

# **Construction and Demolition (C&D) Materials Scoping Study: Building Materials Reuse Centers**

**U.S. Environmental Protection Agency  
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## **1. BUILDING MATERIALS REUSE CENTERS AND REUSE STORES**

### **1.1 Introduction**

As part of the expansion of its *Municipal Solid Waste (MSW) in the United States: Facts and Figures*, EPA is examining the inclusion of construction and demolition (C&D) materials generation, recycling, and reuse in future editions. As part of a C&D materials flow analysis scoping study, EPA tasked the contractor team with studying building materials reuse centers and the types, quantities, and relative weight of the materials handled by these facilities. This scoping study presents the findings generated by this examination of building materials reuse centers and discusses possible approaches for developing a methodology for estimating the amount of C&D materials diverted from the landfill through reuse centers.

### **1.2 National Data Availability**

Currently, there is no existing single source for national statistics on C&D building materials reuse in the United States. One major reason for this is the absence of universal state or national requirements to report or track generation, reuse, recycling, or disposal of C&D materials. While some states and municipalities have C&D reporting requirements, differences in how C&D-related information is reported and classified make any attempt to compile these data into a national estimate extremely challenging. Further, a national estimate based on the small size of the potential data set raises questions of representativeness.

Further complicating the issue is the fact that C&D materials reuse is a decentralized industry. It is essentially a cottage industry with most operations being relatively small scale, local businesses with annual revenues typically far below \$1 million per year.<sup>1</sup> The one exception being Habitat for Humanity's chain of 825 ReStores in North America. Even the ReStores, however, are run autonomously by the local Habitat affiliates and are not centrally managed. Most ReStores do track their inventory in some manner, such as number of windows sold or revenue generated from window sales. This lack of national reporting requirements and the decentralized nature of the building materials reuse industry make estimating national reuse levels extremely difficult.

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<sup>1</sup> Thomas R. Napier, Research Architect / Principal Investigator, U.S. Army Corps of Engineers, Construction Engineering Research Laboratory/ Building Materials Reuse Association (Telephone conversation July 31, 2012).

Even with the lack of national data, it is obvious that only a small share of the total C&D waste stream currently is being reused. Several of the individuals interviewed for this study stated that C&D building materials reuse represents a very small fraction of the total C&D generation agreeing that it very likely represents less than 1 percent of total generation by weight.<sup>2,3,4</sup> A study of the C&D markets in the Chicago area by Weber, et al. estimate reuse at “far below 10 percent”<sup>5</sup> while another more recent study reports that less than 0.5 percent of the total C&D waste stream has been reused in the city of Chicago.<sup>6</sup>

### **1.3 Defining Reuse Centers and Reuse Stores**

In discussing reuse businesses, the industry makes a distinction between building material reuse centers and reuse stores. The differences lie not only in the size of the operation, but also the type of materials being procured and sold by each.

Reuse centers deal primarily with overstocked, discontinued, new and used building materials donated by manufacturers, businesses, contractors and individuals. They handle large volumes of salvaged and/or reusable building materials such as doors, windows, cabinets, plumbing fixtures, lumber, millwork, metals, flooring, hardware, bricks, and fencing. Most also handle used goods including architectural salvage, furniture, appliances, and lighting fixtures. Appendix A provides a more extensive list of the types of materials typically handled by reuse centers.

Reuse centers represent a small percentage of the total number of reuse retail businesses (i.e., reuse centers and reuse stores), but manage the largest volumes and percentage of reused C&D materials.<sup>7</sup> Reuse centers also generate the largest total revenue from the sale of reused C&D materials. While many reuse centers seek to control inventory procurement via arrangements with contractors or by operating their own deconstruction services, most businesses often are forced to rely on the donations of manufacturers, contractors, salvage companies, other businesses, and individuals for their inventory supply. This means they are often dealing with large volumes of low-value materials (e.g., bricks, dimensional lumber, flooring, fencing).

What constitutes a “reuse store” is less clearly defined and could be construed to encompass a wide range of retail operations. Reuse stores deal primarily with architectural

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<sup>2</sup> John Majercak, EcoBuilding Bargains/Center for Ecological Technology (Telephone conversation August 31, 2012).

<sup>3</sup> Anne Nicklin, Executive Director, Building Materials Reuse Association (Telephone conversation August 6, 2012).

<sup>4</sup> Dirk Wassink, Second Use Building Materials, Inc. (Telephone conversation September 12, 2012).

<sup>5</sup> R. Weber, S. Kaplan, and H. Sokol’s 2009 Market Analysis of Construction and Demolition Material Reuse in the Chicago Region ([www.uic.edu/depts/ovcr/iesp/research/deltareport.pdf](http://www.uic.edu/depts/ovcr/iesp/research/deltareport.pdf)).

<sup>6</sup> Delta Institute. *Cook County Deconstruction Strategy Report: Market Analysis of Construction and Demolition Material Reuse in Suburban Cook County*, July 11, 2011.

<sup>7</sup> Anne Nicklin, Executive Director, Building Materials Reuse Association (Telephone conversation August 6, 2012).

salvage materials and other finished products. They generally are much smaller than reuse centers (in terms of square footage of retail space). They are more selective and eclectic in procuring inventory, looking for higher-value items, such as used furniture and antique fixtures, and typically are not interested in bulk materials. There are far more reuse stores than reuse centers, but they handle a smaller percentage of overall C&D materials than centers.<sup>8</sup> An antique shop that deals in salvaged furniture, architectural features, and/or fixtures could be considered a reuse store. Some thrift shops could also meet this definition.

In reaching out to individual building material reuse operations for this study, the contractor focused on reuse centers as they manage the largest volume of C&D materials. The contractor's initial research also identified several reuse centers actively tracking their inventory and the contractor assumed they would be the best sources for data useful for developing a methodology for estimating annual C&D materials reuse.

#### **1.4 Estimates of the Number of Reuse Centers and Stores in the United States**

Estimating the number of building materials reuse centers and stores in the United States is difficult. One reason for this difficulty is the problem of defining what exactly qualifies as a reuse center or store as discussed above. With no clear industry accepted definition, counting facilities proves troublesome.

Another detail making it difficult to estimate the number is the lack of North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes for reuse centers and stores. Currently most reuse centers and stores would likely fall under the "Retail" NAICS code while deconstruction activities would likely be classified as "Waste Management." The Building Materials Reuse Association (BMRA) has begun the petitioning process with the U.S. Department of Labor for the creation of a separate C&D reuse NAICS code. According to Anne Nicklin of BMRA, this can be a long process and requires an industry to demonstrate a need for a new code by self reporting for a period of time.<sup>9</sup>

The BMRA reports having approximately 1,500 used material sales outlets included in its online directory. This directory, however, includes in addition to reuse centers and stores, deconstruction companies, companies that develop new products from recovered C&D materials, designers, architects, and researchers — in other words, more than just sites that accept and sell reused building materials. BMRA created this directory 10 years ago through an active effort by BMRA staff to identify all reuse centers and stores in the United States. Since then, businesses have been added when they contact BMRA and ask to be included or when BMRA identifies a business through other day-to-day projects (i.e., BMRA is not actively updating the database on

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<sup>8</sup> Anne Nicklin, Executive Director, Building Materials Reuse Association (Telephone conversation August 6, 2012).

<sup>9</sup> Anne Nicklin, Executive Director, Building Materials Reuse Association (Telephone conversation August 6, 2012).

a regular schedule—but it would be very interested in doing this if a funding source became available).

According to the Habitat for Humanity website, there are 825 Habitat ReStores in North America. Of these 825, 763 are located in the United States and 62 are located in Canada.<sup>10</sup> While this obviously does not include all of the other local centers and stores, it does represent the largest (and only) national chain of reuse stores in the United States. An educated guess that there are approximately 1,000 reuse centers and stores nationwide by one of the reuse center managers the contractor spoke with is the only other estimate the contractor was able to obtain.<sup>11</sup>

Although not as extensive as BMRA's, several other national associations have member databases or directories of reuses centers and stores. They might, however, have a focus greater than just reuse centers (e.g., C&D recyclers or haulers), or be limited to specific geographic regions. As examples:

- The National Institute of Building Sciences' Construction Waste Management Database ([www.wbdg.org/tools/cwm.php](http://www.wbdg.org/tools/cwm.php)) contains information on companies that haul, collect, and process recyclable debris from construction projects. This includes approximately 100 companies that process salvaged/surplus materials for reuse nationwide, but also includes companies that collect/haul recyclables. This database is generally more focused on the waste management aspect of C&D materials, rather than strictly reuse.
- The Reuse Development Organization (ReDo) provides an online directory of reuse stores ([loadingdock.org/reto/Search/index.html](http://loadingdock.org/reto/Search/index.html)) that contains more than 100 reuse centers, but only covers 37 states and Washington D.C.
- The Southern Waste Information eXchange, Inc. database (<http://swix.ws/resources/Building-Material-Reuse-Centers/>) lists 68 reuse centers in the Southeastern U.S. (North Carolina, South Carolina, Florida, Alabama, Louisiana, Illinois, Tennessee, Georgia, Arkansas, and Pennsylvania).
- Several state and local environmental agencies have local directories as well, such as the Connecticut DEP whose *Building Material Reuse Centers within Connecticut* lists 11 reuse centers in Connecticut and 3 others in neighboring states<sup>12</sup> and the Recycling & Waste Reduction Commission of Santa Clara

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<sup>10</sup> Habitat for Humanity's ReStores ([www.habitat.org/restores](http://www.habitat.org/restores)).

<sup>11</sup> John Majercak, EcoBuilding Bargains/Center for Ecological Technology (Telephone conversation August 31, 2012).

<sup>12</sup> Connecticut DEP. Building Material Reuse Centers within Connecticut. ([http://www.ct.gov/deep/lib/deep/reduce\\_reuse\\_recycle/brochures/building\\_materials\\_reuse\\_centers\\_mrn\\_brochure.pdf](http://www.ct.gov/deep/lib/deep/reduce_reuse_recycle/brochures/building_materials_reuse_centers_mrn_brochure.pdf).)

County which lists 10 C&D material reuse and recycling firms located in the county.<sup>13</sup>

Based upon the limited information available, the contractor's best estimate is that there are between 1,000 and 1,500 reuse centers in the United States.

## **1.5 Inventory Tracking by Reuse Centers**

While all reuse centers and stores are required to track their revenue from sales for state and local sales tax, business tax, and auditing purposes; the vast majority of reuse centers and stores do not track their inventory. One reason for this is that often there are no accounting requirements to put a value on inventory. As donated and salvaged items often are valued at \$0 until sold, accounting requirements for retailers to record and track inventory are deemed not to apply. Without this requirement, many reuse centers and stores simply take in donated materials and sell them without ever recording the type, amount, or value of these items.<sup>14</sup>

There are a few reuse centers that do track their inventories closely and use this information to generate estimates of tons of materials diverted and other environmental benefits. These centers maintain computerized inventory systems that track materials by product category or type, such as doors, windows, cabinets, sinks, and bath tubs. These items are simply counted and entered into the inventory system, typically no effort is made to weigh individual items. Other materials such as dimensional lumber, bricks, flooring are likely entered in terms of volume, area, or board feet.<sup>15</sup> Below are descriptions of three reuse centers that closely track their inventory.

### **1.5.1 *Second Use Building Materials***

*Second Use Building Materials, Inc.* (Second Use) in Seattle, Washington, uses a self-made FileMaker Pro information-management system for tracking of inventory, salvage jobs, contacts, and sales information. This system continues to evolve with constant changes and revisions to meet their business needs. As materials come into the center, every item with a value greater than \$10 is entered into the system and tied to a salvage job and supplier. Items valued at less than \$10 are entered as well, but under an "other" or "bulk" category and no sale data are recorded. As is typical of most reuse centers, Second Use does not weigh incoming or outgoing materials. Second Use also records the amount paid for the item, the supplier, and the specific job site from which it was derived. When the item is sold, its sale price is recorded. Recording and tracking this level of detail allows Second Use to closely track materials as they pass through

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<sup>13</sup> Recycling & Waste Reduction Commission of Santa Clara County ([www.sccgov.org/sites/iwm/Business/Pages/Directory-of-Construction-and-Demolition-Material-Reuse-and-Recycling-Firms.aspx](http://www.sccgov.org/sites/iwm/Business/Pages/Directory-of-Construction-and-Demolition-Material-Reuse-and-Recycling-Firms.aspx)).

<sup>14</sup> John Majercak, EcoBuilding Bargains/Center for Ecological Technology (Telephone conversation August 31, 2012).

<sup>15</sup> Thomas R. Napier, Research Architect / Principal Investigator, U.S. Army Corps of Engineers, Construction Engineering Research Laboratory/ Building Materials Reuse Association (Telephone conversation July 31, 2012).

its center and tie it to a specific supplier and job site. Second Use uses this system to determine which items move quickly and which remain on site for long periods of time. They also use it to identify good and problematic suppliers and specific jobs.<sup>16</sup>

Another use of this inventory tracking system is in preparing the annual recycling reports required by the State of Washington and city of Seattle. Unfortunately, Washington and Seattle do not distinguish between “recycling” and “reuse” in these reports so even though nearly all of Second Use’s reported data are for reused materials, it is categorized as “recycling.” The metric used for these reports are tons of material. Since Second Use tracks its inventory by item type, not weight, it makes assumptions about average weights of the different types of items and multiplies this by the number of each item sold that year to generate tonnage estimates for reports. Second Use has found that some materials reused in large quantities are relatively uniform and easy to make assumption about (e.g., doors, appliances, board feet of lumber). For other materials, this is more difficult due to variations in size, shape, and composition (e.g., fencing, trim, cabinets). For these materials Second Use makes a best estimate.

Second Use does not use the “tons diverted from the landfill” by the center for marketing or promotional purposes. Occasionally, it will use its data to provide suppliers with statistics on the tons diverted by a specific job and also the embodied energy and carbon saved by reusing those materials (given as an equivalent of some amount of fuel, e.g., xxx gallons of gasoline). For these estimates Second Use relies on the University of Bath’s Sustainable Energy Research Team’s (SERT) Inventory of Carbon & Energy (ICE) database to help make the calculations.<sup>17</sup>

### ***1.5.2 EcoBuilding Bargains***

*EcoBuilding Bargains* in Springfield, Massachusetts uses a Microsoft Retail Management System to track its sales. With this system, they track materials as they are sold (by product type or category), but do not necessarily track inventory as it comes into the center. With this system they can generate data on the numbers of items sold by type. To estimate the total weight of materials sold and diverted from the landfill, *EcoBuilding Bargains* developed a rough estimation method of converting sales by product type into weights using average item weights (see Figure 1). Through this approach, *EcoBuilding Bargains* estimates that, on average, it diverts between 10 and 20 tons of C&D building materials per month.<sup>18</sup>

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<sup>16</sup> Dirk Wassink, Second Use Building Materials, Inc. (Telephone conversation September 12, 2012).

<sup>17</sup> Dirk Wassink, Second Use Building Materials, Inc. (Telephone conversation September 12, 2012).

<sup>18</sup> John Majercak, *EcoBuilding Bargains/Center for Ecological Technology* (Telephone conversation August 31, 2012).

<b>Environmental Impact - August 2012</b>			
<b>Department</b>	<b>Average Weight</b>	<b>Quantity</b>	<b>Total Weight Kept Out of Landfills (lbs)</b>
Appliances	60	21	1,260
Bathroom sinks	25	38	950
Building Materials	20	2045	40,900
Cabinet Sets	500	5	2,500
Cabinets	50	87	4,350
Doors	35	174	6,090
Electrical	5	168	840
Flooring	3	687	2,061
Furniture	20	71	1,420
Hardware	1	374	374
Kitchen Sinks	20	10	200
Lighting	30	405	12,150
Lumber	1	3410	3,410
Plumbing	5	155	775
Paint	20	72	1,440
Recycling	0.3	795	238.5
Siding/Decking/Roofing	50	3	150
Tools	12	40	480
Windows	30	107	3,210
<b>Total Weight of Materials Kept Out of Landfills (in Tons)</b> <b>(1 ton = 2,000 lbs)</b>			<b>41.40</b>

**Figure 1. Example of Average Weight Values and Monthly Diversion Estimates**

EcoBuilding Bargains operates its own fleet of trucks to pickup materials, but it also accepts drop-off donations. Homeowners provide about half the number of donation events, but contractors provide the majority of materials. EcoBuilding Bargains has considered weighing incoming truckloads, but do not have a truck scale on site at this time and access to off-site scales is cost-prohibitive.

EcoBuilding Bargains has a fulltime “sales person” that actively seeks out materials. He calls contractors, visits job sites, and speaks with retailers to identify new construction jobs as sources for new materials. They also advertise using direct mailings to contractors, web advertising, social media outlets (e.g., Facebook, Twitter), and traditional media (newspapers, radio, television).

EcoBuilding Bargains tries to turn over its entire inventory at least once annually. New surplus items tend to move faster than used items. Also, low-value used items tend to sit longer

than more expensive items. While both high- and low-value items all are priced at 1/3 retail price, customers are attracted to the greater absolute dollar savings for higher priced items. For the low-value items, absolute savings are not great enough to encourage customers to buy the used item. Essentially, when the new item is cheap, people tend to just buy it new. Items that do not sell are marked down several times and eventually put in the Free Area for giveaway. Some unsold items eventually are recycled (e.g., aluminum sinks).

### ***1.5.3 ReBuilding Exchange***

*The ReBuilding Exchange* in Chicago currently tracks material sales through its point-of-sales software. At the time of sale, items are entered into the system by item type or category. In the past they tried entering incoming inventory but this proved too difficult. It also has a working relationship with a deconstruction service to provide salvaged materials. This deconstruction service weighs C&D materials generated on site and is able to provide the weights of the materials it sends to ReBuilding Exchange. Through this relationship ReBuilding Exchange has been able to generate accurate data on the weights of a portion of the reused materials it sells. The remainder of its inventory comes from three-times-a-week pickups it makes and drop-off donations. No weight data are available for these materials. ReBuilding Exchange has considered installing a scale, but has no immediate plans to do so. To estimate the weights of these materials when sold, ReBuilding Exchange uses average item weights generated through a weight study by Planet Reuse. Planet Reuse measured weights of materials in a reuse warehouse in Kansas City and used this data to create average weight tables for common C&D building materials. ReBuilding Exchange plans to enter Planet Reuse's average weights into its point-of-sales system to be able to quickly generate tons diverted estimates. At this time it calculates diversion estimates by hand. On its website, ReBuilding Exchange claims to have "diverted more than 5,000 tons of building material from the landfill since 2009, making over \$2 million worth of quality reclaimed building materials available to the public for sustainable reuse." According to Elise Zelechowski, this estimate is based upon the actual measurements provided by ReBuilding Exchange's deconstruction service partner and estimates of pickup and drop off materials sold using the average weight table.<sup>19</sup>

### ***1.5.4 Community Forklift***

*Community Forklift* in Edmonston, Maryland, is currently working with a local college professor on developing a methodology for estimating C&D building materials inventories and weights based upon sales revenue. The contractor attempted to contact Community Forklift to discuss this methodology; at this time methodology details are not available.

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<sup>19</sup> Elise Zelechowski, ReBuilding Exchange in Chicago. (Telephone conversation September 13, 2012).

### **1.5.5 Other Reuse Centers**

Several other reuse centers were identified as maintaining good inventories, but were not contacted at this point due to time and budgetary restrictions. These include:

- The Habitat for Humanity ReStore in Austin, Texas
- The Habitat for Humanity ReStore in Wake County, North Carolina
- The Habitat for Humanity ReStore in Charlottesville, Virginia
- The Habitat for Humanity ReStore in Fayetteville, North Carolina
- Build it Green! NYC in Brooklyn, New York

Whether a reuse center is operated as a not-for-profit or for-profit business does not seem to influence whether it tracks its inventory or not. For both types of operations, there are incentives for inventory tracking. For the non-profit operations, measuring amounts of waste diverted from the landfill, jobs created, impact on local economy, and other environmental benefits are measurements they can use to demonstrate their positive environmental impacts. For-profit operations can be interested in these same measurements for use in advertising and promoting their business. They also use inventory flow information to assess markets for materials and improve operations. In addition, in some states and municipalities, recycling and waste management reporting requirements make tracking necessary.

## **2. EXISTING STUDIES ON C&D BUILDING MATERIALS**

The contractor reviewed the following existing reports on C&D building materials. A summary of the relevant information and data garnered from each of these reports is included in Appendix B.

*Market Analysis of Construction and Demolition Material Reuse in the Chicago Region.* R. Weber, S. Kaplan, and H. Sokol, 2009.

(<http://www.uic.edu/depts/ovcr/iesp/research/deltareport.pdf>)

The goal of this report was to analyze the market for C&D material reuse in the Chicago area to determine whether one or more reuse stores could be supported in the region. The report concluded that the market for used building material in the Chicago region exists but is currently undeveloped. The data collected for this report included information on the size and location of C&D materials supply in the Chicago area, existing demand for C&D materials, estimating of the potential demand for a reuse facility, and market barriers to building deconstruction and material reuse.

*Cook County Deconstruction Strategy Report: Market Analysis of Construction and Demolition Material Reuse in Suburban Cook County*, July 11, 2011. Prepared by the Delta Institute. ([blog.cookcountyil.gov/sustainability/cook-county-deconstruction-strategy-report/](http://blog.cookcountyil.gov/sustainability/cook-county-deconstruction-strategy-report/))

This report attempts to capture the potential market and economic development opportunities for deconstruction and C&D reuse activities in Cook County Illinois. It includes

information from audits of deconstruction projects in Cook County. Data generated by these audits include weights of total C&D generated, weights of reusable and recyclable materials, and weights of materials bound for disposal. The study concludes with key recommendations for promoting the widespread adoption of deconstruction and materials reuse in Cook County.

*A New Decade of Growth for Remodeling*, The Joint Center for Housing Studies of Harvard University, January 13, 2011. ([www.jchs.harvard.edu/research/publications/new-decade-growth-remodeling](http://www.jchs.harvard.edu/research/publications/new-decade-growth-remodeling))

This report looks at and predicts residential remodeling spending. It provides data and analysis of homeowner improvement expenditures from 1995 through 2009. The report also provides 2009 data on homeowner replacement projects and provides projected home improvement expenditures for 2010–15. The report concludes that as the economy and the housing market return to more normal conditions over the next five years, so too will homeowner improvement spending.

*Estimating 2003 Building-Related Construction and Demolition Materials Amounts*, U.S. EPA March 2009. ([www.epa.gov/osw/conserva/imr/cdm/pubs/cd-meas.pdf](http://www.epa.gov/osw/conserva/imr/cdm/pubs/cd-meas.pdf))

Appendix B of this report contains an article that provides an update on trends in the deconstruction and reuse industry. It provides data from a 2006 BMRA survey of 450 deconstruction, reused materials retail sales, and value-added product manufacturing organizations on the number of employees, annual sales revenues, and the average amount of materials handled annually.

*U.S. EPA. Characterization of Building-Related Construction and Demolition Debris in the United States. Draft Report.* February 16, 2007.

This report provides a discussion of deconstruction and its role in C&D materials recycling and reuse. It provides information on the USDA Forest Service's directory of 420 companies that are involved in the deconstruction and reuse of materials from wood-framed structures. It concludes that deconstruction minimizes contamination of C&D materials and increases the potential for marketing reusable materials.

### **3. NATIONAL AND REGIONAL ORGANIZATIONS THAT PROMOTE C&D MATERIALS REUSE**

In performing this scoping study, the contractor began its research by examining the websites of national and regional organizations that promote the reuse of C&D building materials. Part of this research was to identify the organizations most likely to possess listings of reuse centers to help generate an estimate on the number of centers nationwide. The second part was to identify any groups actively collecting C&D building materials reuse data. Two of the organizations — the Building Materials Reuse Association and Habitat for Humanity — appeared to possess the type of information desired, prompting follow-up calls and discussions. Provided below is a list of the organizations investigated. A summary of the information and data available from each is included in Appendix C.

### 3.1 National Organizations

- The **Building Materials Reuse Association** ([www.bmra.org](http://www.bmra.org)) maintains an online directory of reuse stores with approximately 1,500 entries.
- **Habitat for Humanity** ([www.habitat.org/restores](http://www.habitat.org/restores)) operates a chain of 825 ReStores across North America. Of these, 763 Habitat ReStores are located in the United States and 62 in Canada.
- **Reuse Development Organization (ReDo)** ([loadingdock.org/redo/Search/index.html](http://loadingdock.org/redo/Search/index.html)) has an online reuse center directory that lists nearly 120 reuse centers and stores in 37 states and Washington DC.
- **National Institute of Building Sciences' Whole Building Design Guide** ([www.wbdg.org/tools/cwm.php](http://www.wbdg.org/tools/cwm.php)) is a web-based portal providing information on companies that haul, collect, and process recyclable debris from construction projects.
- **Reuse Alliance** ([www.reusealliance.org](http://www.reusealliance.org)) educates the public about the social, environmental and economic benefits of reuse.
- **American Builder Surplus** ([www.americanbuildersurplus.com](http://www.americanbuildersurplus.com)) is a national online building material surplus clearing house.
- **U.S. Green Building Council** ([www.usgbc.org](http://www.usgbc.org)) is dedicated to ensuring a prosperous and sustainable future through cost-efficient and energy-saving green buildings.
- **PlanetReuse** ([planetreuse.com/](http://planetreuse.com/)) is a consulting and brokering company that matches materials with designers, builders and owners to save projects money and serve LEED efforts. PlanetReuse has created C&D building materials average weight tables.

### 3.2 State and Regional Organizations

- The **Connecticut Department of Environmental Protection (DEP)** publishes *Building Material Reuse Centers within Connecticut* which lists 11 reuse centers located in Connecticut and 3 more located in neighboring states.
- The **Southern Waste Information eXchange, Inc.** provides a listing of 68 reuse centers in the southern United States (i.e., North Carolina, South Carolina, Florida, Alabama, Louisiana, Illinois, Tennessee, Georgia, Arkansas, and Pennsylvania).
- **Recycling & Waste Reduction Commission of Santa Clara County** maintains an online and printable *Directory of Construction and Demolition Material Reuse and Recycling Firms* in Santa Clara County.

#### 4. CONCLUSIONS

The primary difference between the C&D building materials reuse industry and the C&D recycling industry is that the building materials reuse industry deals primarily in finished items and products, not in commodities. Reuse centers and stores do not track the mass of materials passing through their facilities. Many in fact do not maintain product inventories at all. Those that do track inventories and/or sales mostly do so on an item or product count basis. The contractor has identified two potential methods for measuring C&D diversion through reuse. Also included in this section are industry opinions on the reuse market and support for EPA's efforts to measure diversion through reuse.

The most common approach being employed for estimating C&D materials diverted from the landfill is the use of counts of items sold and average material weights. Only one reuse center reported using direct measurement, and that was only for the portion of materials supplied to it by its partner deconstruction service which weighed materials as generated on the job site. The advantage of the items sold/average weight approach is that it uses readily available and easily tracked sales data and several organizations have developed average weight values and tables. An effort to identify, collect and combine the existing average weight values could lead to the development of a universal set of values that could be a first step towards developing an industry standard.

A second possible approach would be to use center/store square footage and revenue figures to develop a sales per square foot rate. In discussing this approach with several reuse experts, most felt that it was equally as valid as the items sold/average weight approach. Similar to the items sold/average weight approach, a number of assumptions would have to be made and defended. One factor to consider in the square footage approach is store inventory turnover. For reuse centers, inventory turnover is much lower than that of retailers of new goods. Reuse centers on average completely turnover their inventory one to three times per year.<sup>20</sup> Another confounding factor is differences in how efficiently facilities use their floor space. Some reuse centers use their space very efficiently having clear uncluttered aisles that allow buyers to access all materials. Other less organized stores can have portions of their floor space so over packed that inventory is blocked off and inaccessible to buyers, and in extreme cases, materials can get damaged, lost, or forgotten altogether. These lead to loss of revenue and influence the space to revenue ratios.

Another factor that would need to be addressed is price uniformity across the nation. In setting product prices, EcoBuilding Bargains follows the widespread industry standard pricing rule-of-thumb which is to sell items for 1/3 of retail price of a new item. When asked about geographical price variation, Mr. Majercak responded that, in his experience, prices for run-of-the-mill items seem to be fairly uniform within a region. He was unable to comment on price variations across the country though. Drastic regional price variations also could affect space to revenue rates and would need to be accounted for. Another aspect of price differences is that

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<sup>20</sup> John Majercak, EcoBuilding Bargains/Center for Ecological Technology (Telephone conversation August 31, 2012).

item prices can vary widely depending upon quality of product, rarity, or other characteristics. While the average sink sells for \$50, for example, some can sell for as little as \$5 while other high-end sinks can sell for \$300. If a center or a methodology were to use item average prices to generate revenue data, then this could cause a distortion in the final calculation. With large enough data sets, however, you could assume that the outliers will be averaged out.

It is the contractor's opinion that the larger number of assumptions (and therefore increased uncertainty) in the center/store square footage method, makes that approach less favorable than the items sold/average weight approach. The existence of several average weight data sets and the prevalence of reuse centers tracking inventory by item counts, leads the contractor to believe that the items sold/average weight approach is a simpler and more accurate approach given the available data. The fact that several organizations are using this approach lends further support to this conclusion.

Overall, the percentage of C&D materials currently being reused is extremely small, and when compared to amount of C&D materials recycled, can seem insignificant. Best estimates place C&D reuse at less than 1 percent of total C&D generation. While the industry experts the contractor spoke to acknowledged that the amount of building materials being reused is quite small, they all agreed the potential for growth is significant; however, for industry-wide growth the market demand for reused materials would need to expand to foster that growth.

A market expansion idea expressed by several individuals is the calculation and presentation of environmental benefits beyond the simple tonnage measurement. In many cases, the simple tonnage measurement does not adequately capture the true value of C&D materials reuse. The real value of reuse is in preserving the embodied energy and carbon of items.

As an example, a door might be painted, contain metal, glass, and other material components, and therefore would not likely be recycled through chipping for mulch or composting. It would most likely be disposed through combustion or landfilling. The embodied energy and carbon in this 35 pound door, however, is much greater than a comparable 35 pounds of concrete aggregate. Consequently, using embodied energy and carbon metrics, reusing a door has a much greater environmental benefit than recycling a comparable weight of concrete. Presenting the benefits of C&D reuse in this light puts it on a more even and favorable playing field when comparing it to C&D recycling.

From this initial scoping study of the C&D reuse industry, the contractor found that industry representatives are very willing to participate in future data gathering efforts including the national reuse association BMRA. The contractor also believes that many reuse centers and stores would be willing to participate in studies or respond to questionnaires on inventory tracking and estimating diversion rates. The primary driver at the store level would be using the data to document the environmental benefits of their operations. Potential facility and operations data might include revenue generated from sales, number of items sold, facility square footage, and number of employees.

The industry experts the contractor spoke with were supportive of EPA's effort to include C&D materials in its annual characterization study and to capture the value of the C&D reuse industry diversion efforts.

### **Appendix A. Types of Materials Handled at Reuse Centers and Stores**

Appliances	Landscaping & Fencing
Architectural Salvage/Details (columns, fireplace mantels, moulding)	Light Fixtures
Bathroom fixtures (toilets, tubs, sinks)	Linoleum/Vinyl Flooring
Bricks	Lumber/Dimensional Lumber
Cabinets	Paint
Carpet Tiles	Plumbing
Cast Iron Sinks	Radiators
Cast Iron Tubs	Reclaimed Lumber from used wood designers and manufacturers
Ceramic Tile	Roofing & Moisture Protection
Countertops	Salvage Arts
Doors	Shelf Boards
Electrical	Shutters & Window Treatments
Fencing (wood/metal)	Sinks
Furnishings/ Furniture	Stone
Glass & Mirrors	Toilets
Granite & Marble	Tool Department
Hardware	Trim
HVAC	Wallpaper
Kitchen Cabinets & Sets	Windows
Knotty Pine Paneling	Wood Flooring

## Appendix B. Existing Studies

The contractor reviewed the following existing reports on C&D building materials. Provided below are summaries of the relevant data garnered from these reports.

***Market Analysis of Construction and Demolition Material Reuse in the Chicago Region.*** R. Weber, S. Kaplan, and H. Sokol, 2009.  
(<http://www.uic.edu/depts/ovcr/iesp/research/deltareport.pdf>)

This report was commissioned by the Delta Institute and funded through a grant from the Illinois Department of Commerce and Economic Opportunity. The goal of this report was to analyze the market for C&D material reuse in the Chicago area to determine whether one or more reuse stores could be supported in the region. Weber et al. used permit data and “widely accepted conversion algorithms” to estimate the total residential C&D materials generated in Chicago in 2007. In their analysis, they found that a small share of the total C&D waste stream is reused in the Chicago area — estimated at “far below 10 percent.” In this report, Weber et al. also cites another estimate that puts deconstruction and reuse diversion rate at 0.2 percent of total waste stream.

Weber et al. also surveyed several reuse stores across the country to compare the volumes of materials handle by stores of different sizes. As part of this report, they presented the Kansas City Habitat for Humanity ReStore as a case study, presenting the following information:

- In 2007, it handled inventory valued at approximately \$1.7 million and generated approximately \$1.6 million in sales.
- Sales consisted of:

— 19% Lumber	— 11% Doors
— 13% Tile Brick	— 10% Cabinets
— 13% Windows	— 34% Other Materials
- These sales diverted an estimated 2,609 tons of C&D materials from the landfill.
- Materials were supplied by:

— More than 50% from drop offs by homeowners and contractors;
— 36% collected off-site; and/or
— 11% from its deconstruction service.

***Cook County Deconstruction Strategy Report: Market Analysis of Construction and Demolition Material Reuse in Suburban Cook County,*** July 11, 2011. Prepared by the Delta Institute. ([blog.cookcountyil.gov/sustainability/cook-county-deconstruction-strategy-report/](http://blog.cookcountyil.gov/sustainability/cook-county-deconstruction-strategy-report/))

This report attempts to capture the potential market and economic development opportunities for deconstruction and C&D reuse activities in Cook County Illinois. It includes information from audits of deconstruction projects in Cook County. Data generated by these audits include weights of total C&D generated, and weights of reusable and recyclable materials and those bound for disposal. The report cites that approximately 13 percent of the building material generated in deconstruction was reusable. The study also identified 22 existing reuse and salvage centers in Cook County.

***A New Decade of Growth for Remodeling***, The Joint Center for Housing Studies of Harvard University, January 13, 2011. ([www.jchs.harvard.edu/research/publications/new-decade-growth-remodeling](http://www.jchs.harvard.edu/research/publications/new-decade-growth-remodeling))

This report looks at and predicts residential remodeling spending. It provides data and analysis of homeowner improvement expenditures from 1995 through 2009. This report also provides 2009 data on homeowner replacement projects, including: door/window; floor/paneling/ceiling; insulation; siding; roofing; electrical; plumbing; kitchen; bath...etc. For each category, the report provides the total number of replacement projects reported, average expenditure per job, and total annual expenditure for these projects. It also lists other "Property Additions and Replacements," (e.g., sheds, porches, patios, fences, garages; driveways). The report also provides projected home improvement expenditures for 2010–15.

**U.S. EPA. *Estimating 2003 Building-Related Construction and Demolition Materials Amounts*** EPA530-R-09-002 pp. B8-B12. March 2009. ([www.epa.gov/osw/conserves/imr/cdm/pubs/cd-meas.pdf](http://www.epa.gov/osw/conserves/imr/cdm/pubs/cd-meas.pdf))

Appendix B of this report contains an article attributed to Brad Guy and dated November 6, 2006 which reports the following:

- In 2006 BMRA sent an email survey to 450 organizations identified as deconstruction services, reused materials retail sales, and value-added product manufacturers using reclaimed wood. It received 76 responses (approximately 17 percent return rate)—41 retail only reuse stores, 28 reuse stores with their own deconstruction services, and 7 wood reuse/remanufacturing companies. Of the reuse only stores, 59 percent reported conducting some form of active salvage operations, while the remaining 41 percent relied on donation only.
- The majority of reuse stores do not employ a large number of full-time employees. More than 85 percent (approximately 88 percent) of the survey respondents reported less than 15 full-time employees. Many of the non-profit reuse stores rely on volunteer staff to meet a significant portion of their labor needs. Companies with their own deconstruction services tend to have a greater number of full-time employees than the retail only companies.
- Deconstruction Services are used by many reuse centers to ensure a steady stream of high-quality inventory. Some Centers operate their own deconstruction services

while others have formal or informal relationships with independent deconstruction contractors.

- Reuse stores with their own deconstruction services reported slightly greater average annual revenues than the retail only stores (\$430,796 vs. \$383,849). Many stores provide deconstruction services to increase and improve the quality of used materials they receive. These stores tend to have a greater number of employees.
- The reported average amount of material handled annually by stores with deconstruction services was 1,011,286 pounds. Retail-only reuse stores averaged 583,376 pounds annually. Most of the respondents, however, did not know the mass of materials handled annually and they only tracked revenue generated from sales. Of the retail-only stores, 69 percent did not know the mass of materials handled, and only tracked revenue, while 61 percent of the stores with deconstruction services likewise only tracked revenue.

If these survey results are extrapolated to BMRA’s entire membership and C&D materials sales outlets in its database (approximately 1,500 organizations), then an estimated 200,000 tons of C&D materials are reused in the U.S annually.

Some statistics from the study:

	FTE	Average Annual Revenue	Revenue/ FTE	Pounds of Materials (Annually)	Revenue/ Pound
Combine Retail and Deconstruction	5.8	\$430,796	\$73,900	1,011,286	\$1.39
Retail Only	4.6	\$383,849	\$96,516	583,376	\$0.91

**U.S. EPA. *Characterization of Building-Related Construction and Demolition Debris in the United States. Draft Report.*** Contract 68-W-02-036, Work Assignments 3-06 and 4-12. February 16, 2007.

This report provides a discussion of deconstruction and its role in C&D materials recycling and reuse. It includes information on the USDA Forest Service’s directory of companies that are involved in the deconstruction and reuse of materials from wood-framed buildings. It includes a table which shows 420 companies listed by state in the following four business activity categories:

- Companies that broker recovered materials;
- Companies that use reclaimed materials;
- Deconstruction companies that practice partial or whole building disassembly for the purpose of recovering building materials; and

- Demolition companies that engage in selective dismantling and deconstruction of buildings.

Deconstruction companies (192) and demolition companies (148) account for more than 80 percent of the total number of companies. California is listed as having the most companies: 55 out of the 420 or 13 percent. New York is shown with 23 companies, Florida with 22, Ohio and Pennsylvania with 20 each, and Texas is listed with 18 companies. These five states account for another 25 percent of the total.

## Appendix C. National and Regional Organizations That Promote C&D Materials Reuse

The information and data available from each of the organizations investigated are summarized below.

### National Organizations

- The **Building Materials Reuse Association** ([www.bmra.org](http://www.bmra.org)) is a 501(c)3 non-profit educational and research organization whose mission is to facilitate building deconstruction and the reuse and recycling of recovered building materials. It produces information on deconstruction techniques and information on how to start and run a successful deconstruction or reuse business. Its members convene annually at its Annual Members Meeting and at its biennial Decon conferences to transfer this knowledge among contractors, government representatives, and researchers. It maintains its Directory of Reuse Stores: (<http://www.bmra.org/reuse-stores>) that includes reuse stores/centers, deconstruction companies, companies that develop new products from recovered C&D materials, designers, architects, and researchers — i.e., more than just reuse centers. BMRA says there are approximately 1,500 used material sales outlets included in its database. The directory included BMRA members and non-members.
- **Habitat for Humanity**—a nonprofit, ecumenical Christian ministry that uses volunteers to build simple, decent, and affordable homes for low-income families around the world— operates a chain of 825 ReStores ([www.habitat.org/restores](http://www.habitat.org/restores)) across North America. Of these, 763 Habitat ReStores are located in the United States and 62 in Canada. ReStores are retail outlets for donated and reclaimed building materials operated by Habitat for Humanity affiliates as a fundraising mechanism for their local home-building programs. They focus on home improvement goods like furniture, home accessories, building materials, and appliances. ReStores are independently run by the local Habitat affiliates; they are not centrally managed or controlled by Habitat International. ReStores accept new and used building materials and other items in good usable condition and sells these items at 50 to 75 percent of retail. ReStores in the U.S. generated \$80 million in revenue from July 1, 2010 through June 30, 2011. In 2010, each ReStore in Canada produced an average of \$195,000 in revenue for its affiliate.
- **Reuse Development Organization (ReDo)** is a 501(c) (3) non-profit organization promoting reuse on every level. Its online Find a Reuse Center directory ([loadingdock.org/redo/Search/index.html](http://loadingdock.org/redo/Search/index.html)) lists nearly 120 reuse centers and stores in 37 states and Washington DC.
- **National Institute of Building Sciences' Whole Building Design Guide** is a web-based portal providing government and industry practitioners with one-stop access to up-to-date information on a wide range of building-related guidance,

criteria and technology from a 'whole buildings' perspective. The site is divided into three major categories—Design Guidance, Project Management, and Operations & Maintenance. Its **Construction Waste Management Database** ([www.wbdg.org/tools/cwm.php](http://www.wbdg.org/tools/cwm.php)) contains information on companies that haul, collect, and process recyclable debris from construction projects. The Database lists approximately 100 companies that process salvaged/surplus materials for reuse nationwide, but also includes companies that collect/haul recyclables. The organization is more focused on all aspects of building materials waste management, rather than strictly on reuse.

- **Reuse Alliance** ([www.reusealliance.org](http://www.reusealliance.org)) is a national 501(c) 3 nonprofit organization working to increase awareness of reuse by educating the public about its social, environmental and economic benefits. Its emphasis is on the communication/outreach/educational focus aspects of reuse and it focuses on more than just building materials, promoting the reuse of clothes, furniture, electronics, and other durable goods.
- **American Builder Surplus** ([www.americanbuildersurplus.com](http://www.americanbuildersurplus.com)) is a national online building material surplus clearing house. Its website provides extensive listings of products creating “an on-line trading community of reusable and sustainable building materials for construction professionals. ... [that] uses sixteen standard construction divisions to identify and to locate posted products.” It includes an extensive list of service providers, but does not appear to track the flow of materials in any way and does not present any reuse data or statistics.
- **U.S. Green Building Council** ([www.usgbc.org](http://www.usgbc.org)) is a 501(c) 3 nonprofit organization dedicated to ensuring a prosperous and sustainable future through cost-efficient and energy-saving green buildings. Its mission encompasses much more than promoting building materials reuse (though that is something it advocates) and does not present any C&D materials reuse data.
- **PlanetReuse** ([planetreuse.com/](http://planetreuse.com/)) initially an internet-based material brokerage, has evolved into a consulting and brokering company that matches materials with designers, builders, and owners to save projects money; serve LEED efforts; and sustain the planet. In partnership with a Kansas City reuse center, PlanetReuse performed a C&D materials weight study that measured weights of materials and used this data to create C&D building materials average weight tables. As a spin-off endeavor, PlanetReuse founders developed **InvenQuery** ([www.invenquery.com/](http://www.invenquery.com/)) a technology platform that integrates inventory management, point-of-sale, and state of the art and e-commerce applications. It is marketed as an inventory management system “geared towards retailers' of unique items.”

## State and Regional Organizations

- The **Connecticut Department of Environmental Protection (DEP)** publishes *Building Material Reuse Centers within Connecticut* which lists 11 reuse centers located in Connecticut and 3 more located in neighboring states. ([www.ct.gov/deep/lib/deep/reduce\\_reuse\\_recycle/brochures/building\\_materials\\_reuse\\_centers\\_mrn\\_brochure.pdf](http://www.ct.gov/deep/lib/deep/reduce_reuse_recycle/brochures/building_materials_reuse_centers_mrn_brochure.pdf))
- The **Southern Waste Information eXchange, Inc.** is a regional non-profit clearinghouse and repository for businesses and government agencies looking for information regarding recycled products, availability of and demand for waste materials, waste management services and products, solid and hazardous waste management, and other waste-related resources. It provides a listing of 68 reuse centers in the southern United States (i.e., North Carolina, South Carolina, Florida, Alabama, Louisiana, Illinois, Tennessee, Georgia, Arkansas, and Pennsylvania). ([swix.ws/resources/Building-Material-Reuse-Centers/](http://swix.ws/resources/Building-Material-Reuse-Centers/))
- **Recycling & Waste Reduction Commission of Santa Clara County** maintains an online and printable *Directory of Construction and Demolition Material Reuse and Recycling Firms* in Santa Clara County. Of the more than 70 companies listed, 10 of the organizations listed accept and manage salvage and reusable building materials. The rest are recycling operations. ([www.sccgov.org/sites/iwm/Business/Pages/Directory-of-Construction-and-Demolition-Material-Reuse-and-Recycling-Firms.aspx](http://www.sccgov.org/sites/iwm/Business/Pages/Directory-of-Construction-and-Demolition-Material-Reuse-and-Recycling-Firms.aspx))