



**Moving towards Zero Waste & Cost Savings –  
A Roadmap for Builders & Contractors for Construction & Demolition Projects**

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## Table of Contents

Introduction .....	1
Understanding the Materials & the Opportunities .....	1
Materials Management Planning .....	1
Waste Minimization & Recycling Goals .....	2
Waste Minimization Strategies.....	2
Materials to be Reused & Recycled .....	3
Identifying Reuse & Recycling Opportunities .....	5
Estimating what will be Reused or Recycled .....	6
Costs & Savings .....	7
Maximizing the Value of Recycling .....	7
Calculating the Cost Effectiveness of Recycling.....	8
Hazardous Materials .....	9
Planning the Process for Materials Collection, Storage, & Hauling.....	9
Tracking.....	10
Education for Employees & Subcontractors .....	10
Marketing Your Business as Green .....	11
Learning More.....	11
Resources & References .....	12
Appendices.....	14
Appendix A: Sample Construction & Demolition Waste Management Plan.....	15
Appendix B: Deconstruction & Materials Management Reporting.....	18
Appendix C: Hazardous Building Materials Found in Homes & Other Structures.....	19
Appendix D: Definitions .....	22
Appendix E: Recycling Evaluation Tools.....	23
Table 1: Advantages & Disadvantages of Source Separated & Commingled Recycling.....	7

## Introduction

Zero waste is a path that can lead to savings and profit. Zero waste does not actually mean “zero waste,” as some think. Instead it is a goal and en route to that goal, great change and value can be achieved. And, contractors can realize cost reductions by following this path. Zero waste in construction and remodeling projects focuses on looking for opportunities:

- Generating less waste by using materials more efficiently – saves money;
- Reusing materials on site, or selling or donating them to someone else for reuse – cost containment, potential revenues or tax benefits; and
- Recycling whenever possible – might save you money and could even bring in revenue.

Zero waste in construction and remodeling is a win-win proposition, and not as hard to do as you might think.

## Understanding the Materials & the Opportunities

The essential step in moving towards zero waste in construction and demolition is to develop a thorough appreciation of what materials will be used or generated onsite and to identify opportunities for new ways to approach them.

- Are there ways that the amount of materials *used* can be decreased?
- Can anything be *reused* or *re-purposed* onsite?
- Will any of the materials have *reuse value to someone else*?
- How about *recycling*? Are the materials recyclable?

An effective strategy for assessing and understanding these opportunities is to go through the process of developing a Materials Management, or Waste Minimization Plan. This is a straight forward process that draws on the type of analysis and research you already do for any project, but adds some new twists.

### **Materials Management Planning**

Prior to the start of a project, engage the property owner (manager or developer), architect, and essential crew members and subcontractors in the development of a Materials Management Plan. Each plan will be unique, but should reflect the following decisions about waste minimization, reuse, and recycling:

- Waste minimization and recycling goals;
  - Waste minimization strategies to be implemented;
  - Materials to be reused and recycled—on or off-site;
  - Expected quantity of each reusable, salvageable, and/or recyclable materials;
  - Estimated costs and savings as a result of the proposed plan;
  - Hazardous materials management;
  - Plan and process for materials collection, storage, and hauling;
  - Methods for tracking weight or volume, destination, and end-uses of all reused and recycled materials;
- and
- An education plan about reuse and recycling for everyone working at the jobsite.

A sample Materials Management Plan is in Appendix A.

### **Waste Minimization & Recycling Goals**

Starting with a goal will help guide the decision-making process, as well as provide direction for subcontractors and suppliers. It also provides a baseline for measuring how well the project succeeded with waste minimization and recycling. This provides you with “boasting rights.” As will be discussed in the final section of this document, in addition to the cost savings and environmental good that is achieved through waste minimization and recycling, it positions your business in a unique niche that can benefit your overall business development. Being able to prove that you have succeeded in the past is therefore essential. Having a goal and measuring your results provides that proof.

An example of a goal could be: To have no more than xx [roll-offs or tons] from the jobsite go to disposal while reusing or recycling at least x%<sup>1</sup> of what is generated.

The goal should be something that you truly consider to be achievable, but that passes the “straight face” test. For example, a goal that stated “to see if we can reduce our waste” while worthwhile, does not give you a true basis for measurement.

### **Waste Minimization Strategies**

Waste minimization includes:

- Using only those materials that you need;
- Decreasing the amount of material that has to be disposed of as trash; and
- Diverting materials from disposal to reuse or recycling.

Minimizing what you need to buy and planning to use these materials efficiently is the first step to avoid waste. There are many effective strategies to achieve this; all of which also lead to cost savings and increased profitability. Consider the following strategies; many of which you may already be part of your regular practices, but new ideas may occur to you as you move through this list. In all instances, apply the old adage “measure twice cut once” and avoid over-estimating and rounding-up the purchasing requirements. Rounding-up leads to wasted money and wasted materials that you have to deal with at the end of the job.

### **General**

- Consider using components or materials that are available through building supply reuse outlets, salvage businesses, or through a materials exchange<sup>2</sup>. These same ventures may present opportunities for you to divert materials and components to reuse.
- Use a centralized cutting area. Studies indicate that when centralized cutting sites are used, lumber consumption and waste can be significantly reduced.<sup>3</sup>
- Assign one person to be responsible for overseeing reuse and recycling. This can also be the “go to”

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<sup>1</sup> Recycling percentage is calculated as follows:

weight (or volume) of material recycled/total weight (or volume) of trash+ reused materials + recycled materials

<sup>2</sup> See Appendix C: Definitions

<sup>3</sup> [Toward more sustainable construction](#), a 3-part series in iGreenbuild, by J. Laquatra and M. Pierce. Published July, September, October, 2011

person for questions and suggestions.

### **Lumber**

- Design to standard material sizes to reduce cuts-offs. For some framing elements you can order them pre-cut (e.g., 2x4 studs pre-cut to be 92")
- Use prefabricated frames and trusses to reduce timber waste.
  - Use good dimensioning and modular components.
- Develop detailed framing layouts to avoid waste when ordering lumber.
  - Use advanced framing techniques that design for reduced wood use.<sup>4</sup>
- Plan to store lumber on level blocking under cover to minimize warping, twisting and waste.
- In remodeling, evaluate whether using salvaged lumber is possible.

### **Masonry**

- During construction, collect, stack and cover brick and other masonry materials to prevent soiling or loss.

### **Wallboard**

- Order wallboard in optimal dimensions to minimize cut-off waste. Create a wallboard sheetrock layout plan prior to ordering.
  - Wallboard is available in different lengths, and designed dimensions should correspond to standard sizes.
- Wallboard is available in "lightweight" form. This will decrease the weight (and cost) of disposal if recycling is not available.

In the Materials Management Plan, detail the strategies that you will use to achieve waste minimization. In other words, write down what you will intentionally do to avoid waste. This might seem unnecessary, but it provides a roadmap for the project and a resource that you can use for future projects. It also is a strategy that you can include in future marketing efforts; demonstrating that you intentionally approach projects from a waste minimization, cost savings, environmentally sustainable perspective. Some examples of statements you might include are:

- All cardboard on the site will be kept dry and recycled.
- All vendors will be asked to minimize the amount of packaging they use and to take-back packaging, such as pallets, for reuse.
- Left over roofing materials will either be donated to Habitat for Humanity<sup>5</sup> or recycled.

### **Materials to be Reused & Recycled**

The Plan should list the specific materials that you intend to reuse or recycle. The first step is to understand which materials have reuse or recycling potential and knowing which of these will be part of your project. Following are suggestions of items that often have reuse and recycling potential.

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<sup>4</sup> See resource section of this document.

<sup>5</sup> Habitat for Humanity has an initiative called the [ReStore](http://www.habitat.org/restores/directory) ([www.habitat.org/restores/directory](http://www.habitat.org/restores/directory)) where you can donate materials and find materials. It is challenging for most Habitat affiliates to manage donations directly.

## Reuse

Many of the materials used on a construction site, and that might have traditionally been handled as waste, can instead be reused; either re-purposed onsite, donated, or sold.

### Asphalt shingles

- Left over bundled asphalt shingles can be donated to organizations such as Habitat for Humanity.

### Fixtures

- Cabinets, light fixtures, bathtubs, sinks, mortar mix, hardware, nails, screws and plumbing fittings and supplies are all accepted by Habitat for Humanity.

### Insulation

Install left-over insulation in interior wall cavities or on top of installed attic insulation if it cannot be used on another job.

### Lumber/wood

- Set aside lumber and plywood/OSB cut-offs to be used later as fire blocking, spacers in header construction, etc.
- Save small wood scraps to use as kindling for clients or crew members (no plywood or treated wood).
- Larger pieces of leftover lumber (6 feet or more) may be able to be donated to Habitat for Humanity.
- Save clean sawdust for use in compost piles or around gardens. Avoid sawdust that might contain painted or treated wood. This should be bagged separately and handled as trash.
- Long pieces of dimension lumber can be used as nailing material; shorter pieces can be used for blocking and furring strips.<sup>6</sup>
- Check with industrial arts departments and tech schools to see if scrap lumber would be useful for their class projects.<sup>7</sup> Also check with the theater departments (stage set construction)

### Masonry

- Salvage usable bricks, blocks, slate shingles, tile and other masonry materials from remodeling and construction. Store for future jobs or divert to salvage operations.
- Check to see if your masonry supplier will accept the return of materials in good condition.
- Good quality used concrete (also known as urbanite) can be used as brick or block for landscaping walls or foundations for small buildings.

### Metal

- During *remodeling*, separate metal radiators, grates, piping, aluminum siding, and old appliances for salvage or recycling.
- During *construction*, separate metals for recycling, including copper piping, wire and flashing; aluminum siding, flashing and guttering; iron and steel banding from bundles, nails and fasteners, galvanized flashing and roofing, and rebar; and lead chimney flashing.

### Paint, stain, solvents, sealants

- Donate unused portions that are in good condition to Habitat for Humanity, or save for your next job.

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<sup>6</sup> [Toward more sustainable construction](http://www.igreenbuild.com/coreModules/content/contentDisplay.aspx?contentID=3602)

(<http://www.igreenbuild.com/coreModules/content/contentDisplay.aspx?contentID=3602>) a 3-part series in iGreenbuild, by J. Laquatra and M. Pierce. Published July, September, October, 2011

<sup>7</sup> Id.

Keep in mind that some building codes prevent the use of used materials (i.e. reused studs) as structural members. Non-structural materials such as trim or siding are rarely regulated.<sup>8</sup> Be sure to check with the local building inspector.

## Recycling

Materials that cannot be reused, very likely can be recycled. And keep in mind that recyclable materials are not only generated through the construction process, but also by employees. Following are examples of materials that are readily recycled in most areas:

- Appliances and fixtures (bathroom fixtures, hardware, windows, doors, plumbing, insulation, used appliances, white goods, etc.)
- Asphalt shingles
- Batteries (including rechargeable tools)
- Bottles and cans (glass, plastic, metal)
- Brush and trees (yard and landscaping waste)
- Buckets (5-gallon)
- Cardboard and paper (must be kept dry)
- Ceiling tiles<sup>9</sup>
- Clean wood cut-offs, flooring, trim, pallets
- Lumber and plywood (without nails)
- Metals (copper tubing, insulated copper and aluminum wires, copper bus bar, brass water meters, brass pipe, aluminum & brass scrap, brass faucets, paint cans, rebar, all other scrap metals)
- Pallets (plastic and wood)
- Plastic film/sheeting
- Plastic bags
- Windows and doors
- Yard debris, such as branches and trees (or use a chipper on site to create landscaping mulch)

Harder to recycle because opportunities are not as widely available, but may be available in your area, include:

- Carpet<sup>10</sup>
- Masonry
- Painted/treated wood
- Wallboard - unpainted<sup>11</sup>

## **Identifying Reuse & Recycling Opportunities**

Learning about reuse and recycling opportunities are by their nature local questions. Recycling markets, processors, and reuse outlets vary depending on where you are. A good starting point to learn about what is available in your area is to speak with your solid waste hauler—or contact haulers you have not worked with before to find out about additional services and cost saving opportunities. In addition, a call to the municipal recycling coordinator may help you identify C&D recycling and reuse opportunities.

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<sup>8</sup> [Construction Waste Recycling \(http://constructionwaste.sustainablesources.com/\)](http://constructionwaste.sustainablesources.com/)

<sup>9</sup> See resource list for Armstrong ceiling tile recycling program

<sup>10</sup> See resource list for carpet recyclers.

<sup>11</sup> See resource list.

Other suggestions include:

- Contact local salvage companies and stores that buy and sell used and surplus C&D. These resources can be found in the phone book or by searching the Internet. See also the resource list for a directory of ReStores.
- Post reusable items on materials exchange websites. The [Reuse Marketplace \(www.reusemarketplace.org\)](http://www.reusemarketplace.org) is a free regional materials exchange service for businesses in the states of Connecticut, Delaware, Massachusetts, New Jersey, New York, Rhode Island and Vermont.
  - Additional materials exchange reuse opportunities for building materials can be found in a comprehensive online resource [Materials Exchanges in the Northeast \(http://www.nerc.org/documents/material\\_exchanges\\_in\\_the\\_northeast.html\)](http://www.nerc.org/documents/material_exchanges_in_the_northeast.html).
- Several resources exist online that can direct you to outlets for specific materials. These include:
  - [Asphalt shingles \(http://www.shinglerecycling.org/content/find-recycler\)](http://www.shinglerecycling.org/content/find-recycler);
  - [Ceiling tiles \(www.armstrong.com/common/c2002/content/files/15976.pdf\)](http://www.armstrong.com/common/c2002/content/files/15976.pdf);
  - [Carpet \(https://www.carpetrecovery.org/collector-finder/index.html\)](https://www.carpetrecovery.org/collector-finder/index.html);
  - [Wallboard \(http://www.wallboardrecycling.org/links.html\)](http://www.wallboardrecycling.org/links.html); and
  - [Rechargeable batteries \(www.call2recycle.org/locator\)](http://www.call2recycle.org/locator).

There are also general resources, such as the Construction Materials Recycling Association (CMRA) maintains a “finder a recycler” feature on its website (<http://www.cdrecycling.org/find.html>) and the [Building Materials Reuse Association \(BMRA\) \(http://www.bmra.org\)](http://www.bmra.org) includes a reuse outlet search feature. See the Resource section of this document for additional information.

### **Estimating what will be Reused or Recycled**

Estimating the weight and/or volume of specific material streams that will be generated from the project will help guide your waste reduction decisions, and will be essential for the next step in the planning process; calculating the costs and savings. In particular, develop estimates for each reusable, salvageable, and/or recyclable material and begin the process of deciding how you will manage the material: reuse onsite, resale, recycling, or disposal.

For remodeling or deconstruction jobs, start by conducting a walk-through to inventory materials in the building. This can be done with a deconstruction crew if one is brought in or if you’re planning to sell materials pulled out of the project to a salvage company, have them come along on the walk-through. Consider potential onsite uses and resale or donation options when inventorying reusable items. If remodeling is the goal, consider options for repairing or reusing items in place, such as gypsum wallboard. Identify items that can be removed with little damage, such as those attached with mechanical fasteners instead of glue. Items with unique or antique features are desirable, as are materials or items that are fairly new and in good condition to be easily reused. And, of course, scrap metal is always an important by-product. Copper tubing and wiring, and aluminum can generally be sold. Even old radiators can have value. See Appendix B for a sample inventory. Appendix E provides a more detailed approach.



As you develop the inventory, you may find that you readily know who to work with to reuse or recycle the materials, but in other cases you will not have established relationships. In these cases, researching the opportunities in your area becomes important. Refer to the previous section, as well as the resource section of this document, for suggestions about how to find markets for the materials.

In addition to the materials that will be used to complete the job, and/or removed, there will be packaging and other waste generated that can be recycled. High volume materials include cardboard and pallets. Lower volume, but readily recyclable, are bottles, cans, and plastic bags from the crew.

There are certain materials that should not be recycled or reused because of their hazardous characteristics. These materials require special handling and attention to appropriate disposal. See Appendix C for information on hazardous building materials found in homes and other structures.

### **Costs & Savings**

#### **Maximizing the Value of Recycling**

In addition to helping you to identify the type of recycling services available, your hauler and/or the company you work with to recycle materials will have advice about how best to manage the materials on the jobsite. An important question is whether to “source separate” or “commingle” your recyclables. Source separated means that specific materials are put into designated containers; and only those materials. Examples might be only wallboard, or only plastic sheeting. Commingled is when more than one material type is put into the same container. For example, concrete and bricks in the same container is an example of commingled. Table 1 provides an overview of the primary advantages and disadvantages of each method.

**Table 1: Advantages & Disadvantages of Source Separated & Commingled Recycling**

<b>Source Separated Materials</b>	
<b>Advantages:</b>	<b>Disadvantages:</b>
Higher recycling rate	Multiple containers on site
Higher quality and valued material	Jobsite workers separate materials on site
Materials ready to go directly to market	Multiple markets
Potential revenue	More information to manage
Cleaner, safer work environment	Likely to cost more – hauler, equipment, staff
Report includes tonnage of each material recycled	
<b>Commingled Materials for Recycling</b>	
<b>Advantages:</b>	<b>Disadvantages:</b>
Only two containers on site (trash and recyclables)	Lower recycling rates
Less information to manage	Lower quality and less valued material
Workers don't need to separate material	Less revenue for recyclables
	Dependent on availability of facility that separates materials
	Tonnage reports are for mixed recyclables

Note that some materials only have recycling outlets when they are source separated—for example wallboard and carpet—and many materials must be kept dry. These include wallboard, carpet, and paper.

**Calculating the Cost Effectiveness of Recycling**

When considering if recycling materials from the jobsite makes financial sense, it is possible to estimate the cost of recycling versus the cost of disposal in a few simple steps.

**Step 1.** Determine if the recyclable materials will be source separated or commingled in one dumpster.

**Step 2.** Estimate the tons of each waste material to be generated at the jobsite.

**Step 3.** Convert the material tonnages to volume so that an estimate of dumpster size and the number of dumpsters can be estimated. Haulers/recycling companies will be able to provide the conversion rates for each material type they handle. For example, a 30-yard dumpster will be needed for cardboard at a jobsite. It is estimated that the 30 tons of cardboard to be generated will require the dumpster to be emptied 20 times.

**Step 4.** Calculate the cost of recycling each material type:

$$\begin{aligned} \text{Cost of recycling} = & \\ & (\text{Number of dumpsters} \times \text{the haul rate (also known as the pull rate)}) + \\ & (\text{the total tons of material} \times \text{the tipping fee charged per ton of material}) \end{aligned}$$

In many communities, especially in the northeast, the hauling and tipping fees for recyclables is far less than disposal costs, and for materials like cardboard, there may be no tipping fee at all. The table below provides an example of calculating the cost for recycling cardboard.

Cardboard Recycling					
Dumpster Size	Anticipated #of Dumpsters	Haul Rate (Pull Rate)	Tipping Fee per ton/material	Material (Tons)	Total Recycling Cost = (20*\$150)+(30*\$0)
30 yard	20	\$150	\$0	30	\$3,000

**Step 5.** Compare the cost of recycling to disposal to determine the cost effectiveness of recycling each C&D material. The same formula is used, but the costs are for disposal, rather than recycling. In the example provided, the cost of disposing the cardboard is more than four times the cost of recycling it.

$$\begin{aligned} \text{Cost of disposal} = & \\ & (\text{Number of dumpsters} \times \text{the haul rate (also known as the pull rate)}) + \\ & (\text{the total tons of material} \times \text{the tipping fee charged per ton of material}) \end{aligned}$$

Cardboard Disposal					
Dumpster Size	Anticipated #of Dumpsters	Haul Rate (Pull Rate)	Tipping Fee per ton/material	Material (Tons)	Total Disposal Cost = (20*\$350)+(30*\$175)
30 yard	20	\$350	\$175	30	\$12,250

**Total Disposal Fee = \$12,250**

**Total Recycling Fee = \$3,000**

By calculating and reviewing the recycling cost for each material to be generated, you may identify opportunities to save a substantial amount of money on disposal.

### ***Hazardous Materials***

When considering salvaging materials from remodeling or deconstructing a building, it is important to know which materials contain hazardous materials that present environmental and health concerns for workers and the public.

Hazardous materials may involve federal, state, and local laws or regulations. Regulatory requirements vary, so it is important to contact state and local agencies to ensure compliance and environmental safety for workers and others that may be impacted by the project. See Appendix C for more information.

### ***Planning the Process for Materials Collection, Storage, & Hauling***

As discussed above, having a conversation with your hauler, recycler, and/or the local recycling coordinator can help you to determine how best to store and manage the materials on site. Among the issues that you will consider will be costs, space constraints, reuse and recycling opportunities, and whether you are source separating or commingling materials.

Decide, before the project begins, where containers and storage areas will be located, and plan for appropriate signage. You want to be sure that the purpose of the containers or storage areas are obvious to onsite workers, as well as subcontractors, and haulers. Having the correct materials in the correct locations will result in the highest value to you and will help avoid unintended disposal costs due to material contamination, or wasted time by people trying to decide where to put what and subcontractors and haulers not using their time the most effectively. Location, location, location is true on the jobsite as well!

There are also important security questions. Many of the materials generated and used on the site are valuable; not just to you but for resale. Theft prevention needs to be considered. Strategies such as where the materials are stored—e.g., *not* where they are the most easily spotted and removed—and having locked containers or secured areas may be important.

The majority of the material that you determine to reuse and, especially, recycle, will require that a hauler come to the site and remove the materials. In some limited instances you may “self-haul”; for example taking bottles and cans from lunch to the local recycling center. You may find that you will enter into agreements with different haulers for different materials; and that sometimes the hauler will be the recycler itself. For example, if you there is a wallboard recycler that serves your area, it may be willing to come and pick-up loads of material. Minimum volumes/weights will have to be met and this will impact the site layout.

In addition to the possibility of there being multiple containers or storage areas onsite for the materials to be reused and recycled, there will be questions of timing. Pacing of site activities and subcontractors is an activity with which you are certainly familiar, and planning for reuse and recycling can be considered in the same light as a subcontractor. There is a logical sequence to materials use and generation, and the same sequence should apply to when materials are generated for reuse and recycling and when they should be removed from the site.

## **Tracking**

Include in the Plan a system for tracking the materials set aside for reuse offsite, reused onsite, recycled, handled as hazardous waste, and managed as regular trash. Tracking is important for many reasons, including:

- Cost containment – being sure you pay only for the services you use
- LEED points – if you are seeking LEED certification, then tracking reuse and recycling will be essential
- Regulatory compliance – if there are laws that pertain to the management of any of the materials, tracking will be essential to document regulatory compliance. And, documentation will likely be a regulatory requirement itself.
- Evaluating the success of the waste minimization program and having data available to prove the effectiveness of your project to future customers.
- Using the data to calculate the environmental impacts of your actions: energy saved, greenhouse gas emissions avoided, and solid and hazardous waste avoided.<sup>12</sup>

There are a number of methods for tracking weight or volume, destination, and end–uses of all reused and recycled materials. There are samples in the Appendices of forms and strategies to be used. In addition, there are online tools such as [WasteCapTRACE \(http://www.wastecaptrace.org\)](http://www.wastecaptrace.org), which assists with tracking ongoing construction and demolition debris recycling and documents the results.

## **Education for Employees & Subcontractors**

Planning is only valuable if the strategies detailed within it are implemented. On the jobsite, this means that all employees and subcontractors need to be aware of the Plan, how it affects their responsibilities, what expectations there are, and how they will benefit from implementation of the Plan. Therefore, the Plan needs to detail how this education and buy-in will be implemented. At a minimum, the following actions should be included:

- The contractor will be required to inform subcontractors about the requirements of the Waste Management Plan and will supply all subcontractors with the specifications and recycling plan, which will explain how to handle recyclable materials used by their specific trade.
  - Any contractors/subcontractors that are working on a fixed-price contract need to be made aware of the Waste Management Plan before bidding the job, in case it is determined that compliance will create increased labor costs.
- The general contractor’s site superintendent will be available to answer questions and assist in maintaining the re-use and recycling plan.
- All employees will have the Plan explained to them and what their responsibilities are.
- The materials to be reused and recycled will be explained to all employees and subcontractors.
- The locations for storing materials to be reused or recycled will be clearly identified and pointed out to all employees and subcontractors.

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<sup>12</sup> EPA WARM environmental benefits calculator ([http://www.epa.gov/climatechange/waste/calculators/Warm\\_home.html](http://www.epa.gov/climatechange/waste/calculators/Warm_home.html))

Signage is important. Signage about what goes where, and what *shouldn't* go there, is important to ensure that what is planned happens, but signage has another role as well. Employees on a jobsite that are reusing and recycling are generally proud of what is taking place and their part in it. Boasting about what is being accomplished boosts moral and encourages ongoing participation. Consider signage that reports back to the jobsite what has been achieved. For example, 100 tons of metal recycled to date, etc. This can also be an important public relations tool for you as the community will also see what is being accomplished.

### **Marketing Your Business as Green**

After all the work you put in to developing and implementing the Waste Management Plan, and achieving the waste reduction, reuse, and recycling goals, use it to your advantage. Consider pursuing LEED certification for your projects, promote your business as “green”, and use press releases to boast about your accomplishments. You can use the data you collected through tracking to prove you made a difference.

You can also measure and boast about the environmental benefits of the jobsite reuse and recycling program by plugging the material tonnages into the US Environmental Protection Agency's [WARM Tool](http://www.epa.gov/climatechange/waste/calculators/Warm_home.html) ([http://www.epa.gov/climatechange/waste/calculators/Warm\\_home.html](http://www.epa.gov/climatechange/waste/calculators/Warm_home.html)). This information can be used in any marketing materials developed to promote the project.

### **Learning More**

There are workshops and training courses available to the construction trade for those that are interested in learning more about reuse and recycling on the jobsite. In particular, WasteCap Recycling Solutions ([www.wastecap.org](http://www.wastecap.org)) is a national leader in offering accredited reuse and recycling training for construction and demolition projects, and the Green Building Council, the owner of the LEED program, also offers many courses (<http://new.usgbc.org/courses>).

## Resources & References

[Advanced Framing - Build It Green](#)

(<http://www.builditgreen.org/attachments/wysiwyg/22/Advanced-Framing.pdf>)

[Advanced Wall Framing - EERE - U.S. Department of Energy](#)

([http://apps1.eere.energy.gov/buildings/publications/pdfs/building\\_america/26449.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/26449.pdf))

[Armstrong Ceiling Tile program](#)

([www.armstrong.com/common/c2002/content/files/15976.pdf](http://www.armstrong.com/common/c2002/content/files/15976.pdf))

[Asphalt Shingles Manufacturing & Waste Management in the Northeast](#) – Includes a list of asphalt shingle recycling companies in the Northeast

(<http://www.nerc.org/documents/asphalt.pdf>)

[Building Materials Reuse Association \(BMRA\)](#) – Includes a search tool for locating C&D reuse outlets

(<http://www.bmra.org>)

[CARE Carpet Reclamation Partners](#) – Link to carpet recyclers, nationally

(<http://www.carpetrecovery.org/collector-finder/index.html> )

[Carpet Recycling Infrastructure in the Northeast](#) – List of carpet recycling companies and services in the Northeast

([http://www.nerc.org/documents/carpet\\_recycling\\_infrastructure\\_in\\_northeast.pdf](http://www.nerc.org/documents/carpet_recycling_infrastructure_in_northeast.pdf))

[Construction Materials Recycling Association \(CMRA\) “finder a recycler”](#)

(<http://www.cdrecycling.org/find.html>)

[Construction Waste Minimization Methods Fact Sheet](#)

([http://www.neo.ne.gov/home\\_const/factsheets/const\\_waste\\_min.htm](http://www.neo.ne.gov/home_const/factsheets/const_waste_min.htm))

[Construction Waste Recycling](#) - Information about how to recycle construction waste

(<http://constructionwaste.sustainablesources.com>)

[Habitat for Humanity](#) – Search tool for locating Habitat for Humanity ReStores

(<http://www.habitat.org/restores/directory>)

[LEED Resources \(Green Building Council\)](#)

(<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=75>)

[Market Resources for Recycling Industries](#) – Includes links to trade associations for particular material types.

[http://www.nerc.org/documents/market\\_resources\\_recycling\\_industries.pdf](http://www.nerc.org/documents/market_resources_recycling_industries.pdf))

[Materials Exchanges in the Northeast](#) – Comprehensive listing of materials exchange opportunities in the Northeast

([http://www.nerc.org/documents/material\\_exchanges\\_in\\_the\\_northeast.html](http://www.nerc.org/documents/material_exchanges_in_the_northeast.html)).

[Recycling Markets Database](#) – Searchable database of companies accepting and recycling materials in the northeast; with an emphasis on companies serving New York State.

(<http://esd.ny.gov/businessprograms/secondarymarketinfo.html>)

[Summary of U.S. States' & Municipalities' C&D Recycling Regulations & Requirement](#)

([http://www.nerc.org/documents/summary\\_of\\_state\\_candd\\_reg\\_requirements.pdf](http://www.nerc.org/documents/summary_of_state_candd_reg_requirements.pdf))

[Taking construction site waste management to the next level](#), Journal of Green Building, 4(4): 29-32, by J. Laquatra and M. Pierce, 2009

(<http://www.atypon-link.com.proxy.library.cornell.edu/CPUB/doi/pdf/10.3992/jgb.4.4.29>)

[Toward more sustainable construction](#), a 3-part series in iGreenbuild, by J. Laquatra and M. Pierce. Published July, September, October, 2011

(<http://www.igreenbuild.com/coreModules/content/contentDisplay.aspx?contentID=3602>)

[WasteCap Recycle Solutions](#) – Offers workshops and webinars on C&D reuse and recycling, as well as offering services and supplies

([www.wastecap.org/](http://www.wastecap.org/))

[Waste Management on the Construction Site](#), Laquatra and Pierce, Cornell Cooperative Extension, 2002

([http://www.human.cornell.edu/dea/outreach/upload/Waste\\_Management-booklet.pdf](http://www.human.cornell.edu/dea/outreach/upload/Waste_Management-booklet.pdf))

[Winning Construction Bids and Gaining Customers through Waste Management: Minimizing Waste and Material Reuse and Recycling](#) – Recommendations for contractors and builders

([http://www.nerc.org/documents/winning\\_construction\\_bids.pdf](http://www.nerc.org/documents/winning_construction_bids.pdf))

## **Appendices**

[Appendix A: Sample Construction & Demolition Waste Management Plan](#)

[Appendix B: Sample Inventory](#)

[Appendix C: Hazardous Building Materials Found in Homes & Other Structures](#)

[Appendix D: Definitions](#)

[Appendix E: Recycling Evaluation Tools](#)



**Appendix A: Sample Construction & Demolition Waste Management Plan**  
**[Project location]**

**[Date]**

**Project Description: Residential Interior Demolition and Reconstruction**

**Waste Disposal Company:** [Name]

Contact: [Name, phone number]

**Recycling Hauler:** [Name]

Contact: [Name, phone number]

Some or all recyclables may be hauled by the builder.

**Site Manager for Reuse & Recycling/Plan Implementation:** [Name, phone number]

**1) Waste Management Goals:**

- a) The Client and the Contractor have determined that this project shall generate at least 60% less waste for disposal by source reducing waste materials, and diverting unavoidable waste materials to reuse and recycling markets. Source reduction methods shall include prevention of damage to materials to be incorporated into the work due to mishandling, improper storage, contamination, inadequate protection or other factors, minimizing poor quantity estimating, and efficient building design. Reuse and recycling waste diversion will include seeking out available markets for all waste materials. All materials diverted through reuse and recycling will be tracked by tonnages, as well as the end destinations for all materials.

**2) Responsibility:**

- a) Contractor shall be responsible for the implementation of the administrative portions of this program, including the notification of subcontractor management, the training of the site supervisor, the onsite posting of this plan.
- b) The site supervisor will be responsible for the implementation of the onsite portions of this program including: the initial and on-going training of subcontractor personnel, implementing the waste diversion procedures, and monitoring the proper diversion of all materials.

**3) Waste Prevention Planning:**

- a) In addition to other requirements specified herein it is a requirement for the work of this project that the contractor comply with the applicable federal, state and local waste disposal requirements.
- b) Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling where markets are available. Waste disposal in landfills or incinerators shall be minimized. On new construction projects this means careful recycling of jobsite

waste. On demolition projects this also means careful removal of building materials for salvage. When possible, materials will also be re-used on the jobsite.

- c) Project Construction Documents: The General Contractor will contractually require all subcontractors to comply with these source reduction, reuse, and recycling guidelines. A copy of this “Construction Waste Management Plan” will accompany all subcontractor agreements and require subcontractor participation.
- d) The “Construction Waste Management Plan” shall be implemented and executed as follows and as on the chart below:
  - i) Salvageable materials will be diverted from disposal when markets are available.
  - ii) There will be a designated area on the construction site reserved for materials that can be diverted for reuse and recycling.
  - iii) Areas shall be marked to designate what recyclable materials are to be stored there.
  - iv) Hazardous waste will be properly managed by a licensed hazardous waste vendor. A list of hazardous waste will be provided to all subcontractors.
  - v) An ongoing record of materials used on the site, how they are handled, end destinations, and amount will be maintained.

#### **4) Communication & Education Plan:**

- a) This Waste Management Plan will be posted onsite.
- b) Each subcontractor will be made aware of the intent of this project with respect to reduction of waste, reuse, and recycling. Onsite recycling containers and/or areas will be plainly marked with signage.
- c) The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan.
- d) All recycling containers/areas will be clearly marked.
- e) Lists of acceptable/unacceptable materials and the designated areas for storing materials for reuse and recycling will be posted on site and clearly marked.
- f) All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.

#### **5) Motivation Plan:**

- a) The General Contractor will conduct a pre-award meeting for subcontractors. Subcontractors under consideration will be required to attend the meeting to review project goals and requirements with the project team. Attendance will be a prerequisite for award of subcontracts. This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the jobsite.

#### **6) Expected Project Waste, Disposal, and Handling:**

The following chart identifies waste materials expected on this project, their intended disposal methods and handling procedures. New items may be added as needed.

<b>Material</b>	<b>Quantity</b>	<b>Disposal Method</b>	<b>Handling Procedure</b>
Land clearing debris	None	Keep separate for reuse and or wood sale. Suitable materials may be delivered to a composting site. Separate topsoil and rock for future landscaping.	Keep separated in designated areas onsite.
Clean dimensional wood and palette wood	None	Keep separate for reuse by onsite construction or by site employees for either heating stoves or reuse in home projects. May be offered to public.	Keep separated in designated areas onsite.
Plywood, OSB, particle board	TBD	Reuse onsite when possible, landfill or recycle off site.	Keep separated in designated areas onsite. Place in "Trash" container.
Painted or treated wood	TBD	Reuse, off site recycle, landfill.	Keep separated in designated areas onsite. Place in "Trash" container.
Concrete	TBD	Recycle when possible.	
Concrete Masonry Units	None	Keep separate for re-use by onsite construction or by site employees	Keep separated in designated areas onsite
Metals	TBD	Recycle off site when possible. Separate copper wire when possible.	Keep separated in designated areas onsite. Place in "Metals" container.
Gypsum wallboard (unpainted)	None	Recycle with supplier when possible.	Keep scraps separate for recycling. Stack on pallets onsite. All scrap wallboard will be taken back by contractor to wallboard supplier.
Paint	TBD	Reuse onsite; donate to Habitat for Humanity ReStore.	Keep separated in designated areas onsite
Insulation	TBD	Reuse, landfill.	
Flooring	TBD	Reuse, landfill.	
Carpet and pad	TBD	Reuse or recycle with carpet. Manufacturer	
Glass	Minimal	Glass Bottles: recycle locally.	Keep separated in designated areas onsite.
Plastic	Minimal	Plastic Bottles: recycle locally; be aware of plastics that are acceptable to recycle facility.	Keep separated in designated areas onsite.
Beverage containers	Minimal	Recycle locally	Keep separated in designated areas onsite.
Cardboard	TBD	Recycle locally	Keep separated in designated areas onsite.
Paper	Minimal	Recycle locally	Keep separated in designed sites.

## Appendix B: Deconstruction & Materials Management Reporting

In order to determine which opportunities to pursue, developing an inventory of which materials will be on the jobsite and how you propose to manage them will help direct the rest of the planning process. This document can be used both at the initial stages of project planning, as well as for tracking the actual activities and results of your waste minimization efforts.

Brief description of deconstructed materials or materials expected to be generated onsite	Tonnage/Volume	End Location (Name of Receiving Company and Location)	Description of End Use

## Appendix C: Hazardous Building Materials Found in Homes & Other Structures

When considering salvaging materials from remodeling or deconstructing a building, it is important to know which materials contain hazardous materials that cause environmental and health concerns. It is also important to know which items can be reused and how to dispose of the items that can't be. This document will provide basic information on these items and handling procedures for them.

Hazardous materials may involve federal, state, and local laws or regulations. Regulatory requirements vary, so it is important to contact state and local agencies to ensure compliance and environmental safety for workers and others that may be impacted by the project.

Note: Detailed information and guidance on environmental regulations, protective measures and removal procedures for asbestos and lead based paint, as well as other hazardous material and safety issues and recommendations, are beyond the scope of this document. Additional information on environmental hazards relating to salvaging and deconstruction is presented in numerous resources which can be found via an Internet search, including [A Guide to Deconstruction](http://www.deconstructioninstitute.com/files/learn_center/45762865_guidebook.pdf) ([http://www.deconstructioninstitute.com/files/learn\\_center/45762865\\_guidebook.pdf](http://www.deconstructioninstitute.com/files/learn_center/45762865_guidebook.pdf))

### *Asbestos and Lead*

Before remodelers renovate or deconstruct a structure built before 1978, environmental surveys for friable and non-friable asbestos, as well as lead, conducted by a certified environmental consultant are required by law. The U.S. EPA, OSHA, and HUD regulate asbestos containing materials and lead-based paint. Contractors who work on homes built before 1978 are required to be trained and certified in using lead-safe work practices.<sup>13</sup> Plan accordingly for the costs involved in abatement and the impact on the overall project schedule for surveying and abatement. Asbestos and lead removal contractors are responsible for following all health and safety regulations relating to the handling and disposal of asbestos and lead-based materials, if they are present in the structure.

The asbestos abatement contractor should ensure that proper notifications and permit applications to the state environmental protection agency are filed. Be sure to consult with the abatement contractor about the planned salvaging activities and whether the items to be salvaged may be damaged during the abatement process. All asbestos containing materials must be removed and the abatement must receive proper clearance certifying that the building is safe prior to beginning any deconstruction and salvage work.

An overview of materials and the associated issues with reuse follows:

- [Table 1: MATERIALS CONTAINING ASBESTOS OR LEAD](#)
- [Table 2: MATERIALS REQUIRING SPECIAL HANDLING INSTRUCTIONS](#)
- [Table 3: RECYCLABLE MATERIALS](#)
- [Table 4: TREATED WOOD](#)

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<sup>13</sup> [Renovation, Repair and Painting Rule](http://www.epa.gov/fedrgstr/EPA-TOX/2008/April/Day-22/t8141.htm) (<http://www.epa.gov/fedrgstr/EPA-TOX/2008/April/Day-22/t8141.htm>)

**Table 1: MATERIALS CONTAINING ASBESTOS OR LEAD**

<b>Material</b>	<b>Reuse</b>	<b>Environmental/Health Concerns</b>
Plaster & gypsum wallboard	Repair cracks or cover with textured paint. Install new wallboard over old.	Nuisance dust, lead paint, and asbestos in older wallboard
Wood (lumber, flooring, etc.)	Timbers, dimensional lumber, plywood, flooring, and molding.	Lead paint
Windows	Windows in good condition, preferably with good insulating value. High value, such as old multi-paned windows.	Lead paint, asbestos in older window glazing, and low insulation qualities of older windows
<b>Procedures:</b> Do not reuse if lead paint or asbestos is suspected. Contact local solid waste office about disposal.		
<b>Material</b>	<b>Reuse</b>	<b>Environmental/Health Concerns</b>
Cabinets	Can be re-faced	Lead paint, formaldehyde in particleboard or interior grade plywood
Plumbing	Sinks, tubs, faucets	Lead content in faucets, solder, and old galvanized pipe
<b>Procedures:</b> Do not reuse if lead paint is suspected. Contact local solid waste office about disposal options.		
<b>Material</b>	<b>Reuse</b>	<b>Environmental/Health Concerns</b>
Non-wood flooring (tile, carpeting)	Difficult, unless removed intact, clean carpet in good, dry condition	Asbestos contents in 9-inch tiles or sheet vinyl flooring.
Roofing materials	Retain sheathing if in good condition, terra cotta or slate tiles	Possible asbestos content
Siding		Possible asbestos content
<b>Procedures:</b> Do not reuse if asbestos is suspected. Contact local solid waste office about disposal options.		
<b>Material</b>	<b>Environmental/Health Concerns</b>	
HVAC systems and ductwork insulation, ceiling, wall and vermiculite insulation	Possible asbestos content	
<b>Procedures:</b> Do not reuse if asbestos is suspected or insulation is wet. Contact local solid waste office about disposal options.		
<b>Material</b>	<b>Reuse</b>	<b>Environmental/Health Concerns</b>
Electrical products	Only if in good working order or re-wired	Frayed wires and possible asbestos in the insulation
<b>Procedures:</b> Do not reuse if asbestos is suspected, or wires are frayed. Contact local solid waste office about disposal options.		
<b>Material/Item</b>	<b>Environmental/Health Concerns</b>	
“Popcorn” textured ceilings, ceiling tiles, wall plaster	Possible asbestos content	
<b>Procedures:</b> Do not reuse. Contact local solid waste office about disposal options.		
<b>Material</b>	<b>Environmental/Health Concerns</b>	
Miscellaneous materials including electrical insulators, light fixtures, other materials	Possible asbestos content	
<b>Procedures:</b> Do not reuse if asbestos is suspected or in disrepair. Contact local solid waste office about disposal options.		

**Table 2: MATERIALS REQUIRING SPECIAL HANDLING INSTRUCTIONS**

Material/Item		Environmental/Health Concern
Pre-1979 electrical devices (e.g., capacitors, fluorescent light fixture ballasts, motors, pumps), some plastics, molded rubber parts, coatings or sealants, caulking, adhesives, insulation; and felt or fabric products (e.g., gaskets)		May contain PCBs (polychlorinated biphenyls). PCBs were commonly used pre-1979. PCBs are oily liquids that are usually pale yellow to clear.
<b>Procedures:</b> Do not reuse. Securely store suspected devices/ items containing PCBs. Do not remove PCB liquid. PCB disposal is regulated. If handling & disposal requirements are not followed, all project parties may be held liable. Contact a hazardous waste disposal company. <sup>14</sup>		
Material/Item	Reuse	Environmental/Health Concern
Fluorescent lamps, tubes, bulbs	Reuse newer bulbs	Contain varying amounts of mercury.
<b>Procedures:</b> Do not break or crush. Securely store fluorescent lamps, tubes, & bulbs in a box or container to prevent breakage. Contact local solid waste office about disposal options.		
Material/Item		Environmental/Health Concern
Thermostats, switches, load meters, supply relays, and a range of other devices. Hospitals, clinics, labs, dental offices, and schools are likely to have mercury in sink traps and other equipment and devices.		Contain mercury.
<b>Procedures:</b> Replace mercury thermostats & other devices with newer, non-mercury containing models. Do not reuse. Do not remove mercury from a device. Remove the device intact & store securely in a covered container to prevent breakage. Label the container. Check with an HVAC supply center to see if it will accept thermostats for recycling or contact the <a href="http://www.thermostat-recycle.org/">Thermostat Recycling Corporation</a> ( <a href="http://www.thermostat-recycle.org/">http://www.thermostat-recycle.org/</a> ). If mercury containing devices other than thermostats are found, contact a hazardous waste disposal company or the local solid waste office.		
Material/Item		Environmental/Health Concern
Animal Droppings		Biological hazards, including bird & rat droppings
<b>Procedures:</b> Do not vacuum. Wipe with wet cloth, dispose in sealed bag. Use protective clothing, eyewear, & air mask/filter.		

**Table 3: RECYCLABLE MATERIALS**

Material	Reuse	Environmental/Health Concern
Paints, oils, corrosive or flammable liquids		Hazardous if improperly handled or disposed
Propane tanks	Check canisters to ensure intact & safe for reuse.	Contain propane under pressure.
Refrigerators, freezers, air conditioners, other items with refrigerants	Do not reuse older models-lower energy ratings.	Contain refrigerants
Smoke detectors, emergency lighting, elevator control panels, exit signs, security systems and alarms		Contain batteries. Emergency lighting may also contain radioactive materials.
<b>Procedures:</b> Properly recycle by consulting with local solid waste agency for disposal options.		

**Table 4: TREATED WOOD**

Material	Reuse	Environmental/Health Concern
Landscape materials	Timbers, stone, & concrete	Toxic chemicals in pressure-treated wood
<b>Procedures:</b> Use wood only if in good condition. Do not mulch treated wood.		

<sup>14</sup> PCB regulations (<http://www.epa.gov/epawaste/hazard/tsd/pcbs/index.htm>) are on the EPA website. Also consult the [EPA Guide](http://www.epa.gov/compliance/resources/publications/assistance/sectors/constructmyer/myer1c_pcb.pdf) ([http://www.epa.gov/compliance/resources/publications/assistance/sectors/constructmyer/myer1c\\_pcb.pdf](http://www.epa.gov/compliance/resources/publications/assistance/sectors/constructmyer/myer1c_pcb.pdf)) to handling and proper disposal of PCBs. Fluorescent bulbs are universal wastes and must either be recycled or handled as hazardous waste.

## Appendix D: Definitions

**Construction and Demolition (C&D) Debris:** Is waste that is generated during the construction, remodeling, repair, or demolition of buildings, bridges, pavements, and other structures. C&D debris includes concrete, asphalt, lumber, steel girders, steel rods, wiring, dry wall, carpets, window glass, metal and plastic piping, tree stumps, soil, and other miscellaneous items related to the activities listed above. This category also includes natural disaster debris. (U.S. EPA, 1989, 1994d)

**OSB:** Oriented Strand Board. A type of plywood.

**Reuse:** refers to the use of a product or component in its original form more than once. Examples include refilling glass or plastic bottles, repairing wood pallets, using corrugated or plastic containers for storage, and returning milk crates. (U.S. EPA, 1994d)

**Recycling:** refers to the series of activities by which discarded materials are collected, sorted, processed, and converted into raw materials and used in the production of new products. Excludes the use of these materials as a fuel substitute or for energy production. (National Recycling Coalition, 1995)

### End Uses that Are *Not* Considered Reuse or Recycling by Most States

- Materials disposed of in landfills.
- Materials sent out-of-state for disposal.
- Materials sent to waste-to-energy facilities.
- Materials used for alternative daily cover at landfills.
- Clean chipped wood or other materials used for biofuel.

**Materials Exchange** is a free service—often online—that links organizations that have reusable goods that they no longer need to those who can use them



## **Appendix E: Recycling Evaluation Tools**

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#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for the evaluation of recycling operations.

#### 1.3 CONSTRUCTION OR DEMOLITION WASTE MANAGEMENT PLAN FORM

A. The purpose of the Construction Waste Management Plan Form is to identify construction waste reduction goals, identify targeted materials, and explain specific waste reduction actions to be taken, by whom, and when.

#### 1.4 SITE MONITORING FORM

The most effective construction waste management programs include methods for providing feedback on how successful the program has worked. Tracking project costs may indicate whether money is being saved, but may not indicate why money is being saved. Furthermore, it cannot indicate whether the savings are the maximum possible. Waste audits, on the other hand, reveal opportunities for increased savings, such as significant amounts of recyclables ending up in waste bins, or non-recyclables ending up in bins designated for recyclables. Waste audits provide feedback throughout the duration of the Project.

- A. Allows the Contractor to quantify the amount of recyclables being discarded and to identify missed opportunities.
- B. Guides the Contractor through the removal and sorting process of materials.
- C. Provides a listing of potential categories of materials for sorting the waste dumpster.
- D. A photographic record taken during a waste audit of recyclables found in the waste dumpster can be very effective.
- E. Requires the Contractor to identify major subcontractors on site contributing to the waste stream.
- F. Takes approximately 15 minutes to fill out.
- G. Should be used weekly, or at a minimum, during major shifts in construction activities.
- H. Identifies specific items that may be hindering the recycling program and can be addressed for immediate results.
- I. Creates a record over time to show improvements in sorting or identifies phases of the Project that need extra attention.

#### 1.5 MONITORING RESULTS

Waste audit results indicate whether a change in the Construction Waste Management Plan is necessary. An audit may indicate that more of a particular material waste is being generated than originally anticipated. If so, the material should be targeted for the remainder of the Project. The waste audit serves as a reminder to seek new recycling options that have become available since the commencement of the Project.

Construction or Demolition Waste Management Plan Form

## Construction or Demolition Waste Management Plan Form

Project Name:

Contractor:

Construction Waste Management Plan Manager (Contractor's Representative):

Project Location:

Estimated Construction Dates:

PROJECT SCOPE - indicate type of structure (e.g., steel, concrete, etc.), building size, project cost, space constraints, etc.

RECYCLING GOAL - To recycle \_\_\_ % of waste generated on the site by weight. (Minimum goal 50%)

Goals and Intent:

**Reduce:** The Project shall generate the least amount of waste and methods shall be used that minimize waste due to error, poor planning, breakage, mishandling, contamination, or similar factors. Promote the resourceful use of materials to the greatest extent possible.

**Reuse:** The Contractor and Subcontractors shall reuse materials to the greatest extent possible. Reuse includes the following:

- A. Salvage reusable materials for resale, for reuse on this Project, or for storage for use on future projects.
- B. Return reusable items (e.g., pallets or unused products) to the material suppliers.

**Recycle:** As many of the waste materials not able to be eliminated in the first place or salvaged for reuse shall be recycled. Waste disposal in landfills shall be minimized to greatest extent possible.

### ANALYSIS OF ESTIMATED CONSTRUCTION WASTE TO BE GENERATED

#### 1. Projected waste materials

- Asphalt
- Brick
- Cans and bottles
- Cardboard
- Carpet
- Carpet pad
- Ceiling tile scrap
- Concrete
- Glass
- Gypsum board
- Insulation scrap
- Land clearing wood
- Metal – wire, pipe cutoffs, etc.
- Pallets
- Paper
- Plastics including stretch wrap, plastic bags and Styrofoam
- Untreated wood, plywood, OSB, particleboard
- Structural steel
- Vinyl
- Other (specify) \_\_\_\_\_

2. Produce a preliminary list of materials that may be targeted for reuse or recycling (based on size and type of construction and other relevant information). Complete the list based on the availability of recycling and waste reduction services and on feedback from key Subcontractors who will be working on the Project. Focus recycling efforts on high potential materials and practices. Select materials that are generated in greatest volume, that have the most market value, that can be easily separated and that are recycled locally.
  
3. Estimated quantities of waste materials, by type (use Project estimates or commercial construction weight estimates below, compiled by WasteCap Wisconsin based on WI State Averages and commercial construction projects. Actual percentages will vary based on the project and type of construction.)

Material	Estimated % (by weight)	Estimated Tons
Total Estimated		
Trash (25%)		
Cans & Bottles (2%)		
Cardboard (5%)		
Concrete/masonry (21%)		
Drywall (11%)		
Metal (11%)		
Wood (25%)		
Reuse (0%)		
Other		
Total (100%)		

**TYPE OF RECYCLING SERVICE PROVIDERS AND TARGETED MATERIALS**

(Refer to Construction Waste Management Appendix)

Evaluate Cost and Services Offered     Service Provider Agreements in Place

Company #1

Company #2

Company #3

Company #	Material	How and where waste is disposed or diverted
	Trash	
	Cans & Bottles	
	Cardboard	
	Concrete/Masonry	
	Scrap Metal	
	Wood	
	Other	
	Other	
	Other	

**MATERIALS-HANDLING PROCEDURES**

Contractors and Subcontractors will separate and handle materials as stated below.

*Example: Cardboard: Separate and flatten clean cardboard and boxboard and place in designated containers on the Project site. Do not include waxed cardboard, tissue, paper plates or towels, pizza boxes or any item that is not paper. Separate plastic, Styrofoam and other items which may be stuck to the cardboard boxes. Staples may be left in cardboard. Cardboard that is over 50% covered in mud, paint or other contaminants should be disposed of as trash. The cardboard will be sorted, sold and made into new paper products.*

**RECYCLING OPERATIONS**

Action ***	Who
Order dumpsters - oversee delivery _____	
Site dumpsters/collection sites for optimum convenience _____	
Educate Project site personnel on recycling requirements _____	
Order signs for dumpsters and other recycling bins _____	
Sort or process recyclables on site _____	
Take trash and recyclables to the dumpsters _____	
Schedule dumpster pickups/drop offs _____	
Monitor dumpsters for contamination _____	
Document recycling results _____	

\*\*\* Depending on the service option chosen, these may be the responsibility of the field personnel, construction waste manager, the hauler, a recycling contractor, or the Subcontractors.

**EDUCATIONAL AND MOTIVATIONAL PLAN – Check all items intended to be used**

Actions

- Complete Construction Waste Management Plan
- Hold Orientation/Kick Off Meeting
- Update & Progress in Weekly Project-Site Meetings
- Encourage Just-in-time deliveries
- Post Targeted Materials (signage)
- Distribute tip sheets to Project-site personnel
- Post goals/progress (signage)
- Use formal agreements committing subs to program
- Require those who contaminate dumpsters to re-sort
- Provide stickers, t-shirts, hats or other incentives
- Public recognition of participating subs
- Take photos to document progress and share
- At site visits, discuss waste management with Project-site personnel
- Conduct periodic presentations for Project-site personnel on waste issues
- \_\_\_\_\_

**WASTE AUDITING PROCEDURES – Describe how the recycling program will be monitored so that recycling and trash containers are kept free of contamination. Include frequency of monitoring**

**DOCUMENTATION PROCEDURES**

Who

- Perform monthly cost and materials tracking (required) \_\_\_\_\_
- Perform final evaluation (required) \_\_\_\_\_

Site Waste and Recyclables Monitoring Form

Project Name: \_\_\_\_\_

Date/Time: \_\_\_\_\_

Monitor Name: \_\_\_\_\_

1. Are all containers (trash and recycling) together in one area?       Yes     No
2. Do all containers have clear signs for the materials that belong in them?     Yes     No
3. Are the signs clearly visible to workers who approach them?       Yes     No
4. Is there easy access to all containers? (Is there anything in the way?)     Yes     No  
(If "No," describe measures to be taken to eliminate the obstructions)
5. Is the dumpster area dry and firm?     Yes     No
6. Is the dumpster area (check one):
  - Neat and tidy
  - Somewhat messy
  - Dirty (needs to be cleaned)

Comments: \_\_\_\_\_

7. Check individual dumpsters

**TRASH**

Contamination (Check all applicable items)

- |  |                                    |
|--|------------------------------------|
| <input type="checkbox"/> Auto batteries  | <input type="checkbox"/> Paper     |
| <input type="checkbox"/> Cans or bottles | <input type="checkbox"/> Tires     |
| <input type="checkbox"/> Cardboard       | <input type="checkbox"/> Waste Oil |
| <input type="checkbox"/> Concrete        | <input type="checkbox"/> Wood      |
| <input type="checkbox"/> Metal           |                                    |
| <input type="checkbox"/> Other _____     |                                    |

Comments: \_\_\_\_\_

**CARDBOARD**

Contamination (Check all applicable items)

- |  |  |
|--|--|
| <input type="checkbox"/> Muddy or painted cardboard                          | <input type="checkbox"/> Boxes with trash or sweepings in them |
| <input type="checkbox"/> Oily cardboard                                      | <input type="checkbox"/> Beverage containers                   |
| <input type="checkbox"/> Pizza boxes or other food containers                | <input type="checkbox"/> Metal                                 |
| <input type="checkbox"/> Waxed cardboard                                     | <input type="checkbox"/> Plastic                               |
| <input type="checkbox"/> Mortar and cement bags                              | <input type="checkbox"/> Wood                                  |
| <input type="checkbox"/> Boxes with plastic, wood, or other packing material | <input type="checkbox"/> Trash                                 |
| <input type="checkbox"/> Other _____   |  |

Does this container require cleaning?  Yes     No

(Note: Small amounts – up to 5% -- of these materials are acceptable)

Comments: \_\_\_\_\_

**CONCRETE**

Contamination (Check all applicable items)

- Dirt
- Organic materials (brush, grass, etc.)
- Wire mesh
- Other \_\_\_\_\_

Does this container require cleaning?  Yes     No

Comments: \_\_\_\_\_

**METAL**

Contamination (Check all applicable items)

- |  |   |
|--|---|
| <input type="checkbox"/> Loose welding rods            | <input type="checkbox"/> Aerosol cans                         |
| <input type="checkbox"/> Aluminum cans                 | <input type="checkbox"/> Batteries (any kind)                 |
| <input type="checkbox"/> Electrical ballast            | <input type="checkbox"/> Freon bottles (or other gas bottles) |
| <input type="checkbox"/> Electrical capacitors         | <input type="checkbox"/> Lead                                 |
| <input type="checkbox"/> Insulated electric wire       | <input type="checkbox"/> Barrels and drums                    |
| <input type="checkbox"/> Metal painted with lead paint | <input type="checkbox"/> Oil cans and filters                 |
| <input type="checkbox"/> Glass                         | <input type="checkbox"/> Paint cans                           |
| <input type="checkbox"/> Light bulbs                   | <input type="checkbox"/> Closed containers of any kind        |
| <input type="checkbox"/> Other _____                   |   |

Does this container require cleaning?  Yes     No

Comments: \_\_\_\_\_

**GYPSUM BOARD**

Contamination (Check all applicable items)

- |  |   |
|--|---|
| <input type="checkbox"/> Painted gypsum board                          | <input type="checkbox"/> Reinforced-type gypsum boards          |
| <input type="checkbox"/> Cement board                                  | <input type="checkbox"/> Other specialty gypsum board(s)        |
| <input type="checkbox"/> Moisture-resistant gypsum board (green board) | <input type="checkbox"/> Corner bead (or other metal strips)    |
| <input type="checkbox"/> Does this container require cleaning?         | <input type="checkbox"/> Nails, screws or other metal fasteners |
| <input type="checkbox"/> Yes <input type="checkbox"/> No               |   |

Comments: \_\_\_\_\_

**WOOD**

Contamination: (Check all applicable items)

Very small amounts (about 2% or less) of the following materials are acceptable in the wood containers. Document their presence in writing.

- Cardboard
- Paper or paper cups
- Other \_\_\_\_\_

The following items, if present in the wood container, require immediate removal. Notify the Lead Contractor's representative.

- |  |   |
|--|---|
| <input type="checkbox"/> Treated lumber              | <input type="checkbox"/> Pallets or wooden spools with bolts and fasteners 1/4-inch or larger |
| <input type="checkbox"/> Painted or varnished lumber | <input type="checkbox"/> Truss plates   |
| <input type="checkbox"/> Metal strapping             | <input type="checkbox"/> Any metal other than nails and staples                               |
| <input type="checkbox"/> Reinforcing rod             | <input type="checkbox"/> Glass bottles  |

Try to determine where the contaminants came from and how they got in the dumpster. Possible source of contamination:

\_\_\_\_\_

Does this container require cleaning?  Yes  No

Comments: \_\_\_\_\_

**OTHER**

Material being recycled: \_\_\_\_\_

Contamination (List contaminants) \_\_\_\_\_

Does this container require cleaning?  Yes  No

Comments: \_\_\_\_\_

Mark the areas that need attention to help meet the Project's recycling goals:

- Lack of space to place containers
- Subcontractors not knowledgeable of recycling requirements
- Subcontractors not cooperative
- Recycling bins are not provided
- Recycling markets are not available
- Dumpsters are not in fenced area
- Other \_\_\_\_\_

## Final Construction Waste Management Plan Form

Project Name: \_\_\_\_\_  
 Plan Manager: \_\_\_\_\_  
 Representing: \_\_\_\_\_  
 Location: \_\_\_\_\_  
 Date: \_\_\_\_\_

### Construction Waste Reduction Goals

To evaluate the quantitative success of your program summarize the data on your monthly tracking form, measured against goals set in your Construction Waste Management Plan.

Percent Reduction Goal: \_\_\_\_\_ Actual Percent Reduction: \_\_\_\_\_

Cost Savings Goal: \_\_\_\_\_ Actual Cost Savings: \_\_\_\_\_

### Construction Waste Management Program Strengths and Weaknesses

Please evaluate the strengths and weaknesses of each aspect of the Construction Waste Management Plan in the charts below. Space is also provided to list any original ideas implemented and/or suggest improvements to the existing aspects and tools.

#### Methods to Reduce, Reuse and Recycle

Strengths	Weaknesses	Suggested/implemented Improvements

#### Communication and Motivation Tools

Strengths	Weaknesses	Suggested/implemented Improvements

#### Evaluation Tools

Strengths	Weaknesses	Suggested/implemented Improvements



### Trash/Recyclables/Reuse Materials Hauling Log

Project Name: \_\_\_\_\_

Date	Material (Trash, Wood, Concrete, etc.)	Hauled By	Ticket No.	Dumpster Size/ Weight/Volume

**Recycling Coordinator:** Complete for all materials that leave the Project site.

**Project Manager:** Verify hauling invoices with information on this log.

Log Faxed To Construction Waste Manager

Log Faxed To Project Manager

Date: \_\_\_\_\_