

CONSTRUCTION SALVAGE AND RECYCLING

Toolkit

Start Smart

Construction salvage
and recycling guide

A local how-to blueprint
for LEED salvage and
recycling points



METRO

CONSTRUCTION SALVAGE AND RECYCLING **Toolkit**

Purpose of this publication

Metro created this publication to help the metro region building industry become more efficient in their use of resources. There is a specific focus on commercial building materials because they represent the biggest opportunity and the biggest challenge in taking them from disposal as garbage into salvage and reuse programs. The U.S. Green Building Council has done a good job of providing incentives to deconstruct as well as build with used materials, but builders and architects have found that attaining the LEED points for these practices can be difficult, even for experienced builders. For this reason, this publication is structured around the use of LEED programs and explicitly describes how local project teams can make salvage and reuse easier, maximize their LEED points related to reuse and salvage and minimize project cost.

June 2007

CONSTRUCTION SALVAGE AND RECYCLING

Toolkit

Construction salvage and recycling are good for business and for the environment. Metro offers practical tools to help contractors, architects and developers save money, earn credit for “green” building practices and keep reusable or recyclable building materials out of the landfill.

Start Smart guide

A local how-to blueprint for attaining LEED salvage and recycling points from the U.S. Green Building Council

Find a Recycler directory

A go-to listing and map of more than 100 nearby recycling sites

www.BoneyardNW.com

An online marketplace for buying and selling used commercial building materials

Request a copy of the Start Smart guide or the Find a Recycler directory and map by calling Metro Recycling Information at (503) 234-3000. Visit **www.metro-region.org/toolkit** to download electronic copies of the books or to search an interactive directory for the recycler nearest you.

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INTRODUCTION

Green building is transforming the marketplace. The market for green building products and services topped \$7 billion in 2005 – a 37 percent increase over 2004.¹ Green buildings represented about 2 percent of the American commercial construction market in 2004, but by 2010, experts expect that percentage to grow to between 5 and 10 percent of the market, with a value between \$10.2 billion and \$20.5 billion.

Developers who build green can expect to reap a premium of about 7.5 percent compared to standard construction. Similarly, owners of green buildings can expect an average increase of 6.6 percent in return on investment, 3.5 percent in occupancy ratio and 3 percent in rents.² The success of this transformation is due in part to the popularity of the U.S. Green Building Council's rating system, known as LEED™.³

Because of the strength of this trend, most of the industry is familiar by now with green building strategies such as using energy-efficient and water-efficient fixtures, recycling construction and demolition waste and improving indoor air quality. However, green building practices encompass a wide variety of other strategies and approaches, including some that may seem more challenging than choosing efficient light fixtures. Chief among these are deconstruction, salvage and materials reuse.

Deconstruction is the process of removing a building by disassembly in a manner that preserves the usefulness of the building materials. It often occurs in roughly the reverse order in which the building was constructed. Salvage is the removal of certain valuable reusable building materials before demolition, while materials reuse is the incorporation of salvaged building materials into a new or remodeled building.

This guide was developed for owners, developers, designers and contractors who want to use deconstruction, salvage and materials reuse techniques to remodel or build new commercial buildings in the metro region. It is intended to provide in-depth yet concise guidance on how to deconstruct a building,

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salvage materials and reuse building materials in a new commercial project. The guide is divided into five sections:

- Part I is for industry professionals who are new to green building, deconstruction, salvage and materials reuse. It provides more information on how these approaches can benefit a business, and presents case studies of local projects that successfully deconstructed buildings and/or reused building materials.
- Part II provides detailed guidance on how to plan a deconstruction project and salvage materials. It also discusses how to sell salvaged materials to others.
- Part III describes how to plan for incorporating salvaged materials into a new commercial project, and presents some ideas on ways to reuse building materials.
- Part IV is a list of resources for those who want more information about these techniques, or who want to locate deconstruction and reuse related businesses in the metro region. It also contains examples of specifications, deconstruction tracking forms, LEED documentation forms and other reference materials.

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If you want to know...

- Why deconstruction and reuse are good for a business go to *Why deconstruction and reuse?* on page 3
- More about the LEED rating system go to *What is LEED?*, page 5
- How to use deconstruction and reuse to gain LEED credits go to *LEED-NC credits*, page 10
- How to plan for deconstruction go to *Planning for deconstruction*, page 27
- Where to find local contractors, salvaged materials and more, go to *Sources*, page 68

The **Start Smart Toolkit** – a local how-to blueprint for LEED salvage and recycling points



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Deconstruction and LEED – a natural fit

Part 1





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Deconstruction and LEED

Deconstruction and materials reuse will appeal to owners and project teams that want to build green. In fact, these strategies are excellent first steps to help a project team achieve LEED certification. This section describes why some industry professionals are choosing to deconstruct buildings and reuse building materials, shows how deconstruction can help achieve LEED-certification goals, and includes case studies of commercial building projects in the metro region that successfully deconstructed an old building and reused salvaged materials on a new or rehab project.

Why deconstruction and reuse?

Why deconstruct a building? Perhaps the most obvious benefit is that deconstruction cuts waste and associated disposal costs. However, project owners who have deconstructed buildings cite a variety of other benefits.

- **Generating revenue.** Because deconstruction preserves the value of building materials, project teams can sell them. Alternatively, project teams can reuse salvaged materials, thus avoiding the expense of buying new products. In contrast, demolition practices generate expenses in the form of high disposal fees for waste.
- **Creating a unique product.** Deconstruction of older buildings, especially antique or historic buildings, creates a product that's not available in the new material marketplace
- **Sustainability.** Modern demolition practices typically use heavy machinery to demolish buildings. This method can have significant air quality implications, and heavy machinery can damage sensitive areas such as shorelines, stream banks and tree roots. Deconstruction reduces these effects. As a result, the permitting process for deconstruction can be simpler than for demolition.
- **Safety.** Compared to traditional demolition, which uses heavy equipment, deconstruction poses less serious risk of worker injury.

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- **Being responsive to the larger community.** Unlike demolition, deconstruction diverts materials from disposal, creates a local source of building supplies and reduces the demand for virgin materials.

From a purely bottom-line perspective, deconstruction and reuse offer the following advantages over traditional demolition and the exclusive use of new building materials:

- The market for sustainable building is growing rapidly in the metro region and nationally: the 2006 *Green Building SmartMarket Report* estimates that by 2010, green commercial construction starts in the United States will be worth between \$10.2 and \$20.5 billion. As mentioned above, green buildings already command higher prices. Developers who build green expect to reap a premium of around 7.5 percent compared to standard construction. Owners of green buildings can expect an average increase of 6.6 percent in return on investment, 3.5 percent in occupancy ratio and a 3 percent increase in rents.⁴

Developers who build green expect to reap a premium of around 7.5 percent compared to standard construction.

- Using deconstruction and salvage can help owners, designers and construction professionals market themselves and the new building as green or sustainable. Savvy firms can use deconstruction and salvage to create a story about a new building's green elements that piques potential tenants' or customers' interest. In particular, salvaged elements lend even brand-new buildings a sense of history and roots in the community.
- Using salvaged materials may reduce costs, particularly for tenant improvement projects. For example, one tenant in the Jean Vollum Natural Capital Center in Portland saved more than \$45,000 by using salvaged materials to create cubicles and work stations.⁵
 - Deconstructing an existing building will not automatically reduce costs, but it might if planned carefully. If the project team can reuse or sell many of the materials that are salvaged from the old building, then the cost savings and revenue generated may equal or exceed the higher labor costs of

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deconstruction. Depending on the project and the salvage value in a particular building, deconstruction may cost less than mechanical demolition.

- Firms that establish a reputation for successfully executing deconstruction and reuse projects can market themselves as specialists in a field of generalists. This experience may translate into greater selection of future work.
- Deconstruction and reusing salvaged materials can help project teams achieve Materials and Resources credits in LEED. It can also help a building project qualify for local or state tax incentives.

What is LEED?

LEED, or Leadership in Energy and Environmental Design, is a green building rating system that sets a voluntary standard for high performance, sustainable buildings. The U.S. Green Building Council (USGBC) developed this standard and continues to refine it.

According to the USGBC web site,⁶ the council created LEED for the following purposes:

- Define “green building” by establishing a common standard of measurement
- Promote integrated, whole-building design practices
- Recognize environmental leadership in the building industry
- Stimulate green competition
- Raise consumer awareness of green building benefits
- Transform the building market

So far, it seems to be working: demand is growing for LEED-certified buildings. In fact, the city of Portland currently has the most LEED-certified buildings per capita in the nation.⁷ Elsewhere in the Pacific Northwest, the city of Seattle recently changed its building codes to allow developers to add extra stories to downtown buildings, but only if the buildings meet the LEED-silver standard. The state of Washington requires all of its new buildings and major renovation projects above 5,000 square feet to be built to LEED standards.

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A wide variety of programs recognize businesses' efforts to build



green. Some programs focus on one aspect of green building, such as energy efficiency, while others are broader. For example, the Green Globes standard mirrors LEED's focus on sites, energy, water, air and materials.

The United States office of the Green Building Initiative promotes the Green Globes. Their web site is www.thegbi.com/greenglobes.

The USGBC has developed different rating systems for different types of building projects: new construction and major renovations, core and shell, commercial interiors, and neighborhoods, to name a few. All of them work on a point system. A project's LEED certification level depends upon the number of points it achieves. There are four levels: certified (26-32 points), silver (33-38 points), gold (39-51 points) or platinum (52-69 points). The points are divided among six categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design Process.

Most of the LEED credits related to deconstruction and materials reuse are in the Materials and Resources section. There may, however, be opportunities to use deconstruction and materials reuse to obtain credit in the Innovation and Design section. For more information about how deconstruction and reusing building materials can help project teams achieve LEED certification, see the LEED-NC credits section on page 10.

Why build green?

In 2005, McGraw Hill Construction surveyed owners and architectural, engineering and contractor firms to attempt to answer this question. The two primary reasons respondents cited for building green were as follows:

1. Lowering lifecycle costs, such as energy efficiency and productivity increases (73 percent)
2. Being part of an industry that values the environment (72 percent).⁸

Because deconstruction and reuse reduce the environmental impacts of a construction project, these techniques are excellent ways to demonstrate that a project team values the environment. Deconstructing a building preserves the building components' value, allowing them to be reused or at least recycled. Reuse of building materials keeps valuable materials out of the landfill and extends their useful lives, reducing the need to manufacture and transport new building materials.

Currently, one of the best ways for owners and project teams to demonstrate their commitment to the environment is to achieve LEED certification. The building industry, government agencies and the general public all have accepted LEED as a standard that indicates a building's environmental performance. Deconstruction and reusing salvaged materials can help owners and project teams qualify for LEED credits.

The State of Oregon offers a tax credit to owners whose buildings achieve a LEED-silver rating or higher. For more information, visit the Oregon Department of Energy's web site at oregon.gov/ENERGY/CONSIBUS/tax/sustain.shtml.



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Deconstruction + reuse = LEED credits

LEED awards up to 12 points for using salvaged materials, diverting materials from the landfill and maintaining parts of the building intact. Deconstruction and reusing salvaged building materials are excellent ways to help achieve these points. This section explains how, and includes suggestions to help with documentation.

As mentioned above, the USGBC offers several LEED rating systems for use in different types of building projects. This guide focuses on LEED-NC Version 2.2, which is for new commercial construction and major renovation projects. However, all LEED rating systems (except for the proposed LEED Homes program) offer points for deconstruction and reuse. The table below shows how LEED rating systems for commercial projects address deconstruction and salvage.

LEED™

Comparison of materials and resources credits related to deconstruction and reuse

LEED-NC v2.2	New! Nine credits relate to deconstruction and reuse, and up to four credits available for innovation in design
LEED-EB v2.0	Existing buildings. Eight credits relate to deconstruction and reuse
LEED-CI v2.0	Commercial interiors. Nine credits relate to deconstruction and reuse
LEED-CS	pending Core and shell. Seven credits relate to deconstruction and reuse

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The checklist below, an excerpt from the LEED-NC checklist, shows the Materials and Resources credits, including those that are relevant to deconstruction and reuse.



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

<< enter project name >>

<< enter city, state, other details >>

Yes ? No

Materials & Resources			13 Points	
Y				
			Prereq 1 Storage & Collection of Recyclables	Required
			Credit 1.1 Building Reuse , Maintain 75% of Existing Walls, Floors & Roof	1
			Credit 1.2 Building Reuse , Maintain 100% of Existing Walls, Floors & Roof	1
			Credit 1.3 Building Reuse , Maintain 50% of Interior Non-Structural Elements	1
			Credit 2.1 Construction Waste Management , Divert 50% from Disposal	1
			Credit 2.2 Construction Waste Management , Divert 75% from Disposal	1
			Credit 3.1 Materials Reuse , 5%	1
			Credit 3.2 Materials Reuse , 10%	1
			Credit 4.1 Recycled Content , 10% (post-consumer + ½ pre-consumer)	1
			Credit 4.2 Recycled Content , 20% (post-consumer + ½ pre-consumer)	1
			Credit 5.1 Regional Materials , 10% Extracted, Processed & Manufactured Regionally	1
			Credit 5.2 Regional Materials , 20% Extracted, Processed & Manufactured Regionally	1
			Credit 6 Rapidly Renewable Materials	1
			Credit 7 Certified Wood	1

Yes ? No

Most project teams that focus on deconstruction and reuse can achieve 5 or 6 credits toward LEED certification.

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LEED-NC credits

All LEED rating systems include six categories, as described earlier in this guide. Although all the categories are important to the successful completion of a LEED project, the Materials and Resources category is the primary one relevant to deconstruction and reuse.

Deconstruction and salvage relate to a surprising number of LEED credits within the Materials and Resources section. Project teams can obtain LEED points in four of the seven Materials and Resources credits (or a potential for 9 out of 12 points total) as well as for credits in Innovation and Design (1-3 points⁹). The following paragraphs briefly explain how deconstruction and reuse can help project teams achieve credits in LEED-NC Version 2.2; Appendix A: Summary of LEED-NC Version 2.2 credits related to deconstruction and salvage contains a table that summarizes this information.

In the metro region the Materials and Resources credits are some of the easiest to attain because the deconstruction, reuse and recycling infrastructure is well developed and industry professionals already know so much about it. These credits are also one of the few areas of LEED that often don't cost more than traditional demolition and construction methods to achieve.



Building reuse: Maintain 50 to 70 percent of existing walls, floors and roof

Materials and Resources credits 1.1 and 1.2

Two points are possible: one point for maintaining 50 percent, and an additional point for maintaining another 20 percent or more of the existing walls, floor and roof.

Deconstruction is a logical way to achieve these credits, which apply only to remodeling projects. Instead of using standard demolition that creates debris, project teams can use deconstruction techniques to strip materials out gently, leaving much of the walls, floors and roof intact. The USGBC is interested in building reuse because it reduces demand for new building materials that require resource extraction as well as energy for manufacture and transportation. Moreover, it prevents useful materials from being sent to the landfill.

Building reuse: Maintain 50 percent of interior non-structural elements

Materials and Resources credit 1.3

One point is possible. Like the credits above, this credit applies only to remodeling projects. It focuses on keeping items such as doors, interior walls, floor coverings and ceiling systems in place. Doing so preserves their value, decreases the need for manufacturing and transporting new building materials and keeps valuable resources out of the landfill.

Use deconstruction techniques to carefully remove unwanted items, leaving the retained elements in good condition. This approach may leave parts of the projects out of the normal “sequence of work,” but project teams can use other salvaged materials such as plywood or carpet pad to protect these areas from construction damage.

Note that none of the building reuse credits apply if the project includes an addition that is more than twice the square footage of the existing building.

Construction waste management: Divert 50 to 75 percent from disposal

Materials and Resources credits 2.1 and 2.2

Two points are possible here: one point for diverting 50 percent and an additional point for diverting another 25 percent of material from disposal. Although there's more to achieving these credits than deconstruction, deconstruction can help project teams achieve these points in two ways:

- Deconstructing materials helps preserve their value as building materials. As a result, they can be reused on site, sold to others for reuse, or donated to a local non-profit, which diverts them from disposal.
- Deconstruction also helps crews keep different materials separated, which makes recycling them easier. In some cases, it also means that recyclers will pay for the materials, rather than charging for them. In all cases, the materials are diverted from disposal.

Planning, tracking and communication are the keys to achieving these credits, and they are explained in more detail in Part II of this guide. Typically, the general contractor is responsible for creating a plan for deconstructing, reusing, selling and recycling as much material as possible. Alternatively, they can hire out the work to a deconstruction consultant. Because documentation is

Although tenant improvement projects differ considerably from new construction, opportunities to reuse salvaged materials within tenant improvement projects and achieve LEED credits also exist. Many of the ideas presented here work in tenant improvement projects as well.



required to achieve LEED credits, the general contractor also should institute a tracking system so that all materials, whether salvaged, recycled or disposed of, are recorded. (See Appendix B.)

In addition to deconstruction and materials reuse, recycling will be an important strategy for achieving these points. It may also be required - the city of Portland mandates job-site recycling of rubble (concrete/asphalt), land-clearing debris, corrugated cardboard, metals and wood on all construction and demolition projects with a permit value exceeding \$50,000. Other jurisdictions in the metro region strongly encourage recycling of construction and demolition debris. Visit www.metro-region.org/toolkit for a searchable database of recyclers; the site will also display a map of the area around the recycler's location.

Materials reuse: 5 to 10 percent

Materials and Resources credits 3.1 and 3.2

To achieve these credits, project teams must use salvaged, refurbished or reused materials in the project so that they constitute at least 5 percent of the cost of all materials on the project. Although these credits don't require deconstruction, deconstruction is still a great way to achieve them because it gives project teams a supply of salvaged materials that they control. Using salvaged materials may be particularly helpful in remodeling projects, because the materials may match the remaining architectural style. Deconstruction also has the following additional advantages:

- It improves a project's efficiency. Reusing materials that are already on site means project teams avoid paying for disposal and buying new items.
- It helps build a marketplace. Deconstruction creates a supply of salvaged building materials, which makes it more likely that salvaged materials will be available to those who wish to build a green building. It also creates jobs, both for laborers and for salvaged materials retailers.

LEED-NC Version 2.2 divides materials salvaged on site into two categories – “fixed” components and “finish” materials. Fixed components are those that were permanently installed before the project started. For these to qualify as reused, project teams must document that they could no longer be used for

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their original function, recondition them and install them for a different use or in a different location. Finish materials may continue to serve their original function, but must be refurbished in order to be functional.

Project teams can also purchase salvaged materials elsewhere to achieve these credits. For these materials, LEED-NC Version 2.2 simply requires that they were previously used, though not necessarily in a building. PART III of this guide provides a list of places to find salvaged materials and describes in detail the strategies and steps necessary to reuse building materials successfully in a new commercial project.

Regional materials: 10 to 20 percent extracted, processed and manufactured regionally

Materials and Resources credits 5.1 and 5.2

Two points are possible here: one credit for using local materials for 10 percent of the total value of all building materials used in the project; and an additional point for projects that use 20 percent local materials.

To achieve these credits, project teams must use building materials that are extracted, harvested or recovered, or manufactured within 500 miles of the project site for 10 to 20 percent of the total value of materials used in the project.

Reusing building materials salvaged locally is an excellent way to achieve LEED Materials and Resources credits 5.1 and 5.2. Moreover, the USGBC often allows for double counting points towards both Materials and Resources credits for regional materials and materials reuse (credit 3). As is true for all credits, remember to document that the materials used were salvaged locally. Deconstructing an existing building is an ideal solution to this challenge; otherwise, ask salvaged materials suppliers to provide proof of origin, perhaps with photos, upon delivery.

Note that LEED-NC Version 2.2 does not grant credit for the reuse of mechanical, electrical and plumbing components, or specialty items such as elevators

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and equipment, for this credit or the materials reuse credits described above. The intent of this prohibition is to prevent project teams from reusing inefficient items in new buildings.

Innovation in design

ID credits 1.1 through 1.4

Up to four points are available in this category, with one point per innovation. The intent of these credits is to recognize design teams for performance that exceeds the requirements of the LEED rating system, and/or for innovative performance in green building categories that LEED-NC does not address. The USGBC suggests that one way to achieve these credits is to use approaches that demonstrate a comprehensive approach and quantifiable environmental and/or health benefits.



Project teams may be able to win an Innovation and Design credit for salvaging and reusing very new lighting, plumbing, or mechanical fixtures. As described above, the materials reuse and regional materials credits do not allow project teams to include these materials in the calculations for those credits. However, if the materials meet current codes and amounted to a significant percentage of the total cost for related materials,¹⁰ the certifiers may consider reusing them to be part of a comprehensive approach to deconstruction and materials reuse.

An Innovation and Design point may also be awarded for project that can demonstrate that they attained at least a 95 percent level of project recycling and salvage.

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To qualify for these credits, project teams must submit, in writing, the following information:

- The intent of the proposed innovation credit
- The proposed requirement for compliance
- The proposed submittals to demonstrate compliance
- The design approach (strategies) that might be used to meet the requirements

For more information about Innovation and Design credits, visit the USGBC web site at www.usgbc.org.

Documentation and LEED

A LEED project can be more work than conventional projects because project teams have to prove that their building meets the LEED standard. At first, documenting LEED requirements may seem daunting, but once the procedures are established, it can go smoothly. This section explains why the U.S. Green Building Council requires proof, and offers documentation strategies for the beginner as well as the seasoned expert.

Why documentation is the key to LEED

The LEED rating system relies on a third-party certification process. This process has distinguished LEED from other commercial building rating systems, and made LEED one of the most recognized and respected green building standards in the industry.

To maintain its rigor, the USGBC requires that project teams document all phases of a project - from pre-design through demolition to construction and commissioning. The documentation requirements are significant. Appendix C contains examples of the documentation forms that LEED-NC Version 2.2 requires.

Although the documentation process does take time, the result is worth it. LEED certification has high credibility among government agencies, the building industry, and perhaps most importantly, the market.

Documentation success strategies

To streamline the documentation process, the USGBC has launched an online documenting tool. Nevertheless, documentation does take time and effort.



The USGBC now allows project teams to fill out all the forms online, which can make things simpler and faster. Check out www.usgbc.org/leed.

Project teams can also win one point in LEED-NC Version 2.2 for using a LEED-accredited professional on the design team.



A great way to start the LEED documentation process is to sit down with members of the project team who may have an impact on deconstruction and salvage (such as the owner, architects, interior designers, engineers and demolition/deconstruction and construction professionals) and review the LEED-NC checklist. Often project teams brainstorm a project in an “eco-charrette,” a strategy session focused on identifying the project’s environmental objectives and how the team can best meet them. Eco-charrettes allow the design team to consider input from all potential stakeholders on

the priorities for the project, and allows for synergies to reveal themselves. For example, an operations engineer might point out to the designer that installing a light fixture in an out-of-the-way place would impose needlessly high maintenance costs.

In planning for salvage and deconstruction, however, a separate team meeting may be appropriate. Make time for the owner, contractor, design team and specification writer to meet and focus specifically on how deconstruction, reuse and salvage will be incorporated into the overall process. Compare pending strategies and schedules to the LEED-NC checklist to determine whether they will maximize (or hinder) achieving points within the Materials and Resources category. Consider bringing in a LEED-accredited professional or consultants who specialize in LEED documentation to help with the process.

Additional strategies for success include the following:

- 1. The owner should allocate resources to the general contractor for LEED documentation.** If the owner’s goal is to achieve LEED credits, the owner should be willing to pay the general contractor for the time it takes to produce the documentation necessary to achieve that goal. For most mid- to large-size LEED projects, the general contractor should budget approximately

a quarter FTE to monitor all LEED documentation during the project (not just for deconstruction) and produce documentation upon project completion.

- 2. Hire a good deconstruction/demolition contractor.** Deconstruction/demolition contractors who understand the deconstruction process and are familiar with LEED can be a true asset to a project. A good deconstruction/demolition contractor should be willing to document the deconstruction process, and may already have systems in place to smooth this process.
- 3. Use “photologs.”** In LEED, as in life, a picture is worth a thousand words. Take photographs of deconstruction efforts early and often. For example, use photos to document that the project team removed fire doors, refinished them and reused them in the new building. Take pictures of a buyer taking delivery of a load of salvaged bricks, or the hauler pulling a drop-box full of gypsum scrap. These photos may become more important; receipts and documents sometimes get misplaced, and photos can help supplement the record.
- 4. Create tracking forms and give them to subs.** To help subs keep track of the materials that they deconstruct, reuse, recycle or dispose of, the general contractor (or the deconstruction/demolition contractor) should create and distribute deconstruction tracking forms for them to fill out. These forms should be simple but capture the information needed to prove how much material went where. A sample form is in Appendix B.
- 5. Assign responsibility for the tracking forms to one person.** A detail-oriented field staff person skilled at using MS Excel can be immensely helpful for the LEED documentation process. Responsibility for materials tracking is no small task; materials leave a job site in many different ways, ranging from sales to the highest bidder to recycling to theft. Therefore, project teams should not assign this task to a person who has many other duties. Even so, the project manager and superintendent need to stay involved in the documenting process to ensure that the salvage and deconstruction phases occur within their required timeframes and that the process is well documented for LEED.

Case Study

Building One at The Elements at Gateway

As part of an innovative campus of multi-use buildings in the Gateway District of southeast Portland, a new retail and office building known as “Building One” features a myriad of salvaged and reused materials. This four-story, 114,000 square-foot structure is designed to earn a silver rating under the U.S. Green Building Council’s LEED program.

While contractors adopted salvage and reuse techniques on the interior of the building, they chose to salvage the original building that was located on their work site, rather than demolishing it altogether. By salvaging the old building and moving it to another location, contractors were able to start construction of Building One without hazardous, environmentally-contaminating demolition efforts.



VIEW OF NORTHEAST CORNER,
NE 102ND AVE. AND PACIFIC ST.

BUILDING ONE

GMB UNLIMITED, LLC, DEVELOPER
GRAYCO, LLC, DEVELOPER
NORRIS BEGGS & SIMPSON, LEASING AGENT

THE ELEMENTS PORTLAND, OREGON
AT GATEWAY

ankrom moisan
associated architects

When it came time to find quality lumber for the structural support of the building, the developer of Building One looked no further than an article in a local newspaper about the deconstruction of a nearby ninety-two year-old streetcar garage. From this building, he was able to purchase more than



70,000 board feet of old-growth Douglas fir 6"x8"s and 8"x12"s in lengths ranging from 10 feet to 50 feet. These timbers were then sent to The West Cost Timber Company in Ashland, Oregon, one of the country's largest recycled lumber mills, and processed for use in Building One. Reprocessing gave the beams a lustrous, clean finish and straightened out any age-related warps in the wood.

As a result, salvaged lumber forms much of the structure of the building, and strategically placed salvaged lumber lends a decorative touch to the building's glass and steel features. Excess salvaged lumber that was not required for Building One will be featured in other structures on the surrounding Gateway property, giving the Elements at Gateway an overall environmentally sustainable feel and beautiful, natural appearance.

Case Study

Jean Vollum Natural Capital Center

Spurred by Ecotrust's vision, this neglected circa-1895 warehouse (pictured to the X), has been transformed into a state-of-the-art, 70,000 square foot home for a number of retailers, businesses, and nonprofit organizations. By renovating the building according to green building principles, contractors were able to preserve the architectural integrity of the original structure, salvage high quality materials from selected demolition within the building, and save money through the reuse of salvaged materials. This project is one of the most comprehensive examples of deconstruction and reuse in the Metro region.

In addition to retrieving materials through the deconstruction process, contractors working on the Natural Capital Center project garnered used wood and construction materials from other local demolition projects and sites undergoing renovation. While all of the trim, base, interior and exterior doors, wainscoting, and much of the shelving and furniture were crafted from original salvaged materials, much of the third floor ledger, post & beam work,



purlin, and overall heavy timber construction were created from salvaged materials that were found within one block of the Center. Due to their wise use of salvaged materials, contractors saved upwards of \$150,000 on the post, beam, and purlin structure for the third floor alone (\$0.55/board foot) and one of the tenant



build outs saved \$45,000 on their cubicles and work stations by reusing original and locally donated materials. With its use of salvage materials and environmentally friendly techniques, the Natural Capital Building has been certified as LEED Gold.

Finished Product	Salvage Material Used	Source
3rd floor post & beam structure	3 x 16's, 14x14's, misc. blocking	Deconstructed annex and neighboring building
Trim, casing, base, molding, shelving throughout	Flooring, beams, timers, etc. remilled and finished on site	Deconstructed annex and neighboring building
Misc. interior doors	Original interior doors refinished	Original building
Exterior doors and some interior doors	Re-milled from salvaged beams and timbers	Deconstructed annex and neighboring building
Parapet wall and infill areas	Brick	Deconstructed annex and portions of original building
Interior/exterior benches	3x16's	Original building
Interior walls 8 feet high and under	Dimensional lumber and misc. framing connectors	Original building and the ReBuilding Center
Low, cubical walls on 2nd floor	1x6 sub flooring, dimensional lumber, beams milled for trim	Original building
Cubicles on 2nd floor, south end	FSC certified particle board doors custom crafted into work stations	Donated by Collins Pine—were rejected as door

Lovejoy OPSIS Building

Rather than constructing their offices from scratch, Opsis Architecture chose to renovate the 1910 Marshall Wells Stable Building located in the Slabtown district of Portland. Retaining roughly 75% of the original structure helped contractors drastically reduce the amount of construction debris that would typically go to a landfill. Deconstruction and reuse strategies trimmed the disposal bill even further. For example, in modifying the building, contractors had to cut out a section of the upper floor to make room for a new elevator. Engineers recovered nearly all of the wooden beams that were removed in this process, remilled them, and used this material to make the current building's stair treads, bridge, and benches. To increase the amount of natural daylight streaming into the Lovejoy Opsis building, contractors

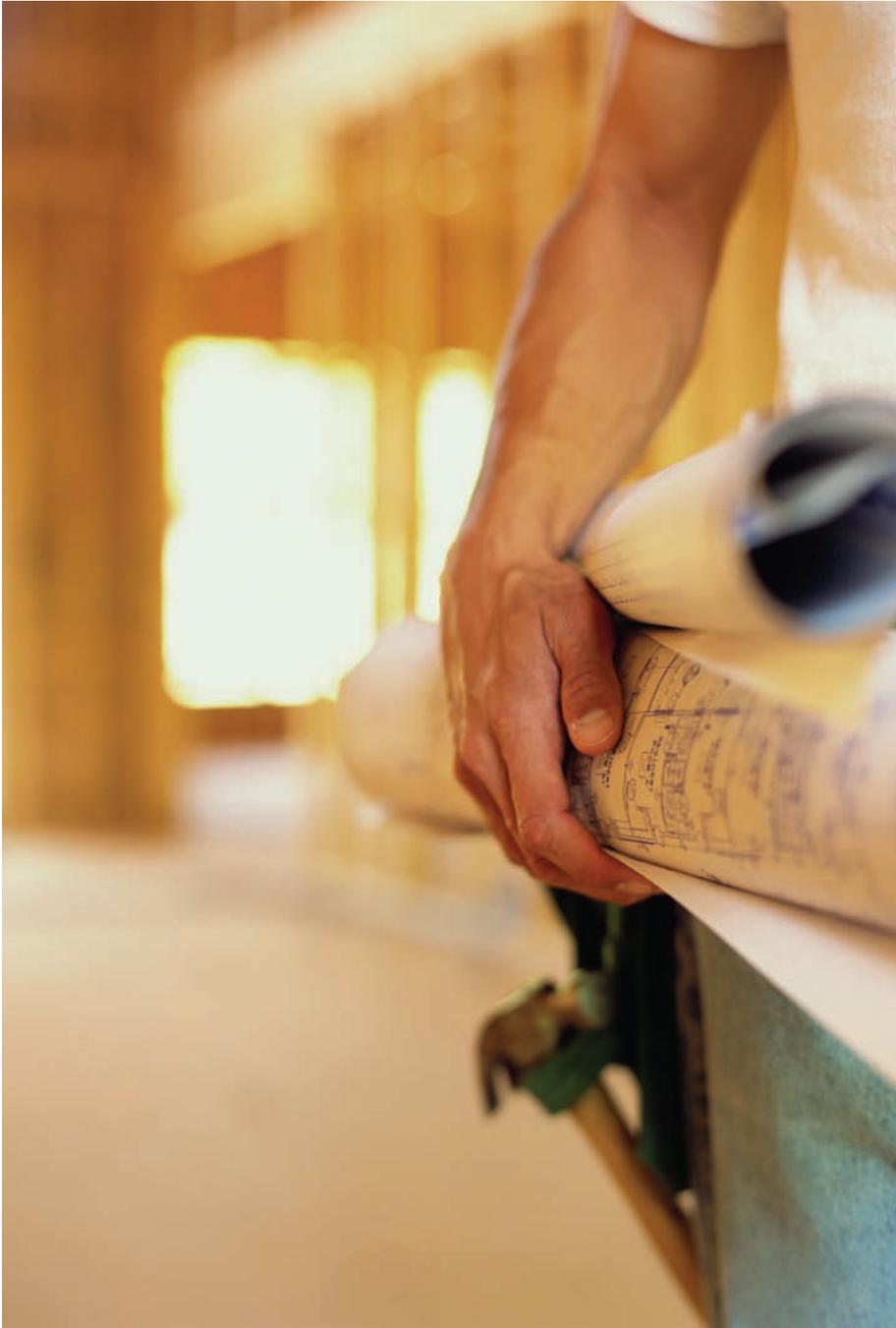


removed the bricks surrounding the original windows and vertically extended the window spaces. Bricks salvaged from this process were then used to create a quick-draining floor in the building's parking stall and in the wells surrounding trees outside of the office.

How to deconstruct



Part 2



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How to deconstruct

Deconstruction requires a different mindset from current demolition methods, although it's really just a return to pre-track-hoe demolition methods. This section of the guide offers step-by-step instructions through the deconstruction process including ideas for deconstruction planning, tips for selling the recovered materials in the marketplace, and lessons learned from deconstruction projects in the Pacific Northwest.

Planning for deconstruction

Admittedly, deconstruction often takes longer than standard demolition. Even so, the effort can lead to a healthy return on the investment if the salvage, deconstruction and reuse processes are well integrated with the overall construction schedule and deadlines. Successful deconstruction can not only increase points for LEED, but also offset disposal costs.

Successful deconstruction involves:

- Assessing the potential
- Establishing salvage and reuse goals
- Identifying materials
- Developing specification language
- Making time
- Creating a plan
- Communicating amongst team members



This section explains how to assess a building's salvage potential and create a plan for maximizing it. It describes a step-by-step process for planning for deconstruction, assuming that the project owner has decided to apply for LEED certification and therefore is motivated to deconstruct. It also assumes that the general contractor has salvage rights to the building. Of course, every project is

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different, with different circumstances, but project teams can adapt the information in this guide to fit those circumstances.

Salvage rights are the rights to sell, reuse, recycle or dispose of the materials extracted from an old building during deconstruction. Although it may not be possible to sell the salvage rights for all projects, every project team must establish who owns them so that it is clear who has the authority to collect payment for material sales, and who is responsible for the final disposition of materials.

Team members' responsibilities

As for any construction project - deconstruction or not - a successful project requires strong communication, continual coordination and clearly defined roles among all team members. These relationships become particularly important when pursuing LEED certification. The rigor of the LEED point system, which can at first be viewed as a burden, often turns into a welcome catalyst that pulls teams together into hard-working management groups that move efficiently through the planning, design and construction processes.

Deconstruction requires participation from multiple team members. The owner can help immensely by endorsing and leading the process. Likewise, the designer, contractor and specification writer should work together to ensure that the salvage and reuse phases complement, rather than contradict, one another.

In other words, a team approach to deconstruction is the key to success, particularly if the owner has decided to apply for LEED certification. Each person needs to understand his or her role in a deconstruction project, preferably in the pre-bid phase. The table below outlines those responsibilities.

Team member	Responsibilities
Owner	<p>Identify project goals and LEED target</p> <p>Ensure that the owner's project completion date and funding are sufficient to incorporate deconstruction and meet these goals</p>
Architect, engineers, landscape architect and interior designer	<p>Design the project with the intention of including salvaged materials, particularly as finishing and landscape materials</p>
Specification writer	<p>Craft specs that require deconstruction</p> <p>Craft specs that allow for the use of salvaged materials</p> <p>Ensure that specs contain no language hidden in the boilerplate that interferes with deconstruction and use of salvaged materials</p>
General contractor	<p>Interpret the specs to develop a bid package that meets the deconstruction and reuse requirement</p> <p>Create a work plan for getting deconstruction done, selling and storing materials, and using salvaged materials in the new project</p> <p>If the owner has a LEED target, create a tracking system to document the amounts of materials diverted from the landfill and reused in the new building</p>
Subcontractors	<p>Understand and implement the plan for deconstruction, storing materials and reusing salvaged material</p> <p>Understand and implement the tracking system</p>

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The pre-bid phase

Early planning for deconstruction and well crafted specifications greatly increase success. During the pre-bid phase the team has an opportunity to create plans and specifications, and determine what materials will be salvaged, sold or reused during the new construction phase. Fortunately, deconstruction and materials reuse should not affect the bid procedure; these strategies are appropriate for any procurement method.

Consider the following steps:

Step 1

Decide how much to deconstruct.

Deconstruction is a continuum. In some cases it is possible to deconstruct an entire building, but in others it may make more sense to deconstruct parts of the building for reuse, and demolish other parts of the building for recycling. A design team walk-through, with a deconstruction expert if desired, is highly recommended to identify potential materials to salvage and determine how extensively to deconstruct the existing structure. This information is critical for developing the project schedule and budget, incorporating salvaged materials into the project design and crafting the specifications for the project.

Deconstruction and materials reuse can fit into any procurement method.

In this process, don't forget to consider any plants or trees that may be on the site. Some vegetation can be dug up and reused in the new landscape, donated to nonprofits, sold, or offered to the public free of charge. In fact, plant salvage can be a powerful marketing tool, particularly if the surrounding community is not completely in favor of the project.

Step 2

Decide who has salvage rights.

The owner must decide who will own the salvage rights, or the rights to sell, reuse, recycle or dispose of the materials extracted from the old building during deconstruction. The specifications must clearly spell this

out. If the owner decides to keep the salvage rights, the owner can use the sale of salvaged materials, or the avoided costs from reusing salvaged materials, to offset other project costs. If the owner grants the salvage rights to the general contractor or the subcontractors, the general contractor might save on the demolition costs.

Because a project's specifications direct a contractor's work, they are key in a smooth salvage operation. If the project team wants the salvage contractor to be responsible for all the materials in a building, not just the ones that have resale value, then the specifications must clearly require this approach. Deconstruction/demolition contractors often have systems and markets already in place to handle all salvaged material, regardless of value.

Step 3

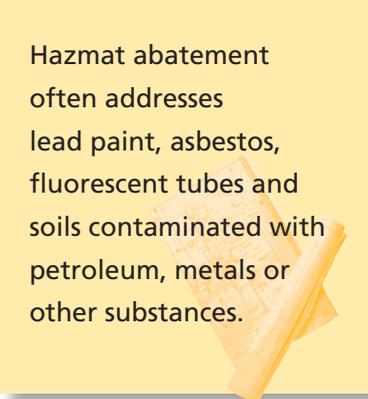
Use the right specifications.

This step is the key to actually implementing deconstruction and using salvaged materials. The spec writers, in coordination with the other members of the design team, need to ensure that the specs require deconstruction and allow for the use of salvaged materials in the new building. For best results, the specs should detail the required performance outcomes that the

Performance specifications state the outcomes that the owner wishes to achieve, but do not necessarily require particular means and methods. For example, a performance specification might require the contractor to salvage and convert 5-gallon flush toilets to 1.6-gallon ones. In contrast, a prescriptive specification might require the contractor to salvage and refurbish the toilets using XYZ Corporation's conversion kit. The performance spec gives the contractor flexibility in the event that the XYZ Corporation conversion kit is unavailable or is not compatible with the project's toilets.

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Hazmat abatement often addresses lead paint, asbestos, fluorescent tubes and soils contaminated with petroleum, metals or other substances.



owner desires. The construction professionals bidding and performing the work will then have the flexibility to adapt their methods to the specific project conditions and desired outcomes. The specifications writer also needs to check the project general conditions carefully to be sure they contain nothing that prevents deconstruction and salvaged material reuse. Drawing notes need to be consistent as well.

Don't overlook the specifications for the hazmat abatement phase of the project. Because the hazmat abatement phase occurs before full deconstruction begins, the hazmat team might unwittingly damage or even remove materials designated for salvage. However, project teams get what they specify, so the best way to address this potential issue is in the specifications. The specifications must identify the ways in which the hazmat abatement team needs to modify its usual practices.

For example, a project team might decide to salvage a fir floor that is overlain by a composite floor that contains asbestos. The specifications must require the hazmat abatement team to remove the composite floor in a manner that leaves the underlying fir floor intact and undamaged. Otherwise, the hazmat team will use the most efficient method, which may involve cutting the composite floor and the fir floor into panels that they can remove and dump, rendering the fir floor useless.

Appendix D contains examples of full specifications that work for deconstruction and salvage.

**Step
4**

Assess the value of salvageable materials in the building.

The general contractor (or whoever owns the salvage rights) should bring in a deconstruction and salvage expert to assess the value of the materials in the building. This person should be able to determine what's worth salvaging and what isn't, and an approximate value for those materials. The pre-bid walk-through is a good time to do this assessment, so that the general contractor can decide whether to use this information to present a lower bid. Part IV of this guide provides a list of local sources experienced with this type of assessment.

This is also a good time to figure out where to store salvaged items on site. Check current local codes, including fire codes, and the requirements and limitations of the Occupational Safety and Health Administration (OSHA). Ensure that the builder's risk insurance policy negotiated for the project accommodates storing and protecting materials on site.

**Step
5**

Consider hiring a demolition/deconstruction contractor.

Good demolition/deconstruction contractors can make the deconstruction process much simpler for the general contractor and other contractors. Demolition/deconstruction contractors know how to take buildings apart, often already have markets identified for salvaged materials, and may even have experience with documenting the deconstruction process for LEED or



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other green building standards. Their experience means that project teams new to deconstruction don't waste time reinventing the wheel. See the Sources section of this document for a list of demolition/deconstruction contractors.

Also, don't be deterred by the word "demolition" in a company's name. Many demolition companies are realizing that deconstruction is a viable line of business, and have the experience necessary to deconstruct a building successfully. Check references and conduct interviews to determine whether the company fits with the project's goals.

Step 6

Hold a pre-bid meeting.

If desired, the owner and/or design team can hold a pre-bid meeting for interested contractors. At this meeting, the owner or the owner's representative can present the project's green goals and objectives, and answer questions about deconstruction, salvage, reuse and any other green techniques planned for the project.

Step 7

Assemble and present a bid.

The good news is that deconstruction and materials reuse can fit into any type of procurement process. In assembling a bid, however, the general contractor needs to account for how deconstruction will change the usual practices. For example, deconstruction will lengthen the demolition phase and may require additional or different workers. The general contractor also should plan for reusing materials in the new building, and decide whether to use any projected cost savings from deconstruction and reuse to present a lower bid.

If the bid is competitive, the general contractor should be sure to make a pitch for the deconstruction effort in the cover letter. If the bid is qualified and the owner is clearly greening the project or going for LEED certification, the general contractor should be sure to highlight his or her intentions for deconstruction and salvage, and experience if appropriate.

The award phase

Once the project has been awarded, the general contractor should do some exploratory deconstruction to see what lies behind the drywall, plaster or other layers of materials. The building code officials may allow some non-structural salvage activities to start prior to securing the demolition or building permits. Tag all items that will be salvaged, and identify a safe area that can be used to clean, prepare and/or store salvaged materials.

Step 8

Decide what can be reused on site.

Take a closer look at the salvageable materials to decide which ones are appropriate for reuse on site. The project specifications are the ultimate guide, but currently most owners, designers and contractors have the highest success using salvaged materials in finishes, rather than as structural components. For ideas on reusing items, see Part III of this guide.

Generally, salvaged materials will require some work to prepare them for installation. For example, teams may need to remove old paint from some materials, repair or replace hardware, or clean mortar off bricks. Project teams should not let that extra work slow the project timeline. Instead, plan to have subcontractors or laborers tackle these tasks during a down time or schedule the necessary subcontractors appropriately.

Step 9

Pre-sell as many of the remaining items as possible.

This step is probably the most important strategy for cost-effective deconstruction. If the general contractor or the deconstruction/demolition contractor can find buyers for materials before salvage begins, project teams will enjoy the following advantages:

- Knowing the buyer's requirements. For example, if there is no buyer for those sinks before deconstructions start, teams may have to devote time to removing the faucets, packaging the faucets and other hardware together, and making sure that the fixtures stay with the sink. If the general contractor knows that the person who is buying those sinks wants them to come with

the faucets, workers won't waste time taking the faucets out. Knowing the buyer increases efficiency.

- Moving materials off site quickly. If materials have a buyer already, the general contractor or deconstruction/demolition contractor can let the person know in advance when to pick them up. This approach minimizes the amount of space needed for storing materials on site, not to mention the effort required to protect them.
- Reducing uncertainty. Pre-selling better justifies the labor necessary to salvage materials. If buyers give a good price for an item, crews may get extra time to spend on extracting or repairing difficult-to-salvage items. Project teams are often surprised at how interested the crews become in salvaging items once they begin.

Although pre-selling may sound daunting, it's fairly straightforward with a digital camera, an internet connection and a little bit of thought. The key is to clean up the items if possible, because buyers are far less interested in items that are dirty or dented. Spend a little time cleaning them up, and then take photos and post the items for sale online. Ideas for marketing items include the following:



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- Use Metro’s new BoneyardNW web site (www.BoneyardNW.com) to sell your used commercial building materials. The site is free for both buyers and sellers, uses the Construction Specifications Institute system to organize materials and was designed for the commercial construction industry.
- Post items on Craigslist (www.portland.craigslist.org). Include key words such as deconstruction, salvage, used, commercial and building materials to help buyers with their searches. Providing photographs usually increases the price paid for and interest in an item.
- Market items to local businesses that are similar to the business that used to occupy the building to be deconstructed. For example, if a project involves deconstructing a restaurant, advertise the kitchen equipment, furniture, lighting fixtures, countertops, backsplashes and other materials to other local restaurants.
- Market to other industries that might be able to use the materials. Advertise wood products to furniture makers, for example.
- Advertise the materials to the local arts community. Craftspeople may reuse broken tiles to make mosaics, wood to make birdhouses, or metals for jewelry or sculpture. Theaters may be able to use furniture or lighting fixtures for sets.
- Connect with nonprofits (like community garden builders) who can use salvaged materials and provide an opportunity for a tax deduction.

This step is where a good demolition/deconstruction contractor can add significant value. These contractors often know the markets well, and have their own outlets for various materials. Alternatively, there are a small number of salvage consultants who can help project teams market their materials. See Part IV of this guide for more ideas.

**Step
10****Create a plan.**

With a well thought-out plan, deconstruction will be well coordinated, efficient and maximize the potential for LEED certification.

First, do a simple cost-benefit analysis of each item identified for salvage. The expected benefits of salvage, from selling or reusing the material, should indicate how much to spend on deconstruction. This cost-benefit balance indicates where to stop with the deconstruction process for each material. Pre-selling helps with this because the buyers' requirements will be known.

Second, the general contractor should create a written plan for deconstruction and salvage, which may be a subset of a construction waste management plan (Appendix E contains a sample deconstruction and salvage plan, as a well as a sample construction waste management plan). It can be simple, but it needs to be written so the general contractor can post it on the job site and communicate it clearly to the subcontractors. (In addition, the specifications may require the owner to approve a written plan.) The plan should include the following:

- Each material to be salvaged and the condition the material should be in once salvaged
- The tools needed to extract the materials in the specified condition
- The trade skills and number of workers needed to complete the work
- The schedule for deconstruction
- How to stage the job
- Where to store items until the buyer comes to pick them up or until they are reused
- If the team plans to sell materials on site, where that will happen, and to whom (If materials will be sold to other construction professionals only, the location may not be very important because construction professionals know how to conduct themselves on a construction site. If materials will be offered to the public, find a place - like the loading dock - where the public can come without safety gear. If there's no room, find a nearby off-site storage location. For more details about creating a plan for selling materials on site, see the Mechanics of salvage section of this guide, page 43).

- When to turn off utilities to the building (If the team cuts the power to the elevator too early, it will be tough to get materials down from the 15th floor.)
- A tracking system to document the amount of materials deconstructed, reused, sold to other markets, recycled and disposed of. (A sample tracking form is in Appendix B.)

The general contractor may also want to include strategies for recycling and disposing of materials that won't be reused, so that all field staff use a single, comprehensive construction waste management plan.

Step 11

Communicate the plan.

During the subcontractor buy-out process, the general contractor needs to communicate this plan and tracking system to all subcontractors. Because subcontractors may carry out much of the work, they must understand the plan for it to succeed.

After explaining the plan and tracking system, the general contractor should verify with the subcontractor that the subcontractor's bid accounts for all costs necessary to achieve the owner's green goals and track progress toward LEED credits. This verification should occur before the general contractor signs a contract with the subcontractor. If the general contractor uses a standard subcontractor contract, the general contractor should ensure that the contract has specific language in the description of work or special terms sections about the deconstruction requirements. The general contractor also should consider making subcontractors' payment contingent on them filling out and submitting the completed materials tracking forms.

During pre-construction meetings, the general contractor should make sure that those who are actually doing the work are aware of the requirements. For example, the general contractor should review the deconstruction plan and tracking system with each subcontractor's workers, to be sure that everyone understands the following:

- The schedule for deconstruction
- The condition that each salvaged material should be in when removed

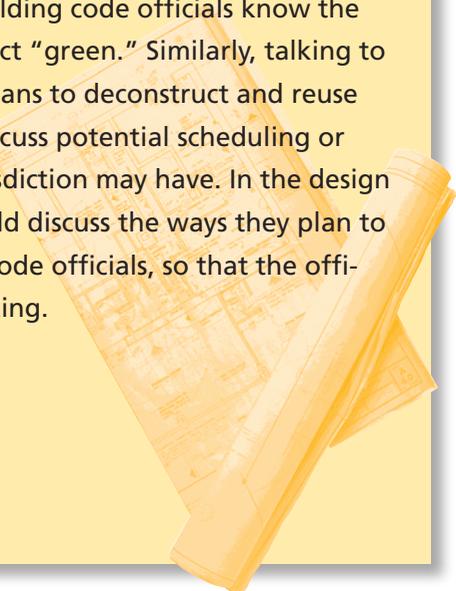
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- Where and how salvaged materials should be stored
- The steps needed to get salvaged materials ready for installation in the new building
- How to document the deconstruction process and what happens to the salvaged material once removed.

Once project work begins, the general contractor should review the plan frequently with the contractor team to keep it fresh in workers' minds. For example, the general contractor could use the weekly safety meeting as an opportunity to review the deconstruction work planned for that week, or different aspects of the plan. The general contractor also should post the plan on site so that workers can refer to it as needed.

Deconstruction and the permitting process

Depending on the jurisdiction, some non-structural salvage and deconstruction can begin prior to receiving a demolition permit. It is, however, advisable at the pre-permit conference to take the opportunity to let the local building code officials know the team's intention to make the project "green." Similarly, talking to the building code officials about plans to deconstruct and reuse materials allows both parties to discuss potential scheduling or specific requirements the local jurisdiction may have. In the design review process, project teams should discuss the ways they plan to reuse materials with the building code officials, so that the officials can identify any needs for testing.



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Mechanics of salvage

Salvage is the process of taking the building apart in such a way that its contents retain their value. Because every building and project is different, it's impossible to present precise instructions here. Therefore, this section presents some lessons learned from successful salvage projects in the Pacific Northwest, and is intended for the person in the field who will actually take the building apart.

Strategies for salvage success

- Consider hiring a good deconstruction/demolition contractor. These contractors understand the salvage process, know how to protect materials' resale value, employ skilled workers, and know how to market salvaged materials.
- Always keep in mind the buyer's specifications for a given material. This focus will help avoid spending extra time on items that don't require it, or a disappointed buyer who decides not to buy the product after all because it doesn't meet their specifications.
- Verify workers' skill levels and/or budget for basic training to develop worker skill and awareness to ensure that the materials they salvage will be reusable. Even the most minor damage may decrease a material's value significantly or render it unsalvageable.
- Take photos of materials before removing them from the building. These photos can serve as a guide to the future buyer, or if it will be reused on site, to the crew that installs it in the new building.
- Make sure to gather all of the components together and label them. Again, the objective is to satisfy buyers of pre-sold items or attract buyers for unsold items. It may be obvious, but people are much more likely to buy something that has all of its parts.
- Look online to find manufacturers' cut sheets and include them with the materials so that the buyer will know how to use them. Manufacturers' web sites are probably the best source for cut sheets. Or, if possible, ask the origi-

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nal building's facilities personnel for their operations and maintenance manuals, which should have the cut sheets. If the cut sheet for that model is not available, a cut sheet from a later model may prove useful.

- If the buyer is a retailer of salvaged materials, do not invest much time in cleaning or altering materials in any way, beyond keeping all component parts together. The retailer knows the market, and will know what preparation steps are needed for a particular material.
- Project teams that sell materials on site or off site should think about marketing. Clean up the material and package it in an acceptable manner. Damaged goods covered in construction debris don't sell. For example, have someone clean all the mortar off of the bricks and stack them neatly on pallets. For additional insight into how to set up and manage an on-site sales yard, see Appendix E.
- In the case of plant salvage, find a wholesaler who will buy the plants. If that is not possible, consider working with a nursery to help keep plants healthy. The nursery could pick up the plants, tend them and deliver them back to the site when needed. This strategy avoids relying on construction crews to maintain plants and keeps the plants out of the way of construction.
- Some materials will be sacrificed to salvage the good stuff. Recycle as much of that material as possible.

Deconstruction is the process of removing a building by disassembly, in a manner that preserves the usefulness of the building materials. This process often occurs in roughly the reverse order in which the building was constructed. Salvage is



the removal of certain valuable reusable building materials before demolition. Materials reuse is the incorporation of salvaged building materials into a new or remodeled building and/or its landscaping.



Buildings on the National Historic Register are appealing candidates for salvage and reuse of interior materials, but be aware that a building's presence on the Historic Register will slow down the project's schedule significantly and may prevent project teams from removing materials from the building. The Secretary of the Interior's standards for rehabilitation of buildings on the historic register specify that "an interior floor

plan, the arrangement and sequence of spaces, and built-in features and applied finishes are individually and collectively important in defining the historic character of a building."¹¹ Therefore, preserving as much of the original interior as possible and refurbishing and reusing the rest on site will be important success strategies. In contrast, local historic building ordinances, such as Portland's, often don't cover changes to the interior of a building.¹² In all cases, the exterior of the building must remain largely intact.

Lessons learned

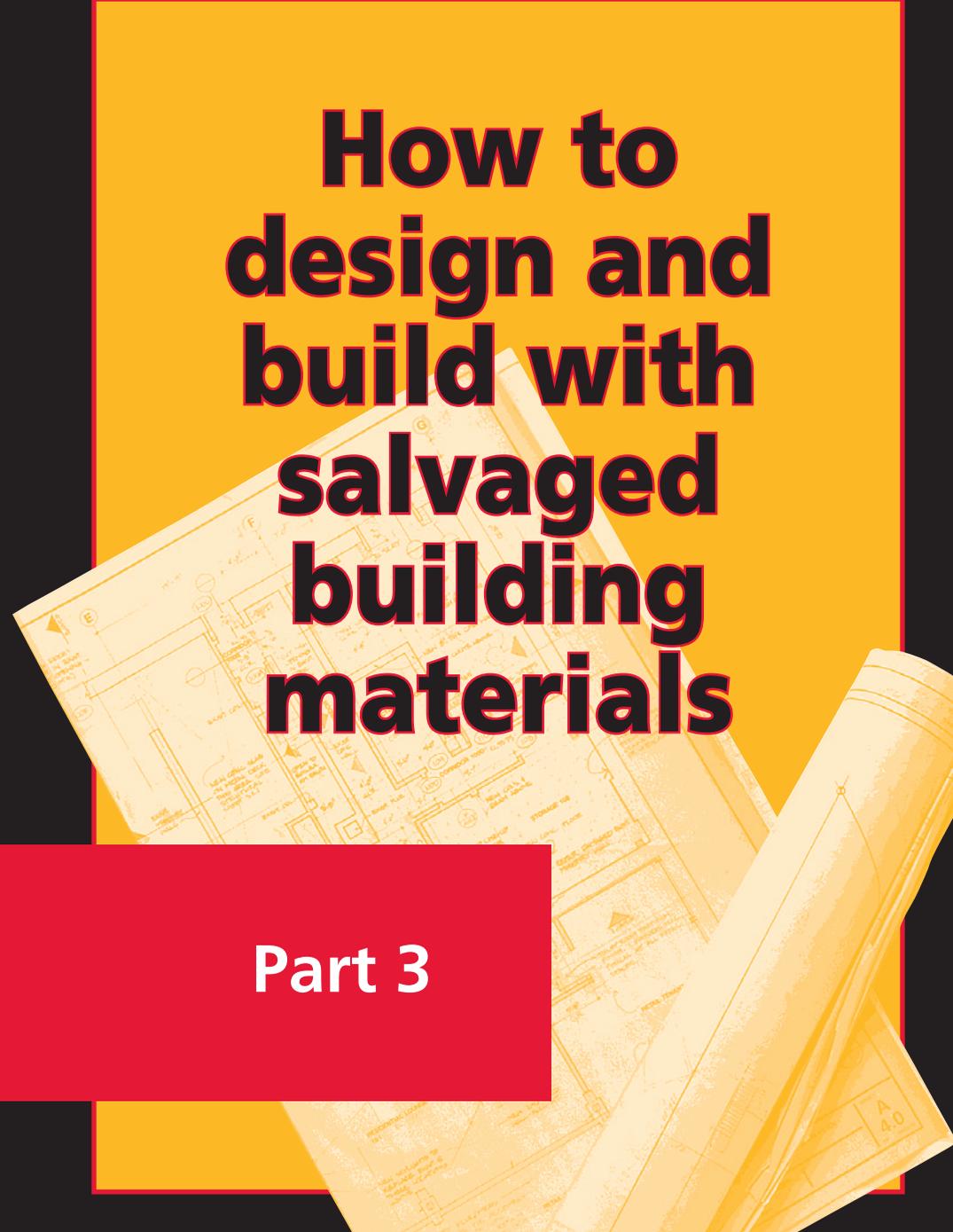
As more and more construction projects throughout the Pacific Northwest incorporate deconstruction and salvage techniques into their process, lessons have emerged that weigh the effort for deconstruction against the overall objectives for the project. Key among them are the following:

- There are treasures to be found from salvaging materials. Not just the coveted slate blackboards and school gymnasium floors, but also the two-by-fours and doors recovered from office buildings, warehouses or even

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homes. As high-quality timber continues to increase in price, even postwar-era buildings can provide the clear wood that is increasingly harder to find.

- Balance the amount of time spent on deconstruction against competitive price points. Spending inordinate amounts of time on salvaging items will drive up the cost of the recovered materials to a point where they can't compete against a comparable new material. Exceptions to this rule include items of unique historic or architectural value, such as antique facades or large timbers.
- Deconstruct all that is feasible within a project's timeline.

The background features a bright yellow square with a thin red border. Overlaid on this are several architectural blueprints. One blueprint is partially unrolled, showing a floor plan with various rooms, walls, and annotations. Another blueprint is rolled up into a cylinder on the right side. The text is centered over the blueprints.

How to design and build with salvaged building materials

Part 3



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How to design and build with salvaged building materials

This section of the guide explains how to include salvaged materials in a new commercial building project. It begins with a discussion of the role of each team member in successful materials reuse, and then presents some ideas about which materials to reuse and how.

Team member responsibilities

As with deconstruction, the use of salvaged materials requires a team approach. The matrix below summarizes each team member's responsibilities. The paragraphs that follow describe key responsibilities in more detail.

The owner

**Step
1**

Specify green goals.

The owner must communicate his or her green building goals, whether LEED or otherwise, to the design team and specifications writer in the project design phase. The owner must ensure that the team has the skills and experience to translate these goals into the new building design, landscaping design and the specifications package. When hiring a general contractor, the owner should look for one who supports these goals and has ideas about how to achieve them.

**Step
2**

Create a line item in the project budget for reclaimed or salvaged materials.

Although this step is optional, it's a good way to control project costs. There are risks associated with the uncertainty of procuring suitable salvaged material and the labor that will be required to prepare those materials before they can be incorporated into the project. The owner can decide how much money to devote to purchasing and remanufacturing salvaged materials for use

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Team member	Responsibilities
<p>Owner</p>	<p>Identify material reuse goals and LEED credit targets.</p> <p>Ensure the project completion date allows for use of salvaged materials.</p> <p>Earmark funds in the budget for the use of salvaged materials.</p>
<p>Architect, engineers, landscape architect and interior designer</p>	<p>Design the project with the intention of including salvaged materials, particularly as finishes and landscape materials. This approach will require flexible thinking that can accommodate the uncertainty of locating a suitable supply.</p>
<p>Specification writer</p>	<p>Ensure that the team’s specification writers, each responsible for their discipline’s sections, speak consistently regarding the use of salvaged materials. Hiring a lead specification writer familiar with using salvaged materials can be helpful.</p> <p>Craft specifications that allow for the use of salvaged materials. A performance-type specification that focuses on material performance and appearance will be the most successful.</p> <p>Ensure that specifications contain no language that contradicts the intent to use salvaged materials. Strive to write all document sections consistent with the project goals so that it is clear that the use of salvaged materials is desirable.</p> <p>If the project is to be LEED certified, use a LEED-based specification product, such as BSD SpecLink®. If not, use a similar “green” specification such as BuildingGreen.com’s GreenSpec®.</p>

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Team member	Responsibilities
<p>General contractor</p>	<p>Develop a bid package that meets the specifications' reuse requirements.</p> <p>Create a work plan for storing materials, if necessary, remanufacturing salvaged materials and using salvaged materials in the new project.</p> <p>Procure salvaged materials. Seek out local sources such as those listed in Part IV of this guide.</p> <p>Work with the other project management team members to develop submittals for salvaged materials.</p> <p>If the owner has a LEED target, use a tracking system to document the costs of materials reused in the new building.</p>
<p>Subcontractors</p>	<p>Understand and implement the plan for using salvaged material</p> <p>Understand and implement the tracking system</p>

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in the new project. The general contractor then allocates the funds to maximize the desired outcome. These funds should be line items in both the owner's and general contractor's budgets.

Step 3

Think big.

In the end, because of remanufacturing requirements, the cost of using salvaged materials may be higher than the cost of using new materials. However, the first cost is not the only factor to consider: the team also avoids sending materials to the landfill, uses materials with low embodied energy, and perhaps most importantly, moves a step closer to the owner's

What is embodied energy? Embodied energy is the sum of all the energy, from both renewable and nonrenewable sources, that goes into bringing a material from its naturally occurring, raw state to its place in a building.¹³ The extraction and manufacturing processes needed to produce new building materials from virgin resources involves significant waste. Salvaged materials, though they may originally have been procured from a distant source, are considered to have low embodied energy because they can be used with little further input of energy. (For example, they usually don't need to be heated, melted or extruded.) Also, reusing salvaged materials eliminates the need to spend additional resources on disposing of them. Therefore, salvaged materials represent an efficient use of materials and energy.

Why is it important? If the goal is a sustainable building, using materials with low embodied energy is a critical step in the process to sustainability. Local reuse is important as it decreases energy required to transport goods and offsets the project's disposal quantities. Local reuse can also create jobs for workers who staff salvaged material retail centers or join deconstruction crews.

overall green building goal. In the metro region, building green can increase the value of a building and enhance the public's perception of the project and the project team.

The design team

Currently, most commercial projects that incorporate salvaged materials use them as finishes, rather than in structural applications. It's frequently difficult - although not impossible - to remove structural elements in a condition that allows their reuse in structural applications. The exceptions to this rule are timber and dimensional lumber, which can be reused structurally after a lumber grading professional re-grades and certifies it. Alternatively, the project engineer could inspect the lumber and approve its use in the project, but this approach also requires approval from a building code official.

Therefore, the design team should focus on ways to reuse salvaged materials as finishes in a new commercial project. The Designing with salvaged materials section of this guide presents some ideas.

The specifications writer

The specifications writer may have the most difficult task of all team members. Instead of the standard language that requires materials to be new and arrive in a box from the manufacturer, the spec writer must craft language that doesn't prohibit reuse and rewards innovation in, or outright requires, the use of these materials.

Perhaps the best way to accomplish this goal is to write performance specifications that address the fact that these materials are used and may show wear. These performance specifications also must define the minimum tolerable acceptance, or the minimum amount of deviation from the new condition, for each material. For hardwood floors, the specifications might require that the boards have no dings deeper than an eighth of an inch or the size of a dime, state whether surface nail holes are acceptable, and indicate whether the boards can show water stains or wear. Since sanding floors to refinish them can

remove a substantial amount of the board, the spec might identify a thickness standard for each board so that the useful lifespan of the reclaimed flooring is not substantially shorter than the lifespan of the building.

The specifications will also need to state requirements for code and qualification requirements such as Underwriters Laboratories (UL) and American Society for Testing and Materials (ASTM) labeling. Products will need to be inspected or reclassified prior to installation. Such inspection may be beyond the scope of the members of the design team. If the materials don't meet these requirements, the specifications should state what needs to occur to bring the materials up to the required standard.

Appendix D contains examples of specifications that allow for and encourage the use of salvaged materials in new commercial projects.

The general contractor

Step 1

Write a green bid.

If the owner has green goals, the general contractor should make it clear that green building is part of his or her bid. If LEED is part of the program, the bid should address LEED certification, the credits the general contractor can help the owner achieve, and the general contractor's plan for how to achieve them using deconstruction and salvaged materials. (See the LEED-NC credits section of this guide for ideas.)

Step 2

Procure salvaged materials.

Procuring salvaged materials is no different from procuring other materials. As with any other project, the general contractor should take the following steps:

- Identify the places where using salvaged materials are required in the specifications. If the project includes deconstructing an existing building, determine whether the old building has some of those materials present. Make sure that the subcontractors who will be doing the deconstruction are aware of the steps needed to remove the materials for reuse.

- Check whether any materials are “owner-furnished, contractor-installed” (OFICI). If they are, find out from the owner what condition they are in, and whether the general contractor is responsible for any costs associated with getting them ready for installation.
- Find sources for the remaining materials. The subcontractors may already have ideas or firm sources. Otherwise, engage them in a collective effort to find appropriate salvaged materials. In general, local suppliers are best - particularly for LEED, which offers credit for locally sourced materials - but the search may extend beyond the metro region. Local sources also reduce transportation costs. Part IV of this guide lists a number of regional businesses that market salvaged materials.
- One of the challenges will be to make sure the salvaged material meets the design team’s appearance and performance specifications. If they don’t, then the subcontractor responsible for supplying the material should, in his or her bid, budget for bringing the materials up to specification requirements.

LEED-NC offers project teams credit for using materials that are extracted or harvested within 500 miles of the project site.



Step 3

Create a plan.

As with deconstruction, written plans for how and when to include salvaged materials in a new commercial project are critical to success, except on small projects with a very small number of people involved.

In all likelihood, project teams will produce two plan documents. First, the owner and design team should create a plan that identifies the types and amounts of salvaged materials to be used, and how they will be used in the project. The owner and design team also should determine the steps needed to refinish salvaged materials for their new uses.

Based on that information, the general contractor and/or the relevant subcontractors should create a plan that includes the following elements:

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- The tools and number of workers needed to refinish the salvaged materials
- A schedule for the refinishing work
- A tracking system to document the costs of the salvaged materials. (This tracking system will be particularly important if the project owner has LEED goals.)

Once the general contractor's plan is complete, the general contractor should review his or her plan with the design team to be sure that the general contractor's plan and the design team's plan for salvaged materials will achieve the owner's vision for the completed project, both in terms of design elements and LEED certification. The general contractor also should review his or her plan with the LEED consultant, if the project team includes one.

Step 4

Develop submittals.

Construction professionals normally submit information about every product that they are to incorporate into a building. Submittals for new products are fairly straightforward; generally they consist of presenting the design team with cut sheets, performance data, test results, owner and operating manuals and warranty information. Submittals for salvaged materials will not be this simple, because much of the information typically received from the manufacturer will not be available. In particular, manufacturer's warranties will not be available. The project team, including the owner, will need to work closely together to develop specific project expectations for submittals for used materials.

A note about warranties: the lack of product warranties and potential liability issues may be sticking points for some building and design professionals. Two facts may help assuage these worries; building codes cover structural integrity issues, and a recent study shows that there has never been a case in which a salvaged materials reseller or building professional was sued over problems with salvaged building materials.¹⁴ If liability is a major concern, project teams can start small with using salvaged materials - for example, use salvaged lumber to craft trim work, which can be fixed quickly and fairly inexpensively if something in fact does go wrong.

**Step
5****Get materials ready for installation.**

In general, salvaged materials will require some remanufacturing before they are ready for installation. This may be possible on site but may also require removing them off site for refurbishment. For example, trim or floors may need to be refinished, or period light fixtures may need to be rewired. These tasks may best be completed in a controlled environment - either on site if space permits, or off site by a specialty contractor - to prevent contamination of new spaces with dust and fumes. The general contractor should create a plan for accomplishing this work that fits within the project schedule.

Designing with salvaged materials

Deciding where and how to use salvaged materials in a new commercial project may seem more difficult than deconstructing an old building. This section presents some ideas intended to spark a design team's creativity. It begins with a "top ten" list of the easiest commercial building materials to reuse, and then provides some more creative ideas to help reuse other materials.

Top ten materials

In 2004, Metro conducted a survey of building and design professionals to identify ways to expand the reuse of salvaged building materials. Nearly 500 professionals responded to an online survey, and 34 of these professionals also consented to a personal interview. Of these 500 professionals, 57 percent had used salvaged building materials. According to these professionals, the 10 salvaged materials that are easiest to reuse on commercial projects are:¹⁵

1. Finish wood
2. Doors, windows and storefronts
3. Structural wood
4. Masonry
5. Cabinets and casework
6. Lighting and electrical fixtures
7. Door and window hardware
8. Plumbing fixtures
9. Specialties such as cubicles, writing boards, chutes, partitions, lockers and postal equipment
10. Concrete formwork

The paragraphs below present some ideas for reusing these and other materials.

Finish wood and structural wood

Salvage often yields a wealth of wood, both finish wood and dimensional lumber. Much of this wood is of high quality, and in some cases it is superior to new wood products. As a result, salvaged finish wood and smaller dimensional lumber are often available from salvaged materials suppliers. Demand for heavy timbers is strong, and timbers are usually in short supply. However, heavy timbers can lend a building a historic presence and tend to add considerable aesthetic value.

Project teams can sand, paint and reuse finish wood as finish wood. Structural wood can be re-graded and reused as structural wood. If re-grading is not economical, use salvaged wood for non-structural purposes such as blocking and building shelves. Other ideas include using salvaged wood to build forms or protect other salvaged materials from construction damage.

The table below shows the availability of finish wood and structural wood from metro-area salvaged material suppliers.

Finish Wood Material	Availability	Structural Wood Material	Availability
wood flooring	always	dimension lumber	always
wood paneling and trim	always	heavy timbers	always
siding and trim	always	glulams	always
wood moldings	always	wood trusses	occasionally
plywood	always	plywood	always
tongue and groove	always		

Storefronts and doors, windows and their hardware

Usually, design teams order custom-built storefront systems for commercial buildings. However, if a project team finds a salvaged storefront first and builds the walls to fit, a salvaged storefront can perform just as well as a new one, often at significantly lower cost.

Salvaged materials suppliers offer a huge selection of salvaged doors and windows. Usually, suppliers sell frames with doors, and carry both rated and non-rated assemblies. Doors can be reused as doors, especially if refurbished, but depending on the desired design, doors also make attractive office partitions.

Windows can be more difficult to reuse - they are often removed from buildings because of poor performance, for example - so they're generally not suited for exterior reuse. However, project teams can use windows to create office partitions or interior re-lights, or salvage the glass for use in table tops or other finishes. Most salvage yards that carry windows will cut glass to order on site.

Salvaged materials suppliers usually keep door and window hardware together with the doors and windows. Reuse the hardware with the doors or windows, or use it as cabinet or drawer pulls. The table below shows the availability of these materials from metro-area salvaged material suppliers.

Doors and storefronts	Availability	Windows	Availability
steel doors and frames	often	aluminum windows	always
flush wood doors	always	wood windows	always
panel wood doors	always	vinyl windows	occasionally
aluminum sliding glass doors	always	glass	always
overhead doors	occasionally	sealed glazing units	always
door hardware	always	mirrors	always
aluminum	occasionally		

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Masonry

Salvaged material yards usually offer a healthy supply of salvaged bricks, but salvaged bricks can vary considerably in quality. Because it is rarely economical to separate lower quality bricks (known as salmon bricks) from high quality bricks (known as face bricks) during deconstruction projects, salvaged bricks are often a mixture of the two. Project teams that buy salvaged bricks should plan to test them to ensure they are suitable for the new building.

Project teams should use salvaged bricks, particularly salmon bricks, in building interiors or in covered outdoor spots where the bricks will stay dry. Try paving an atrium or a covered patio with salvaged bricks, for example.

The table below shows the availability of masonry items from metro-area salvaged material suppliers.

Masonry	Availability
brick	always
concrete block	rarely
glass unit masonry	occasionally
exterior stonework	occasionally

Cabinets and casework

Cabinets and casework are plentiful at salvaged material yards. With a little work to clean them up, both can be reused for their original purposes. Salvaged casework can become new desks for receptionists or security guards. Because cabinets are usually hidden from the public eye in office spaces, they are an excellent first step towards reuse for building owners or project teams who may be skeptical of using salvaged items. Use salvaged cabinets for the supply room, mail room or other utilitarian space.

Cabinets and casework are always available at metro-area salvaged material suppliers.

Lighting and electrical fixtures

Vintage electrical fixtures, particularly lights, add considerable character to a new building and are usually easy to find at salvaged materials supply stores. Of course, in a green building, project teams should strive to find efficient fixtures or retrofit them for efficiency. Many retrofit packages are available for a reasonable cost. Reuse these fixtures for their original purposes.

Note that LEED-NC Version 2.2 does not allow project teams to include the reuse of mechanical, electrical and plumbing components and specialty items such as elevators and equipment, in the calculations to determine whether a project qualifies for the materials reuse credits (Materials and Resources credits 3.1 and 3.2). The intent of this prohibition is to prevent the reuse of inefficient fixtures and equipment in LEED-certified buildings. However, project teams may still decide to reuse fixtures in a new project if they are in good working order, efficient and meet current code.

The table below shows the availability of lighting and electrical fixtures at metro-region salvaged material suppliers.

Lighting and Electrical Fixtures	Availability
fluorescent lighting	always
industrial lighting	always
pot lights	always
switches	always
fuse switches	always
panel boxes	always
smoke detectors	always
transformers	always
wiring/cable/conduit	always

Plumbing fixtures

Like electrical fixtures, plumbing fixtures are common at salvaged building supply stores. Project teams can reuse sinks, toilets and other fixtures in new bathrooms and kitchens, but only after retrofitting them to meet water-efficiency codes and policies. Because the residential building market often reuses plumbing fixtures, the market for salvaged plumbing fixtures and retrofitting kits is well established.

Plumbing fixtures offer skeptical project teams another hidden and low risk way to incorporate salvaged materials into a new project, because only employees use the restrooms in many commercial spaces. Alternatively, because reused plumbing fixtures can be eye-catching, salvaged plumbing fixtures can offer project teams a way to highlight a building's green features in spaces where the public will use the restrooms.

Plumbing fixtures such as toilets, sinks and bathtubs are always available at metro-area salvaged material suppliers.

Specialty items

Last in, first out - because specialty items such as furniture, cubicle partitions and lockers are installed after construction is completed, they generally are easy to remove and salvage. As a result, a healthy market for salvaged office furniture and other materials exists in the metro region. Because the material quality is usually high, reusing these items can generate considerable cost savings for project teams (or new tenants). Lockers from an old school can live up a bike locker room, cubicle partitions can rise again, and postal equipment can help sort out a new employee mailroom.

Salvaged material suppliers and used office furniture companies in the metro region always have salvaged office furniture available, and often have items like cubicles and lockers available also.

Concrete is one of the easiest materials to reuse on site.

Concrete and concrete formwork

The weight of concrete alone encourages many developers and contractors to seek opportunities to reuse concrete on site. In addition to crushing concrete and using it as infill, project teams can break up concrete sidewalks and convert the pieces into stepping stones or incorporate them into a mosaic walkway. Even if it's impractical to reuse the concrete for the planned new structure, saving a portion of the concrete (or asphalt) for staging or a storage area can offset the time and cost of creating a new one.

Project teams can salvage and reuse concrete formwork again as formwork on the next project. Alternatively, teams can reuse formwork as temporary bracing and staging materials.

Because concrete is easy to reuse on site, it is only occasionally available at salvaged materials supply shops, usually in the form of concrete pavers or historic masonry units.

Vegetation

Plants, trees and shrubs on a project site offer project teams a variety of opportunities. Rather than viewing existing trees and shrubs as a landclearing expense, project teams can harvest them. Consider having the project's landscape architect survey and assess trees for robustness and approximate value, and incorporate the targeted trees into the new landscape plan. An arborist or nursery can move and maintain trees and shrubs until they're required.

Another alternative is to sell the trees for other projects. Many large trees and shrubs have inherent value. For example, at a site in Seattle, Wash., an arborist valued one tree at \$75,000 - and the developer decided to preserve it.

Lastly, project teams can offer plants to the public free of charge. These plant salvage opportunities can help improve a project's public image.

A note about hazardous materials

Although many materials are reusable, some are not. In particular, project teams should evaluate whether to reuse items that contain toxic materials such as lead paint or asbestos. In some cases, it may make sense to remediate these items if it can be done properly. For example, in two recent deconstruction projects the U.S. Army used a new mobile lead-based paint removal system that planes lead-based paint from used wood siding. The system also mills the newly reusable wood into highly marketable products such as tongue-and-groove flooring and V-groove paneling.¹⁶ This industry is highly innovative, so design and construction professionals should stay on top of new technologies for materials reuse as they do in other areas of their fields.

Local examples

Many project teams are using salvaged materials creatively here in the metro region. This section highlights some of the more creative uses of salvaged materials in Portland, Oregon, buildings:

- The ledger, post and beam, purlin and overall heavy timber construction of the entire third floor of the Jean Vellum Natural Capital Center is out of salvaged materials sourced from the warehouse down the block. In this case, perhaps the major innovation was that the general contractor went over to talk to the general contractor of the warehouse to find out what they were doing with their materials.
- All trim, base, interior and exterior doors, wainscoting, and much of the shelving and furniture in the Jean Vellum Natural Capital Center is made from salvage.
- One tenant of the Jean Vellum Natural Capital Center used salvaged materials in its build-out to make cubicles and work stations, and saved \$45,000.¹⁷

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Case Studies

The ReBuilding Center

The ReBuilding Center, a building materials recovery center and project of the nonprofit Our United Villages, features attractive and practical overhead skylights made from salvaged materials in its warehouse. The skylights, made from windows that were previously a part of the Penguinarium at the Oregon Zoo, were a perfect way to improve natural lighting in the warehouse and decrease the building's dependency on fluorescent lighting and overall electricity. The ReBuilding Center, a great place to find salvaged building materials, is located in Portland's NW Mississippi corridor. The Center estimates that it will recover and divert nearly 10 tons of salvaged demolition and construction materials each day by 2008.



Green Dog Pet Supply

Green Dog Pet Supply, located in the courtyard of Fremont Commons in Portland, has decorated its retail establishment with a host of recycled and salvaged materials. Owners Christine and Mike Mallar, along with contractor Allen Schmuck of Old Wood Goods, created product displays from salvaged five- and six-paneled doors. The owners also used reclaimed doors to craft a sturdy, attractive table, and constructed a large built-in cabinet for the back wall made from planks of salvaged wood boards, cedar planks, doors, and trim left over from the construction of Fremont Commons. In addition to this larger shelving unit, Green Dog Pet Supply has a number of freestanding shelves and storage units made from recovered materials, including a unit constructed from picket fence boards and another set of shelves that's decorated with an unpainted bead board.



- The Elements at Gateway Building One incorporates salvaged old-growth timbers in the building's façade.
- Gravy, a restaurant, features benches made from salvaged fir boards, a coffee table made from a sewer grate, a bar made from salvaged lumber, bar stools made from old tractor seats, and a salvaged window between the dining room and the kitchen, among other items.
- Green Dog Pet Supply used old doors as display fixtures, tables and shelving, salvaged lumber for partitions and trim, and salvaged beadboard and picket fencing for shelving.
- The General Services Administration, when remodeling the Gus Solomon Courthouse, reused access flooring purchased from Tate Access Floors. Tate Access Floors had taken the used flooring back from Intel when Intel remodeled one of its spaces.¹⁸

These examples demonstrate that project teams in the metro region are successfully incorporating salvaged materials into new commercial projects. Reusing building materials does not have to mean that a new project's design is funky, distressed or vintage. Design teams can find ways to reuse building materials that are not obvious to others - salvaged materials might be hidden inside the walls, floor or roof of a new building. In short, the ways to use salvaged materials, particularly as finishes, are virtually unlimited.

End notes

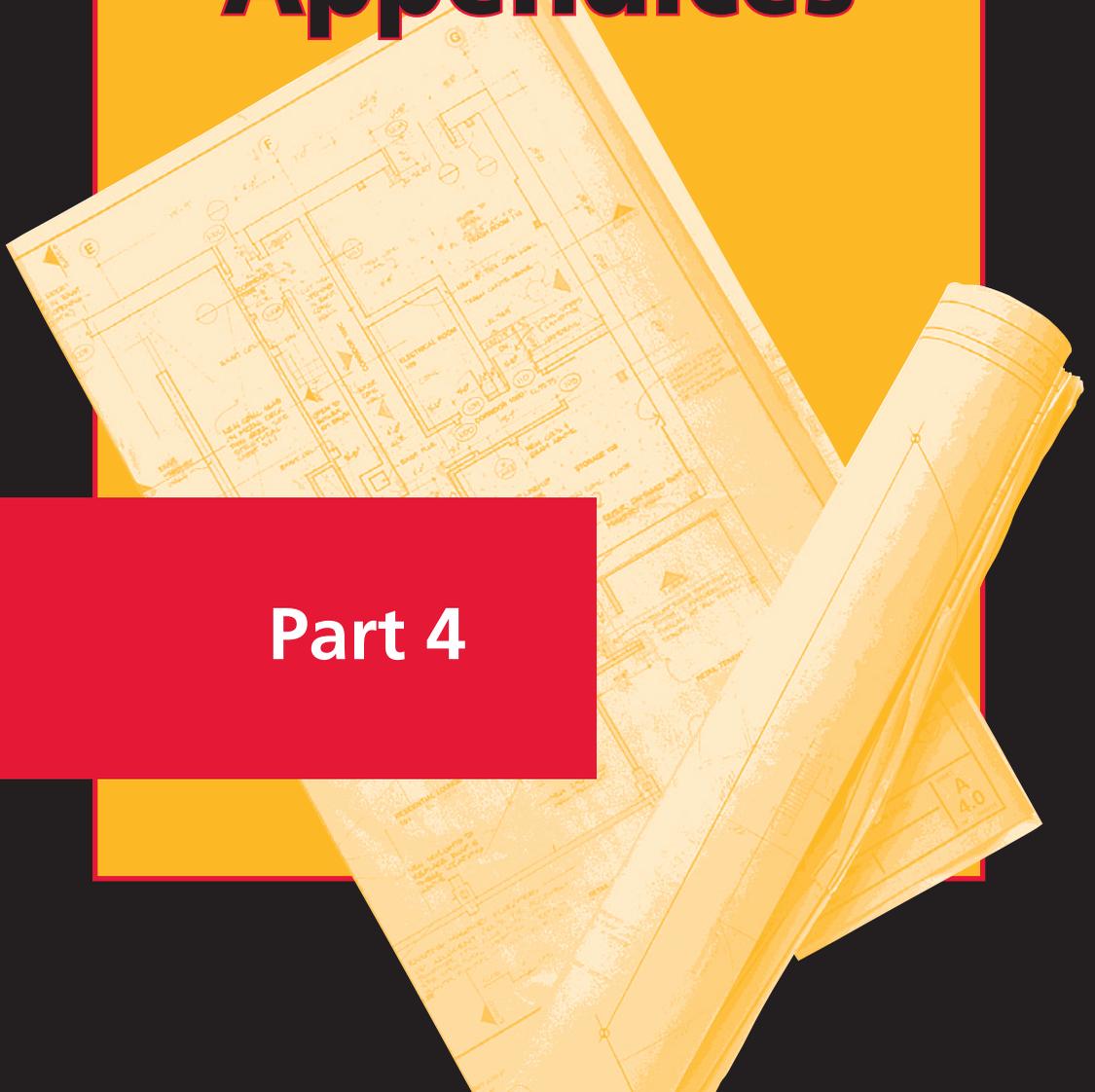
1. U.S. Green Building Council, 2006. Green Building by the Numbers. www.usgbc.org/Display-Page.aspx?CMSPageID=1442. Accessed July 10, 2006.
2. McGraw Hill Construction, 2006. Green Building SmartMarket Report. Produced in conjunction with the U.S. Green Building Council.
3. LEED, or Leadership in Energy and Environmental Design, is a rating system that sets a standard for green buildings.
4. McGraw Hill Construction, 2006. Green Building SmartMarket Report. Produced in conjunction with the U.S. Green Building Council.
5. Kane, Alisa, 2006. Salvaging the Past, Present, and Future: The Thoughtful Reuse of Salvaged Building Materials in Commercial Construction. Office of Sustainable Development, Portland Metro.

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6. U.S. Green Building Council web site. What is LEED? Accessed on June 20, 2006. www.usgbc.org/DisplayPage.aspx?CategoryID=19.
7. Portland Oregon Visitor's Association web site. Portland's Green Appeal. Accessed on June 20, 2006. www.pova.com/meeting_planners/green_meetings/portland.html#building.
8. McGraw Hill Construction, 2006. Green Building SmartMarket Report. Produced in conjunction with the U.S. Green Building Council.
9. LEED-NC allows up to four points total for Innovation and Design. However, it is likely that most project teams could achieve only three points in this category using deconstruction and salvage: one for exemplary performance in reused materials, one for exemplary performance in construction waste management, and one for exemplary performance in reused furnishings.
10. For example, if a project team reused relatively new light fixtures, then these light fixtures should represent a significant percentage – such as 5 percent – of the total value of electrical components.
11. www.cr.nps.gov/hps/TPS/tax/rhb/spaces01.htm
12. Carrie Baldwin, Architect, personal communication to Cascadia Consulting Group, Inc., July 10, 2006.
13. From Crosbie, Michael J., 2006. "Sustainable Materials – How to Do the Right Thing," Green-Source, June 2006.
14. Metro, Final Report: Research and Strategy Development to Increase the Reuse of Used Commercial Building Materials in Commercial Construction, November, 2004.
15. Cascadia Region Green Building Council and Carrington Barrs Consulting and Construction, LLC, 2004. Old to New Design Guide: Salvaged Commercial Building Materials in New Construction. Prepared by Metro Solid Waste and Recycling, Metro Contract No. 925629.
16. National Defense Center for Environmental Excellence, 2005. "NDCEE Develops Comprehensive Planning Tools for Deconstruction and Building Material Recovery." NDCEE Newsletter, Fall 2005, p.3.
17. Cascadia Region Green Building Council and Carrington Barrs Consulting and Construction, LLC, 2004. Old to New Design Guide: Salvaged Commercial Building Materials in New Construction. Prepared by Metro Solid Waste and Recycling, Metro Contract No. 925629.
18. Kane, Alisa, 2006. Salvaging the Past, Present, and Future: The Thoughtful Reuse of Salvaged Building Materials in Commercial Construction. Office of Sustainable Development, Portland Metro.
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Sources and Appendices

Part 4



Sources

Deconstruction and salvage are innovative ways to achieve LEED credits and win a green reputation for a building or a company. Listed below are resources to help construction and design professionals deconstruct and reuse salvaged materials.¹⁹

General resources

- **Metro Recycling Hotline**
Information on construction site recycling options
(503) 234-3000 (web?)
- **Metro Construction Salvage and Recycling Toolkit**
Tools to support construction industry salvage and recycling including an online version of this guide, the Find a Recycler web tool and other resources
www.metro-region.org/toolkit
- **City of Portland Office of Sustainable Development G/Rated program**
Technical resources, training and information on green building
www.green-rated.org
- **Building Savings: Strategies for Waste Reduction of Construction and Demolition Debris from Buildings**
Downloadable study from the U.S. Environmental Protection Agency
www.epa.gov/osw (click on "Construction and Demolition Debris," then on "Publications")

Retail outlets for salvaged materials

- **The ReBuilding Center** (503) 331-1877
3625 N. Mississippi Ave., Portland, OR 97227
www.rebuildingcenter.org
- **Rejuvenation** (503) 238-1900
1100 SE Grand Ave., Portland, OR 97214
www.rejuvenation.com

Recycling questions? Call (503) 234-3000 or visit www.metro-region.org/toolkit

- **Hippo Hardware** (503) 231-1444
1040 E. Burnside St., Portland, OR 97215
www.hippohardware.com
- **Habitat for Humanity ReStore** (503) 283-6247
66 SE Morrison St., Portland, OR 97214
www.pdxrestore.org
- **Endura Wood Products** (503) 233-7090
1303 SE Sixth Ave., Portland, OR 97214
www.endurawood.com
- **Environmental Building Supplies** (503) 221-3881
819 SE Taylor St., Portland, OR 97214
www.ecohaus.com

Salvaged lumber mills and grading services

- **West Coast Lumber Inspection Bureau**
A nonprofit that writes inspection rules and provides lumber grading and inspection services www.wclib.org
- **Trails End Recovery and Custom Milling** (503) 221-3881
34661 Airport Lane, Warrenton, OR 97146
www.trailsendtimbers.com
- **The West Coast Timber Company** (541) 488-8090
456 Guthrie St., Ashland, OR 97520
www.westcoasttimber.com
- **The G.R. Plume Company** (360) 384-2800
1373 West Smith Road, Suite A-1, Ferndale, WA 98248
www.grplume.com

Online sales/exchanges

- **BoneyardNW.com**
Free service provided by Metro. An online service like Craigslist, but just for the buying and selling of used commercial building materials
www.BoneyardNW.com
- **NW Materialsmart**
Free listings for used and surplus building materials
www.NWmaterialsmart.org
- **Craigslist**
Free community bulletin board
www.portland.craigslist.org
- **Industrial Materials Exchange (IMEX)**
Searchable list of industrial and surplus materials
www.govlink.org/hazwaste/business/imex

Organizations and incentive programs

- **U.S. Green Building Council (USGBC):** A coalition of building industry leaders that develops and manages the Leadership in Energy and Environmental Design (LEED) rating program
www.usgbc.org
- **Oregon State Business Energy Tax Credit Program:** Tax credits for businesses that invest in energy conservation, recycling, renewable energy resources and less-polluting transportation fuels
egov.oregon.gov/ENERGY
- **Northwest Eco-Building Guild:** An association of builders, designers, homeowners, tradespeople, manufacturers, suppliers and others interested in ecologically sustainable building
www.ecobuilding.org
- **Northwest Green Directory:** Online resource directory with links to green building products and professional services in the Pacific Northwest
www.nwgreendirectory.com

- **Green Globes:** An online building and management environmental audit that includes an assessment protocol, rating system and guide for integrating environmentally friendly design into commercial buildings. www.greenglobes.com or www.thegbi.com/greenglobes

Demolition/deconstruction contractors

- **Aurora Mills Architectural Salvage** (503) 678-6083
Contact: Mike Byrnes
- **Hay Loft Enterprises** (503) 628-5634
Contact: Lee Hebert
- **Hippo Hardware** (503) 231-1444
Contact: Steve Appenhauer
- **Architectural Recovery** (503) 240-2684
Contact: Craig Osbeck, (503) 312-3038
- **Rebuilding Center of Our United Villages** (503) 331-1873
- **Dennis Snyder Contracting** (503) 657-5000
Contact: Dennis Snyder
- **Willamette Valley Environmental Services LLC** (503) 645-2775, (503) 998-2015 Fax: (503) 430-0606
Contact: Glenn Guidoux
- **Elder Demolition** (503) 760-6330
Contact: Al Kackman
- **Konell Construction and Demolition** (503) 668-7023
Contact: Steve Konell

(**Note:** the purpose of this list is to increase awareness of deconstruction and salvage as a method of demolition. This list in no way constitutes an endorsement or recommendation by Metro of any individual business or its services. Metro assumes no responsibility for the products, information or services provided by the parties listed in this document.)

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Appendix A:

Summary of LEED-NC Version 2.2 credits related to deconstruction and salvage

LEED-NC credit	Excerpt of requirements	Relationship to deconstruction and salvage
Materials and Resources (MR)		
<p>MR 1.1 (1 point) Building Reuse: maintain 75% of existing walls, floors and roof and</p> <p>MR 1.2 (1 point additional) Building Reuse: maintain 95% of existing walls, floors and roof</p>	<p>Maintain at least 75% (based on surface area) of existing building structure (including structural floor and roof decking and envelope (exterior skin and framing, excluding window assemblies and non-structural roofing material).</p> <p>Maintain an additional 20% (95% total, based on surface area) of existing building structure.</p>	<p>Through deconstruction and salvage, the elements of the building worth keeping can be better preserved</p>
<p>MR 1.3 (1 point) Building Reuse: maintain 50% of interior non-structural elements</p>	<p>Use existing interior non-structural elements (interior walls, doors, floor coverings and ceiling systems) in at least 50% (by area) of the completed building (including additions).</p>	<p>Materials salvaged from the existing building are often best adapted for non-structural applications and be incorporated back into the finished building design</p>
<p>MR 2.1 (1 point) Construction Waste Management: divert 50% from disposal and</p> <p>MR 2.2 (1 point additional) Construction Waste</p>	<p>Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris. Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on site or commingled.</p> <p>Recycle and/or salvage an additional 25% beyond the MR credit 2.1 (75% total) of non-hazardous construction and demolition debris.</p>	<p>At the heart of successful deconstruction exists a construction waste management plan that maps out the materials salvaged to obtain a 50 – 75% diversion rate.</p>

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LEED-NC credit	Excerpt of requirements	Relationship to deconstruction and salvage
<p>Management: divert 75% from disposal</p> <p>MR 3.1 (1 point) Materials Reuse: 5% and</p> <p>MR 3.2 (1 point additional) Materials Reuse: 10%</p>	<p>Use salvaged, refurbished or reused materials such that the sum of these materials constitutes at least 5%, based on cost, of the total value of materials on the project.</p> <p>Use salvaged, refurbished or reused materials for an additional 5% beyond MR credit 3.1 (10% total, based on cost).</p>	<p>Using materials obtained from other buildings also contributes to reuse and builds demand for salvaged materials.</p>
<p>MR 5.1 (1 point) Regional Materials: 10% extracted, processed and manufactured regionally and</p> <p>MR 5.2 (1 point additional) Regional Materials: 20% extracted, processed and manufactured regionally</p>	<p>Use building materials or products that have been extracted, harvested, or recovered as well as manufactured within 500 miles of the project site for a minimum of 10% (based on cost) of the total materials value.</p> <p>Use building materials or products that have been extracted, harvested, or recovered as well as manufactured within 500 miles of the project site for an additional 10% beyond MR credit 5.1 (total of 20%, based on cost).</p>	<p>Salvaged materials incorporated back into projects counts toward using materials that are obtained from within a 500 mile radius.</p>
Innovation and Design (ID)		
<p>ID (1–4 points)</p>	<p>The Intent is to provide design teams and projects the opportunity to be awarded points for exceptional performance above the requirements set by the LEED green building rating system and/or innovative performance in green building categories not specifically addressed by LEED.</p>	<p>Salvage and recycling programs that achieve 95% recovery or higher may be eligible for an innovation point.</p> <p>Innovative design teams may also demonstrate that the reuse of lighting fixtures or elevators qualify, provided that they meet up-to-date energy efficiency requirements</p>

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Appendix B: Sample tracking forms

The matrix below is an example of a form that subcontractors can use to track quantities of materials salvaged, reused, sold, recycled and disposed of. In other words, this matrix tracks what happens to materials once they have been removed from a building.

Material	Quantity Present in Building	Deconstruction & Salvage				Recycling & Disposal			
		Quantity Salvaged	Quantity Reused	Quantity Sold	% Diverted thru Salvage	Quantity Recycled	% Recycled	Quantity Disposed	% Disposed

The matrix below is an example of a form that subcontractors can use to track the sources and value of salvaged materials reused in a new commercial project. Project teams that plan to apply for the materials reuse (Materials and Resources credits 3.1 and 3.2) and regional materials (Materials and Resources credits 5.1 and 5.2) credits in LEED-NC Version 2.2 can use this matrix to help with documentation.

Salvaged Material	Quantity	Reused As	Value of Reused Materials	Source	Distance from Site	Documentation Attached?

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Appendix C:

LEED forms

This appendix includes sample LEED documentation forms. The first is a checklist for LEED-NC Version 2.2. The others are the forms that project teams must complete to apply for the construction waste management (Materials and Resources credits 2.1 and 2.2) and materials reuse (Materials and Resources credits 3.1 and 3.2) credits in LEED-NC Version 2.2.



LEED-NC Version 2.2 Registered Project Checklist

<< enter project name >>
<< enter city, state, other details >>

Yes ? No

			Sustainable Sites	14 Points
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Y			Prereq 1 Construction Activity Pollution Prevention	Required
Y			Credit 1 Site Selection	1
Y			Credit 2 Development Density & Community Connectivity	1
Y			Credit 3 Brownfield Redevelopment	1
Y			Credit 4.1 Alternative Transportation, Public Transportation Access	1
Y			Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
Y			Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
Y			Credit 4.4 Alternative Transportation, Parking Capacity	1
Y			Credit 5.1 Site Development, Protect of Restore Habitat	1
Y			Credit 5.2 Site Development, Maximize Open Space	1
Y			Credit 6.1 Stormwater Design, Quantity Control	1
Y			Credit 6.2 Stormwater Design, Quality Control	1
Y			Credit 7.1 Heat Island Effect, Non-Roof	1
Y			Credit 7.2 Heat Island Effect, Roof	1
Y			Credit 8 Light Pollution Reduction	1

Yes ? No

			Water Efficiency	5 Points
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Y			Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
Y			Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
Y			Credit 2 Innovative Wastewater Technologies	1
Y			Credit 3.1 Water Use Reduction, 20% Reduction	1
Y			Credit 3.2 Water Use Reduction, 30% Reduction	1

Yes ? No

			Energy & Atmosphere	17 Points
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Y			Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y			Prereq 2 Minimum Energy Performance	Required
Y			Prereq 3 Fundamental Refrigerant Management	Required
Y			Credit 1 Optimize Energy Performance	1 to 10
Y			Credit 2 On-Site Renewable Energy	1 to 3
Y			Credit 3 Enhanced Commissioning	1
Y			Credit 4 Enhanced Refrigerant Management	1
Y			Credit 5 Measurement & Verification	1
Y			Credit 6 Green Power	1

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			Materials & Resources		13 Points
Y			Prereq 1	Storage & Collection of Recyclables	Required
			Credit 1.1	Building Reuse , Maintain 75% of Existing Walls, Floors & Roof	1
			Credit 1.2	Building Reuse , Maintain 100% of Existing Walls, Floors & Roof	1
			Credit 1.3	Building Reuse , Maintain 50% of Interior Non-Structural Elements	1
			Credit 2.1	Construction Waste Management , Divert 50% from Disposal	1
			Credit 2.2	Construction Waste Management , Divert 75% from Disposal	1
			Credit 3.1	Materials Reuse , 5%	1
			Credit 3.2	Materials Reuse , 10%	1
			Credit 4.1	Recycled Content , 10% (post-consumer + ½ pre-consumer)	1
			Credit 4.2	Recycled Content , 20% (post-consumer + ½ pre-consumer)	1
			Credit 5.1	Regional Materials , 10% Extracted, Processed & Manufactured Regionally	1
			Credit 5.2	Regional Materials , 20% Extracted, Processed & Manufactured Regionally	1
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1

Yes ? No

			Indoor Environmental Quality		15 Points
Y			Prereq 1	Minimum IAQ Performance	Required
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
			Credit 3.1	Construction IAQ Management Plan , During Construction	1
			Credit 3.2	Construction IAQ Management Plan , Before Occupancy	1
			Credit 4.1	Low-Emitting Materials , Adhesives & Sealants	1
			Credit 4.2	Low-Emitting Materials , Paints & Coatings	1
			Credit 4.3	Low-Emitting Materials , Carpet Systems	1
			Credit 4.4	Low-Emitting Materials , Composite Wood & Agrifiber Products	1
			Credit 5	Indoor Chemical & Pollutant Source Control	1
			Credit 6.1	Controllability of Systems , Lighting	1
			Credit 6.2	Controllability of Systems , Thermal Comfort	1
			Credit 7.1	Thermal Comfort , Design	1
			Credit 7.2	Thermal Comfort , Verification	1
			Credit 8.1	Daylight & Views , Daylight 75% of Spaces	1
			Credit 8.2	Daylight & Views , Views for 90% of Spaces	1

Yes ? No

			Innovation & Design Process		5 Points
			Credit 1.1	Innovation in Design : Provide Specific Title	1
			Credit 1.2	Innovation in Design : Provide Specific Title	1
			Credit 1.3	Innovation in Design : Provide Specific Title	1
			Credit 1.4	Innovation in Design : Provide Specific Title	1
			Credit 2	LEED® Accredited Professional	1

Yes ? No

			Project Totals (pre-certification estimates)		69 Points
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Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points

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Appendix D:

Sample salvage/deconstruction specifications

The specifications below were adapted from specifications developed for the City of Seattle's Resource Venture business assistance program.

**MASTER
SECTION 024293 (01736)
BUILDING DECONSTRUCTION
SECTION 024293 [01736] - BUILDING DECONSTRUCTION**

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Deconstruction and removal of [selected portions of] [entire] building or structure for salvage.
2. Deconstruction and removal of [selected] site elements for salvage.
3. Demolition and removal of selected portions of building or structure for disposal.
4. Salvaging items for reuse by Owner.

B. Related Sections:

1. Division 01 Section "Construction Waste Management and Disposal" for disposal of demolished materials.

1.2 DEFINITIONS

- A. Full Deconstruction: Removal by disassembly of a building in a safe manner so as to preserve the usefulness of the materials in roughly the reverse order in which it was constructed.
- B. Selective Deconstruction: Disassembly and removal of selected portions of building or structure.
- C. Salvage: Removal of disassembled building materials for the purpose of reuse or recycling.
- D. Demolish: Remove and legally dispose of off site.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, debris and waste incidental to the deconstruction process becomes property of Contractor.
- B. Materials salvaged by the deconstruction process, of value for reuse, will be the property of [Owner] [general contractor].
- C. Materials salvaged by the deconstruction process, of value as recyclables for sale, will be the property of [Owner] [general contractor]. The[Owner] [general contractor] will administer this process at no additional cost to the project.

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- D. Materials salvaged by the deconstruction process, to be recycled for cost, will be at the expense of [Owner] [general contractor]. The [Owner] [general contractor] will administer this process at no additional cost to the project.

1.4 SUBMITTALS

- A. Qualification Data: For deconstruction firm. The requirements are as follows;
- B. Schedule of Deconstruction Activities: Indicate the following:
 - 1. Detailed sequence of deconstruction and removal work, with starting and ending dates for each activity.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
 - 6. Means of protection for items to remain and items in path of material removal from building.
- C. Inventory: After deconstruction is complete, submit a list of items that have been salvaged, recycled and disposed of and documentation (receipts/scale tickets/way-bills) showing the quantities.
- D. Deconstruction Photographic Documentation: Document general condition of materials to be salvaged prior to removal.
- E. Submit deconstruction plan prior to start of work.

1.5 QUALITY ASSURANCE

- A. Deconstruction Firm Qualifications: Company(ies) experienced and specializing in performing the Work of this Section with documented experience in similar types of deconstruction work.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
 - 1. Comply with noise and dust regulations of authorities having jurisdiction.
- C. Pre-Deconstruction Conference: Conduct conference at Project site. Review for conformance, methods and procedures related to deconstruction including, but not limited to, the following:
 - 1. Inspect and discuss condition of building to be deconstructed.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize deconstruction schedule and verify availability of materials, personnel, equipment and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by deconstruction operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review method for removing materials from the site.
 - 7. Review staging area for materials on the site.

1.6 PROJECT CONDITIONS

- A. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner's Representative. Owner will remove hazardous materials under a separate contract.
- B. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during deconstruction operations.
 - 1. Maintain fire-protection facilities in service during deconstruction operations.

1.7 DECONSTRUCTION PLAN

- A. Material Identification: Indicate anticipated types and quantities of materials to be salvaged, recycled and disposed of. Indicate quantities by weight or volume, but use same units of measure throughout.
- B. Procedure: Describe deconstruction methodology, sequencing and materials handling and removal procedures. Include the anticipated final destination of each material.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped as required.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of deconstruction required.
- C. Inventory and record the condition of items to be removed and salvaged.
- D. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during deconstruction operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or videotapes.
- F. Perform surveys as the Work progresses to detect hazards resulting from deconstruction activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during deconstruction operations. <omit for complete building removal>
- B. Service/System Requirements: Locate, identify, disconnect and seal or cap off indicated utility services and mechanical/electrical systems.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct deconstruction operations to ensure minimum interference with roads, streets, walks, walkways and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to comply with local safety regulations and prevent damage to salvageable materials.
 - 1. Provide protection to ensure safe passage of workers around deconstruction area.
 - 2. Provide weather protection for all salvage materials (and items to remain) before, during and after deconstruction.
- C. Temporary Shoring: Provide and maintain shoring, bracing and structural supports as required [to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain] <omit for complete building removal>, [and/or to prevent unexpected or uncontrolled movement or collapse of construction being deconstructed].
 - 1. Strengthen or add new supports when required during progress of deconstruction.

3.4 DECONSTRUCTION

- A. General: Deconstruct and remove existing construction in accordance with the materials identified for removal in the deconstruction plan. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with deconstruction systematically, from higher to lower level. Complete deconstruction operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing, prying or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain <omit for complete building removal>.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off site in accordance with all federal, state and local regulations.
 - 7. Remove structural framing members in such a way as to maintain their highest value.
 - 8. Locate deconstruction equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors or framing.

9. Dispose of demolished items and materials promptly.
- B. Salvaged Items:
1. Sort and organize salvaged materials as they are removed from the structure.
 2. Pack, crate or band materials to keep them contained and organized.
 3. Store items in a secure and weather protected area until removed from the site or transferred to Owner.
 4. Transport items to Owner's long-term storage area [on site] [off site] [designated by owner] [indicated on Drawings] <if owner is to maintain ownership of salvaged materials>.
 5. Protect items from damage during transport and storage <if owner is to maintain ownership of salvaged materials>.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during deconstruction activities. When permitted by Architect, items may be removed to a suitable, protected storage location during deconstruction and cleaned and reinstalled in their original locations after deconstruction operations are complete. <omit for complete building removal>

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them.
1. Do not allow demolished materials to accumulate on site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt and debris caused by deconstruction operations. Return adjacent areas to condition existing before deconstruction operations began.

3.7 SALVAGED MATERIALS FOR REUSE BY OWNER SCHEDULE

- A. Existing Items to Be Removed and Salvaged: <Insert description of items to be removed and salvaged for reuse by owner.>

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Appendix E:

Sample waste management plans

This appendix contains sample plans for deconstruction and reuse, and overall job-site waste management. The specifications for a waste management plan and sample overall job-site waste management plan were developed for the 2002-2003 Seattle-King County Contractors Guide. Project teams can adapt these to fit their project needs.

CONSTRUCTION WASTE MANAGEMENT 01505-1 SECTION 01505 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Administrative and procedural requirements for construction waste management activities.
- B. Related section, 02050-Demolition and Salvage

1.02 DEFINITIONS

- A. Construction, Demolition, and Landclearing (CDL) Waste:** Includes all non-hazardous solid wastes resulting from construction, remodeling, alterations, repair, demolition and landclearing. Includes material that is recycled, reused, salvaged or disposed as garbage.
- B. Salvage:** Recovery of materials for on-site reuse, or offsite sale or donation to a third party.
- C. Reuse:** Making use of a material without altering its form. Materials can be reused on-site or reused on other projects off-site. Examples include, but are not limited to the following: Grinding of concrete for use as subbase material. Chipping of land-clearing debris for use as mulch.
- D. Recycling:** The process of sorting, cleaning, treating, and reconstituting materials for the purpose of using the material in the manufacture of a new product.
- E. Source-Separated CDL Recycling:** The process of separating recyclable materials in separate containers as they are generated on the job-site. The separated materials are hauled directly to a recycling facility or transfer station.
- F. Co-mingled CDL Recycling:** The process of collecting mixed recyclable materials in one container on-site. The container is taken to a material recovery facility where materials are separated for recycling.
- G. Approved Recycling Facility:** Any of the following:
 1. A facility that can legally accept CDL waste materials for the purpose of processing the materials into an altered form for the manufacture of a new product.
 2. Material Recovery Facility: A general term used to describe a waste-sorting facility. Mechanical, hand-separation, or a combination of both procedures, are used to

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recover recyclable materials. Co-mingled containers are to be taken to a material recovery facility with at least a 50% co-mingled recycling rate.

1.03 SUBMITTALS

- A. Waste Management Plan: Submit plan within seven days of date established for the Notice to Proceed.
- B. Waste Management Report: Submit report concurrent with the final Application for Payment.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Material from demolition projects shall be recycled or reused whenever practicable (State of Washington RCW 39.04.135). Divert a minimum of 50% CDL waste, by weight, from the landfill by one, or a combination of the following activities:
 - 1. Salvage
 - 2. Reuse
 - 3. Source-Separated CDL Recycling
 - 4. Co-mingled CDL Recycling
- B. CDL waste materials that can be salvaged, reused or recycled include, but are not limited to, the following:
 - 1. Asphalt
 - 2. Asphalt shingles
 - 3. Concrete
 - 4. Metals
 - 5. Window glass
 - 6. Wood
 - 7. Field office waste, including office paper, aluminum cans, glass, plastic, and office cardboard.

See section 02050 for salvage detail.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Conduct construction waste management activities in accordance with State of Washington RCW 70.95.240, Seattle Municipal Code Chapter 21.36 and all other applicable laws and ordinances.
- B. Preconstruction Conference: Review methods and procedures related to waste management including, but not limited to, the following:
 - a. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - b. Review requirements for documenting quantities of each type of materials that will be salvaged, recycled or disposed of as waste.
 - c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.

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- d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
- e. Review waste management requirements for each trade.
- f. Review and distribution of the following publications and programs (request copies by calling the King County Solid Waste Division at (206)296-4466:
 - 1) Construction Recycling Directory for Seattle/King County.
 - 2) Contractors Guide: Save money and resources through job-site recycling and waste prevention
 - 3) King County Solid Waste Division Report of Comingled Recycling Facilities (available at <http://www.metrokc.gov/dhrp/swd/constructionrecycling/comingled.asp>).

1.06 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste types, quantity by weight, methods of disposal, handling and transportation procedures. Include separate sections in plan for demolition and construction waste.
- B. Organize the waste management plan in accordance with the sample plan included at end of Part 3, including the following information:
 - 1. Types and estimated quantities, by weight, of CDL waste expected to be generated during demolition and construction.
 - 2. Proposed methods for CDL waste salvage, reuse, recycling and disposal during demolition including, but not limited to, one or more of the following:
 - a. Contracting with a deconstruction specialist to salvage materials generated,
 - b. Selective salvage as part of demolition contractor's work,
 - c. Reuse of materials on-site or off-site sale or donation to a third party.
 - 2. Proposed methods for salvage, reuse, recycling and disposal during construction including, but not limited to, one or more of the following:
 - a. Requiring subcontractors to take their CDL waste to a recycling facility,
 - b. Contracting with a recycling hauler to haul recyclable CDL waste to an approved recycling or material recovery facility,
 - c. Processing and reusing materials on-site
 - d. Self-hauling to a recycling or material recovery facility.
 - 4. Name of recycling or material recovery facility receiving each of the CDL wastes.
 - 5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

1.07 WASTE MANAGEMENT REPORT

- A. Waste Management Report: Submit a cumulative waste management report on the form included at end of Part 3 with the final Application for Payment with the following attachments:
 - 1. A record of the type and quantity, by weight, of each material salvaged, reused, recycled or disposed.

2. Total quantity of waste recycled as a percentage of total waste.
3. Disposal Receipts: Copy of receipts issued by a disposal facility for CDL waste that is disposed in a landfill.
4. Recycling Receipts: Copy of receipts issued by approved recycling facilities for co-mingled materials. Include weight tickets from the recycling hauler or material recovery facility and verification of the recycling rate for co-mingled loads at the facility.
5. Salvaged Materials Documentation: Types and quantities, by weight, for materials salvaged for reuse on site, sold or donated to a third party.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 CONSTRUCTION WASTE MANAGEMENT, GENERAL

- A. Provide containers for CDL waste that is to be recycled clearly labeled as such with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials recycled at the receiving material recovery facility or recycling processor.
- B. The collection containers for recyclable CDL waste must contain no more than 10% non-recyclable material, by volume.
- C. Provide containers for CDL waste that is disposed in a landfill clearly labeled as such.
- D. Use detailed material estimates to reduce risk of unplanned and potentially wasteful cuts.
- E. To the greatest extent possible, include in material purchasing agreements a waste reduction provision requesting that materials and equipment be delivered in packaging made of recyclable material, that they reduce the amount of packaging, that packaging be taken back for reuse or recycling, and to take back all unused product. Insure that subcontractors require the same provisions in their purchase agreements.
- F. Conduct regular visual inspections of dumpsters and recycling bins to remove contaminants.

3.02 SOURCE SEPARATION

- A. General: Separate recyclable materials from CDL waste to the maximum extent possible. Separate recyclable materials by type.
 1. Provide containers, clearly labeled, by type of separated materials or provide other storage method for managing recyclable materials until they are removed from Project site.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
 3. Stockpile materials away from demolition area. Do not store within drip line of remaining trees.

4. Store components off the ground and protect from weather.

3.03 CO-MINGLED RECYCLING

A. General: Do not put CDL waste that will be disposed in a landfill into a co-mingled CDL waste recycling container.

3.04 REMOVAL OF CONSTRUCTION WASTE MATERIALS

A. Remove CDL waste materials from project site on a regular basis. Do not allow CDL waste to accumulate on-site.

B. Transport CDL waste materials off Owner's property and legally dispose of them.

C. Burning of CDL waste is not permitted.

SECTION 01505 CONSTRUCTION WASTE MANAGEMENT SAMPLE WASTE MANAGEMENT PLAN

Company: Northwest Best Construction
Project: Northwest Bank Building, Kent, WA

Designated Recycling Coordinator: John Doe

Waste Management Goals:

This project will recycle or salvage for reuse xx% [e.g. 75%] by weight of the waste generated on-site.

Communication Plan:

- Waste prevention and recycling activities will be discussed at the beginning of each safety meeting.
- As each new subcontractor comes on-site, the recycling coordinator will present him/her with a copy of the Waste Management Plan and provide a tour of the recycling areas.
- The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan.
- All recycling containers will be clearly labeled.
- Lists of acceptable/unacceptable materials will be posted throughout the site.

Expected Project Waste, Disposal, and Handling:

The following charts identify waste materials expected on this project, their disposal method, and handling procedures.

Demolition Phase

Material	Quantity	Disposal Method	Handling Procedure
Asphalt from parking lot	100 tons	Ground on-site, reused as fill	
Wood Framing	6 tons	Recycled - Wood Recycling Northwest	Separate "clean wood" in clean wood bin
Decorative Wood Beams	300 bd. ft.	Salvaged - Timber Frame Salvaging	Remove by hand, store on-site, load on pallets for pickup
Remaining Materials	8 tons	Landfill - Sound Disposal	Dispose in "trash" dumpster

Recycling questions? Call (503) 234-3000 or visit www.metro-region.org/toolkit

SECTION 01505
CONSTRUCTION WASTE MANAGEMENT
REPORT FORM

WASTE MANAGEMENT PROGRESS REPORT				
MATERIAL CATEGORY	DISPOSED IN MUNICIPAL SOLID WASTE LANDFILL	DIVERTED FROM LANDFILL BY RECYCLING, SALVAGE OR REUSE		
		Recycled	Salvaged	Reused
1. Asphalt (cu yds)				
2. Concrete (cu yds)				
3. Porcelain Plumbing Fixtures (lbs)				
4. Ferrous Metals (lbs)				
5. Non-Ferrous Metals (lbs)				
6. Wood (lbs)				
7. Glass (lbs)				
8. Clay Brick (lbs)				
9. Bond Paper (lbs)				
10. Newsprint (lbs)				
11. Cardboard (lbs)				
12. Plastic (lbs)				
13. Gypsum (lbs)				
14. Paint (gal)				
15. Insulation (lbs)				
16. Other (insert description)				
17. Other (insert description)				
Total (In Weight)		(TOTAL OF ALL ABOVE VALUES – IN WEIGHT)		
		Percentage of Waste Diverted	(TOTAL WASTE DIVIDED BY TOTAL DIVERTED)	

For downloadable versions of these forms, go to
www.metro-region.org/toolkit

Where to find reusable commercial construction materials? Visit www.BoneyardNW.org

Appendix F:

How to sell materials on site

If the project team plans to sell salvaged materials directly from the site, a plan for on-site sales will be crucial to success. Generally, the general contractor is responsible for creating such a plan. The main issues to consider are on-site location, business entity structure, staffing and marketing.

If the project team includes a demolition/deconstruction contractor, the general contractor should work closely with that contractor to make on-site sales a success. Often, demolition/deconstruction contractors have good markets for materials already lined up, or even operate their own sales yards. The general contractor and the demolition/deconstruction contractor need to clarify who will be responsible for selling what materials, from where, and when.

On-site location

New construction will most likely begin before all salvaged materials are sold, so ensure the sales area is out of the way, both to protect it and to ensure that buyers cannot wander off into areas of active construction. If the building being deconstructed has a loading dock or breakdown room that can be directly accessed from a public street, consider using it for the sales area. A portion of a parking lot will work well too if weather-sensitive materials can be protected (try portable shelters and steel storage boxes). Make it visible from the street or provide adequate signage to direct buyers to the sales site. Ensure the sales area is large enough to display materials with adequate access. This strategy is most successful in high profile projects with lots of street traffic.

If a suitable area cannot be created on site, find a nearby off-site location such as a warehouse or parking lot that does meet these requirements.

Business entity

Determine the form of business entity that will manage the wholesale/retail sale of material. Does a separate business entity need to be set up or does the owner's or general contractor's business structure allow for on-site sales? There will be advantages and disadvantages to having a separate entity. This decision will

need to be made during the pre-bid phase. Regardless of the decision, consider it a real business that has to compete with other material sellers, whether they are selling new or used materials. Be careful not to treat it like a garage sale.

Staffing

Consider hiring temporary personnel who are experienced in retail, and staff it like a permanent retail operation. Do not staff it with part of the project management team or other construction staff who will have other responsibilities to focus on.

Accounting

Do not treat salvaged materials sales as a minor effort. The entity running the sales operation will need an accounting system in place that includes inventory, expense and income controls. Consider establishing a merchant credit card account so that buyers can use credit cards, which increases the likelihood of making sales.

Marketing

Unfortunately, the materials will not sell themselves. Consider selling building materials online using Metro's new web site for buying and selling used commercial building materials, www.BoneyardNW.com – it's free and puts information about your materials in front of thousands of prospective buyers. Think about placing print ads in local newspapers, on-site banners and word-of-mouth advertising. Take advantage of any project press releases to promote the availability of premium salvaged materials. Plan to present the materials in an organized and tidy manner.

On-site sales are a temporary part of the deconstruction and salvage process, but they likely will compete with other project requirements for space and energy. An effective plan, well executed, can help speed this part of the operation to completion, which is better for the project overall.

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www.metro-region.org/toolkit

Where to find reusable commercial construction materials? Visit www.BoneyardNW.org

Metro **People places • open spaces**

Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy.

Your Metro representatives

Metro Council President – David Bragdon

Metro Councilors – Rod Park, District 1; Brian Newman, District 2;

Carl Hosticka, District 3; Kathryn Harrington, District 4; Rex Burkholder, District 5; Robert Liberty, District 6.

Auditor – Suzanne Flynn

Metro's web site: www.metro-region.org