HENNEPIN COUNTY CONSTRUCTION AND DEMOLITION WASTE STUDY

June 29, 2023

Prepared for:
Hennepin County
Department of Environment and Energy

Prepared by:
Stantec Consulting Services, Inc.
One Carlson Parkway
Plymouth, MN 55447

Project Number: 227705302

The conclusions in the Report titled Hennepin County C&D Waste Study are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from Hennepin County (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided to applicable authorities having jurisdiction and others for whom the Client is responsible, Stantec does not warrant the services to any third party. The report may not be relied upon by any other party without the express written consent of Stantec, which may be withheld at Stantec's discretion.

Prepared by: Sonya Betker
Nick Vetsch
Samantha Wheeler

Reviewed by: 

Signature

Brad Sullivan

Printed Name

Approved by: 

Signature

Sonya Betker

Printed Name

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

A Construction and Demolition (C&D) Waste Study (Study) was completed by Stantec on behalf of Hennepin County in 2022. The Study aimed to gain insight into reuse and recycling practices at remodeling and renovation projects via interviews with contractors, site visits, and waste management data collection. Remodel projects were selected for the Study using building permit lists provided by the cities of Minneapolis, Edina, and Shorewood.

Outreach was conducted via phone and email. Contractors were asked to answer a series of interview questions focused on reuse and recycling practices. These questions centered around a specific project selected from the building permit lists, but also touched on general practices. Contractors were also asked about barriers to sustainable practices and suggestions for systemic improvement that would encourage participation. Additionally, contractors were asked to provide waste weight and diversion data associated with the focus project. A $100 gift card was provided as an incentive to the companies which completed the interview and provided data.

A total of 126 contractors were contacted. Of those, 29% participated in an interview and 17% provided waste management data. Interview results indicated that 17% of contractors were participating in source separation and 43% were participating in reuse. Both participation rates were slightly higher on residential projects than commercial projects. The most common form of reuse was by the current owner either utilizing items in the same space or repurposed in a new space. Items that were most frequently reused included doors, cabinets, and fixtures.

The most common barriers to reuse and recycling reported by contractors were time and labor costs. Time concerns associated with reuse and recycling included time spent coordinating logistics of reuse, hauling time, and additional effort invested in deconstruction. Another barrier reported is the perception of undesirability or that items being removed from their projects are of low value. Differences in barriers between residential and commercial projects are discussed in this Report. Contractors also provided specific suggestions for the County to improve C&D reuse/recycling opportunities including a no-cost collection service, financial incentives, and education for contractors, homeowners, and architects.

Contractors were also asked about utilization of reused materials within their projects. None of the projects studied were installing reused materials brought in from an external source. Some were re-installing items reused from the same space. Several contractors reported that their clients are looking for a fresh look in their remodel projects, which requires new building materials. However, some contractors did report sourcing salvaged building materials for other projects to match the look of historic buildings. Concerns were also raised about quality and longevity of reused materials.

Recommendations outlined in this report include the establishment of a contractor advisory board, centralization of reuse systems via informational resources and a public-private partnership warehouse, a contractor education program, an investment in recycling resources, and the promotion of sustainable building materials.

1 Introduction

1.1 Purpose

The goal of the Hennepin County Construction and Demolition Waste Study (Study) was to collect qualitative and quantitative data on waste management at commercial and residential remodel projects in Hennepin County (County). The County solicited the help of Stantec to gather and analyze this data. The Study aimed to better understand reuse and recycling practices at remodeling sites, final destinations for construction and demolition (C&D) waste, and contractor perspectives on and experiences with reuse and recycling of building materials. The County also requested that Stantec use the data collected to provide recommendations for system improvements, including policy and program suggestions.

1.2 Project Parameters

Hennepin County established the following parameters to select construction projects for the Study:

- Remodeling and renovation projects
- Projects valued over $10,000 (inclusive of demolition and construction)
- Project sites within Hennepin County, and specifically within Minneapolis, Edina, and Shorewood

Projects within Minneapolis, Edina, and Shorewood were included in this Study due to the fact that each city's existing building permitting system could easily identify and share project information with the County that met this Study's criteria.

Table 1 shows the original goals set by Hennepin County for the number of projects to be captured in each category. Hennepin County later allowed Stantec to collect data from projects in other cities within the County, in cases where contractors did not yet have data from the project associated with the original contact.

Table 1 - Outreach Goals

City	Residential Projects	Commercial Projects	Total
Minneapolis	7	5	12
Edina	6	4	10
Shorewood	3	0	3
Total	16	9	25

1.3 Review of Existing Information

1.3.1 DECONSTRUCTION POLICIES

First reviewed was the *Draft Hennepin County Construction and Demolition Reuse and Recycling Policy* dated July 2022 (supplied via email). This policy proposes guidelines applicable to internal Hennepin County funded construction projects to reuse and recycle building materials. For example, county projects involving the removal of a residential structure built in 1955 or earlier should be fully deconstructed so that materials may be evaluated for reuse. Further recommendations are outlined for other types of projects such as commercial remodels and renovations and road and bridge improvements.

A brief selection of ordinances from around the US was reviewed and it was noted that:

- Milwaukee, WI[1] - homes built before 1930 must be deconstructed effective 2018. (Note: This ordinance has been frozen since 2019 with no current plans to re-implement it).
- Portland, OR[2] - homes built in or before 1916 must be deconstructed effective 2016, expanded to homes built before 1940 in 2019.
- San Antonio, TX[3] - Phase I homes built in or before 1920 must be deconstructed effective 2022 for City-executed demolitions, Phase II homes built in or before 1920 must be deconstructed effective 2023 for all demolitions, Phase III homes built in or before 1945 must be deconstructed effective 2025 for all demolitions.
- St. Louis Park, MN[4] – Full or partial deconstruction requirements for projects that receive or use $200,000 or more in city financial assistance and/or receive approval for certain land use applications and include the removal of buildings constructed prior to 1956.

These examples are all city-level ordinances. Any Hennepin County policies surrounding deconstruction are strictly internal and not ordinance requirements. However, if cities within the County look to implement deconstruction ordinances, the County would explore options to support cities in the development and implementation process.

The phased approach of expanding the original construction date requiring full deconstruction used in the Portland, OR and San Antonio, TX examples may be useful as the Hennepin County program continues to develop.

[1] https://www.cdrecycler.com/article/milwaukee-ordinance-calls-for-deconstruction/#:~:text=An%20approved%20ordinance%20in%20Milwaukee%20is%20designed%20to,demolition%20must%20be%20deconstructed%20rather%20than%20torn%20down.
[2] https://www.portland.gov/bps/news/2019/7/24/proposed-amendment-deconstruction-ordinance-would-increase-deconstruction#:~:text=In%202016%2C%20the%20Portland%20City%20Council%20adopted%20a,earlier%20or%20designated%20as%20historic%20regardless%20of%20age
[3] https://www.wastedive.com/news/san-antonio-deconstruction-ordinance-building-materials-reuse-circular-economy/634377/
[4] https://www.stlouisparkmn.gov/home/showpublisheddocument/23233/637902841408170000

1.3.2 HENNEPIN COUNTY WEB RESOURCES

The Hennepin County webpage *Construction and Demolition Waste for Contractors*[5] provides a variety of resources. Information sections on the site include:

- Pre-demolition inspections,
- Materials that must be removed prior to demolition,
- Properly dispose of regulated materials,
- Salvage reusable building materials,
- Deconstruction, and
- Recycling construction and demolition materials.

The document *Before You Demo: Guide for Contractors*[6] is provided as a link on the webpage and includes similar information to what is published on the webpage.

The "Salvage reusable building materials" section of the webpage states:

> "The following organizations and businesses offer salvage opportunities for building materials. Contact the retailer directly to check for materials accepted, drop-off hours, and other considerations, such as material pick-up. This list does not constitute approval of any of the firms identified nor do we claim the list is complete."

The webpage then lists the following known salvage businesses including their contact information and acceptable materials:

- A Plus Appliances (St. Paul, MN)
- Accent Store Fixtures (Minneapolis, MN)
- Architectural Antiques (Minneapolis, MN)
- Art & Architecture (Minneapolis, MN)
- Bauer Brothers Salvage, Inc. (Minneapolis, MN)
- Better Futures Minnesota (Minneapolis, MN)
- Bridging (Bloomington, MN)
- City Salvage (Minneapolis, MN)
- Furnish Office & Home (Minneapolis, MN)
- Guilded Salvage (Minneapolis, MN)
- Habitat for Humanity ReStore (Minneapolis, MN and New Brighton, MN)
- Historic Stone Company (Minneapolis, MN)
- Northwest Architectural Salvage (St. Paul, MN)
- No Boundary Tiny Homes (Eau Claire, WI (willing to travel to Twin Cities))
- Second Chance Recycling (Minneapolis, MN)

[5] https://www.hennepin.us/demolition
[6] https://www.hennepin.us/-/media/hennepinus/business/recycling-hazardous-waste/documents/before-you-demo-guide-contractors.pdf

Two additional material outlets are provided under "Recycling construction and demolition materials":

- Atomic Recycling
- Dem-Con

As discussed further in Section 4.2 Centralization, it is recommended that these resources for contractors be expanded upon in a centralized tool to coordinate available inventory and desired items/materials of the various outlets. The outlets listed could also be expanded upon to include additional recycling outlets, particularly scrap metal recyclers, to promote upstream diversion.

1.3.3 OTHER WEB RESOURCES

Also discussed in Section 4.2 Centralization, the Minnesota Technical Assistance Program (MnTAP) Materials Exchange Program[7] is a central hub which has been developed to connect organizations that have goods they no longer need to those who are able to utilize them. They broker a variety of materials through the website from art supplies to sporting goods to building and construction materials. The Materials Exchange Program operates similarly to Craigslist or Facebook Marketplace (which also offer salvage-type listings), relying on providers and users to coordinate marketing and exchange of goods.

Connecting as many resources as possible into a central tool that could more effectively let users know when goods they need are available and allow suppliers to more quickly get rid of items they don't want would incentivize both diversion and reuse by making the process more efficient. Collection, storage, and delivery of items and materials are potential aspects of a system which would need to be accounted for.

1.3.4 PREVIOUS C&D STUDY

The 2015 *Construction and Demolition Diversion Capacity Study*[8] produced for Hennepin County by Foth assessed the capacity of existing Metro C&D processing facilities to further divert additional materials. The study identified ample capacity for the facilities to process additional material, as well as identifying potential barriers to the expansion of the reuse retail outlets discussed in this report. As citied in the Foth study, MPCA estimated as of 2013 that 30 percent of Twin Cities Metro C&D waste is recycled based on permitted facilities. These findings show that there is significant opportunity to increase the recovery of C&D materials.

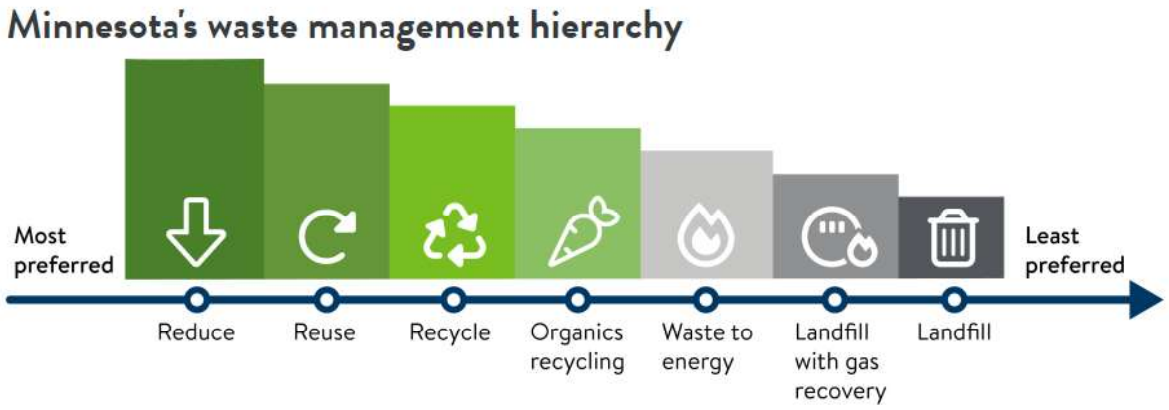
[7] http://www.mntap.umn.edu/services/matex/
[8] https://www.hennepin.us/-/media/hennepinus/your-government/projects-initiatives/solid-waste-planning/construction-demolition-diversion-capacity-study.pdf

2 Methods

2.1 Outreach and Interview Methods

The general approach of the Study in generating interview questions is based on Minnesota's waste management hierarchy, seeking to direct discarded items and materials to their highest and best use. Figure 1 presents a detailed example of a waste hierarchy. Another resource utilized for background on material uses was the US EPA *Sustainable Management of Construction and Demolition Materials*[9] webpage.

Figure 1 – Minnesota Pollution Control Agency Waste Management Hierarchy[10]



The data collection process was based on direct outreach to contractors. Lists of contractors were generated by the cities of Minneapolis, Edina, and Shorewood based on recently issued building permits. The lists were filtered using the project parameters defined above. The lists were further refined by eliminating projects which were not expected to produce significant quantities or varieties of waste (i.e., deck and shed additions, garage finishes, etc.).

In some cases, direct contractor contact information was provided. When this was not the case, contact information was found online. Stantec received the building permit lists at varying intervals for approximately two months. A group of miscellaneous contractors (those not on the permit lists) that regularly perform related work regionally was also contacted via personal and professional connections.

[9] https://www.epa.gov/smm/sustainable-management-construction-and-demolition-materials

[10] https://www.pca.state.mn.us/air-water-land-climate/waste-planning-and-recycling

Outreach included a combination of phone calls and emails. In most cases, Stantec reached out to contractors initially by phone, then by a follow-up email as needed. Voicemails were left whenever possible. The original approach was to use the first contact to set up an interview at a future time. However, the approach was adjusted mid-project to complete interviews at the time of the first contact. This change was made because contractor schedules were not conducive to planning a future interview time.

A $100 Visa gift card was provided to contractors who participated in the interview and provided waste data. Twenty-five gift cards were available based on the project budget. The gift card incentive was mentioned at the point of initial contact (both phone and email). It was noted to contractors that providing data would be required to be eligible for the gift card.

Interviews were conducted using the questionnaire in Appendix A. The interview approach was tailored based on contractor responses and time available. Questions about separation, reuse, and waste management challenges and recommendations were prioritized. Stantec took notes during each interview and filled in the questionnaire shortly after the interview using contractor responses.

Follow-up emails and phone calls were completed as needed to reach contractors that had agreed to participate in interviews or data collection. In cases where contractors were not able to provide data for the project related to the initial contact, they were given the option to provide data from a different project which met the project parameters and occurred within approximately the past year.

The option for a site visit was offered to contractors at the time of initial contact. In some cases, Stantec requested a site visit with contractors who showed a particular interest in the topic during or after their phone interview or initial email contact. Site visits included more in-depth conversations with contractors, viewing and photos of the dumpster and other waste, and observation of the construction areas and materials to be demolished.

In addition to contractor interviews associated with specific building permits, Stantec conducted supplementary interviews with two additional industry professionals from Renewed Life Construction and the University of Minnesota ReUse Program (Appendix D).

2.2 Data Analysis Methods

2.2.1 INTERVIEW DATA

To analyze interview data, Stantec used notes from each interview to categorize common contractor sentiments. For example, comments on reuse/recycling challenges were tallied by themes (time/cost, space, quality of materials), which allowed for the calculation of the percent frequency at which contractors discussed each theme. There was some level of subjectivity involved in categorizing contractor comments in order to analyze them numerically. The percent frequency of common comments was also calculated by project type and by city to look for trends. In order to account for valuable contractor perspectives not captured by the data, Stantec also analyzed anecdotal comments and included the most relevant ones in this report.

Not every contractor responded to every interview question, so numerical datapoints are based on a percentage of contractors responding to a particular question.

2.2.2 WASTE DATA

To analyze waste data, Stantec used simple and conditional averages to calculate the metrics shown in Section 3.3 below. It should be noted that not all waste data included yards, tonnage, and cost, so each metric is not necessarily representative of the entire dataset. In cases where the averages only included one or two datapoints, the category was not included in this report due to insufficient data. For example, all Shorewood data was based on a sample size below five, so it is not included in all analyses. Residential data was frequently used to compare cities because all three cities had multiple residential datapoints.

3 Results and Discussion

3.1 Outreach Response

A total of 126 contractors were contacted as part of outreach efforts. Of those, 29% participated in an interview and 17% provided data. Six site visits were conducted. Table 2 shows outreach results and original project goals. In some cases, contractors provided data for multiple projects, or for projects in different categories than the one related to their original contact.

Table 2 – Outreach Goals and Results

	City	Minneapolis	Edina	Shorewood	Miscellaneous	**Total**
Residential	**Interview Goal**	7	6	3	0	**16**
	Interviews	9	9	4	0	**22**
	Data	13	7	3	3	**26**
	Site Visits	2	1	0	1	**4**
Commercial	**Interview Goal**	5	4	0	0	**9**
	Interviews	10	3*	0	0	**13**
	Data	8	0*	0	1	**9**
	Site Visits	2	0	0	0	**2**
Total	**Interview Goal**	12	10	3	0	**25**
	Interviews	19	12	4	0	**35**
	Data	21	7*	3	4	**35**
	Site Visit Goal					**8**
	Site Visits	4	1	0	1	**6***

*Goal not met

All outreach goals were met, except for Edina commercial projects and site visits. The challenge faced with Edina commercial outreach was rooted in a lack of projects meeting the project criteria. Only eight commercial projects in Edina were deemed suitable for outreach, as opposed to 44 in Minneapolis. The interview and data response rates were such that many more outreach contacts would have been required to receive data from five Edina commercial projects. Site visit response is discussed later in this section.

The overall response rate reflects the busy and unpredictable schedules of contractors during peak construction season (outreach occurred from August to October). Some contractors did not have time for an interview or to search for data due to their work schedules. Others had last-minute schedule changes making them unavailable during scheduled interviews.

The outreach response rate was approximately the same between the three cities (29-31%). This metric was calculated based on the city associated with the building permit that led to initial contact – not necessarily the city for which data was provided. The response rate was higher among residential contractors (35%) as opposed to commercial (23%).

Contractors expressed mixed opinions on the gift card incentive. Some did not feel that the compensation would be sufficient to spend time looking for data, while others were interested in participating regardless of the gift card. Contractor interest in a site visit was generally low. Stantec proposes a few possible explanations for this trend:

- Challenges with scheduling a future time for a site visit (similar to challenges with setting up future interview appointments).
- Discomfort with inviting someone on site due to lack of familiarity with Stantec representatives or client/company policies.
- Quantity of requests associated with the Study (some contractors were willing to provide interview and data but stopped responding once the site visit was requested).

Some interview techniques which proved to be beneficial in gaining information from contractors included:

- Using specific contractor email addresses or phone numbers whenever possible, as opposed to the general company contact information.
- Conducting the interview during the outreach call, rather than setting up a second call at a future time.
- Leading with the project address of interest and explaining where the address was sourced from.
- Providing examples of reuse/recycling/deconstruction, as some contractors were participating in these practices but did not necessarily label them as such.
- Asking for contractor approval or feedback on ideas for County waste management initiatives, rather than asking an open-ended question for recommendations.
- Using construction industry language.
- Requesting data and/or a site visit at the end of an interview after building rapport, as opposed to including the request in the initial pitch.
- Providing project-specific details in the data request (i.e., “We are requesting invoices from Dem-Con and Express Metals from this project at 1200 Aldrich Ave S.”).

3.2 Interview Results

Results from phone, email, and in-person interviews are discussed in this section. Photos from the site visits are included in Appendix B. Some photos directly correspond with interview responses discussed below.

3.2.1 SOURCE SEPARATION AND REUSE RATES

This section (3.2.1) addresses all waste that was <u>not</u> collected in a mixed-use dumpster. In this Study, mixed-use dumpsters were defined by the contents of the dumpster (containing multiple material types, as opposed to sorting by material type), not the final destination of the waste (i.e., landfill vs. recycling).

This definition matches language used by contractors to describe their waste management methods. Data on mixed-use dumpster load sizes, waste vendors, and costs were captured more accurately in the data collection process than in interviews, as many contractors did not remember project-specific details about each mixed-use load at the time of the interview. See Section 3.3 below for a summary of the waste data collected in this Study, including mixed-use loads.

For the purpose of categorizing interview responses, source separation was defined as a separation of materials for recycling, as opposed to placing everything in a mixed-use dumpster. Source separation rates do not completely represent recycling rates because some mixed-use loads captured in this Study went to waste facilities with C&D waste recycling capabilities, as discussed in Section 3.3.1 below.

Reuse was defined as diverting items away from dumpsters/disposal sites. This included donation and sale of items, reuse or refurbishing within the same project, contractor or owner removal for personal use, and contractor use in a different project.

Interview responses were categorized by practices reported at the specific project associated with the initial outreach/interview (the focus project), and practices that contractors mentioned more generally for their other projects, but were not taking place on the focus project.

Table 3 – Source Separation and Reuse Rates

	Total	Commercial	Residential	Minneapolis Residential	Edina Residential	Shorewood Residential
Source separation on the focus project	17%	15%	18%	22%	22%	0%
Source separation on other projects, not the focus project	14%	Not specified	Not specified	Not specified	Not specified	Not specified
Reuse on the focus project	46%	46%	45%	33%	67%	25%
Reuse on other projects, not the focus project	37%	Not specified	Not specified	Not specified	Not specified	Not specified

3.2.1.1 Source Separation

The most common form of source separation was scrap metal recycling. In some cases, scrap metal was organized in a separate dumpster but still went to the same facility as the mixed-use dumpster (Dem-Con

or Atomic). In other cases, contractors self-hauled to Express Metals, Northern Metals, or another recycling facility where they were paid for the metals. Six contractors reported that they ordered a separate scrap metal or cardboard dumpster if they knew they would have a lot of those materials coming out of the project.

Other source-separated materials included shingles and concrete (contractor self-haul to crushing facility). One contractor was unable to take concrete to a crusher due to contamination with insulation. Two contractors reported utilizing residential recycling pickup or drop off facilities for cardboard recycling. One large commercial project participated in significant source separation (asphalt, electrical conduit, ceiling tiles, roofing), where all of those separate streams went to Atomic. Some contractors noted that waste vendors provide discounts for source separation in this manner, but these discounts were not itemized or noted on any invoices captured in this Study.

One commercial contractor estimated that they capture approximately 80% of scrap metal in source separation and the rest ends up in the mixed-use dumpster. Not all metal can be captured because some of it is contaminated with insulation. Most projects utilizing scrap metal dumpsters reported metal being removed from the dumpster by scrappers overnight.

Source separation for recycling was sometimes accomplished using a separate dumpster (such as one provided by Dem-Con along with the mixed-use dumpster) but typically utilized a self-hauled dump trailer.

3.2.1.2 Building Material Reuse

75% of reuse happening in the focus projects consisted solely of items being kept by the current owner. This included preservation within the current space, removal/restoration/reinstallation in the same project, and use by the property owner in a different space. The most common items being saved within the space were wood floors, wood trim, doors, and bathroom fixtures. The most common items being taken by property owners for a different space were cabinets and light fixtures. One contractor noted that the trim is saved for the purposes of making repairs/patching in other parts of a commercial building.

Reused materials diverted to a different owner off-site (the remaining 25% of reuse practices) included:

- Cast iron sinks acquired by an employee of the property owner for personal use.
- Doors sold online (Craigslist or Facebook Marketplace) or placed on the curb for people to take.
- Doors reused as temporary construction doors on future projects.
- Pallets brought to Menards for reuse.
- A variety of fixtures, cabinets, doors, etc. removed by Better Futures on one residential project. See Appendix C for an example Better Futures inventory from this project. This contractor uses Better Futures as a standard practice on most of their projects. Better Futures comes in before demolition to take what they can use, then the contractor completes the remaining demolition and puts those materials in a mixed-use dumpster.

Appliances that were not kept by the owner or contractor were most frequently sold online, or sold to Warners' Stellian.

37% of contractors surveyed claimed to participate in reuse on some other projects, but not on the focus project. Ten of these contractors commented that they occasionally donate items to reuse organizations if they feel the item has particularly high value or quality. These items typically include bathroom fixtures, doors, and light fixtures. Reuse organizations mentioned by contractors included the Habitat for Humanity ReStore and Architectural Antiques. Many contractors also reported selling these types of items online on Craigslist or Facebook Marketplace.

When asked about extra materials leftover from projects, most contractors said they return those items to the vendor for a refund. However, multiple contractors noted that they save small extra items such as partial containers of adhesive or boxes of nails for use on future projects. One contractor with a large warehouse and passion for reuse saves more materials such as lumber, flooring, trim, and doors. He keeps them until they can be reused on another project, sold, or taken by one of his employees. He also compiles small pieces of items like plumbing and electric material until he has enough to use on a project. These practices lead to large amounts of materials being stored in his warehouse for extended periods of time. He believes this business practice is only possible because he runs a small company with a small amount of overall waste to manage.

Other recurring comments on reuse included:

- The contractor used to donate more frequently to reuse organizations but has recently found the process to be more difficult due to time and selectiveness of the reuse organizations.
- Donation or sale of items for reuse is typically handled by the property owner. The contractor may support this effort or make suggestions to donate high quality items.
- "Informal reuse" happens when contractors or their employees see something that would be thrown away and take it home for their personal use.

Contractors participating in reuse rarely had a separate container to collect reusable items. In most cases they would self-haul singular items to their destination.

3.2.2 BARRIERS TO REUSE

One of the original interview questions (see Appendix A) was "What are the main challenges to reuse and recycling on this project?" However, after beginning conversations with contractors, Stantec found that most contractors were already using waste vendors that participate in recycling and did not have many challenges surrounding that practice (see Section 3.3 below). Therefore, the conversation typically focused on barriers to reuse.

The most common barrier to reuse, reported by 63% of contractors, was time/cost (time being related to both construction completion schedule and labor costs required to manage materials). Time/cost was reported as an issue by 77% of commercial contractors and 55% of residential contractors. For most contractors, time and cost are one-in-the-same because of their need to pay employees and subcontractors. Some contractors said that aside from the cost aspect they were just too busy to pursue reuse options. Material management costs (i.e., fees charged by recycling or reuse organizations) were not considered an obstacle by most contractors.

Time concerns generally fell into three categories: logistics, hauling, and demolition. In the logistics category, contractors were frustrated with the process of researching and contacting multiple facilities to figure out who would take the reusable item. Two contractors noted the time required to supervise Better Futures or other organizations on site to pick up materials would not be feasible. It should be noted that Better Futures does not require owner or contractor supervision while on site. However, the contractor interviewed who uses Better Futures as a standard practice does supervise the Better Futures team as part of their own due diligence process.

Many were also unwilling to self-haul reusable materials because it takes them away from the job site. Some contractors were offput with the time-consuming process of deconstructing and removing a reusable item by hand (to avoid damage), as opposed to quick demolition with equipment. However, the concern about time spent deconstructing did not come up as frequently in interview responses as concerns about self-haul and coordinating reuse logistics.

Eight contractors pointed out that they do not have sufficient or any financial incentive to participate in reuse. This often leads to a high level of selectivity, only saving items that will sell for a significant price or provide high value to the owner. One contractor stated that tax breaks were not sufficient to offset the extra cost.

Two residential contractors (one in Shorewood and one in Edina) estimated that about 25% of their clients express an interest in where their waste goes. In many cases, they would prefer for the waste from their home to go to reuse and recycling rather than landfill. However, contractors also reported that those interested in reuse/recycling are not typically willing to pay the extra costs associated with it, which ends up causing it to be eliminated from the project. Most contractors did not discuss experiences with reuse/recycling grants in their interview responses. One contractor reported that he had tried to use deconstruction grants in the past but found that they did not cover the time spent on logistics and paperwork.

On the topic of barriers to reuse, responses from commercial contractors stood out. Three commercial contractors commented that the demo process moves rapidly once they are on site, so the reuse of materials would need to be planned by the architect or owner before the contractor was involved. Setting up the plan for reuse in advance would allow it to be included in bid specs.

40% of contractors (45% of residential and 31% of commercial) found that the focus project did not have any items which they deemed valuable or high quality enough to reuse. One remarked, “If the homeowner doesn’t want it, probably no one else does.” This led to the recommendation for contractor education detailed in Section 4.3 below.

3.2.3 SUGGESTIONS FROM CONTRACTORS

Contractors were also asked for their suggestions to increase reuse and recycling of C&D waste. Common responses included:

- A demolition contractor that could sort and remove all waste, including reusable, recyclable, and landfill waste, so that the contractor had a clean slate to work with.

- A place where material could be sorted and stored so that it did not have to happen on site.
- Reliable pickup service for reusable items that could be scheduled within one to two days of initial contact.
- Standard dimensions/specifications for donation to reuse organizations so that their items will not be turned away.
- Reuse organizations that are better suited to accept commercial items.
- A dumpster for reusable materials that is provided at a lower cost than the mixed-use dumpster.
- Opportunities for recycling at the city transfer stations when they are not using Atomic or Dem-Con.
- Financial incentives/subsidies for waste fees and/or contractor participation in reuse efforts.
- Consistent training resources for contractors provided throughout the year.
- Encourage property owners to think about reuse/recycling before involving the contractor.
- A resource to ask about where certain types of materials should go (i.e., a 411-type number).

Some contractors also recommended that the County work with demolition waste disposal companies such as Atomic and Dem-Con to increase recycling rather than focusing on the contractor side.

3.2.4 UTILIZATION OF REUSED MATERIALS

While the bulk of interview questions in this Study focused on the disposal method of materials coming out of remodel projects, contractors were also asked about reused and recycled materials going into their projects as part of the final design. None of the projects interviewed were installing reused materials brought in externally. As discussed in Section 3.2.1 above, some projects were reinstalling items that were pulled out of the same project. 29% of contractors reported that they sometimes source reused materials for other remodel projects. Ten contractors from various project types and cities said that their clients would rarely or never be interested in sourcing reused items for their remodel projects.

The most common reason for disinterest in reused items was that remodel clients are looking for a refreshed look which requires new materials. A common exception to this trend was using salvaged items to match the look of historic buildings. Examples of reused items used for historic buildings include light fixtures, doors, and trim.

For residential projects, two contractors noted that the process of acquiring salvaged items would typically be carried out by the homeowner, as it can be time consuming and requires stylistic choice. One contractor noted that this practice is more common in Minneapolis homes than suburban homes. On commercial projects, four contractors reported that the decision about incorporating reused materials in the remodel would be determined by the architect and is not influenced by the contractor. For this reason, two contractors suggested that a database of reused materials would be useful to allow architects to include specific reused materials in their designs.

Another common comment about reused items was that they are more expensive than purchasing new items. One contractor looking for oak flooring considered a reused option, but it was too expensive to justify. However, this cost barrier may be overcome if the convenience of the reused material is much higher. One contractor reported sourcing reused doors during COVID-19 supply chain shortages which made lead times on new doors several weeks or more.

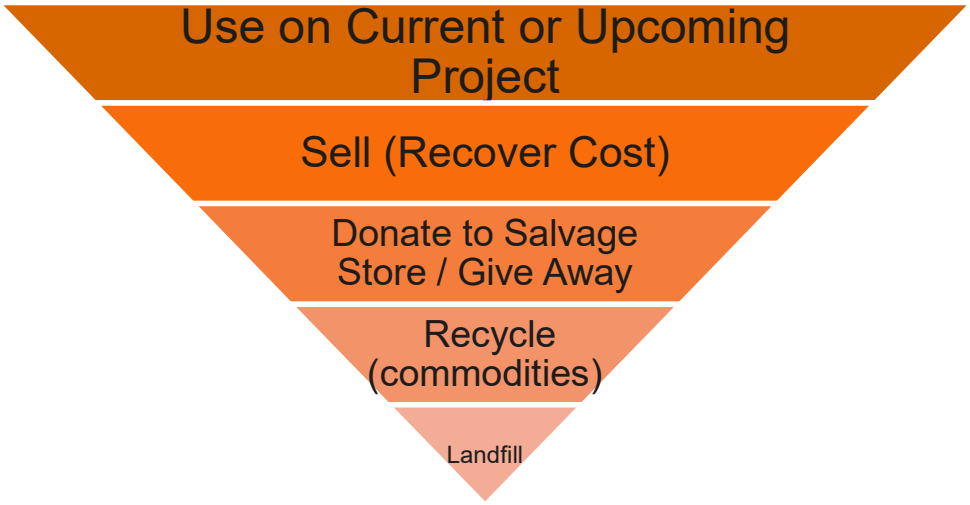
One contractor remarked that he would not put reused materials into one of his projects because he could not guarantee the longevity or quality of that material. Another contractor noted that it is hard to get old reused light fixtures past inspections. These comments led Stantec to pursue additional information about the safety and permitting implications of reused materials. The International Association of Certified Home Inspectors warns that reused building materials may have associated safety and code conformance hurdles, such as[11]:

- Reclaimed lumber may not have a grading stamp. Reused material must be inspected and approved if it is to be used for structural purposes.
- Reused materials (lumber, plumbing piping) may contain lead or lead-based paint.
- Old light fixtures may not meet safety or energy guidelines.
- Old plumbing fixtures may not meet water-use guidelines.

These implications indicate that it may be more straightforward to reuse newer materials which are more consistent with current ordinances and guidelines, as opposed to historic pieces. It should also be noted that Architectural Antiques, a salvage organization in Minneapolis, offers services to rewire and restore historical light fixtures for UL-certification[12]. See Section 4.3 below for recommendations to increase education and overcome hurdles associated with safety and permitting implications of reused materials.

The hierarchy below illustrates the preferred methods of reuse for building materials. Use on a current or upcoming project is the most preferred form of reuse, and was the top form of reuse on projects captured by this Study. While Figure 2 shows the optimal reuse hierarchy, it should be noted that adherence to this process is not common at this time due to time and budget constraints for the contractor, as discussed in Section 3.2.2 above.

Figure 2: Hierarchy of Uses for Building Materials



[11] https://www.nachi.org/salvaged-building-materials-inspection.htm
[12] https://www.archantiques.com/light-shop

3.3 Data Summary

Most data collected from contractors were in the format of waste hauler invoices. An invoice was frequently the only waste documentation available, either because everything on site went to the mixed-use dumpster, or because their form of informal reuse was not documented. Waste vendor invoices typically included yards, cost, and taxes/fees. Some invoices also included tonnage. Many contractors provided partial data from a project because the project was only partially completed.

Data was collected for 173 loads of waste, 95% of which were open-top dumpsters (including very few mini dumpsters and "tubs" at 3-4 yards each). In most projects, apart from only the largest commercial jobs, contractors had only one mixed-use dumpster on site at a time. The first site visit shown in Appendix B (a large commercial project in Minneapolis) goes through about eight dumpsters per day, but this rate varies based on the stage of the project. This project disposed of 12 steel-only loads and 45 mixed-use loads (167 tons total) over the month of September.

Table 4 through Table 6 summarize only the dumpster loads. Table 4 shows the average sizes of dumpster loads by project market and city.

Table 4 – Average Dumpster Sizes

Project Market	Average Load Size (yd)
Commercial	28
Residential	24
City	**Average Load Size (yd)**
Minneapolis	27
Edina	24

3.3.1 WASTE VENDORS

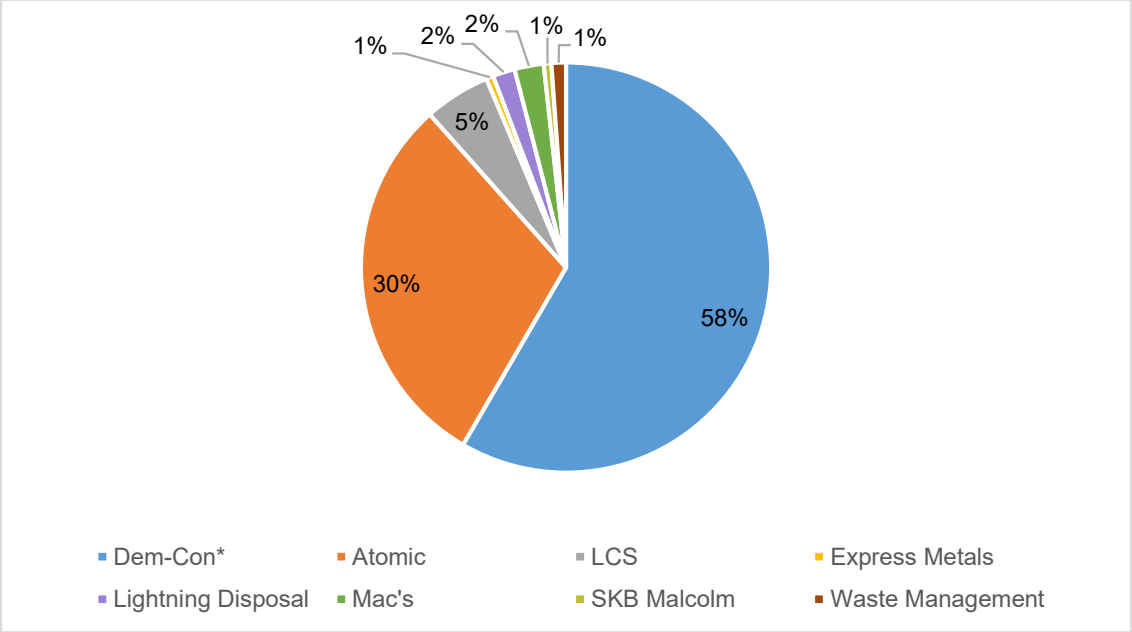
As shown in Figure 3, Dem-Con hauled over half (58%) of the waste accounted for in this Study. Atomic hauled 30%. Dem-Con and Atomic have C&D waste recycling facilities which claim to recycle approximately 70% of the C&D waste they receive. It is unknown whether all of the waste hauled to Dem-Con went through the recycling facility (see Section 3.3.1.1 for further explanation). All waste loads taken to Atomic in Minneapolis were sent through their recycling processing facility (see Section 3.3.1.2). It should be noted that both Dem-Con and Atomic may direct waste from their own dumpsters/hauling service to non-recycling disposal locations if needed based on project location and other factors.

Both Dem-Con and Atomic accept waste loads from third-party haulers. It is unknown whether waste hauled by the other vendors shown in Figures 3 and 4 was brought to Dem-Con or Atomic for recycling sortation because invoices provided by these vendors did not specify the destination of the waste. The third most-utilized vendor for waste captured in this Study was LCS (LIoyd's Construction Services Inc.). LCS hauled significantly less waste than the two leading vendors (5% of total).

Percentages in Figure 3 are significantly impacted by a few large commercial projects using one waste hauler for over 20 loads each. Figure 4 shows the breakdown by waste vendor for residential waste loads only.

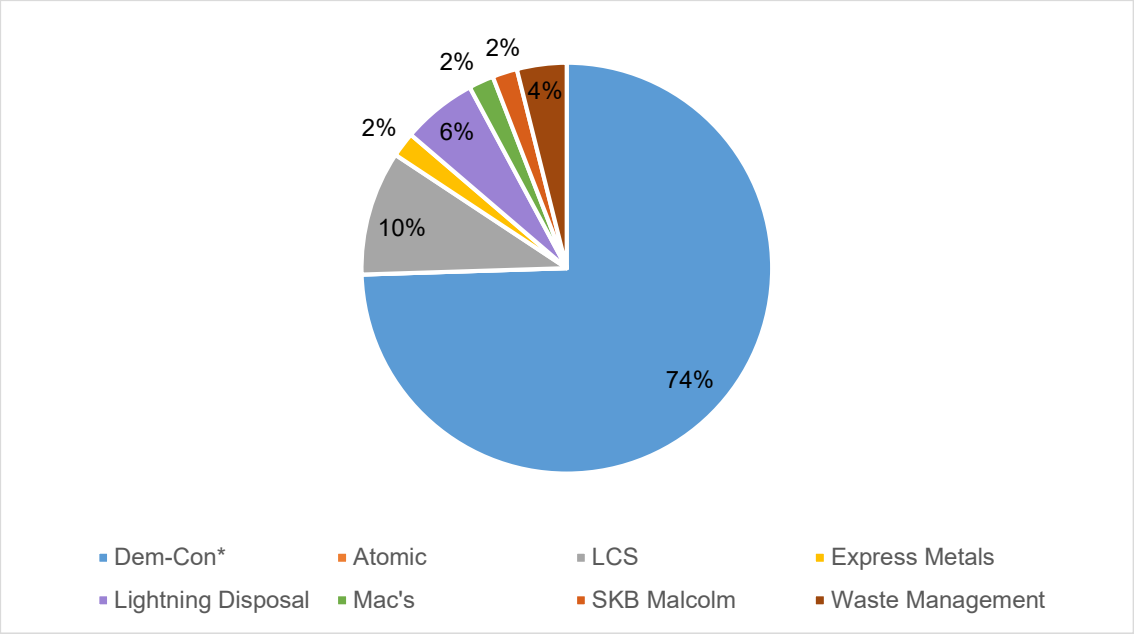
In addition to dumpsters, the data in Figures 3 and 4 include five loads from mixed-use self-haul dump trailers (hauled to SKB Malcolm and Dem-Con) and three Waste Management (WM) Bagster® bags. These waste disposal methods are discussed later in this section.

Figure 3 – Waste Vendor by Load



*Dem-Con data includes Total Sanitation data because Total Sanitation has been acquired by Dem-Con.

Figure 4 – Waste Vendor by Residential Load



*Dem-Con data includes Total Sanitation data because Total Sanitation has been acquired by Dem-Con.

Dem-Con hauled 75% of the residential waste loads captured within this Study. It is notable that Atomic was not used for any residential waste captured in the dataset. LCS was the second most-used waste vendor for residential projects.

3.3.1.1 Dem-Con Waste Management

Waste data collected (depicted in Figures 3 and 4) shows that Dem-Con was one of the top waste vendors used for projects in this Study. Based on a recommendation from the County at the start of the Study, Stantec asked several contractors using Dem-Con (and/or Total Sanitation) as a primary waste vendor whether their waste was going through Dem-Con's recycling facility. This question aimed to determine whether all C&D waste hauled by Dem-Con went through Dem-Con's recycling sorting facility, or if some waste went straight to Dem-Con's C&D landfill.

The most common response from contractors was an unfamiliarity with the difference between the two pathways. Most stated that they trusted Dem-Con to do as they saw fit with the waste and assumed that Dem-Con recycled when possible. None of the contractors surveyed noted an option to choose between recycling or landfill, nor did they mention making a request made to Dem-Con to ensure recycling. There was one exception to this trend: a commercial project in Minneapolis for which the contractor requested recycling reports from Dem-Con due to a client request. The recycling reports provided by Dem-Con note that the C&D mixed loads underwent "Off-Site Separation" and that about 75% of waste was recycled.

A small portion of contractors using Dem-Con were unaware that Dem-Con has recycling capabilities. This was especially prevalent in contractors who had previously used Total Sanitation and recently switched to Dem-Con due to the acquisition. In general, contractors without a specific project requirement

for recycling (i.e., LEED) had little information about their project waste after the point of pickup by the waste hauler. This is addressed further in the recommendations in Section 4.3 and 4.4.

The following is a summary of information provided to Stantec by Dem-Con about their waste management protocols, as it relates to this Study: Dem-Con's operations include a C&D recycling sorting facility (materials recovery facility, or MRF) in Shakopee, Minnesota, and C&D landfills. The recycling facility is certified by the Recycling Certification Institute and has recycled an average of 70.36% of waste received in the past 12 months, including 36.53% of the incoming material being used as alternative daily cover (ADC).[13] The recycling process includes sortation by size and hand-picking items for recovery. Residuals from the recycling facility go to the C&D landfill.

Not all C&D waste collected in Dem-Con dumpsters goes through the recycling sorting facility. Some contractors (such as those working on LEED projects or projects with other sustainability goals) work with Dem-Con to specifically earmark their waste for the recycling facility. These earmarked loads are sorted for recovery even if they have very low recyclables contents. Waste that is not specifically marked for recycling may go through recycling sorting, or may be directly landfilled, depending on factors such as project geography and contents of the loads. Waste from projects that are far from the Shakopee Dem-Con facility may be taken to a different Dem-Con landfill (if not earmarked for recycling). All undesignated C&D waste taken to the Shakopee facility undergoes a visual evaluation upon entry, and may be sent to the recycling facility if it appears to contain sufficient recoverable materials.

Dem-Con reported that contractors may be charged an additional fee for recycling services as opposed to landfilling if there is an extended hauling distance to bring waste to the Shakopee facility. However, for waste loads already directed to Shakopee, there is typically not an extra fee for contractors requesting recycling sorting, assuming that contractors follow policies about waste types that can be sent through the recycling facility. Dem-Con works with contractors to discuss project-specific options for waste management. Dem-Con and Total Sanitation invoices captured in this Study did not specifically state whether the waste was sorted for recycling, nor did they note different fees based on landfill vs. recycling.

3.3.1.2 Atomic Waste Management

Atomic Recycling was acquired by LRS in 2021. Atomic Recycling/LRS's Broadway Resource Recovery C&D recycling processing facility in North Minneapolis uses both manual and mechanical sorting technologies to separate recyclable C&D material from mixed dumpster loads. Aggregate, metals, shingles, wood, cardboard, and tires typically make up about 75% of materials recycled from the facility with the other 25% residuals sent to landfill. About 20% of the recycled materials are used for landfill alternative daily cover (ADC). The facility offers customers Atomic/LRS dumpster containers and also accepts dumpsters from third-party haulers. Customers using an Atomic/LRS dumpster that want their load to go through the Broadway Resource C&D recycling processing facility need to specify recycling at the start of the project. It should be noted that some Atomic/LRS dumpsters at project sites located a

[13] https://dem-con.com/wp-content/uploads/2023/04/March-LEED.pdf

farther distance from the North Minneapolis facility may be sent to partner disposal sites to reduce transportation.

3.3.2 DUMPSTER SIZE AND TONNAGE

Table 5 – Average Tonnage for Dumpster Loads

Unit of Measure	Average Tonnage
30-Yard Dumpster	2.92
20-Yard Dumpster	1.52
Per Yard	0.10
Per Commercial Yard	0.10
Per Residential Yard	0.10
Table 5 includes 12 steel-only dumpsters from a large commercial project which went to Dem-Con. The average weight for the steel-only dumpsters was 0.06 tons/yd. The rest of the loads were mixed-use.	

As shown in Table 5, the average 30-yard dumpster held 92% more tonnage than the average 20-yard dumpster, despite only having 50% more volume. There was no significant difference in tonnage per yard observed between residential and commercial dumpsters.

3.3.4 COSTS

Table 6 – Average Costs for Dumpster Loads

Unit of Measure	Average Cost
30-Yard Dumpster	$453
20-Yard Dumpster	$380
40-Yard Dumpster	$536
Per Ton*	$430
Per Yard*	$20
Per Commercial Yard*	$18
Per Residential Yard*	$20
Per Minneapolis Residential Yard*	$19
Per Edina Residential Yard*	$23

*Not all projects provided both yards and tonnage. This may influence the data.

Most waste invoices captured in this Study listed one fee per dumpster, which is assumed to cover the dumpster itself, transport, and disposal of waste.

The average cost of a yard of residential demolition waste was approximately $2 more than the average cost of a yard of commercial demolition waste. The average cost of a yard of residential waste in Edina was approximately $4 more than that in Minneapolis. There are many possible explanations for these cost differences, including project types, property types, contractor company size, relationship with waste vendor, etc. Stantec would recommend increasing the sample size before drawing conclusions on cost differences between project market and city.

Average prices varied slightly between waste vendors, from $16-$22 per ton. As noted in Section 3.3.1.1 above, invoices did not designate rates for recycling sorting vs. landfilling, for those facilities with a recycling option.

WM Bagster® and self-haul loads were not included in Tables 4-6. Prices for self-haul loads varied from $48-$93 per ton. The facilities which received mixed-use self-haul loads were Dem-Con and SKB Malcolm. There were no reported self-haul loads taken to the City of Minneapolis South Transfer Station. Interview responses revealed that WM Bagster® or self-haul were often used on smaller projects that could not fill a whole dumpster or projects that no longer had a dumpster on site.

Most waste vendors charged taxes by yard ($0.60/yd). In addition to taxes, the invoices reflected a variety of fees, including appliance fees, fuel surcharges, re-spot fees, and street permit fees. Appliance fees were approximately $20 each and included a water heater, microwave, and general appliance. Fuel surcharges ranged from $16.50 to $52 and were not present on all invoices. Stantec speculates that the presence and price of fuel surcharges were based on gas prices at the time of hauling. A relationship was not observed between city and fuel surcharge, indicating that fuel surcharges are not necessarily influenced by the geographical location of the site. There were no additional environmental fees observed

on invoices. Re-spot fees (fees charged to relocate the dumpster within the site) were only observed on one vendor's invoices, at a rate of $160 each (for 20-yard dumpsters). Street permit fees ranged from $85-$93 in Minneapolis and were not observed in Shorewood or Edina.

3.3.5 RECYCLING

One contractor provided a receipt from a self-haul of metals to the Express Metals recycling facility. This load is not included in Tables 4-7. The contractor was paid $44 for 598 pounds of mixed metals, which is equivalent to approximately $147/ton. This was the only documentation of financial compensation to the contractor for materials captured in this Study.

Three of the commercial projects in the dataset (accounting for 52 total loads) provided waste vendor recycling reports. One of these projects used Dem-Con and the other two used Atomic. The percentage of total tons recycled was approximately 75% for all three projects (remainder was directly landfilled). A summary of recycling reports for the two projects using Atomic is included in Table 7. The recycling report from Dem-Con did not include material or destination details.

Table 7 – Atomic Recycling Summary for Two Commercial Projects

Material Type	Average Percentage of Total Waste from Project (by weight)	Final Destination(s)
Fiber (cardboard and paper)	<1%	Pioneer
Aggregate (asphalt, concrete, masonry)	49%	CS McCrossan, Minneapolis Concrete, Waste Management (Burnsville and Elk River), Carl Bolander
Metals (iron, copper, aluminum, brass)	3%	Alliance Recycling Group, AMG Resources, Northern Metals, Spectro Alloys, A1 Appliance, K&K Metal Recycling
Mixed Wood	2%	OTI, SMSC Organics Recycling, Stockman, KRD
Alternative Daily Cover	20%	Vonco
Shingles	<1%	Vonco

4 Recommendations

4.1 Contractor Input

Throughout the interview process, Stantec found that many contractors value waste reduction and have an interest in where their project waste ends up. However, they expressed that pursuing waste diversion and reduction was often not compatible with their tight business model and/or high quality standards. For this reason, Stantec recommends that the County continues to engage with contractors on the topic of C&D waste and considers their perspectives on any new policies and programs.

Stantec's recommendation to gain ongoing contractor input is to establish a contractor advisory board. The board could be used to gain contractor insight and evaluation of programs before they are rolled out, as well as feedback during the programs' implementation. The board should include representatives from multiple sides of the construction industry (commercial, residential, high-end, flippers, etc.). Stantec recommends reaching out to organizations such as the National Association of the Remodeling Industry (Minnesota chapter), the Minnesota Construction Association, and Housing First Minnesota. These are pre-existing groups of contractors and other construction professionals who may be interested in helping formulate policies and programs at the County level.

4.2 Centralization

To overcome barriers to materials recovery, locating sources and outlets for materials must be as simple and efficient as possible for contractors. Centralizing the coordination and logistics of various reuse outlets would increase participation in the various current programs. Contractors could be informed about current desired and available items through a central database available online which contractors would be informed of during the permitting process.

Similar databases do currently exist such as the Minnesota Technical Assistance Program (MnTAP) Materials Exchange Program[14] which has been created by the University of Minnesota to connect organizations that have goods they no longer need to those who are able to utilize them. They broker a variety of materials through the website from art supplies to sporting goods to building and construction materials. This database is widely available, but typically does not contain many current items and does not coordinate other data sources. Creating a County resource specifically for C&D materials could target relevant generators and users of this category of materials and coordinate multiple resources and encourage additional participation for both the donation and usage of posted items.

A common concern of contractors was the acceptability of items at different salvage locations. Centralizing the availability of information on the range of reuse outlets reduces the chances that contractors are turned away from a reuse outlet and are discouraged from future attempts. Stantec recommends that the County create an informational handout on the topic of C&D material reuse and

[14] http://www.mntap.umn.edu/services/matex/

recycling which cities can provide to contractors at the time of permit issuance. This handout would serve to inform contractors of items that are needed and accepted by organizations which the contractor may not have previously known had outlets. It should be updated at least semiannually with current contact information and items currently being accepted. Frequently updating the handout would allow it to include relevant information about values of raw materials for recycling, items in high demand, items in surplus (not being accepted), etc. Much of the base information would be similar to educational materials that the County has already developed, but providing it directly to contractors and homeowners at the start of each project would help directly correlate the resources with the need.

Offering a singular location with guaranteed acceptance would provide for the maximum possible diversion but could also invite excessive disposal of non-salvageable items. To establish a singular location with broad acceptance, a public-private partnership approach could be utilized to subsidize some of the management of non-salvageable items while economically recovering applicable items. The available inventory would be integrated to an online database for contractors to source materials and to solicit desired materials from contractors. Contractors would be the primary providers of incoming materials, but individuals would be the primary market for outgoing materials. By focusing on individuals, the warehouse could target homeowners doing small projects, landlords, flippers, and others who are looking for a low price and large selection. Contractors may also utilize the warehouse for small projects to obtain small quantities of materials (tile, concrete block, flooring).

To develop the policies and business model for the centralized warehouse, Stantec recommends engaging in ongoing discussion with Todd Tanner and others involved in the University of Minnesota ReUse program. Lessons learned from ReUse, such as marketing to individuals, could be implemented in the Hennepin County warehouse program. However, unlike ReUse, the warehouse program would be C&D specific, and may require a higher level of selectivity when accepting materials.

4.3 Education

While many contractors were interested in waste reduction and diversion concepts, interview responses also revealed a level of misinformation and confusion amongst contractors. Topics of confusion included where and how to give items to reuse organizations, where waste goes after the mixed-use dumpster, differences between waste vendors, and value/desirability/viability of items that could be reused. Many contractors were pleasantly surprised to find out that their waste vendor was probably recycling a portion of their waste, as they were not previously aware that they were working with a recycling facility.

Contractor education could be linked with the centralized information flyer proposed in Section 4.2 above. The handout would serve as a reminder for contractors already aware of reuse options and educate contractors who were not previously aware. The handout will contain up to date information regarding the needs of the reuse environment, options for reuse/recycling, and examples of historical projects that need reused/historical materials.

A contractor education or certification program could be built in as a universal permitting requirement or could be viewed as a specialty program to promote sustainability-minded contractors. This would be most

readily achieved as an online on-demand course, however in-person courses are typically considered to be more impactful but are less convenient for contractors to access.

A "Sustainable Contractor Certification" program could involve training topics such as:

- Identification of waste materials and their applicability to reuse, recycling, and disposal outlets
- Lifecycle of C&D wastes, including:
    - New materials packaging and recycled content in new materials
    - Onsite reuse or repurposing
    - Fate of waste at different reuse, recycling, or disposal outlets
    - How and why to request waste end-of-life information from waste vendors
- Incorporating sustainable waste management into the design and planning phases of projects, including educating property owners on reuse options during the beginning of projects
- Legal implications of reuse, including:
    - Liabilities of contractors and reuse organizations
    - Reused building materials and safety implications (i.e., UL listing)
- Right-sizing dumpsters and maximizing the use of air space for different materials (e.g., breaking down cardboard)
- Sustainable landscaping considerations

A few residential contractors who were asked about the Sustainability Certification concept believed that some portion of their clients would be interested in contractors with a Sustainability Certification. Stantec believes that this certification would be best suited for residential projects where individuals are more likely to be making decisions about their own homes and may have personal preferences about sustainability. The considerations for contractors on residential versus commercial projects vary significantly and a separate course for commercial contractors could be offered which could include information on US Green Building Council (USGBC) certification programs such as LEED[15] and TRUE[16]. LEED certifies the architectural elements of the physical building, while TRUE certifies the operations within a building but also applies to construction and remodeling phases of operation[17].

As described in Section 3.2.4, there are safety and permitting implications to consider associated with reusing building materials. Education will be a key component in overcoming these hurdles. The first step in overcoming the reuse hurdle is to identify the two main classifications of materials being salvaged.

For construction materials (Lumber, Steel, and Brick):

- Create public private partnerships to grade reuse lumber that will meet inspection.
- Materials that do not meet construction standards can be used by homeowners for small non-structural projects.
- Sold as scrap project wood for non structural projects.

[15] https://www.usgbc.org/leed
[16] https://support.usgbc.org/hc/en-us/articles/4431403163667-TRUE-certification
[17] https://www.eventscribe.net/2022/Greenbuild/fsPopup.asp?efp=TkVMS1hlTEwxNjU3Mg&PresentationID=1093624&rnd=0.8626193&mode=presinfo

For appliances and ornamental materials (lighting fixtures, bathtubs, sinks, toilets, doors, etc.):

- Old light fixtures can be rewired
- Iron work can be reused
- countertops
- Market advantages: The upside of using reclaimed materials:
- The homeowner will see cost savings: the products are usually less expensive than new counterparts.
- Environmentally friendly – saving resources that would be used in the production of the new product.
- Some reclaimed material is more valuable than the new material (old growth wood)

As stated in the interview results above, some contractors felt that the power to decide about reuse of materials was in the hands of property owners and architects, especially as it relates to reuse of materials within the same project. Therefore, Stantec additionally recommends an architect and property owner education program. This could include information campaigns on the functional, environmental, and stylistic qualities of reused items. It could also provide a look at where C&D waste goes and an explanation of why reuse and recycling practices may cost more, so that property owners tangibly understand the extra money they are spending for a sustainable solution. This type of program may also include information on sustainable building certification programs such as LEED, TRUE, and SITES[18] offered via USGBC.

4.4 Investment in Recycling

A significant number of remodel contractors are working with waste vendors that recycle C&D waste to some extent. The two most common waste vendors used on projects in this Study were Dem-Con and Atomic; both have recycling facilities which claim to recycle approximately 70% of the C&D waste they receive. It is unknown whether all of the waste hauled by these vendors went through recycling sortation (see Section 3.3.1.1 for further explanation). The recycling methods used at these facilities vary by environmental impact, with some having larger footprints than others.

To target the greatest impacts to overall diversion, Stantec recommends investment in C&D recycling facility technologies alongside any investments in reuse. These investments may include improvements to sorting technologies to improve recovery and quality of materials or may be technologies at the back-end to process hard to recycle materials into value added products. By increasing facility recovery rates, decreasing contamination levels, and bolstering environmentally preferred recycling options, landfilled C&D waste would be reduced without asking contractors to significantly change their practices. Working with waste vendors on this effort would allow the County to investigate opportunities to increase recycling rates at existing recycling facilities, and to introduce a pilot protocol for reusable items to be removed from recycling streams arriving at those facilities. Emerging technology working in concert with a C&D landfill can reduce the input to the landfill but also produce a beneficial byproduct. For example, a drywall

[18] https://www.usgbc.org/resources/sustainable-sites-initiative-sites%E2%84%A2

recycling facility could create multiple feedstock lines for beneficial use, land use, or high density building blocks.

4.4.1 PROVIDE ECONOMIC SUPPORT

One option to reduce contamination, and therefore increase recycling rates, would be to initiate incentives for source separation of materials. This may begin with separation of metals and cardboard. Steel, aluminum, copper, and other metals have long had scrap yards compensating generators, or whomever may bring them material. Upstream diversion of other materials such as lumber, cardboard, or rigid plastics could follow the example of metal scrap yards, dependent on the market value of the specific materials. Some of the mixed use dumpster loads evaluated during site visits (depicted in Appendix B) appeared to include relatively clean lumber that would have had a higher potential for reuse/recycling had it been source-separated. To provide adequate incentive for contractors to separate lower value materials such as lumber, there may need to be some level of subsidized rebate to target challenging materials or a form of subsidized collection to reduce contractor labor and transport costs.

Optimizing dumpster space and allowing for fewer collection trip fees is an additional way to encourage contractors economically. Diverting materials to higher and better uses is the most direct way for contractors to reduce their waste management needs. Mobile compacting services (dumpster with an integrated hydraulic compactor to increase tonnage per dumpster load) are an emerging method to conserve dumpster space. A contractor as part of this study had looked into this service and found that it was almost as expensive as ordering a new dumpster, and therefore it did not save enough dumpster space to be worth the cost. However, if the cost can be reduced for this approach or if there were another less expensive option for on-site compacting, contractors would have the opportunity to use less dumpsters over the course of a project. This would reduce hauling costs and transportation emissions.

Expanding Hennepin County's offering of grant programs, as well as facilitating contractor access to state[19] and federal grants, could be used to further offer incentives to contractors for specific practices. Grants could further be applied to providing the public with greater means to utilize items for reuse, upgrading recovery facilities, or end market development of recovered materials to improve access to outlets for upstream materials.

4.4.2 PROMOTE SUSTAINABLE BUILDING MATERIALS

There are many sustainable materials that have long been facets of the construction industry which deserve promotion. For example, steel and aluminum are some of the most recycled materials in the world, but because these already have strong global commodity markets for discarded material they will not be discussed at length here. This section will focus on innovative sustainable materials that are not currently heavily utilized and whose markets could be greatly expanded.

[19] https://www.pca.state.mn.us/grants-and-loans/waste-reduction-and-reuse-grants

4.4.2.1 Build for Deconstruction

Deconstruction is often complicated by the original construction methods used which may include fasteners, adhesives, or finishes that cannot be readily removed without damaging the attached goods. Some simple substitutes which can be utilized to facilitate future deconstruction include substituting: screws for nails, bolts for welding, or brackets for adhesives. Viewing structures as material stores to be further utilized in the future beginning at the design phase will allow for the maximum reuse of materials and can also facilitate future renovations or expansions by designing walls and other stationary features as modular units which can later be removed without damaging adjoining units.

Utilizing the embodied energy of existing structures, as was observed at North Community High School, is the ultimate form of C&D reuse and retrofitting of existing structures can provide significant opportunities to plan for future deconstruction. As it is eloquently summarized in *Recycling Our Cities, One Building at a Time*[20] , "we've got to learn to rework what we've already got." A modular approach to improving the efficiency of an existing structure is described in *Prefab Second Skin can Make Old Apartments Net Zero*[21].

Hennepin County can promote building for deconstruction most directly through tax incentives or grant funds for building projects with explicitly designed deconstruction elements. Ultimately, design for deconstruction should be embodied in the standard design process of buildings, so education and outreach to project developers, working architects, and architecture students will ultimately drive the standard practice. Interior designers and structural engineers may further be targets of outreach.

4.4.3 FUTURE STUDY: MIXED-USE LOAD PATHWAYS

One lesson learned in this Study was that the destination of waste from remodel projects is often unknown to the contractor. To investigate the waste disposal process beyond the purview of contractors, the County could conduct a future study on the pathways followed by waste materials after they enter mixed-use dumpsters. This proposed study would focus on interviews and site visits with waste vendors, including transfer stations and recycling facilities. Data could be requested to determine the rate at which undesignated C&D waste is sorted for recycling, and how that rate might be improved. The waste pathway study would fill information gaps identified in contractor interviews about waste vendor recycling rates and sortation practices. In conversations with waste vendors, the County may find opportunities to increase communication to contractors about the final destinations of their waste. Some suggestions for further exploration include:

- A standardized reporting method for waste vendors to share waste recycling options with contractors and property owners on invoices or contracts.
- Education for contractors on how to request recycling sortation services from waste vendors, and how this might impact their waste fees, if at all.

[20] https://www.bloomberg.com/news/features/2022-11-23/sustainable-construction-how-to-refurbish-upcycle-and-green-old-buildings
[21] https://www.bdcnetwork.com/prefab-second-skin-can-make-old-apartments-net-zero

- Establishing documentation or protocols to improve outcomes of visual assessments used to designate mixed-use loads for recycling sorting vs. landfill, to minimize landfilling of recoverable materials.

5 Conclusion

Interviews with contractors completed as part of this Study pointed to the vital role that contractors will play in any C&D waste initiatives. The first recommendation provided in Section 4 highlights the importance of continuing to engage contractors as the County develops future programming. Contractors have a sense of where reuse and recycling improvements can be made without jeopardizing their business. Additionally, educational resources for contractors, property owners, and architects will be a cost-effective way to strengthen relationships with stakeholders and increase voluntary implementation of sustainable practices. Recommendations for education programming are presented in Section 4, including development of a Sustainable Contractor Certification program, distributing resources on safety and permitting implications for reuse and recycling, and providing an up-to-date waste management handout at the time of building permit approval.

The recommendation presented in Section 4 which was most directly influenced by contractor suggestions was the centralization of options for contractors to donate or sell items for reuse. Centralization should first include a consolidation of reuse organization information into easily accessible and digestible materials. The educational handout mentioned above would provide a platform to inform contractors on items accepted at certain locations, and how to donate. A future step to reduce barriers for contractors would be the establishment of a centralized reuse facility via a public-private partnership. All efforts to centralize reuse options will help minimize time and logistical concerns expressed by contractors.

Waste data captured in this Study indicate that many commercial and residential remodel contractors in Hennepin County are utilizing Atomic Recycling and/or Dem-Con as their primary waste hauler. While contractors interviewed in this Study were not able to provide exact information on recycling rates due to uncertainty about waste destinations after the mixed-use dumpster, the prevalence of Atomic and Dem-Con indicates a significant opportunity for recycling of C&D waste. The County could pursue a future study to gather information from waste vendors and fill in recycling information not provided by contractors. This report also presents recommendations to invest in recycling of C&D waste, which may include financial support for source separation of materials, building for deconstruction, recycling facility upgrades, and establishing end markets for recovered materials. All of these options would benefit from collaboration with waste vendors in order to maximize recycling rates.

The recommendations presented in Section 4 work to move all C&D discards up the waste hierarchy and reframe these materials as resources to be recovered rather than wastes to be disposed. Reducing the total waste landfilled by encouraging reuse of usable goods and increasing recycling rates will continue to improve the sustainability of C&D waste management in Hennepin County.