapped resource. Although many case studies exist about sustainable building projects, it is often difficult find examples of material reuse. This is particularly true in commercial-scale construction, where integrating material reuse into the design and construction process can sometimes seem daunting. The *Design for Reuse Primer* is part of an ongoing initiative by Public Architecture to bring reuse stories to light. By discussing the challenges and demonstrating the benefits of reclaimed materials, we hope to demystify reuse.

The case studies represent a diverse mix of program type, location, size and client. They reveal that there is not one path to material reuse. However, some common lessons to consider can be found across projects:

Think reuse from the start

Building sustainably requires thinking about relevant strategies from the early phases of design. Material reuse, which should be integrated into a comprehensive sustainability strategy, should be

Ever since ScrapHouse, a demonstration house built completely from scrap in 2005 in San Francisco, Public Architecture has been committed to inspiring and facilitating reuse. Previous resources developed include a podcast, articles and presentations. Visit designforreuse.org to learn more.

discussed from the beginning. The project team of the Vancouver Materials Testing Facility found strategizing early about reuse made it easier to navigate the challenges and capitalize on the benefits.

Aluminum panels from the original structure's dome addded color to the Long Center's facade.

Get team buy in

Beyond starting the discussions early, it is critical to engage all stakeholders in the process. Many good ideas arise outside of the formal design process. At the Alberici Corporate Headquarters, members of the construction team came up with the idea of using reclaimed sheet piling for a landscaping retaining wall.

Don't write the specs in stone

Reclaimed materials aren't off the shelf products for which a manufacturer can provide standard information. It is important to write specifications that are clear about expectations, such as structural performance or storage requirements, but build in flexibility, such as providing a range of acceptable hues for a particular finish material. Clear specifications for the Long Center for Performing Arts helped with the deconstruction and reuse of tricky items such as the multicolored aluminum roof panel. By also being clear about who has responsibility for sourcing, approving, purchasing, storing, decontaminating, refurbishing or modifying, and installing the reclaimed materials, they made it easier for subcontractors to bid on the job.

Build reuse relationships

Several projects, including the Mountain Equipment Co-op stores in Ottawa and Winnipeg, obtained materials through "shopping the site," or onsite deconstruction. Others, such as the Omega Center for Sustainable Living and the Chartwell School, showed how reclaimed material stores, suppliers and brokers can also be valuable sources. Building relationships with these additional sources can make you more familiar with the range of materials available and make suppliers better acquainted with your needs. Knowing more can facilitate a more efficient, creative and cost-effective material reuse process.

Be flexible

Reclaimed materials have an inherent variability to them. Everyone, from the client to the designer to the contractor, needs to maintain some flexibility around material appearance and availability. But also identify things that shouldn't be compromised, such as energy efficiency, indoor air quality and overall aesthetic goals.

Factor in time

On every construction project, timing is always an issue, and it's even more so when it comes to material reuse. New materials can often be ordered within a defined time frame that fits the mainstream building process. The infrastructure around reclaimed materials, particularly for commercial-scale construction, is less refined. By engaging a reuse supplier early in the design process, the Sidwell Friends Middle School project team was able to factor into the overall project schedule adequate time for identification, sourcing, procurement and refurbishment of key reclaimed materials.

Be strategic with contracts

From design/build to multiple prime, there are various types of contracts used in the building industry. When it comes to reuse, it is important to clarify roles and responsibilities regardless of the type contract used. The Portola Valley Town Center found the multiple prime contract struc-

"MOM TAUGHT US TO EAT EVERYTHING ON THE PLATE. I VIEW IT THE SAME WAY DEALING WITH STRUCTURE. IF THERE'S MATERIAL AVAILABLE, WHY WASTE IT IF IT COULD BE SENSIBLY BUILT IN A NEW DESIGN?"

—Paul Fast, structural engineer, Vancouver Materials Testing Facility

ture facilitated the reuse process through strategies such as phasing. Splitting up abatement, deconstruction and demolition helped manage costs. It also enabled them to have a construction manager serve as the primary reuse champion and keep everyone on track.

Be creative

Think of reclaimed materials as a tool for creative invention. Their features can sometimes provide textures, colors or sizes unavailable — or unaffordable — new. Also think about reusing materials in applications different than their original use, such as the steel railroad tracks used as a trellis at the Eastern Sierra House or the exterior aluminum roof panels used as interior paneling at the Long Center for the Performing Arts.

Test it out

Reclaimed materials may not come from a factory, but that doesn't mean they can't be viewed beforehand. Try to get samples during the design process, and test out ideas and address challenges with mockups as was done with the interior wall and ceiling panel assemblies in the Portola Valley Town Center. Testing materials for structural integrity or grading wood can also make the reuse process easier.

Share the story

Unlike most new materials, reclaimed materials often come with a history. Incorporating these materials, with their embedded narrative of a place or culture, can provide a meaningful connection to a sustainable vision. Projects such as the Omega Center for Sustainable Living and the Sidwell Friends Middle School show how highlighting reclaimed materials through design, signage or tours shares that history and vision with others.

"WE WANTED A BUILDING THAT WOULD PHYSICALLY EMBODY WHO WE WERE."

—Rabbi Brant Rosen, client, Jewish Reconstructionist Congregation

DOES REUSE COST MORE?

As frustrating as it can be to hear this, the answer is: It depends.

Sometimes using reclaimed materials is flat-out less expensive, such as when reclaimed lumber provided a cost savings over new Forest Stewardship Certified wood for the Omega Center for Sustainable Living. Reuse can also be a way to build with higher quality materials that would be too expensive if purchased new, such as the wood flooring at Benny Farm. In other cases, the cost of the material or refurbishment may be a significant increase over new but the client may choose it anyway because it meets their design, functional or environmental goals. When building their Town Center, the Town of Portola Valley decided to purchase reclaimed Alaska Yellow Cedar at a premium because it provided an aesthetic that reflected the values of the community. Reclaimed materials often have intangible financial benefits. Several projects, such as the Portola Valley Town Center and the Long Center for Performing Arts, found that incorporating reclaimed materials provided a compelling narrative that gave their capital campaign efforts an extra boost

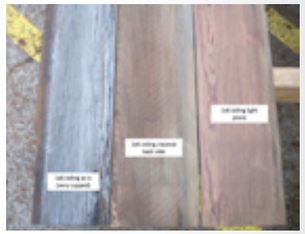
When evaluating cost, it is important to be strategic and to understand tradeoffs. Before deciding on a material, the project team should assess what's involved, from decontamination and storage to refurbishment, installation and future maintenance. Tapping into the network of reuse consultants such as deconstruction contractors, reuse suppliers and reuse brokers can help supply this knowledge. This evaluation should not only be based on pre-installation cost, but should also include what it takes to maintain the material once the project is built.

Portola Valley Town Center. Reclaimed Yellow Cedar was used to create sunscreen louvers. The buildings are clad in reclaimed redwood.

THE REUSE PROCESS

The various projects reveal several strategies of how to deal with these issues. In general, it is useful if material identification occurs at the project start or initial design phases. Research around sourcing should also occur at this point, but depending on the contract structure and materials desired, actual sourcing and procurement, can occur in the latter design phases or during construction. It is sometimes advisable for the owner to pre-purchase high value materials that may be of limited availability. But the financial and storage capacity of the owner is an important consideration. In some cases, reuse brokers or contractors may be able to help provide the space.

Any reclaimed material chosen should be carefully evaluated for its refurbishment needs, and the time associated with that process should be factored into the overall project timeline. This information as well as details concerning selection, storage, and installation processes should be captured in the project's material specifications. During construction, the design team should review the quality of any reclaimed materials procured by the contractor.



Reclaimed wood samples considered for use in the Operation Comeback 5200 Dauphine Street project.

WHAT TO REUSE?

Wood is by far the most commonly reclaimed material used in the case study projects. In the past decade, the infrastructure around this market has matured considerably. There are many sources, from deconstruction companies to reuse retailers to specialty suppliers. Much of the reclaimed wood available is old growth lumber, often of greater quality and durability than the newer woods on the market. If using reclaimed wood from onsite deconstruction, a certified wood grader is helpful for verifying strength and quality. A structural engineer should be brought in if the wood is to be

used in structural applications.

Other common materials used include brick and metal. But many of the projects profiled here also provide examples of a wide range of reclaimed materials and components, from marble toilet partitions in the Long Center for the Performing Arts, airplane flaps in the Eastern Sierra House, granite slabs in the Alberici Corporate Headquarters, carpet in the Philips Eco-Enterprise Center and gas-fired HVAC units in the Vancouver Materials Testing Facility.

A shelf made from a salvaged airplane flap in the Eastern Sierra House.

WHERE DO WE GO FROM HERE?

As sustainable building continues to evolve beyond energy efficiency to encompass issues like cradle to cradle design and carbon footprint reduction, material reuse takes on even greater importance. Clearly, the infrastructure of the reclaimed materials market has not fully matured. Issues around codes, supply and demand, and experience present challenges to development. This is not dissimilar to the state of the recycled materials market more than a decade ago. At the time, few manufacturers developed products with — let alone provided information about — recycled content. Yet, as the green building movement matured, demand for such products increased. Now, there are countless products that brandish their recycled content as the foundation of their marketing strategy. Such materials have become commonplace.

At the heart of many of the issues around a material reuse market is lack of awareness. Sharing knowledge is perhaps the best solution to that. The *Design for Reuse Primer* features process-based case studies of 15 projects from the U.S. and Canada and a variety of resources. From a school for children with learning differ-

ences to a performing arts center to a corporate headquarters, the diverse projects in the *Design for Reuse Primer* provide insights about the material reuse process in many contexts. Notably, they are not just fascinating examples of material reuse, but inspiring models of good design.

Chartwell School not only incorporates reuse, but thinks for the future by being designed for disassembly.

---

p. 3 Photo: Steve Hall © Hedrich Blessing
p. 4 Photo: Copyright © Assassi
p. 5 Photo: © 2005 Cesar Rubio Photography
p. 6 Photo: © Nelsen Partners, Dan Gruber
p. 5 Photo: © 2009 Cesar Rubio Photography
p. 11 Photo: ©Edward Caldwell edwardcaldwellphoto.com
p. 12 Photo: Michael David Rose / MDRP.NET

CIVIC

Civic

"IF YOU BUILD A PROMINENT PROJECT THAT CHANGES THE PERCEPTION OF THE MASSES, THEN THE DEMAND WILL GO UP."

—David Desrochers, client, Vancouver Materials Testing Facility

Federal, state, and local governments are helping to propel the sustainable building movement by enacting green codes and policies. Civic buildings are increasingly serving as models of how to build better and greener. These buildings illustrate a commitment to sustainability that can be more concrete than changes in policy. Despite this trend, material reuse has been an underutilized strategy in civic buildings, often because of concerns about cost and quality. The public projects featured here demonstrate that reclaimed materials can be used to create beautiful, high quality buildings without breaking the bank. Portola Valley's new Town Center exemplifies how carefully selected reused materials can reflect and reinforce a community's sense of self. Vancouver's Material Testing Facility incorporates extensive material and equipment reuse, resulting in a building that instilled a sense a pride in the project team, clients, and building users. In these civic projects, we find not only beacons of sustainability but also of reuse.

Civic

TOWN

Photo: © 2009 Cesar Rubio

Civic

TOWN

Photo: © 2009 Cesar Rubio

Civic

TOWN

Photo: © 2009 Cesar Rubio

Civic

TOWN CENTER

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Portola Valley Town Center

LOCATION
Portola Valley, CA

YEAR COMPLETED
2008

PRIMARY USE
Assembly, Public order & safety, Library

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$20 million

CERTIFICATIONS
LEED-NC Platinum

SIZE
19,900 Sq ft

CLIENT/OWNER
Town of Portola Valley

ARCHITECT
Siegel & Strain Architects with Goring & Straja Architects

CONTRACTOR MANAGER
TBI Construction & Construction Management

STRUCTURAL ENGINEER
Forell/Elsesser Engineers

REUSE CONSULTANT
Reusable Lumber Company

DECONSTRUCTION CONTRACTOR
Roldan Construction

CIVIC CENTER WINS SUPPORT BY HONORING THE PAST AND BUILDING FOR THE FUTURE

Portola Valley's new Town Center is "a story about reusing materials," said Town Councilmember Ted Driscoll.

Since opening its doors in 2008, this small but remarkable civic center has pulled in numerous design awards and honors, including LEED Platinum certification. Reflecting the community's long-standing commitment to environmental stewardship, the new Town Center was envisioned as a model of green design, with deconstruction and reuse at the heart of the green building strategies.

The Town Center's three buildings—a town hall, library, and community hall—replaced seismically unsafe structures built in the 1940's. Rather than demolishing the old facility and landfilling the materials, the buildings were carefully dismantled and the materials creatively incorporated into the new structures. The new campus, which features three single-story buildings clustered around a plaza, has a low-key beauty that blends into the wooded landscape.

Portola Valley is an affluent bedroom community for Silicon Valley and Stanford University, with residents who value the area's scenic landscape and rural character. When town leaders proposed replacing the outdated Town Center with a new campus, there was an outcry from many citizens who felt an emotional connection to the old buildings.

But as the project's architects introduced the proposed design—and as that design evolved in response to the community's concerns and priorities—attitudes changed.

A focus on sustainability, including a commitment to reuse, ultimately earned the project overwhelming community approval. In fact, there was such a groundswell of support that $17 million of private donations flowed into the town's coffers, funding 85 percent of the project's costs.

"We are a unique town," said Councilmember Driscoll. "We had the resources and education level to know what do. If not here, where? It was important for us to show leadership."

"IF NOT HERE, WHERE? IT WAS IMPORTANT FOR US TO SHOW LEADERSHIP."

— Ted Driscoll, Town Councilmember

FLEXIBILITY IS ESSENTIAL WHEN DESIGNING FOR REUSE

Siegel & Strain Architects, Goring & Straja Architects and TBI Construction and Construction Management were all brought on board while the town was still determining budget. Without this early engagement, a high level of material reuse probably wouldn't have been possible given thatthe availability of salvaged material drove many of the design decisions.

Upfront costs of deconstruction also need to be built into the budget from the start. As Driscoll recalls, Larry Strain of Siegel & Strain Architects argued that if you pay more for deconstruction rather than demolition, you'll save in materials cost later.

"Larry was always talking about the economics of this," Driscoll said. Persuaded by Strain, the town council agreed that it would be cost effective to pay more for deconstruction in order to salvage reusable materials.

Following the schematic design development, which laid out the project's general scope, the architects wrote a deconstruction specification that instructed the salvage crew on exactly what should be extracted from the buildings. The building industry doesn't have common standards for this and Strain admitted that this one—the first his firm had written—was far from perfect.

Later when Jim Steinmetz of Reusable Lumber Company joined the team as a deconstruction consultant, he advised the architects to reconsider certain materials they had planned to use. For instance, the specification called for milling new interior wall paneling out of the old Town Center's Douglas Fir roof framing beams. However, Steinmetz noted that there was plenty of 2x6 roof decking available, which had fewer knots and could be de-nailed and milled into interior wall paneling more easily than the thick framing beams. A decision was made to use the roof decking, instead, which saved time and money.

As the project progressed, the community's commitment to green building and reuse grew. This sparked some design changes. The exterior siding of the new buildings, for example, was originally designed to be cement fiber shingles. But in light of the town's commitment to using salvaged materials, the architects changed course and specified reclaimed redwood siding—sourced offsite—for the building exteriors. Cladding the building with old-growth redwood linked the buildings to the redwood groves on site and became a major featureof the Town Center's visual identity.

Flexibility is one of the keys to success when designing with reused materials, said Strain. The design needs to be adaptable as new reclaimed materials become available or expected ones go away.

Ultimately, "well over 90 percent of the old buildings, by weight, were reused," said Driscoll.

Interior of library building with salvaged wood ceiling paneling.

"WELL OVER 90 PERCENT OF THE OLD BUILDINGS, BY WEIGHT, WERE REUSED."

— Ted Driscoll, Town Councilmember

MULTI-PRIME CONTRACTS CAN HELP MANAGE COSTS

From a contractual standpoint, deconstruction and onsite reuse can be challenging to execute. For the Town Center, deconstruction required three separate contractors—an abatement contractor to remove materials contaminated with lead paint, a deconstruction contractor to dismantle and stockpile the salvageable materials, and a demolition contractor to remove what was left.

The project team initially put the demolition contract out to bid beforedoing the abatement and deconstruction work. The bids came back higher than anticipated, in part because the bidding contractors didn't know how much material would be removed during deconstruction.

"Sometimes the demo guy doesn't know what the salvage guy is going to take out," said the project's construction manager, C.R. Hodgson of TBI Construction and Construction Management. "Sometimes the salvage guy takes out a lot and sometimes not."

The town decided to hold off on awarding the demolition contract, and Hodgson began looking for ways to hold down costs. The project's multiple prime contract structure proved to be an effective means of cost control.

In such a structure, each contract can be let out to bid

individually rather than all at once. This allowed Hodgson to stagger the bids on the abatement, deconstruction, and demolition work. The abatement work was carried out first to remove contaminated material. This made the subsequent deconstruction work easier and reduced its cost.

Even so, Jeff Roldan of Roldan Construction, the selected deconstruction contractor, said that "it was difficult to bid because a lot of the materials were hidden. It's hard to guarantee. During bidding, I was concerned about covering our hours because deconstruction was not something we had historical data for."

After Roldan completed deconstruction and the demolition contract was rebid, the bidding contractors could see how little of the buildings remained. Thus, they were able to provide more accurate—and significantly lower priced—bids.

The multi-prime contract structure also provided flexibility when sourcing off-site reclaimed materials. If desired materials like the redwood siding were not available at a given time, the construction manager would postpone bidding out that portion of work until an adequate source was located. This ability to "shop around" saved money and produced a higher quality end result. For each material sourced off site, Strain listed several possible suppliers in the specifications. For some materials, Hodgson also used the Internet to find additional sources.

Salvaged wood from old town center buildings being reworked by Reuseable Lumber.

"IT WAS DIFFICULT TO BID BECAUSE A LOT OF THE MATERIALS WERE HIDDEN."

— Jeff Roldan, deconstruction contractor

CONSTRUCTION PROCESS CHARACTERIZED BY CREATIVE PROBLEM SOLVING

On a typical construction project, if you underestimate how much of a material you need, you can buy more. But it's not always that easy when building with reclaimed materials. Some salvaged wood, for example, has a unique look that can be difficult and expensive to match if the original supply runs short.

For the Portola Valley team, the potential for shortages was amplified by the fact that the deconstruction specification was written so early in the design process. Fortunately, Hodgson was extremely proactive in working with the contractors to find solutions when problems arose.

In one instance, when a contractor ran short of the salvaged Douglas fir he was using as trim for highly visible windows, his instinct was to make up the remainder with new fir. But when Hodgson got wind of the shortage, he remembered that metal roofing panels had been shipped to the site in crates made of fir. The crates, which were still on site, were disassembled, de-nailed, and cut to size for the window trim. The crate wood matched the salvaged wood trim that was already in place so well that the architect didn't notice the change until Hodgson pointed it out.

During the course of construction, the quest to reuse materials became almost competitive, recalls Driscoll. "I'd show up and the contractor or superintendent on the project would say they had to take down a tree but saved it for reuse. Everyone got into it," he said. "It was like they were trying to one-up each other a little bit."

For certain design elements, mock-ups were used to evaluate salvaged material options. For example, the architect originally requested that 20-foot long boards be used to create interior wall and ceiling paneling. However, Reusable Lumber Company, which was doing the milling, wasn't able to obtain 20-foot boards from the available salvaged wood.

Hodgson then requested samples of shorter boards in order to build a mock-up. He also requested "worst-case scenario" samples from the milling contractor, in order to prepare the architect and client for the unpredictable look that can sometimes result when using salvaged materials. The mock-ups, which went through a series of iterations, allowed everyone to visualize what the paneling would look like before it was installed.

A PLACE TO BE PROUD OF

The project achieved Platinum certification, the highest rating available from the LEED for New Construction Green Building Rating System. Among the LEED credits it achieved were Materials and Resources (MR) 3.1 and 3.2, two resource reuse credits that are rarely attained by LEED certified buildings. The Portola Valley Town Center earned them thanks to its extensive use of reclaimed wood and other salvaged materials.

Strain estimated that approximately 25 percent, in board feet, of the wood used to build the Town Center was reclaimed. Overall, reclaimed materials accounted for 14 percent of the total materials cost, well over the 10 percent threshold required for achieving the MR 3.1 and 3.2 credits. In fact, Strain noted that it was easier to achieve this credit than some of the other materials and resources credits.

After the project was completed, Strain continued to analyze its impacts in an effort to understand and demonstrate the power of material reuse to significantly reduce a building's carbon footprint. Using the U.S. EPA's WAste Reduction Model (WARM), a tool that calculates the greenhouse gas emissions savings of waste management practices, Strain determined that the project's use of salvaged lumber saved 24.8 tons of carbon over the purchase of new lumber.

Pulverizing the old buildings' concrete foundations and reusing the crushed concrete as site fill and road cover saved 11.7 tons of carbon by eliminating many truck trips to and from the site.

Town staff now use the project to encourage residents and local businesspeople to include more deconstruction and reuse in their construction projects. "When people come to the town and say, 'I don't really think it's a good idea to deconstruct my house in a sustainable way and reuse it,' the person behind the desk can say we did it and got a really nice building out of it," said Driscoll.

In fact, it's much more than a nice building. Portola Valley's Town Center exemplifies a civic center at its best: it's a place that brings people together and showcases the values of the community.

New libary building with salvaged redwood siding and Alaskan Yellow Cedar sunscreen louvers.

p. 21, 24 Photos: © 2009 Cesar Rubio
p. 22 Photo: Courtesy Siegel & Strain

LESSONS LEARNED

MAKE MOCK-UPS
Budget for mock-ups. Use them to resolve unexpected problems and help the team evaluate design decisions related to reused materials.

BE FLEXIBLE
Be willing to adjust certain design elements to accommodate special characteristics of salvaged materials, such as available board lengths. This flexibility makes it easier for contractors to source salvaged materials in sufficient quantity and quality.

THINK REUSE FROM THE START
Committing to reuse early in the design process allows time to gain team and community acceptance for salvaged materials.

ONE STEP AT A TIME
Consider phasing in abatement, deconstruction and demolition to allow for more accurate bids. More clarity about the structure and materials can help reduce the fear of unforeseen field conditions that tend to trigger large cushions within bids.

BID BETTER
Consider contract structures, such as multiple prime contracts, that can provide flexibility in the bid process and facilitate deconstruction and reuse.

IDENTIFY REUSE CHAMPIONS
Make sure the project has leaders—like the Town Center's construction manager—who embrace the project's reuse goals and help the entire construction team accomplish them.

PLAN FOR SHORTFALLS
Anticipate potential shortages of reclaimed materials and identify additional sources or alternatives before you need them.

FIND COMMON GROUND
Tap into the community's values. Reusing the old Town Center's building materials conveyed that the town respects its people, its past, and the planet.

LEARN MORE

ABOUT THE PORTOLA VALLEY TOWN CENTER
portolavalley.net/index.aspx?page=102

AIA COTE TOP TEN CASE STUDY
aiatopten.org/hpb/overview.cfm?ProjectID=1322

GORING & STRAJA ARCHITECTS
gasarchitects.com

SIEGEL & STRAIN ARCHITECTS
siegelstrain.com

TOWN OF PORTOLA VALLEY C&D WASTE ORDINANCE
portolavalley.net/Modules/ShowDocument.aspx?documentid=549

"WE DID IT AND GOT A REALLY NICE BUILDING OUT OF IT."

— Ted Driscoll, Town Councilmember

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
6x10 dimensional lumber	Beams	Beams	On-site	On-site	400 Ln ft 2,000 Bd ft	Faces resawn
2x6 Douglas Fir	Roof Decking	Interior paneling	On-site	On-site	3,650 Bd ft	Milled
2x6 Douglas Fir	Roof Decking	Ceiling paneling	On-site	On-site	8,220 Bd ft	Milled
Glu-lam beams	Beams	Countertops	On-site	On-site	150 Sq ft	Milled
Blue-gum Eucalyptus trees	Trees	Wood flooring	Offsite	Portola Valley, CA	2,635 Bd ft	Milled
Redwood		Exterior siding	Offsite, vendor: McMullin Lumber	Crescent City, CA	11,914 Bd ft	Milled
Alaskan Yellow Cedar		Sunscreen louvers	Offsite, vendor: Bear Creek Lumber	Winthrop, WA	2,660 Bd ft	Milled
12” – 16” Alder trees	Trees	Cladding for steel columns	On-site	On-site	54 Ln ft	Cut-to-size
Concrete & CMU		Site fill, road base rock	On-site	On-site	2,770 Tons	Crushed

Civic

MATERIALS TESTING FACILITY

Photo: Courtesy of Busby Perkins+Will

Civic

MATERIALS TESTING FACILITY

Photo: Courtesy of Busby Perkins+Will

Civic

MATERIALS TESTING FACILITY

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Vancouver Materials Testing Facility

LOCATION
Vancouver, BC, Canada

YEAR COMPLETED
1999

PRIMARY USE
Public order & safety, Laboratory

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$550,000 CDN

SIZE
4,284 Sq ft

CLIENT/OWNER
City of Vancouver

ARCHITECT
Busby + Associates (now Busby Perkins+Will)

CONTRACTOR MANAGER
Ken King & Associates

STRUCTURAL ENGINEER
Fast + Epp

MEP
Keen Engineering (now Integral Group)

CLIENT'S PROJECT MANAGER
David Desrochers

MATERIALS TESTING FACILITY SHOWS THE SURPRISING BEAUTY OF WASTE

The City of Vancouver runs its own advanced asphalt manufacturing plant that makes new asphalt as well as recycling old asphalt from the city's roads. The Materials Testing Facility provides lab spaces and offices for a small group of engineers who develop customized asphalt mixes for a range of applications.

When the time came to build a new testing facility, the city initially planned to erect a pre-engineered structure. Architect Peter Busby of Busby + Associates proposed an alternative: creating a new building out of old materials. Not only did reuse offer environmental benefits, it seemed appropriate for a client committed to reuse and recycling in their own work. An integrated project team of the client's project manager, architect, contractor, and structural and MEP (mechanical electrical and plumbing) consultants treated the project as an opportunity to experiment with material reuse and provide the city with an inspirational model of green building. The project ultimately included a wide diversity of reused finishes, structural members and MEP equipment. There was initially some discomfort among the lab's employees about the decision to build the new facility out of reclaimed materials. But the final product convinced the staff that they were not going to work in a "garbage building," as project manager David Desrochers put it, but in a "beautiful building built of garbage."

Office with beams and wood flooring from salvaged glulam.

"I'M SURE WE COULD HAVE DONE A PRE-FAB THAT NO ONE WOULD HAVE BEEN PROUD TO WORK IN, FOR CHEAPER, BUT IT WOULD HAVE BEEN NOWHERE NEAR THE QUALITY WE GOT AT THAT PRICE WITH REUSE."

— David Desrochers, client's project manager

DESIGN FOR REUSE HIGHLIGHTS

— The project site had several wood warehouses slated for removal. Busby and structural engineer Paul Fast of Fast + Epp visited the site to identify potential materials. Together, they selected timber trusses, glulam beams and roof decking.

— Most of the project team came on board during the pre-design phase. Such early involvement allowed reused materials and equipment to shape the design. For example, Fast + Epp worked with Busby + Associates to modify heavy timber trusses from the original building to create a span adequate for the new building. Highest quality individual pieces from all original trusses were swapped in as needed to create the two trusses used.

— Mechanical engineer Kevin Hyde of Keen Engineering obtained surplus heaters, air conditioners and plumbing systems from other job sites in the city. He sourced lighting fixtures and piping from more traditional salvage sources.

— The team based its design on materials they saw in local salvage yards. Uncertain of the availability of the reclaimed materials, contractors initially submitted high bids based on using new materials. In response, the client purchased most of the reclaimed materials and furnished them to the contractors for installation.

— The high initial bids also led the team to switch from a fixed tender to a multiple prime contract structure with a construction manager. The construction manager, Ken King & Associates, sent components out to bid only when the materials were identified and if necessary, refurbished.

— The client wanted a double-glazed curtain wall with a warranty. The architects wanted to accommodate this request and still incorporate reclaimed wood and glass. They found a contractor who agreed to fabricate double-glazed glass pieces out of used, single-glazed windows *and* provide a warranty.

— Reused materials include heavy timber trusses combined to create new trusses, glulam beams transformed into floor decking, and surplus gas-fired HVAC units.

— A third-party examiner calculated that over 80 percent of the materials in the facility are reclaimed.

LESSONS LEARNED

BID BETTER
Consider contract structures, such as multiple prime contracts, that can provide flexibility in the bid process and facilitate reuse.

DON'T FORGET ABOUT MEP
Reclaimed MEP equipment can be tricky because older equipment is often less efficient. But sometimes other construction projects have good quality heating units and other equipment that is headed for the junk pile—either new products that were misordered or lightly used equipment that's no longer needed. Passive equipment such as piping is often fine to reuse.

CHANGE THE CODES
During construction, the electrical inspector noted that the building code required new electrical devices. The reclaimed electrical devices were CSA rated (equivalent of an American UL rating) and fully functional. Busby met with the City to seek a resolution. Within a week, the code was rewritten to allow "new or used" electrical devices.

MAKE STRUCTURAL CONSTRAINTS WORK FOR YOU
Fast + Epp often found clever solutions around the structural constraints of reclaimed materials. Unsure about the structural integrity of the glulam beams, they used many of them as flat 5" thick finished floor decking. Not only did they avoid relying on the glue for structural strength, the thickness of the deck also satisfied the municipal code's fire separation requirements.

ENGAGE THE ENTIRE TEAM IN REUSE
Working together from the start can allow all project stakeholders—the client, architect, contractor and structural and MEP consultants—to play meaningful roles in the reuse process.

LEARN MORE

BUSBY PERKINS + WILL
busby.ca

CASCADIA GREEN BUILDING COUNCIL, CASE STUDY
cascadiagbc.org/resources/case-studies/COVTestingcenter-casestudy.pdf

DESIGN FOR DECONSTRUCTION, CASE STUDY
design4deconstruction.org/pdf/MaterialsTestingFacility.pdf

FAST + EPP
fastepp.com

INTEGRAL GROUP
integralgroup.com

"THE MANAGER OF THE DEPARTMENT WAS DEAD-SET AGAINST THE CONCEPT OF REUSE, FEARING THE WORST… BUT ON THE DAY IT OPENED HE AGREED THE PROJECT WAS SPLENDID AND A GREAT NEW HOME FOR HIS TEAM."

— Peter Busby, architect

p. 31 Photo: Courtesy Busby Perkins+Will

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Heavy timber trusses	Trusses	Trusses	On-site	On-site	5 Trusses	Reconfigured into 2 large trusses
Glulam	Beams	Joists	On-site	On-site	100 Beams	Cut-to-size
Glulam	Beams	Wood flooring	On-site	On-site		Milled
2x6 tongue & groove lumber	Roof Decking	Roof decking, sheathing, exterior windows	On-site	On-site	30,000 Sq ft	N/A
2x4 dimensional lumber	Framing	Framing	Off-site, vendor	Vancouver, BC		Cut-to-size
Doors	Doors	Doors	Off-site, vendor	Vancouver, BC		Refinished
Glass panels	Various	Curtain wall	Off-site, vendor	Vancouver, BC		Cut-to-size, thermally broken
Plywood	Formwork	Sheathing	Off-site, vendor	Vancouver, BC		Cut-to-size
Interior lighting	Interior lighting	Interior lighting	Off-site, vendor	Vancouver, BC		
Water closets	Water closets	Water closets	Off-site, vendor	Vancouver, BC		Retrofitted
Steel pipes	Piping	Piping	Off-site, vendor	Vancouver, BC		
Fuel-fired heaters	N/A	Fuel-fired heaters	Off-site, construction surplus	Vancouver, BC		
Air handling equipment	N/A	Air handling equipment	Off-site, construction surplus	Vancouver, BC		
Exhaust hoods	N/A	Exhaust hoods	Off-site, construction surplus	Vancouver, BC		

EDUCATION

Education

“THERE ARE PROBABLY A LOT OF PEOPLE WHO ARE USING RECLAIMED MATERIALS BECAUSE OF THE STORY THEY TELL AND THE TEXTURE AND THE VIBRANCY THEY BRING TO A SPACE ”

—Iris Amdur, consultant, Sidwell Friends Middle School

Successful green schools do more than conserve energy ; they help advance sustainability on a broader level by creating environments that are more conducive to learning and more harmonious with nature. By integrating sustainable features that are visible to their users, the buildings become learning tools that increase environmental literacy in the community. Material reuse figures prominently into the green schools featured in this section. Chartwell School uses reclaimed materials to play to the strengths of their students who have language learning differences and respond better to visual cues. At Sidwell Friends Middle School, reclaimed materials tangibly communicate the school’s commitment to social responsibility through action. For the University of Texas Health Science Center’s School of Nursing and Student Community Center, material reuse contributes to the school’s vision of a nurturing building. Together, the projects illustrate how reclaimed materials can provide a meaningful and highly visible statement of educational and environmental stewardship.

Education

CHARTWELL

Photo: Michael David Rose / MDRP.NET

Education

CHARTWELL

Photo: Michael David Rose / MDRP.NET

Education

Education

CHARTWELL

Photo: Michael David Rose / MDRP.NET

Education

CHARTWELL SCHOOL

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Chartwell School

LOCATION
Seaside, California

YEAR COMPLETED
2006

PRIMARY USE
K-12 education

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$9.2 million

CERTIFICATIONS
LEED-NC Platinum, CHPS (Collaborative for High Performance Schools) Designed

AWARDS
CHPS 2007 Green Apple Award, 2007 U.S. EPA Pacific Southwest Environment Award

SIZE
21,200 Sq ft

CLIENT/OWNER
Chartwell School

ARCHITECT
EHDD Architecture

CONTRACTOR
Ausonio, Inc.

STRUCTURAL ENGINEER
Tipping Mar + Associates

DECONSTRUCTION CONSULTANT
Brad Guy

DECONSTRUCTION CONTRACTOR
Paul T. Beck Contractors (On-site Asphalt); Fort Ord Reuse Authority and John Stephens (lead-based paint removal)

CREATING BUILDINGS THAT TEACH

At Chartwell School, you won't find educational signs explaining the campus's green features. The buildings themselves teach the students about sustainability. The motivation behind this was due in part to the unique educational needs of the school's student body. Chartwell is an independent school on California's Monterey Peninsula that serves first through eighth graders with language-related learning differences such as dyslexia.

Douglas Atkins, the school's executive director, describes Chartwell's students as bright learners "who have relative strengths in visual and spatial problem solving and are relatively weak at print learning." At the school's new campus, completed in 2006 at Fort Ord, a decommissioned U.S. Army base, students are surrounded by building materials and exposed systems that serve as hands on educational tools. Oral and visual narratives, Atkins believes, have the power to engage students and make environmental values more real to them.

Atkins envisioned the new campus as a place that would foster the development of "sustainability natives," children who grow up with the idea of sustainability as second nature. And so he directed the project team to create the greenest campus possible—with healthy, daylit buildings that generate much of their own electricity and make the most of beautiful salvaged wood.

Naturally, there are stories behind all that salvaged wood. The redwood bench tops in the courtyard were fashioned from deconstructed trestles that once supported railroad bridges in Sacramento. The campus's two buildings—a multi-use building and a classroom building—are clad inside with Douglas Fir salvaged from barracks disassembled at Fort Ord. The exterior cladding comes from old-growth redwood from dismantled wine and olive oil tanks. When the school's builders were first working with the wood, they could still smell the wine, although by now the fragrance is long gone.

Inside the buildings, beams, roof joists and other framing components were left exposed so that students can see how the structures were put together and how, someday, they might be taken apart and their materials reused. In fact, both buildings were deliberately designed for disassembly. Compared with a conventional building, they should be easier to dismantle in whole or in part. The idea following that in the future the buildings can be readily adapted for different uses and their components reused.

PROJECT TEAM DOES THEIR HOMEWORK

Chartwell selected EHDD Architecture in San Francisco to design the project, due to their strong background in school design and sustainable design. The school provided the architectural team with an "envisioning report" that the school administration alongside a board of experts had produced to articulate the school's needs and hopes for the new campus.

Scott Shell, Principal at EHDD, brought Brad Guy onto the project team. Guy is a leading researcher in deconstruction and design for disassembly (DfD). Design for disassembly is still an emerging technology and at the time, wasn't common practice in the building industry. But Shell and Guy thought the concept held promise for Chartwell: should the school's needs change in the future, DfD would make it easier to adapt and update the spaces and infrastructure. The DfD strategy also reinforced the school's commitment to sustainability.

Shell and Guy brought the DfD idea to Atkins who embraced it. Together, they applied for the U.S. EPA's Waste Reduction grant. This grant--a little over $29,000--allowed the design team, working with Timonie Hood at the EPA's Region 9 office, to conduct an in-depth analysis of material choices and research "design for disassembly" concepts.

Over the course of his career, Shell has worked on many school renovations that resulted in considerable waste because components like windows and wood framing weren't designed or installed in a manner that allowed for easy replacement. Shell believes much of this waste could be avoided if design for adaptation or disassembly were standard practice among architects.

For Chartwell School, the DfD research process began with a look at construction materials that tend to be replaced most frequently, both in the short term and long term. The researchers explored how the design and detailing of specific materials and building components could allow for easy removal later on. The material choices allowed for minimal disruption to adjacent materials and systems, such as how old windows could be removed and new ones installed without affecting adjacent finishes and waterproofing.

The design team also calculated the total embodied carbon for all major building materials in the proposed design and performed a lifecycle assessment using ATHENA software to try to understand and minimize the environmental impacts of major materials.

The project research was published in a report funded by the EPA grant, "Design for Deconstruction," which documents the design team's process of creating mock-ups, testing scenarios, researching local resources, and analyzing the climatic impacts of material choices.

Exterior walkway with view to reclaimed redwood siding.

AN EPA GRANT ALLOWED THE PROJECT TEAM TO RESEARCH MATERIAL CHOICES AND DESIGN FOR DISASSEMBLY CONCEPTS.

DESIGNING A BUILDING THAT CAN BE UNBUILT

The lifecycle assessment contributed to the choice of wood for the structural frame as well as exterior siding and interior paneling. Although the school was built with a large amount of wood, the design team employed a number of strategies to use the material efficiently and facilitate future reuse. In addition to reusing old wood for finishes and furnishings, they utilized advanced framing strategies, including framing 24 inches on center, which uses less wood than the more conventional 16 inch on center framing.

Reducing the overall amount of structural wood saved the school money, which freed up funds to specify Forest Stewardship Council (FSC) certified wood for all the framing lumber; a sustainably forested wood, FSC certified wood often costs more than conventional lumber.

"Design for disassembly" figured prominently in the construction process, although, in retrospect, the concept could have been communicated more clearly to the contractor in early team meetings and in the construction specifications. Joseph Piedimonte, Ausonio's CFO/project manager, recalls that when his crew started framing lumber and roughing in electrical and plumbing

Atkins happened to be on site. Atkins halted the work and pointed out that by not drilling into the framing lumber, it would be easier to reuse in the future and would preserve its quality and value. Ausonio's team instead routed over fifteen miles of conduit around the framing.

To preserve the integrity of the high quality reclaimed wood used for the interior paneling, the team utilized fastener systems instead of screws or nails that can damage the wood. Wherever possible, connections between materials were simplified to facilitate deconstruction, and larger structural members were chosen over smaller ones to reduce the number of attachments. In addition, the roof is constructed of energy-efficient structural insulated panels (SIPs) that can be readily removed as individual units and reused elsewhere.

Classrooms clad with reclaimed redwood siding.

A NEW HOME FOR OLD WOOD

Atkins, EHDD, and Ausonio all played a role in locating salvaged wood for the project, with the client and architect approving all material samples. Most of the reclaimed wood was purchased from TerraMai, a supplier that the architects had dealt with previously. Working with a large reclaimed-wood specialist made it easier to obtain the materials needed to meet project specifications and reduced the need to store materials on site. Wood that needed to be stored on site was kept outside and protected under plastic sheeting.

The U.S. Army Engineer Research and Development Center had worked with local contractors to deconstruct numerous wooden buildings on the former army base. Atkins wanted the new campus to include some of that wood both to reduce the project's carbon footprint and help keep the site's history alive. Unfortunately, much of the wood was coated with lead-based paint. Using funds from the EPA grant, the team was able to work with the Fort Ord Reuse Authority and John Stephens who had developed a mobile, on-site system for removing lead-based paint.

Ultimately, only about 800 board feet of vertical grain Douglas fir from the old barracks was used for interior paneling because its availability did not coincide with Chartwell's construction schedule.

TerraMai provided the remainder of the fir paneling, which had previously been the floor of the former Esprit company headquarters in San Francisco.

In one of the most visually striking examples of reuse, a Monterey Cypress tree trunk, found already cut down in an arborist's yard and sourced through Urban Lumber Jacks, was turned into a 12-foot tall structural column in the atrium entrance to the classroom building.

FIR FOR INTERIOR PANELING CAME FROM THE DECONSTRUCTED BARRACKS AT FORT ORD AND THE FORMER ESPRIT HEADQUARTERS IN SAN FRANCISCO.

RIPPLE EFFECTS OF REUSE

Chartwell School was the first complete educational campus to be awarded LEED-NC Platinum certification from the U.S. Green Building Council. The project's use of reclaimed materials earned it both LEED credits for resource reuse (MR 3.1 and 3.2), as well as the regional materials credit (MR 5).

The project also earned the certification from the Collaborative for High Performance Schools and was honored with the California Governor's Economic Leadership Award. In addition, the Chartwell School project and its Design for Deconstruction report helped inspire the EPA's Lifecycle Building Challenge, a competition that honors innovative projects and ideas related to "design for disassembly."

The design and construction process benefited from highly qualified team members who were committed to the project's sustainability goals. At EHDD Architecture, sustainability continues to be a leading principle. They have applied the lessons learned on Chartwell School to subsequent projects, particularly material efficiency and design for disassembly.

Although the general contractor, Ausonio, Inc., had never previously worked on LEED or green building projects, Chartwell School took them in a new direc-

tion. The company has since worked on a number of LEED Platinum projects, has been hired as green building consultants and green general contractors, and has used design for deconstruction principles on subsequent projects.

For Chartwell's students, administrators, faculty and wider constituencies, the new campus embodies the community's dual commitments to care for the environment and help children achieve their full potential.

Redwood benches with wood from railroad bridges.

p. 46 Photo: Michael David Rose / MDRP.NET

LESSONS LEARNED

DO YOUR HOMEWORK—AND WRITE IT DOWN
When embarking on groundbreaking projects with few precedents, do thorough research and analysis. Make mock-ups when appropriate. Document and publicize research, methods and results, like the Chartwell team did with their Design for Deconstruction report, to help others follow in your path.

TAKE THE LONG VIEW
Give future generations a break and do your part to ensure that the reclaimed materials you are using today will still be usable 50 or 100 years down the line. At Chartwell School, fasteners were used to hang the interior paneling without nails or screws, protecting the quality of the old-growth Douglas Fir.

COMMUNICATE EARLY, COMMUNICATE OFTEN
Designing for disassembly and building with reclaimed materials aren't standard practice in the building industry. Early and frequent communication about the project's goals, methods and materials allows for a more collaborative approach and reduces costly mistakes.

CONNECT DESIGN AND VALUES
The most successful green buildings do more than conserve resources. They express the client's hopes for the future. At Chartwell School, the reclaimed materials, design for disassembly and other green building elements speak to the priority placed on creating interactive learning environments and building a sustainable future.

SAY YES TO SUSTAINABLE SCHOOLS
School administrators and boards can sometimes be risk averse, notes Atkins, and can shy away from building green because they fear it will cost more. But Chartwell's new campus—an extraordinary place that significantly advanced the school's mission and elevated its stature—came in 15% under the cost of average school construction in California, Atkins said.

LEARN MORE

AIA COTE TOP TEN CASE STUDY
aiatopten.org/hpb/overview.cfm?ProjectID=1385

AUSONIO, INC.
ausonio.com

CHARTWELL SCHOOL
chartwell.org

DESIGN FOR DECONSTRUCTION REPORT
chartwell.org/UserFiles/File/Design_for_Deconstruction.pdf

EHDD ARCHITECTURE
ehdd.com

EPA LIFECYCLE BUILDING CHALLENGE
lifecyclebuilding.org

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Old growth redwood	Wine barrels	Fascia board, interior paneling	Offsite, vendor: Terra Mai	California	5850 Bd ft	Milled
Clear grain Douglas-fir	Wall paneling & soffits	Fascia board, interior paneling	Offsite, vendor: Terra Mai	San Francisco, CA	2850 Bd ft	Milled
Old growth redwood	Wine and olive storage barrels	Exterior siding	Offsite, vendor: Terra Mai	Various locations, CA	1171 Bd ft	Milled
Vertical grain Douglas-fir	Flooring	Millwork	Offsite, vendor: Crossroads Lumber		68 Sq ft	Milled
100-year-old Douglas-fir	Framing studs from old barracks at Fort Ord	Interior paneling	Onsite, vendor: Pacific Heritage	Seaside, CA	800 Bd ft	Lead paint abatement, Milled
Clear all heart redwood	Wood trestle from railroad bridge	Millwork	Offsite, vendor: Reclaimed Wood Products Company	Sacramen-to, CA	50 Pieces	Milled
Redwood			Offsite, vendor: Hayward Lumber		398 Bd ft	Milled
Asphalt	Paving	Foundation sub base	On-site	On-site	1385 Cu yd	Crushed
Eucalyptus tree	Tree	Wood framing	Offsite, vendor: Urban Lumber Jacks	Salinas, CA	1 Tree	Refurbished

Education

SIDWELL

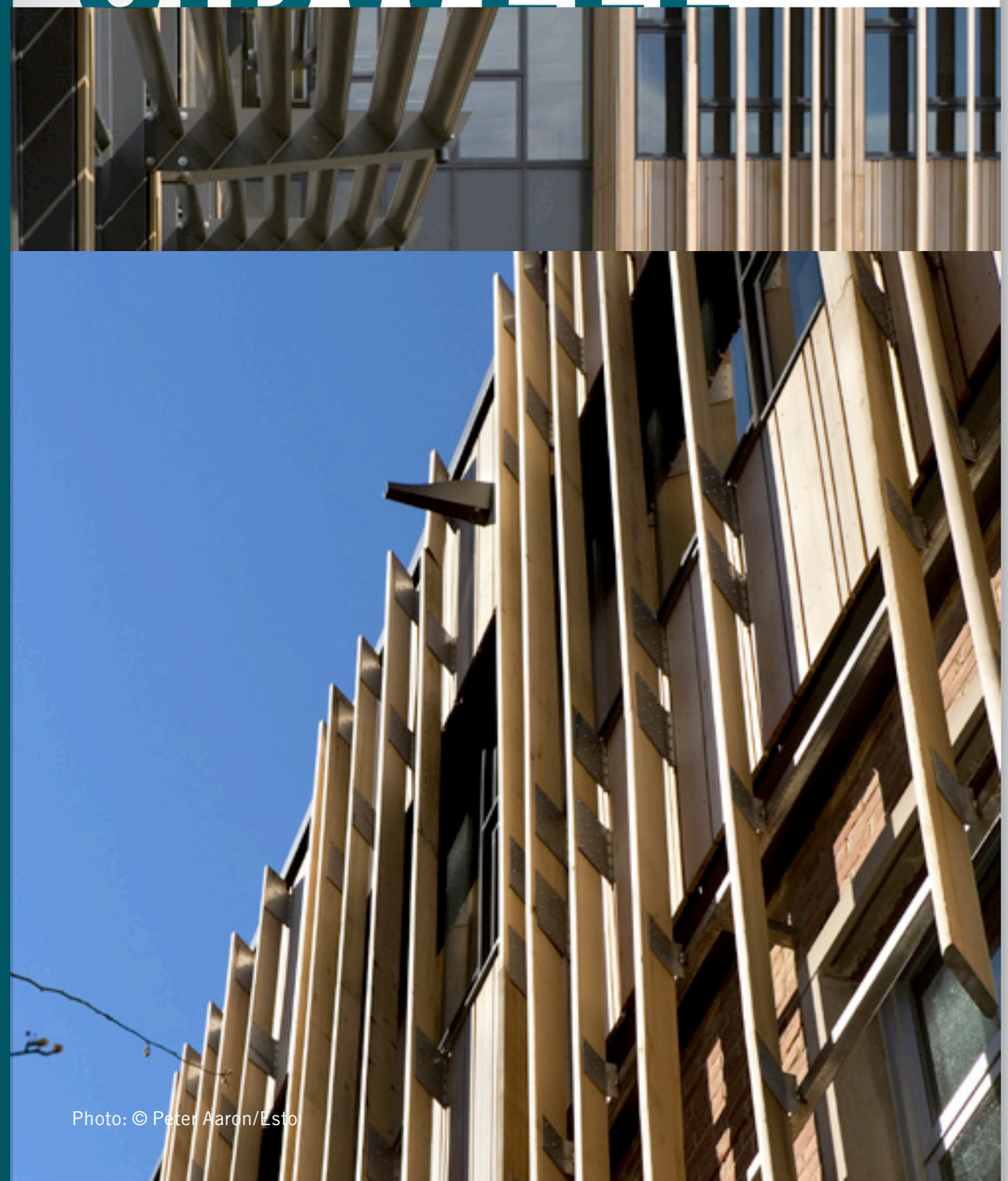


Photo: © Peter Aaron/Esto

Education

SIDWELL

Photo: © Peter Aaron/Esto

Education

SIDWELL FRIENDS SCHOOL

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Sidwell Friends Middle School

LOCATION
Washington, D.C.

YEAR COMPLETED
2006

PRIMARY USE
K-12 education

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$28 million (includes central plant)

CERTIFICATIONS
LEED-NC Platinum

SIZE
72,500 Sq ft

CLIENT/OWNER
Sidwell Friends School

ARCHITECT
KieranTimberlake

CONTRACTOR
HITT Contracting Inc.

STRUCTURAL ENGINEER
CVM Engineers

SUSTAINABILITY CONSULTANT
GreenShape LLC, Integrative Design Collaborative

REUSE CONSULTANT
Armster Reclaimed Lumber Company, CitiLogs

FABRICATOR
Symmetry Products Group, Loewen Windows

SIDWELL FRIENDS SCHOOL BUILDS A BEACON OF ENVIRONMENTAL STEWARDSHIP

Sidwell Friends School is a private pre-K through12th grade institution in Washington, D.C. founded in 1883 on Quaker principles. As a prominent institution—and alma mater to several children of U.S. presidents—the school embraced the opportunity to boldly promote sustainability in the design of their Middle School Building's renovation and addition. Drawing upon the Quaker values of environmental stewardship and social responsibility through action, the school set the ambitious goal of achieving LEED NC Platinum certification. It ultimately became the first LEED Platinum K-12 building in the country.

The project scope consisted of renovating the 55-year-old, 33,500-square-foot building and constructing a 39,000-square-foot addition. Material reuse provided a prominent unifying element, aesthetically linking the exteriors of both wings through a reclaimed cedar panel system of vertical fins that protect the interior spaces from excessive heat gain. Reclaimed greenheart, a durable tropical hardwood, flows from the outside decking to the floor of the entry lobby, linking the natural environment outdoors to the learning environment inside.

From the outset, the Middle School building was intended to serve as a learning tool. Through integration of environmental sustainability lessons into the curriculum and green building tours offered to the public, the project educates students and others about environmental building practices. Reclaimed materials form an important part of this story, providing a tangible statement of the school's commitment to sustainability.

"THE USE OF RECLAIMED MATERIALS IN HIGHLY VISIBLE AREAS WAS VERY SUCCESSFUL IN THAT IT REALLY DRAWS PEOPLE IN AND GETS THEM EXCITED ABOUT GREEN BUILDING."

— Mike Saxenian, client

DESIGN FOR REUSE HIGHLIGHTS

— The architect, KieranTimberlake, collaborated with sustainability consultant GreenShape and the client to generate an overall material strategy that balanced conceptual and aesthetic desires with LEED Platinum requirements.

— The design team deliberately used reclaimed materials in highly visible applications, such as the wood panel façade, to emphasize connections to local habitat and demonstrate the school's dedication to environmental stewardship.

— Armster Reclaimed Lumber Company joined the team early, during the design development phase. They offered insight into available types and sources of reclaimed wood as well as provided samples and mockups that played a significant role in detailing. KieranTimberlake originally designed the cedar fins to be 7/8" thick, but at Armster's suggestion, they decreased the thickness to ¾" to reduce cost and waste.

— The bidding process for reclaimed lumber was a "sole sourcing" arrangement, with Armster Lumber as the designated supplier. Armster assumed responsibility for procurement, storage, and transportation of wood products to the site or the fabricator.

— Several subcontractors were hesitant to procure materials outside of their traditional sources. HITT Contracting was able to alleviate their concerns by purchasing certain reclaimed materials for the subcontractors' use.

— Reclaimed materials include 100-year-old Western red cedar from wine tanks that form the exterior fins on the façade, greenheart pilings from Baltimore Harbor that provide exterior decking and entry lobby flooring, and old Douglas fir bleachers that gain new life as window trim.

— Over 40,000 board feet of reclaimed wood was incorporated into the project. In total, reclaimed materials represented over 9% of the overall materials costs.

Window trim made from high school bleachers.

LESSONS LEARNED

START EARLY
By considering reuse early in the project, the team benefited from the insight of several consultants as the design developed. Klaas Armster of Armster Reclaimed Lumber Company said that the long time frame gave him and the architects time to work out solutions to potential challenges, such as the appropriate sizes for the façade fins.

BUILD REUSE RELATIONSHIPS
The project team's network of reuse experts—including GreenShape, Armster Reclaimed Lumber Company and CitiLogs—gave them valuable advice on reclaimed lumber that informed the design.

GET SAMPLES AND BUILD MOCKUPS
The design details and specifications benefited from an understanding of material types and qualities. Samples and mockups gave team members a better understanding of technical details, weathering, and how to achieve the team's desired aesthetic.

WASTE NOT
The salvaged greenheart pilings from Baltimore Harbor had to be ordered four to five months in advance to allow for adequate drying time. What's more, the team was cautioned that quantities yielded from milling could vary. These conditions led the contractor to be even more judicious than normal with the wood. According to Kimberly Pexton, HITT's Director of Sustainable Construction, they "didn't have the luxury of being wasteful."

KEEP LOOKING FOR WAYS TO REUSE
While most material reuse elements were incorporated into the design early, some materials like the Douglas fir window trim emerged during the construction documents phase. Armster found the fir, which was reclaimed from high school bleachers. The wood had drill holes every four feet where the bleachers had been bolted, but its history and look suited the project.

UNDERSTAND TRADE-OFFS
When considering a reclaimed material, be sure to understand both the short- and long-term costs. In some cases, the client paid a premium for the reclaimed wood materials; however, the durable wood will allow the client to avoid the cost and labor of constant upkeep.

SHOW IT OFF
Reclaimed materials are used to their best advantage when they are prominently featured. The materials relay the importance of sustainability to an institution by providing a strong visible (and often tactile) connection to the earth. Sidwell's sustainability-influenced curriculum and green building tours reinforce this connection and inspire those within the Sidwell Friends community and beyond. They also reinforce the school's role as an environmental steward.

LEARN MORE

ARMSTER RECLAIMED LUMBER COMPANY
woodwood.com

GREENSHAPE
greenshape.com

HITT CONTRACTING INC.
hitt-gc.com

KIERANTIMBERLAKE
kierantimberlake.com

SIDWELL FRIENDS SCHOOL, MIDDLE SCHOOL BUILDING
sidwell.edu/about_sfs/green-buildings/ms-green-building/index.aspx

USGBC PROJECT PROFILE
usgbc.org/ShowFile.aspx?DocumentID=3943

p. 54 Photo: © Peter Aaron/Esto

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Western Red Cedar	Wine tanks	Fins for exterior cladding	Offsite, vendor: Armster Reclaimed Lumber Co.	Erie, PA	30,000 Bd ft	Milled
Green Heart	Pilings in Baltimore Harbor	Exterior decking, interior flooring	Offsite, vendor: Armster Reclaimed Lumber Co.	Baltimore, MD	1,000 Sq ft	Milled
Green Heart	Pilings in Baltimore Harbor	Exterior decking, interior flooring	Offsite, vendor: Armster Reclaimed Lumber Co.	Baltimore, MD	2,000 Bd ft	Milled
Douglas-fir	High school bleachers	Exterior window trim, sills, and jam covers	Offsite, vendor: Armster Reclaimed Lumber Co.		6,000 Bd ft	Milled
Stone		Exterior masonry	Offsite, vendor: Paul W. Steinbeis-er Inc.			

SCHOOL OF

Photo: © Hester + Hardaway Photographers (www.PhotoGypsies.com)

Education

Education

SCHOOL OF

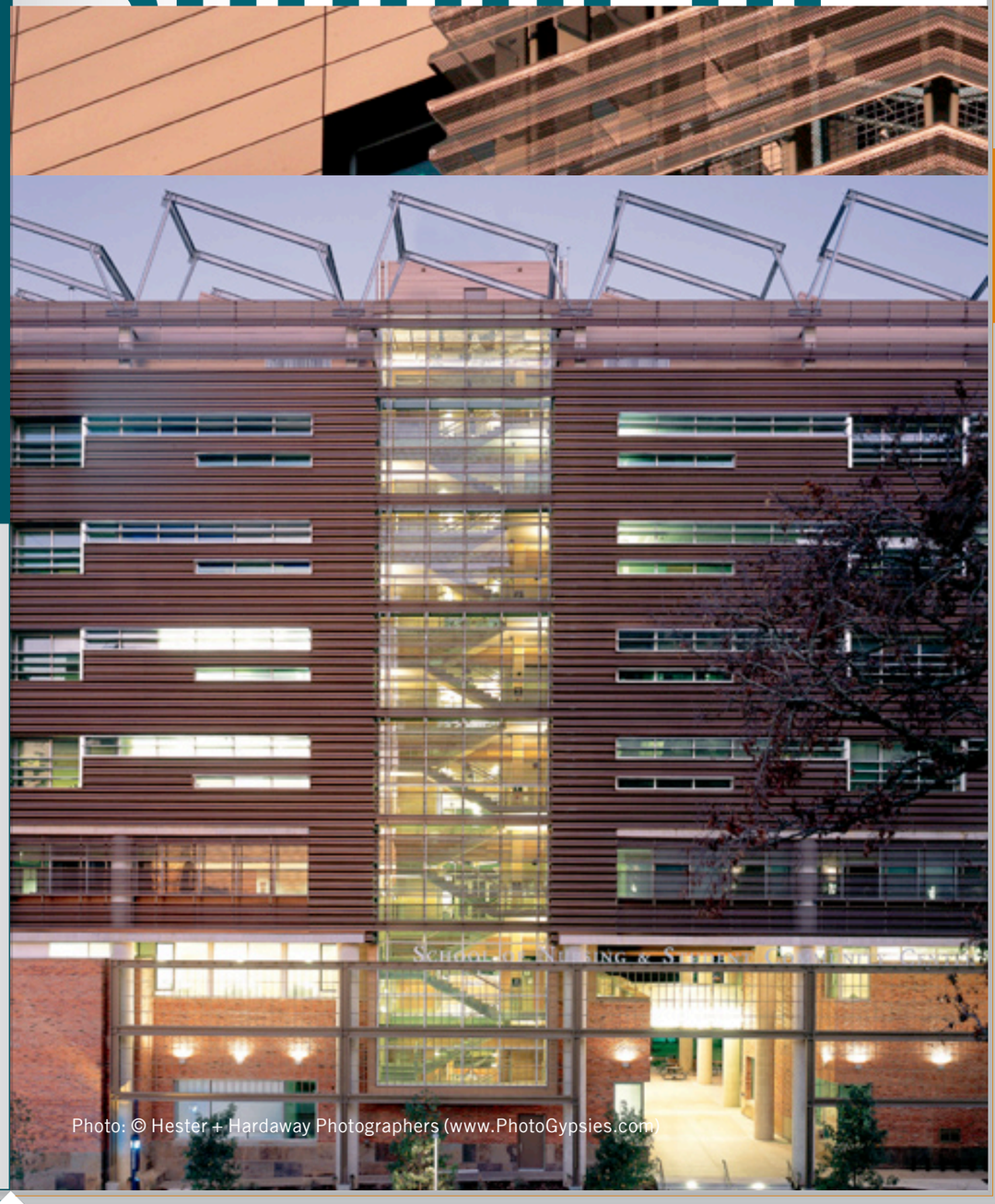


Photo: © Hester + Hardaway Photographers (www.PhotoGypsies.com)

Education

SCHOOL OF

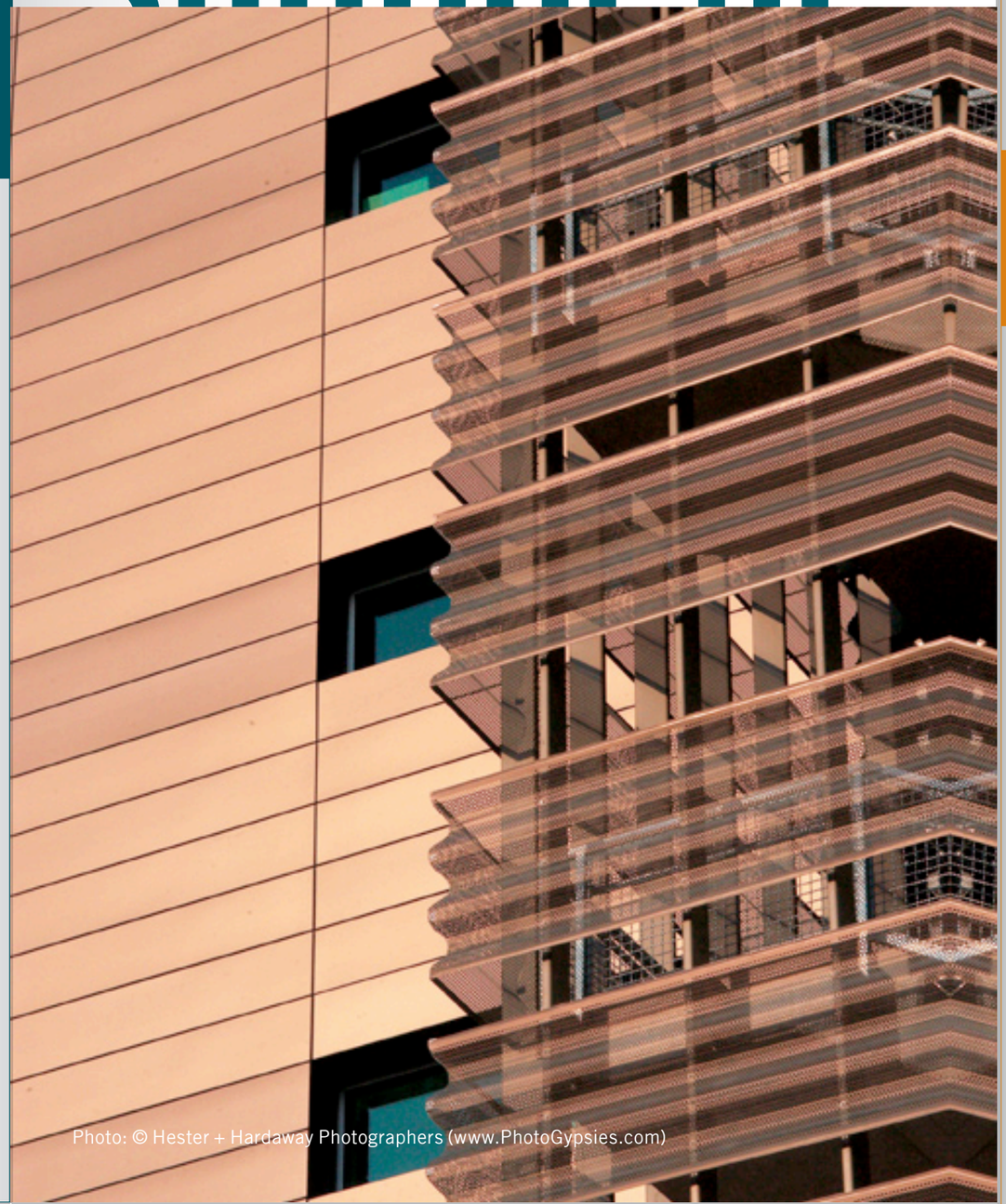


Photo: © Hester + Hardaway Photographers (www.PhotoGypsies.com)

SCHOOL OF NURSING

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
University of Texas School of Nursing & Student Community Center

LOCATION
Houston, TX

YEAR COMPLETED
2004

PRIMARY USE
Higher education, Laboratory

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$57 million

CERTIFICATIONS
LEED-NC Gold

SIZE
195,000 Sq ft

CLIENT/OWNER
University of Texas Health Science Center at Houston

ARCHITECT
BNIM and Lake | Flato Architects

STRUCTURAL ENGINEER
Jaster Quintanilla & Associates

SUSTAINABILITY CONSULTANT
Center for Maximum Potential Building Systems

DECONSTRUCTION CONTRACTOR
D. H. Griffin of Texas, Inc.

CONSTRUCTION MANAGER
Jacobs Vaughn

UNIVERSITY OF TEXAS BUILDS NURTURING FACILITY FOR ITS NURSING SCHOOL

For the University of Texas Health Science Center at Houston's new School of Nursing and Student Community Center, Dean Patricia Starck wanted a building that was "nurturing"—a building that would foster human well-being and be easier on the environment. Inspired by Dean Starck's vision, the project team committed to creating a sustainable building from the outset. From its classrooms to laboratories, the building acts as a learning tool. It teaches its users about sustainability both inside and out, according to architect David Lake of Lake | Flato Architects. Completed in 2004, this was the University's first LEED certified building.

Material reuse emerged as a strategy in the early design phases. An existing brick building onsite inspired the architectural team of BNIM and Lake | Flato to incorporate reclaimed brick into their design. The brick deconstructed from the original building was ultimately unsuitable for the new facility, but the team went on to source reclaimed brick as well as sinker cypress logs from regional sources. With the engaging variegated character of the brick and the deep rich coloring of the cypress siding, the façade sets the tone for a nurturing building where the next generation of caregivers is trained.

Reclaimed brick helps frame view to exterior courtyard.

"IT WAS A GREAT OPPORTUNITY TO SHOW HOW A RECLAIMED MATERIAL STRATEGY CAN HAVE APPLICATION IN A LARGE PROJECT, PARTICULARLY IN AN INSTITUTIONAL SETTING LIKE A UNIVERSITY."

— Gail Vittori, sustainability consultant

DESIGN FOR REUSE HIGHLIGHTS

— Several companies played a role in the reuse effort. The architects drafted the deconstruction specifications for the original building and sourced the sinker cypress logs (logged timbers that sank to the bottom of a river). Along with the Center for Maximum Potential Building Systems (CMPBS), the architects researched regional sources for reclaimed bricks.

— Though the architects had worked with reclaimed materials before, they had never written a deconstruction specification. They took a pragmatic approach, building in contingencies where appropriate. When they couldn't identify how a component was put together, they wrote instructions for the most likely conditions. For instance, a specification could provide instruction for a bolted connection and a welded connection. Influenced by this clarity, the final bids from the subcontractors were quite competitive.

— The brick from the original building inspired the idea of reclaimed materials, however it could not be easily removed and so could not be reused on this project. Additional brick was sourced offsite using suppliers with whom the architects had worked with previously. The suppliers were familiar with their needs, particularly in terms of quality, which eased the process.

— As a public institution, the University did not want a single source supplier for any of the materials. The team wrote the specifications detailing the quality of material needed. They indicated that the contractor could use material sourced by the initial vendor or present the equivalent.

— The team reached out to the brick supplier during the design process, giving him enough time to source the quantities and quality needed. New brick tends to be monotone in color. Older brick has a variation in color and texture, which the architects were drawn to. To ensure the reclaimed bricks met the specifications, the supplier sent sample bricks to the team for review.

— The brick specifications required that the supplier collect the true count. In other words, broken bricks could not be considered in the overall count needed. This assured that the majority of the bricks delivered were usable.

♻

p. 61 Photo: © Hester + Hardaway Photographers (www.PhotoGypsies.com)

LESSONS LEARNED

START EARLY
Defining goals early allows time for creating alternate strategies if conditions change. When the original brick proved unusable, the project team had enough time to engage an offsite vendor to source enough brick for the project.

BE SMART ABOUT DECONSTRUCTION
The architects knew that there were several unknowns with the condition of the materials in the original building.
As a result, they wrote the deconstruction spec with contingencies.

BUILD REUSE RELATIONSHIPS
Given that both architecture firms had incorporated reclaimed materials into other projects, they knew reuse vendors, such as the brick supplier, who were familiar with the quality of materials they were looking for. Making use of these kinds of connections his can save time and money.

WORK AROUND MULTIPLE VENDOR REQUIREMENTS
Public buildings often have restrictions against sole sourcing. The team worked around the University's restrictions by specifying that the contractor could source from the vendor listed or the equivalent, as long as the material met the given requirements.

UNDERSTAND TRADE-OFFS
When considering a reclaimed material, be sure to understand both the short- and long-term costs. Rich in color, the cypress siding provides a unique beauty to the project. However, its post-occupancy maintenance cost has been less than ideal.

EMBRACE BEAUTY IN IMPERFECTION
Salvaged materials are not perfect but there can be beauty in that imperfection. New brick would have provided a uniform look. The project team welcomed the distinctive character of the reclaimed brick.

LEARN MORE

AIA COTE TOP TEN CASE STUDY
aiatopten.org/hpb/overview.cfm?ProjectID=444

BNIM ARCHITECTS
bnim.com

LAKE I FLATO ARCHITECTS
lakeflato.com

SCHOOL OF NURSING AND STUDENT COMMUNITY CENTER
son.uth.tmc.edu

"YOU'RE STRIVING FOR A BUILDING THAT IMMEDIATELY HAS AN INTRINSIC CHARACTER BECAUSE OF THE NATURE OF THE MATERIALS."

— David Lake, architect

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Reclaimed Brick	Exterior masonry in 19th century warehouse	Exterior masonry	Offsite	San Antonio, TX	120,000 Bricks	
Reclaimed Sinker Cypress	Trees	Exterior siding	Offsite, vendors: Frenchman Contractors & Riverfront Lumber	Mississippi River, TX		Kiln dried, Milled

HOUSING

"WE OFTEN PROMOTE THESE MATERIALS BECAUSE THEY'RE OF A HIGHER QUALITY… OR THEY JUST HAVE THE CHARACTER THAT WE'RE AFTER."

—David Arkin, architect, Eastern Sierra House

Reclaimed materials have a long history of use in custom-designed single-family homes. Reuse is relatively straightforward when sourcing basic components, such as a reclaimed wooden door or a kitchen sink. The two projects featured in this section make the case for expanding beyond the basics of reuse. In Eastern Sierra House, a nimble team of architects and a builder help a sustainability-minded client incorporate unusual materials such as airplane flaps and ailerons in addition to more traditional elements such as reclaimed lumber. The architects of Benny Farm used simple reclaimed materials, such as bricks and radiators, to bring more life and texture to an affordable multifamily residential development. Though very different in scale and use these two projects represent signature models of housing infused with a deeper and more tangible sense of place.

Housing

BENNY FARM

Photo: Courtesy L'OUEF

Housing

BENNY FARM

Photo: Courtesy L'OUEF

Housing

BENNY FARM

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Benny Farm

LOCATION
Montreal, QC, Canada

YEAR COMPLETED
2006

PRIMARY USE
Multi-unit housing

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$5 million CDN

CERTIFICATIONS
Novoclimat certified

SIZE
70,460 Sq ft

CLIENT/OWNER
Z.O.O. (Zone of Opportunity) Housing Cooperative

ARCHITECT
L'OEUF

CONTRACTOR
Edilbec Construction

STRUCTURAL ENGINEER
Jan Vrana

MEP
Martin Roy et Associes

REHAB OF POST-WAR DEVELOPMENT PROVIDES SUSTAINABLE MODEL OF AFFORDABLE HOUSING

The 18-acre site at Benny Farm, in Montreal, was originally developed in the 1940s to provide housing for WWII veterans and their families. Its design incorporated "Garden City" concepts, such as abundant green spaces, and progressive ideas about social housing. Over time, residents formed a tight knit community in which neighborhood associations and recreational groups thrived. When plans to replace the existing housing with a new high-density, market-rate development were unveiled in the early 1990s, the community rallied to promote an alternative that would preserve the complex's unique socio-cultural heritage. After years of negotiations between the community and the government, a redevelopment plan was adopted in 2003.

The architecture firm L'OEUF, which had a long history of involvement in the community, was hired by Z.O.O. (Zone of Opportunity) Housing Cooperative to redevelop 46 units across two buildings on the site (several other buildings on the site, not covered by this case, were renovated/constructed by various architecture firms, including L'OEUF). L'OEUF proposed a plan that prioritized preservation, reclamation and affordability.

Ultimately, over 35% of the original structures across the 18-acre site were rehabilitated, and substantial quantities of materials from the dismantled buildings were incorporated into new construction and renovated buildings throughout the site. Reuse was part of a larger vision with multiple strategies intended to provide environmental, economic and social benefits.

Reclaimed wood forms part of exterior wall assembly.

"WHEN WE TOOK A POSITION OF NO DEMOLITION, IT WAS A SOCIAL POSITION."

— Danny Pearl, architect

DESIGN FOR REUSE HIGHLIGHTS

— With both public and private entities involved, deconstruction often was undertaken by the government and their contractors rather than the project team. L'OEUF provided clear instructions about which materials to save and how to reclaim them.

— All materials for reuse came from the site. Prior to construction, all materials were stored on site. Wood flooring was stored in shipping containers while radiators were locked in buildings not deconstructed. The contractor took responsibility for all materials except the brick.

— Brick from deconstructed buildings was dismantled and cleaned according to a specification developed by L'OEUF. Mortar used in older brick construction tends to come off more easily than mortar used today. The team was able to easily knock down and separate the brick.

— The contractor was concerned about the lack of guarantee on the brick. The project team sent samples to a lab to be tested. Results indicated that the water absorption rate and strength in old brick was better than new brick, so the client accepted its use.

— To create more harmony between the new buildings and existing construction, L'OEUF used reclaimed brick on facades on the main street and new brick was used on side and rear facades. L'OEUF created a design mixing brick from several buildings to create an interesting pattern.

— Social housing budgets generally accommodate vinyl for flooring and electric baseboards for heating. Reclaimed wood flooring provided a higher quality look that wouldn't have been affordable as new. Reconfigured radiators worked well with the geothermal heating system and save more energy than electric heating.

— The project's sustainability features, including reuse, are promoted using signs at the site, as well as through reports and green building workshops.

— Reclaimed materials include brick used as part of the exterior façade, glass block at accessible entry vestibules, and wood flooring and radiators repurposed for the same use.

— Over 50% of both the brick and glass block were successfully recovered from several deconstructed buildings.

LESSONS LEARNED

LINK THE OLD WITH THE NEW
Not only does reuse provide a tangible link with the community's past, the design of the brick façade provides a visual language to link old and new construction.

OLD MATERIALS CAN WORK IN HIGH PERFORMANCE ENVIRONMENTS
Reclaimed materials and components can work with modern building performance goals. By installing new electronic systems in reclaimed radiators that are served by a geothermal heating system, the team was able to provide an affordable yet high quality heating solution. The reclaimed brick was tested and found to be stronger and less water absorbent than new brick.

DO MORE WITH LESS
Reclaimed materials can provide a means to incorporate high quality materials in projects that couldn't afford the equivalent quality in new materials.

KNOW YOUR STUFF
Knowing the properties of a material can facilitate reuse. Brick provided an ideal reuse opportunity in part because older construction processes meant the mortar was easier to remove and required less cleaning.

LEARN MORE

HOLCIM FOUNDATION FOR SUSTAINABLE CONSTRUCTION
holcimfoundation.org

L'OEUF
loeuf.com

Z.O.O.
zoneofopportunity.tripod.com

Brick from dismantled buildings.

p. 71, 73 Photos: Courtesy L'OUEF

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Brick	Exterior masonry walls	Exterior masonry walls	On-site	On-site		Cleaned
Glass block	Exterior facade	Exterior facade	On-site	On-site		N/A
Wood strapping	Exterior wall assembly	Exterior wall assembly	On-site	On-site		N/A
Radiators	Radiators	Radiators	On-site	On-site		Refinished and retrofitted
Wood flooring	Wood flooring	Wood flooring	On-site	On-site		Refinished

EASTERN

Photo: ©Edward Caldwell www.edwardcaldwellphoto.com

Housing

EASTERN

Photo: ©Edward Caldwell www.edwardcaldwellphoto.com

Housing

EASTERN

Photo: ©Edward Caldwell www.edwardcaldwellphoto.com

Housing

EASTERN SIERRA HOUSE

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Eastern Sierra House

LOCATION
Northwestern Nevada

YEAR COMPLETED
2004

PRIMARY USE
Single-family residential

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
Undisclosed

SIZE
2,998 Sq ft (main house), 452 Sq ft (guest house)

CLIENT/OWNER
Suzanne Johnson

ARCHITECT
Arkin Tilt Architects

CONTRACTOR
Sage Design Build

STRUCTURAL ENGINEER
Peak Consulting Engineers

PHOTO DOCUMENTATION
Ed Caldwell

IN NEVADA'S HIGH DESERT, INVENTIVE REUSE GIVES RISE TO DISTINCTIVE DWELLING

Interested in developing a house that could be a canvas for high level sustainability, Suzanne Johnson purchased land just east of the Sierra Nevada Mountains. Johnson wanted a house that would tread lightly on the earth during construction and use and that would be healthy to live in. Johnson, together with Arkin Tilt Architects and Sage Design/Build, created a house that maximizes solar design elements. It also incorporates an impressive number of other sustainable systems including green roofs and insulated concrete form and straw bale walls.

The decision to integrate material reuse was in many respects intuitive to the sustainable design process. Material reuse can divert waste, reduce raw material extraction and manufacturing, and reduce the risk of off-gassing chemicals in the home. A wide diversity of common and not-so-common reclaimed materials—from wood doors to steel railroad tracks—played into the team's creativity and inventiveness.

Johnson, her architects and her general contractor were all active in identifying and sourcing materials. They speak as fondly of the process of design and construction as of the final product. The end result is a highly acclaimed model of sustainable design in which reclaimed materials visibly articulate a depth of character that resonates for the client and all who visit the house.

Used airline flaps were repurposed as garden shade fins.

"IT WAS AMAZING THE THINGS AVAILABLE TO REUSE."

— Suzanne Johnson, client

Photo (above): Courtesy Arkin Tilt Architects

DESIGN FOR REUSE HIGHLIGHTS

— Arkin Tilt kept their drawings loose so that the design could accommodate the inherent variability of reclaimed materials. This flexibility allowed them to adapt the design as needed.

— For some design elements, they hoped to incorporate reclaimed materials but hadn't identified a material. In such cases, a "skeleton" was inserted in the drawings to indicate the approximate material size and function. For example, horizontal shade fins were indicated on the greenhouse exterior. It was not until later in the project that contractor Rick Walters recognized that specific airplane flaps and ailerons could indeed be used.

— Reclaimed materials were sourced throughout the project's design and development stages by the client, architects and contractor. The team kept a running list of items needed and communicated regularly to discuss their progress.

— In addition to reuse stores, the team used the Internet to find materials. Nontraditional, industrial sources such as a mining equipment company, an airplane salvage yard and a railroad salvage yard also yielded valuable reclaimed materials.

— An avid glider pilot, Walters was well connected to the local flying community. In addition to the airplane flaps, he also sourced wood from a deconstructed hangar. The wood was milled for several applications including ceiling beams, trim, framing, and decorative "barn wood" finishes.

— Building inspectors requested confirmation of the structural capacity of certain reclaimed materials used for structural purposes. Arkin Tilt had such applications certified by the structural engineer.

— Reclaimed materials include maple schoolhouse flooring, vinegar vat fir milled into ceiling finish, steel railroad tracks as trellis beams, metal mining screens that form part of custom light fixtures, and airplane flaps that were modified into greenhouse shade fins.

— Over 7,000 board feet of various types and sizes of reclaimed wood were used. Five steel railroad rails, 44 airplane flaps and ailerons, and 50 panels of glass (used in the trombe wall) also found new life in this project.

LESSONS LEARNED

DEVELOP A SHARED VISION OF REUSE
With different perspectives united around a common vision of reuse, the entire team participated in identifying and sourcing reclaimed materials. Using their respective networks, they each brought to the table materials that others on the team might not have thought of.

COMMUNICATE AND COLLABORATE
Since multiple team members were engaged in the reclaimed materials search, it was important to maintain regular communication across the project team. Team members kept track of each other's progress and collaborated on ways to use unique materials.

KNOW WHEN TO SAY NO
The team's nimbleness in evaluating and incorporating materials as they were identified greatly facilitated the reuse process. But David Arkin and Anni Tilt caution that working with reuse requires a keen aesthetic eye and an ability to say no to items that do not augment the design. Evaluating the viability of a reclaimed material needs to include not only aesthetics but also cost, character and refurbishment needs.

BE OPEN TO NONTRADITIONAL MATERIALS
Though easy to visualize how a used door or flooring could be reused in a residential application, nontraditional materials can also find use in such settings. Airplane flaps molded into shade fins and steel railroad tracks employed as trellis beams provide striking visual examples.

LEARN MORE

AIA COTE TOP TEN CASE STUDY
aiatopten.org/hpb/overview.cfm?ProjectID=434

ARKIN TILT ARCHITECTS
arkintilt.com

"REDUX: DESIGNS THAT REUSE, RECYCLE, AND REVEAL"
Jennifer Roberts, Gibbs Smith, Publisher (2005)

"VIRTUAL TOUR: JOHNSON HOME"
youtube.com/watch?v=mgUCAztSyZg&feature=player_embedded

Metal mining screens provide shroud for light sconces.

Photo (above): courtesy Arkin Tilt Architects

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Wood	Airport Hangar Trusses	Ceiling beams, interior paneling	Offsite, vendor: Soaring Club	Nevada	1370 Bd ft	Milled
Fir wood	Heinz Vinegar barrel staves	Ceiling paneling	Offsite, vendor: Recycled Lumber Works	Ukiah, CA	420 Sq ft	
Wood		Millwork	Offsite, vendor: Jefferson Recycled Wood Works	McCloud, CA	300 Bd ft	
Douglas-fir Tree	N/A	Trellis and columns	On-site	On-site	1 Tree	Cut-to-size
Maple flooring	Floor decking	Wood flooring	Offsite, vendor	Berkeley, CA	400 Sq ft	Refinished
Salvaged fir timbers		SIP splines	Offsite, vendor: Pioneer Millworks	Farming-ham, NY	2270 Bd ft	N/A
Short fir timbers		Joists	Offsite, vendor: Jefferson Recycled Wood Works	McCloud, CA	3020 Bd ft	N/A
Redwood		Wood trim	Offsite, vendor: Recycled Lumber Works	Ukiah, CA	350 Bd ft	Milled
Wood doors	Interior doors	Interior doors	Offsite, vendor: Urban Ore	Berkeley, CA	2 Doors	Modified, Refurbished
Wood doors	Exterior door	Exterior door	Offsite, vendor: Whole House Building Supply	East Palo Alto, CA	1 Door	Refinished
Metal door	Interior door	Interior door	Offsite, vendor: This and That Salvage	San Pablo, CA	1 Door	N/A

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Wood doors	Interior Doors	Interior doors	Offsite, donation	Berkeley, CA	4 Doors	Refinished
Window	n/a	Window	Offsite, vendor: window man-ufacturer	Berkeley, CA	1 Window	N/A
Explosion proof safety light fixture	Light fixture in mine	Interior lighting	Offsite, vendor: Lund's Used Mining Equip.	Berkeley, CA	1 Unit	Retrofitted
Steel posts		Trellis support	Offsite, vendor: Gilman Salvage	Berkeley, CA	6 Posts	N/A
Steel track cart wheels	Fruit cart wheels	Trellis support	Offsite, vendor: Lund's Used Mining Equip.	Mound House, NV	4 Wheels	N/A
Steel track cart wheels	Ore cart wheels	Trellis support	Offsite, vendor: Lund's Used Mining Equip.	Mound House, NV	2 Wheels	N/A
1906 steel railroad track	Railroad track	Trellis beams	Offsite, vendor: K&N Railroad Salvage	Stockton, CA	100 Lin ft	N/A
Glass panels		Trombe Wall	Offsite, vendor: Urban Ore	Berkeley, CA	50 Panels 250 Sq ft	N/A
Metal screen	Mining screen	Light shroud for interior lighting	Offsite, vendor: Lund's Used Mining Equip.	Mound House, NV		Refabricated
Aluminum	Airplane ailerons + flaps	Greenhouse shade fins	Offsite, vendor: Aircraft Part Salvage	Northern California	44 Units	N/A
Aluminum	Cessna aircraft stabilizer	Shelf	Offsite, vendor: Aircraft Parts Salvage	Northern California	1 Unit	Cut-to-size

OFFICE

Office

“IF WE COULD REUSE SOMETHING, WE DID.”
—Thomas Taylor, client/team leader,
Alberici Corporate Headquarters

As the nexus of an organization’s operation, an office headquarters can be an incubator and communicator of the organization’s beliefs and goals. For the organizations profiled in this section, reusing materials demonstrated their respect for the project site’s historical and cultural context. Prominent reclaimed materials such as steel crane rail beams helped Alberici Redevelopment Corporation’s headquarters set the tone for a construction company moving toward a sustainability-based practice. The material reuse in the Phillips Eco-Enterprise Center helped give physical shape to a pioneering project in the aftermath of a long environmental justice battle. Always part of larger green building strategies, material reuse in both projects symbolizes the commitment of the clients and their project teams to an optimistic vision of a sustainable future.

PHILLIPS ECO-ENTERPRISE

Photo: © 2000 Don F. Wong

Office

PHILLIPS ECO-ENTERPRISE

Photo: © 2000 Don F. Wong

PHILLIPS ECO-ENTERPRISE

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Phillips Eco-Enterprise Center

LOCATION
Minneapolis, MN

YEAR COMPLETED
1999

PRIMARY USE
Commercial office, Industrial

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$6 million

CERTIFICATIONS
Energy Star Rated 2008 & 2009

SIZE
64,000 Sq ft

CLIENT
The Green Institute

PROJECT ARCHITECT
LHB,Inc.

PRE-DESIGN ARCHITECT
Sirny Architects

CONTRACTOR
Kraus-Anderson

STRUCTURAL ENGINEER
LHB, Inc.

PIONEERING SUSTAINABLE BUSINESS HUB EMERGES IN AFTERMATH OF ENVIRONMENTAL JUSTICE BATTLE

In 1999, the Green Institute opened the Phillips Eco-Enterprise Center (PEEC), a building that provides office and manufacturing space to community-oriented, environmentally conscious businesses. The Green Institute arose from an environmental justice movement to prevent the construction of a garbage transfer station in Phillips, an economically challenged, environmentally degraded neighborhood in Minneapolis. Years of protest led the state to abandon the proposed project even though relocation and demolition had already begun. The movement's organizers founded the Green Institute to channel the momentum from the protest effort into a positive economic engine, based on environmental and social activism, for the neighborhood.

When the time came to construct a headquarters facility that would also serve as a green business center, the organization was determined to "walk the talk" by making the building as green as possible. A pilot project for the LEED certification system, many of the facilities' features such as geothermal heating were far from the norm at the time.

Reclaimed materials were integral to the design. An early program of the Green Institute had been the ReUse Center, a building deconstruction and material resale program. Incorporating reclaimed materials into the PEEC was both a natural extension of the ReUse Center's activities and an opportunity to model sustainability for the neighborhood and beyond.

Facade features brick from a deconstructed industrial warehouse.

"WE WANTED TO DO THINGS DIFFERENTLY; WE WANTED TO STRETCH IN AREAS THAT OTHERS MIGHT NOT."

— Corey Brinkema, client

DESIGN FOR REUSE HIGHLIGHTS

— The client established an initial goal of using 10% salvaged materials. Some materials, such as the brick and wood used around the main entrance, were incorporated into the design early. Others, like fire extinguisher cabinets, were found later in the process.

— The contractor, Kraus-Anderson Construction, came on board in the Design Development phase. Material reuse was discussed as part of the bid process, and the contractor factored in an allowance for reclaimed materials into their bid.

— Reclaimed material came from the ReUse Center and a variety of other sources. Heavy timbers came from the deconstruction of an Army warehouse. The contractor secured the kitchen cabinets from another demolition project. Project architect LHB found the steel joists that formed nearly three-quarters of the building's structural system, from a classified newspaper ad.

— Unfamiliarity of subcontractors with material reuse sometimes led to challenges. Computer modeling and testing determined usability of the steel joists. However, the subcontractor insisted on also welding all the connections, which added an unanticipated cost.

— There was no storage space or financing to pre-purchase much of the materials. Many reclaimed materials were delivered directly to the construction site after purchase or refurbishment.

— Final installation design was determined in the field for materials not obtained until construction.

— Reclaimed materials often were sourced regionally, reducing the environmental and financial cost of long distance transport oftedn associated with new materials.

— The Green Institute uses tours and signage to educate visitors about the reclaimed materials and other green building strategies.

— Reclaimed materials include 100-year-old brick used as exterior cladding, and 5,000 square feet of carpet that only had two years of use.

— Reclaimed timber beams used as stair treads and trim avoided the use of 804 board feet of virgin wood. Reclaimed steel joists saved nearly 50 tons of new steel that would have required 110 million BTUs of energy to manufacture.

LESSONS LEARNED

START EARLY
Material reuse was factored into design and construction early. It was included as part of the initial construction bidding process, and the contractor developed an understanding of the code and specifications requirements early.

BE FLEXIBLE
With limited resources to buy or store materials prior to the design phase, many of the reclaimed materials were secured during construction. The project team maintained flexibility around design and installation details in order to accommodate materials as they were found.

TALK IT OVER
An open dialog was established across the team and with building officials and inspectors early on. This communication facilitated material sourcing and procurement and helped the team deal with challenges during construction.

GET SUPPORT FROM THE TOP
Having a client who values reuse is key if reclaimed materials are going to be effectively incorporated into a project. When challenges arise during procurement, design or construction, a supportive client can help smooth bumps in the road.

TURN SUBCONTRACTORS INTO REUSE CHAMPIONS
Contractors may participate in early meetings about reuse, but subcontractors are often ultimately responsible for material installation. Unfamiliarity with reclaimed materials can lead to decisions that increase costs. Get everyone—including subs—on board at the start of construction, and keep talking about material reuse strategies throughout construction.

LEAVE NO SOURCE UNTURNED
Reclaimed materials don't only have to come from a reuse store or salvage yard. Project team members sourced materials from places as diverse as newspaper ads, a deconstructed Army warehouse, and another demolition job.

LEARN MORE

KRAUS-ANDERSON CONSTRUCTION
kraus-anderson.com

LHB, INC.
lhbcorp.com

THE GREEN INSTITUTE
greeninstitute.org

THE REUSE CENTER
thereusecenter.com

p. 91 Photo: LHB, copyright 2010

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Steel	Roof joists	Joists	Offsite, vendor in newspaper	Hugo, MN	50 Tons	Sandblasted and refinished
Wood timbers	Beams	Stair treads & trim	Offsite, army warehouse deconstruction	Minneapolis, MN		Milled
Brick	Exterior masonry	Exterior masonry	Offsite, industrial warehouse decon.	Chicago, IL	22,000 Bricks	Cleaned
Countertops	Countertops	Countertops	Offsite, vendor: Re-Use Center	Minneapolis, MN		
Fire Extinguisher Cabinets	Fire Extinguisher Cabinets	Fire Extinguisher Cabinets	Offsite, vendor: Re-Use Center	Minneapolis, MN		
Photovoltaics	Solar Energy Collectors	Solar Energy Collectors	Offsite, vendor: Re-Use Center			
Carpet	Carpeting	Carpeting	Offsite, contractor demo job	Minneapolis, MN	5,000 Sq ft	
Kitchen cabinets	Kitchen Cabinets	Kitchen Cabinets	Offsite, vendor: Re-Use Center			
Sinks	Restroom sinks	Sinks	Offsite, vendor: Re-Use Center	Minneapolis, MN		
Benches and exterior deck	Benches and decking	Benches and exterior decking	Offsite, vendor: Re-Use Center	Minneapolis, MN		
Workstations	Workstations	Office workstations	Offsite, vendor: Re-Use Center	Minneapolis, MN		Refurbished
Doors and frames	Exterior doors and frames	Interior doors and frames	Offsite, vendor: Re-Use Center	Minneapolis, MN		
Windows	Exterior windows	Interior windows	Offsite, vendor: Re-Use Center	Minneapolis, MN		

Office

ALBERICI

Photo: Courtesy Alberici

Office

Office

ALBERICI

Photo: Courtesy Alberici

Office

ALBERICI

Photo: Courtesy Alberici

Office

ALBERICI HEAD-QUARTERS

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Alberici Corporate Headquarters

LOCATION
Overland, MO

YEAR COMPLETED
2004

PRIMARY USE
Commercial office

CONSTRUCTION TYPE
Adaptive reuse

TOTAL PROJECT COST (LAND EXCLUDED)
$20.1 million

CERTIFICATIONS
LEED-NC Platinum

SIZE
110,000 Sq ft

CLIENT/OWNER
Alberici Redevelop-ment Corporation

ARCHITECT
Mackey Mitchell Associates

STRUCTURAL ENGINEER
Alper Audi, Inc.

SUSTAINABILITY CONSULTANT
Vertegy, an Alberici Enterprise

CONSTRUCTION MANAGER
Alberici Constructors, Inc.

CONSTRUCTION COMPANY TRANSFORMS FORMER METAL PLANT INTO MODERN HEADQUARTERS BUILDING

Alberici Redevelopment Corporation is a construction company with a portfolio across the Midwest, Southeast, Canada and Mexico. Headquartered in St. Louis, Missouri, the company had outgrown their original facility, and purchased a 14-acre site for their new headquarters. It was not until after the site had been selected and the project budget determined that John Alberici, Chairman of the Board, boldly set a goal of achieving LEED NC Platinum certification. It would be the first LEED certified project that the company had worked on.

After a series of 'eco-charettes,' the project team decided not to build from the ground up. Instead, they opted to renovate the 156,000-square-foot former metal manufacturing facility and reclaim materials from a vacant 1950's three-story office building, both located on-site. The original budget didn't account for any added green building or LEED certification costs, requiring the project team to be extremely resourceful.

Material reuse was a major component of the project team's efforts to do a lot with a little. By taking advantage of the abundance of materials in the existing buildings, as well as Alberici's easy access to construction debris from other projects, material reuse became a creative means of achieving sustainability goals despite budget constraints.

Used metal sheet piling from other Alberici job sites was used to reshape the landscape for stormwater mitigation.

"YOU HAVE TO HAVE… A LITTLE BIT OF A DUMPSTER-DIVER MENTALITY OF, 'WHAT CAN WE USE THIS STUFF FOR?'"

— Thomas Taylor, client/team leader

DESIGN FOR REUSE HIGHLIGHTS

— This was a design-build project, in which a single entity oversees both design and construction. As a contractor-led design-build project, Alberici was at the helm and Mackey Mitchell was the design firm.

— This arrangement allowed more time and flexibility for locating reclaimed materials. Apart from the crane rail beams indentified in the pre-design phase, all other reclaimed materials were sourced by Alberici during construction. Alberici used Mackey Mitchell's drawings as the basis of the design and made substitutions where appropriate.

— The crane rail beams once supported large overhead cranes in the manufacturing facility. In the renovated building, they support the second floor, complementing the heavy steel presence of the building's original structure. Since the beams had a greater load capacity than what was specified, it was easy for the structural engineer to approve their use.

— The crane rail beams required decontamination. Spot abatement occurred on connections in situ to facilitate safe dismantling. More comprehensive paint stripping occurred once the beams were removed. Then they were visually inspected for structural deficiencies.

— Many of the offsite reclaimed materials came from other Alberici job sites. For a retaining wall, Alberici was able to secure large quantities of used metal sheet piling, discarded from another site.

— Taylor sought to create buy-in about reuse across the entire project team. The construction crew became resourceful in sourcing materials, such as suggesting precast panels removed from another Alberici project for use in the transfer culvert pipe.

— The project achieved MR credit 3.1. Taylor noted that it was not difficult to track the reclaimed materials used, but it was difficult to achieve the credit's minimum threshold because it is based on costs. The project benefited from materials with high replacement values such as steel and brick.

— The project's reclaimed materials include 4,000 linear feet of crane rail beams used as structural support, sheet pile used in the landscaping retaining wall, broken granite slabs turned into countertops in the conference rooms, and approximately 9,000 tons of reused concrete and brick.

LESSONS LEARNED

BE RESOURCEFUL
Instead of being a hindrance, the tight budget sparked creativity. When seeking finishes for a conference room, Taylor reached out to local granite vendors for broken slabs. Such high quality granite would not have otherwise been affordable within the project budget.

GET TEAM BUY-IN
Excited about the possibilities of reuse, team members uncovered opportunities that might have otherwise gone overlooked.

OVERSIZE STRUCTURAL MEMBERS
Using reclaimed structural members that are larger than specified can increase the likelihood of approval by the structural engineer.

FOR LEED CREDITS, BE STRATEGIC ABOUT REUSE
The LEED credits relating to material reuse, MR 3.1 and 3.2, currently are based on reclaimed materials as a percentage of overall material costs. By strategically using materials with high replacement value, the project team overcame the cost barrier often associated with this credit.

STAND OUT FROM THE CROWD
The adaptive reuse of the manufacturing facility created a distinctive appearance that architect Jim Konrad of Mackey Mitchell calls "very strong and brawny." The scale of the large crane rail beams fit perfectly within this context, and provided a look that would have been unaffordable if purchased new.

LEARN MORE

AIA COTE TOP TEN CASE STUDY
aiatopten.org/hpb/overview.cfm?ProjectID=662

ALBERICI ENTERPRISES
alberici.com

MACKEY MITCHELL ARCHITECTS
mackeymitchell.com

Open offices within former metal manufacturing facility.

p. 99, 101 Photos: Courtesy Alberici

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Steel	Crane rail beams	Beams	On-site	Overland, MO	4,000 Ln ft	Lead Paint Abatement, Cut-to-Size
Steel	Steel sheet piling	Steel sheet piling	Off-site, contractor job site	St. Louis, MO		N/A
Concrete	Precast concrete panels	Pipe culvert	Off-site, contractor job site	St. Louis, MO	8 Panels	N/A
Brick and concrete	Masonry	Site fill	On-site	Overland, MO	>9,000 Tons	Crushed
Broken granite slabs	N/A	Stone tabletops	Offsite, vendor: granite supplier	St. Louis, MO		Cut-to-size
Limestone	Window sills and parapet coping	Landscape elements	On-site	Overland, MO		Cut-to-size
Wind turbine	Wind turbine	Wind turbine	Offsite	California	1 Wind turbine	N/A

RETAIL

107 Mountain Equipment Co-op Ottawa & Winnipeg

Retail

"WE BUILD WHAT WE BUILD BECAUSE IT'S THE RIGHT THING TO DO."

—Sandy Treagus, client, Mountain Equipment Co-op

A retail company's stores are the visual calling card of its brand, physically relaying a company's values to their clientele. To be effective, brand strategy must extend beyond one location to the entire network of stores. Mountain Equipment Co-op (MEC), a recreational gear retailer with locations across Canada, wanted to create stores that would reflect the company's commitment to sustainability and their customers' passion for the outdoors. In particular, they wanted their stores, their staff, and their product supply chain to move toward carbon neutrality. Building their new stores with reclaimed materials was a significant part of this sustainable vision. The case study that follows profiles two of the company's stores, demonstrating not only a long-term enthusiasm and dedication to building green but also large-scale models of reuse for Canada and beyond.

MOUNTAIN

Photo: Courtesy Mountain Equipment Co-op

Retail

MOUNTAIN

Photo: by Gerry Kopelow

Retail

MOUNTAIN

Photo: by Gerry Kopelow

MOUNTAIN EQUIPMENT CO-OP

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

OTTAWA STORE

PROJECT NAME
Mountain Equipment Co-op Ottawa

LOCATION
Ottawa, ON Canada

YEAR COMPLETED
2000

PRIMARY USE
Commercial office

CONSTRUCTION TYPE
Retail

TOTAL PROJECT COST (LAND EXCLUDED)
$2.9 milion CDN

CERTIFICATIONS
C-2000 standard

SIZE
26,910 Sq ft

CLIENT/OWNER
Mountain Equipment Co-op

ARCHITECT
Linda Chapman Architect / Christopher Simmonds Architect

STRUCTURAL ENGINEER
Cleland Jardine Engineering Limited

CONSTRUCTION MANAGER
Justice Construction

WINNIPEG STORE

PROJECT NAME
Mountain Equipment Co-op Winnipeg

LOCATION
Winnipeg, MB Canada

YEAR COMPLETED
2002

PRIMARY USE
Retail

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$2.5 million CDN

CERTIFICATIONS
LEED Canada–NC 2.1 Gold, C-2000 standard

SIZE
30,200 Sq ft

CLIENT/OWNER
Mountain Equipment Co-op

ARCHITECT
Prairie Architects

STRUCTURAL ENGINEER
Wolfrom and Associates

CONSTRUCTION MANAGER
Milestone Project Management

DESIGN FOR REUSE IS A GOOD FIT FOR OUTDOOR RETAILER

As Canada's largest retailer of outdoor gear, Mountain Equipment Co-op (MEC) attracts customers who care about the health of the environment. So it is only natural that the company has made a commitment to designing and operating its stores to use natural resources efficiently.

For more than a decade, MEC has been building green "because it's the right thing to do," said Sandy Treagus, MEC's Chief Financial Officer. The company's Ottawa and Winnipeg stores, built in 2000 and 2002 respectively, were the first two retail buildings to meet the requirements of Canada's C-2000 Program for Advanced Commercial Buildings. This early green building standard served as a precursor to LEED Canada. The Winnipeg store has also been certified at the Gold level by LEED Canada.

Although these two stores are no longer new, they continue to serve as models for how retailers and other businesses can reduce their carbon footprint, enhance their brand and conserve resources by designing for reuse.

"IT'S THE RIGHT THING TO DO."

— Sandy Treagus, client

OTTAWA STORE DESIGN TAKES DECONSTRUCTION FULL CIRCLE

When MEC set out to build a new store in Ottawa, they acquired a property occupied by a 40-year-old grocery store. The company and its project architects, Linda Chapman Architects and Christopher Simmonds Architect, evaluated the existing two-story, steel-frame structure and decided it wasn't practical to adapt it to suit MEC's needs. Rather than demolishing the building, they took a greener path: they had it deconstructed and designed the new building to reuse as much of the old one as possible. Materials not slated for reuse were sold at the end of deconstruction at an onsite sale to demolition contractors and the general public.

Architect Linda Chapman saw an advantage to combining deconstruction with reuse on the same property. "It makes it more cost effective if the building that you're salvaging materials from is the building that happens to be on the site," she said.

While scheduling is sometimes a challenge when working with reclaimed materials, CFO Treagus noted that planning ahead solved most issues and that the benefits of reuse make the extra effort worthwhile.

Using an integrated design process, the team designed a struc-

tural framework that combines salvaged timber on the ground floor with a second-story and roof built of steel reclaimed from the old grocery store.

The design team initially considered a ground-floor structural system made of new steel or concrete, but were dissuaded by the high embodied energy of those materials. Instead, they designed a timber-frame structure, using high quality Douglas fir timbers salvaged from the bottom of the St. Lawrence River; the timbers were once floating log booms used to keep logged trees from drifting away.

The timbers were evaluated by a professional grader, remilled into posts and beams, and used to build a dramatic, exposed timber frame that subtly evokes the experience of hiking through a forest. Additional salvaged fir was used for exterior siding and shade trellises.

From a resource conservation perspective, using salvaged timber made sense, and from the shopper's perspective, the look of salvaged wood "just fits," says store manager Colleen Mooney.

For the second-story structural frame and roof, the team used all the steel posts, beams and open-web joists from the original building. These components were disassembled, labeled and taken to an off-site facility. After inspection by a structural engineer, the steel components were modified as needed and returned to the site. There they were reassembled, along with new steel components, to form the new roof and supporting structure.

To make it easier to reuse the steel columns, beams and foundation, the architects followed the column locations and structural grid dimensions of the original building. Components that could not be removed without compromising their structural integrity, such as the welded roof deck, were sent to a recycling facility.

Other reused materials include the old grocery store's concrete slab and terrazzo flooring, which was retained on the first floor, and glass blocks that were reused as interior partitions. Concrete blocks from the original building were mixed with new blocks to form the façade, creating a visual effect similar to tumbled marble, Chapman said. Additional flooring material was milled of red elm beams from a deconstructed barn.

Chapman estimates that 75 percent of the material, by weight, was reused from the original building. The project team, however, took a different approach to valuing the reclaimed materials than the LEED Green Building Rating System does. LEED's material reuse credits are based on the cost of the reclaimed materials as a percentage

of the overall project material costs. MEC's priority was not on material cost, Chapman said, but on the weight and volume of material kept out of the landfill. Ultimately, more than 1,300 tons of salvaged material was used on the project, accounting for roughly 57 percent of the total material used to construct the building.

In addition to reusing much of the old building, the project team took their commitment to reuse a step further: they designed and built the Ottawa store for disassembly. Its structural systems are nail free, with connections either bolted or screwed so that the building can be readily adapted or deconstructed in the future.

"IT MAKES IT MORE COST EFFECTIVE IF THE BUILDING THAT YOU'RE SALVAGING MATERIALS FROM IS THE BUILDING THAT HAPPENS TO BE ON THE SITE."

— Linda Chapman, Ottawa store architect

WINNIPEG STORE KEEPS THREE BUILDINGS OUT OF THE LANDFILL

A few years later, MEC built on the successes of the Ottawa store when developing a new store in Winnipeg. When the company acquired the Winnipeg property, the City of Winnipeg was on the verge of demolishing three derelict buildings on the site. MEC and their architects, Prairie Architects, asked the city to hold off on the demolition and brought in a structural engineer to evaluate whether the buildings could be reused or their materials reclaimed. The engineer inspected the three buildings and advised that the largest of them, a four-story building, was structurally sound. The others were too dilapidated for occupancy but could be deconstructed and their materials recovered.

Prairie Architects came up with a design concept that combined a complete overhaul of the four-story building with a significant addition, and together with MEC convinced the city to reallocate the demolition funds to deconstruction.

As deconstruction proceeded, the project team developed "a shopping list of all the materials that were taken out," said Dudley Thompson, Principal of Prairie Architects. "That is what we used to design the new building."

While the two smaller buildings were being deconstructed, the remaining building served as a warehouse for all the salvaged materials. In a sense, "the lumber store was already onsite," said Thompson.

Materials not slated for reuse in the MEC store were put on the sidewalk with a "free" sign; not surprisingly, those materials disappeared quickly. In an innovative deal, MEC donated the 300,000 bricks stripped from the deconstructed buildings to Habitat for Humanity, which brought in volunteers to clean the mortar from the bricks. Habitat for Humanity then sold back 100,000 bricks to MEC at a discounted price of 10 cents (Canadian) per brick. They sold the remaining bricks publicly at market prices and as a result of these transactions made enough money to build two homes.

MEC used the refurbished bricks on the facade and as flooring on the ground level. Brick flooring was an unusual choice for a store, but it looks beautiful and costs much less than the imported tile that was original specified.

The majority of the materials recovered during deconstruction were reused in the Winnipeg store, Thompson said. Timber and steel from the deconstructed building now serve as the new structural system. During deconstruction, six beautiful old cast iron columns were found ensconced in one of the walls. The structural design was modified slightly to accommodate the columns, which were left exposed. Old sheathing was reused for the new floor decks and wall sheathing. Tyndall stone, a type of limestone quarried only in Manitoba, was removed from the original foundation and used to create the lower portions of the facade.

The building achieved Gold certification from the LEED Canada NC Green Building Rating System and received both Resource Reuse credits, MR 3.1 and 3.2. The store was the first LEED certified building in Winnipeg and has helped Prairie Architects build a reputation for sustainable design.

Douglas Fir from St. Lawrence River were reused as columns and beams in the Ottawa store.

BUILDING ON SUCCESS

MEC's goal is not only to build and operate their stores more sustainably but to create positive models for their customers, the general public and other companies. "The biggest compliment anyone could give us is by copying what we are doing," said CFO Treagus.

Every MEC store has a sustainability coordinator who oversees waste reduction efforts and green building audits in addition to conducting green building tours. MEC is developing an in-house standard for sustainable building that will include guidelines for using reclaimed materials and designing for a building's end of life. Their Burlington store, completed in 2008 in Ontario, has a structure and envelope designed for disassembly. Panelized walls, mechanically fastened structural wood, and some exterior and interior finishes can be readily taken apart and reused if the building needs to be adapted or taken down in the future.

Concrete block from the original structure on the Ottawa site found new life in the exterior facade.

"THE BIGGEST COMPLIMENT ANYONE COULD GIVE US IS BY COPYING WHAT WE ARE DOING."

—Sandy Treagus, client

LESSONS LEARNED

LEAD BY EXAMPLE
Deconstruction, reuse, and design for disassembly take more effort than conventional demolition, design and construction. The most successful reuse projects start with clients and designers explicitly committed to sustainability.

DEVELOP A SHARED VISION OF REUSE
Instead of viewing dilapidated structures as obstacles to be removed from the site, look at them as gold mines of high quality, inexpensive materials with which to build a signature and cost effective new building.

ENHANCE YOUR BRAND
Reused building materials can help give buildings a distinctive look and feel that will draw in customers and keep them coming back. The dramatic salvaged timbers in MEC's Ottawa store reinforce the company's reputation as a protector of the environment.

LEAVE A SMALLER FOOTPRINT
When shoppers think about the carbon footprint of a product like hiking boots, they tend to focus on the energy and resources that went into making and shipping those boots. But climate-savvy retailers like MEC pay attention to the bigger picture, including how they build and operate their stores. Material reuse can help retailers and other business tread a little more lightly.

COMPLETE THE CIRCLE
Using reused materials in construction is a good beginning. But leading designers and building owners are going the next step and designing their buildings for disassembly—making it easier for future remodeling and for the next round of designers and owners to keep valuable resources in circulation.

LEARN MORE

CHRISTOPHER SIMMONDS ARCHITECT
csarchitect.com

LINDA CHAPMAN ARCHITECT
smartarchitecture.com

MOUNTAIN EQUIPMENT CO-OP
mec.ca

PRAIRIE ARCHITECTS
prairiearchitects.ca

Winnepeg customers and staff have praised the character provided by the reclaimed wood.

p. 112, 113 Photos: Courtesy Linda Chapman Architect
p. 114 Photo: by Gerry Kopelow

OTTAWA STORE

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Douglas-fir	Log booms in St. Lawrence River	Columns, beams, truss, wood siding	Offsite, vendor: Goodfellow Inc.		258,168 Lbs	Milling
Steel	Structural steel framing	Joists, columns, and beams	On-site	On-site	74,055 Lbs	Brushed
Red elm	Beams in old barn	Wood flooring	Offsite, vendor: Antique Timber Products	Lanark, ON	29,140 Lbs	Milled
Glass block	Exterior walls	Interior partitions	On-site	On-site	2,000 Lbs	De-mortared
Concrete block	Exterior walls	Exterior and interior masonry walls	On-site	On-site	100,600 Lbs	De-mortared

WINNIPEG STORE

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Bricks	Exterior Masonry	Flooring and facade	On-site	On-site	5,965,820 Lbs	De-mortared
Cast iron	Columns	Columns	On-site	On-site	117 Ln ft 7,605 Lbs	
Steel L	Structur-al steel framing	Structural steel framing	On-site	On-site	695 Ln ft 13,435 Lbs	
Tyndall stone	N/A	Exterior stone cladding	On-site	On-site	285,000 Lbs	
Plywood		Wood flooring	On-site	On-site	4,224 Lbs	
Wood flooring	Wood flooring	Wood flooring	On-site	On-site	20,000 Ln ft	Sandblasted
Shiplap siding	Sheathing	Exterior siding	On-site	On-site	26,910 Ln ft	
Wood beams	Wood beams	Wood beams	On-site	On-site	3,120 Ln ft	Sandblasted
2x dimen-sional lumber	Wood framing	Wood framing	On-site	On-site	44,025 Ln ft	Sandblasted
1x dimen-sional lumber	Wood framing	Wood framing	On-site	On-site	33,440 Ln ft	Sandblasted

INTER-PRETIVE CENTER

Interpretive Center

"WE DON'T HAVE TO BUILD NEW TO ACCOMMODATE CLIMATE CHANGE."

— Pam Bryan, client, 5200 Dauphine Street

The definition of what it means to build sustainably is constantly evolving. Mainstream definitions often revolve around new technologies such as high efficiency solar thermal or ventilation systems. More recently however, the concept of the triple bottom line—people, profit, planet—has been gaining acceptance as a more holistic vision of sustainable design and its benefits. The two interpretive centers profiled here directly engage this broader notion of sustainability. Rising out of the destruction of Hurricane Katrina, 5200 Dauphine Street will be a community and education center that exemplifies a new standard for rebuilding in New Orleans. The project approaches the area's rebirth quite literally by repurposing the ruins. Showcasing the principles of the newly launched Living Building Challenge, the Omega Center for Sustainable Living brings together ecological sensitivity with human well-being. In both projects, material reuse becomes an effective tool for the clients to demonstrate new models of sustainable building and living.

5200 DAUPHINE STREET

Photo: Courtesy Preservation Resource Center

Interpretive Center

5200 DAUPHINE STREET

Photo: by Operation Comeback Materials Reuse Shop

Interpretive Center

5200 DAUPHINE STREET

Photo: by Wayne Troyer WTA

Interpretive Center

5200 DAUPHINE STREET

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Operation Comeback 5200 Dauphine Street

LOCATION
New Orleans, LA

YEAR COMPLETED
2010 (anticipated)

PRIMARY USE
Assembly, Commercial office, Interpretive center, Retail

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$450-540,000 (estimated)

CERTIFICATIONS
LEED-NC Platinum (anticipated)

SIZE
2,670 Sq ft

CLIENT/OWNER
Preservation Resource Center

ARCHITECT
Wayne Troyer Architects

GENERAL CONTRACTOR
Insight Builders

STRUCTURAL ENGINEER
Avegno, Bailey, & Associates

SUSTAINABILITY CONSULTANT
PGAV Architects

REUSE CONSULTANT
Brad Guy

DECONSTRUCTION CONTRACTOR
Hal Collums Construction

HISTORIC PRESERVATION CONSULTANT
William Dupont

LEED CONSULTANT
Chip Henderson

DECONSTRUCTION/ RECONSTRUCTION: A MODEL FOR DISASTER RECOVERY

The new home of the Holy Cross Neighborhood Association in New Orleans will be a model for how communities devastated by natural disasters can rebuild sustainably. By combining green building design with cultural and historic preservation, the facility retains a strong aesthetic connection to the neighborhood while celebrating its regrowth.

A few years after Hurricane Katrina, the Preservation Resource Center (PRC), which rebuilds historic properties in blighted areas, acquired the property at 5200 Dauphine Street. The two-story, 100-year-old structure was located in the Holy Cross neighborhood of New Orleans's Lower Ninth Ward, one of the areas most affected by the flooding. Today, five years later, only about 20 percent of Holy Cross's former residents have returned.

Before Katrina, the wood-frame building at 5200 Dauphine had already suffered years of neglect; however the hurricane's winds and floods left the bones of the building unsalvageable. Although PRC focuses on rehabilitating older homes, in this case it was clear that the building could not be saved.

Across the neighborhood, scores of similar buildings have been razed. "Since Katrina there has been an incredible amount of demolition in the city and the majority of it has just gone straight to the landfills," said architect Wayne Troyer, who worked with PRC on the 5200 Dauphine Street project.

With conventional rehabilitation unworkable because of the structure's advanced state of ruin, and with demolition unpalatable to an organization focused on preservation, PRC forged a new path.

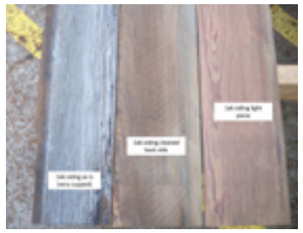
"We want to be able to provide an alternative to either demolition or preservation. There is a middle ground there," said Pam Bryan, director of PRC's Operation Comeback, which has been working since 1987 to revitalize New Orleans.

Instead of flattening the structure and hauling it off to a landfill, the building was carefully deconstructed, the salvageable materials catalogued and stored, and a new building constructed in a similar form using much of the original material.

The project team expects 5200 Dauphine Street, slated to be completed in Fall 2010, to be the first LEED Platinum certified commercial building in Louisiana. PRC also hopes that the project will be a model for building owners and the building industry, demonstrating the possibilities of sustainable

design and material reuse even in the face of massive reconstruction needs.

"This strategy is going to serve as an economic model for other areas that are afflicted with disasters," Bryan said.



Wood from the original structure was deconstructed and sorted.

"THIS STRATEGY IS GOING TO SERVE AS AN ECONOMIC MODEL FOR OTHER AREAS THAT ARE AFFLICTED WITH DISASTERS."

—Hal Collumns, deconstruction contractor

NEW DESIGN REFLECTS THE OLD

The building was deconstructed over the course of three weeks with the help of many volunteers. An estimated 60 percent of the building—primarily framing lumber, wood flooring and cypress siding—was salvaged and stored in anticipation of later reuse.

The design process got underway more than a year later, in the summer of 2009. Aided by a grant from the Kresge Foundation, the PRC held a series of design charrettes with experts in historic preservation, sustainable design, and material reuse. This group joined staff from PRC and the Holy Cross Neighborhood Association in two design charrettes to explore and articulate the project's goals. PRC also hired Troyer's firm, which had experience blending modern, sustainable design with New Orleans's distinctive architectural styles.

The new building, which is located on a prominent corner in the neighborhood, isn't intended to be a faithful recreation of the old one. Instead, it evokes the look of the original residence—a vernacular style called "camelback shotgun"—that started as a one-story double shotgun-style house, with a second story added later.

In its later years, the building housed a neighborhood store. Newly rebuilt, the building will

serve as a community center of a different sort, acting as the headquarters of the Holy Cross Neighborhood Association, a well-established organization engaged in rebuilding the area. One of the Association's other projects is the Lower Ninth Ward Center for Sustainable Engagement and Development (CSED), a resource center that teaches returning residents about sustainable rebuilding, including material reuse.

For PRC and the architects, one of the major design challenges was deciding on the best uses for the salvaged materials. "The type of work I enjoy the most is adaptive reuse," said Troyer, "and looking at ways of using the existing fabric and complementing that with new technologies and new systems so that there's an expression of the past and present occurring in each and every project that we do."

Recognizing the cultural legacy that salvaged materials represent, Troyer and his design colleague Julie Kaminski looked for ways to make them as visible as possible and to evoke the building's past uses. The new building's tiled front step, for example, still reads "Ruiz Sandwich Shop," giving people a taste of the site's history.

MILLING AND FABRICATING, WITH A LITTLE HELP FROM THE PRINCE

The deconstruction contractor, Hal Collums Construction, catalogued the materials as the building was dismantled, recording the original use and location of each piece of wood. "It really helps to have the technical knowledge as to how these parts were put together originally for you to be able to take them apart to preserve them," Hal Collums said. Most of the materials were stored in a trailer on the site. Materials that required refinishing or remilling were stored offsite at PRC's warehouse.

In 2009, PRC created a mill shop staffed with graduate apprentices of the Building Crafts Training Program. PRC started the program in collaboration with The Prince's Foundation for the Built Environment, an organization established by the Prince of Wales. This Prince's Rebuilding Program had been awarded a grant from the Louisiana Recovery Authority and the Louisiana Workforce Commission. In the mill shop, workers cleaned and remilled the wood from the deconstructed building. They also fabricated new components, including windows and exterior doors made from both new and used materials. The original exterior windows and doors could not be reused as is because they

don't meet today's building code requirements. The materials and components were then installed in the building by the general contractor, Insight Builders.

Several team members credit PRC's capacity to store and recondition salvaged materials with helping to reduce the project's cost. However, keeping track of who had responsibility for supplying or installing the various materials and components was a challenge, according to Kaminski.

In the end, the architects noted all the reclaimed materials as well as components that were made with reclaimed materials in the specifications. They then delineated the items into two categories: those provided and installed by owner, versus those provided by owner and installed by contractor. PRC is currently overseeing construction to ensure close coordination between themselves and the contractor when installing these items.

"THE BEAUTY OF THE INDIGENOUS MATERIALS DOWN HERE IS THAT THEY SURVIVED THE STORM FAIRLY WELL."

—Wayne Troyer, architect

A NEW BUILDING GOES UP, ONE OLD BOARD AT A TIME

Despite the ravages of time and the floodwaters, much of the salvaged wood was still in excellent condition upon deconstruction.

"The beauty of the indigenous materials down here is that they survived the storm fairly well," said Collums.

The old-growth cypress that had once clad the building was cleaned, remilled and used as interior wainscoting. Structural framing lumber was milled into flooring. The building's counters and casework were made from wood salvaged from the original structure. For the exposed ceiling trusses in the main assembly hall, there wasn't enough large-dimension structural lumber left from the old building, so the trusses were instead built with wood from a deconstructed 19th-century cotton warehouse located elsewhere in the state.

Some of the reused materials proved to be more challenging. The colorful ceramic tiles from the building's first floor and storefront steps were installed directly on the slab, which made it impossible to remove them intact. They could also not be incorporated into the new building's first floor because FEMA now requires structures in this area to be elevated three feet above the highest grade. Faced with these limitations, the design team came up with an ingenious solution. They retained the original tiled front steps at the site's northwest corner. On the building's east side, a portion of the original ceramic flooring now serves as pavement for an outdoor courtyard. The remaining floor tiles are still intact three feet beneath the new building, visible through viewports in the floor.

The way in which the reclaimed materials were used was influenced in part by the LEED Green Building Rating System, Kaminski said. The Material Reuse credits are calculated in a manner that favors using reclaimed materials for finishes instead of for structural purposes, she said, because it is based on replacement value. Using reclaimed material for high value finishes makes it easier to earn the credits than using them for lower value structural components. Based on this strategy, the project team expects it to earn both Material Reuse credits, MR 3.1 and 3.2.

Reclaimed wood was milled and planed by the PRC.

INSPIRING A NEW APPROACH TO REBUILDING

Until now, the Preservation Resource Center has mostly focused on renovation and resale of historic houses in blighted neighborhoods. The 5200 Dauphine Street project is PRC's first major deconstruction and commercial construction venture, and may serve as their springboard into the realm of sustainable redevelopment of commercial properties in the Holy Cross neighborhood.

PRC plans to publish a technical manual detailing the building systems and features, including the deconstruction and reuse process, as well as the project's decision-making and design processes.

This project was a new venture for many of the participants, one that they hope will be a model for how communities can rebuild themselves after natural disasters. When buildings are irreparably damaged, deconstruction and material reuse offer an important way to affordably recover high quality building materials, create good jobs, retain the community's cultural, historical, and architectural legacies, and build sustainably for the future.

♻

p. 124 Photo: by Brad Guy
p. 127 Photo: by John Robert Portman

LESSONS LEARNED

PROVIDE STRONG LEADERSHIP
The design charrette team—a diverse group of building experts, designers, educators and activists—contributed a variety of ideas that were often in conflict with each other. Strong direction and a clear mandate from the client are required to create a cohesive design that meets the tenant's and community's needs.

LOOK FOR A MIDDLE PATH
When working in historic neighborhoods or rebuilding after natural disasters, rehabilitation or demolition aren't the only options. Deconstruction and rebuilding with the salvaged materials provides a third path that can integrate green building design with historic and cultural preservation.

KNOW ITS WORTH
Knowing the value of old building materials—including how much it would cost to replace them—can help make the economic case for deconstruction. Not only can reuse often save money on material purchases, but frequently the old materials are stronger, more durable and more beautiful than comparable new materials.

UNCOVER LINKS TO THE PAST
Sometimes, materials are worth preserving even if they can't be put to work as a building component. At 5200 Dauphine Street, a window in the floor gives people a peek at the charming old floor tiles—a poignant reminder of what came before.

LEARN MORE

HAL COLLUMS CONSTRUCTION
halcollums.com

HISTORIC GREEN
historicgreen.org

HOLY CROSS NEIGHBORHOOD ASSOCIATION
helpholycross.org

PRESERVATION RESOURCE CENTER
prcno.org

WAYNE TROYER ARCHITECTS
studiowta.com

"THERE'S AN EXPRESSION OF THE PAST AND THE PRESENT..."

—Wayne Troyer, architect

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Cypress	Exterior siding	Interior wainscot	On-site	On-site	1,070 Sq ft	
Lumber	Wood framing in St. Bernard Housing Project	Wood flooring	Offsite, vendor: Jim Walters Importer/ Exporter	New Orleans, LA	2,700 Sq ft 4,200 Lbs	Milled
Tongue & groove wood	Wood flooring	Ceiling paneling	On-site	On-site		
Structural-grade wood	Wood framing	Trusses	Offsite, vendor: Albany Woodworks	Albany, GA		
Wood	Varied	Millwork	On-site	On-site		
Wood	Varied	Exterior windows and doors	On-site	On-site		Milled
Doors	Interior doors	Interior doors	On-site	On-site		

Interpretive Center

OMEGA

Photo: copyright © Assassi

Interpretive Center

Interpretive Center

OMEGA

Photo: copyright © Assassi

Interpretive Center

Interpretive Center

OMEGA

Photo: copyright © Assassi

Interpretive Center

OMEGA CENTER

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Omega Center for Sustainable Living

LOCATION
Rhinebeck, NY

YEAR COMPLETED
2009

PRIMARY USE
Educational, Waste-water Treatment Facility, Interpretive Center

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$3.2 million

CERTIFICATIONS
LEED-NC Platinum (pending), Living Building Challenge Certification

SIZE
6,200 Sq ft

CLIENT/OWNER
Omega Institute for Holistic Studies

ARCHITECT
BNIM Architects

CONTRACTOR
David Sember Construction

REUSE CONSULTANT
PlanetReuse

INSTITUTE FOR HOLISTIC LIVING DEMONSTRATES ULTIMATE SUSTAINABILITY

The Omega Center for Sustainable Living, located on 195 acres in the Hudson River Valley, is the newest building at the Omega Institute for Holistic Studies. The Institute, an educational retreat center dedicated to personal and social change, developed the new building to be a natural wastewater treatment facility and an innovative education center. It includes learning space for the community as well as a research facility that focuses on wetland composition and ecology. Sustainability is a core part of the Omega Institute's mission, reflecting their ideals of the holistic relationship people should have with one another and with nature.

The project team received the mandate to make Omega Center the greenest building possible, leading them to pursue both a LEED Platinum rating and Living Building certification. The Living Building Challenge (LBC), for which the Omega Center is a pilot project, is a sustainability standard developed by the Cascadia Region Green Building Council. It's framed around seven performance categories, including energy, materials and beauty. LBC's goal is to promote the most advanced measures of social, environmental and economic sustainability possible today. From minimizing the carbon footprint to providing significant cost savings, material reuse played an integral role in helping the Omega Center for Sustainable Living set a new standard for sustainable building.

Reclaimed cypress wood siding came from mushroom farms.

"I WOULD USE REUSED WOOD ON EVERY PROJECT."

— David Sember, contractor

DESIGN FOR REUSE HIGHLIGHTS

— Architect Brad Clark of BNIM notes that the firm approached Skip Backus, executive director of the Omega Institute, with the draft LBC guidelines early in the project. The client quickly signed on and the building's initial design focused on meeting this standard.

— Dave Sember Construction joined the team halfway through the construction documents phase. Sember had no prior experience with reuse, but he undertook extensive materials research. Unprompted by BNIM, he began sourcing materials online such as wood from mushroom farms.

— The LBC has specific requirements about the maximum distances that materials can be transported. In general, wood must hail from within 500 miles of the project. It would have been expensive to buy new FSC (Forest Stewardship Council) that met this requirement. Instead, the project team procured reclaimed wood within the distance perimeter for a 70 percent cost savings over new FSC wood.

— Sember discovered the high costs associated with new, locally sourced wood at the beginning of the construction process. This left a window of one month to find the reclaimed materials. In addition to his own research, Sember brought on PlanetReuse, a materials broker, to help source and procure materials.

— BNIM decided early on to use wood extensively in the project. It tied in well to Omega's holistic vision and its bucolic setting. Reclaimed materials such as the interior paneling, originally from tobacco warehouses, bring a distinctive look and tactility that is in harmony with this context.

— Reused materials include wood beams from mushroom farms in Pennsylvania used as exterior siding, beech from tobacco warehouses that serve as interior paneling, interior doors from a hospital and a mill, and dimensional lumber and plywood from President Obama's Inauguration stage which find renewed life as framing and sheathing.

— Over 52,000 pounds of reclaimed wood were used in this project. This represents over 90 percent of the total wood used overall.

LESSONS LEARNED

CONSIDER A REUSE BROKER
Reuse brokers, such as PlanetReuse, are emerging to serve clients, architects and contractors in their material sourcing needs. A good broker should handle chain of custody documents (bill of sale and certificate of documentation), engineering reports, and coordination around refurbishment, transport and storage for all reclaimed materials. For the Omega Center, this support helped the contractor overcome a very short timeline.

BUILD FLEXIBILITY INTO SPECS
Specifications can be written like performance standards. A project team should consider how flexible their "design" is to allow for use of available reclaimed materials. BNIM originally specified maple as the interior paneling. Benjamin ultimately found reclaimed beech at a cheaper price that satisfied the performance requirements.

USE REUSE TO SUPPORT SUSTAINABILITY GOALS
The LBC promotes building to the highest sustainability level possible. Reclaimed materials are the ultimate form of recycling. Reusing materials that otherwise would become waste can significantly reduce our carbon footprint. Use of culturally rich elements like wood from the inaugural stage and aesthetic pieces like the wood from the mushroom farms contributed to the LBC's broader view of sustainability.

SAVE MONEY WITH RECLAIMED MATERIALS
During construction it became clear that new FSC wood had a significant price tag. Reclaimed wood provided considerable cost savings. This savings enabled the team to balance increased costs elsewhere due to other green project components.

Exterior siding detail.

"USING RECLAIMED MATERIALS IS ONE OF THE PUREST WAYS TO BUILD GREEN."

—"Flow," publication by BNIM

LEARN MORE

BNIM ARCHITECTS
www.bnim.com

OMEGA CENTER FOR SUSTAINABLE LIVING
www.eomega.org/omega/about/ocsl

PLANETREUSE
www.planetreuse.com

p. 133,135 Photos: Copyright © Assassi

Interpretive Center

Omega Center

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Cypress beams	Beams in mushroom farm buidlings	Exterior siding	Offsite, deconstruc-tion project	Pennsylva-nia		Milled
Beechwood	Tobacco Warehouse	Interior paneling	Offsite, deconstruc-tion projects	Jackson, OH and	550 Sq ft	Milled
Dimensional lumber	Wood framing in old tobacco warehouses	Wood framing	Offsite	Pittsburg, PA	3,766 Bd ft	Milled
2x dimen-sional lumber and plywood	Framing and platform in Obama in-auguration stage	Framing and interior paneling	Offsite, deconstruc-tion project	Washing-ton, D.C.	1,411 Bd ft	N/A
2x dimen-sional lumber and plywood	Joists and beams	Framing and sheathing	Offsite, deconstruc-tion project	Randolph, VT	12,620 Bd ft	
Interior doors	Interior doors	Interior doors	Offsite, deconstruc-tion project	Spring-field, VT	4 Doors	N/A
Toilet par-titions and accessories	Toilet par-titions and accesso-ries	Toilet par-titions and accessories	Offsite, deconstruc-tion project	Kansas City, MO		
Timbers	Wood framing	Interior trim	Offsite, deconstruc-tion project	Layton-ville, CA	807 Bd ft	Milled
Wood doors	Doors	Interior doors	Offsite, deconstruc-tion project	Philadel-phia, PA		N/A

CULTURAL/ RELIGIOUS

“REUSE FIT RIGHT INTO THE COMMUNITY. AND SO THE BUILDING, WHAT IT IS AND HOW WE GOT THERE, CONTINUES TO MATCH UP WITH THE PEOPLE WHO ARE GOING TO USE IT.”

—Donald Rutledge, client’s project manager, the Long Center

Whether it’s a house of worship or a home for the arts, cultural and religious buildings hold special significance in our communities. The institutions they contain offer opportunities for communities to come together or to celebrate our heritage. By building in a conscientious way that honors the values or memories of a community, material reuse can bring visibility and tactility to the intangible. In the Jewish Reconstructionist Congregation, the architects used reclaimed cypress to echo the wood-clad synagogues of Eastern Europe. The architects of the Long Center for the Performing Arts retained a connection to a beloved icon by reusing its distinctive colorful metal panels prominently. These two projects illustrate how a building can embody a community’s beliefs and cultural mores as well as the process it takes to get there.

Cultural/Religious

JEWISH

Photo: Steve Hall © Hedrich Blessing

Cultural/Religious

JEWISH

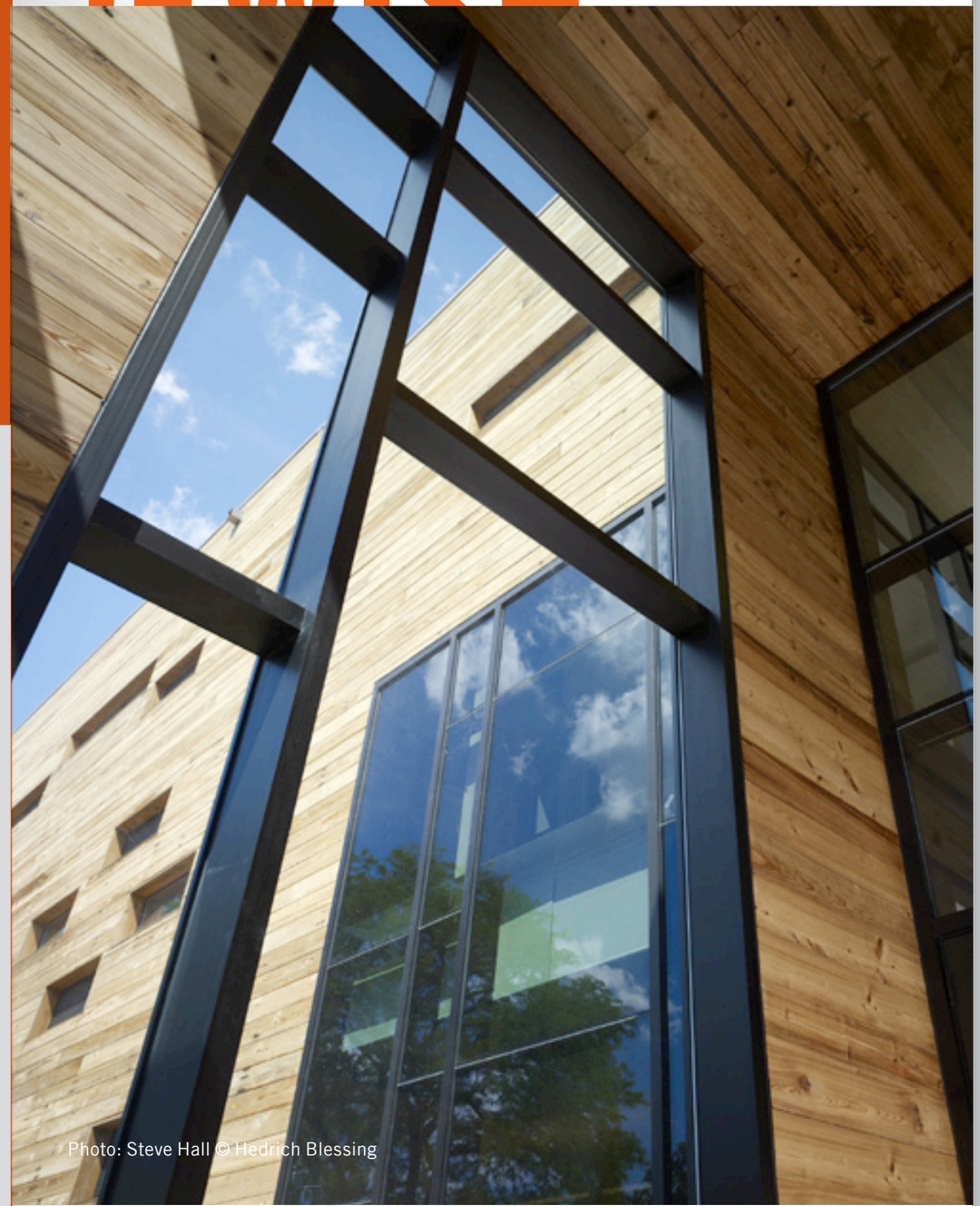


Photo: Steve Hall © Hedrich Blessing

Cultural/Religious

JEWISH RECONSTR-UCTIONIST

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Jewish Reconstruc-tionist Congregation

LOCATION
Evanston, IL

YEAR COMPLETED
2008

PRIMARY USE
Assembly

CONSTRUCTION TYPE
New construction

TOTAL PROJECT COST (LAND EXCLUDED)
$7.6 million

CERTIFICATIONS
LEED-NC Platinum

SIZE
31,600 Sq ft

CLIENT/OWNER
Jewish Reconstructionist Congregation

ARCHITECT
Ross Barney Architects

CONTRACTOR
Bulley & Andrews

STRUCTURAL ENGINEER
C. E. Anderson & Associates

SUSTAINABILITY CONSULTANT
Environmental Building Consultant

LEED CONSULTANT
Helen Kessler Asso-ciates

BUILDING SACRED COMMUNITY

More than a decade ago, the Jewish Reconstructionist Congregation (JRC) came face-to-face with the fact that their old synagogue building in Evanston, IL no longer met their needs. The congregation took a hard look at their options, including adapting the existing structure, relocating to a new site, or tearing down and replacing the old building. With their analysis indicating the latter solution to be the most cost effective, the congregation set out to create a new home that would reflect their spiritual and environmental values.

At the project's inception, the JRC board came to a consensus that the new building would be the as green as feasible, said Rabbi Brant Rosen, a decision that paved the way to using reclaimed materials and ultimately led to the first LEED Platinum place of worship. Underlying the congregation's resolve is an environmental ethic built on the Jewish principle Bal Tashchit, which teaches "do not destroy or waste," as well as their application of the principle of Tikkun Olam, "repairing the world," to environmental action.

THE DESIGN PROCESS: REUSE AS REBIRTH

In Ross Barney Architects, the congregation found a partner who shared their commitment to pursuing sustainable strategies and who had experience incorporating reused materials in their designs. The congregation, which takes their role as educators seriously, wanted the building to be a visible example of sustainable design. The architects identified the exterior cladding as a place where the aesthetic power of a reused material could have the most impact. Originally, they envisioned the exterior walls as gabions filled with demolition rubble from the former synagogue. A traditional method of building walls, dams and dikes, gabions typically consist of wire frameworks filled with earth or stones.

Although the congregation was not comfortable with the look of this initial cladding concept, it piqued their interest about the possibilities of reused materials. Looking for alternatives to the gabions, the project team drew upon a tradition of wood-clad synagogues from the shtetl era, a period that often stands to symbolize 19th century Eastern European Jewish culture. The clients were drawn to the idea of reimagining this culturally significant building type in a contemporary setting. The architects were enthusiastic about how

the character of reclaimed wood, with its nail holes and irregularities, would aesthetically express this reinterpretation.

The architects initially designed the building with a rain-screen cladding made from an unspecified source of reclaimed wood. (A rain screen is a weather-resistant surface that stands off from the structural wall, repelling moisture and allowing air to circulate behind it to keep the wall dry.) Later, when they located reclaimed cypress for the project, they developed the specific milling and installation details.

In the process, the architects learned how important it is for reused-material specifications to be somewhat flexible. Ross Barney's original specifications for the siding stipulated a minimum board length. To meet this spec, the contractor wound up ordering excess wood. Had the architects realized the procurement implications of the board length, they would have relaxed the specification, and directed the contractor to intersperse shorter boards with longer ones to achieve their aesthetic intentions with less wood.

The architects returned to the gabion concept for the design of low walls around the site's gardens and children's play area. As visitors approach the synagogue, they encounter these unusual walls, which are filled with a mix of waste brick and rubble from local demolition projects. Though the debris is not from the former synagogue, these pieces of crushed masonry nonetheless relate a story of demolition and rebuilding that links the old with the new.

Among the congregation, however, the gabion walls remain controversial. For some, the rubble brings to mind destruction, or perhaps even the Holocaust. But for Rabbi Rosen, "This is destruction that would have been discarded into some landfill and in fact it was reclaimed, renewed, reused. For me it represents rebirth, not destruction," he said.

Reclaimed Cypress was used for interior wall and ceiling paneling, as well as library shelving.

"WE HAVE LEARNED THAT IT IS NOT THE BUILDING BUT THE PROCESS OF BUILDING THAT CREATES SACRED COMMUNITY."

— Rabbi Brant Rosen, client

SOURCING REUSED MATERIALS: A TEAM EFFORT

During the schematic design phase, the architects started their search for salvaged wood for the rain screen and the interior slat walls of the sanctuary and chapel. Because this was a project for a private client, they were able to procure materials early, unhindered by requirements that public projects typically have for competitive vendor sourcing. Starting this search early proved critical since the process of finding appropriate materials required considerable effort.

Initially, they found cypress logs from freight that had been dumped from shipwrecks in the Great Lakes and the Gulf of Mexico. But when they had sample boards milled, the wood's greenish hue did not match their aesthetic intentions. Ultimately, they found cypress that had a color and grain they liked; the wood came from dismantled mushroom-growing buildings in the Northeast.

Since this cypress was located before the construction contract was put out to bid, the congregation pre-purchased the wood and made its use a requirement of the contract. For the contractor, Bulley & Andrews, procurement and scheduling of the reclaimed wood was no more difficult than using virgin material. All told, they used about 18,000 square feet of the cypress, with the supplier delivering it in stages as it was needed, allowing the contractor to work at their own pace without storage concerns.

To save money and resources, a rock crusher was brought on site to crush 2,700 tons of concrete and other masonry from the demolished synagogue. The former basement walls were left standing and backfilled with the crushed debris to form the new foundation.

Construction of the gabion walls took place later in the construction process, as these were freestanding site walls in the landscape. Because the team had used all the crushed masonry from the old synagogue for the new foundation's fill, they had to seek other sources of debris for the gabion fill material. The architects gave the contractors loose parameters, stipulating that the fill be local and not virgin material but remaining open about its other qualities. The contractors located broken waste bricks from a local pre-cast manufacturer, and additional brick and concrete from local demolition projects.

As the project progressed, the contractors became increasingly proactive about looking for reused materials. They found reclaimed black walnut for the bimah, the raised dais in the main sanctuary. Ordinarily, municipal trees are mulched when they have

to be removed, which is a shame since the wood is often high quality hardwood. These particular black walnuts, cut down from Chicago parks, were milled into 1,000 square feet of flooring for the bimah.

Four crimson maples that could not be saved on the property were cut down and milled locally. These were used as the cladding for the synagogue's ceremonial door, helping to keep alive the congregation's connection to its history.

Exterior view with reclaimed Cypress.

"THIS IS DESTRUCTION THAT WOULD HAVE BEEN DISCARDED INTO SOME LANDFILL AND IN FACT WAS RECLAIMED, RENEWED, REUSED."

— Rabbi Brant Rosen, client

UNPREDICTABILITY IS PREDICTABLE WITH SOME REUSED MATERIALS

Quality control in the cypress milling process was the only significant reuse challenge the project team experienced. Although having the cypress milled to size for the exterior cladding and interior slat walls entailed only a very small cost premium—at that time negligible compared to new wood—the supplier was not very experienced and some of the wood they delivered was unsuitable.

Irregularities in the boards, including damaged ends that had to be cut out onsite, meant the contractors had to buy 5 to 10 percent more wood than had initially been planned. This also significantly increased the labor required to prepare and install the wood.

Architect Michael Ross admits that "reusing material in a new form has its own unpredictable consequences." But overall, the team found the process of building with reused materials to be quite manageable. One reason for the success of the construction process was that Bulley & Andrews had been retained at the outset of the project for pre-construction services, including cost estimating. As a result, they became very familiar with the architect's and client's intentions, including the commitment to material reuse. JRC

did have four other pre-qualified general contractors bid on the project, but ultimately awarded it to Bulley & Andrews.

Ceiling paneling of reclaimed Cypress.

"REUSING MATERIAL IN A NEW FORM HAS ITS OWN UNPREDICTABLE CONSEQUENCES."

— Michael Ross, architect

PATH TO CERTIFICATION

To achieve Platinum certification, it's important to address the LEED process from the first conversations with the client, said Ross. Most of the strategies they employed to achieve LEED Platinum, including many regarding materials, were in place before schematic design.

The project team earned both the resource reuse credits, MR 3.1 and 3.2. With the help of a LEED consultant, they rigorously monitored reused material selection from design development forward, tracking the materials against the thresholds required by the LEED credits. In addition, one of the project team's weekly meetings every month was devoted to ongoing evaluation of LEED documentation.

SHARING THE STORY WITH THE LARGER COMMUNITY

The salvaged wood siding and interior slat walls look dramatic, said Rabbi Rosen, but there is more to them than meets the eye. "They have a story behind them," he said, "so you don't really understand the full meaning of them until they're explained to you."

Education is central to the congregation's view of its role in the larger community. During construction, Rosen maintained a blog that he used to share information about the building's progress, including the use of reclaimed materials. With the building complete, the congregation developed a formal docent program and an accompanying manual about the building, and gives weekly guided tours. A section of JRC's website, "Green Synagogue," champions the concept of sustainability in relation to the congregation's values, supplies detailed information about the building's green features, and lists resources for others looking to build and live green.

"We're on the map as being the first LEED Platinum house of worship in the world," said Rabbi Rosen, "and that means we have to pony up in terms of our advocacy of environmental issues."

Gabion walls were filled with broken brick from demolition.

"WE'RE ON THE MAP AS BEING THE FIRST LEED PLATINUM HOUSE OF WORSHIP IN THE WORLD, AND THAT MEANS WE HAVE TO PONY UP IN TERMS OF OUR ADVOCACY OF ENVIRONMENTAL ISSUES."

— Rabbi Brant Rosen, client

LESSONS LEARNED

DON'T WRITE SPECS IN STONE
Specifications must clearly define critical elements such as structural properties, but can sometimes be more open for certain aspects of the design, especially those that relate to reused materials. On the JRC project, flexibility around the board lengths for the exterior cladding would have reduced the amount of wood needed and lowered labor costs.

INCORPORATE REUSE STRATEGIES EARLY
The process of researching and procuring reclaimed materials can be lengthy. JRC's architects started their search early in the schematic design phase, which allowed them to find materials that are featured prominently in the building's design, such as the beautiful salvaged cypress.

ENGAGE THE CONTRACTOR EARLY
Having the contractor on the team early, even if only in an advisory capacity, can help establish shared priorities and understanding about intentions for including reuse materials.

SPOT OPPORTUNITIES IN UNEXPECTED PLACES
As the synagogue's construction got underway, the architects and contractors began to recognize possibilities for sourcing and incorporating salvage in unplanned for ways, such as the black walnut for the Bimah floor and the crimson maples for the ceremonial doorway.

INVOLVE THE COMMUNITY
The decision to build a LEED Platinum building captured the congregation's imagination and boosted participation in the project's capital campaign. According to Rabbi Rosen, the congregation ultimately raised more money than needed to construct the synagogue building.

GET THE CLIENT'S SUPPORT
Having a dedicated and engaged client who was flexible, open minded, willing to take some risks, and committed to sustainability made it easier to achieve LEED Platinum and incorporate reclaimed materials.

LEARN MORE

AIA COTE CASE STUDY
aiatopten.org/hpb/overview.cfm?ProjectID=1304

BULLEY & ANDREWS, LLC
bulley.com

JEWISH RECONSTRUCTIONIST CONGREGATION
jrc-evanston.org/green_synagogue

RABBI BRANT ROSEN'S CONSTRUCTION PROCESS BLOG
en.wordpress.com/tag/jrc-construction-diaries

ROSS BARNEY ARCHITECTS
www.r-barc.com

p. 144, 146, 147, 148 Photos: Steve Hall
© Hedrich Blessing

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Cypress wood		Exterior siding, interior paneling, library shelving	Offsite, de-construction project	Canada	18,000 Sq ft	Milled
Concrete and Brick	Foundation masonry	Site fill	On-site	On-site	2700 Tons	Crushed
Black Walnut Trees	Trees	Wood flooring	Offsite, vendor: Municipal Parks	Chicago, Il	1000 Sq ft	Milled
Broken brick	Demolition debris and brick man-ufacturing waste	Gabion wall fill	Offsite, vendor: brick manu-facturer and other	Chicago, Il	1780 Sq ft	N/A
Maple Wood Trees	Trees	Ceremonial door	On-site	On-site	240 Sq ft	Milled

LONG CENTER

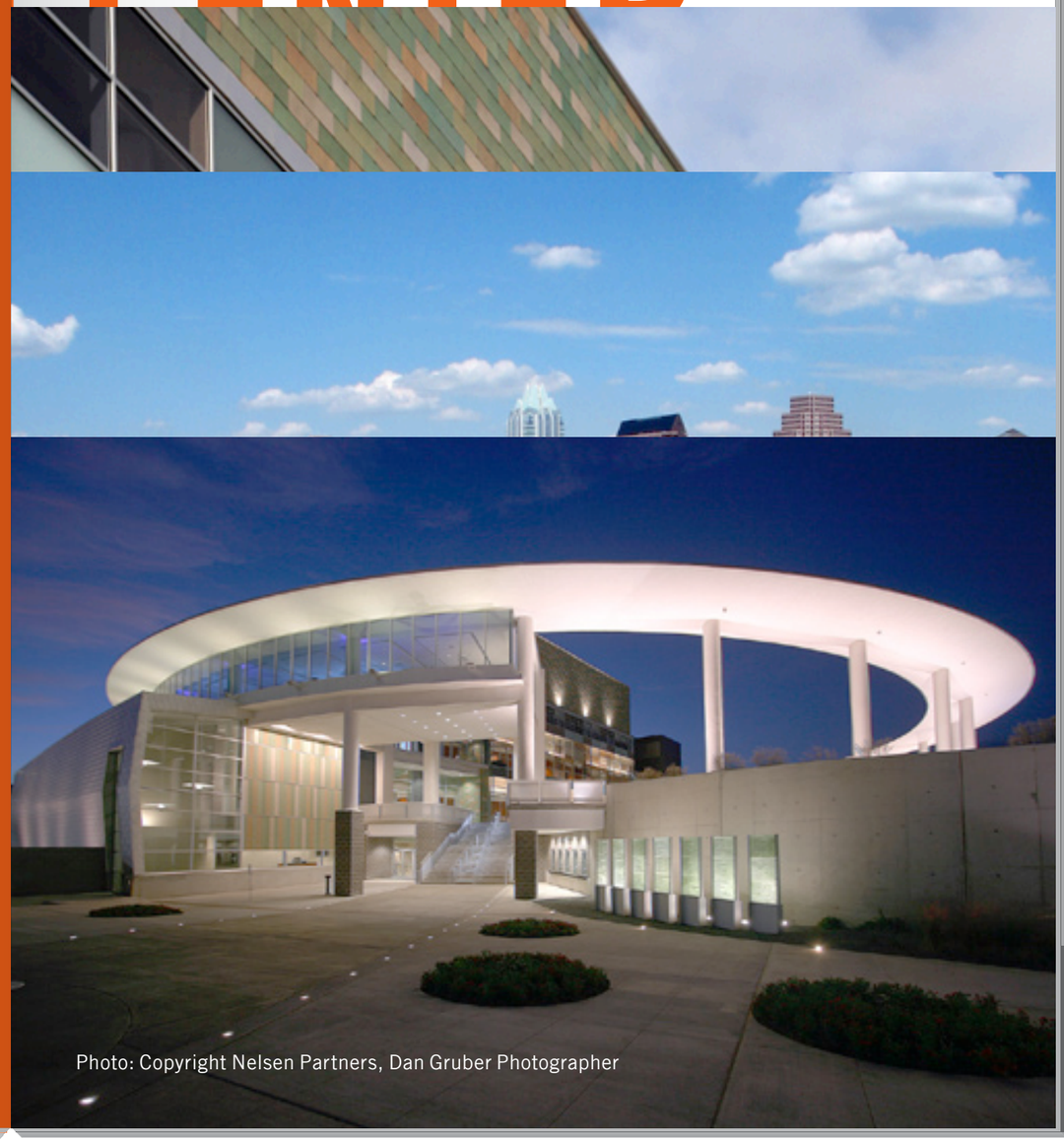


Photo: Copyright Nelsen Partners, Dan Gruber Photographer

Cultural/Religious

LONG CENTER

Photo: Copyright Nelsen Partners, Dan Gruber Photographer

Cultural/Religious

LONG CENTER

Photo: Copyright Nelsen Partners, Dan Gruber Photographer

Cultural/Religious

LONG CENTER

KEY INFO AND REUSE-RELATED PROJECT TEAM MEMBERS

PROJECT NAME
Long Center for the Performing Arts

LOCATION
Austin, TX

YEAR COMPLETED
2008

PRIMARY USE
Assembly

CONSTRUCTION TYPE
New Construction

TOTAL PROJECT COST (LAND EXCLUDED)
$77 million

SIZE
168,000 Sq ft

CLIENT/OWNER
The Long Center for the Performing Arts, the City of Austin

ARCHITECT
Nelsen Partners

ARCHITECT OF RECORD
Zeidler Partnership

CONTRACTOR
Austin Commercial

STRUCTURAL ENGINEER
Architectural Engineers Collaborative

DECONSTRUCTION CONTRACTOR
A&R Demolition

AUSTIN LANDMARK REBORN AS A STATE-OF-THE ART PERFORMANCE CENTER

The Long Center for the Performing Arts in Austin, TX developed in response to the longstanding need for a quality performing arts venue in the city. As a public-private partnership between the nonprofit Long Center for the Performing Arts and the City of Austin, the Center opened its doors not only as a theater but the permanent home of a number of local performing arts groups, including the ballet, symphony and opera.

The original project scheme, developed in 2001, called for demolishing Palmer Auditorium, a colorful mid-century domed landmark, and building a new structure. However, the difficult fundraising environment at the time made the $125 million price tag challenging. Architect Stan Haas of Nelsen Partners, who worked for years as a pro bono advisor to the project, suggested a new approach that focused on reusing the original foundation and structure around the stage as well as salvaging materials.

Although reuse was initially implemented as a cost savings measure, the client and project team found it had innumerable benefits, not the least of which was catalyzing the project's capital campaign and infusing the building with what Haas refers to as the "embodied energy of memory."

Original Palmer Auditorium under construction.

"IF WE HAD NOT REUSED THE STRUCTURE AND THE MATERIALS, IT WOULD HAVE BEEN HARDER TO FUND AND IT WOULD NOT HAVE ENJOYED THE [SAME] SUCCESS IN THE COMMUNITY."

— Donald Rutledge, client

DESIGN FOR REUSE HIGHLIGHTS

— Alex Gregg of Austin Commercial, the project's general contractor, joined the team in Design Development. Austin Commercial contributed significantly to reuse related pre-construction activities such as construction specifications and the original building's selective demolition.

— Haas and Gregg surveyed the original building extensively prior to demolition. They identified a variety of non-structural materials, such as the glass curtain wall and aluminum roof panels, that could be repurposed and inspire creative design opportunities.

—The client oversaw abatement of the original building. Then the structure underwent selective demolition, keeping the foundation and stagehouse (includes stage and supporting structure) intact. The demolition contractor set aside any material specified for reuse by the project team.

— As directed in the specifications, the materials were stored carefully between demolition and construction. The contractor stored mahogany paneling in metal containers on site to prevent moisture damage. Aluminum roof panels were stacked on pallets and taken for resizing and storage by the roofing contractor.

— Reused materials include colorful aluminum panels that adorn exterior facades and interior paneling, marble toilet partitions recut into countertops, and glass curtain wall recast into donor plaques. The ring beam that supported the dome of the old auditorium serves as an iconic architectural element in the exterior plaza.

— Over 44 million pounds of construction materials were removed from the original Palmer Auditorium. Ninety-five percent of that material was recycled or reused in the new building or projects elsewhere in the region. Notably, 60,000 square feet of the aluminum panels found new life in the walls of the Long Center.

Glass curtain wall turned into donor panels.

p. 155 Photo: Courtesy, Austin History Center
p. 156 Photo: Copyright Nelsen Partners, Dan Gruber Photographer

LESSONS LEARNED

REPURPOSE
Be open to reusing materials in a new capacity. The Palmer Auditorium's old dome was ultimately incompatible with the acoustical goals of the new facility, but the project team was able to reuse the ring beam that supported it as a prominent gateway to the new building. The roof's multi-colored aluminum panels are highly visible as exterior cladding and interior paneling.

THINK STRATEGICALLY
Material reuse doesn't have to cost more. For the Long Center, the early decision to do reuse and strategic project planning made incorporating reclaimed materials easier and more cost effective. Materials such as the marble toilet partitions and light fixtures were cost savings. New aluminum panels would have cost less, but the project team's detailed instructions for removal, resizing, and installation kept the reclaimed panels' cost reasonable. The project still came in well below market.

UNDERSTAND INTANGIBLE BENEFITS
Reclaimed materials can tell a powerful story. Although the decision to reuse the original structure was made because it saved $1.5 million, reuse also had intangible benefits, said Donald Rutledge, the Director of Design & Construction for the Long Center for Performing Arts. It strengthened the community's connection to the building and propelled the capital campaign across the finish line.

BE SPECIFIC
Clarity in specifications can be key to successfully incorporating reclaimed materials. The Long Center's specifications served as a comprehensive reference guide, spelling out the materials to be selected and structure to be preserved, the ways in which these materials were to be preserved prior to installation and by whom, and how and when they were to be refurbished and installed. As such, subcontractors were easily able to provide reasonably priced bids for this aspect of the project.

LEARN MORE

AUSTIN COMMERCIAL
austin-ind.com/commercial

THE LONG CENTER
thelongcenter.org

NELSEN PARTNERS
nelsenpartners.com

ZEIDLER PARTNERSHIP
zeidlerpartnership.com

"WITH PROPER PLANNING, REUSE CAN BE DONE WITHOUT ADDED COST OR EXPENSE TO A PROJECT."

— Austin Gregg, contractor

MATERIAL	ORIGINAL USE	REUSE APPLICATION	SOURCE	SOURCE LOCATION	QTY	REFURBISHMENT
Concrete	Perimeter ring beam	Architectural feature	On-site	On-site		
Steel	Structur-al steel framing	Structural steel framing	On-site	On-site	5 Tons	Melted and recast
Steel	Compres-sion ring	Landscape element	On-site	On-site		Refinished – lead paint sealed in
Aluminum	Roof shingles	Exterior and interior paneling	On-site	On-site	60,000 Sq ft	Cut-to-size
Marble	Restroom stall parti-tions	Countertops	On-site	On-site		Cut-to-size
Wood	Interior paneling	Interior paneling	On-site	On-site		Cut-to-size and refin-ished
Glass	Curtain wall	Donor plaques	On-site	On-site		Melted and recast
Interior lighting	Interior lighting	Interior lighting	On-site	On-site		Retrofitted

LEARN MORE

GLOSSARY

ABATEMENT
The removal of a hazardous or toxic coating (e.g. lead paint or asbestos) from a building material.

ADAPTIVE REUSE
The process of adapting existing (typically old) materials or structures for purposes other than those initially intended. Oftentimes a building's historical features will remain intact even if the use changes.

CONSTRUCTION MANAGER
Individual who directs the construction process and coordinates all contractors. In some cases the construction manager is an agent of the general contractor, overseeing a group of subcontractors. In other project delivery structures, like multiple prime, the construction manager may oversee contractors contracted to separate entity, typically the client.

CONSTRUCTION WASTE MANAGEMENT
The separation of recoverable waste materials generated during construction and remodeling from landfill waste. These separated materials may be scraps of new building materials or old building materials removed from the site. Separated materials may be reused, but this is not necessarily the case. The materials are most often recycled.

DECONSTRUCTION
The careful, selective disassembly of building components for reuse. Deconstruction is an alternative to demolition, which often leaves materials unrecoverable.

DEMOLITION
The planned, rapid destruction of a full or partial building structure.

DESIGN BUILD
A project delivery system in which a single entity is in charge of both design and construction. Unlike a design-bid-build delivery system in which design and construction typically occur in distinct phases, distinct phases are not required in design-build.

DESIGN FOR DISASSEMBLY
A design strategy to maximize the recovery and reuse of building systems, components, and materials. It is meant to ease disassembly or reconfiguration. Design for disassembly includes strategies such as building with single-material parts and using fasteners instead of adhesives. (also called **design for deconstruction** or **design for reuse**).

EMBODIED CARBON
A measurement of the carbon impact of a product's lifecycle, from cradle to grave, including extraction, manufacture, production, and disposal. Embodied carbon is different from embodied energy because it takes into account the intrinsic physical properties of a product. For instance, cement emits about half of its embodied carbon because of a chemical process unrelated to energy use.

EMBODIED ENERGY
An assessment of the energy required to extract raw materials from nature, plus the energy used in primary and secondary manufacturing activities to provide a finished product and to dispose of that product.

FIXED-PRICE CONTRACT
A contract structure in which a contractor agrees to complete a predetermined scope of work at a predetermined fee.

FOREST STEWARDSHIP COUNCIL
A nonprofit organization devoted to encouraging the responsible management of the world's forests. The FSC is considered one of the world's leading standard-setting and accreditation services in the area of sustainable forestry.

GRADE
A classification of the quality of lumber based on factors including the amount and size of knots, twist, and cracks in the material. Many wood types have their own grading systems; there is no universal standard for all woods.

LEED™ MATERIAL REUSE CREDITS
The credits within the USGBC's LEED rating system that are available to buildings which incorporate material reuse. The requirement for credit is that reclaimed materials account for at least 5% (Credit 3.1) or 10% (Credit 3.2) based on cost, of the total value of materials on the project.

LIFECYCLE ASSESSMENT
The Lifecycle Assessment (LCA) is an environmental assessment that considers the entire value chain involved in producing, using, and disposing of a product. It includes data points such as energy consumption and related greenhouse-gas emissions.

LIFECYCLE BUILDING CHALLENGE
An annual competition for "lifecycle buildings," which are buildings that incorporate strategies of adaptability and disassembly to allow recovery of all building systems, components, and materials.

LIVING BUILDING CHALLENGE
A certification program that is considered the most advanced measure of sustainability in the built environment. The program has stringent requirements for the materials and energy impact of a building.

MATERIAL EXCHANGE
A service that connects individuals and entities wishing to offload materials and products with those in need. Many exchanges are web-based, but some also have a physical warehouse or retail component.

MATERIAL REUSE
The act of incorporating reclaimed materials into a new assembly.

MATERIALS BROKER
Consultants that locate and connect reclaimed materials with designers, owners, or contractors for a fee. They often specialize in a particular material such as paper, metals or plastic, although some will handle multiple categories of materials.

MILL
To shape wood to a desired dimension and profile by running the wood a machine that removes material.

MULTIPLE PRIME
A project delivery structure in which all contractors are employed under a separate contract with the client, rather than as sub consultants to a general contractor.

PLANE
To pass wood through a device which smooths its surface.

RECLAIMED MATERIALS
Materials extracted from the waste stream that are reused without further processing or with only minor processing that does not alter the nature of the material.

RECYCLING
The processing of used materials into new products to prevent waste or reduce consumption of raw materials. Recycling includes a series of changes and/ or treatments, as opposed to reuse which does not include significant treatments.

REFURBISH
To restore a material, product or assembly through cleaning, refinishing or other modification.

REUSE RETAILER
A commercial outfit selling used and salvaged goods. Often reuse retailers have physical stores targeting specific markets.

SINKER LOGS
Logs recovered from the bottom of rivers. In the 19th and 20th centuries, the lumber industry often transported logs to sawmills via rivers. Sinker logs are those that sank along the way. Preserved beneath the river, these logs are often in excellent condition and offer a grade and character of wood not currently available on the market.

SURPLUS MATERIALS
Materials and equipment that go unused or are no longer needed during a construction project either due to over-ordering or change-order. Often this material or equipment is new or only lightly used.

INFORMATIONAL WEBSITES

AGC RECYCLING TOOLKIT: DECONSTRUCTION
agc.org/cs/industry_topics/environment/recycling_toolkit/deconstruction

As part of the Association of General Contractors' (AGC) collection of resources for construction professionals, the Deconstruction section provides links to many related organizations. The website includes basic tools for deconstruction, compiled by the organization.

BUILDING MATERIALS REUSE ASSOCIATION
bmra.org

The Building Materials Reuse Association (BMRA) is a nonprofit that promotes deconstruction and material reuse through education, research, and advocacy. The website serves a wide spectrum of stakeholders including building owners, designers, government agencies, contractors, as well as the general public. It provides news, event info, discussion forums, and resources including best practices, case studies, and how-to guides.

DECONSTRUCTION INSTITUTE
deconstructioninstitute.com

The Deconstruction Institute website shares information with anyone who is interested in deconstruction as an alternative to demolition. The interactive website provides a place for users to upload case studies, photos, and listings of reuse businesses, as well as engage in discussions with others.

EPA REDUCING C&D MATERIALS: RESOURCES BY MATERIAL TYPE
epa.gov/epawaste/conserve/rrr/imr/cdm/reuse.htm

The website aggragates information on reused materials from other websites. Material types include asphalt, shingles, gypsum, steel, wood, paint, and carpet among others. The website is operated by the Envirionmental Protection Agency (EPA).

LIFECYCLE BUILDING CHALLENGE
lifecyclebuilding.org/resources.php

The Lifecycle Building Challenge is an annual competition for lifecycle buildings (which incorporate strategies adaptability and disassembly). Competition participants include academics, students, and professionals in the construction and deconstruction industries. The website shares competition entries as well as provides resources related to deconstruction, design for disassembly, and material reuse to competition participants and others interested in lifecycle building.

REUSE ALLIANCE
reusealliance.org

The Reuse Alliance is membership-based national nonprofit focused on promoting and supporting reuse-related organizations and municipal agencies. The website provides news, reuse facts, and resources to these organizations.

REUSE DEVELOPMENT ORGANIZATION
redo.org

The Reuse Development Organization (ReDo) is a national nonprofit focused on facilitating and promoting reuse of surplus and discarded materials. The website provides info about the benefits of reuse. It also provides information on ReDo's material donation program and a detailed list of reuse centers across the country.

CALCULATORS

ATHENA INSTITUTE
athenasmi.org

The Institute's website provides two tools, the *ATHENA Impact Estimator for Buildings* and the *ATHENA EcoCalculator for Assemblies*, for lifecycle analysis of a building's environmental impact. The free EcoCalculator allows analysis of individual assemblies within a building (i.e. wall, floor, roof). The *Impact Estimator* is available for purchase and allows analysis of an entire building. Both tools factor the environmental impact of building materials from a cradle-to-grave perspective.

BUILDING MATERIALS REUSE CALCULATOR
deconstructioninstitute.com/download.php?dowID=19

The Building Materials Reuse Calculator is a tool for gauging the benefits of material reuse. It measures the amount of savings that reclaimed materials provide from the negative environmental impacts (e.g. greenhouse gas emissions and embodied energy) resulting from extracting, processing, manufacturing, and transporting new building materials.

CARNEGIE MELLON ECONOMIC-INPUT LIFECYCLE ASSESSMENT
eiolca.net

The EIO-LCA estimates the materials, energy, and emissions required for and resulting from activities in our economy. Users indicate the industry and sector of a particular activity, such as the scale of the activity in dollar value. The calculator estimates the associated economic activity, greenhouse gases, energy, toxic releases, and water use in dollars. The EIO-LCA can provide a broad-level understanding of the impacts of construction for various building types, however it does not allow evaluation of the impacts of specific construction methodologies or materials.

EPA WASTE REDUCTION MODEL (WARM) CALCULATOR
epa.gov/warm

The U.S. EPA's WAste Reduction Model (WARM) calculates the greenhouse gas emission savings of waste management practices. Users can compare baseline and alternative waste management practices for over thirty materials. The WARM Calculator does not recognize 'reuse' as a waste management practice but it can be a useful tool for estimating the amount of carbon offset of keeping materials out of the waste stream.

REUSE RETAILERS

NATIONAL

BUILDING MATERIALS REUSE ASSOCIATION
bmra.org

HABITAT RESTORE
habitat.org/env/restores.aspx

THE REUSE PEOPLE
thereusepeople.org

TERRA MAI
terramai.com

EAST

BOSTON BUILDING RESOURCES
bostonbmrc.org
Boston, MA

BUILD IT GREEN!NYC
bignyc.org
New York, NY

COMMUNITY FORKLIFT
communityforklift.com
Edmonston, MD

THE LOADING DOCK, INC.
loadingdock.org
Baltimore, MD

REBUILD
resourcevt.org
Burlington, VT

REBUILD
rebuildwarehouse.org
Springfield, VA

RENEW BUILDING MATERIALS AND SALVAGE, INC.
renewsalvage.org
Brattleboro, VT

RESTORE
restoreonline.org
Springfield, MA

WEST

BUILDING RESOURCES
buildingresources.org/index.html
San Francisco, CA

BRING RECYCLING
bringrecycling.org
Eugene, OR

MATERIALS MATTER
materialsmatter.org
Laguna Hills, CA

OHMEGA SALVAGE
ohmegasalvage.com
Berkeley, CA

THE REBUILDING CENTER
rebuildingcenter.org
Portland, OR

RESOURCE YARD
resourceyard.org
Boulder & Fort Collins, CO

THE RE STORE
re-store.org
Seattle & Bellingham WA

SECOND USE
seconduse.com
Seattle, WA

URBAN ORE
urbanore.ypguides.net
Berkeley, CA

WHOLE HOUSE BUILDING SUPPLY & SALVAGE
driftwoodsalvage.com
East Palo Alto, CA

SOUTH/ CENTRAL

THE GREEN PROJECT
thegreenproject.org
New Orleans, LA

REBUILDING EXCHANGE
rebuildingexchange.org
Chicago, IL

THE REUSE CENTER
thereusecenter.com
Minneapolis, MN

STARDUST BUILDING SUPPLIES
stardustbuilding.org
Phoenix & Mesa, AZ

PRESERVATION RESOURCE CENTER
www.prcno.org/shop/salvagestore.php
New Orleans, LA

WASTECAPDIRECT
wastecapwi.org/wastecap-direct/about-wastecapdirect
Wisconsin

REUSE BROKERS & EXCHANGES

NATIONAL

AMERICAN BUILDER SURPLUS
americanbuildersurplus.com

BUILDER2-BUILDER.COM
builder2builder.com

CONSTRUCTION MATERIAL DEPOT
cmdepot.com

CRAIGSLIST
craigslist.org

DIGGERSLIST.COM
diggerslist.com

EPA'S LIST OF MATERIAL EXCHANGES
epa.gov/epawaste/conserve/tools/exchange.htm

THE INSTITUTION RECYCLING NETWORK (IRN)
wastemiser.com/index.html

PLANET REUSE
planetreuse.com

THE RECYCLER'S EXCHANGE
recycle.net/exchange

RE-USE CONSULTING
reuseconsulting.com

SALVAGED BUILDING MATERIALS EXCHANGE
greenguide.com/exchange/index.html

THE LOADING DOCK
loadingdock.org

THE REUSE INSTITUTE
thereusepeople.org/ReUseInstitute

USED BUILDING MATERIALS EXCHANGE
build.recycle.net/exchange

REGIONAL

2 GOOD 2 TOSS NETWORK
2good2toss.com

BONEYARDNW
boneyardnw.com

CALIFORNIA MATERIALS EXCHANGE (CALMAX)
calrecycle.ca.gov/CalMAX

GREEN RECYCLING NETWORK (GRN)
greenrecyclingnetwork.com

INDUSTRIAL MATERIALS EXCHANGE (IMEX)
lhwmp.org/home/IMEX/index.aspx

NW MATERIALSMART
nwmaterialsmart.com

NYC WASTEMATCH
wastematch.org

REBUILDING EXCHANGE
rebuildingexchange.org

WASTE XCHANGE
wastexchange.org

PUBLICATIONS, FILMS, AND PODCASTS

PUBLICATIONS

BUILDING WITH RECLAIMED COMPONENTS AND MATERIALS
Bill Addis
2006

CRADLE TO CRADLE
Wiliam McDonough & MIchael Braungart
2002

REDUX: DESIGNS THAT REUSE, RECYCLE, AND REVEAL
Jennifer Roberts
2005

REMATERIAL: FROM WASTE TO ARCHITECTURE
Alejandro Bahamón & Maria Camila Sanjinés
2010

UNBUILDING: SALVAGING THE ARCHITECTURAL TREASURES OF UNWANTED HOUSES
Bob Falk & Brad Guy
2007

SUPERUSE: CONSTRUCTING NEW ARCHITECTURE BY SHORTCUTTING MATERIAL FLOWS
Ed van Hinte, Cesare Peeren, & Jan Jongert, ed. 2007

STUDIES & GUIDES

A GUIDE TO DECONSTRUCTION
Brad Guy & Eleanor Gibeau
2003

DESIGN FOR DECONSTRUCTION
Scott Shell, Octavio Gutierrez, Lynn Fisher, et al for U.S. Environmental Protection Agency
2006

DESIGN FOR DISASSEMBLY IN THE BUILT ENVIRONMENT: A GUIDE TO CLOSED LOOP IN DESIGN AND BUILDING
Brad Guy & Nicholas Ciarimboli for the City of Seattle

FEDERAL GREEN CONSTRUCTION GUIDE FOR SPECIFIERS
Dru Meadows
2010

GREEN HOME REMODEL: SALVAGE & REUSE
Thor Peterson for Seattle Public Utilities Sustainable Building Program
2005

INCORPORATING RECLAIMED AND SALVAGED MATERIALS AND COMPONENTS NTO CANADIAN CONSTRUCTION PROJECTS
Lawrence Morettin & Dr. Mark Gorgolewski
2008

LEAD PAINT AND HISTORIC BUILDINGS: TRAINING MANUAL
Dennis Livingston, Jeff Gordon, Carol J. Dyson
2000

LIFECYCLE CONSTRUCTION RESOURCE GUIDE
U.S. Environmental Protection Agency
2008

OLD TO NEW DESIGN GUIDE: SALVAGED BUILDING MATERIALS IN NEW CONSTRUCTION V. 3
Scott Shell, Octavio Gutierrez, Lynn Fisher, et al for U.S. Environmental Protection Agency
2006

WASTESPEC: MODEL SPECIFICATIONS FOR CONSTRUCTION WASTE REDUCTION, REUSE, AND RECYCLING
Judith Kincaid, Cheryl Walker & Greg Flynn
1995

FILMS & PODCASTS

SCRAPHOUSE: SAN FRANCISCO
Anna Fitch
2006, The National Geographic Channel

SUPER USE, E² DESIGN, SEASON 3
Tad Fettig & Karena Albers
2008, PBS

USGBC PODCAST: SALVAGED MATERIAL REUSE
Liz Ogbu &Tom Dietsche
2010
itunes.apple.com/us/podcast/usgbc-knowledge-exchange/id357912494

PROJECT TYPE

CONSTRUCTION TYPE

*Indicates on-site deconstruction

LOCATION

DESIGN FOR DISASSEMBLY

LEED MR 3.1/3.2 CREDIT ACHIEVED

MATERIALS BY CSI (REUSE APPLICATION)

© 2010 Public Architecture. All rights reserved.
The photographs in this book are used with permission and their authors retain all rights in their possession.
Designed by Studio Lin www.studiolin.org