



CONSTRUCTION AND DEMOLITION DEBRIS

BRIEFING PAPER: REDUCING, REUSING AND RECYCLING

A Waste or a Resource?

Did you know that approximately 30% of Wisconsin's non-municipal waste stream is made up of construction and demolition debris¹? The construction and demolition waste stream provides many opportunities for diverting huge quantities of often relatively clean materials, and interest in recovering these materials is growing in Wisconsin.

Do you want to decrease the amount you are sending to the landfill and save your company money? This publication highlights the efforts of some companies that are successfully saving money, reducing construction and demolition waste, and conserving resources. It will provide you with valuable resources and solutions to reduce, reuse, and recycle your construction and demolition debris. Whether you design, demolish, or build, we hope you will find this publication useful.

Construction and Demolition Waste Quantity and Composition.

Nationally, the EPA estimates that 136 million tons of construction and demolition debris are generated each year². In 1999, Wisconsin is expected to have generated nearly one million

tons of these building-related materials³. This estimate translates to about one pound of construction and demolition waste per person in Wisconsin every day³.

Asphalt shingles, dimensional wood, drywall, and brick and block materials represent the most significant percentages by weight of the construction and demolition waste stream⁴. See figures 1 and 2.

Wisconsin's Recycling law.

Wisconsin's Waste Reduction and Recycling Law bans several materials found at construction and demolition sites from landfills and municipal solid waste incinerators. Banned items include:

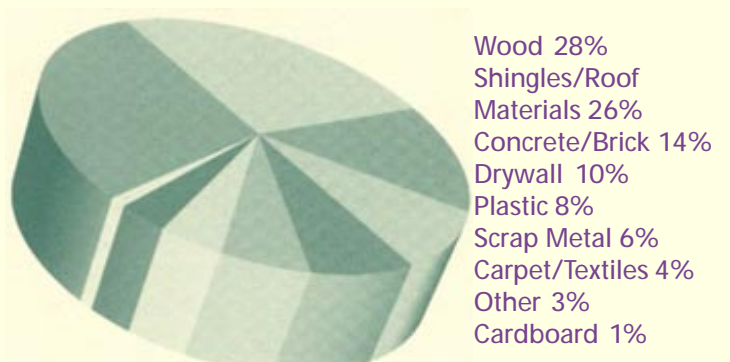
Major appliances	Newspapers
Used motor oil	Aluminum containers
Tires	Steel containers
Yard waste	Bi-metal containers
Corrugated cardboard	Glass containers
Office paper	Plastic containers (#1 & #2)
Magazines	Lead acid vehicle batteries

Grandfathered incinerator exemption: Residents located in an area served by an incinerator licensed prior to 5/11/90 and under contract for at least one year with incinerator, may send their combustible items (newspaper, magazines, cardboard, office paper and plastic containers) to the licensed incinerator.

Figure 1 Construction Waste in Wisconsin⁴



Figure 2 Demolition Waste in Wisconsin⁴



WASTE REDUCTION AND REUSE

Glenville Timberwrights Case Study

Building Without A Dumpster: Reducing and Reusing on the Construction Site

Glenville Timberwrights, a design-build firm that crafts timberframe homes in Wisconsin, is committed to reusing and recycling timbers in the construction of their buildings.

No new trees are harvested for their timberframes. The owners, Tom and Sue Holmes, have found that they do not have to sacrifice quality or beauty when using reclaimed, turn-of-the-century timbers from former industrial buildings. The reclaimed wood does not warp, twist or shrink, and it produces a sturdier frame not subject to the snap, crackle and joint pull-away inherent in new wood. Tom Holmes notes that: "the beautiful straight grain seen in the lengths of this reclaimed wood is unmatched in the lumber seen in today's market."

The cut-offs taken from the remilling operations are used as much as possible for items such as: stair parts, railings, flooring, baseboards and trim. Pieces too small to use for millwork are used to fuel the wood stove that heats their shop. Even the shavings find a new home as animal bedding for local farmers' sheep and horses or as mulch for plants.

The house frame is enclosed with super-insulated panels. To further reduce waste, all door and window openings are pre-cut into the panels at the factory using standard sizes for construction.

It is this effort to reduce and recycle which allows Glenville Timberwrights to build their timberframe homes with virtually no on-site waste, saving them considerable hauling costs, providing valuable materials to others and saving valuable natural resources.

The story is not over with the finished product. Their homes can one day give back the wooden beams by virtue of the fact that wooden pegs are used as fasteners rather than nails. Thus, workers can safely disassemble the beams for future reuse or recycling. From design to disassembly, Glenville Timberwrights finds consideration for the environment in harmony with aesthetic beauty, cost-effectiveness and worker safety.

Contact: Tom Holmes, Glenville Timber-wright's
(608) 356-9095

Keeping an eye on waste reduction during design and purchasing can significantly impact the amount of waste generated at a job site. Once actual building begins, focus should turn to reusing as many materials as possible. Here are some tips for reducing waste and reusing products:

During the Design Phase

- ✓Specify standard size materials (e.g. eight-foot lengths and 16-inch on-center stud spacing to use entire boards, drywall sheets, etc).
- ✓Evaluate the efficiency of material use.
- ✓Optimize use of subfloor and sheathing in floor plans.
- ✓Specify building techniques that use less material (e.g. reduce header sizes and corner details).
- ✓Include job site recycling in specification language.

Through Purchasing Decisions

- ✓Confirm that the correct amount of material is brought to the site.
- ✓Ask suppliers to take back substandard, rejected items and their packaging.
- ✓Purchase good quality, salvaged items.
- ✓Require that supplies be delivered in sturdy, returnable pallets and containers.
- ✓Ask suppliers to take or buy back empty containers, unused wood, pallets, crates and drywall.

On Site, Material-Specific Waste Reduction and Reuse Suggestions

Wood

- ✓Designate a centralized wood-cutting area so that scraps and cutoffs are available when short-length pieces are needed.
- ✓Use scrap wood for blocking, bracing, and back framing, or as spacers in header construction. Use small pieces of plywood for drywall hanging and carpet tack strips.
- ✓Grind wood waste and leave it on site as a landscaping mulch product or for erosion control. This greatly reduces the amount of construction waste to be hauled off-site and provides an attractive temporary and renewable ground cover at the conclusion of construction. Note: do not use wood with adhesives or other chemicals for land applications.
- ✓Replane and reuse relatively clean, undamaged pieces of wood with nails removed such as hardwood flooring from salvage operations.

Drywall

- ✓Provide a central location for drywall cutting so that smaller pieces of drywall are available for use.
- ✓Save sizable pieces of drywall for use around doors, windows, built-ins, or on another job.

Brick

- ✓Reuse high-quality salvaged bricks on site.
- ✓Confirm that the correct number of bricks is delivered to the site to reduce waste.

Searle Case Study by Flad & Associates Specifying The Reduction and Recycling of Waste

Flad & Associates, a Wisconsin-based architectural firm, worked with an owner to develop construction waste management specifications for a building demolition project on the Searle campus in Skokie, IL. The building was a 35,000 square foot, single-story warehouse which needed to be removed to make way for a new chemistry lab (which will be built as a U.S. Green Building Program pilot building). Though the owner had not worked on environmentally sustainable projects before, because of Searle's commitment to the U.S. Green Building Council's LEED rating program, they were receptive to the notion of dismantling and salvaging the warehouse rather than simply razing it.

Flad & Associates used "WasteSpec" and "Resourceful Specifications" (see Resources) as models for the specifications they created for this project. Before the deconstruction, Searle did its own inventory of the building to determine what they wished to salvage for their own reuse. Materials recycled or reused as part of the dismantlement included recycled scrap iron, non-ferrous metals, concrete, and brick.

Results:

- ✓72% of total demolition debris was recycled.
- ✓1,134,000 pounds of metal material were recycled.
- ✓1,380,000 pounds of solid fill materials (concrete, brick, etc.) were kept out of landfills.
- ✓Net savings: \$52,579 in avoided disposal costs and money received for recyclable material.

A similar waste management plan is now underway in the construction of the new facility on the property. It is Searle's intent to continue these efforts in future work. Flad & Associates plans to use the specifications model that they created to help future customers save money and reduce construction and demolition waste.

Contact: Garrick Maine, Flad & Associates
(608) 238-6727

St. Vincent dePaul Dig & Save Case Study Building Materials Reuse Center

St. Vincent de Paul's Dig & Save Outlet (and other building materials reuse centers - see Markets) takes building materials in good condition from contractors and others and sells them for reuse. Since they are a nonprofit organization, contractors and other donors get a tax deduction for their donations. Also, contractors often find that taking materials to a building materials reuse center means lower trash costs.

The Dig & Save accepts materials in good condition including doors, reusable lumber (without nails), door knobs, electrical and plumbing supplies, plumbing fixtures, some electrical fixtures, cabinets and counters. Misordered items often find a new use through this and other reuse centers.

Materials can be purchased by contractors or do-it-yourselfers for less than the materials would cost new, and sometimes more unusual materials needed for older buildings can be found.

St. Vincent de Paul hopes this part of their business expands and helps save money for those with excess materials, and those who need inexpensive building materials. They also hope to help raise money for their community efforts.

Contact: Ralph Middlecamp, St. Vincent de Paul
(608) 250-6370

Packaging

Many materials arrive at the job packaged in Cardboard, shrink wrap, wood pallets, frames, or metal bands. To reduce packaging wastes:

- ✓Specify minimal packaging when ordering materials.
- ✓Return reusable or recyclable packing materials to the supplier on subsequent shipments.
- ✓Use cardboard boxes as collection containers.
- ✓Protect finished floors with large pieces of cardboard.

Concrete

- ✓Use broken concrete to fill in embankments and berms or as a subbase under walkways or driveways.
- ✓Recycle unused concrete.

Metal

- ✓Save structural steel for reuse. Steel framing joined with screws is relatively easy to disassemble, and generally meets building codes for structural reuse unless the steel is fire damaged.
- ✓Use prefabricated or precut components such as precut steel studs.
- ✓Invite scrap haulers to collect and recycle metal wastes.

STEPS TO SET UP A RECYCLING PROGRAM ON A CONSTRUCTION OR DEMOLITION SITE

1. Select a coordinator

Designate a staff member to promote and monitor the recycling program. The coordinator will educate staff and subcontractors about the program (especially in the beginning) and keep records on salvaged and recycled materials and the costs incurred.

2. Identify target materials at the job site that can be recovered from the waste stream (Will the composition of your waste closely match the state average? - See figures 1 and 2)

- ✓For construction, monitor what is being thrown in the dumpster. Look at how much and what materials are being discarded. Use this opportunity to assess waste reduction and reuse opportunities.
- ✓For demolition, look for materials that can be stripped out and resold or reused when you evaluate the structure and building components. Note the condition of these materials, any unique qualities they possess and the quantity of each material.
- ✓Identify target materials for recycling from the above two steps. Remember to separate items banned from Wisconsin landfills. Additional target materials should:
 - ✗be generated in significant quantities (at least 1-2 cubic yards per week).
 - ✗have a good market value (see Markets) or provide avoided disposal costs (see Economics Worksheet).
 - ✗be fairly easy to sort on site or be removed from the waste by your recycling service provider.
- ✓For construction contractors, determine which subcontractors are generating what materials. For example, carpenters generate mainly wood waste whereas finish subcontractors generate packaging waste, such as cardboard and polystyrene. By determining who disposes what materials, you can make each subcontractor responsible for reducing or recycling specific materials on the job site.

3. Develop a staged recycling plan for construction and demolition that corresponds with the generation times of specific target materials

- ✓For example, during construction, most dimensional lumber scrap is generated during the framing stage and drywall later in the building phase.
- ✓Site recycling containers during the times when the majority of a material is generated. This action can cut down on container rental costs, illegal dumping, and contamination.

4. Evaluate the economics of recovering those materials (see Economics Worksheet)

- ✓Account for staff time in your cost estimates of the program.
- ✓Determine the cost per month of salvaging and recycling services from service providers who accept your target materials. Look at collection services as well as drop-off centers. Use the yellow pages, the market list in this publication, or your local recycling coordinator to help find service providers. Shop around for the best deal. Contact recyclers to find out:
 - ✗what materials they accept and how they must be prepared
 - ✗the quantities you must generate cost
 - ✗what services they will provide
 - ✗what happens to the materials after they are collected

Cornerstone Case Study Recycling Residential Construction Debris

Cornerstone is a hauling company that has developed a system for recycling at large residential building projects. They utilize a time-based separation strategy and frequent service to cut down on contamination and divert the maximum amount of materials from landfills. They site recycling containers during the period when the majority of a particular recyclable material is generated. Recyclables are kept separate from other materials.

On one project⁶, they recycled over 40% of construction materials from the construction of 261 homes comprised of:

- ✓ Wood 18%
- ✓ Cardboard 22.2%
- ✓ Carpet Padding 0.1%

Contact: Steve Clements, Cornerstone
(800) 653-1972

5. Develop a plan for the recovery of those materials

- ✓Set aside time to manage the program (approximately 1-2 hours per week and 4-6 hours up front for construction and 4-8 hours extra per project for demolition).
- ✓Select recycler(s) and make arrangements for collection.
- ✓Determine where to place containers, how many, what type are needed, and when. Ideally, the recycling containers will be a different color and/or shape than the trash containers. Make sure to put a trash container near all recycling containers or the recycling container may become a trash container.
- ✓Write up a waste reduction and recycling plan. Describe what target materials you will salvage and recycle, the method for collecting the materials, the recycling providers to be used, and the target material generation schedule.

6. Educate

- ✓Set aside time to explain the program to all of the subcontractors at the site, and instill in them that it is their responsibility to ensure that their laborers participate in the program.

J. Spear Associates

Business-to-Business Tip

Siting Containers For Highest Diversion/Lowest Cost

J. Spear Associates works with the waste industry to improve the efficiency construction and demolition waste collection at demolition and construction sites.

Their experience has been that:

"Just in time delivery of special boxes for waste can result in waste construction materials being source separated and the individual materials being low in contaminants. For example, just-in-time placement of 10 or 15 cubic yard capacity boxes at a demolition or roofing site, oriented such that it is most convenient for the workers to place shingles in the box(es) results in loads of uncontaminated roofing materials that can be transported to a shingle recycler without any further processing.

Joe Spear, J. Spear Associates
(414) 263-5715

Stone Oak Landscapes Case Study

Recycling Commercial Construction Debris

The staff of Stone Oak Landscape, a design-build firm, reuses and recycles all that they can. Here are just a few of the materials they reuse and recycle from a typical project:

Concrete: When they tear out concrete, they take it to a local company which crushes it into stone. To close the loop, they purchase crushed stone from that company.

Brick: When they take out materials that are reusable, including old brick and plant material, they keep the materials and reuse them.

Pallets: They grind up pallets and reuse the chips as landscaping mulch.

Brush: Brush is piled up and brought back to their yard where it is ground and used as compost and mulch.

contact: Patrick Devereux, Stone Oak Landscapes
(414)289-9790

- ✓Distribute the waste reduction and recycling plan to all levels of management.
- ✓Post signs that explain which materials go in which containers for the program. It is essential to the success of the recycling program that each container is clearly marked. Containers may need to be marked on several sides and written in several languages. Your recycling service provider may be able to help provide signs.

7. Monitor the program, make adjustments and celebrate successes

- ✓Periodically check the containers to ensure that the proper materials are going into them. If problems exist, find the person or people responsible and instruct them or their supervisor how to properly participate.
- ✓Have recycling service providers provide you with records of how much material is being removed and at what cost/savings.
- ✓Promote success in the program to managers, contractors, clients and the public. For example, one contractor took his employees on company-sponsored fishing trip with the funds recycling steel.

Recycling Economics Worksheet

The following worksheet is designed to help determine the cost-effectiveness of recycling waste generated by a given construction project. Avoided disposal costs achieved by recycling has saved money for companies around the state. (If tons are used rather than cubic yards for billing purposes, tons may be substituted for cubic yards in the worksheet.)

STEP ONE Estimate Total Project Waste:

Estimate the Total Project Waste, including recyclable materials (in cubic yards) _____ cy
 Use information from previous projects, if comparable, or use the table below.

Size of waste containers (cubic yards)	Number of waste containers	Number of container pulls per month	Total Waste Generated Per Month	Months of Project	Total Project Waste
cy	x	x	=	cy	x
					=
					cy

STEP TWO Estimate Amounts of Recycleable Materials:

Of the total above, how much is recycleable? Take a look at the waste the project is generating, or use the Wisconsin industry estimates.

Material	WI Average Commercial Construction Debris (by weight) ⁴	WI Average Residential Construction Debris (by weight) ⁴	Current Project Estimate (% volume)	Cubic Yards. multiply % (from previous column) by Total Project Waste (from step one)
A. Wood Waste (dimensional lumber, broken crates and pallets - no manufactured or treated wood products)	36%	37%		cy
B. Corrugated Cardboard	13%	8%		cy
C. Gypsum Drywall	20%	20%		cy
D. Scrap Metal (ferrous)	13%	7%		cy
E. Recycleable material #1: identify				cy
F. Recycleable material #2: identify				cy
G. Recycleable material #3: identify				cy
H. Recycleable material #4: identify				cy



STEP THREE Estimate Cost-Effectiveness of Recycling. Whether you throw it away or recycle it, you'll have to pay for collection and hauling. What's cheaper? Step three and four will tell you.

Material	Cubic yards (from step two)	Multiply by cost per cubic yard for recycling*	Add estimated cost for additional labor for sorting, monitoring and education **	Cost to recycle the material per cubic yard
A. Wood Waste (dimensional lumber, broken crates and pallets - no manufactured or treated wood products)		X	+	=
B. Corrugated Cardboard		X	+	=
C. Gypsum Drywall		X	+	=
D. Scrap Metal (ferrous)		X	+	=
E. Recycleable material #1: identify		X	+	=
F. Recycleable material #2: identify		X	+	=
G. Recycleable material #3: identify		X	+	=
H. Recycleable material #4: identify		X	+	=

* To calculate cost per cubic yard, divide cost of container (if applicable, add per-pull costs) by size of container (e.g. \$500 for a 30-yard container = \$12.50 per cubic yard). Call several recycling haulers for estimates or use costs from previous jobs.

** In most cases, little or no additional labor is required to separate the recyclable materials if you can keep the recycling program as similar to the current waste disposal system as possible. Set aside approx. 1-2 hours per week total and 4-6 hours total up front time to manage the recycling program for construction. Set aside 4-8 extra hours per project total for demolition to manage the recycling program⁷. Multiply projected number of hours for the material by cost of labor. And, some projects have shown that by recycling, the materials are stored better than if they are discarded for landfilling, reducing accident costs and thus insurance costs.

(You may want to use the table above to determine the cost effectiveness of self-hauling some materials to market. Use the second column for the cost of container rental and the third column for labor and transportation costs for your company.)

STEP FOUR Calculate Net Benefit or Cost:

Material	Cubic yards (from step two)	Multiply by cost per cubic yard for landfilling*	Cost to landfill the material	Subtract cost to recycle the material (from step 3)	Net Benefit or Cost to Recycle
A. Wood Waste (dimensional lumber, broken crates and pallets - no manufactured or treated wood products)		X	=	-	=
B. Corrugated Cardboard		X	=	-	=
C. Gypsum Drywall		X	=	-	=
D. Scrap Metal (ferrous)		X	=	-	=
E. Recycleable material #1: identify		X	=	-	=
F. Recycleable material #2: identify		X	=	-	=
G. Recycleable material #3: identify		X	=	-	=
H. Recycleable material #4: identify		X	=	-	=

* To calculate cost per cubic yard, divide cost of container (if applicable, add per-pull costs) by size of container. Call several recycling haulers for estimates or use costs from previous jobs.

Consider recycling some materials that have a slightly higher cost than landfilling and some that have a lower cost than landfilling.

Buying Recycled

The purchase of recycled-content building products helps to develop markets for recyclable building products. Several references exist to help identify recycled-content building materials. (See the "buy recycled" section of the Resources page of this paper.) Your current suppliers and the phone book can also be excellent resources for finding recycled products.

Design Coalition, Inc. Case Study

Wright Again: Reuse Including The Roof of Frank Lloyd Wright's Church.

Design Coalition, Inc. is an architectural firm which specializes in socially-conscious and environmentally-responsible design. They worked with the Taylor family on a home renovation project that reuses an entire house - and reuses materials from other buildings as well. During the expansion and renovation, as much of the building's current structure as possible was either salvaged or reused.

The home is a contemporary design clad in reused materials. Some of the siding on the house is reused old copper roofing from Frank Lloyd Wright's nearby Unitarian Church. The rest of the siding on the house is reused weathered siding boards from a red Wisconsin barn. New wood used for construction is sustainably-harvested wood. The framing wood is reused. Even the kitchen cabinets are made from recycled Douglas Fir. The old kitchen cabinets? Sold for reuse, of course.

Along with these reuse strategies, energy-efficient strategies were implemented, such as maximizing the use of natural lighting, creating passive solar sunspace, and sheltered sunny spaces that can be utilized much of the year, even in Wisconsin's climate.

Lou Host-Jablonski of Design Coalition, Inc. notes that additional benefits of the owner's commitment include "not taking native land out of use, and helping to revitalize existing neighborhoods."

Contact: Lou Host-Jablonski, Design Coalition, Inc.
www.designcoalition.org
(608) 246-8846

Key elements to a successful buy recycled program include: Ask - many suppliers will work with you to locate or develop recycled-content products. Be persistent; Specify - change your specifications to remove barriers and provide incentives to buy recycled; Contract - tell others that you expect them to buy recycled; Document - track costs and results to help you make future purchasing decisions.

**This publication was created by
WasteCap Wisconsin in partnership with
the following organizations:**

AIA Wisconsin
Associated General Contractors of Greater Milw.
Education Design Link
Energy Center of Wisconsin
EnviroPartners for Dane County Businesses
Madison Area Builders Association
Metropolitan Milwaukee Builders Association
UW-Extension Solid & Haz. Waste Ed. Center
Wisconsin Builders Association
Wisconsin Green Building Alliance
Wisconsin Recycling Market Development Board

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