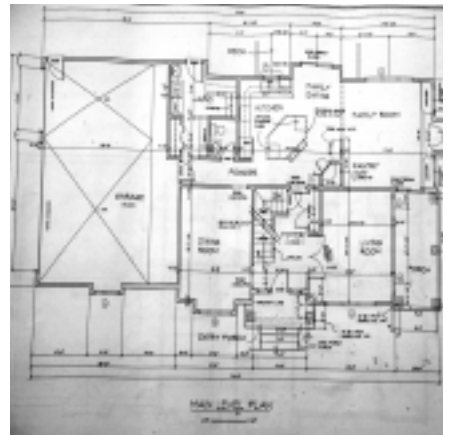


# Residential Construction Waste Management

## A Builder's Field Guide

How to Save Money and Landfill Space

REDUCE



REUSE



RECYCLE



## ACKNOWLEDGMENTS

This field guide is the culmination of the work of dozens of individuals from several different industries, including home builders, waste haulers, building product manufacturers, and government officials. Although it is not possible to acknowledge all of these people here, many are recognized throughout this field guide.

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<b>How to Use This Guide</b>	

This field guide provides builders with information on cost-effective and voluntary construction waste management. The **First Steps** section helps you determine the approach(es) appropriate for your business. The **Options** section discusses the conditions affecting the success of the various options and presents results from builders currently using the techniques. The **Marketing** section explains how to take credit for your efforts and the **Appendices** provide supporting information.

It is important to note that this field guide is *national* in perspective, and consequently may not provide critical information unique to your community. The field guide presents a wide variety of waste management solutions from throughout the United States and discusses the key conditions which must be considered at the *local* level.

If you or your local home builder association would like to use the field guide to develop innovative construction waste management in your community, call the Research Center for information on sponsoring a local construction waste management seminar. And, if you are using techniques not covered in this guide, please call the Research Center so that the idea can be shared with other interested builders.

Although the emphasis of the field guide is on *new residential* construction, most of the information can be applied to *remodeling* and *commercial* construction waste as well. A remodeler's field guide to waste management will be available in 1998.

## DEVELOPING A WASTE MANAGEMENT PLAN

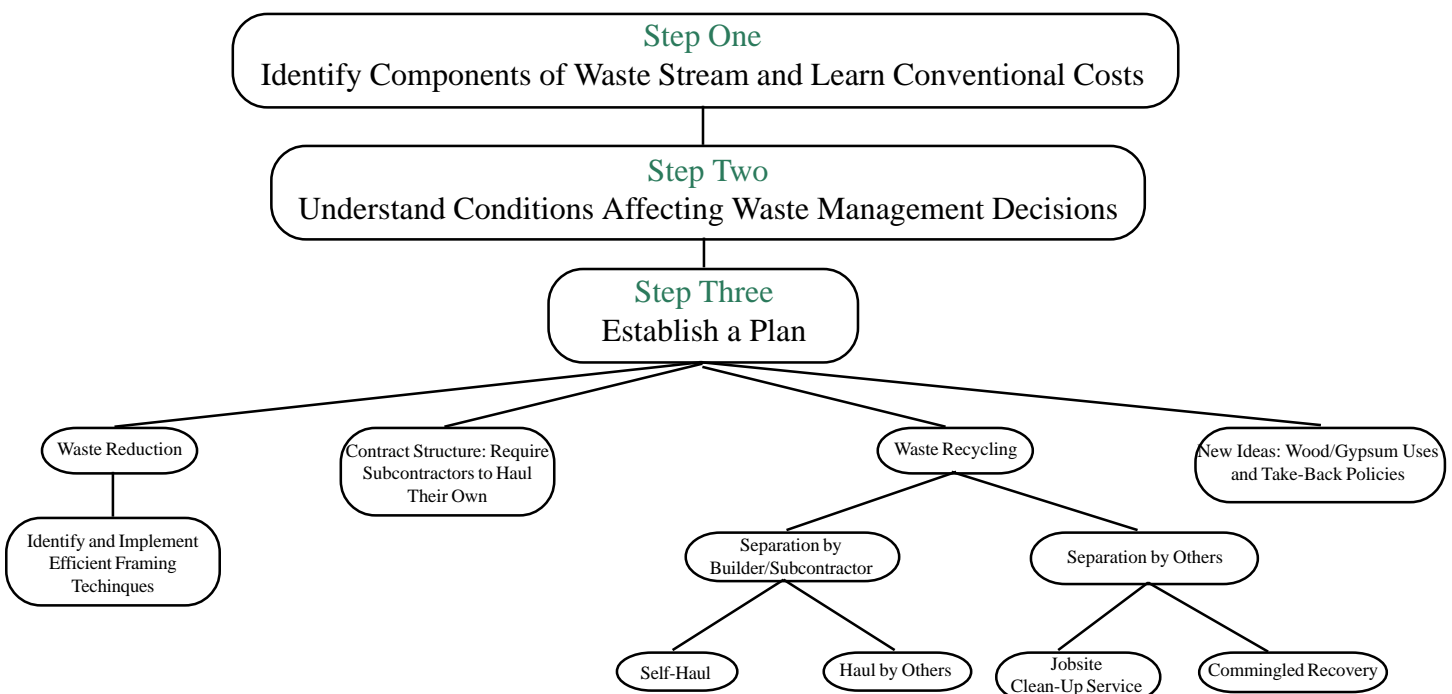
The flow chart below gives the big picture on construction waste management; the table on the facing page presents all the options covered in this guide. These two pages will help you find your way through the field guide. Not every technique works for all builders. In fact, some techniques require bigger changes at the office or jobsite than others.

You can develop a waste management plan by following the three simple steps outlined below:

**1Know what you throw and how much it costs.** A general sense of the types and quantities of waste materials generated on your jobsites and the dollars spent to dispose of these materials provides a good starting point. See pages 5 and 6 of this guide.

**2Understand the conditions** affecting waste management decisions such as local tipping fees, the availability of recycling outlets, and how waste haulers structure their fee schedule. Keep in mind that a waste management plan can be site-specific - a plan that works at one jobsite may not work as well at another. Pages 11 and 12 will help determine where and when jobsite recycling can be cost-effective for you.

**3Establish a plan.** Note that different options require you to work with different people. For example, the waste reduction options - efficient framing and contract structure - involve subcontractors and probably your architect or estimator. Jobsite recycling, on the other hand, can involve your subcontractors and waste hauler.





FIRST STEPS

A Tip on Waste Generation Rates

Use the following ballpark figures to get a sense of how much construction waste may be generated on your jobs:

Material	Lbs./Sq.Ft
Wood	1.3-2.1 <sup>1</sup>
Drywall	1.0-1.2
Cardboard	0.1-0.5 <sup>2</sup>
Metals	0.02-0.13
Other Waste (plastics, shingles, etc.)	0.5-1.3
<b>Total</b>	<b>3.0-5.2</b>

<sup>1</sup> Range for wood waste depends on material used for wall sheathing, siding, trim, and roofing.

<sup>2</sup> Range for cardboard depends on type of siding and whether windows, doors, and

CONSTRUCTION WASTE: TYPES AND QUANTITIES

Key Points

Here are some important generalizations about residential construction waste.

- By weight or volume, wood, drywall, and cardboard make up between 60 and 80 percent of jobsite waste.
- Vinyl and metals are generated in small quantities but have good recycling value.
- Cardboard waste is increasing on most jobsites as more components - windows, appliances, cabinets, siding - are shipped to builders over long distances.
- Most wood waste is “clean” - unpainted, untreated, and recyclable. The term “clean” usually includes dimensional lumber, plywood, OSB, and particle board without laminates.
- Brick, block, and asphalt shingle waste are insignificant in volume but can be important in terms of weight.
- For most builders, the largest share of waste that could be considered hazardous is generated from painting, sealing, staining, and caulking.
- Drive-by contamination (waste placed in a container by a party other than the builder/subcontractor) can be as much as 30 percent of the total volume hauled from a site.

CONSTRUCTION WASTE BY VOLUME

(Chart not available)

CONSTRUCTION WASTE BY WEIGHT

(Chart not available)

## SOME BASICS ABOUT DISPOSAL COSTS

There are three costs that make up waste management: handling, transporting, and tipping.

- **Handling** - It takes about 2.4 hours per ton to gather and carry construction waste to a dumpster. However, this number can vary widely based on the type of material and the distance from the jobsite to the dumpster. **Note:** The cost of handling construction waste is rarely considered in a builder's total waste management costs.
- **Transporting** - Trucking costs include ownership, operation, and the driver's labor. For more information on transportation costs, see the self-hauling section on page 16.
- **Tipping** - Tipping is the fee charged by the facility that receives the material. Landfills and recycling outlets can charge by volume (cubic yard) or by weight (ton). Use the "tip on conversions" to work from one type of measurement to the other (see side bar).

**Fee Structures** - Haulers cover the costs of trucking and tipping by charging builders based on time - a daily or monthly container rental fee; weight - a per ton charge; volume - a cubic yard or "pull" charge; or a combination of the three. Clean-up services may charge by the square foot of the house.

**Future Costs** - Your disposal costs are largely dependent on local landfill capacities and state/federal solid waste regulations. Therefore, information on trends in your disposal costs is important. For example, a July 1996 federal rule (see Appendix B) covering the operation of landfills receiving construction and demolition waste will increase landfilling costs in some states as the rule takes effect. Developing new approaches to waste management may pay back in the long run even if current conditions do not warrant them.

### A Tip on National Averages

In a 1995 NAHB survey, builders reported paying on average just over \$500 per home for waste removal and disposal.

There are big differences in disposal costs across the country, with some builders paying less than \$250 per home and others paying more than \$1,000.

Almost three out of four builders use a roll-off, but a significant number of builders, particularly in the West, work with haulers that do not use on-site containers. In addition, builders may handle their own waste removal and disposal.

### A Tip on Volume-Weight Conversions

Material	Conversion Rate
Wood	300 lbs./cu. yd. 6.7 cu. yd./ton
Cardboard yd. (loose)	30-100 lbs./cu. 20-50 cu. yd./ton
Drywall ton	400 lbs./cu. yd. 5 cu.yd./
Mixed	350 lbs./cu. yd.

# Options

## PROFILE: Material Savings

Estimating software was used to quantify the material savings of selected value-engineering techniques.

**Software:** Argos Systems  
Bedford, MA  
**Builder:** DeLuca Enterprises  
Newtown, PA  
**House type:** 2,300 square feet,  
single-family detached

Techniques	Savings <sup>1</sup>
- In-line framing spaced at 24" o.c.	\$960
- Increased spacing of floor joists from 16" to 24"	\$747 <sup>2</sup>
- Reduced header sizes	\$162
- Relocating four windows and doors	\$45
- Ladder framing at intersecting walls	\$45
- Two stud and backer corner framing	\$30

<sup>1</sup> Savings based on lumber prices from mid-Atlantic region in March 1996.

<sup>2</sup> Because the builder typically uses 3/4" floor sheathing, the increased joist spacing did not require thicker floor sheathing.

## Reducing Framing Waste

For most home builders, framing lumber is one of the largest material purchases and the largest component of the waste stream. Designing and framing a house efficiently can not only reduce the required amount of material but can also decrease disposal costs by keeping excess cutoffs to a minimum.

Efforts to reduce waste must be addressed during several phases, including design, engineering, estimating, and framing. Be prepared to implement changes with your architect, your estimator, and your framing crew(s). The techniques listed below offer the potential for significant savings.

- **Increased Spacing of Joists and Studs** - This technique can reduce the amount of framing material required by 30 percent.
- **In-Line Framing** - Aligning framing members such as trusses, studs, and joists to bear directly over each other is the most efficient way to transfer loads from the roof to the foundation. Using this technique, regardless of the spacing of the framing members, allows the use of a single top plate.
- **House Configuration and Roof Design** - A house plan with overall dimensions on a two-foot module permits the optimum use of floor and wall materials. Modest changes to either the pitch of the roof or the width of the overhang can reduce the amount of material required or the amount of waste generated. Appendix A lists the optimum range of eave widths for efficient roof design.

(Graphic not available)

## Modular Roof Design



- **Slab-on-Grade Foundations** - Under suitable site conditions, concrete slab-on-grade construction can provide a cost-effective foundation-floor combination.
- **Excessive Waste Factors and Take-Off Tools** - In many cases, the combination of waste factors and take-off tools results in estimates with excessive overages. As a builder, you know that all material delivered to the site is used up regardless of the waste factor assumed in the order.
- **Construction Drawings** - A detailed set of working drawings provides the basis for accurate material estimates. In addition to standard floorplans and elevations, more accurate material estimates can be generated with detailed framing plans (including joist layout and stud plans), floor and roof sheathing plans, and miscellaneous framing details.
- **Separation of Reusable Lumber** - Cutoff 2x wood waste can be used for bridging, stakes, bracing, shims, drywall nailers, and blocking where interior walls run parallel to joists or trusses. Similarly, cutoff sheathing waste can be used for drywall stops and furring.
- **Header Sizes** - It is simple to value-engineer the headers over openings by following the header tables included in most codes. Headers in non-loadbearing walls can be eliminated entirely.



## PROFILE: Material Savings

Estimating software was used to quantify the material savings of selected efficient framing techniques.

**Software:** SoftPlan Systems  
Brentwood, TN  
**Builder:** Caruso Homes  
Crofton, MD  
**House type:** 2,300 square feet;  
single-family detached

Techniques	Savings <sup>1</sup>
- Accurate take-off tools	\$595
- Increased spacing of floor joists from 12" to 19.2"	\$412 <sup>2</sup>
- Modular roof design	\$194
- House configuration (modular overall dimensions)	\$124
- Reduced header sizes	\$39

<sup>1</sup> Savings based on lumber prices from mid-Atlantic region in March 1996

<sup>2</sup> Because the builder typically uses 3/4" floor sheathing, the increased joist spacing

## A Tip on Wood Waste

Many builders use the stud-per-foot rule of thumb for estimating studs. A 1996 waste audit of a Maryland builder who used this approach revealed that about 15 percent (by weight) of the 2x4s and structural sheathing ended up in the dumpster.

# OPTIONS

- **Relocating Doors, Windows and Stairs** - Moving the horizontal position of such openings as doors, windows, and stairwells to coincide with modular studs reduces the number of framing members required to frame a wall or floor. Although moving some openings is often limited by a desired aesthetic, furniture layout, or mechanical requirements, others can be shifted slightly without adversely affecting the home's form or function.
- **Corner Details** - The stud/block/stud detail is commonly used for framing many corners. The two-stud/1x backer detail and ladder framing detail shown below reduce the number of studs required to frame outside corners and intersecting walls.

(Graphic not available)



**Corner Detail**

## PROFILE: Material Savings and Waste Reduction

**Builder:** American Value Homes  
**Construction Manager:** Keystone Builders Resource Group  
**Location:** Richmond, VA  
**House Type:** 2,100 square feet, single-family detached

### Approach:

- detailed construction documents
- in-line framing on first and second floors with modified top plate
- increased spacing for non-loadbearing wall studs (int. & ext.)
- reused scrap 2x lumber
- slab-on-grade (This technique represents a significant portion of the savings listed below. Framing a first-level floor would have raised the framing material cost approximately \$0.75/sf).
- roof design
- header sizes
- ladder connection detail
- house configuration

### Savings:

	<u>American Value Homes</u>	<u>Conventional</u> <sup>1</sup>
<b>Framing material cost</b>	<b>\$2.00/sf</b>	<b>\$3.75/sf</b>
<b>Wood waste generation rate</b>	<b>0.5 lbs/sf</b>	<b>1.5 lbs/sf</b>

<sup>1</sup> Average of conventionally framed houses audited by the NAHB Research Center.

## CONTRACT STRUCTURE

While the general contractor frequently provides a dumpster on site for use by all subcontractors, another approach is to require subcontractors to remove their own waste. Even though such an approach does not guarantee the recovery of material, it can offer several benefits.

- It can be more **cost-effective** than conventional disposal. Admittedly, some subcontractors will likely increase their contract price to include disposal. Nonetheless, the elimination of containers from the jobsite eliminates the additional costs general contractors typically absorb as a result of drive-by contamination.
- The approach promotes the **efficient use** of building materials by establishing a direct link between installer and disposer.
- It creates the opportunity for **easier recycling** by subcontractors because it prevents the commingling of waste.
- The jobsite's **appearance** improves.

### Disposal of Potentially Hazardous Waste

Establishing subcontractor responsibility for waste material disposal does not necessarily relieve a general contractor of all waste disposal liabilities. The liability issue is particularly important for subcontractors generating potentially hazardous waste. For more information on waste disposal statutes, including an example of contract language and a list of potentially hazardous materials, see Appendix B.

#### PROFILE: Contract Structure

**Builder:** Bosgraaf Builders  
**Location:** Holland, -MI  
**House Types:** Approximately 55 single-family, detached homes and duplex condominium starts per year.

#### Approach:

Requires subcontractors to haul their own waste -- no dumpsters used on site. Containers for cardboard and general waste provided behind the general contractor's office parking lot. Wood scrap hauled to office parking lot and offered to general public as "free wood." (Bosgraaf has also advertised the wood scrap in a local paper and delivered to area residents.)

#### Savings:

Disposal costs totaled approximately \$80 per start; the regional average during a 1995-1996 pilot program was over \$400 per start.

#### A Tip on Liability

Builders can handle the lion's share of their liability exposure by requiring their painting subcontractor to show proof of proper disposal or to switch to more benign paints, stains, caulks, and solvents.

"All subs are responsible for their own construction waste removal from the site. It is very important for all the subs to share the vision."

*Amy Alderink  
Bosgraaf Builders*





## WASTE RECYCLING: MARKETS AND METHODS

### A Tip on Material Prices

Be aware that the prices for recyclable construction materials are highly variable by region and can fluctuate significantly from month to month.

### Prices for Recyclable Construction Materials<sup>1</sup>

Wood            You pay \$20/ton  
Drywall        You pay \$13/ton

Cardboard     Payback of \$5/ton  
Ferrous Metals Payback of \$40/ton  
Vinyl           Payback of \$100/ton  
Aluminum     Payback of \$600/ton

### Conventional Disposal Price

C&D landfill   You pay \$30/ton

<sup>1</sup> All materials are clean, loose, and unprocessed. Price estimates for mid-Atlantic region, June 1996.

Many construction waste materials can be recycled: wood, drywall, cardboard, metals, and plastics - particularly vinyl. Cost-effective recycling is driven by one or both of the following: high market value and high landfill tipping fees. The savings associated with recycling is affected by the following:

- **Scrap wood** and **drywall** have low market value. You will generally not find outlets willing to pay for these materials, but you may find outlets that charge less per ton or cubic yard than landfills. The best markets for scrap wood tend to be as a fuel for power generation and as an ingredient for mulching and compost. Recycling drywall into new wallboard is something many gypsum manufacturers are working on over the long term. See page 18 for a discussion of agricultural applications.
- **Cardboard's** market value is better than that for wood and drywall but highly variable. Cardboard recycling is widespread - outlets are usually easy to find. This is a good material to keep out of your dumpster, particularly if you pay by volume.
- **Metals** and **vinyl** have good market value but the small amounts generated per job make cost-effective recycling more difficult. Some type of stockpiling or backhauling to a supplier by the subcontractors generating the metal or plastic waste can work. See page 18 for a discussion of take-back policies.

Although highly variable with material type, the overall disposal savings from recycling is determined in large part by local tipping fees.

If the tipping fee at your local landfill is..	Approximate disposal savings by recycling
0-\$30/ton	-5 to +5%
\$30-\$75/ton	5 to 25%
Over \$75/ton	Over 25%







## Approaches to Waste Recycling

There are four basic approaches to waste recycling presented below, with increasing levels of builder involvement. For an overview of the four options, see the table on page 4.

### Material Separation by Party Other Than Builder

**Jobsite Clean-up Service** - The builder moves all waste to the front of the house or the curb. The waste management firm establishes the service schedule and container type (if any) and separates, transports, and tips the material. Fee structures are often based on the size of the house.

**Jobsite Commingled Recovery** - Commingled processing facilities accept mixed waste and retrieve recoverable materials mechanically and/or manually. The builder puts all waste in a conventional container and schedules service; the waste management firm transports and tips the material. Fee structures are normally the same as for conventional disposal.

### Material Separation by Builder

**Jobsite Separation** - The builder is responsible for separating the material and scheduling container service; the waste management firm transports and tips the material. Although the fee structures are often the same as for disposal, savings can be achieved through the higher value of separated materials.

**Self-Haul** - The builder handles all phases of waste management: separation, containers, transport, tipping. Disposal/recycling costs are determined by vehicle cost, tipping fees, and required labor.



### Tips on Recycling

Look for a member of your staff/crew who may have an interest in recycling. Most recycling plans succeed if someone in the company takes responsibility for the program.

Work through your HBA - a jobsite recycling committee can provide the forum for information/options that you might otherwise miss.

You may feel that any savings from lower recycling tipping fees will not cover the extra time required for separation. Keep in mind that any extra time spent on recycling normally decreases as your crews and subcontractors get used to a new system of waste management.

Contamination is the key to successful recycling. Be sure that your idea of a “clean” load is the same as your recyclers’.



## WASTE RECYCLING: JOBSITE CLEAN-UP SERVICES



Jobsite clean-up services typically take advantage of the fact that most residential construction waste materials - wood, drywall, cardboard (to some extent), and siding materials - are generated during discrete stages of construction. If jobsite service by the hauler is coordinated with the construction schedule, waste materials are separated over time.

Clean-up services eliminate the standard 30-yard roll-off service and instead provide jobsites with smaller containers or none at all. The builder's only responsibility is to get the unsorted waste material to the designated spot (for example the front of the house or the curb). The hauler is responsible for establishing the service schedule, locating the recycling outlets, and transporting the material.

Clean-up services on construction jobsites are a relatively new business venture and not yet widely available. Many clean-up services' fee structures are based on the size of the house, which provides the builder with an up-front cost for waste disposal.

In the profile below, Kent Homes' conventional waste haulers, i.e., 30-yard roll-off service, structure their fees on time (a rental fee) and weight. This means construction delays, such as weather, increase the price of waste disposal. The fees of *Site Clean*, on the other hand, are based on the size of the house and take advantage of reduced tipping fees for heavy, separated materials such as wood and brick.

"Because Site Clean's fee structure is based on the size of the house my total waste management cost is predictable."

*Dan Kent,  
Kent Homes*



### PROFILE: Clean-up Service

<b>Builder:</b>	<b>Dan Kent, Kent Homes</b>
<b>Waste Hauler:</b>	<b>Site Clean</b>
<b>Location:</b>	<b>Wilmington, North Carolina</b>
<b>Building type:</b>	<b>3,300 square foot, single-family detached</b>

#### Approach:

Site Clean's service method includes general site cleaning as well as the removal of waste materials. The six or seven site visits by Site Clean are timed to recover wood and brick which are tipped at a lower fee than the area landfill. Materials are contained on site in a 8x8x4 fenced area (about 10 cubic yards) and loaded into dumptrucks with a Bobcat.

<b>Diversion Rate:</b>	<b>Approximately 60%</b>
<b>Savings:</b>	<b>Approximately \$600.00</b>



## WASTE RECYCLING: COMMINGLED RECOVERY

Commingled recovery facilities take construction and demolition waste and recover metals, wood and other materials by separating them mechanically and/or manually. The off-site recovery means business as usual onsite for the builder with fee structures similar to those for conventional disposal. These processing facilities typically compete with local landfills and therefore offer competitive tipping fees to the waste hauler.

### PROFILE: Full-Scale Commingled Recovery

**Facility:** Environmental Resource Return Corp. (ERRCO)  
**Location:** Epping, NH

#### Approach:

A 22,500 square foot, privately-owned processing facility recycles incoming construction and demolition loads through crushing, shredding, chipping, waste and magnetic separation, and screening. All wood, metals, soil fines, and large timbers are recovered. The tipping fee at ERRCO is \$60/ton, which is \$5/ton less than the only area landfill.

**Diversion Rate:** Approximately 95%

“I wish all my business decisions were as easy as choosing a hauler that takes my jobsite waste to a recycling facility like ERRCO instead of a landfill.”

*Eric Chinburg  
Chinburg Builders*

Full scale operations, such as ERRCO’s, are generally not available in areas where tipping fees at the local landfill are less than \$50/ton. However, selective recovery operations, such as Ritchie’s, can work in areas with lower tipping fees.

### PROFILE: Selective Commingled Recovery

**Facility:** Ritchie Land Reclamation  
**Location:** Forestville, MD

#### Approach:

Scale house operator directs selected loads to 5000 square foot reclamation facility. Reusable lumber and plywood, doors, and slate are reused by parent company or sold; cardboard and metals are recycled; concrete, brick, block, and asphalt material are taken to adjacent crusher and reused by parent company or sold. Unsalvageable material is transported to the landfill. The recovery process at this privately-owned landfill is driven by conservation of landfill space and value of recovered material. Operation allows for increase or decrease in the level of recovery without significant additional capital investment. None of the equipment used by the facility is solely dedicated to the facility - all of the equipment is used in other operations at the landfill.

**Diversion Rate:** Approximately 25% (by volume) for selected loads

## OPTIONS



### WASTE RECYCLING: JOBSITE SEPARATION

#### A Tip on Fee Structure

The startup phase of a jobsite separation program may initially decrease the turnover rate of containers. For this reason, be sure your fee structure does not include time-based rental fees for containers. This will virtually guarantee that your total waste management costs will not increase during this critical period.

Depending on the resources and willingness of the company, many conventional hauling companies can offer jobsite separation. A successful program can be highly visible to the general and buying public, thereby providing market exposure for the builder and the hauler.

Jobsite separation works only when the builder and subcontractors keep the loads clean and separated and the hauler provides prompt and timely container service. In some cases, the hauler may need to offer a fee structure with economic incentives such as reduced charges to obtain clean loads. Ultimately the success of a jobsite separation program rests on the builder's/subcontractors' and hauler's commitment levels. Key elements of a jobsite separation program include:

- The container turnover rate is important to ensure cost-effectiveness (for the hauler and, in turn, the builder), and to control contamination. The availability of various container sizes (six- and eight-yard front-loading, 10-, 20- and 30-yard roll-offs) and the level of construction activity determine an efficient container turnover rate.
- Containers should be well marked to control contamination from noncompliant subcontractors and/or those living around the site. Multiple signs may be required if the container can be approached from more than one direction.



#### PROFILE: Source Separation

<b>Builder:</b>	<b>Lee Kitson Builder</b>
<b>Hauler:</b>	<b>United Waste of Michigan</b>
<b>Location:</b>	<b>Grand Rapids, MI</b>
<b>House Types:</b>	<b>Development of 1,700 square foot single-family homes; one or two starts per month</b>

#### Approach:

- Wood contained in a 10 yard roll-off box, moved as necessary to framing activity
- Cardboard collected in a centrally located, 8 yard front-loading container;
- Drywall stored in vacant wall cavities on selected homes (see Appendix C);
- General waste contained in a centrally located 30 yard roll-off box;
- The fee structure included flat pull charges for wood and waste, and a flat fee per month for cardboard.

<b>Diversion rate:</b>	<b>48% by volume</b>
<b>Savings:</b>	<b>20% (projected)*</b>

\* The switch from disposal to recycling has led to a new hauler, a new fee structure, and the projected savings for Lee Kitson.



## WASTE RECYCLING: SELF-HAUL

Of all the ways to manage construction waste, self-hauling requires the most commitment in terms of time, effort, and information gathering. Builders large enough to dedicate a crew and equipment to full-time waste management or small enough to make waste management an integral part of daily business trips are best suited to self-hauling.

Advantages to the self-haul approach include elimination of any middlemen and first hand knowledge of how efficiently materials are used at the jobsite. Cost-effective self-hauling requires detailed information on distances to outlets and landfills, outlet and landfill policies, and vehicle and personnel costs.

### PROFILE: Self-Haul

**Builder:** Frank Delano  
**Location:** Grand Rapids, MI  
**Building Type:** About 6-12 single-family detached starts per year (scattered sites)

#### Approach:

Using a Ford 150 3/4-ton pick-up truck (with cap), Frank spends an extra 4 to 5 hours per house handling and hauling all of the materials (waste and recyclables). By planning his trips to the landfill and recycling outlets into his daily business routine, Frank typically drives an additional 40 to 50 miles per house. Recyclable materials hauled in pickup include wood (about 2 loads per house), cardboard (about 2 loads per house), metals, and plastics (vinyl siding and rigid insulation). Materials hauled in the pickup to the landfill include paint cans, caulk tubes, flooring scraps, and roofing shingle cut-offs (about 2 loads per house combined). Scrap gypsum board is hauled by drywall subcontractors to a local recycler or landfill, whichever is closest to the jobsite.

**Diversion rate:** 20 - 66% by volume (depending on drywall)  
**Savings:** 45%



## OPTIONS

### A Tip on Self-Hauling Costs

Sorting/separating waste materials:  
Add 1 - 3 hr/ton (highly variable)

Vehicle operation - total cost (ownership, operation, and operator):

Pickup truck: \$ .70/mile  
(capacity: 3+yards or 1 ton)

12-ft. Stake body \$ .90/mile  
(capacity: 12+yards or 2+ tons)

10 wheeler roll-off tractor truck  
\$1.50/mile  
(capacity: 30 yards or 12+ tons)

"My crews are used to the separate piles for recycling and I'm used to planning my route to hit the outlets as needed. I know I save money this way, my job sites are cleaner, and my crews know I'm serious about using materials wisely."

*Frank Delano  
Franklin R. Delano,-Builder*

# OPTIONS

## BUILDING MATERIALS REUSE CENTERS

Reuse centers accept and then resell used, salvaged materials and mis-ordered or slightly damaged new materials. Materials come from building material retailers and manufacturers, remodelers, and new home builders.

A reuse operation can provide three basic services: warehousing (gathering materials for retail sale via collection or dropoff); brokering (transporting directly from donors to recipients without warehousing); and listing (cataloging and circulation of donated items).

Many reuse operations are not-for-profit organizations. Donors can take tax deductions, reduce their disposal costs, and enhance their corporate image. For-profit facilities, on the other hand, buy at reduced margins or collect materials that otherwise would be taken to the closest landfill.

“This partnership with Habitat for Humanity has been a great way to put discarded materials to use and honor a commitment to develop Steiner Ranch with respect for the environment.”

*Gerald Kucera  
MK-Development*



### PROFILE: Reuse Center

<b>Builders:</b>	<b>MK Development Corporation, Newmark Homes, and Morrison Homes</b>
<b>Reuse Center:</b>	<b>The Habitat RE-Store</b>
<b>Location:</b>	<b>Steiner Ranch Development, Austin, Texas</b>
<b>House Types:</b>	<b>2,600 square foot homes in a 4,400 acre master-planned community</b>
<b>Approach:</b>	Reusable, discarded building materials (bricks, doors, trim, lumber, etc.) are placed in an 8-yard, front-loading storage container at a recycling area centrally located in the development. The Habitat RE-store handles periodic pick-up.
<b>Diversion Rate:</b>	<b>25%</b>

## ON THE CUTTING EDGE: NEW IDEAS

Here are some new approaches to dealing with waste materials that you may want to investigate or develop for use in your area.

- **On-Site Reuse of “Clean” Wood and Drywall Waste** - Unpainted and untreated wood and drywall waste can be reused on site (see Appendix D). Chipped wood can be used as mulch and pulverized drywall can be used as a soil amendment. You should consider two important issues before undertaking on-site reuse.

1. Make sure that the inclusion of engineered wood products (plywood, OSB, etc.) in your wood mix is acceptable to local/state solid waste officials. Some jurisdictions have expressed concern over the impact of adhesives in these building materials on soil and water. Similarly, some states or localities will require proof of the beneficial effects on the soil when ground drywall is applied. Appendix D provides support for reusing these materials on site.

2. Check on the availability and cost of a mobile grinder in your area. Cost-effectiveness may be based on the number of sites that can be served at one time (a grinder that processes three to five tons/hour may cost \$100 to \$150/hour). Grinders suitable for wood and drywall are available and new grinders are being developed.

- **Take-Back Policies** - The most efficient way to handle the recovery of some building material waste may be for the supplier or even the manufacturer to take back clean, separated waste (the policy could be offered as a customer service plan). The key to the take-back approach is to backhaul materials, thereby eliminating transportation costs. Take-back and backhauling policies may work for everything from cardboard to drywall to vinyl siding.

### PROFILE:

#### Drywall as Soil Amendment

**Builder:** Habitat for Humanity  
**Location:** Americus, Georgia  
**House Types:** 20 homes-in-1-week blitz build

### Approach:

- Approval obtained from Georgia Department of Natural Resources
- Drywall scrap piled at curb
- "Bobcatted" into dump truck
- Pulverized with tub grinder
- Raked into soil prior to laying sod at rate of 2-10 tons per acre ( a 5 gallon bucket for 40 sq.ft.)

### Diversion Rate:

100 cubic yards (15 tons) diverted -



### PROFILE: Vinyl Siding Take-Back

**Partners:** Vinyl Institute, Lubbers Resource Systems, four area vinyl siding suppliers, local vinyl installers  
**Location:** Grand Rapids, MI

### Approach:

Installers bring vinyl siding cut-off waste back to the supplier as they return for new materials. The hauler services the container (a 10-yard box), and sells the baled material to a plastics recycler when a trailer load is accumulated.

### Results:

- Both the installers and suppliers were pleased with the program. The installers offer their general contractors an opportunity to reduce waste and suppliers provide a service to their customers.
- The hauler encountered some contamination problems (primarily aluminum trim waste).
- The value of vinyl is probably not high enough to eliminate container service fee.
- A vinyl siding recycling handbook is available from the American Plastics Council (see Appendix E).

# MARKETING

## BUILDER MARKETING



If you are taking the time and initiative to manage your construction waste, there are a number of ways that you can let your homebuyers and the community know about your efforts. Here are some examples.

- **Move-in gift and brochure** - Give your new homebuyers a trash container with your company's logo and the three chasing arrows symbolizing recycling. Include with this container a one-page brochure explaining your company's waste management program and the total annual landfill space your company is conserving.
- **Site Signs** - Real estate sale signs or site construction signs can include language such as "This builder recycles" or "Another 15 cubic yards of landfill space saved", to let the buying public know about your resource efficiency. Some builders have shared the cost of site signs with their waste/recycling hauler.
- **The "Build America Beautiful" (BAB) Program** - Individual builders and home builder associations (HBAs) across the country are using this joint program of NAHB and the Keep America Beautiful campaign to promote clean, safe jobsites and construction waste recycling programs. The BAB program includes a national awards program giving broad recognition to builders and HBAs that lead the country in waste reduction and recycling efforts. Contact your local HBA for more information.

### PROFILE: Builder Marketing

**Builder:** Greg Shinault, Pride Homes

**Location:** Lincoln, Nebraska

#### Approach:

- Participation in the Build American Beautiful (BAB) program. Each Pride home is distinguished by a front yard sign and recycling bins with the BAB decal.
- Presentation of Lincoln BAB-program to audiences across the state, including Nebraska State Recycling Association.
- Pride Homes has a recovery rate of over 50 percent. Wood, cardboard, metal, and scrap insulation are reused or recycled. All Pride Homes subcontractors are required to source separate and paints/stains are handled separately by a licensed disposal contractor.

#### Results:

- Winner of the 1995 BAB Award for builders, 20 or less homes a year category.
- Local and statewide recognition, including a media event attended by Nebraska Governor.

## HOME BUILDER ASSOCIATION OUTREACH

It can be tough for builders acting on their own to investigate local waste management options, develop new ones, and then market their efforts. Your local HBA can serve as the focal point for compiling information resources, bringing together related businesses to discuss waste management options, and getting the word out on builder waste management practices. Below are some examples of how local HBAs have become leaders in innovative construction waste management.

### PROFILE: HBA-Outreach

**HBA:** Central New Mexico  
**Partners:** New Mexico Department of the Environment, Keep New Mexico Beautiful, Inc., MCT (waste hauler/processor), Ponderosa Products (recycler), builder and associate members

#### Approach:

- Publication of news articles and quarterly newsletters with features on new information, builder practices, and updated recycling outlets prices.
- Development of recycling pilot project involving several local builders.
- Provision of recycling bins for lumber, metal, and plastic at local transfer station for small projects such as do-it-yourself remodeling jobs.

### PROFILE: HBA-Outreach

**HBA:** Greater Grand Rapids, MI  
**Partners:** Kent County Solid Waste Department, Grand Rapids Area Chamber of Commerce, associate and builder members, numerous local businesses and other organizations.

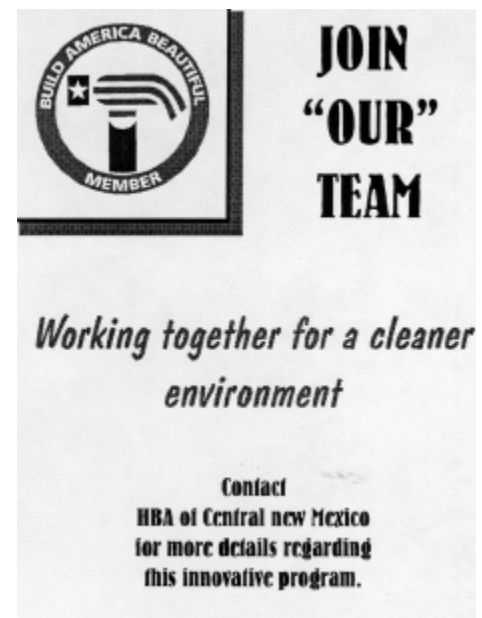
#### Approach:

- Job Site Recycling Committee - The HBA created this committee to provide a forum for builders, product manufacturers, waste haulers, and local solid waste officials to share perspectives and new ideas.
- Business and Industry Team for the Environment (BITE) - The HBA worked to establish BITE, creating a link between the building and other local industries and coordinating recycling networks and new recovery developments.

"The public is becoming more educated and concerned with our environment and limited resources. Construction waste management can be an integral part of a marketing plan for the builder and the local HBA."

*David Lopez,  
 Artisan Custom Builders,  
 Chairman*

*Build America Beautiful Program of Central New Mexico HBA*



## APPENDIX A

### VALUE-ENGINEERED ROOF DESIGN

Value-engineering principles can be applied to nearly all components of a house. For example, a value-engineered roof has a top chord/rafter dimension on the two-foot module, i.e., 12, 14, 16, 18 and 20 feet in length, to minimize sheathing waste. In addition, the range provided in this table will minimize rafter cutoff. The table assumes a square cut at the rafter end; an adjustment can be made for a plumb cut.

Using these eave widths with the corresponding design conditions results in sheathing cutoffs no greater than 12 inches in width. Although eave dimensions can differ from the front to the back of houses, use of a two-foot module (as opposed to a four-foot module) assumes that a 24-inch-wide strip of sheathing could be used on the other side of the roof.

### OPTIMUM RANGE OF EAVE WIDTHS FOR VALUE-ENGINEERED ROOF DESIGN

(Chart not available)



## APPENDIX B

### GUIDELINES FOR REQUIRING SUBCONTRACTORS TO REMOVE WASTE

This appendix summarizes some of the key issues in requiring subcontractors to remove their own waste (particularly potentially hazardous waste). Contractors should be aware that the complexity of federal environmental statutes makes it difficult for a contractor to shift potential liability for “hazardous” waste materials generated on their jobsites. However, steps can be taken to provide a contractor with protection against charges of violating local and/or state solid waste regulations.

#### Potentially Hazardous Materials in the Residential Construction Waste Stream

The largest sources of residential construction materials that could be considered hazardous under state and federal statutes are waste solvents, paints and coatings, and adhesives. Examples of potentially hazardous materials are included in (but not limited to) the following list.

- adhesives
- sealers
- paint stripper
- asphalt
- paint/lacquer
- resins/epoxies
- waterproofing agents
- coatings
- antifreeze
- shellac
- solvents
- caulking

#### Options

Given the general contractor’s exposure under federal law (outlined below), it is prudent to require subcontractor documentation of disposal methods for hazardous wastes or for the general contractor to oversee the waste disposal to ensure that such disposal is lawful. Other options include the following:

- Seek written contractual arrangements with subcontractors likely to generate hazardous waste materials:

*{The subcontractor shall at all times keep the building and the premises broom clean of debris and any other waste materials generated from the performance of this contract. The subcontractor is responsible for the removal from the site and proper disposal of all the debris created by its work.}*

- Strongly manage a Material Safety Data Sheet (MSDS) reporting system to help identify potentially hazardous substances. Alternatively, a contractor can encourage or require subcontractors to employ less toxic substitute materials as a way of reducing both parties’ potential liability for hazardous waste material.

- Identify conditions affecting contractor liabilities. In some cases, the “generator” of the waste may be the property owner and not the contractor. Builders hired to construct new homes on owners’ or developers’ sites should be aware of contract provisions that may expose them to increased liability.

#### Applicable Solid and Hazardous Waste Regulations

Two federal programs affect home builders and remodelers by regulating the treatment and disposal of solid and hazardous wastes. They are described as follows:

- The Resource Conservation Recovery Act (RCRA) governs present and future activities that generate solid wastes (including hazardous wastes). Under RCRA, generators are responsible for determining if their wastes are hazardous; in most cases, the builder would be considered the generator. A generator is considered “conditionally exempt” if less than 220 pounds of hazardous waste is generated in one calendar month and less than 2,200 pounds of hazardous waste is stored on site. Based on waste assessments conducted by the

Research Center in 1994, most builders could be categorized as conditionally exempt small quantity generators (CESQG) under RCRA depending on the amount and type of waste they generate.

However, a new federal rule passed in July 1996 (effective 1998) requires construction and demolition (C & D) landfills either to stop accepting loads containing CESQG waste or to meet new location and ground water monitoring requirements. Builders using landfills no longer able to accept CESQG waste, will be required to separately dispose of CESQG waste in an approved municipal solid waste landfill. Builders using landfills that have upgraded to continue accepting CESQG waste will almost certainly face higher tipping fees.

- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund), is designed as a cleanup or response program to deal with already existing hazardous waste sites. Under CERCLA, a contractor could be liable at a later date as a “generator” or “transporter” of any amount of a potentially hazardous substance whether defined as a product or a waste.

Two NAHB publications offer additional information: *The Regulation of Solid and Hazardous Wastes: A Builder’s Guide* and *Contracts and Liabilities for Builders and Remodelers*. Both are available from NAHB by contacting the Home Builder Bookstore at (800) 223-2665.

## APPENDIX C

### GUIDELINES FOR STORING DRYWALL SCRAPS IN VACANT WALL FRAMING CAVITIES

This appendix explains the conditions that make drywall cavity storage a cost-effective option, addresses commonly expressed concerns, and offers guidelines for employing the technique.

It is not a given that storing drywall scraps in vacant framing cavities is the most cost-effective option. Most drywall crews report that the technique requires two labor hours for a 2,000-square-foot house.

- Whether the two hours spent cutting and filling cavities is more or less than the time associated with conventional disposal depends on the distance between the roll-off container and the house.
- Cost-effectiveness may also depend on the traditional responsibility for disposal. Cavity storage places responsibility for the cutoff waste on the drywall subcontractor. Frequently, the general contractor assumes responsibility for scrap drywall.

The major considerations associated with drywall cavity storage are:

- *Disposal savings.* Approximately 80 to 90 percent of waste can be expediently stored, representing a significant disposal saving for either the general contractor or the drywall contractor.
- *Liability.* While none of the national model building codes prohibit implementation of the technique, local building officials can be consulted for additional concerns. After reviewing the guidelines for the technique, builders need to decide whether permission from or notification of homeowners/buyers (not required) is prudent. Finally, builders should verify that the drywall crew fully understands the proper practice of drywall cavity storage.
- *Future remodeling activity.* The guidelines have been designed to minimize the impact on subsequent remodeling activity.
- *Drywall rattling within the cavity.* The guidelines suggest toe-nailing to secure drywall scraps in vacant framing cavities.
- *Impact on dead load.* Given a wallboard density of just under two pounds per square foot for 1/2-inch-thick wallboard, even total cavity fill would not require structural modifications.
- *Sound transmission, fire retardance, and thermal mass.* The contributions of this technique to reduced sound transmission, improved fire retardance, and increased thermal mass are undocumented and probably minimal. Builders need to be careful not to overstate the technique's benefits.
- *Preservation of landfill space.* Drywall cavity storage is more of a deferral of disposal rather than guaranteed elimination of waste. Presumably, the opportunities for recovery of the drywall waste will be greater at the end of the structure's use in 50 to 100 years.



## GUIDELINES FOR STORING DRYWALL SCRAPS IN VACANT WALL FRAMING CAVITIES

1. ***Use only framing cavities that do not have insulation, wiring, plumbing, or HVAC duct runs.*** Do not use exterior framing cavities that require insulation. Do not use interior cavities with plumbing, electrical, or HVAC runs, thereby preventing damage to the work of previous trades or eliminating the need for special cuts around such items as outlets or switch boxes (see figure below).
2. ***Identify the vacant cavities before you start.*** Second-floor closet, bathroom, bedroom, stairwell, garage, and finished basement vacant framing cavities work well.
3. ***Consider the order in which walls are hung so that vacant wall cavities remain available.*** This may require starting another room before the last one is completely hung, but remember the waste must be generated first.
4. ***There is no need to fill the entire cavity by using precise measurements.*** Speed is important; approximate and score the scrap to a size less than the width of the framing cavity. Multiple scores can be used on larger scraps to create an “accordion”-type bundle. In some cases, the scraps can be placed to allow double stacking (see figure above).
5. ***Fill the cavity before hanging the second side of the wall.*** This allows access to the scraps for proper placement and fastening (steps 6 and 7).
6. ***Provide adequate clearance for future wiring.*** Always provide at least 1-1/2 inches of clearance for any future wiring; stacking four sheets deep is the maximum for 1/2-inch-thick drywall in a 2x4 stud wall; eight sheets is the maximum in a 2x6 stud wall.
7. ***Prevent movement of drywall.*** To reduce the possibility of drywall scraps shifting or rattling in a framing cavity, screws or nails can be “toe-nailed” to secure the scraps.
8. ***Never place anything other than drywall scraps in the framing cavity. This method is for drywall waste only.***

## GUÍA PARA ALMACENAR TROZOS DE LÁMINAS DE CARTÓN-YESO EN LAS CAVIDADES VACÍAS DEL ENMARCADO

1. ***Utilice solamente los espacios que no tienen aislamiento, cables eléctricos, tuberías o conductos de aire acondicionado.*** No utilice las cavidades de enmarcado exterior que requieren aislamiento. No utilice cavidades interiores con tuberías, cables eléctricos o conductos del aire acondicionado evitando así dañar el trabajo de otros especialistas o eliminando la necesidad de efectuar cortes especiales alrededor de elementos tales como tomas de corriente o cajas de conmutadores (véase la figura a continuación).
2. ***Identifique las cavidades vacías antes de comenzar.*** Son apropiadas casi todas las cavidades vacías que se encuentran en los armarios integrales, baños, dormitorios y escaleras del segundo piso, así como en los garajes y los sótanos.
3. ***Considere el orden en el que se cuelgan las paredes para que queden cavidades vacías disponibles.*** Para ello, puede ser necesario comenzar en otra habitación antes de colgar completamente la última pared, pero recuerde que los desechos tienen que generarse primero.
4. ***No es necesario llenar toda la cavidad utilizando medidas exactas.*** La rapidez es importante; para aproximar el corte, recueste el pedazo contra la pared y corte simplemente un trozo más pequeño que el ancho de la cavidad del enmarcado. Pueden utilizarse cortes múltiples en trozos mayores para crear un trozo en forma de acordeón. En algunos casos, los pedazos pueden colocarse de forma que se almacenen unos encima de otros (vea la figura arriba).

5. ***Llene la cavidad antes de colgar el segundo lado de la pared.*** Esto permitirá acceso a los trozos de láminas de cartón-yeso para colocación adecuada y fija (pasos 6 y 7).
6. ***Deje espacio adecuado para la instalación de cables en el futuro.*** Deje siempre un mínimo de 1-1/2 pulgadas libres para futuros cables: el almacenamiento de cuatro piezas en profundidad es el máximo para una lámina de cartón-yeso de 1/2 pulgada colgada de una pared construida con entramado de 2 x 4; ocho láminas es el máximo para una pared construida con entramado de 2 x 6.
7. ***Evite el movimiento de los trozos de cartón-yeso.*** Para reducir la posibilidad de ruidos o movimiento de los trozos de cartón-yeso en el interior del entramado, se pueden utilizar tornillos o clavos para fijarlos.
8. ***No coloque nunca materiales distintos de los pedazos de cartón-yeso en el entramado interior. Este método sólo se aplica a los trozos de láminas de cartón-yeso.***

## APPENDIX D

### SUPPORTING DOCUMENTS FOR AGRICULTURAL USES OF WOOD AND DRYWALL



United States  
Department of  
Agriculture

Agricultural  
Research  
Service

Plant Sciences Institute  
E-Mail  
rkorcak@asrr.arsusda.gov

Bldg. 003, room 232  
Beltsville, Maryland  
20705-2350  
Tel. (301) 504-6591  
Fax (301) 504-5521

#### **Suggested Utilization of Cut-Off Gypsum Wallboard Scraps from New Home Construction**

Ronald F. Korcak  
November 4, 1996

Gypsum wallboard is made up of a gypsum core (90<sup>+</sup>% calcium sulfate dihydrate) and two paper faces (~7% by weight). Cut-off scraps from new home construction are generated at a rate of approximately one pound per square foot of floor area (Yost, personal communication).

Research has demonstrated that the beneficial effects of pulverized gypsum wallboard waste are nearly identical to those of agricultural grade gypsum<sup>1</sup>. Gypsum improves plant growth on a variety of soils due to:

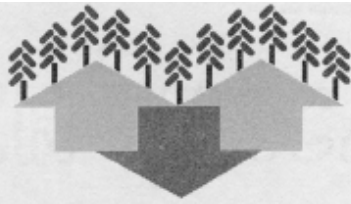
- \* increase in available calcium and sulfur
- \* improved soil tilth and root penetration, particularly in clayey soils
- \* treatment of salt problems in sodic soils.

Unlike agricultural limestone, where application rates can be quite easily determined using indexes such as soil pH, gypsum application rates are difficult to ascribe. Generally, gypsum application rates normally fall within the range of 2 to 8 tons per acre. Beneficial responses to gypsum application usually occur on heavier textured soils that are acidic, compacted and/or prone to crusting. Direct application of scrap wallboard around construction sites is compounded by the fact that the recipient soils are usually subsurface horizon materials. In fact, beneficial responses are more likely to occur on such subsurface materials since they tend to be heavier and/or more acidic than the surface soil materials. As an overall recommendation, if extension personnel recommend the application of gypsum as a soil amendment, the application of pulverized wallboard should result in similar benefits.

The scrap drywall should be clean, cut-off drywall waste (no paint, no Type X or moisture-resistant board). The scrap material should be pulverized to a minus 1 inch to 1/4 inch size and spread evenly around the site. The spread material can either remain on the surface and allowed to dissolve during rainfall events or incorporated with top soil materials. Applicators should avoid wet soil areas, since under prolonged anaerobic conditions hydrogen sulfide gas formation may occur.

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<sup>1</sup>Scrap Construction Gypsum Utilization - Final Report, R. F. Korcak, Submitted to the Gypsum Association, Washington, D.C. Copies available on request from the Gypsum Association, 810 First Street NE, #510, Washington, D.C. or from the author at the letterhead address.



## Orange Regional Landfill

A partnership of Town of Carrboro, Town of Chapel Hill, Orange County



Orange Community Recycling

A program of the Orange Regional Landfill

### **Recycling Alternatives for Clean Construction and Demolition (C&D)** **Wood Wastes**

Blair L. Pollock  
December 12, 1996

The Orange Regional Landfill, [Orange County, NC] has been working to incorporate clean construction and demolition wood wastes, including engineered wood products, into its current yard waste mulching operation. The project objective is to combine unpainted, untreated construction and demolition wood into the yard waste mulch currently produced and sold by the landfill.

The North Carolina Office of Solid Waste does not currently allow inclusion of engineered wood products into mulching operations. Based on testing at the Orange Regional Landfill of mulched and stockpiled construction wood in the winter of 1995-96, the State in July 1996, issued conditional approval to grind, stockpile and blend all unpainted, untreated construction wood wastes with yard waste mulch. Permanent approval of use of this blended wood mulch is pending formal submittal of test results for heavy metals and formaldehydes. These tests have been conducted and both the lab results on the mulch and the testing of the runoff from the pile of mulch produced from 50% construction waste and 50% yard waste show no significant environmental problems. The pH of the mulch is slightly acidic and the NC Dept. of Agriculture laboratory recommends making the pH more neutral before using the material for plant growth medium. Their lab test comments show the product otherwise suitable for unrestricted use.

With the increased use of engineered wood products throughout the construction industry, very little economically feasible diversion of waste wood from construction is possible without including these products. Efforts of Orange Regional Landfill staff since December 1995 to allow inclusion of engineered wood wastes, as well as other construction wood wastes in the mulch, have included:

collecting, grinding, blending and testing six tons of construction wood waste for formaldehydes and heavy metals [no metals or formaldehydes were found in amounts exceeding the yard waste mulch],

applying a mulch of 100% construction wood waste at a landscaped test plot and comparing its performance to the standard yard waste mulch at an adjoining test plot,

conducting a second larger test grinding of untreated construction and industrial wood products for a second larger test grinding,

testing stormwater runoff and blended mulch products created at the Orange Regional Landfill site.

Assuming the manufactured product meets state standards, the blended yard waste and construction wood mulch product will be test marketed in the spring of 1997.



## APPENDIX E

### NATIONAL AND STATE INFORMATION SOURCES

#### RESOURCES

##### ***Cost-Effective Home Building***

NAHB Research Center, Inc.  
400 Prince George's Boulevard  
Upper Marlboro, MD 20774  
(800) 638-8556

NOTE: A handbook compiling material-saving methods of efficient design and construction.

##### ***Resources for Environmental Design Index (REDI) Guide***

Iris Communications, Inc.  
P.O. Box 5920  
Eugene, OR 97405-0911  
(800) 346-0104  
<http://oikos.com>

##### ***The Harris Directory***

Stafford Harris, Inc.  
522 Acequia Madre  
Santa Fe, NM 87501  
(505) 995-0337  
[bjharris@igc.apc.org](mailto:bjharris@igc.apc.org)

##### ***Guide to Resource Efficient Building Elements (GREBE)***

Center for Resourceful Building Technology  
P.O. Box 3866  
Missoula, MT 59806  
(406) 549-7678

NOTE: The *REDI Guide*, the *Harris Directory*, and *GREBE* all provide useful information for specifying or procuring resource-efficient building materials. For example, information on the recycled-content of building materials can be found in these guides.

##### ***Environmental Building News (EBN)***

RR1 Box 161  
Brattleboro, VT 05301  
(802) 257-7300

NOTE: *EBN* is a bimonthly newsletter on environmentally sustainable design and construction.

##### ***Environmental Resource Guide (ERG)***

American Institute of Architects  
1735 New York Avenue, NW  
Washington, DC 20006  
(202) 626-7331

NOTE: The *ERG* compiles information about the environmental aspects of building materials including life-cycle analyses and application profiles.

##### **WasteSpec**

Triangle J Council of Governments  
P.O.-Box 12276  
Research Triangle Park, NC 27709  
(919) 549-0551

NOTE: Provides model specifications for construction waste reduction, reuse and recycling - particularly useful in commercial construction.

#### NATIONAL ASSOCIATIONS

##### **American Forest and Paper Association (AF&PA)**

1111 19th Street, NW  
Suite 800  
Washington, DC 20036  
(202) 463-2467

Fax: (202) 463-2791

NOTE: The AF&PA sells the *National Wood Recycling Directory* at a cost of \$5.

##### **American Plastics Council (APC)**

1801 K Street, NW  
Washington, DC 20005  
(800) 243-5790

NOTE: APC offers a number of free publications, including the *Recycled Plastic Products Source Book* and *Stretch Wrap Recycling: A How To Guide*, and *Vinyl Siding Recycling Handbook* (available Spring, 1997).

##### **Contractors Register, Inc. (CRI)**

P.O. Box 500  
Jefferson Valley, NY 10535  
(800) 431-2584

NOTE: CRI publishes *The Blue Book: Building and Construction* annually and by region. It is essentially a "yellow pages" for the building industry. Construction and demolition recycling is now listed as a heading. The publication is for sale and is generally available at local libraries.

##### **Gypsum Association (GA)**

810 First Street, NE  
Suite #510  
Washington, DC 20002  
(202) 289-5440

NOTE: The GA can provide information on gypsum processing equipment, current research on uses of waste drywall, and member plants that accept drywall.

##### **National Recycling Coalition, Inc. (NRC)**

1727 King Street, Suite 105  
Alexandria, VA 22314  
(703) 683-9025

NOTE: The Buy Recycled Business Alliance and the NRC have several publications including the *Buy Recycled Guidebook for the Commercial Construction Industry*

##### **Steel Recycling Institute**

680 Andersen Drive, Foster Plaza 10  
Pittsburgh, PA 15220-2700  
(800) 876-7274

NOTE: The Steel Recycling Institute has regional offices with local and/or regional contacts for recycling ferrous metals.

##### **The Vinyl Environmental Resource Center**

One Cascade Plaza, 19th Floor  
Akron, OH 44308  
(800) 969-VINYL

NOTE: The Vinyl Institute publishes *A Guide to Vinyl Recycling in the U.S. and Canada* and the *Directory of Companies Manufacturing Products from Recycled Vinyl* (no charge).

#### STATE AGENCIES

Many of these agencies may have publications containing valuable information unique to your state or community. A local guide to recycling outlets, for example, would be helpful supplemental information to this field guide.

##### **ALABAMA**

Dept. of Environmental Management  
Solid Waste Division  
1751 Congressman W.L. Dickenson Drive  
Montgomery, AL 36130-1463  
Russell Kelley  
(334) 271-7761

##### **ALASKA**

Dept. of Environmental Conservation  
Division of Environmental Health  
Solid Waste Management Program Offices  
410 Willoughby Avenue, Suite 105  
Juneau, AK 99801-1795  
(907) 465-5280  
Fax: (907) 465-5362 or -5164

##### **ARIZONA**

Dept. of Environmental Quality Program Division  
Solid Waste Section  
3033 North Central Avenue  
Phoenix, AZ 85012  
(602) 207-4134, (800) 234-5677 (Arizona)  
Solid Waste Hotline: (602) 207-4132

##### **ARKANSAS**

Dept. of Pollution Control and Ecology  
8001 National Drive  
Little Rock, AR 72219  
Fax: (501) 682-0798  
Solid Waste Division: Mike Hood  
(501) 682-0601

##### **CALIFORNIA**

California Integrated Waste Management Board  
Market Development Division  
Construction & Demolition Materials  
Management Program  
8800 Cal Center Drive  
Sacramento, CA 95826  
Steve Austrheim-Smith  
(916) 255-2472  
Fax: (916) 255-2573

##### **COLORADO**

Dept. of Health & Environment HMWMD-B2  
4300 Cherry Creek Drive, South  
Denver, CO 80222-1530  
Solid Waste: (303) 692-3450  
Fax: (303) 759-5355

##### **CONNECTICUT**

Dept. of Environmental Protection  
Waste Management Bureau  
Engineering & Enforcement Division  
165 Capitol Avenue  
Hartford, CT 06106  
(860) 424-3366

**DELAWARE**

Dept. of Natural Resources and Environmental Control  
Solid Waste Management Branch  
P.O. Box 1401  
Dover, DE 19903  
(302) 739-3820

**FLORIDA**

Dept. of Environmental Protection  
Solid Waste Section  
Twin Towers Office Building  
2600 Blair Stone Road  
Tallahassee, FL 32399-2400  
Kathy Anderson  
(904) 488-0300

**GEORGIA**

Dept. of Natural Resources  
Land Protection Branch  
Commercial & Industrial Solid Waste Unit  
4244 International Parkway, Suite 104  
Atlanta, GA 30354  
(404) 362-2696  
Fax: (404) 362-2693

**HAWAII**

Dept. of Health  
Solid and Hazardous Waste Branch  
919 Ala Moana Boulevard, 3rd Floor  
Honolulu, HI 96814  
(808) 586-4245  
Fax: (808) 586-7509

**IDAHO**

Dept. of Health & Welfare  
Division of Environmental Quality  
1410 N. Hilton  
Boise, ID 83706  
(208) 373-0502  
Fax: (208) 373-0417

**ILLINOIS**

Environmental Protection Agency  
Solid Waste Management  
200 Churchill Road  
P.O. Box 19276  
Springfield, IL 62794  
(217) 524-3300  
Fax: (217) 524-3291

**INDIANA**

Dept. of Environmental Management  
Office of Solid and Hazardous Waste Management  
100 N. Senate Avenue  
P.O. Box 6015  
Indianapolis, IN 46206-6015  
Fax: (317) 232-3403  
Solid Waste Compliance  
Leah Foutty, Section Chief  
(317) 232-4536

**IOWA**

Iowa Dept. of Natural Resources  
Environmental Protection Division  
Wallace State Office Building  
502 East 9th Street  
Des Moines, IA 50319-0034  
Marion Burnside  
(515) 281-8443  
Peter Hamlin, Director  
(515) 281-8852  
Fax: (515) 281-8895

**KANSAS**

Kansas Dept. of Health and Environment  
Bureau of Waste Management  
Solid Waste Section  
Forbes Field  
Building 740  
Topeka, KS 66620-0001  
Solid Waste: (913) 296-1594

**KENTUCKY**

Natural Resources and Environmental  
Protection Cabinet  
Division of Waste Management  
Solid Waste Branch  
14 Reilly Road  
Frankfort, KY 40601  
Charlie Richie  
(502) 564-6716  
Fax: (502) 564-6716

**LOUISIANA**

Dept. of Environmental Quality  
Solid Waste Division  
P.O. Box 82178  
Baton Rouge, LA 70884-2178  
(504) 765-0249  
Fax: (504) 765-0299

**MAINE**

Dept. of Environmental Protection  
Bureau of Remediation & Waste Management  
17 State House Station  
Augusta, ME 04333-0017  
Allan R. Ball, Director  
(207) 287-2651  
Fax: (207) 287-7826

**MARYLAND**

Dept. of the Environment  
Field Operations & Compliance Division  
2500 Broening Highway  
Baltimore, MD 21224  
(410) 631-3424 or 631-3364  
Fax: (410) 632-3321

**MASSACHUSETTS**

Dept. of Environmental Protection  
Division of Solid Waste Management  
One Winter Street  
4th Floor  
Boston, MA 02108  
(617) 292-5960  
Fax: (617) 556-1049  
Jim Roberts  
(617) 292-5983

**MICHIGAN**

Dept. of Environmental Quality  
Waste Management Division  
P.O. Box 30241  
Lansing, MI 48909  
Waste Management (517) 373-9523  
Fax: (517) 373-4797

**MINNESOTA**

Pollution Control Agency  
Solid Waste Section  
520 Lafayette Road North  
St. Paul, MN 55155-4194  
(612) 296-7340  
Fax: (612) 296-9707

**MISSOURI**

Dept. of Natural Resources  
Solid Waste Management Program  
P.O. Box 176  
Jefferson City, MO 65102-0176  
(573) 751-5401  
Fax: (573) 526-3902

**MONTANA**

Dept. of Environmental Quality  
Permitting & Compliance Division  
Solid Waste Program  
Metcalf Building  
P.O. Box 200901  
Helena, MT 59620-0901  
(406) 444-1430

**NEBRASKA**

Dept. of Environmental Quality  
Integrated Waste Management Section  
P.O. Box 98922  
Lincoln, NE 68508-8922  
(402) 471-4210  
Fax: (402) 471-2909

**NEVADA**

Nevada Division of Environmental Protection  
Bureau of Waste Management  
Solid Waste Branch  
333 West Nye Lane  
Carson City, NV 89710  
(702) 687-4670 ext. 3003  
Fax: (702) 687-5856

**NEW HAMPSHIRE**

Dept. of Environmental Services  
Solid Waste Management Division  
6 Hazen Drive  
P.O. Box 95  
Concord, NH 03302-0095  
(603) 271-3710  
Fax: (603) 271-2867

**NEW JERSEY**

Dept. of Environmental Protection  
Division of Solid Waste Management  
CN 414  
401 E. State Street  
Trenton, NJ 08625-0414  
(609) 292-3131

**NEW MEXICO**

Environmental Solid Waste Bureau  
1190 St. Francis Drive  
P.O. Box 26110  
Santa Fe, NM 87502  
(505) 827-0155  
Fax: (505) 827-2902

**NEW YORK**

Dept. of Environmental Conservation  
Bureau of Solid Waste  
50 Wolf Road  
Albany, NY 12233-7258  
(518) 457-1859

**NORTH CAROLINA**

Dept. of Environment, Health, and Natural Resources  
Division of Solid Waste  
P.O. Box 27687  
Raleigh, NC 27611-7687  
(919) 733-0692  
Fax: (919) 733-4810

**NORTH DAKOTA**

Dept. of Health  
Division of Waste Management  
1200 Missouri Avenue, Room 302  
Bismark, ND 58506-5520  
(701) 328-5166  
Fax: (701) 328-5200

**OHIO**

Environmental Protection Agency  
Division of Solid and Hazardous Waste Management  
1800 Watermark Drive  
Columbus, OH 43266-0149  
(614) 466-2000

**OKLAHOMA**

Dept. of Environmental Quality  
Solid Waste Management  
Compliance & Inspection  
1000 N.E. 10th Street  
Oklahoma City, OK 73117-1212  
(405) 745-7100  
Fax: (405) 745-7133

**OREGON**

Dept. of Environmental Quality  
Solid Waste Division  
750 Front Street, NE  
Suite 120  
Salem, OR 97310  
(503) 378-8240 ext. 252  
Fax: (503) 378-4196

**PENNSYLVANIA**

Contact your regional office of the  
Dept. of Environmental Protection  
Bureau of Land Recycling and Waste Management

**RHODE ISLAND**

Dept. of Environmental Management  
Office of Waste Management  
255 Promenade Street  
Providence, RI 02908  
Solid Waste: (401) 277-2797

**SOUTH CAROLINA**

Dept. of Health and Environmental Control  
Bureau of Solid and Hazardous Waste Management  
2600 Bull Street  
Columbia, SC 29201  
(803) 896-4000  
Fax: (803) 896-4002

**SOUTH DAKOTA**

Dept. of Environment and Natural Resources  
Waste Management Program  
523 E. Capitol Street  
Pierre, SD 57501-3181  
(605) 773-4217  
Fax: (605) 773-6035

**TENNESSEE**

Dept. of Environment and Conservation  
Division of Solid Waste Management  
401 Church Street  
L & C Tower  
Fifth Floor  
Nashville, TN 37243-1535  
(615) 532-0780  
Fax: (615) 532-0886

**TEXAS**

Dept. of Natural Resource Conservation Commission  
Municipal Solid Waste Division  
P.O. Box 13087  
Austin, TX 78711-3087  
Construction Waste: (512) 239-6781  
Fax: (512) 239-6717

**UTAH**

Dept. of Environmental Quality  
Division of Solid and Hazardous Waste  
P.O. Box 144880  
Salt Lake City, UT 84114-4880  
(801) 538-6170  
Fax: (801) 538-6715

**VERMONT**

Agency of Natural Resources  
Solid Waste Management  
103 South Main Street  
Waterbury, VT 05671-0407  
(802) 241-3444  
Fax: (802) 244-5141

**VIRGINIA**

Dept. of Environmental Quality  
Division of Waste Operations  
P.O. Box 10009  
Richmond, VA 23240-0009  
Waste Division: (804) 698-4147  
Fax: (804) 698-4234

**WASHINGTON**

Dept. of Water and Waste Management  
Solid Waste Division  
921 Lakeridge Drive  
Building 4, Room 100  
Olympia, WA 98502  
Jeff Fernhagen  
David Merrell  
(360) 786-5136  
Fax: (360) 754-4682

**WEST VIRGINIA**

Environmental Protection  
Office of Waste Management  
Solid Waste Section  
1356 Hansford Street  
Charleston, WV 25301  
Paul Benedum  
(304) 558-6350  
Fax: (304) 558-1574

**WISCONSIN**

Dept. of Natural Resources  
Bureau of Waste Management  
P.O. Box 7921  
Madison, WI 53707-7921  
(608) 266-2111  
Fax: (608) 267-2768

**WYOMING**

Dept. of Environmental Quality  
Solid and Hazardous Waste Division  
Herschler Building  
4th Floor  
122 West 25th Street  
Cheyenne, WY 82002  
(307) 777-7752

## WHY CONSTRUCTION WASTE MANAGEMENT?

No one enjoys throwing materials away. But with all of the aspects of home building that require management today, why do we need to add waste? This field guide explains how construction waste management can positively affect a builder's operation, as well as the image of the entire home building industry.

**Cost** - Even though your disposal costs represent only about 0.5 percent of a home's total construction costs, consider that waste management costs could represent as much as five percent of your profit on a home. Waste reduction can reduce your material purchases; recycling can reduce your total disposal costs.

**Efficiency** - You pay twice for materials wasted on your jobsites - once for the original purchase and again when the usable material is hauled off for disposal. It's not difficult to find useful building materials "hidden" within the six-foot-high sides of site dumpsters.

**Resource Conservation** - Roughly 80 percent of a home builder's waste stream is recyclable. Home builders can do their part to conserve natural resources and landfill space by looking at their waste stream and seeing resources instead of refuse.

**Liability** - The general contractor bears some responsibility for any waste generated at jobsites. It is important that you protect your company from any potential liability resulting from unauthorized or illegal disposal of wastes, particularly potentially hazardous wastes.

**Marketing** - Builders who make the effort to build resource-efficient homes should take credit for their work. Distinction in the marketplace can lead to positive press and home sales.



**NAHB**RESEARCH CENTER

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