



# *DEMYSTIFYING POTENTIAL MIDWESTERN BUILDING MATERIAL MARKETS*

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This report was made possible through a cooperative agreement with the Environmental Protection Agency in accordance with the Resource Conservation and Recovery Act to provide data, information and technical assistance to local governments on the management and recovery of construction and demolition materials.

## Executive Summary

Construction and demolition (C&D) waste comprises a significant portion of the waste stream in the Upper Midwest. C&D material represents economic opportunity when it is able to enter the market as raw material, and the Environmental Protection Agency (EPA) has determined that recycling C&D material generates creates more jobs, wages, and taxes than any other material stream.<sup>1</sup> Greater clarity about the amount and type of C&D materials going to landfills can inspire a dialog about material management that could ultimately inform policy and programming resulting in environmental and economic benefits for Region 5.

With support from the EPA, Delta Institute, in collaboration with the Building Material Reuse Association, has worked to identify end markets for reusable and recyclable building materials in the Upper Midwest (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin); provide an estimate of the volume of material that can be managed; and provide an estimate of economic opportunity afforded by the potential markets using economic indicators (e.g. jobs, wages). Demystifying building material end markets provides data to the private and public sector to enable those actors to decrease the disposal rate of reusable materials, and increases capacity of local and state governments to adopt policies encouraging building material reuse and recycling with the recognition of local economic benefits.

Currently, every state, county, and municipality in Region 5 appears to study, plan for, and manage their waste differently, especially with regard to construction and demolition debris. Lack of consistency in information collection presents both economic and environmental opportunity cost for the Upper Midwest. Political geographic boundaries and economic centers where C&D materials are generated and flow through often do not overlap. How states, counties, and municipalities respond to waste can provide opportunity for goods to travel and be reused.

This report looks specifically at lower-quality lumber, brick, concrete, gypsum wallboard, asphalt shingles, vinyl siding, and carpet. These materials typically remain in a structure after metals, architecturally interesting items, and other more valuable and easily removed items and materials have been taken out of the structure. Though both reuse and recycling markets are included in this report, reuse options are prioritized.

## Findings and Recommendations

The table below documents C&D disposal data and economic potential for C&D materials in Region 5 states. Though the available data is inconsistent in many ways including year collected, methodology, comprehensiveness for both geography and materials, it can serve as a baseline to understand the amount and type of C&D debris entering landfills and what impact that material could have on the economy of the Upper Midwest.

| Region 5 State        | Employees of Businesses with Potential to Include Reused or Recycled C&D | Total State Employment October 2018 <sup>2</sup> | Annual Sales Volume for Businesses with Potential to Include Reused or Recycled C&D | % of material disposed at MSW landfills that is C&D | C&D Tons Disposed        | Potential Job Creation through Recycling Disposed C&D <sup>i</sup> |
|-----------------------|--------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------|--------------------------------------------------------------------|
| Illinois              | 9,109                                                                    | 6,218,000                                        | \$2,917,947,000                                                                     | 22.5% <sup>ii</sup>                                 | 4,252,500 <sup>iii</sup> | 991                                                                |
| Indiana               | 7,515                                                                    | 3,402,000                                        | \$3,033,767,000                                                                     | 13.6% <sup>iv</sup>                                 | 1,165,370 <sup>v</sup>   | 272                                                                |
| Michigan              | 8,915                                                                    | 4,700,300                                        | \$2,956,135,000                                                                     | 5.2% <sup>vi</sup>                                  | 1,503,412 <sup>vii</sup> | 350                                                                |
| Minnesota             | 6,285                                                                    | 3,008,000                                        | \$2,203,845,000                                                                     | 8% <sup>viii</sup>                                  | 1,280,000 <sup>ix</sup>  | 298                                                                |
| Ohio                  | 14,576                                                                   | 5,504,000                                        | \$3,770,507,000                                                                     | *7% <sup>x</sup>                                    | 4,900,000 <sup>xi</sup>  | 1,142                                                              |
| Wisconsin             | 10,547                                                                   | 3,075,000                                        | \$2,731,850,000                                                                     | *21.3% <sup>xii</sup>                               | 914,777 <sup>xiii</sup>  | 213                                                                |
| <b>Region 5 Total</b> | <b>56,947</b>                                                            | <b>25,907,300</b>                                | <b>\$17,614,051,000</b>                                                             | <b>12.9%<sup>xiv</sup></b>                          | <b>14,016,059</b>        | <b>3,266</b>                                                       |

***Economic Potential and Disposal Data for C&D Debris in Region 5 States***

*Several sources – see footnotes and endnotes*

<sup>i</sup> The Benefits on Construction and Demolition Materials Recycling in the United States, 2014. CDRA estimates 233 jobs created per million tons of Mixed C&D recycled.

<sup>ii</sup> Illinois Commodity/Waste Generation and Characterization Study, 2009

<sup>iii</sup> Illinois Commodity/Waste Generation and Characterization Study, 2009. The only statewide C&D data is in reference to C&D materials disposed in MSW landfills, 22.5% of 18.9 million tons disposed in MSW landfills.

<sup>iv</sup> Municipal Solid Waste Characterization Study for Indiana, 2012. C&D debris comprised 6.01% and wood comprised 7.54% of material disposed in Indiana MSW landfills

<sup>v</sup> Municipal Solid Waste Characterization Study for Indiana, 2010. 517,260 tons of C&D debris and 648,110 tons of wood were disposed in Indiana MSW landfills.

<sup>vi</sup> Economic Impact Potential and Characterization of MSW in Michigan, 2016. 5.2% only represents the amount of wood disposed in MSW landfills, C&D debris is not measured. Beyond only MSW landfill disposal, C&D comprises 11% of the entire waste stream.

<sup>vii</sup> Economic Impact Potential and Characterization of MSW in Michigan, 2016. Michigan DEQ also reports C&D disposal annually in cubic yards in the Report of Solid Waste Landfilled in Michigan

<sup>viii</sup> Minnesota Statewide MSW Aggregate Composition, 2012. 5.7% of MSW is wood, 2.3% of MSW is carpet – C&D is not a specific category in this characterization study.

<sup>ix</sup> Minnesota Pollution Control Agency. Construction and demolition waste.

<https://www.pca.state.mn.us/waste/construction-and-demolition-waste>. Statewide, MPCA estimates that 80% of the 1.6 million tons of C&D debris generated in 2013 was landfilled.

<sup>x</sup> Ohio's Waste Management System, 2014. C&D was 7% of entire waste stream.\*

<sup>xi</sup> Ohio's Waste Management System, 2014. 3.4 million tons to C&D landfills, 1.5 million tons of C&D material to MSW facilities.

<sup>xii</sup> Wisconsin Statewide Waste Characterization Study, 2010. C&D percentage of entire waste stream.\* Includes both separated C&D loads and C&D mixed into MSW (which is not captured annually)

<sup>xiii</sup> WI Statewide Waste Characterization Study, 2010. Does not include waste generated by road construction.

<sup>xiv</sup> Average

### **Finding: Region 5 states are disposing a significant amount of C&D material and have opportunity to divert a portion of that material from landfills**

Region 5 states are disposing millions of tons of C&D debris each year. This presents a massive opportunity to capture economic value from these materials, while reducing the burden on C&D and municipal solid waste (MSW) landfills. Statewide generation and characterization studies provide a baseline of 14 million tons of C&D debris disposed in Region 5 each year, which should be considered a low estimate. Several states, including Illinois, calculate C&D material disposed in MSW landfills, but do not include material disposed in C&D specific landfill sites, and other states, including Wisconsin, annually calculate separated C&D, but not C&D debris mixed with MSW.

Additionally, Region 5 states have a growing number of both vacant structures and new construction permits, which can provide an opportunity for significant material salvage as vacant and blighted structures are removed, and C&D debris is generated through new construction.

#### **Recommendation**

Region 5 states should develop strategies to manage and reduce C&D waste, and reenter those materials into the marketplace. Local governments should support material reuse organizations and consider legislation to discourage valuable materials from entering landfills. Additionally, government agencies, like state Departments of Transportation, should encourage procurement of C&D debris as raw materials.

The Upper Midwest states are facing similar challenges and opportunities, and regional collaboration can help inform strategies for sustainable materials management.

### **Finding: Data is inconsistent**

Throughout Region 5 states, counties, and municipalities, waste generation and characterization data is collected inconsistently, particularly construction and demolition waste. Solid waste plans and studies often focus exclusively or primarily on municipal solid waste generated from the residential sector. States do not uniformly regulate C&D waste, and data collected inconsistently from processing, collection, and disposition create a barrier to effectively implement regulations.

#### **Recommendation**

State and county governments should support standardization of waste planning and characterization: Waste planning and characterization at the state and county level, particularly planning and characterization with a focus on C&D debris, can help local stakeholders and policy makers understand their waste. Additionally, identifying the source of MSW and C&D debris (e.g. residential, commercial, industrial) can guide waste management and policy decisions. Understanding C&D waste and where it is being generated at a state and county scale can reduce the amount of reusable material sent to landfills, and keep the value of that material in local communities.

### **Finding: There are jobs and capital already present in industries with the potential to include reused or recycled C&D**

Delta Institute identified industries that already use or could potentially use the targeted materials as an input to process and sell as their primary business activity. Those industries included construction, manufacturing, wholesale trade, retail trade and services. Within these larger categories, Delta compiled data from further specified industries in which it was clear that the products could be made with recycled/reused construction demolition materials. ReferenceUSA was used to calculate the current number of employees and sales volumes by state for the businesses in the identified industries, indicating the scale of potential economic impact for each state. While the total number of direct employees ranges between 6,000 to over 14,000 per state, each state has \$2-3 billion in sales. While small in comparison to major sector jobs such as waste management or construction, the number of jobs related to C&D debris management can grow.

Another methodology to determine economic impact of C&D debris recovery, specifically recycling, in Region 5 is through the calculation of jobs per ton of C&D material. The Construction and Demolition Recycling Association's 2014 white paper estimates that 233 jobs in mixed C&D recycling are created per million tons of C&D debris recycled annually.<sup>3</sup> Under this assumption, approximately 3,266 jobs could be created in Region 5 if the disposed tons were instead recovered.

#### **Recommendation**

Increased awareness of this subsector of the construction and demolition industries can encourage investment and innovation in building material reuse and recycling. State and local governments should consider local and regional workshops and meetings to encourage collaboration, provide resources and tools to help broker materials (e.g. Pathways21), and expand the industry's presence in Region 5. Additionally, further research into the job creation potential of recycling and reusing C&D material currently sent to landfills could encourage investment and infrastructure development for the industry.

### **Finding: Opportunities for reuse are not as prevalent as opportunities for recycling**

Markets are generally much stronger for material recycling than reuse, and reuse opportunities typically exist at a very small scale. Recycling material is a significant improvement over landfilling, but material reuse can avoid energy-use and costs associated with extracting materials and producing new products, while also diverting material from landfills.

#### **Recommendation**

State and local governments should identify strategies to incentivize reuse of C&D debris. Investment in specific material research to develop reuse options for these materials can encourage entrepreneurship and innovation. State and local governments could also leverage procurement strategies to incentivize use of C&D debris either through purchasing guidance or on-site reuse requirements when demolishing and constructing new facilities.

Additionally, EPA and other agencies should research alternatives for building materials that are not easily recycled or reused to avoid use of potentially toxic, disposable materials.

## Introduction + Background

With support from the EPA, Delta Institute, in collaboration with the Building Material Reuse Association, has worked to identify end markets for reusable building materials in the Upper Midwest (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin); provide an estimate of the volume of material that can be managed; and provide an estimate of economic opportunity afforded by the potential markets using economic indicators (e.g. jobs, wages). Demystifying building material end markets provides data to the private and public sector to enable those actors to decrease the disposal rate of reusable materials, and increases capacity of local and state governments to adopt policies encouraging building material reuse and recycling with the recognition of local economic benefits.



**Region 5 States**

This report is specific to construction and demolition waste materials inclusive of lower-quality lumber, brick, concrete, gypsum wallboard, asphalt shingles, vinyl siding, and carpet. These materials typically remain in a structure after metals and other more valuable and easily removed items have been taken out of the structure.<sup>4</sup> This research explores if the existing, but underutilized, opportunity to recycle, reuse, and create a market for these low-value materials is worthy of greater pursuit. Material reuse avoids energy-use and costs associated with extraction and producing new products, while also diverting material from landfills. Reuse differentiates from recycling as it involves extending the life of material without shredding, melting, or smelting.<sup>5</sup> Though both reuse and recycling markets are included in this report, reuse options are prioritized.

This report reviews existing methods for calculating construction and demolition debris and investigates current recycling and reuse options for the aforementioned materials. This report also provides an overview of C&D-specific waste planning and available data for each state in Region 5, as well as Upper Midwest-specific data collected through industry research, and a survey created and distributed in partnership with the Building Material Reuse Association.

### Volume estimations

EPA and Michigan State University have established several methods for calculating C&D material available through deconstruction of residential and commercial structures. More broadly, several factors can influence the quality and quantity of salvageable C&D material. On a macro-level, economic conditions and general environmental awareness can affect how likely homeowners and owners of commercial buildings are to undergo renovation and how strongly they feel about ensuring environmentally conscious management of their C&D materials. Locally, amount and



quality of material will be influenced by the typically heightened construction season (spring in the Midwest) and any local ordinances regulating the treatment of C&D debris. In a specific structure, the housing type (age, value, and style of structure) and activity type (renovation, construction, or demolition) will affect the supply of C&D material.<sup>6</sup>

EPA has funded and developed resources to estimate the volume of general C&D debris generated in the United States through construction, renovation, and demolition of residential and nonresidential structures. In 2003, through a review of national industry data and sampling of C&D debris at job sites, EPA estimated the average waste generation for each activity.

| Activity Type               | C&D Debris Generation <sup>7</sup>           |
|-----------------------------|----------------------------------------------|
| Residential Construction    | <b>4.9 pounds</b> per square foot (average)  |
| Nonresidential Construction | <b>4.34 pounds</b> per square foot (average) |
| Residential Demolition      | <b>50 to 158.7 pounds</b> per square foot    |
| Nonresidential Demolition   | <b>36 to 358 pounds</b> per square foot      |
| Residential Renovation      | <b>3.31 to 72.1 pounds</b> per square foot   |
| Nonresidential Renovation   | <b>3 to 28.49 pounds</b> per square foot     |

**C&D Debris Generation by Activity**

*EPA, Estimating 2003 Building-Related Construction and Demolition Materials Amounts, 2009*

Overall, the study, published in 2009, estimated 170 million tons of building-related C&D debris was generated by construction, renovation, and demolition in the United States in 2003.<sup>8</sup> In 2009, K.M. Cochran with EPA and T.G. Townsend with the University of Florida Department of Environmental Engineering Services conducted a material flow analysis to determine C&D debris generation based on purchased materials and expected waste factors (e.g. excess materials, expected material lifespans) for construction, renovation, and demolition projects. Using a short and typical material life span, the study estimated between 610 million and 780 million metric tons of generated C&D material in the United States in 2002. The characterization of this generated material is estimated to be 42% to 59% Portland cement concrete, 26% to 43 % asphalt concrete, 6% to 7% wood, and up to 3% each for brick/clay tile, asphalt shingles, gypsum products, and steel/iron.<sup>9</sup>

The 2017 “Muskegon, Michigan Deconstruction Economic Cluster Feasibility Study” created by Michigan State University’s Center for Community and Economic Development and West Michigan Shoreline Regional Development Commission (WMSRDC) includes material-specific salvage quantity estimates for a typical 1,500 square-foot, single-family home. The estimates provided are based upon literature review and visual inspections in the Muskegon area in western Michigan.<sup>10</sup>



| Material Type                                 | Estimated Quantity (1,500 sq ft Home) <sup>11</sup> |
|-----------------------------------------------|-----------------------------------------------------|
| Framing lumber                                | 4,000 board feet                                    |
| Standard brick                                | 5,000 bricks                                        |
| Asphalt shingles                              | 650 sq ft                                           |
| Concrete                                      | 37 cubic yards                                      |
| Drywall                                       | 1,445 sq ft                                         |
| Siding<br>(80% vinyl, 15% aluminum, 5% other) | 1,620 sq ft                                         |

***Estimated C&D Material Quantities in 1,500 sq ft Home***

*Muskegon, Michigan Deconstruction Economic Cluster Feasibility Study, MSU Center for Community and Economic Development, WMSRDC, 2017*

Vacant buildings can be considered an underutilized resource for municipalities in the Upper Midwest. Assumptions for the total supply of C&D material currently located in vacant properties in Region 5 can be estimated a number of ways based on available data.

Between 2013 and 2015, the City of Gary, Indiana in partnership with the Knight Foundation, the Legacy Foundation, Harris School of Public Policy, and Indiana University Northwest partnered on the Gary Counts program to survey parcels within the City to address issues of property vacancy and blight, and inform redevelopment decisions.<sup>12</sup> Of 58,235 parcels surveyed in Gary, a structure was present on 32,886, and 6,592 of those structures were vacant. Out of the vacant parcels, 1,082 were either in good or excellent condition (eliminating the structures with fire damage and rated as fair, dangerous, or poor condition).<sup>13</sup> It can be reasonably assumed that the Gary vacant structures in good and excellent conditions (around 16% of the surveyed vacant structures in Gary) could be good candidates for deconstruction. Though condition and appropriateness for deconstruction would vary by state and municipality, the comprehensive level of detail in the Gary, Indiana case study provides a baseline to begin understanding the resources that exist within vacant structures in the Upper Midwest.

According to U.S. Census data, there were 2,541,492 vacant housing units in Region 5 in 2010.<sup>14</sup> Using the Gary Counts case study, it can be assumed that around 16% of these vacant structures could be good candidates for deconstruction, totaling 406,639 structures.

If each of the 406,639 vacant structures assumed to be in good condition in Region 5 were deconstructed, using the MSU Center for Community and Economic Development quantity estimations of C&D material in an average 1,500 square foot home, the following materials in vacant Region 5 housing units could be potentially recovered. Though the material estimates in Michigan may vary in other Region 5 states, these estimates provide a baseline to begin developing a sustainable materials management strategy in the region.

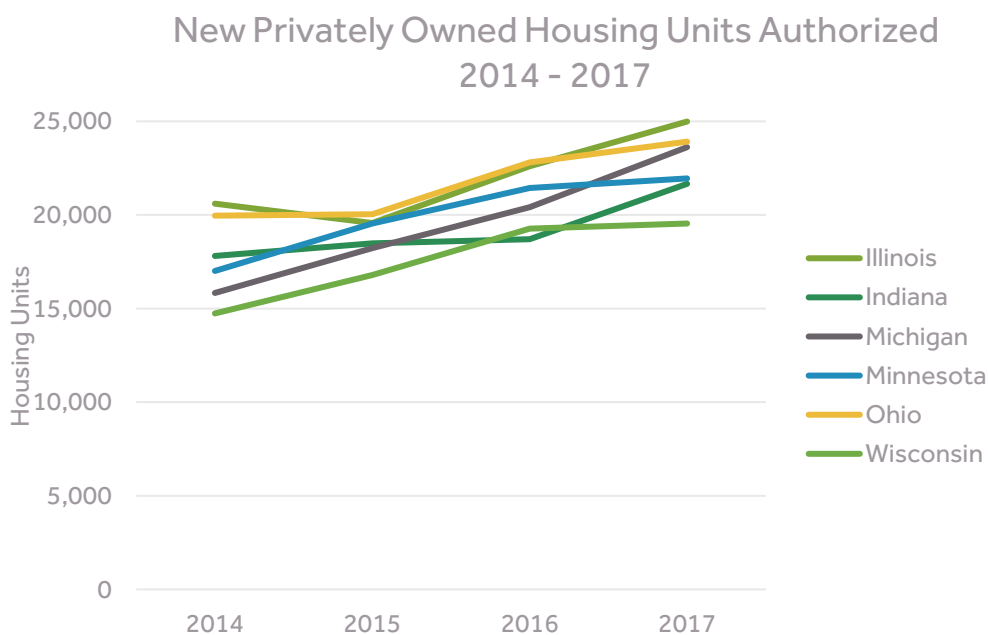
| Material                                      | Estimated Quantity<br>(1,500 sq ft home) | Estimated quantity in 16% of<br>vacant Region 5 homes |
|-----------------------------------------------|------------------------------------------|-------------------------------------------------------|
| Framing lumber                                | 4,000 board feet                         | Over 1.6 billion board feet                           |
| Standard Brick                                | 5,000 bricks                             | Over 2 billion bricks                                 |
| Asphalt Shingles                              | 650 sq ft                                | Over 264 million sq ft                                |
| Concrete                                      | 37 cubic yards                           | Over 15 million cubic yards                           |
| Drywall                                       | 1,445 sq ft                              | Over 588 million sq ft                                |
| Siding (80% vinyl, 15% aluminum,<br>5% other) | 1,620 sq ft                              | Over 658 million sq ft                                |

**Potential Salvageable Material Existing in Region 5 Vacant Homes**

*Several sources, see endnotes*

The table above represents the opportunity for material existing in vacant structures, but current demolition and construction activities are already generating material that needs to be effectively managed.

In 2017, 2,509 demolitions occurred in Detroit, Michigan<sup>15</sup> and 1,120 demolition permits were issued in Chicago, Illinois.<sup>16</sup> Using the estimated 1,500 square foot average for a home and EPA C&D generation estimates, these two cities would have generated between 136,088 and 431,942 tons of C&D debris through demolition activities in 2017 alone.<sup>17</sup> Additionally, each state in Region 5 has authorized construction of an increasing number of new housing units between 2014 and 2017.<sup>18</sup> Though new construction generates less C&D waste per square foot than demolition, this trend still indicates a significant and increasing portion of C&D debris generation.<sup>19</sup>



**Permits for New Housing Units by State in Region 5**

*US Census Bureau, Building Permits Survey*

Another strategy for calculating the amount of C&D material in the Upper Midwest is to review statewide solid waste management plans and characterization studies. Each of the six Region 5 states have published a statewide waste characterization study in the past decade, though C&D material is treated inconsistently in these studies.

The table below includes the estimate of C&D material disposed in each state (*calculation notes located in Executive Summary footnotes*), as well as the percentage C&D material makes up of all material disposed in MSW landfills. The tons of C&D material disposed per state should be considered a minimum amount, as in some cases, states are calculating only C&D materials that are disposed in MSW landfills (as opposed to dedicated C&D landfills).

| Region 5 State             | % of material disposed at MSW landfills that is C&D <sup>xv</sup> | C&D Tons Disposed <sup>xvi</sup> |
|----------------------------|-------------------------------------------------------------------|----------------------------------|
| Illinois <sup>20</sup>     | 22.5%                                                             | 4,252,500                        |
| Indiana <sup>21</sup>      | 13.6%                                                             | 1,165,370                        |
| Michigan <sup>22</sup>     | 5.2%                                                              | 1,503,412                        |
| Minnesota <sup>23 24</sup> | 8%                                                                | 803,700                          |
| Ohio <sup>25</sup>         | 7%                                                                | 4,900,000                        |
| Wisconsin <sup>26</sup>    | 21.3%                                                             | 914,777                          |
| <b>Region 5 Total</b>      | <b>12.9%<sup>xvii</sup></b>                                       | <b>13,539,759</b>                |

***Disposal Data for C&D Debris in Region 5 States***

*Several sources – see endnotes*

Through these different methodologies, a baseline amount of available C&D materials in Region 5 can begin to be understood. Diverting these materials from landfills and planning for material recovery during demolition and construction activities can generate a significant amount of economic activity for the Upper Midwest.

<sup>xv</sup> See footnotes in Executive Summary for further detail

<sup>xvi</sup> See footnotes in Executive Summary for further detail

<sup>xvii</sup> Average

## Target Materials

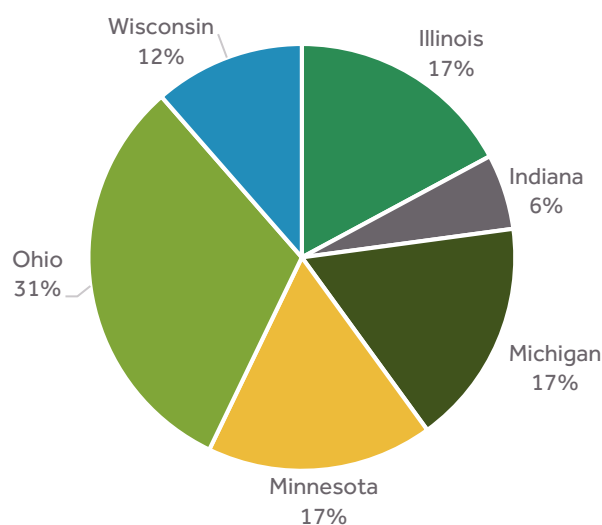
In this report, Delta targeted materials including lower-quality lumber, brick, concrete, gypsum wallboard, asphalt shingles, vinyl siding, and carpet. These materials typically remain in a structure after metals and other more valuable items have been removed,<sup>27</sup> and provide opportunity for innovation and entrepreneurship in recycling and reuse.

## Lumber

Wood is a common feature in residential structures, and three distinct markets for reclaimed wood are relatively well established. The first is old-growth lumber recovered from older structures often used in furniture or for aesthetic interior design purposes. Second, later-period lumber in good condition can be lightly processed and reused for items like crates or pallets in lieu of virgin material. The third existing market is for low quality wood that can be heavily processed to create products such as mulch, particle board, or wood pellets.<sup>28</sup> Though lumber reuse is preferred, wood recycling can provide a good opportunity to keep lower quality material from entering the waste stream.

The American Wood Council, Canadian Wood Council, and the Building Material Reuse Association (BMRA) partnered to create ReuseWood.org, a directory for wood recycling and reuse in North America. Targeting organizations in the reuse sector that accept and sell materials, such as barn wood, board lumber, heavy timber, engineered lumber, and more, 35 retail organizations were identified in Region 5.<sup>29</sup> The Minnesota Pollution Control Agency has also identified 22 salvage and reuse firms in Minnesota, which includes more organizations than those listed in the reusewood.org directory.<sup>30</sup> One Region 5 organization is Odom Reusable Building Materials in northern Michigan.<sup>31</sup> Odom accepts building materials, including 2x4s and other lumber for trade credits usable on other materials in their warehouse.<sup>32</sup> As of early 2019, BMRA is actively updating and maintaining the ReuseWood.org website, which received over 20,000 hits in 2018.<sup>33</sup>

### *DISTRIBUTION OF REUSED WOOD ORGANIZATIONS IN REGION 5*



**Region 5 Wood Reuse Organizations by State**  
ReuseWood.org

With respect to processing and recycling lower quality wood, several end markets exist in the Upper Midwest including mulch, animal bedding, biomass, cross-laminated timber (CLT), and particle board. Delta Institute spoke with Paul Wever, the President of Chip Energy, an organization in Peoria, Illinois specializing in collecting used wood pallets and crates for reuse or recycling into biomass

pellets. Chip Energy partners with large manufacturers in the Peoria area to receive their pallets and crates that may otherwise end up in landfills.<sup>34</sup>

The condition of reclaimed wood can have a major impact on its marketability. Wood that has been damaged by fire, flood, or insect infestation can be difficult to return to a salvageable condition. Wood removed from older houses also must be carefully treated if coated with lead-based paint.<sup>35</sup> Reclaimed building material retailers often take a “buyer beware” position and warn customers to assume that all paint on reclaimed items could be lead-based and instructed how to safely strip and dispose of the paint.<sup>36</sup>

## Brick

Bricks are a common, traditional building material that can be found throughout the Upper Midwest. MSU Center for Community and Economic Development found brick (along with wood) to have the most potential for immediate reuse value,<sup>37</sup> but this value can vary widely depending on the age, style, and condition of the bricks.

Brick color demand can fluctuate with changing tastes. *Construction & Demolition Recycling* interviewed Tom Svoboda with Vintage Brick Salvage in Rockford, Illinois who reported that orange or salmon colored brick, or bricks that are too homogenous in color are not currently valuable. Yellow Chicago brick has recently become more popular, and dark red bricks with some color variation are easily marketed.<sup>38</sup> Newer bricks may include holes or frogs, intended to reduce the amount of material required to create the bricks and weight of the finished brick.<sup>39</sup> Holes and frogs, paint, and remnants of tough mortar typically make bricks less valuable for resale.<sup>40</sup>

Though less common than salvaging for reuse, bricks can also be processed and recycled as aggregate at different sizes. Sioux City Brick in Iowa sells crushed recycled brick for landscaping and backfill purposes, and as baseball diamond and running track material for their most finely ground brick.<sup>41</sup> Finely ground brick can also be used as base material in the manufacture of new bricks.<sup>42</sup> An example of combining brick reuse and recycling in Region 5, Vintage Brick Salvage in Rockford purchases reclaimed bricks for resale and processes full sized bricks into “thin brick” tiling for use in interior design.<sup>43</sup>

## Gypsum

Gypsum, or calcium sulfate dihydrate, is used as a component of drywall (also called wallboard or plasterboard) in residential and commercial building interiors. Naturally-occurring gypsum can be mined, or synthetic gypsum can be produced through flue-gas desulfurization in coal plants.<sup>44</sup> Approximately 15 million tons of new drywall are produced in the United States each year, and around 12% of new drywall used in construction is disposed through the installation process. A general rule of thumb is to expect one pound of drywall waste per each square foot of new construction.<sup>45</sup> Currently, drywall recycling targets this material that is discarded from construction practices, rather than demolition or deconstruction. Particularly for drywall installed before 1980, contaminants like asbestos and lead paint may be present, and nails or other materials can make recycling difficult.<sup>46</sup>

Gypsum Recycling International, a Danish company operating in Northern Europe, has developed equipment to separate the paper backing from drywall to grind and recycle both the gypsum and the attached paper.<sup>47</sup> In the United States, Building Product Ecosystems is working to develop a map of the gypsum wallboard system currently in place, in order to encourage a closed-loop system for wallboard. In Region 5, ten sites (of around 90 in the United States) have been identified, including drywall manufacturers, gypsum mines, and recycling facilities.<sup>48</sup>

Recycled drywall can also be used in agricultural applications. Through EPA funding, WasteCap, a waste reduction organization in Wisconsin, commissioned a study using recycled drywall as a soil amendment to boost crop production. Calcium and sulfur (the elements that comprise gypsum) are both crucial for plant growth and crop yield, and ground drywall can improve soil condition by increasing porosity and improving soil structure. If properly permitted, ground drywall from construction sites could offer an alternative to gypsum fertilizer for Region 5 farmers.<sup>49 50</sup>

Additional markets for recycled gypsum identified by the Michigan Department of Environmental Quality, include Portland cement production (provided the paper content is very low), marking lines on athletic fields, grease absorption, moisture management for animal bedding, and odor management for manure, among others.<sup>51</sup>

## Concrete

Concrete is a prevalent material in roadways and commercial construction. In residential properties, concrete is often found in foundations, driveways, and curbs. Once materials such as steel rebar and wood have been removed, recycled concrete is crushed into construction aggregate for reuse. High-quality and fine-crushed aggregate can be used in the manufacture of new concrete, and less fine aggregate can be used in projects, such as pipe bedding and road base.<sup>52</sup>

Additionally, concrete can often be reused on construction or demolition sites for soil stabilization, landscaping, or, in some cases, clean fill, which eliminates the need for transport and sale to a new end user.<sup>53</sup> The City of Chicago's Municipal Code allows for demolition fill material to include "any combination of uncontaminated brick, broken concrete, stone, mortar, sand, gravel, or dirt" as long as any rebar, lumber, metal or other items have been removed.<sup>54</sup>

## Asphalt Shingles

In residential structures, asphalt shingles are a common roofing material and can be readily recycled. Reuse options for shingles are less prevalent, but they can be used for landscaping paths or other small projects.<sup>55</sup>

Several states, counties, and municipalities across the United States have enacted legislation banning asphalt shingles from being disposed in landfills. The City of Janesville, Wisconsin stopped accepting asphalt shingles in their landfill in 2012, citing opportunity for use in road construction.<sup>56</sup> Illinois has also placed restrictions on asphalt shingle disposal, landfills within 25 miles of a shingle recycling facility are not permitted to accept asphalt shingles.<sup>57</sup>

The Construction & Demolition Recycling Association (CDRA), with funding from EPA Region 5, has developed ShingleRecycling.org, an online resource for asphalt shingle recycling. This site includes a directory of asphalt shingle recyclers, almost 70 of which are located in Region 5 states.<sup>58</sup> William

Turley, the Executive Director of CDRA confirmed that as of early 2019, the research and directory were actively being updated and maintained.<sup>59</sup> Existing end markets for recycled asphalt shingles include addition to asphalt mixes – including hot-mix asphalt, warm-mix asphalt, and cold patches, production of new roofing shingles, and use as aggregate.<sup>60</sup> Barriers to shingle recycling can include the potential for asbestos presence in the material and permitting requirements.<sup>61</sup>

The Illinois Tollway road system includes 286 miles of roadway that carries more than 1.4 million cars per day. In 2009, Illinois Tollway, University of Illinois, and University of Iowa conducted a study to determine the effect of adding reclaimed asphalt shingles (RAS) to roadway asphalt mixes. The study concluded that adding up to 5% RAS to asphalt mixes reduced costs and improved the long term durability of pavement, when compared to pavement made with entirely virgin asphalt. Between 2010 and 2015, the Tollway diverted over 24,000 tons of asphalt shingles through this project, resulting in \$21 million in cost savings.<sup>62,63</sup> In Region 5, Illinois, Indiana, Minnesota, and Wisconsin allow reclaimed asphalt shingles to be included in all Department of Transportation asphalt mixes. Michigan and Ohio allow for RAS in some Department of Transportation mixes, but not all.<sup>64</sup>

## Vinyl Siding

Vinyl siding, comprised of polyvinyl chloride (PVC) resin, became a popular material for home exteriors in the United States around the 1960s. Today, around 35% of new homes are constructed with vinyl siding exteriors.<sup>65</sup> Manufacturing new vinyl has massive health impacts for workers due to the presence of phthalates. Limiting the need for new vinyl through reduction, reuse, and recycling should be a priority for sustainable construction.<sup>66</sup>

Conventional vinyl recycling includes sorting and shredding vinyl material into granulated PVC that can then be used to create new products.<sup>67</sup> VinylPlus, a European organization committed to improving sustainability in the vinyl industry, reports that PVC can be recycled up to eight times without material degradation as the recycling process does not dramatically affect PVC molecules.<sup>68</sup>

Landfill Reduction and Recycling, Inc., a C&D recycling facility in Wisconsin, is one example of a facility that accepts vinyl siding to be processed and used to manufacture PVC pipes and new siding.<sup>69</sup> Additional end markets for recycled vinyl include packaging, parking bumpers, office supplies, and flooring.<sup>70</sup>

## Carpet

Carpet can be found in both residential and commercial structures, either in tiles or broadloom (wall to wall). Carpet tiles, more typically found in commercial buildings, offer the largest opportunity for reuse, but recycling options exist for broadloom carpeting as well.

Delta Institute spoke to Kevin VanderWall with Fibr Carpet Recycling to discuss current conditions, barriers, and opportunities for carpet recycling in Michigan. Fibr Carpet Recycling is located in the Grand Rapids, Michigan area and acts as a marketplace for reused carpet and other materials (e.g. ceiling tiles, office furniture) found in commercial office spaces.<sup>71</sup> Fibr Carpet Recycling focuses reuse efforts on carpet tiles, as opposed to broadloom carpeting, and diverts an estimated 300,000 to 600,000 square feet of carpet tiles annually. The primary barrier to carpet tile reuse is carpet



condition, however, VanderWall is often able to give lower-quality tiles away for free for use in garages or storage units.<sup>72</sup>

In Minnesota, Bro-Tex Carpet Recycling in St. Paul sorts, processes, and extrudes uncontaminated carpet into pellets. The pellets and other carpet products can be used to create new carpet, piping, filler, landscape materials, and other items.<sup>73</sup>

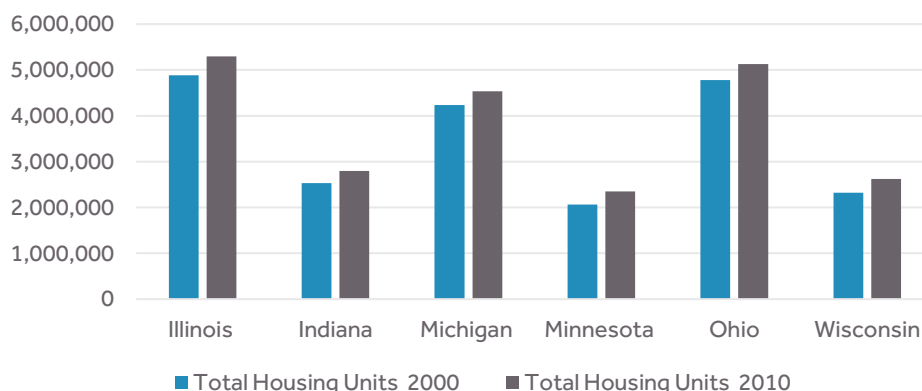
Legislation like the California Carpet Stewardship Bill could help to boost carpet reuse and recycling in the Upper Midwest as it mandates a \$0.25 assessment on each square yard of carpet sold to fund end-of-life management and requires carpet manufacturers to submit stewardship plans to the state.<sup>74</sup>

## Region 5 States – Overview

EPA Region 5 states include Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. Though the Upper Midwestern states face many of the same challenges and circumstances, including an increase in vacant housing structures (partially in response to the 2008-2009 housing crisis), they also have distinct differences in how C&D debris is generated and managed ranging from planning and characterization to physical infrastructure for managing such material. While it can be beneficial to consider regional impacts and strategies, individual states, counties, and municipalities will need to also address the local context that drives the generation and management of the material stream.

Between 2000 and 2010, all six Region 5 states saw an increase in total housing units and vacant housing units, with vacant housing units increasing at a much higher rate. This indicates both a rising demand for building material to construct new housing units, and a rising supply of building material in vacant units.<sup>75</sup>

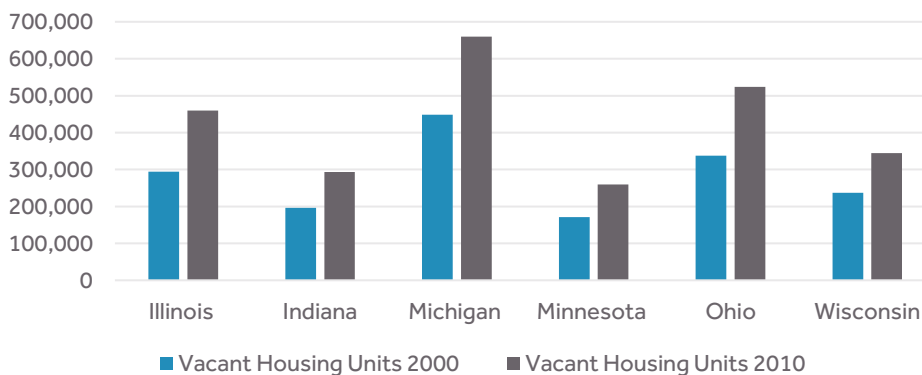
*TOTAL HOUSING UNITS BY STATE: 2000 & 2010*



**Total Housing Units in Region 5 States in 2000 and 2010**

*Census Data, American Fact Finder, 2000 and 2010*

*VACANT HOUSING UNITS BY STATE: 2000 & 2010*

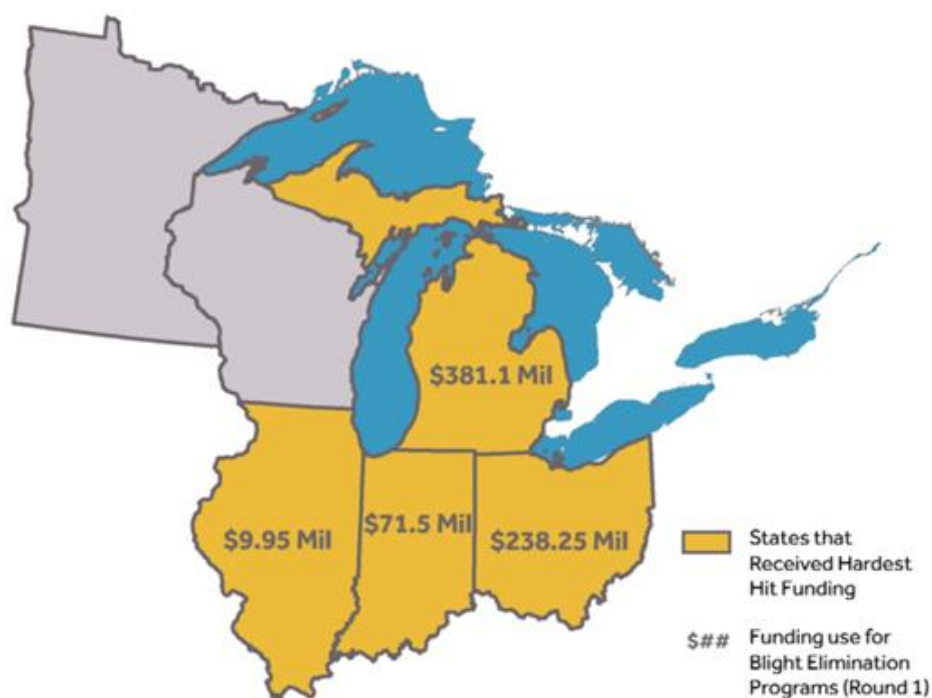


**Total Vacant Housing Units in Region 5 States in 2000 and 2010**

*Census Data, American Fact Finder, 2000 and 2010*

Industrial and other commercial vacancy data is typically less readily available than residential vacancy data. In 2012, the U.S. Energy Information Administration released commercial building data (including vacancy) by region. The “Midwest - East North Central” grouping includes all Region 5 states, except Minnesota (which is included in the “Midwest - West North Central” grouping). Midwest - East North Central region is reportedly home to 296,000 vacant commercial buildings, which span over 3.2 billion square feet.<sup>76</sup>

Established by President Obama in 2010, the Hardest Hit Fund is targeted aid for states particularly affected by the housing crisis in 2008 and 2009. One of the programs supported by the Hardest Hit Fund is blight elimination, including demolition.<sup>77</sup> Local governments that received Hardest Hit funding for demolitions were able to increase the number of publicly funded demolitions, which results in fewer vacant and blighted structures, and also an increase in C&D debris generation. Federal spending priorities can act as a bellwether for state and regional public and private demolitions, as well as general blight management strategy.



**Region 5 States Receiving Hardest Hit Funding + Round 1 Amounts for Blight Elimination**  
US Department of the Treasury, Hardest Hit Fund

Each of the states in Region 5 have designated C&D landfills, though distribution of these disposal sites vary widely, from nine C&D sites in Indiana to over 300 in Illinois. Several counties, and municipalities in Region 5 have passed legislation encouraging construction and demolition debris diversion from landfills, however, none of the six Region 5 states have an outright landfill ban on any C&D materials.<sup>78</sup>

## Illinois

According to the 2010 US Census, Illinois has a land area of 55,519 square miles and a population of 12,830,632 people. The statewide population density is 231 people per square mile.<sup>79</sup>

Most recently in 2009, the Illinois Department of Commerce & Economic Opportunity (DCEO) funded the Illinois Recycling Association to develop a statewide Commodity/Waste Generation and Characterization Study.<sup>80</sup> Additionally, any county in Illinois with 100,000 or more residents must develop a solid waste management plan and update the plan every five years. County solid waste management plans include information about waste generated in the county and solid waste processing facilities, as well as recommendations for improved waste management.<sup>81</sup>

As of 2015, there were more than 300 C&D landfills in the state of Illinois, though the majority of these sites intake 10,000 cubic yards or less per year.<sup>82</sup> The 2009 Commodity/Waste Generation and Characterization Study excludes clean construction and demolition debris (CCDD) generated in the state, unless that material is disposed at MSW landfills. CCDD is distinct from C&D debris and is defined as uncontaminated broken concrete without rebar, bricks, stone, pavement, and soil generated from construction or demolition. CCDD is not considered to be waste if used as fill or recycled, and there are 87 IEPA permitted CCDD fill sites in Illinois.<sup>83 84</sup>

In 2008, 22.5% of all material landfilled at MSW sites was C&D debris. By weight, treated wood was the most common C&D material to be disposed at MSW landfills in Illinois in 2008 (604,220 tons), followed by gypsum board (471,650 tons) and composition shingles (405,080 tons).<sup>85</sup>

Several ordinances related to C&D recycling have been passed in Illinois at the municipal and county levels. In 2006, the City of Chicago passed the Construction and Demolition Site Waste Recycling Ordinance, requiring at least 50% of C&D materials generated be reused or recycled.<sup>86</sup> Cook County, Illinois passed the Demolition Debris Diversion Ordinance in 2012, requiring 70% of C&D debris to be recycled and 5% of residential C&D to be reused.<sup>87</sup>

## Indiana

According to the 2010 US Census, Indiana has a land area of 35,826 square miles and a population of 6,483,802 people. The statewide population density is 181 people per square mile.<sup>88</sup>

As of August 2018, Indiana is home to seven state-permitted disposal sites for construction and demolition debris, including scrap lumber, bricks, concrete, stone, glass, wallboard, roofing, plumbing fixtures, wiring, and non-asbestos insulation.<sup>89 90</sup> In addition to these sites, C&D debris is also disposed with municipal solid waste in standard landfills. In the 2012 Municipal Solid Waste Characterization Study for Indiana, wood comprised 6.8% (406,093 tons) of the MSW generated in Indiana and C&D debris comprised an additional 5.4% (324,662 tons) of MSW generated within the state. Dedicated C&D loads were not included in the Characterization Study, indicating an opportunity for further research in Indiana.<sup>91</sup>

The Indiana Department of Environmental Management (IDEM) continues to encourage construction and demolition debris recycling. In early 2018, IDEM awarded \$420,000 to C&D recycling company Bunn Box Inc. to purchase a crusher and other equipment. Estimated impact from these purchases "include 150,000 tons of concrete, 2,500 tons of rebar steel, 2,500 tons of

other metal, 1,000 tons of wood, and 480 tons of cardboard” diverted from landfills.<sup>92</sup> Indianapolis also is home to a liquidation warehouse, which allows consumers to purchase goods wholesale from retailers, including The Home Depot, to prevent excess and returned merchandise from ending up in landfills.<sup>93</sup>

## Michigan

According to the 2010 US Census, Michigan has a land area of 56,539 square miles and a population of 9,883,640 people. The statewide population density is 175 people per square mile.<sup>94</sup>

As of 2014, there were 11 C&D specific landfills in the state.<sup>95</sup> The Michigan Department of Environmental Quality (DEQ) requires all landfills in the state to annually submit a report of the amount of solid waste received, and the origin of that waste whenever possible.<sup>96</sup> Michigan DEQ published a report in 2014, characterizing waste disposed in Michigan landfills that originated both in the United States and in Canada. In FY2014, 5,478,838 cubic yards of C&D debris were disposed in Michigan landfills, with 951,129 of those cubic yards originating in Canada.<sup>97</sup>

In addition to landfill reports, Michigan also requires all counties to conduct solid waste planning,<sup>98 99</sup> though most counties do not include C&D waste diversion or market availability.

The Department of Public Works in Kent County, Michigan (which includes Grand Rapids) operates a material recovery facility (MRF), a transfer station, a waste to energy facility, and a MSW/ash landfill.<sup>100</sup> In 2018, as part of an initiative to reduce landfilled waste in the county, the Department of Public Works released a request for proposal for an innovative resource recovery park to divert materials (including C&D debris) from the adjacent landfill.<sup>101 102</sup> Pursuing resource recovery solutions can provide an opportunity for entrepreneurship and innovation.

## Minnesota

According to the 2010 US Census, Minnesota has a land area of 79,627 square miles and a population of 5,303,925 people. The statewide population density is around 67 people per square mile.<sup>103</sup>

Demolition debris landfills in the state are regulated by the Minnesota Pollution Control Agency (MPCA) and designated as Class I, Class II, or Class III depending on accepted material.<sup>104</sup> Statewide, MPCA estimates that 80% of the 1.6 million tons of C&D debris generated in 2013 was landfilled.<sup>105</sup> Minnesota counties conduct solid waste management planning, but several counties, including Anoka<sup>106</sup> and Dakota,<sup>107</sup> do not currently track construction and demolition waste. However, counties such as Washington County are planning to begin measuring C&D and industrial waste in 2020.<sup>108</sup>

The statewide waste characterization study for Minnesota in 2013 did not sample C&D specific loads, but found that wood comprised 5.7% of all landfilled MSW (168,000 tons) and carpet comprised 2.3% (67,300 tons).<sup>109</sup> A statewide study of C&D debris conducted by Foth Infrastructure & Environment for the Solid Waste Management Coordinating Board in 2007 found that wood was the most prevalent material in the C&D waste stream (comprising 22.5%), followed by roofing (17.1%) and dirt/fines (16.1%).<sup>110</sup>

In the Twin Cities metropolitan area, where 1.78 million tons of C&D material is landfilled each year, the deconstruction of the Twin Cities Army Ammunition Plant provides a leading example. Through the structure removal process, 93% of materials were recycled or reused, including 13,000 tons of recycled steel, 400,000 tons of recycled concrete and asphalt, 8 miles of reused railroad track, 250,000 board feet of reused old growth lumber, and 250 reused steel girders.<sup>111</sup>

## Ohio

According to the 2010 US Census, Ohio has a land area of 40,861 square miles and a population of 11,536,504 people. The statewide population density is 282 people per square mile.<sup>112</sup>

Ohio EPA published "Ohio's Waste Management System" in 2016, outlining waste infrastructure and characterization in the state. In 44 licensed C&D landfills, 3.4 million tons of construction and demolition debris was processed in 2014. Additionally, 1.5 million tons of C&D debris is estimated to have been disposed in MSW landfills.<sup>113</sup> Ohio also requires county-level solid waste planning, though many counties do not include information about C&D debris generation and disposal.

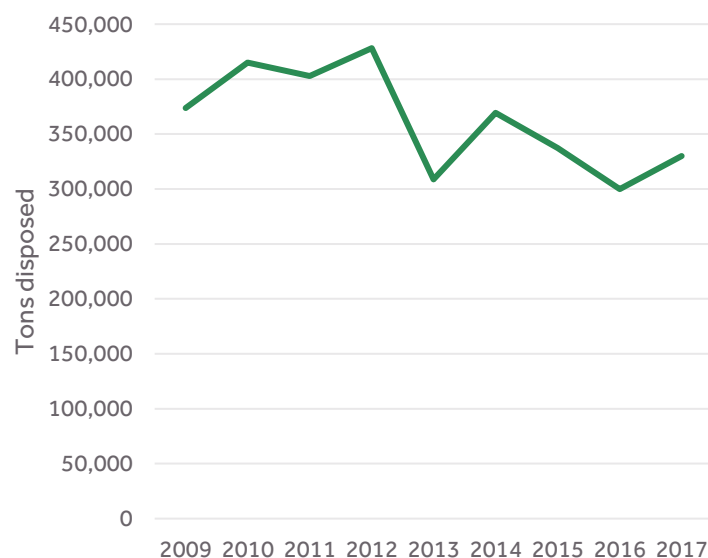
Ohio EPA provides C&D recycling guidance, including equipment that can process C&D material, companies that purchase C&D material and act as local end markets,<sup>114</sup> and companies specializing in reuse of barn wood.<sup>115</sup> Additionally, Ohio, with support from Ohio EPA, and Michigan, with support from MDEQ and MEDC, have used Pathway21 marketplace software to develop online platforms where businesses can post available or desired materials, and be connected to other businesses or individuals with complementary needs.<sup>116 117 118</sup> The cross-industry connections brokered through the existing Materials Marketplaces reduce the amount of C&D material sent to landfills, and reduce the need for virgin material.

## Wisconsin

According to the 2010 US Census, Wisconsin has a land area of 54,158 square miles and a population of 5,686,986 people. The statewide population density is 105 people per square mile.<sup>119</sup> As of 2009, Wisconsin is home to 29 landfills that exclusively accept construction and demolition debris, overseen by the Wisconsin Department of Natural Resources (DNR).<sup>120</sup>

In 2009, MSW Consultants and Recycling Connections Corporation conducted a statewide waste characterization study for the Wisconsin DNR. The study found that in 2009, 21.3% of waste disposed in the state, 914,777 tons,

*SEPARATED C&D DEBRIS DISPOSED  
IN WISCONSIN LANDFILLS (TONS)*



was C&D debris, which did not include roadway waste.<sup>121</sup> The most prevalent C&D material in the Wisconsin waste stream was untreated wood (383,638 tons disposed in 2009, comprising 8.9% of the waste stream), followed by roofing shingles (247,349 tons disposed in 2009, comprising 5.8% of the waste stream).<sup>122</sup> As of 2009, separated C&D loads are reported as a separate category in annual landfill tonnage reports, but does not include the significant portion of C&D debris that is disposed with MSW.<sup>123 124</sup>

Milwaukee and Madison, the two largest cities in Wisconsin by population, have both passed legislation to prevent reusable building materials from entering landfills. Madison passed an ordinance in 2010 requiring clean wood, clean drywall, shingles, corrugated cardboard, and metal to be recycled from new wood construction and renovations over \$20,000 in value. New steel and concrete construction in Madison requires recycling 70% of C&D debris by weight. The Madison ordinance does not require specific metrics for demolition, but contractors must submit a reuse and recycling plan to the city, in order to receive a permit.<sup>125</sup> More recently, in 2018, Milwaukee passed legislation requiring any structure built in 1929 or earlier, as well as any designated historic structures or structures in historic districts, to be deconstructed instead of demolished.<sup>126</sup>



## Economic Indicators – SIC Code Research

To identify end markets and economic potential for the targeted materials in Region 5, Delta Institute identified Standard Industrial Classification (SIC) codes for industries that already use or could potentially use the targeted materials as an input to process and sell as their primary business activity. Those industries included construction, manufacturing, wholesale trade, and retail trade. Within these larger categories, Delta reviewed code extensions of products that could clearly be made with recycled/reused construction demolition materials.

In order to describe the size of potential construction and demolition debris end markets in Region 5, Delta Institute selected the following targeted group of industry classification codes:

| SIC Code                  | Extended Code Categories                                                                                                                                                             | Extended Codes Selected                                                                                                                                                                                                                                                                                                             |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15 - 17 - Construction    | 17 - Construction special trade contractors                                                                                                                                          | 175106 - Woodworkers<br>179504 - Concrete breaking cutting & sawing<br>179954 - Concrete recycling                                                                                                                                                                                                                                  |
| 20 - 39 - Manufacturing   | 24 - Lumber and wood products (except furniture)<br>29 - Petroleum refining and related products<br>32 - Stone, clay, glass, and concrete products<br>34 - Fabricated metal products | 249304 - Wallboard & plasterboard MFRS<br>295101 - Asphalt & asphalt products MFRS<br>327501 - Gypsum & gypsum products MFRS<br>344411 - Siding materials MFRS                                                                                                                                                                      |
| 50 - 51 - Wholesale trade | 50 - Durable goods                                                                                                                                                                   | 503150 - Lumber brokers wholesale<br>503144 - Wallboard & plasterboard wholesale<br>503215 - Asphalt aggregates wholesale<br>503308 - Siding materials wholesale<br>509320 - Salvage-yards wholesale<br>509330 - Wood - waste and recycling wholesale<br>509339 - Asphalt reclaiming wholesale<br>509917 - Wood chippings wholesale |
| 52 - 59 - Retail Trade    | 52 - Building materials, hardware, garden supply, and mobiles home<br><br>59 - Miscellaneous retail                                                                                  | 521104 - Wallboard & plasterboard<br>521118 - Siding materials<br>521123 - Brick - used<br>521152 - Concrete<br>521153 - Drywall materials<br>593206 - Carpet & rug dealers - used<br>593207 - Building materials - used<br>593214 - Lumber - used<br>598904 - Wood pellets - fuel                                                  |

Using those SIC codes, the following industry snapshots were developed for Region 5 states:



# ECONOMIC INDICATORS: ILLINOIS SNAPSHOT

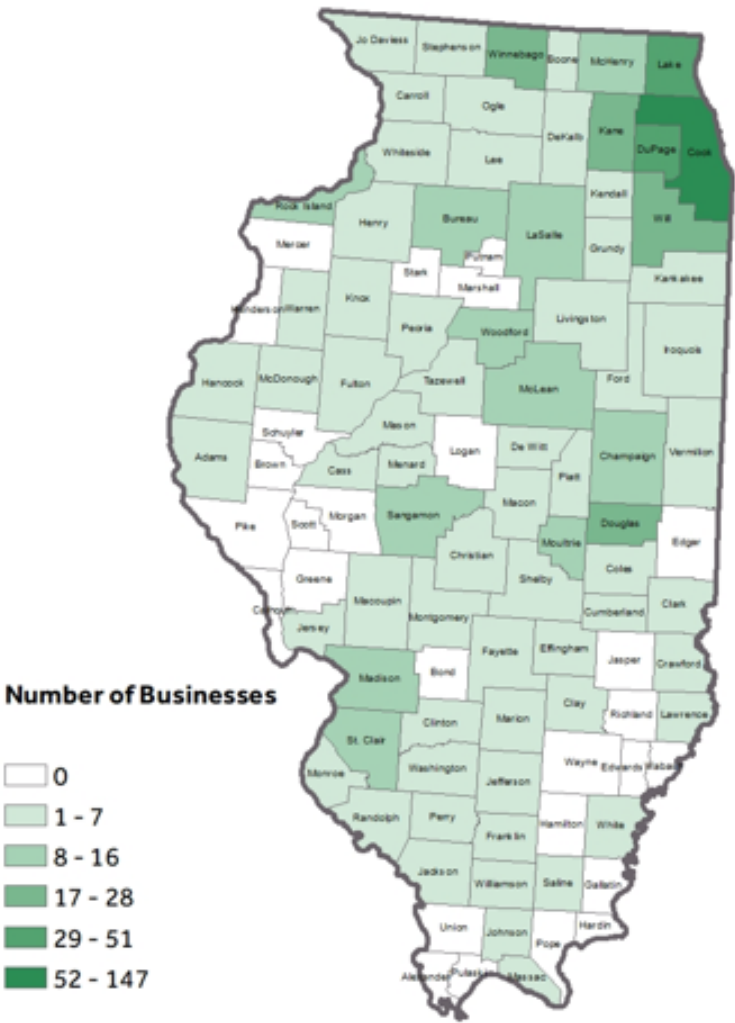
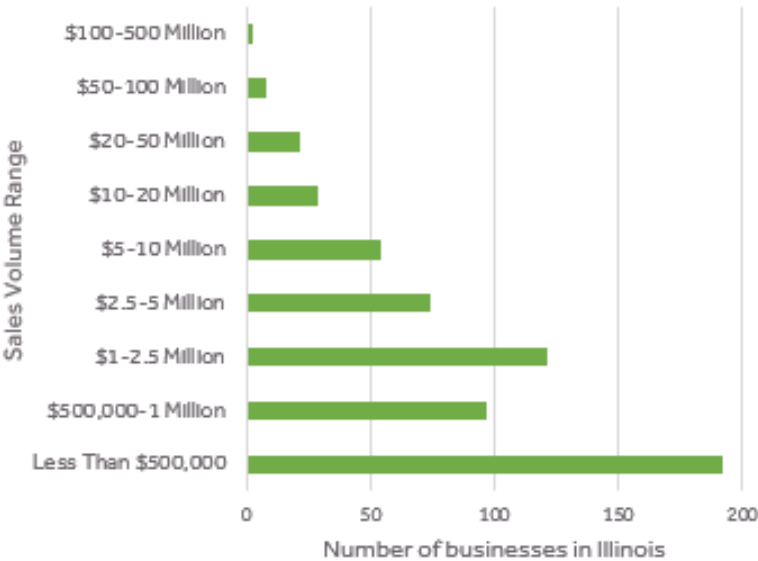
Employees of Illinois Businesses with  
Potential to Include Reused or Recycled C&D:

**9,109 employees**

Sales Volume for Illinois Businesses with  
Potential to Include Reused or Recycled C&D:

**\$2,917,947,000**

Annual Sales Volume for IL Businesses with  
Potential to Include Reused or Recycled C&D





# ECONOMIC INDICATORS: INDIANA SNAPSHOT

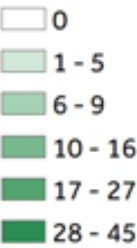
Employees of Indiana Businesses with Potential to Include Reused or Recycled C&D:

**7,515 employees**

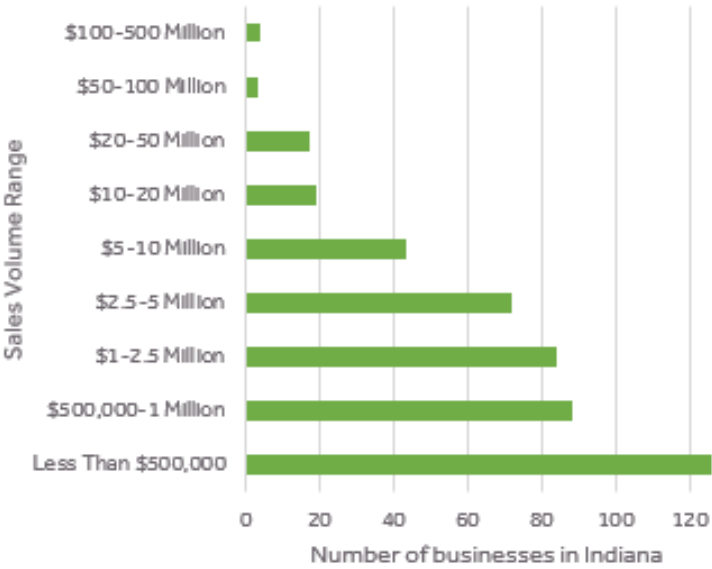
Sales Volume for Indiana Businesses with Potential to Include Reused or Recycled C&D:

**\$3,033,767,000**

Number of Businesses



Annual Sales Volume for IN Businesses with Potential to Include Reused or Recycled C&D



# ECONOMIC INDICATORS: MICHIGAN SNAPSHOT

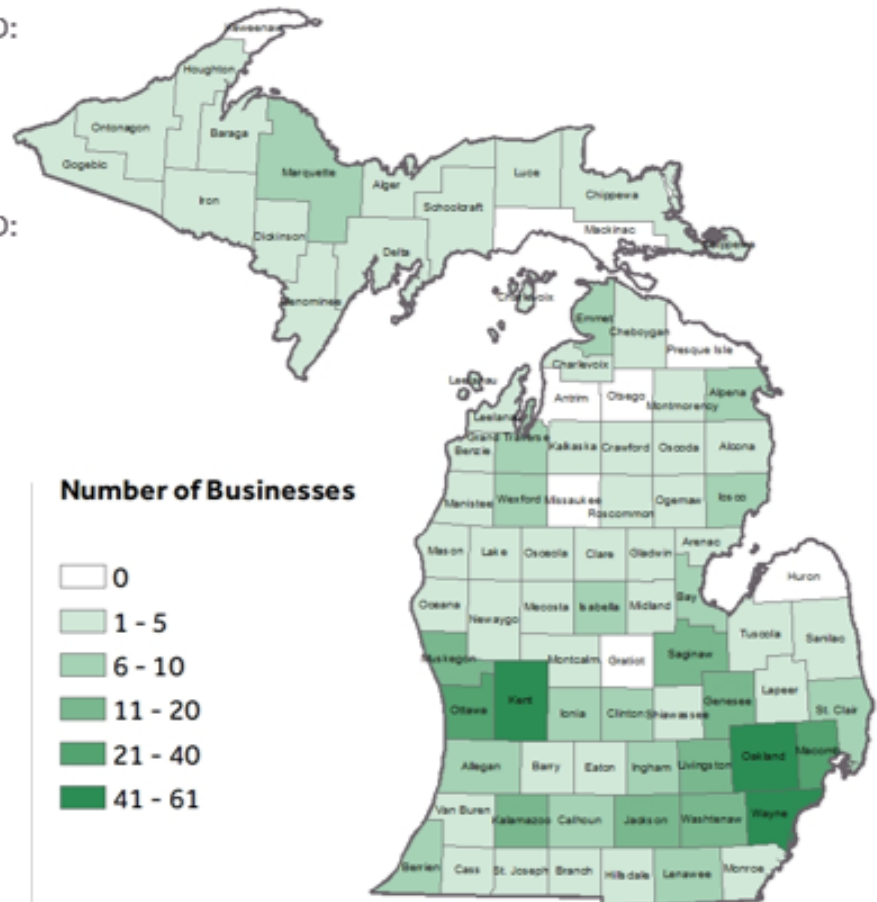
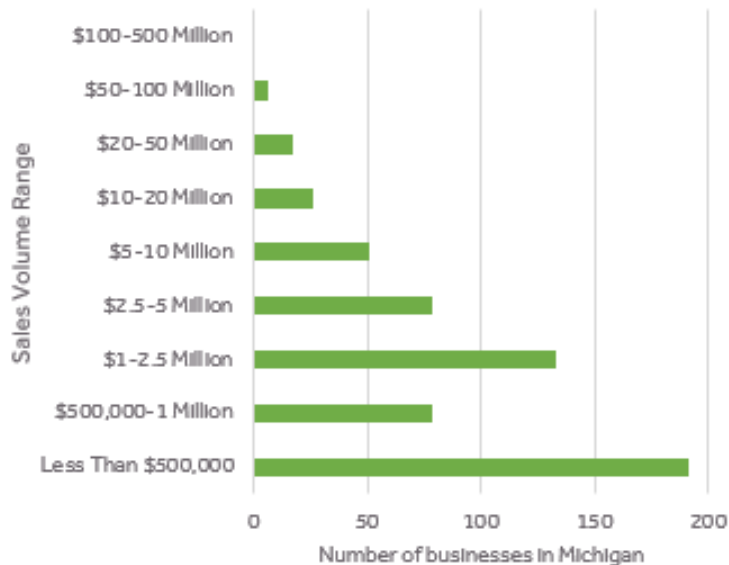
Employees of Michigan Businesses with  
Potential to Include Reused or Recycled C&D:

**8,915 employees**

Sales Volume for Michigan Businesses with  
Potential to Include Reused or Recycled C&D:

**\$2,956,135,000**

Annual Sales Volume for MI Businesses with  
Potential to Include Reused or Recycled C&D



# ECONOMIC INDICATORS: MINNESOTA SNAPSHOT

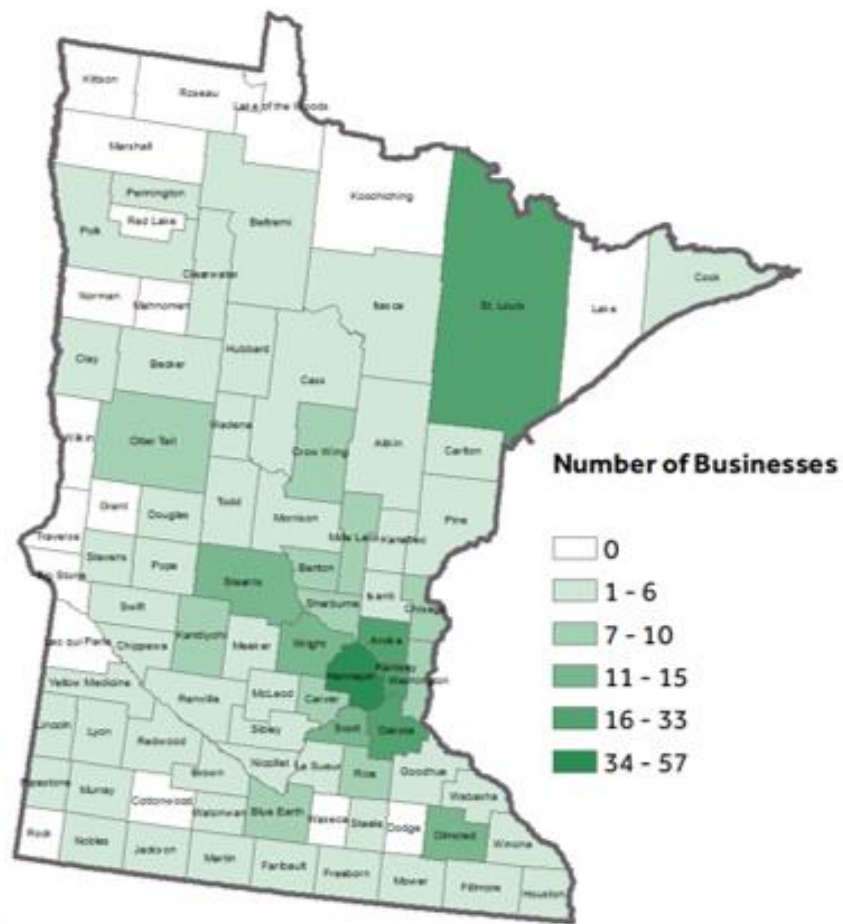
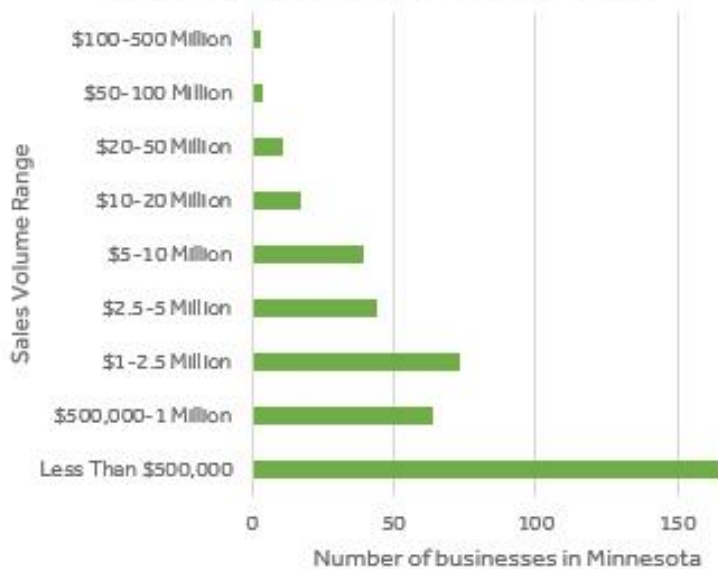
Employees of Minnesota Businesses with  
Potential to Include Reused or Recycled C&D:

**6,285 employees**

Sales Volume for Minnesota Businesses with  
Potential to Include Reused or Recycled C&D:

**\$2,203,845,000**

Annual Sales Volume for MN Businesses with  
Potential to Include Reused or Recycled C&D



# ECONOMIC INDICATORS: OHIO SNAPSHOT

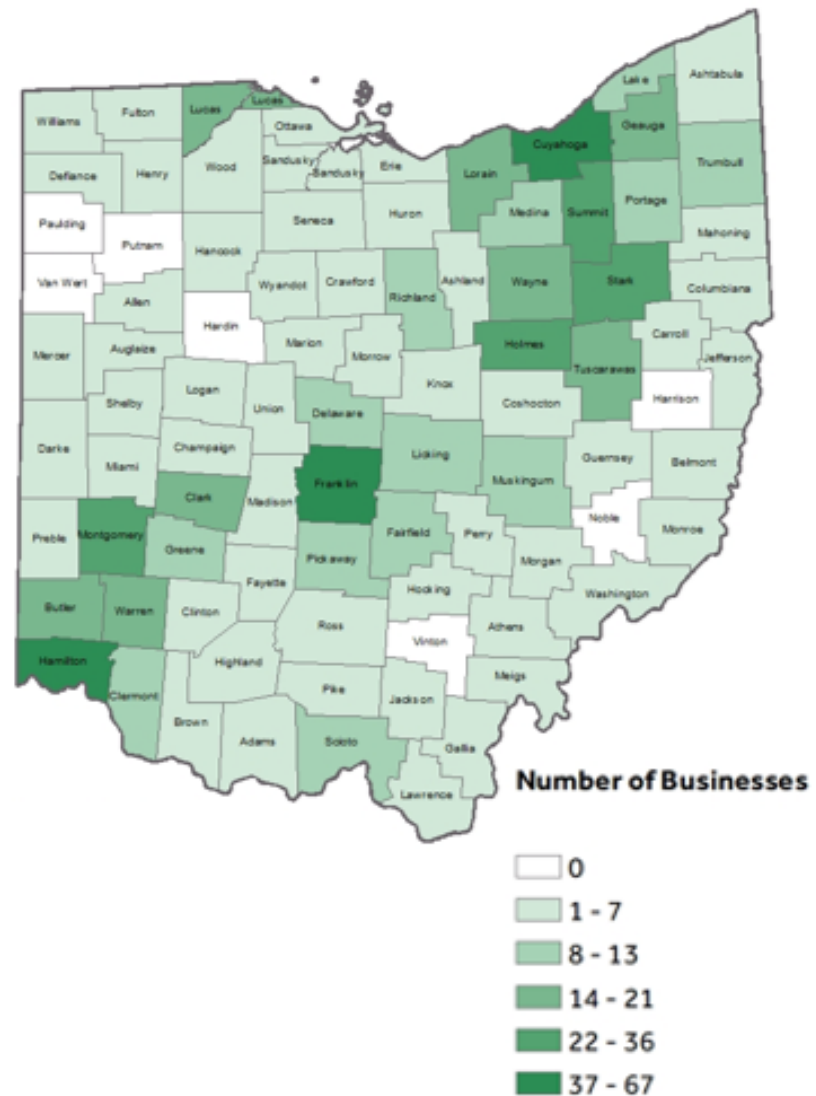
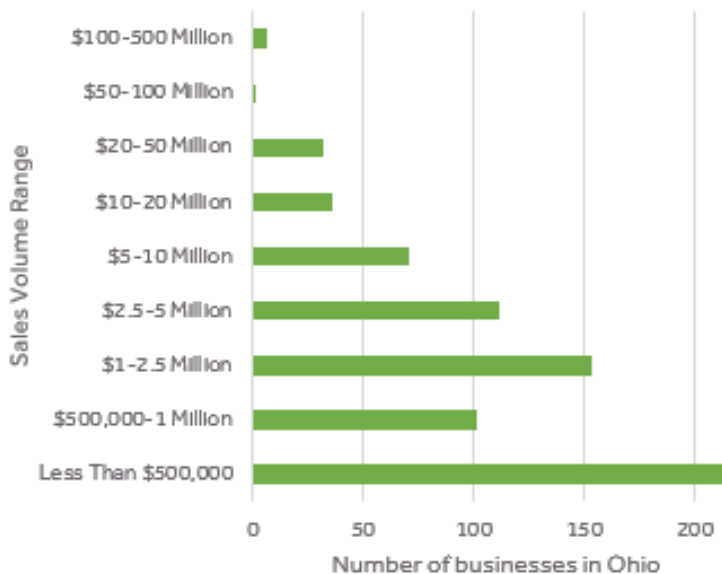
Employees of Ohio Businesses with Potential to Include Reused or Recycled C&D:

**14,576 employees**

Sales Volume for Ohio Businesses with Potential to Include Reused or Recycled C&D:

**\$3,770,507,000**

Annual Sales Volume for OH Businesses with Potential to Include Reused or Recycled C&D





# ECONOMIC INDICATORS: WISCONSIN SNAPSHOT

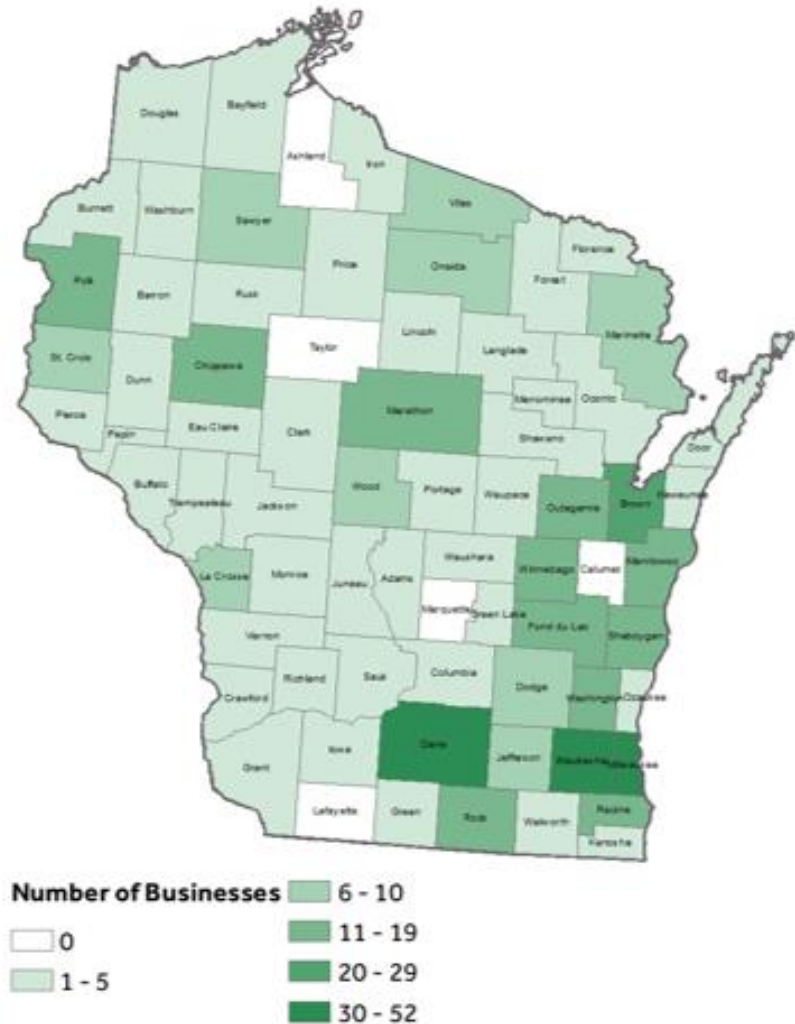
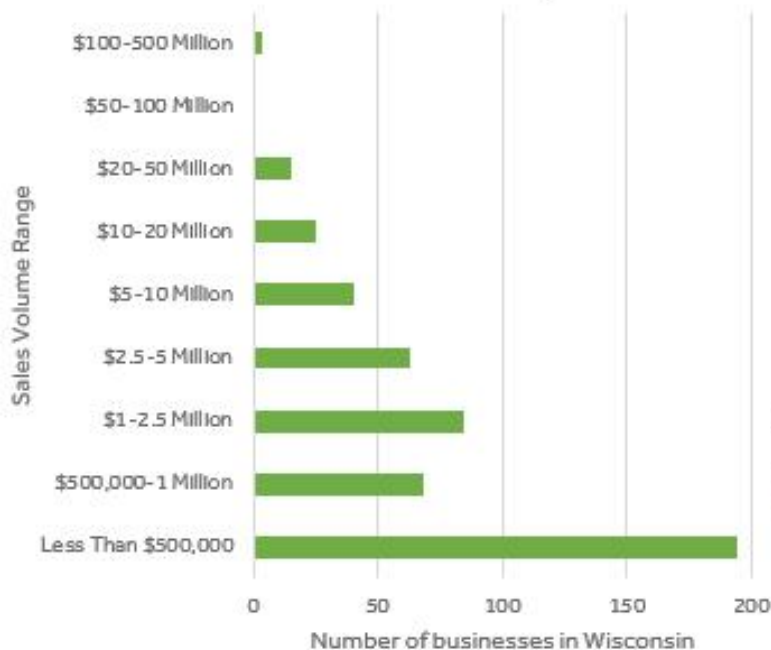
Employees of Wisconsin Businesses with  
Potential to Include Reused or Recycled C&D:

**10,547 employees**

Sales Volume for Wisconsin Businesses with  
Potential to Include Reused or Recycled C&D:

**\$2,731,850,000**

Annual Sales Volume for WI Businesses with  
Potential to Include Reused or Recycled C&D





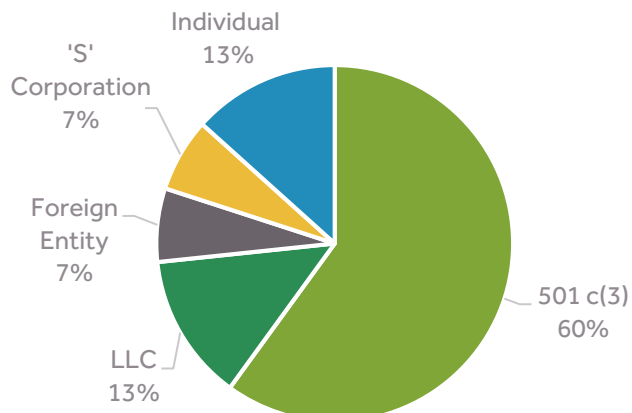
## Building Material Reuse Association Survey

Delta Institute worked with the Building Materials Reuse Association (BMRA) to develop a survey with QuestionPro software to collect information from BMRA members, individuals, and organizations in the deconstruction and building materials reuse industry. The survey contained multiple-choice questions about organization size and tax status, location of work, volume of sales, and volume and reuse strategy of materials encountered. The survey also included questions about organizational BMRA membership and several opportunities for free response. For this report, we have included data only from responders who indicated working in at least one of the six Region 5 states. Survey questions can be found in the appendix.

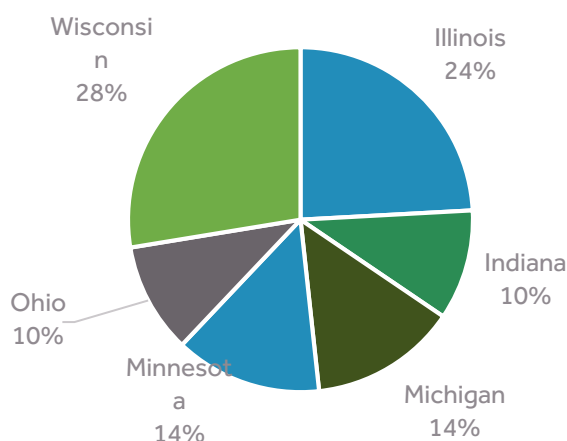
The number of survey respondents from Region 5 states is relatively small (15 individuals), so the data should be considered anecdotal, as opposed to representative. However, several trends emerged for building material reuse organizations in the region.

Region 5 organizations surveyed were predominantly 501c(3) nonprofits, and most had ten or fewer full time equivalent employees. Just over half of the respondents from Region 5 worked in Illinois or Wisconsin, and the largest group of organizations were primarily used building material retailers, with architectural salvage companies, and deconstruction contractors as the second and third most frequent choices. The majority of respondents from Region 5 had a positive outlook (either "a little better" or "much better") for their business as opposed to the previous three years.

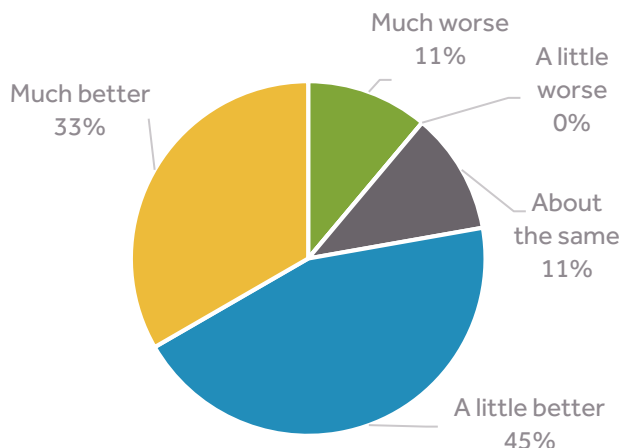
*TAX STATUS FOR 2018 REGION 5 SURVEY RESPONDANTS*



*DISTRIBUTION OF SURVEY RESPONDANTS IN REGION 5*

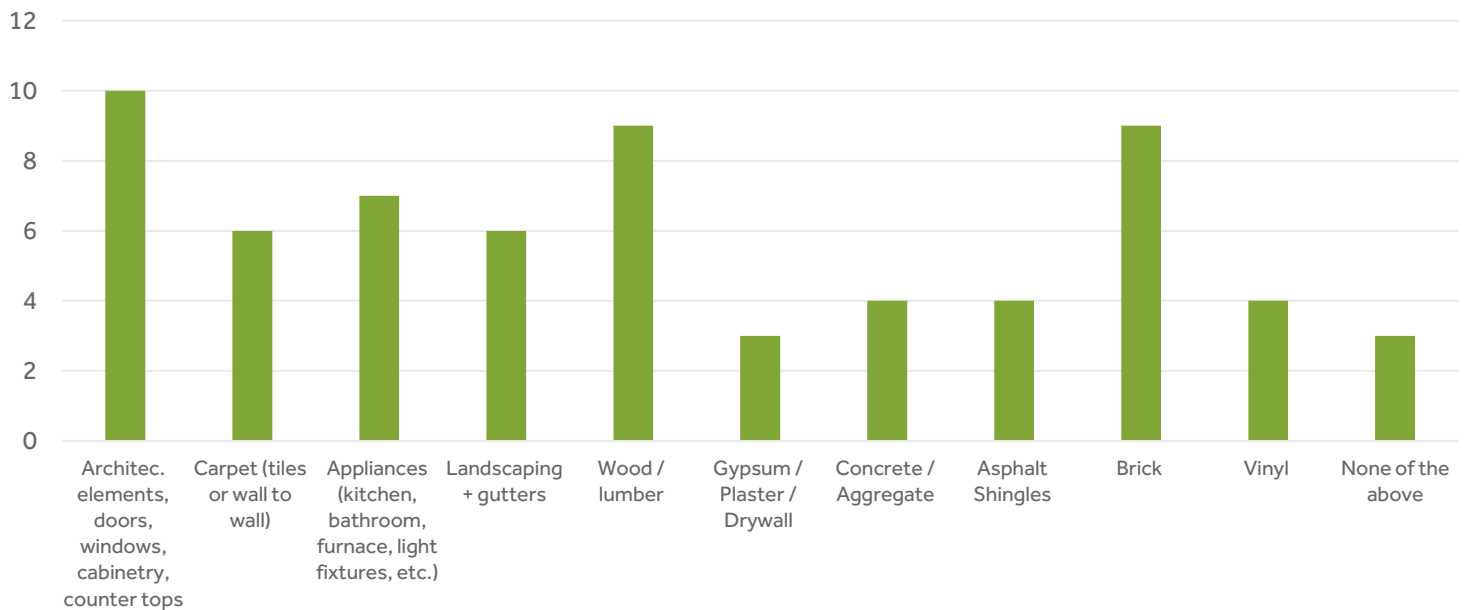


*OVERALL BUSINESS OUTLOOK COMPARED TO LAST 3 YEARS*



The Building Materials Reuse Association has surveyed members in the past, and hopes to use a condensed, streamlined survey to gather more consistent data from a larger group of BMRA members and others in the industry in the future. With annual survey distribution, BMRA will be able to gain valuable insight into the needs and capacity of building materials reuse practitioners.

*MATERIAL TYPES REGULARLY ENCOUNTERED BY SURVEY  
RESPONDENTS FROM REGION 5*



## Summary + Recommendations

Construction and demolition (C&D) waste comprises a significant portion of the waste stream in the Upper Midwest. C&D material represents economic opportunity when it is able to enter the market as raw material. Greater clarity about the amount and type of C&D materials going to landfills can inspire a dialog about material management that could ultimately inform policy and programming resulting in environmental and economic benefits for Region 5.

## Findings and Recommendations

The table below documents C&D disposal data and economic potential for C&D materials in Region 5 states. Though the available data is inconsistent in many ways, including year collected, methodology, and comprehensiveness for both geography and materials, it can serve as a baseline to understand the amount and type of C&D debris entering landfills and what impact that material could have on the economy of the Upper Midwest.

| Region 5 State        | Employees of Businesses with Potential to Include Reused or Recycled C&D | Total State Employment October 2018 <sup>127</sup> | Annual Sales Volume for Businesses with Potential to Include Reused or Recycled C&D | % of material disposed at MSW landfills that is C&D | C&D Tons Disposed             | Potential Job Creation through Recycling Disposed C&D <sup>xviii, 128</sup> |
|-----------------------|--------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------|-----------------------------------------------------------------------------|
| Illinois              | 9,109                                                                    | 6,218,000                                          | \$2,917,947,000                                                                     | 22.5% <sup>129</sup>                                | 4,252,500 <sup>xix,130</sup>  | 991                                                                         |
| Indiana               | 7,515                                                                    | 3,402,000                                          | \$3,033,767,000                                                                     | 13.6% <sup>xx,131</sup>                             | 1,165,370 <sup>xxi,132</sup>  | 272                                                                         |
| Michigan              | 8,915                                                                    | 4,700,300                                          | \$2,956,135,000                                                                     | 5.2% <sup>xxii,133</sup>                            | 1,503,412 <sup>134</sup>      | 350                                                                         |
| Minnesota             | 6,285                                                                    | 3,008,000                                          | \$2,203,845,000                                                                     | 8% <sup>xxiii,135</sup>                             | 1,280,000 <sup>xxiv,136</sup> | 298                                                                         |
| Ohio                  | 14,576                                                                   | 5,504,000                                          | \$3,770,507,000                                                                     | 7% <sup>xxv,137</sup>                               | 4,900,000 <sup>xxvi,138</sup> | 1,142                                                                       |
| Wisconsin             | 10,547                                                                   | 3,075,000                                          | \$2,731,850,000                                                                     | 21.3% <sup>xxvii,139</sup>                          | 914,777 <sup>xxviii,140</sup> | 213                                                                         |
| <b>Region 5 Total</b> | <b>56,947</b>                                                            | <b>25,907,300</b>                                  | <b>\$17,614,051,000</b>                                                             | <b>12.9%<sup>xxix</sup></b>                         | <b>14,016,059</b>             | <b>3,266</b>                                                                |

### *Economic Potential and Disposal Data for C&D Debris in Region 5 States*

*Several sources – see footnotes and endnotes*

<sup>xviii</sup> CDRA estimates 233 jobs created per million tons of Mixed C&D recycled.

<sup>xix</sup> Statewide C&D data references C&D materials disposed in MSW landfills, 22.5% of 18.9 million tons disposed.

<sup>xx</sup> C&D debris comprised 6.01% and wood comprised 7.54% of material disposed in Indiana MSW landfills

<sup>xxi</sup> 517,260 tons of C&D debris and 648,110 tons of wood were disposed in Indiana MSW landfills.

<sup>xxii</sup> 5.2% only represents the amount of wood disposed in MSW landfills, C&D debris is not measured. Beyond only MSW landfill disposal, C&D comprises 11% of the entire waste stream.

<sup>xxiii</sup> 5.7% of MSW is wood, 2.3% of MSW is carpet – C&D is not a specific category in this characterization study.

<sup>xxiv</sup> Statewide, MPCA estimates that 80% of the 1.6 million tons of C&D debris generated in 2013 was landfilled.

<sup>xxv</sup> C&D was 7% of entire waste stream.

<sup>xxvi</sup> 3.4 million tons to C&D landfills, 1.5 million tons of C&D material to MSW facilities.

<sup>xxvii</sup> C&D percentage of entire waste stream

<sup>xxviii</sup> Does not include waste generated by road construction.

<sup>xxix</sup> Average

### **Finding: Region 5 states are disposing a significant amount of C&D material and have opportunity to divert a portion of that material from landfills**

Region 5 states are disposing millions of tons of C&D debris each year. This presents a massive opportunity to capture economic value from these materials, while reducing the burden on C&D and municipal solid waste (MSW) landfills. Statewide generation and characterization studies provide a baseline of 14 million tons of C&D debris disposed in Region 5 each year, which should be considered a low estimate. Several states, including Illinois, calculate C&D material disposed in MSW landfills, but do not include material disposed in C&D specific landfill sites, and other states, including Wisconsin, annually calculate separated C&D, but not C&D debris mixed with MSW.

Additionally, Region 5 states have a growing number of both vacant structures and new construction permits, which can provide an opportunity for significant material salvage as vacant and blighted structures are removed, and C&D debris is generated through new construction.

#### **Recommendation**

Region 5 states should develop strategies to manage and reduce C&D waste, and reenter those materials into the marketplace. Local governments should support material reuse organizations and consider legislation to discourage valuable materials from entering landfills. Additionally, government agencies, like state Departments of Transportation, should encourage procurement of C&D debris as raw materials.

The Upper Midwest states are facing similar challenges and opportunities, and regional collaboration can help inform strategies for sustainable materials management.

### **Finding: Data is inconsistent**

Throughout Region 5 states, counties, and municipalities, waste generation and characterization data is collected inconsistently, particularly construction and demolition waste. Solid waste plans and studies often focus exclusively or primarily on municipal solid waste generated from the residential sector. States do not uniformly regulate C&D waste, and data collected inconsistently from processing, collection, and disposition create a barrier to effectively implement regulations.

#### **Recommendation**

State and county governments should support standardization of waste planning and characterization: Waste planning and characterization at the state and county level, particularly planning and characterization with a focus on C&D debris, can help local stakeholders and policy makers understand their waste. Additionally, identifying the source of MSW and C&D debris (e.g. residential, commercial, industrial) can guide waste management and policy decisions. Understanding C&D waste and where it is being generated at a state and county scale can reduce the amount of reusable material sent to landfills, and keep the value of that material in local communities.

### **Finding: There are jobs and capital already present in industries with the potential to include reused or recycled C&D**

Delta Institute identified industries that already use or could potentially use the targeted materials as an input to process and sell as their primary business activity. Those industries included construction, manufacturing, wholesale trade, retail trade and services. Within these larger categories, Delta compiled data from further specified industries in which it was clear that the products could be made with recycled/reused construction demolition materials. ReferenceUSA was used to calculate the current number of employees and sales volumes by state for the businesses in the identified industries, indicating the scale of potential economic impact for each state. While the total number of direct employees ranges between 6,000 to over 14,000 per state, each state has \$2-3 billion in sales. While small in comparison to major sector jobs such as waste management or construction, the number of jobs related to C&D debris management can grow.

Another methodology to determine economic impact of C&D debris recovery, specifically recycling, in Region 5 is through the calculation of jobs per ton of C&D material. The Construction and Demolition Recycling Association's 2014 white paper estimates that 233 jobs in mixed C&D recycling are created per million tons of C&D debris recycled annually.<sup>141</sup> Under this assumption, approximately 3,266 jobs could be created in Region 5 if the disposed tons were instead recovered.

#### **Recommendation**

Increased awareness of this subsector of the construction and demolition industries can encourage investment and innovation in building material reuse and recycling. State and local governments should consider local and regional workshops and meetings to encourage collaboration, provide resources and tools to help broker materials (e.g. Pathways21), and expand the industry's presence in Region 5. Additionally, further research into the job creation potential of recycling and reusing C&D material currently sent to landfills could encourage investment and infrastructure development for the industry.

### **Finding: Opportunities for reuse are not as prevalent as opportunities for recycling**

Markets are generally much stronger for material recycling than reuse, and reuse opportunities typically exist at a very small scale. Recycling material is a significant improvement over landfilling, but material reuse can avoid energy-use and costs associated with extracting materials and producing new products, while also diverting material from landfills.

#### **Recommendation**

State and local governments should identify strategies to incentivize reuse of C&D debris. Investment in specific material research to develop reuse options for these materials can encourage entrepreneurship and innovation. State and local governments could also leverage procurement strategies to incentivize use of C&D debris either through purchasing guidance or on-site reuse requirements when demolishing and constructing new facilities.

Additionally, EPA and other agencies should research alternatives for building materials that are not easily recycled or reused to avoid use of potentially toxic, disposable materials.

# APPENDICES

## Housing and Vacancy data by State

*Census Data, American Fact Finder, 2000 and 2010*

| ILLINOIS             | 2000      | 2010      | Trend          |
|----------------------|-----------|-----------|----------------|
| Total housing units  | 4,885,615 | 5,296,715 | 8.4% increase  |
| Vacant housing units | 293,836   | 459,743   | 56.5% increase |
| Percent vacant       | 6.0%      | 8.7%      |                |

| INDIANA              | 2000      | 2010      | Trend          |
|----------------------|-----------|-----------|----------------|
| Total housing units  | 2,532,319 | 2,795,541 | 10.4% increase |
| Vacant housing units | 196,013   | 293,387   | 49.7% increase |
| Percent vacant       | 7.7%      | 10.5%     |                |

| MICHIGAN             | 2000      | 2010      | Trend          |
|----------------------|-----------|-----------|----------------|
| Total housing units  | 4,234,279 | 4,532,233 | 7.0% increase  |
| Vacant housing units | 448,618   | 659,725   | 47.1% increase |
| Percent vacant       | 10.6%     | 14.6%     |                |

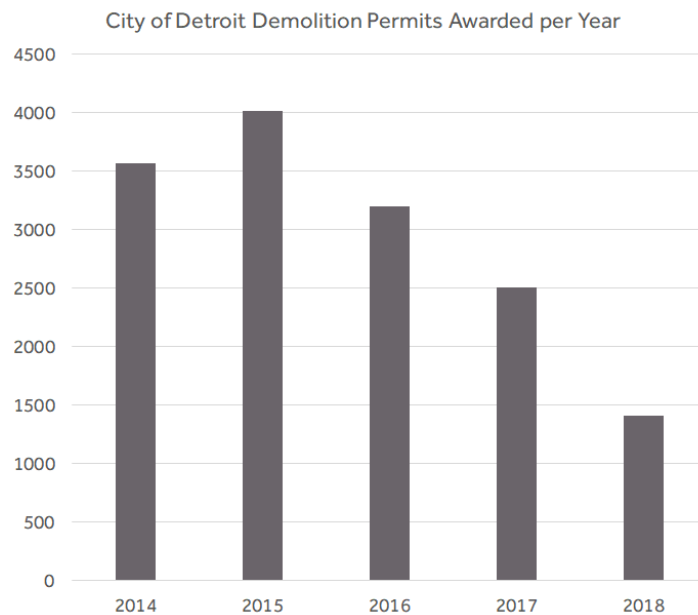
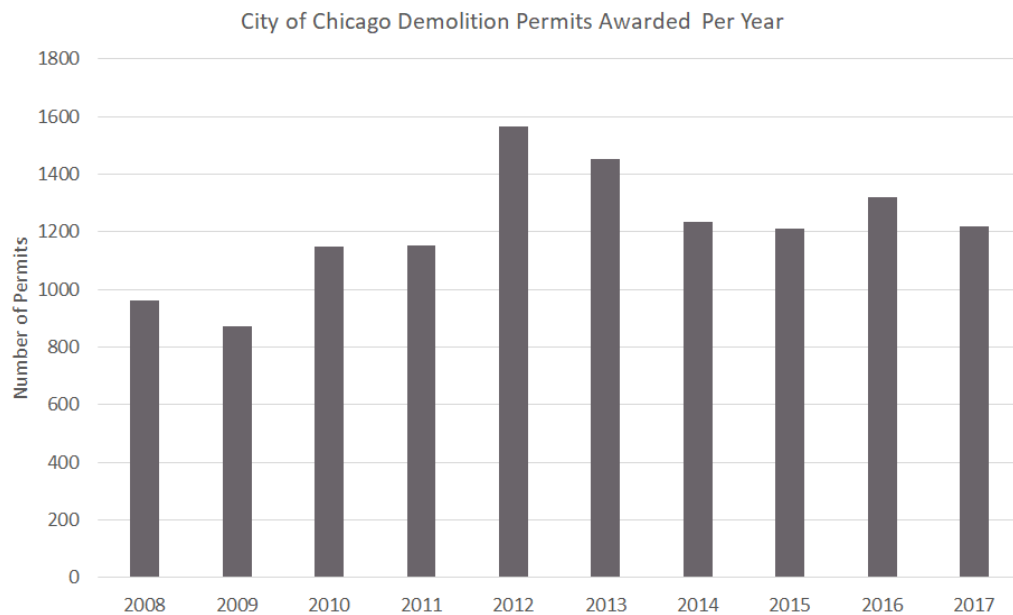
| MINNESOTA            | 2000      | 2010      | Trend          |
|----------------------|-----------|-----------|----------------|
| Total housing units  | 2,065,946 | 2,347,201 | 13.6% increase |
| Vacant housing units | 170,819   | 259,974   | 52.2% increase |
| Percent vacant       | 8.3%      | 11.1%     |                |

| OHIO                 | 2000      | 2010      | Trend          |
|----------------------|-----------|-----------|----------------|
| Total housing units  | 4,783,051 | 5,127,508 | 7.2% increase  |
| Vacant housing units | 337,278   | 524,073   | 55.4% increase |
| Percent vacant       | 7.1%      | 10.2%     |                |

| WISCONSIN            | 2000      | 2010      | Trend          |
|----------------------|-----------|-----------|----------------|
| Total housing units  | 2,321,144 | 2,624,358 | 13.1% increase |
| Vacant housing units | 236,600   | 344,590   | 45.6% increase |
| Percent vacant       | 10.2%     | 13.1%     |                |

## Annual Demolition Permits in Chicago, IL and Detroit, MI

*City of Chicago Building Permits Data Portal, City of Detroit Demolitions Data Lens*





## New Privately Owned Housing Units Authorized – Unadjusted Units for States

US Census <https://www.census.gov/construction/bps/>

| Annual 2017 |        |        |         |             |          |                            |
|-------------|--------|--------|---------|-------------|----------|----------------------------|
|             | Total  | 1 Unit | 2 Units | 3 / 4 Units | 5+ Units | # Structures with 5+ Units |
| Illinois    | 24,992 | 10,181 | 318     | 875         | 13,618   | 400                        |
| Indiana     | 21,664 | 16,075 | 444     | 78          | 5,067    | 272                        |
| Michigan    | 23,623 | 16,652 | 258     | 438         | 6,275    | 325                        |
| Minnesota   | 21,953 | 13,508 | 142     | 174         | 8,129    | 140                        |
| Ohio        | 23,917 | 16,153 | 264     | 591         | 6,909    | 367                        |
| Wisconsin   | 19,545 | 11,769 | 728     | 103         | 6,945    | 292                        |
| Annual 2016 |        |        |         |             |          |                            |
|             | Total  | 1 Unit | 2 Units | 3/4 Units   | 5+ Units | # Structures with 5+ Units |
| Illinois    | 22,603 | 10,187 | 350     | 712         | 11,354   | 347                        |
| Indiana     | 18,713 | 14,068 | 572     | 163         | 3,910    | 219                        |
| Michigan    | 20,408 | 14,534 | 532     | 240         | 5,102    | 263                        |
| Minnesota   | 21,449 | 12,071 | 124     | 215         | 9,039    | 184                        |
| Ohio        | 22,816 | 15,221 | 406     | 540         | 6,649    | 355                        |
| Wisconsin   | 19,274 | 10,998 | 634     | 180         | 7,462    | 286                        |
| Annual 2015 |        |        |         |             |          |                            |
|             | Total  | 1 Unit | 2 Units | 3/4 Units   | 5+ Units | # Structures with 5+ Units |
| Illinois    | 19,571 | 10,076 | 322     | 577         | 8,596    | 276                        |
| Indiana     | 18,483 | 12,646 | 526     | 289         | 5,022    | 316                        |
| Michigan    | 18,226 | 13,398 | 354     | 252         | 4,222    | 243                        |
| Minnesota   | 19,545 | 10,900 | 98      | 332         | 8,215    | 191                        |
| Ohio        | 20,047 | 13,529 | 318     | 657         | 5,543    | 301                        |
| Wisconsin   | 16,793 | 9,791  | 530     | 183         | 6,289    | 290                        |
| Annual 2014 |        |        |         |             |          |                            |
|             | Total  | 1 Unit | 2 Units | 3/4 Units   | 5+ Units | # Structures with 5+ Units |
| Illinois    | 20,602 | 10,577 | 332     | 500         | 9,193    | 275                        |
| Indiana     | 17,813 | 12,136 | 362     | 201         | 5,114    | 299                        |
| Michigan    | 15,836 | 12,278 | 248     | 266         | 3,044    | 175                        |
| Minnesota   | 17,010 | 10,700 | 112     | 188         | 6,010    | 152                        |
| Ohio        | 19,965 | 12,629 | 292     | 676         | 6,368    | 380                        |
| Wisconsin   | 14,741 | 8,696  | 414     | 178         | 5,453    | 282                        |

## Composition Profile of Landfilled MSW in Illinois in 2008

DCEO, IL Recycling Association, CDM, Illinois Commodity/Waste Generation and Characterization Study, 2009

| Material                 | Residential MSW % | ICI MSW % | All MSW % | Tons (all Illinois landfilled MSW) |
|--------------------------|-------------------|-----------|-----------|------------------------------------|
| Clean dimensional lumber | 0.8%              | 3.5%      | 2.2%      | 379,610                            |
| Clean engineered wood    | 1.3%              | 3.0%      | 2.1%      | 365,280                            |
| Wood pallets             | 0.2%              | 1.7%      | 1.0%      | 149,810                            |
| Painted wood             | 1.7%              | 1.8%      | 1.7%      | 269,450                            |
| Treated wood             | 3.1%              | 2.9%      | 3.0%      | 604,220                            |
| Concrete                 | 0.2%              | 2.7%      | 1.5%      | 399,850                            |
| Reinforced concrete      | 0.0%              | 0.1%      | 0.0%      | 38,250                             |
| Asphalt paving           | 0.0%              | 0.0%      | 0.0%      | 6,120                              |
| Rock & other aggregate   | 0.2%              | 0.3%      | 0.3%      | 231,660                            |
| Bricks                   | 0.2%              | 0.6%      | 0.4%      | 64,820                             |
| Gypsum board             | 1.7%              | 3.5%      | 2.6%      | 471,650                            |
| Composition shingles     | 0.5%              | 1.3%      | 0.9%      | 405,080                            |
| Other roofing            | 0.2%              | 0.0%      | 0.1%      | 79,000                             |
| Plastic C&D materials    | 0.1%              | 0.2%      | 0.1%      | 18,760                             |
| Ceramics/Porcelain       | 1.9%              | 0.3%      | 1.0%      | 148,670                            |
| Other C&D                | 0.7%              | 1.3%      | 1.0%      | 206,270                            |

## Composition Profile of Landfilled C&D in Illinois in 2008

DCEO, IL Recycling Association, CDM, Illinois Commodity/Waste Generation and Characterization Study, 2009

| Material                | % of landfilled C&D | Material                 | % of landfilled C&D |
|-------------------------|---------------------|--------------------------|---------------------|
| Composition shingles    | 17.7%               | Bottom fines and dirt    | 6.8%                |
| Concrete                | 12.3%               | Clean dimensional lumber | 5.0%                |
| Rock & other aggregates | 12.2%               | Other roofing            | 3.9%                |
| Treated wood            | 11.8%               | Reinforced concrete      | 2.1%                |
| Gypsum board            | 7.4%                | Painted wood             | 1.9%                |

## Overall Indiana MSW Composition, Including Imports (C&D Materials)

*Abramowitz and Sun, Municipal Solid Waste Characterization Study for Indiana, 2012*

| Material                                       | Tonnage | Mean % |
|------------------------------------------------|---------|--------|
| Non-treated wood                               | 164,796 | 1.92%  |
| Treated wood                                   | 483,314 | 5.62%  |
| Demolition/ renovation/<br>construction debris | 517,260 | 6.01%  |

## Wisconsin Statewide Waste Characterization (C&D Material) in 2002 and 2009

*Recycling Connections, MSW Consultants, Wisconsin Statewide Waste Characterization Study, 2010*

| Material                      | 2002 Tons | 2002 Percent | 2009 Tons | 2009 Percent |
|-------------------------------|-----------|--------------|-----------|--------------|
| Wood - all untreated          | 607,650   | 12.8%        | 383,638   | 8.9%         |
| Clean dimensional lumber      | N/A       | N/A          | 95,554    | 2.2%         |
| Clean engineered wood         | N/A       | N/A          | 73,287    | 1.7%         |
| Painted/ stained wood         | N/A       | N/A          | 188,548   | 4.4%         |
| Other recyclable wood         | N/A       | N/A          | 26,249    | 0.6%         |
| Roofing Shingles              | 284,752   | 6.0%         | 247,349   | 5.8%         |
| Rock/ Concrete/ Brick         | 165,727   | 3.5%         | N/A       | N/A          |
| Treated wood                  | N/A       | N/A          | 38,548    | 0.9%         |
| Drywall - demolition          | N/A       | N/A          | 34,734    | 0.8%         |
| Drywall - clean scrap         | N/A       | N/A          | 21,340    | 0.5%         |
| PVC                           | N/A       | N/A          | 10,841    | 0.3%         |
| Ceramics / Porcelain fixtures | N/A       | N/A          | 11,403    | 0.3%         |
| Other C&D                     | N/A       | N/A          | 93,215    | 2.2%         |

"Wood - untreated" includes untreated dimensional lumber, engineered wood, painted/stained wood, and other recyclable wood

## QuestionPro Survey Text – Distributed to BMRA Members

<https://bmra2018.questionpro.com>

The Building Material Reuse Association and the Delta Institute have teamed up to collect information for the building materials reuse industry with the goal of making reliable industry information available and identifying key questions or challenges facing the industry.

To make it easier to complete, we have greatly simplified and shortened the survey since last executed. Please allow 10-20 minutes to take the survey. We greatly appreciate your feedback in our online survey. All responses will remain anonymous and secure. Please only have one person complete the survey per organization. Because the survey is anonymous, we will not be able to control for duplicates. Thank you in advance for your valuable insights. Your input will be used to ensure that we continue to meet your needs. We appreciate your trust and look forward to serving you in the future.

We have contracted with QuestionPro, an independent research firm, to field your confidential survey responses. Please start the survey now by clicking on the Next button below.

Q1 - Please select the tax status that applies to your organization. (Multiple may be selected to indicate your organization's holdings)

- 501c(3)
- 501c(4)
- LLC
- L3C
- Foreign Entity
- Public Benefits Corporation
- "C" Corporation
- "S" Corporation
- Programmatic initiative of another organizations
- Individual

Q2 - What are your organization's primary building material reuse activities?

- Deconstruction contractor
- Retailer / broker of used building materials
- Exclusively online retailer / broker of used building materials
- Workforce / community development organization
- Architectural salvage
- C&D material recovery center (MRF)
- Single stream material recovery center
- Value added producers
- Other

Q3 - In which U.S. states does your organization work?

Q4 - How many FTE (full time equivalent) employees does your organization employ?

Q5 - Does your organization include a workforce development program?

- Yes – through a partnership with a workforce development organization
- Yes – in house
- No

Q6 - How many FTE (full time equivalent) employees does your Workforce Development program employ?

Q7 - Annually, how many volunteers does your organization have (if any)?

Q8 - Where does your material come from?

- Deconstruction and soft strips
- Contractors (including renovation and new construction)
- Store drop offs
- Store pick ups
- N/A
- Other

Q9 - Please check all material types that your organization regularly comes in contact with

- Architectural elements / doors / windows / cabinetry / countertops
- Carpet (tiles or wall to wall)
- Appliances (kitchen, bathroom, furnace, light fixtures, etc.)
- Landscaping / gutters
- Wood / lumber
- Gypsum / plaster / drywall
- Concrete / aggregate
- Asphalt shingles
- Brick
- Vinyl
- None of the above

*Depending on Q9, survey respondents were asked specific questions for indicated materials, Q10 through Q27 are three-question loops for each target material type – Wood / lumber, Gypsum / plaster / drywall, Concrete / aggregate, Asphalt shingles, and vinyl. Questions included*

- *How is (material) used by your organization?*
- *What is the estimated amount of (material) your organization encounters annually?*
- *What is the estimated amount of (material) your organization is able to divert from landfills annually?*

*If no target materials were selected, survey respondents were taken directly to Q28*

Q28 – What is the average annual revenue for your organization?

Q29 – How many customer purchases did your business record last year?

Q30 – What is the physical size of your operation?

Q31 – What is the overall outlook for your business in comparison to the last three years?

- Much worse
- A little worse
- About the same
- A little better
- Much better

Q32 – Is your organization a member of BMRA?

Q33 – Is there any material that your organization encounters that is difficult to divert that you would like BMRA to research potential end uses for?

Q34 – Is there anything else we should know about building material reuse markets?

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<sup>2</sup> US Bureau of Labor Statistics. Labor force data. <https://www.bls.gov/eag/eag.il.htm>.

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<sup>4</sup> Delta Institute. Cook County deconstruction strategy report. 2011. <https://www.slideshare.net/cookcountyblog/cook-county-deconstruction-strategy-report>.

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<https://www.slideshare.net/cookcountyblog/cook-county-deconstruction-strategy-report>.
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- <sup>29</sup> Reusewood.org. North America's wood reuse & recycling directory. <https://reusewood.org/>.
- <sup>30</sup> Minnesota Pollution Control Agency. Salvage and reuse. <https://www.pca.state.mn.us/waste/salvage-and-reuse>.
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- <sup>34</sup> Delta Institute Interview with Paul Wever, Chip Energy. March 28, 2018.
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