King County
Department of
Natural Resources and Parks
Solid Waste Division

Waste Monitoring Program

Construction and Demolition Waste Characterization and Recycling Industry Profile

FINAL REPORT 2002

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FINAL REPORT 2002

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In association with:
Cunningham Environmental Consulting, Inc.

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Chapter 1
Overview of C&D Disposal and Recycling

Construction and demolition (C&D) waste consists of recyclable or non-recyclable waste that results from construction, remodeling, repair, or demolition of buildings, roads, or other structures.[1] In 2001, King County, not including Seattle, generated more than three-quarters of a million tons of C&D waste. Of these materials, about 264,000 tons of C&D waste were disposed, and about 510,000 tons were recovered for other uses, as shown in Figure 1-1.[2]

Given the magnitude of C&D waste generated, King County conducted this study of C&D waste generation and recovery to develop a better understanding of both this waste stream and the C&D recycling industry. This information will aid the County in identifying opportunities to increase future recovery of C&D materials.

[1] According to King County Code, "'Construction, demolition, and land clearing (CDL) waste' means any recyclable or non-recyclable waste that results from construction, remodeling, repair or demolition of buildings, roads or other structures, or from land clearing for development, and requires removal from the site of construction, demolition or land clearing." (King County Solid Waste Code, Chapter 10.04.020U).

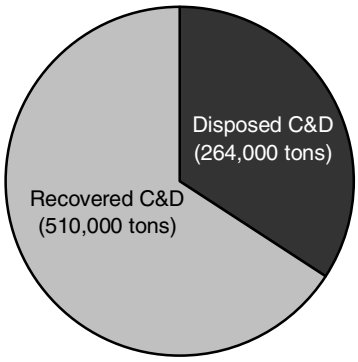
The County chose to exclude land clearing debris from this study because these materials are typically not disposed at the public or private transfer stations. A different set of facilities, such as green wood and yard waste processors, typically handles these materials. Accordingly, this study focused on construction and demolition waste, often referred to in this report as "C&D."

The County's code definition of CDL continues as follows: "Except where otherwise expressly provided, 'CDL waste' or 'county CDL waste' means CDL waste generated in the county jurisdiction. CDL waste includes, but is not limited to, the following listed materials:

> "'Construction waste' includes: wood, concrete, drywall, masonry, roofing, siding, structural metal, wire, insulation and other building material; and plastics, styrofoam, twine, baling and strapping materials, cans, buckets, and other packaging materials and containers. It also includes sand, rocks and dirt that are used in construction and that do not meet the definitions of clean mud and dirt or unacceptable waste;
>
> "'Demolition waste' includes concrete, asphalt, wood, masonry, roofing, siding, structural metal, wire, insulation and other materials found in demolished buildings, roads, and other structures. It also includes sand, rocks and dirt that result from demolition and that do not meet the definitions of clean mud and dirt or unacceptable waste; and
>
> "'Land clearing waste' includes natural vegetation and minerals such as stumps, brush, blackberry vines, tree branches, associated dirt and sand, tree bark, sod and rocks.
>
> "'CDL waste' does not include clean mud and dirt, contaminated soil, asbestos-containing waste material containing more than one percent of asbestos by weight, unacceptable waste, or any other solid waste which does not meet the definition of CDL waste."

[2] The estimated total recovery is based on quantities reported by the 30 processors interviewed in this study; actual total recovery likely exceeds 510,000 tons.

Figure 1-1. Overall C&D Disposal and Recovery



Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

In this report, Chapter 1 provides an overview of the disposal and recycling of C&D materials in King County. Chapter 2 describes the results of the C&D waste sampling conducted at four private transfer stations that handle more than half of the county's C&D waste disposal; it also provides summary information on the remainder of the disposed C&D waste. Chapter 3 presents the findings from interviews with generators, haulers, and processors of C&D materials. Following the main report, nine appendices provide additional information regarding the study's methodology and C&D waste composition.

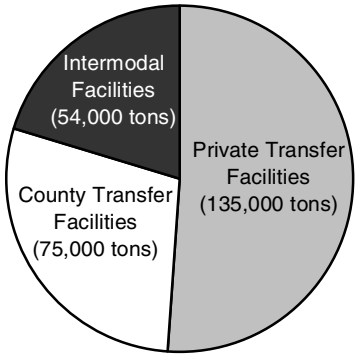
1.1 C&D WASTE DISPOSAL

Four private facilities – Black River, Eastmont, Recycling Northwest, and Third & Lander – handle slightly more than half of the C&D waste disposed in King County. A smaller quantity of waste passes through private intermodal and spot rail facilities, including Argo Yard, Black River, and Third & Lander. This waste arrives at these facilities from job sites in shipping containers, which are then placed directly on a train destined for a landfill in Oregon or eastern Washington. Finally, the County's public waste transfer facilities handle disposed C&D waste from small-quantity generators.[3] Figure 1-2 shows the breakdown of C&D waste deliveries among private transfer facilities, private intermodal and spot rail facilities, and public transfer stations.

[3] Since 1993, King County has banned construction, demolition, and land clearing (CDL) waste at its facilities, except for small quantities transported by private vehicles with gross weights not exceeding 8,000 pounds, or CDL waste contained in loads of mixed municipal solid waste that do not exceed 10% of the load by weight.

Chapter 2 of this report presents new research into the composition of C&D waste disposed at the four private facilities. The report also summarizes information relevant to C&D materials from a 1999-2000 study of the waste disposed at King County's transfer facilities.[4] The current study does not characterize the waste disposed in intermodal containers because the waste materials are difficult to study – the waste arrives at facilities in sealed containers, which are loaded directly onto trains for transport to a landfill.[5]

Figure 1-2. C&D Disposal Tonnages, by Type of Site



Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

C&D Waste Disposed at Private Transfer Facilities

According to waste sampling results, the contents of C&D waste disposed at private transfer facilities can be characterized as follows:

- About 45% of the C&D waste consists of wood, when measured by weight.
- Metals, paper, roofing materials, and drywall/gypsum are also common materials, collectively comprising about 35%.
- The remaining 20% consists of carpet, dirt, yard waste, glass, and other materials, as described in Chapter 2, *C&D Disposal Stream*.

[4] Based on the 1999/2000 study, approximately 75,000 tons of C&D materials were disposed at King County's transfer stations. This total is assumed to have remained relatively constant since 1999/2000 and is included in the estimated total of 264,000 tons disposed.

[5] To estimate types of waste disposed in intermodal containers, composition estimates for non-residential C&D loads disposed at the private facilities were applied to the known tonnages disposed via intermodal containers.

Table 1-1. Estimated Annual Tonnages Disposed from King County at Private Transfer Facilities in 2001, by Major C&D Material Type

C&D Material Type	Annual Tons Disposed
Wood	61,000
Roofing	15,000
Metals	15,000
Gypsum	10,000
Paper	8,000
All Other Types	*26,000*

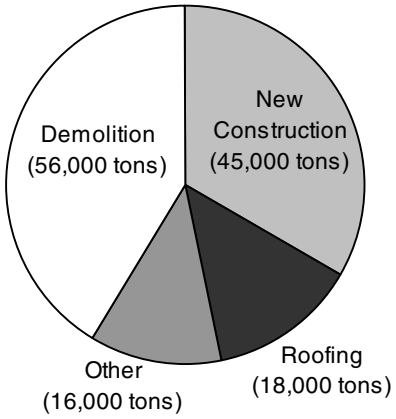
Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

Construction Type Generating C&D Waste

C&D waste is generated during new construction, remodeling or renovation of structures, demolition of existing buildings, road construction and maintenance, and related activities. (As noted above, this definition excludes debris from land clearing activities, which the study did not cover.) The C&D waste disposed at private facilities can be characterized according to its origins in construction or demolition activities as follows:

- C&D waste generated as leftover scrap material during new construction comprises about 33% of C&D waste disposed at private facilities. This waste contains a large amount of recyclable wood.
- C&D waste generated by building demolition represents about 42% of the total C&D waste disposed at private facilities. This material contains much less recyclable wood, but it contains a larger amount of metals.
- C&D waste generated by roofing, other activities, or a mix of sources comprises about 25% of all C&D waste disposed at private transfer facilities.

Figure 1-3. Activities Generating C&D Waste Disposed at Private Facilities



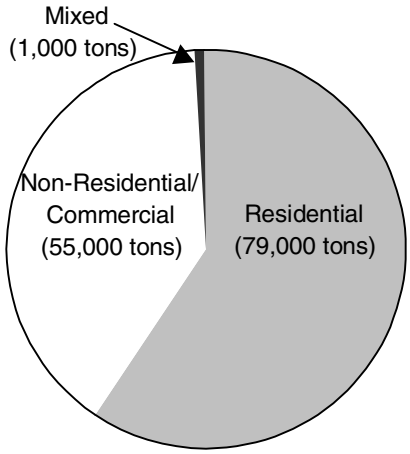
Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

Residential and Commercial Origins of C&D Waste

The study found that C&D waste disposed at the private transfer facilities originates from either residential or commercial sources as follows:

- Waste from residential projects represents about 60% of the C&D waste disposed at private facilities. It typically contains large quantities of wood, roofing materials, and drywall/gypsum.
- Waste from commercial projects comprises about 40% of the C&D waste disposed at private facilities. It commonly contains large quantities of wood, metal, and drywall/gypsum.

Figure 1-4. Generation Source of C&D Disposal at Private Facilities



Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

1.2 C&D MATERIAL RECYCLING

In contrast to C&D waste disposal, the four private facilities handle only a small fraction (less than 5%) of the recycled C&D materials. Most C&D materials destined for recycling are hauled directly to processors without first passing through a transfer facility. Chapter 3 of this report presents results of interviews with generators, haulers, and processors of C&D materials.

C&D Recycling Activities

As stated earlier, about 510,000 tons of C&D materials from King County outside of Seattle were recycled in 2001, based on the results of interviews with processors. While many types of C&D materials can be recycled in some way, only seven are actually recycled in any significant quantity, as shown in Table 1-2: recyclable wood, concrete, gypsum wallboard, roofing, glass, carpet and carpet padding, and metals. Of these materials, concrete and recyclable wood represent the vast majority of recycled C&D materials.[6] Concrete and recyclable wood also have the highest recovery rates, at more than 95% and from 60% to 65%, respectively. Recovery of other materials is much lower, both when measured by tonnage and by recovery rate. For most waste generators, cost and convenience dictate whether C&D materials are recycled or disposed.

In interviews conducted as part of this study, C&D processors reported that the capacity for processing recovered C&D materials far exceeds the quantities currently processed. In fact, overall capacity is at least double the amount processed at present.

It is important to note that the estimated disposed annual tons of the seven most recycled C&D materials shown in Table 1-2 account for about 215,000 tons, or about 81%, of the estimated 264,000 tons of total disposed C&D waste from King County. The data about disposed C&D tonnage in Table 1-2 represent information compiled from all three sources of C&D waste disposed, by type of site: private transfer facilities, private intermodal and spot rail facilities, and County transfer facilities.

It is also important to understand that "estimated recovery rate" in Table 1-2 shows a range of recovery for each material. A range is useful for assessing the relative potential for future recovery of each material listed. Relative potential is an important distinction to make for a number of reasons: not all processors of each material were interviewed for this report, the data obtained through the processor interviews have limitations, sampling error is present in the annual disposal estimates as is common in any sampling or survey result, and the markets for each material fluctuate over time. Therefore, a range for estimated recovery rates reflects an estimate on how much variation there may be in the amount of a material processed and, conversely, on how much variation there

[6] Because King County considers material used to produce hogged fuel to be recyclable C&D waste, hogged fuel tonnages are included in the recycling figures for this study. Hogged fuel is ground-up or shredded wood, sometimes mixed with other materials, that is burned as boiler fuel.

may be in the potential for further processing of that material. For example, dividing the 210,000 tons of processed wood in Table 1-2 by 330,000 tons (the total of both processed wood and disposed wood) yields 63.6%, rounded to the nearest tenth of a percent. Providing a range of 60% to 65% for the recovery rate allows for the variation that may exist in the amount of wood processed. It also allows for thinking in terms of a targeted potential of 35% to 40% more wood that might be captured from the waste stream for processing. Finally, it provides a useful benchmark for tracking changes in market potential over time.

Table 1-2. Estimated Annual Recycling of C&D Materials from King County

C&D Material Type	Estimated Annual Tons Processed from King County	Estimated Annual Tons Disposed from King County	Estimated Annual Tons Processed and Disposed from King County	Estimated Recovery Rate
Wood	210,000	120,000	330,000	60-65%
Concrete	290,000	4,000	294,000	>95%
Gypsum	7,000	19,000	26,000	25-30%
Roofing	1,000	15,000	16,000	5-10%
Glass	<50	6,000	6,050	<1%
Carpet/Padding	<2,000	16,000	18,000	<11%
Metals[7]	—	35,000	—	—

Note: Annual tonnage estimates are rounded. The reported tons processed are based on interviews with the larger processors, but not all King County processors, and depend on the accuracy of the processors' records. The reported tons processed, estimated annual tons disposed, and approximate recovery rate are based on the best available data. For more detail, please see Interpreting the Results *on page 2-5.*

[7] No estimate is available for the amount of metal processed from King County annually because metal processors are unable to identify the sources of the metals they process.

Potential for Future Recovery

Many recoverable materials remain in disposed C&D waste. The quantities of potentially recyclable materials reported in Table 1-3 include material disposed at the private transfer facilities, in intermodal containers, and at the County's public waste facilities. Quantities are reported as ranges because composition estimates are known only for waste disposed at the private and public transfer facilities but not for intermodal containers. The tons of recyclable materials disposed in intermodal containers were estimated by applying the typical composition of non-residential waste disposed at the private facilities to the known tonnage of waste disposed in intermodal containers.

Wood represents the most prevalent recoverable material. Of all C&D waste disposed from locations in King County (and handled at the private transfer stations, intermodal and spot rail facilities, and public transfer stations), an estimated 50,000 to 75,000 tons consists of recyclable wood containing only trace amounts of paint, stain, or other materials. Metals are also common, with about 28,000 to 42,000 recyclable tons disposed in King County. Roofing, carpet, and gypsum together account for between about 29,000 and 43,000 tons of recyclable C&D material disposed in King County. Glass and concrete combined make up the smallest amount of the recyclable material – between about 7,000 and 12,000 tons. Taken together, all these materials account for approximately 114,000 to 172,000 tons of potentially recoverable material.

If the seven most recycled C&D materials could be recovered, processors report that sufficient capacity already exists to process all the wood, metal, concrete, and gypsum in the waste stream. Furthermore, capacity exists to process most of the roofing and glass, although additional capacity or facilities may be needed for those materials.

Table 1-3. Estimated Annual Disposal of Potentially Recyclable Materials from King County

C&D Material Type	Tons of Potentially Recyclable Materials Disposed Annually
Wood	50,000 – 75,000
Metals	28,000 – 42,000
Roofing	12,000 – 17,000
Carpet[8]	9,000 – 14,000
Gypsum	8,000 – 12,000
Glass	4,000 – 7,000
Concrete	3,000 – 5,000

Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

[8] The range of tons of potentially recyclable carpet/padding (9,000 – 14,000) is less than the estimated annual tons of carpet/padding disposed (16,000, as shown in Table 1-2) because interviews for this report indicated that about 75% of the disposed amount is potentially recyclable due to contamination of the other 25%.

Chapter 2
C&D Disposal Stream

Builders, demolition contractors, residents, and businesses in King County outside of Seattle disposed about 264,000 tons of construction and demolition (C&D) waste in 2001. This waste was typically taken to:

- four private C&D transfer stations,
- three intermodal and spot rail facilities, or
- 10 King County transfer stations and drop boxes.

Figure 2-1 shows the proportion of this C&D waste disposal that travels through the private transfer stations, intermodal and spot rail facilities, and public transfer stations. As shown, about 135,000 tons, the largest share of C&D material, went to the four private C&D facilities for disposal:

- Black River,
- Eastmont,
- Recycling Northwest, and
- Third & Lander.

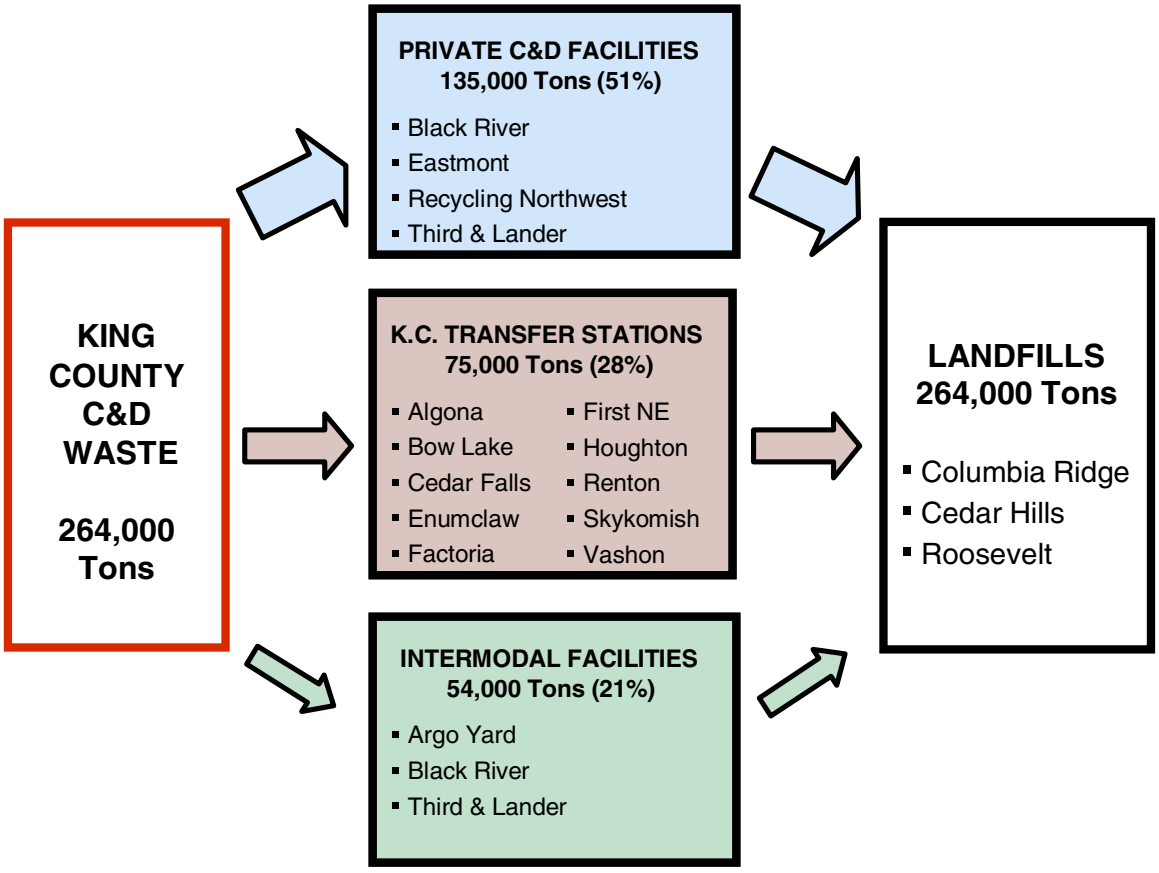
The C&D waste characterization study described in this report focuses primarily on the waste disposed at these four private facilities.

Also shown in Figure 2-1 is the estimated 54,000 tons of C&D waste delivered in intermodal containers to three facilities: Argo Yard, Black River, and Third & Lander. Because the waste arrives at the facilities in sealed containers, this study did not characterize the waste in these loads.

Finally, the estimated 75,000 tons of C&D waste received at the County's eight transfer stations and two drop boxes is shown in Figure 2-1. That estimate was based on data provided in the County's 1999/2000 waste stream characterization study.[9]

[9] Cascadia Consulting Group,*Waste Monitoring Program: 1999/2000 Comprehensive Waste Stream Characterization and Transfer Station Customer Surveys – Final Report*, August 2000.

Figure 2-1. King County C&D Disposal System and Estimated Tonnages, Arranged in Descending Order of Tonnages Disposed



2.1 C&D WASTE CHARACTERIZATION

This section of the report examines the C&D waste disposed at the four private C&D facilities: Black River, Eastmont, Recycling Northwest, and Third & Lander. To assess the types and quantities of C&D materials disposed at these facilities, Cascadia field staff conducted visual composition estimates of 550 loads of C&D waste during four periods of sampling in the spring, summer, and fall of 2001, and the winter of 2002.

For each observation, the field crew provided percentage composition estimates, by volume, for 70 materials, which are defined in Appendix A. Appendix A also groups the 70 materials into 12 main classes. One of those classes, for example, is paper, which includes OCC/Kraft bags or paper, Tyvek vapor barrier, and other paper. Appendix B describes the field observation methods, and Appendix C shows the field forms used in the sampling and surveying.

Using the percentage composition estimates, the sample's total volume, and a density conversion for each of the 70 materials, Cascadia then calculated the composition by weight of each sampled load. Using survey data that recorded sources of the waste by type of vehicle, hauler, generator, and construction activity, Cascadia prepared composition profiles of each of those sources, which are referred to as substreams throughout this chapter. In addition, Cascadia estimated the annual tonnage corresponding to each of the substreams to produce composition profiles using a weighted average process. Appendix D describes these calculations, and Appendix E presents the volume-to-weight conversion factors used in the analysis.

In this chapter, the report provides pie charts that offer a quick overview of the proportion of the 12 main classes of material for each substream, based on their percentage of the tonnage for that substream. The 12 main classes of material are listed below:

- Recyclable wood,[10]
- Non-recyclable wood,
- Glass,
- Hazardous waste,
- Mineral aggregates,
- Metals,
- Paper,
- Plastics and laminates,
- Other materials,
- Other organics,
- Yard waste,
- Municipal solid waste (MSW).

[10] Because King County considers material used to produce hogged fuel to be recyclable C&D waste, hogged fuel tonnages are included in the recycling figures for this study. Hogged fuel is ground-up or shredded wood, sometimes mixed with other materials, that is burned as boiler fuel.

Detail about the 70 sampled materials that make up the 12 main classes of material can be found in Appendix F for each substream. The tables in Appendix F group the 70 materials into the 12 main classes, list the tonnage estimates[11] for all 70 materials and the 12 main classes, and show the estimated mean percentage for each and the error ranges, calculated at a 90% confidence level. For convenient reference, Table F-1, which shows this level of detail for the overall composition of C&D waste, is included in Section 2.3, "Overall Composition," as Table 2-2.

The detailed tables in Appendix F can be used for a variety of analyses. In this chapter, the report provides tables that offer a quick overview of the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage for each substream, arranged in descending order of weight. It is interesting to note that the top 10 materials in each of these tables account for a range of about 59% to 92% of the total tonnage of each substream. Information in each table includes the mean percentage composition of the top 10 materials with the largest tonnage, the annualized number of tons of each material, and the cumulative percentage that those materials represent in descending order of weight.

[11] In the waste composition tables provided in this document, a reported tonnage of zero means either that a particular material was not observed during the sampling process or that the estimated tonnage was less than one-half ton, rounding down to zero.

2.2 INTERPRETING THE RESULTS

When interpreting the results presented in the tables and figures in this report, it is important to consider **the effect of rounding**.

To keep the waste composition tables and figures readable, estimated tonnages are rounded to the nearest ton, and estimated percentages are rounded to the nearest tenth of a percent. Due to this rounding, the tonnages presented in the report, when added together, may not equal the subtotals and totals shown, which were calculated using more precise percentages. Similarly, the percentages, when added together, may not equal the subtotals or totals shown, which represent more precise percentages.

It is important to recognize that the tons shown in the report were calculated using the more precise percentages. Therefore, using the rounded percentages to calculate tonnages yields quantities that are less precise than those shown in the report.

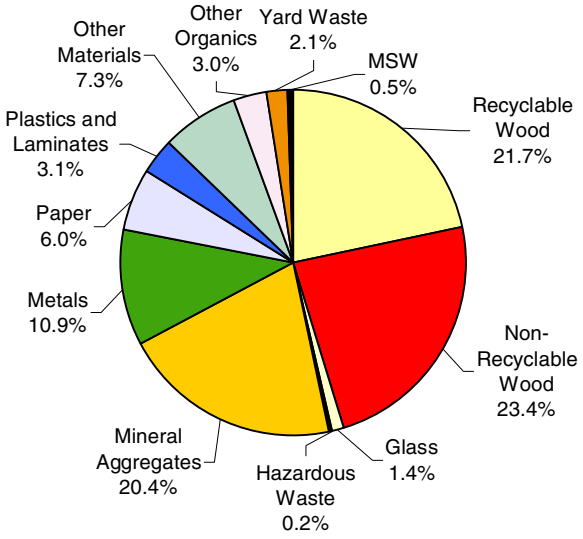
An example will help illustrate the effects of rounding in the report. The rounded percentage for *new/clean used lumber* in Table 2-1 and Table 2-2 is shown as 8.6% of the overall C&D waste stream. The more precise percentage was 8.58880298452406%. Thus, adding the rounded percentages in the tables may not yield the subtotals or totals shown, which are based on the more precise percentages.

If the rounded percentage for *new/clean used lumber* in Table 2-1 and Table 2-2 were used to calculate the tonnage, it would yield the following: 8.6% x 135,129 (the total tonnage) = 11,621.094 tons. However, if the more precise percentage for this material is used, it yields the following: 8.58880298452406% x 135,129 (the total tonnage) = 11,605.9635849575 tons, or 11,606 tons when rounded to the nearest ton. It is the more precise tonnage of 11,606 that is used in the two tables.

2.3 OVERALL COMPOSITION

Generators disposed about 135,000 tons of C&D waste at the four private C&D facilities in 2001. Figure 2-2 shows the proportion of the 12 main classes of material in the overall C&D waste stream, based on their percentage of the overall C&D tonnage.

Figure 2-2. Overview of Waste Composition – Overall C&D



- *Recyclable wood* at about 22%, *non-recyclable wood* at about 23%, and *mineral aggregates* at about 20% combine to represent nearly two-thirds of the total.
- Each of the remaining main material classes – *metals*, *other materials*, *paper*, *plastic and laminates*, *other organics*, *yard waste*, *glass*, *MSW*, and *hazardous waste* – contributes about 11% or less to the total.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-1 lists the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the overall C&D waste stream, arranged in descending order of weight.

Table 2-1. Top 10 Materials with Largest Percentage of Tonnage – Overall C&D

Component	Mean	Cum. %	Tons
Painted/Stained Wood	11.7%	11.7%	15,774
New/Demo. Engineered Wood	9.9%	21.5%	13,336
New/Clean Used Lumber	8.6%	30.1%	11,606
Composition Shingles	6.3%	36.4%	8,489
Galvanized Steel	5.2%	41.6%	6,975
Mixed/Demo. Gypsum Scrap	4.5%	46.1%	6,067
Other Ferrous Metals	4.4%	50.4%	5,923
Mixed Demo. Wood	4.4%	54.8%	5,879
Wood Roofing and Siding	4.2%	59.0%	5,659
OCC/Kraft Bags or Paper	3.5%	62.5%	4,719
Subtotal	**62.5%**		**84,427**
All Other Materials Combined	*37.5%*		*50,702*
Total	**100.0%**		**135,129**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

- The 10 materials with the largest percentage of tonnage in the overall C&D waste stream contribute about 84,000 tons, or about 62% of the total.
- *Painted/stained wood* and *new/demolition engineered wood* account for about 12% and 10%, respectively, of the overall C&D waste stream, while *new/clean used lumber* accounts for about 9%.
- Each of the remaining materials listed in Table 2-1 – *composition shingles*, *galvanized steel*, *mixed/demolition gypsum scrap*, *other ferrous metals*, *mixed demolition wood*, *wood roofing and siding*, and *OCC/Kraft bags or paper* – accounts for about 6% or less of the total waste stream delivered to the private C&D facilities.

Table 2-2 on the next page shows the total waste composition estimates for all 70 sampled materials and the 12 main classes in the overall C&D waste stream. Table 2-2, along with detailed waste composition tables for each substream, can also be found in Appendix F.

Table 2-2. Composition by Weight – Overall C&D

Calculated at a 90% confidence interval

	Tons	Mean	+/–
Recyclable Wood	**29,335**	**21.7%**	
New/Clean Used Lumber	11,606	8.6%	1.5%
New/Demo. Engineered Wood	13,336	9.9%	1.3%
Remanufacturing Scrap	313	0.2%	0.3%
Pallets and Crates	4,070	3.0%	0.7%
Unfinished Furnishings	10	0.0%	0.0%
Non-Recyclable Wood	**31,684**	**23.4%**	
Creosote/Pressure Treated	2,665	2.0%	1.1%
Painted/Stained Wood	15,774	11.7%	2.2%
Mixed Demo. Wood	5,879	4.4%	1.5%
Wood Roofing and Siding	5,659	4.2%	1.0%
Finished Furnishings	643	0.5%	0.2%
Other Wood	1,063	0.8%	0.4%
Glass	**1,829**	**1.4%**	
Clear Containers	56	0.0%	0.1%
Green Containers	0	0.0%	0.0%
Brown Containers	0	0.0%	0.0%
Window Glass	1,704	1.3%	0.7%
Mirror Glass	3	0.0%	0.0%
Other/Non-Recyc. Glass	67	0.0%	0.0%
Hazardous Waste	**219**	**0.2%**	
Latex Paint	90	0.1%	0.1%
Wood Preservatives	0	0.0%	0.0%
Oil-Based Finishes	24	0.0%	0.0%
Solvents and Thinners	0	0.0%	0.0%
Adhesives and Glue	28	0.0%	0.0%
Asbestos	77	0.1%	0.1%
Other Haz Waste	0	0.0%	0.0%
Mineral Aggregates	**27,588**	**20.4%**	
Asphaltic Concrete	506	0.4%	0.6%
Built-Up Roofing	2,683	2.0%	0.8%
Composition Shingles	8,489	6.3%	1.5%
Tarpaper/Asphalt Felt	3,611	2.7%	0.7%
Concrete With/Without Rebar	1,749	1.3%	0.7%
Bricks/Masonry Tile	523	0.4%	0.4%
Concrete Masonry Unit (CMU)	65	0.0%	0.0%
Clay Roofing Tile	191	0.1%	0.2%
Slate/Quarry Tile	161	0.1%	0.2%
New Gypsum Scrap	3,483	2.6%	1.1%
Mixed/Demo. Gypsum Scrap	6,067	4.5%	1.0%
Other Mineral Aggregates	60	0.0%	0.1%

	Tons	Mean	+/–
Metals	**14,684**	**10.9%**	
Drywall Corners/Metal Bindings	650	0.5%	0.2%
Galvanized Steel	6,975	5.2%	0.9%
Insulated Wire/Cable	429	0.3%	0.1%
Other Ferrous Metals	5,923	4.4%	0.9%
Other Nonferrous Metals	707	0.5%	0.3%
Paper	**8,148**	**6.0%**	
OCC/Kraft Bags or Paper	4,719	3.5%	0.6%
Tyvek Vapor Barrier	19	0.0%	0.0%
Other Paper	3,410	2.5%	0.4%
Plastics and Laminates	**4,255**	**3.1%**	
#2 Plastic Buckets	172	0.1%	0.0%
Plastic Film, Bags and Wrap	943	0.7%	0.2%
PVC Pipe	1,244	0.9%	0.5%
ABS Pipe	510	0.4%	0.3%
Polyurethane Foam/Carpet Padding	185	0.1%	0.1%
Laminate/Formica	147	0.1%	0.1%
Fiberglass (Acoustical) Ceiling Panels	365	0.3%	0.2%
Structural Fiberglass	84	0.1%	0.1%
Linoleum	79	0.1%	0.0%
Other Plastics	525	0.4%	0.1%
Other Materials	**9,812**	**7.3%**	
Rock	517	0.4%	0.3%
Dirt	3,701	2.7%	1.0%
Gravel	661	0.5%	0.5%
Sand	0	0.0%	0.0%
Large Appliances	435	0.3%	0.2%
Porcelain	179	0.1%	0.1%
Insulation	1,321	1.0%	0.4%
Other Miscellaneous Fines	2,997	2.2%	0.5%
Other Organics	**4,091**	**3.0%**	
Carpeting	3,157	2.3%	0.6%
Upholstery	306	0.2%	0.1%
Other Organics (e.g., rags)	628	0.5%	0.3%
Yard Waste	**2,780**	**2.1%**	
Stumps and Logs	412	0.3%	0.2%
Large Prunings	822	0.6%	0.7%
Small Prunings	1,076	0.8%	0.3%
Leaves and Grass	470	0.3%	0.2%
MSW	**705**	**0.5%**	
MSW	705	0.5%	0.1%

Sample Count	**550**	**Total Tons**	**135,129**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage and error range are rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages as displayed in the table, when added together, may not equal the subtotals and totals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

2.4 HAULER TYPE

To analyze the C&D waste disposed at the four private C&D facilities, Cascadia divided the universe of haulers bringing waste to those facilities into three main types: certificated haulers, C&D haulers, and self-haulers. Table 2-3 defines and offers examples of each of these hauler types.

Table 2-3. Hauler Definitions and Examples

Hauler	Definition	Example
Certificated Haulers	Haulers that operate under authority granted by the Washington Utilities and Transportation Commission (WUTC) or haulers that contract with cities to operate a garbage collection company	Allied Waste and Waste Management
C&D Haulers	Companies whose principal business includes demolition and/or hauling of construction and demolition materials	Large construction or demolition contractors, such as Bobby Wolford Trucking & Demolition and Nuprecon, Inc.
Self-Haulers	Any party other than a certificated or C&D hauler whose primary business is not waste hauling	Typically contractors, residents, or small business owners

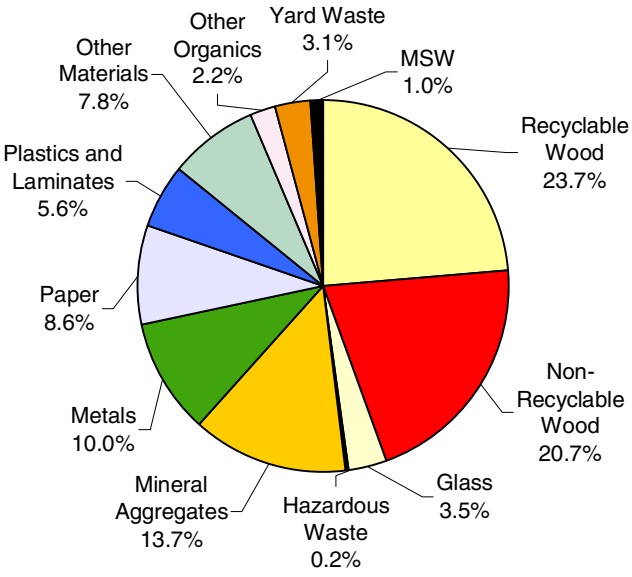
Cascadia further divided the self-hauler substream based on the type of user conducting the activity that produced the waste. The activity type primarily defined the proportion of C&D waste created by do-it-yourselfers versus contractors. Do-it-yourselfers include individuals who are not involved in construction and demolition as business activities. In contrast, the principal business of contractors is construction and/or demolition. The self-haul substream also includes a small category of self-haulers that are neither do-it-yourselfers nor contractors.

The following sections present waste composition data for each of the three hauler types. The self-haulers are further divided into do-it-yourselfers, contractors, and other self-haulers.

Certificated Haulers

Certificated haulers delivered about 40,000 tons of C&D waste to the four private facilities in 2001. Figure 2-3 shows the proportion of the 12 main classes of material in the certificated hauler substream, based on their percentage of the overall tonnage for this substream.

Figure 2-3. Overview of Waste Composition – Certificated Haulers



- *Recyclable wood* and *non-recyclable wood* each contribute more than 20% to the substream.
- At about 14%, *mineral aggregates* represent the next largest material class, followed by *metals*, *paper*, *other materials*, and *plastics and laminates*, each ranging from about 6% to 10%.
- *Glass*, *yard waste*, *other organics*, *MSW*, and *hazardous waste* comprise the remaining 10% of the substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-4 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the certificated hauler substream, arranged in descending order of weight.

Table 2-4. Top 10 Materials with Largest Percentage of Tonnage – Certificated Haulers

Component	Mean	Cum. %	Tons
New/Demo. Engineered Wood	11.3%	11.3%	4,531
Painted/Stained Wood	10.4%	21.7%	4,143
New/Clean Used Lumber	6.2%	27.9%	2,488
Pallets and Crates	6.2%	34.1%	2,460
OCC/Kraft Bags or Paper	5.6%	39.7%	2,236
Other Ferrous Metals	4.5%	44.2%	1,799
Galvanized Steel	3.9%	48.1%	1,564
New Gypsum Scrap	3.7%	51.9%	1,498
Dirt	3.5%	55.4%	1,397
Wood Roofing and Siding	3.4%	58.8%	1,363
Subtotal	**58.8%**		**23,478**
All Other Materials Combined	*41.2%*		*16,471*
Total	**100.0%**		**39,949**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

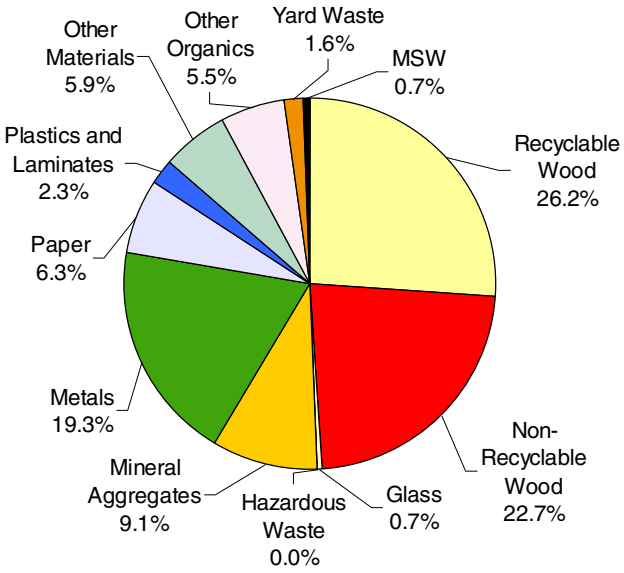
- *New/demolition engineered wood* and *painted/stained wood* each accounts for more than 10% of the certificated hauler substream, or about 9,000 tons combined.
- Each of the remaining materials listed in Table 2-4 – *new/clean used lumber*, *pallets and crates*, *OCC/Kraft bags or paper*, *other ferrous metals*, *galvanized steel*, *new gypsum scrap*, dirt, and *wood roofing and siding* – contributes about 6% or less to the total for this substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-2 in the appendix.

C&D Haulers

C&D haulers accounted for about 29,000 tons of C&D waste brought to the four private facilities in 2001. Figure 2-4 shows the proportion of the 12 main classes of material in the C&D hauler substream, based on their percentage of the overall tonnage for this substream.

Figure 2-4. Overview of Waste Composition – C&D Haulers



- *Recyclable wood* at about 26% and *non-recyclable wood* at about 23% together comprise approximately half of the C&D hauler substream.
- Sizable portions of the C&D hauler substream consist of *metals* at about 19%, *mineral aggregates* at about 9%, and *paper*, *other materials*, and *other organics* at about 6% each.
- The remaining classes combined – *plastics and laminates*, *yard waste*, *glass*, *MSW*, and *hazardous waste* – account for about 5% of the substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-5 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the C&D hauler substream, arranged in descending order of weight.

Table 2-5. Top 10 Materials with Largest Percentage of Tonnage – C&D Haulers

Component	Mean	Cum. %	Tons
Painted/Stained Wood	13.4%	13.4%	3,928
New/Clean Used Lumber	13.0%	26.4%	3,817
Galvanized Steel	12.2%	38.7%	3,585
New/Demo. Engineered Wood	10.6%	49.3%	3,107
Other Ferrous Metals	5.1%	54.4%	1,490
Mixed Demo. Wood	4.8%	59.2%	1,418
OCC/Kraft Bags or Paper	4.4%	63.7%	1,302
Carpeting	4.4%	68.1%	1,291
Mixed/Demo. Gypsum Scrap	3.4%	71.5%	991
Other Miscellaneous Fines	2.3%	73.8%	674
Subtotal	**73.8%**		**21,605**
All Other Materials Combined	*26.2%*		*7,678*
Total	**100.0%**		**29,283**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

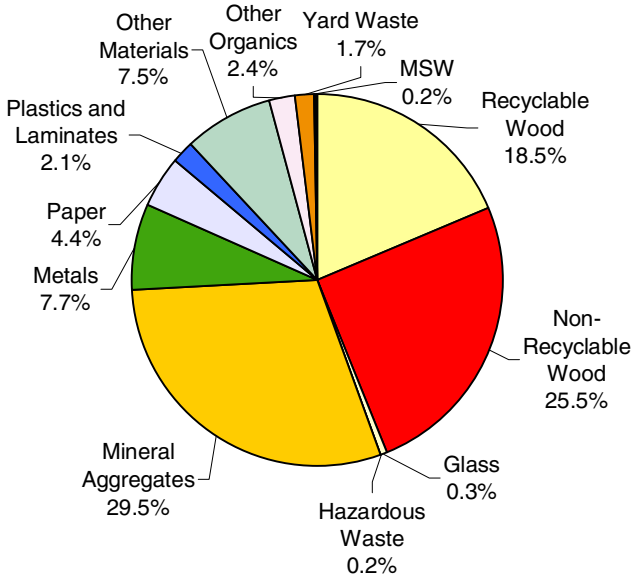
- *Painted/stained wood* and *new/clean used lumber* at about 13.0% each, *galvanized steel* at about 12%, and *new/demolition engineered wood* at about 11% together account for approximately one-half of the waste that C&D haulers brought.
- Each of the remaining materials listed in Table 2-5 – *other ferrous metals*, *mixed demolition wood*, *OCC/Kraft bags or paper*, *carpeting*, *mixed/demolition gypsum scrap*, and *other miscellaneous fines* – accounts for about 5% or less of the total.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-3 in the appendix.

Self-Haulers

Self-haulers brought about 66,000 tons of C&D waste to the four private facilities for disposal in 2001. Figure 2-5 shows the proportion of the 12 main classes of material in the self-hauler substream, based on their percentage of the overall tonnage for this substream.

Figure 2-5. Overview of Waste Composition – Self-Haulers



- *Mineral aggregates* at about 30% comprise the largest share of the self-hauler substream, followed by *non-recyclable wood* at about 26% and *recyclable wood* at about 19%.
- *Metals* and *other materials* contribute about 8% each.
- Combined, the remaining seven material classes – *paper*, *other organics*, *plastics and laminates*, *yard waste*, *glass*, *MSW*, and *hazardous waste* – account for about 11% of the substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-6 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the self-hauler substream, arranged in descending order of weight.

Table 2-6. Top 10 Materials with Largest Percentage of Tonnage – Self-Haulers

Component	Mean	Cum. %	Tons
Painted/Stained Wood	11.7%	11.7%	7,704
Composition Shingles	11.7%	23.4%	7,693
New/Demo. Engineered Wood	8.6%	32.0%	5,699
New/Clean Used Lumber	8.1%	40.1%	5,305
Wood Roofing and Siding	5.8%	45.8%	3,798
Mixed/Demo. Gypsum Scrap	5.7%	51.5%	3,725
Mixed Demo. Wood	5.2%	56.7%	3,425
Tarpaper/Asphalt Felt	4.2%	60.9%	2,778
Other Ferrous Metals	4.0%	64.9%	2,634
Built-Up Roofing	3.6%	68.5%	2,352
Subtotal	**68.5%**		**45,112**
All Other Materials Combined	*31.5%*		*20,784*
Total	**100.0%**		**65,896**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

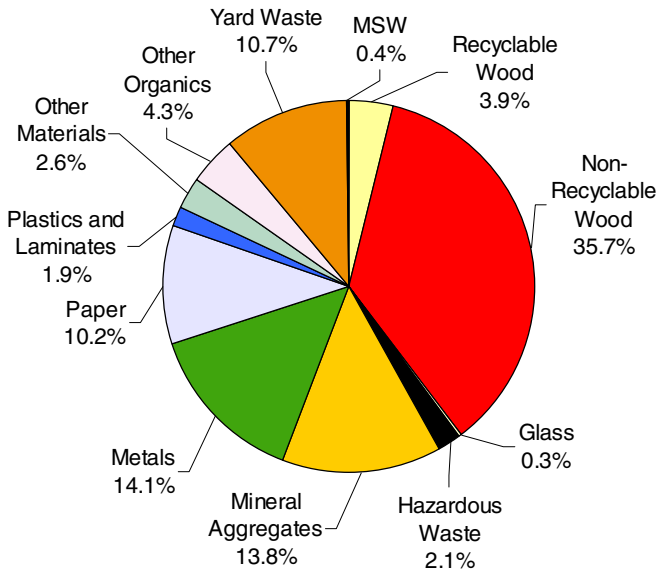
- *Painted/stained wood* and *composition shingles* are the largest components in the self-hauler substream, each representing nearly 12% of the total.
- Two wood categories – *new/demolition engineered wood* at about 9% and *new/clean used lumber* at about 8% – follow in the top 10 ranking.
- Each of the remaining materials in Table 2-6 – *wood roofing and siding*, *mixed/demolition gypsum scrap*, *mixed demolition wood*, *tarpaper/asphalt felt*, *other ferrous metals*, and *built-up roofing* – comprises less than 6% of the substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-4 in the appendix.

SELF-HAULERS: DO-IT-YOURSELFERS

Do-it-yourselfers brought about 5,000 tons of the self-hauled C&D substream to the four private facilities in 2001. Figure 2-6 shows the proportion of the 12 main classes of material in the do-it-yourselfer substream, based on their percentage of the overall tonnage for this substream.

Figure 2-6. Overview of Waste Composition – Do-It-Yourselfers



- *Non-recyclable wood* at about 36% accounts for more than a third of the do-it-yourselfer substream.
- *Metals* and *mineral aggregates – each at about 14%* – represent the next two largest classes of materials found in do-it-yourselfer loads, followed by *yard waste* at about 11% and *paper* at about 10%.
- Each of the remaining seven material classes – *other organics*, *recyclable wood*, *other materials*, *hazardous waste*, *plastics and laminates*, *MSW*, and *glass* – comprises about 4% or less of this substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-7 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the do-it-yourselfer substream, arranged in descending order of weight.

Table 2-7. Top 10 Materials with Largest Percentage of Tonnage – Do-It-Yourselfers

Component	Mean	Cum. %	Tons
Painted/Stained Wood	12.8%	12.8%	644
Other Ferrous Metals	12.6%	25.4%	636
OCC/Kraft Bags or Paper	9.0%	34.4%	453
Mixed/Demo. Gypsum Scrap	7.7%	42.1%	390
Mixed Demo. Wood	7.5%	49.6%	377
Creosote/Pressure Treated	7.4%	57.0%	374
Stumps and Logs	5.7%	62.7%	287
Wood Roofing and Siding	5.2%	68.0%	264
Composition Shingles	4.4%	72.4%	221
Carpeting	4.1%	76.5%	209
Subtotal	**76.5%**		**3,857**
All Other Materials Combined	*23.5%*		*1,183*
Total	**100.0%**		**5,040**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

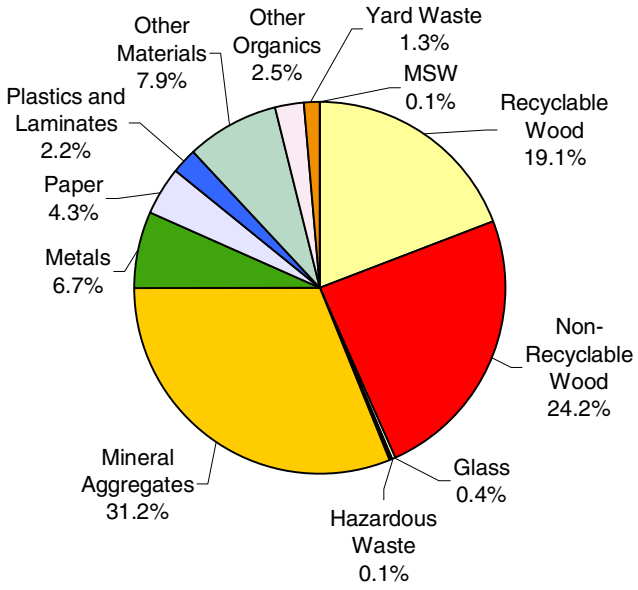
- *Painted/stained wood* and *other ferrous metals* – each at about 13% – constitute the two largest material components in this self-hauler substream, followed by *OCC/Kraft bags or paper* at about 9%.
- Each of the remaining materials listed in Table 2-7 – *mixed/demolition gypsum scrap*, *mixed demolition wood*, *creosote/pressure-treated wood*, *stumps and logs*, *wood roofing and siding*, *composition shingles*, and *carpeting* – accounts for less than 8% of the total substream for do-it-yourselfers.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-5 in the appendix.

SELF-HAULERS: CONTRACTORS

Contractors disposed about 60,000 tons of the self-hauled C&D substream at the four private facilities in 2001. Figure 2-7 shows the proportion of the 12 main classes of material in the contractor substream, based on their percentage of the overall tonnage for this substream.

Figure 2-7. Overview of Waste Composition – Contractors



- *Mineral aggregates* at about 31% comprise the largest portion of the contractor substream.
- *Non-recyclable wood* at about 24% and *recyclable wood* at about 19% represent the next largest material classes.
- *Other materials* and *metals* contributed about 8% and 7%, respectively, and the remaining seven material classes – *paper*, *other organics*, *plastics and laminates*, *yard waste*, *glass*, *MSW*, and *hazardous waste* – contribute about 11% combined.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-8 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the contractor substream, arranged in descending order of weight.

Table 2-8. Top 10 Materials with Largest Percentage of Tonnage – Contractors

Component	Mean	Cum. %	Tons
Composition Shingles	12.9%	12.9%	7,736
Painted/Stained Wood	12.0%	24.8%	7,188
New/Demo. Engineered Wood	9.1%	34.0%	5,489
New/Clean Used Lumber	8.7%	42.7%	5,218
Mixed/Demo. Gypsum Scrap	5.8%	48.5%	3,493
Wood Roofing and Siding	5.6%	54.1%	3,363
Mixed Demo. Wood	4.6%	58.7%	2,767
Tarpaper/Asphalt Felt	4.2%	62.9%	2,544
Other Ferrous Metals	3.4%	66.3%	2,051
Built-Up Roofing	3.3%	69.6%	1,969
Subtotal	**69.6%**		**41,818**
All Other Materials Combined	*30.4%*		*18,250*
Total	**100.0%**		**60,068**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

- *Composition shingles* at about 13% and *painted/stained wood* at about 12% together account for almost a quarter of this self-hauler substream, followed by *new/demolition engineered wood* and *new/clean used lumber* at about 9% each.
- Each of the remaining materials listed in Table 2-8 – *mixed/demolition gypsum scrap*, *wood roofing and siding*, *mixed demolition wood*, *tarpaper/asphalt felt*, *other ferrous metals*, and *built-up roofing* – contributes less than 6% to the substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-6 in the appendix.

SELF-HAULERS: OTHER

The self-haul C&D substream includes a small category of self-haulers that are neither do-it-yourselfers nor contractors. This very small substream, which constitutes about 1,000 tons, is not detailed in this report.

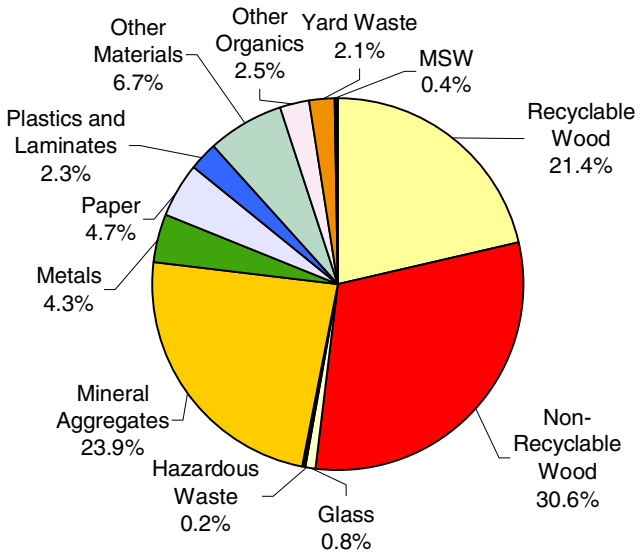
2.5 GENERATOR TYPE

Generator type describes the proportion of C&D waste created by residential and non-residential activities. For this study, the surveyor counted loads as residential waste if at least 80% of the waste originated from single- or multi-family dwellings. Similarly, the surveyor considered the load to be non-residential if at least 80% of the load originated from business, industrial, or other non-residential buildings or sites. A third generator category, called mixed residential/non-residential, describes the other loads consisting of less than 80% residential and less than 80% non-residential in origin.

Residential

With about 79,000 tons, residential generators represented about 60% of the C&D waste stream disposed at the four private facilities in 2001. Figure 2-8 shows the proportion of the 12 main classes of material in the residential substream, based on their percentage of the overall tonnage for this substream.

Figure 2-8. Overview of Waste Composition – Residential Generators



- About three-quarters of the residential substream consists of wood – both *non-recyclable wood* at about 31% and *recyclable wood* at about 21% – and *mineral aggregates* at about 24%.
- The next largest material classes – *other materials* and *paper* – account for 7% and 5%, respectively.
- Each of the remaining seven material classes – *metals*, *other organics*, *plastic and laminates*, *yard waste*, *glass*, *MSW*, and *hazardous waste* – accounts for about 4% or less of the substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-9 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the residential substream, arranged in descending order of weight.

Table 2-9. Top 10 Materials with Largest Percentage of Tonnage – Residential Generators

Component	Mean	Cum. %	Tons
Painted/Stained Wood	16.3%	16.3%	12,895
New/Demo. Engineered Wood	11.6%	27.9%	9,159
Composition Shingles	9.5%	37.4%	7,504
New/Clean Used Lumber	8.2%	45.6%	6,503
Wood Roofing and Siding	7.0%	52.6%	5,544
Mixed Demo. Wood	4.9%	57.5%	3,872
Mixed/Demo. Gypsum Scrap	4.0%	61.5%	3,169
Tarpaper/Asphalt Felt	3.5%	65.0%	2,787
Dirt	2.9%	67.9%	2,293
OCC/Kraft Bags or Paper	2.8%	70.7%	2,196
Subtotal	**70.7%**		**55,922**
All Other Materials Combined	*29.3%*		*23,187*
Total	**100.0%**		**79,109**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

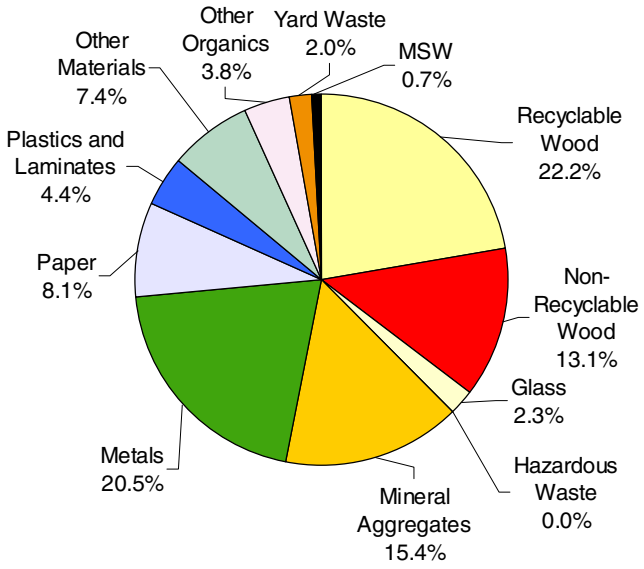
- Two wood categories, *painted/stained wood* at about 16% and *new/demolition engineered wood* at about 12% claimed the first two spots in the top 10 ranking for the residential substream.
- *Composition shingles* at about 10% ranked third, followed by *new/clean used lumber* and *wood roofing and siding* at about 8% and 7%, respectively.
- Each of the remaining materials listed in Table 2-9 – *mixed demolition wood*, *mixed/demolition gypsum scrap*, *tarpaper/asphalt felt*, *dirt*, and *OCC/Kraft bags or paper* – accounts for less than 5% of the total tonnage for the residential substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-7 in the appendix.

Non-Residential

Non-residential generators contributed about 55,000 tons to the C&D waste stream at the four private facilities in 2001. Figure 2-9 shows the proportion of the 12 main classes of material in the non-residential substream, based on their percentage of the overall tonnage for this substream.

Figure 2-9. Overview of Waste Composition – Non-Residential Generators



- *Recyclable wood* and *metals* are the two largest main material classes, each accounting for more than 20% of the non-residential substream.
- The material classes *mineral aggregates* at about 15% and *non-recyclable wood* at about 13% occur in roughly similar proportions.
- *Paper* at about 8% and *other materials* at about 7% represent the next largest material classes.
- Each of the remaining six main material classes – *plastics and laminates*, *other organics*, *glass*, *yard waste*, *MSW*, and *hazardous waste* – accounts for about 4% or less of the substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-10 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the non-residential substream, arranged in descending order of weight.

Table 2-10. Top 10 Materials with Largest Percentage of Tonnage – Non-Residential Generators

Component	Mean	Cum. %	Tons
Galvanized Steel	11.0%	11.0%	5,974
New/Clean Used Lumber	9.0%	19.9%	4,903
New/Demo. Engineered Wood	7.4%	27.3%	4,021
Other Ferrous Metals	7.2%	34.6%	3,954
Pallets and Crates	5.8%	40.4%	3,163
Mixed/Demo. Gypsum Scrap	5.2%	45.6%	2,851
Painted/Stained Wood	5.0%	50.6%	2,751
OCC/Kraft Bags or Paper	4.6%	55.2%	2,501
Mixed Demo. Wood	3.7%	58.9%	2,007
New Gypsum Scrap	3.5%	62.4%	1,892
Subtotal	**62.4%**		**34,018**
All Other Materials Combined	*37.6%*		*20,525*
Total	**100.0%**		**54,543**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

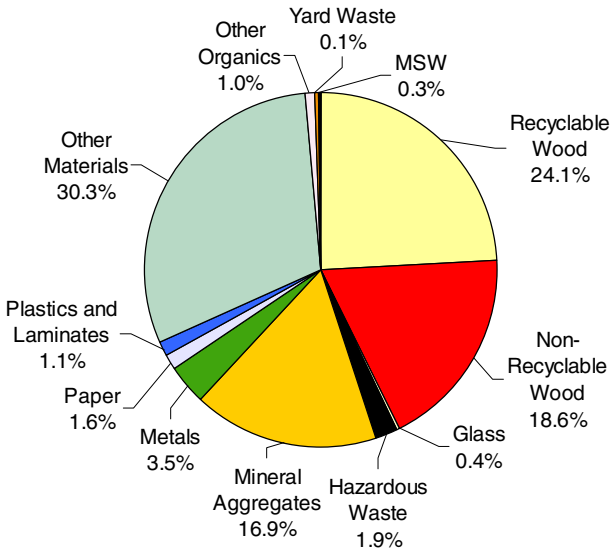
- Accounting for about 11% and about 6,000 tons, *galvanized steel* represents the largest component of the non-residential substream, followed by *new/clean used lumber* at about 9%.
- *New/demolition engineered wood* and o*ther ferrous metals* each accounts for about 7% of this substream.
- Each of the remaining materials listed in Table 2-10 – *pallets and crates*, *mixed/demolition gypsum scrap*, *painted/stained wood*, *OCC/Kraft bags or paper*, *mixed demolition wood*, and *new gypsum scrap* – accounts for less than 6% of the substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-8 in the appendix.

Mixed Residential/Non-Residential

With about 1,000 tons, the mixed residential/non-residential generator represented only about 1% of the C&D waste stream disposed at the four private facilities in 2001. Mixed generator loads consist of less than 80% residential waste and less than 80% non-residential waste. Figure 2-10 shows the proportion of the 12 main classes of material in the mixed generator substream, based on their percentage of the overall tonnage for this substream.

Figure 2-10. Overview of Waste Composition – Mixed Generators



- *Recyclable wood* and *non-recyclable wood* together comprise about 43% of the mixed generator substream.
- *Other materials* and *mineral aggregates* account for about 30% and 17%, respectively.
- *Metals*, *hazardous waste*, *paper*, *plastics and laminates*, *other organics*, *glass*, *MSW*, and *yard waste* together account for about 10% of the substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-11 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the mixed generator substream, arranged in descending order of weight.

Table 2-11. Top 10 Materials with Largest Percentage of Tonnage – Mixed Generators

Component	Mean	Cum. %	Tons
Other Miscellaneous Fines	25.7%	25.7%	379
New/Clean Used Lumber	13.5%	39.2%	200
Built-Up Roofing	11.5%	50.7%	169
New/Demo. Engineered Wood	10.4%	61.1%	154
Painted/Stained Wood	8.2%	69.3%	122
Other Wood	6.9%	76.3%	103
Dirt	4.3%	80.6%	64
Other Ferrous Metals	3.5%	84.1%	52
Wood Roofing and Siding	3.4%	87.5%	50
Mixed/Demo. Gypsum Scrap	3.2%	90.7%	47
Subtotal	**90.7%**		**1,340**
All Other Materials Combined	*9.3%*		*137*
Total	**100.0%**		**1,477**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

- *Other miscellaneous fines* at about 26%, or nearly 400 tons, comprise the largest share of the mixed generator substream.
- *New/clean used lumber* and *new/demolition engineered wood,* both considered recyclable materials, together make up about 24% of mixed generator loads.
- *Built-up roofing* at about 12% accounts for the third largest share of this substream.
- Each of the remaining materials listed in Table 2-11 – *painted/stained wood*, *other wood*, *dirt*, *other ferrous metals*, *wood roofing and siding*, and *mixed/demolition gypsum scrap* – comprises about 8% or less of the substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-9 in the appendix.

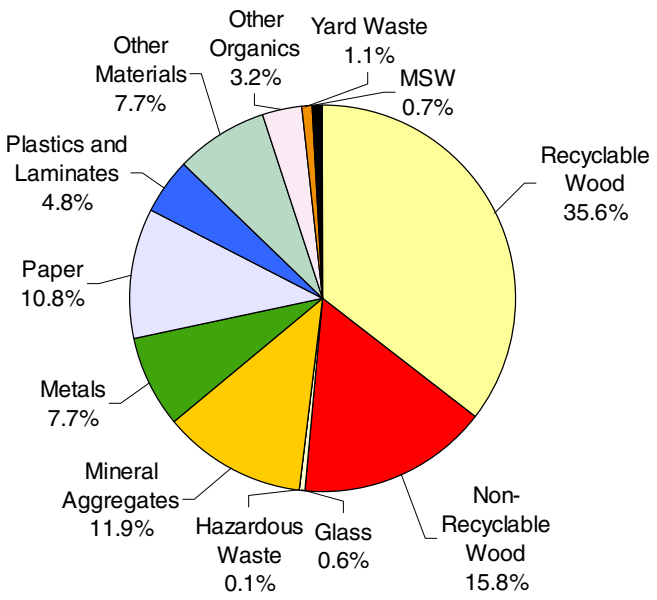
2.6 CONSTRUCTION TYPE

Construction type, which describes the process that created the C&D waste, includes four main categories: new construction, demolition, roofing, and mixed/other construction.

New Construction

New construction activities, which include new materials from both construction and remodel projects, contributed about 45,000 tons to the C&D waste stream brought to the four private facilities in 2001. Figure 2-11 shows the proportion of the 12 main classes of material in the new construction substream, based on their percentage of the overall tonnage for this substream.

Figure 2-11. Overview of Waste Composition – New Construction



- *Recyclable wood* comprises more than one-third of the new construction substream. *Recyclable wood at about 36%* and *non-recyclable wood* at about 16% together account for more than half of the substream.
- *Mineral aggregates* and *paper* each contributes more than 10%, followed by *other materials* and *metals* at about 8% each.
- Each of the remaining six main material classes – *plastics and laminates*, *other organics*, *yard waste*, *MSW*, *glass*, and *hazardous waste* – accounts for less than 5% of this substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-12 shows the 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the new construction substream, arranged in descending order of weight.

Table 2-12. Top 10 Materials with Largest Percentage of Tonnage – New Construction

Component	Mean	Cum. %	Tons
New/Demo. Engineered Wood	19.2%	19.2%	8,741
New/Clean Used Lumber	12.1%	31.3%	5,502
Painted/Stained Wood	10.0%	41.3%	4,532
OCC/Kraft Bags or Paper	6.7%	48.0%	3,031
Other Paper	4.1%	52.1%	1,852
New Gypsum Scrap	4.0%	56.1%	1,829
Dirt	3.8%	59.9%	1,712
Mixed Demo. Wood	3.7%	63.6%	1,688
Pallets and Crates	3.5%	67.1%	1,594
Galvanized Steel	3.4%	70.4%	1,529
Subtotal	**70.4%**		**32,011**
All Other Materials Combined	*29.6%*		*13,434*
Total	**100.0%**		**45,445**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

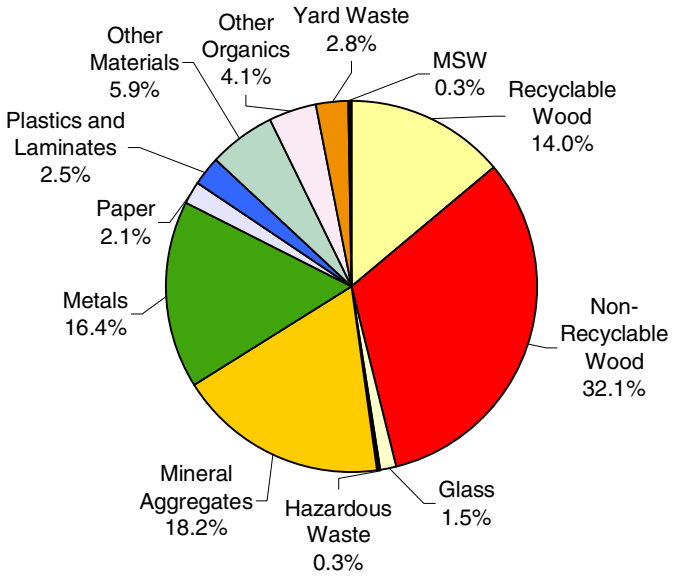
- Three categories of wood – *new/demolition engineered wood* at about 19%, *new/clean used lumber* at about 12%, and *painted/stained wood* at about 10% – together account for more than 40% of the new construction substream, or about 19,000 tons.
- With the exception of *OCC/Kraft bags or paper* at about 7%, each of the remaining materials listed in Table 2-12 – *other paper*, *new gypsum scrap*, *dirt*, *mixed demolition wood*, *pallets and crates*, and *galvanized steel* – represents less than 5% of this substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-10 in the appendix.

Demolition

Demolition activities, which include demolition materials from both demolition and remodel projects, accounted for about 42%, or about 56,000 tons, of the C&D waste disposed at the four private facilities in 2001. Figure 2-12 shows the proportion of the 12 main classes of material in the demolition substream, based on their percentage of the overall tonnage for this substream.

Figure 2-12. Overview of Waste Composition – Demolition



- *Non-recyclable wood* accounts for nearly one-third of the demolition substream.
- *Recyclable wood* accounts for only about 14% of the demolition substream, as compared with about 36% of the new construction substream.
- *Mineral aggregates* at about 18% represent the second-largest main material class of the demolition substream.
- *Metals* total about 16% of the substream, followed by *other materials* at about 6%.
- Each of the remaining seven main materials – *other organics*, *yard waste*, *plastics and laminates*, *paper*, *glass*, *hazardous waste*, and *MSW* – accounts for about 4% or less of this substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-13 shows the 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the demolition substream, arranged in descending order of weight.

Table 2-13. Top 10 Materials with Largest Percentage of Tonnage – Demolition

Component	Mean	Cum. %	Tons
Painted/Stained Wood	18.3%	18.3%	10,290
Galvanized Steel	8.7%	26.9%	4,886
Mixed/Demo. Gypsum Scrap	8.0%	34.9%	4,510
New/Clean Used Lumber	7.9%	42.8%	4,459
Mixed Demo. Wood	6.2%	49.0%	3,474
Other Ferrous Metals	5.9%	54.9%	3,321
New/Demo. Engineered Wood	4.8%	59.7%	2,724
Carpeting	3.3%	63.1%	1,883
Wood Roofing and Siding	3.1%	66.2%	1,739
Composition Shingles	2.9%	69.1%	1,637
Subtotal	**69.1%**		**38,924**
All Other Materials Combined	*30.9%*		*17,435*
Total	**100.0%**		**56,359**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

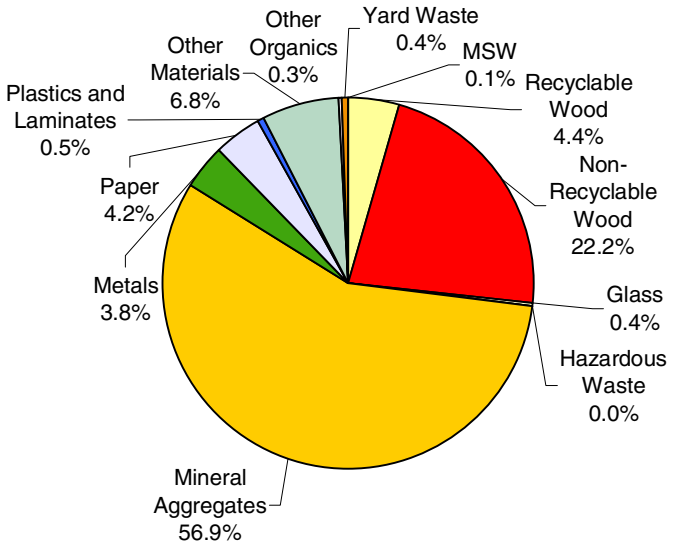
- At the top of the list, *painted/stained wood* accounts for about 18% of the demolition substream, followed by *galvanized steel* at about 9%, *mixed/demolition gypsum scrap* and *new/clean used lumber* at about 8% each, and *mixed demolition wood* at about 6%.
- Each of the remaining materials listed in Table 2-13 – *other ferrous metals*, *new/demolition engineered wood*, *carpeting*, *wood roofing and siding*, and *composition shingles* – represents less than 6% of the demolition substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-11 in the appendix.

Roofing

Roofing activities, which include both new and demolition materials from roofing projects, accounted for about 18,000 tons of the C&D waste disposed at the four private facilities in 2001. Figure 2-13 shows the proportion of the 12 main classes of material in the roofing substream, based on their percentage of the overall tonnage for this substream.

Figure 2-13. Overview of Waste Composition – Roofing



- *Mineral aggregates* make up the majority of the roofing substream at about 57%.
- *Non-recyclable wood* at about 22% and *recyclable wood* at about 4% together comprise about one-quarter of the substream.
- Combined, the other nine main material classes – *other materials*, *paper*, *metals*, *plastics and laminates*, *yard waste*, *glass*, *other organics*, *MSW*, and *hazardous waste* – account for about 17% of the total.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-14 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the roofing substream, arranged in descending order of weight.

Table 2-14. Top 10 Materials with Largest Percentage of Tonnage – Roofing

Component	Mean	Cum. %	Tons
Composition Shingles	34.2%	34.2%	6,063
Wood Roofing and Siding	19.9%	54.1%	3,535
Tarpaper/Asphalt Felt	11.4%	65.5%	2,021
Built-Up Roofing	10.6%	76.1%	1,889
Other Paper	3.8%	79.9%	668
New/Demo. Engineered Wood	3.4%	83.3%	600
Gravel	3.0%	86.3%	537
Other Ferrous Metals	2.5%	88.8%	442
Insulation	2.2%	91.0%	389
Painted/Stained Wood	1.3%	92.3%	238
Subtotal	**92.3%**		**16,381**
All Other Materials Combined	*7.7%*		*1,366*
Total	**100.0%**		**17,747**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

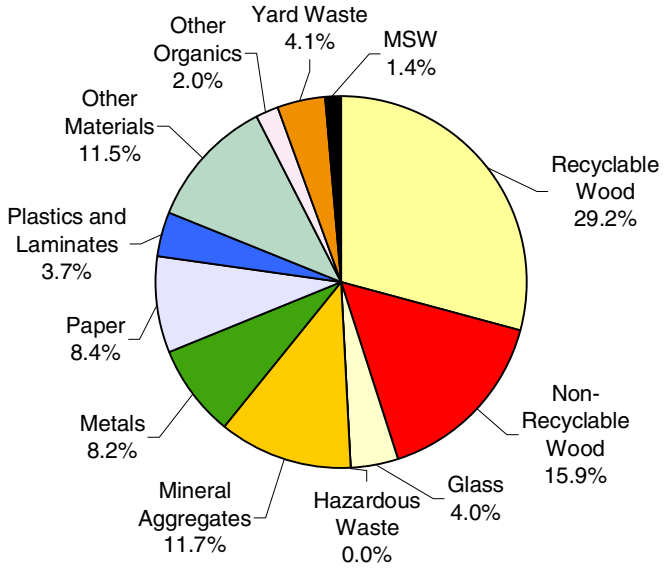
- The top 10 materials account for about 92% of the roofing substream.
- *Composition shingles* at about 34% and *wood roofing and siding* at about 20% together account for more than half of the roofing substream. *Tarpaper/asphalt felt* and *built-up roofing* each accounts for about 11% of this substream.
- Each of the remaining materials listed in Table 2-14 – *other paper*, *new/demolition engineered wood*, *gravel*, *other ferrous metals*, *insulation*, and *painted/stained wood* – accounts for less than 4% of the roofing substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-12 in the appendix.

Mixed/Other Construction

The mixed/other construction substream includes mixed loads of new construction, demolition, and/or roofing materials, and loads of C&D materials from businesses and government agencies. Mixed/other construction waste brought to the four private C&D facilities totaled an estimated 16,000 tons in 2001, which made this substream the smallest of the four construction types. Figure 2-14 shows the proportion of the 12 main classes of material in the mixed/other construction substream, based on their percentage of the overall tonnage for this substream.

Figure 2-14. Overview of Waste Composition – Mixed/Other Construction



- *Recyclable wood* makes up about 29% of the mixed/other construction substream, followed by *non-recyclable wood* at about 16%.
- *Mineral aggregates* and *other materials* each contribute about 12%.
- *Paper*, *metals*, *yard waste*, *glass*, *plastics and laminates*, *other organics*, *MSW*, and *hazardous waste* together represent nearly one-third of the substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-15 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the mixed/other construction substream, arranged in descending order of weight.

Table 2-15. Top 10 Materials with Largest Percentage of Tonnage – Mixed/Other Construction

Component	Mean	Cum. %	Tons
Pallets and Crates	10.9%	10.9%	1,692
New/Clean Used Lumber	10.1%	21.0%	1,574
New/Demo. Engineered Wood	8.2%	29.2%	1,279
OCC/Kraft Bags or Paper	5.7%	34.9%	895
Other Ferrous Metals	5.5%	40.4%	860
Painted/Stained Wood	4.6%	45.0%	712
New Gypsum Scrap	4.5%	49.5%	701
Creosote/Pressure Treated	4.4%	53.9%	679
Dirt	4.2%	58.1%	662
Window Glass	3.9%	62.0%	603
Subtotal	**62.0%**		**9,656**
All Other Materials Combined	*38.0%*		*5,922*
Total	**100.0%**		**15,578**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

- The first three materials in the top 10 list – *pallets and crates* at about 11%, *new/clean used lumber* at about 10% and *new/demolition engineered wood* at about 8% together account for more than one-quarter of the mixed/other construction substream.
- *OCC/Kraft bags or paper* and *other ferrous metals* each accounts for about 6%, while each of the remaining materials listed in Table 2-15 – *painted/stained wood*, *new gypsum scrap*, *creosote/pressure-treated wood*, *dirt*, and *window glass* – contributes less than 5% to this substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-13 in the appendix.

2.7 VEHICLE TYPE AND NET WEIGHTS

The C&D waste stream at the four private C&D facilities can also be analyzed according to the type of vehicle bringing the waste. For this study, the surveyor assigned each vehicle that was surveyed and sampled to one of five vehicle categories:

- Dump trucks,
- Roll-off containers, also known as drop boxes, carried on a specialized truck,
- End-dump tractor trailers, also known as end-dumps,
- Other large vehicles, such as flatbed trucks and box trucks that do not dump, and
- Small vehicles, such as cars, sport-utility vehicles, and pick-up trucks.

Figure 2-15 shows examples of each vehicle type.

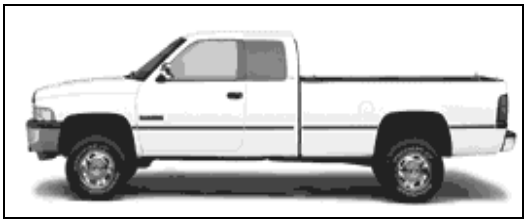
Figure 2-15. Sample Photographs of Various Vehicle Types

Dump Trucks

Roll-Off Containers

End-Dump Tractor Trailers

Other Large Vehicles



Small Vehicles

Table 2-16 shows the average net weight, in tons, of each of these vehicle types, as determined by the vehicle survey. The following sections provide waste composition data for each vehicle type.

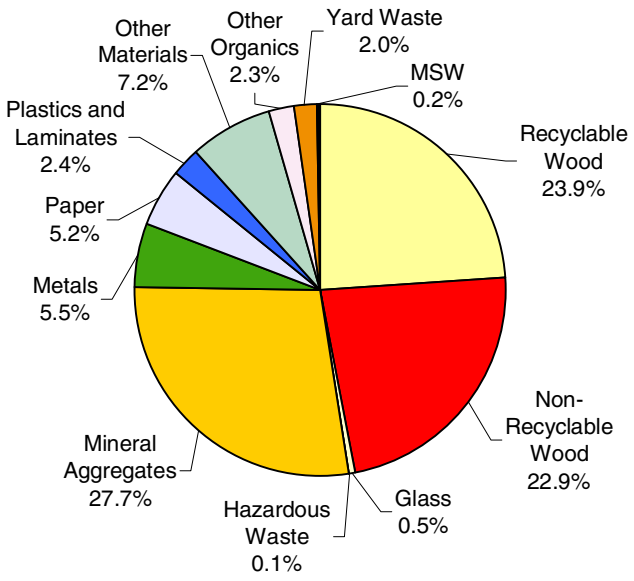
Table 2-16. Average Net Weight in Tons for Each Vehicle Type

	Dump Truck	Roll-Off Container	End-Dump Tractor Trailer	Other Large Vehicle	Small Vehicle
Average Net Weight	2.03	3.17	6.18	1.21	0.86

Dump Trucks

In 2001, about 29,700 dump trucks delivered approximately 52,000 tons of waste to the four private C&D facilities. Figure 2-16 shows the proportion of the 12 main classes of material in the dump truck substream, based on their percentage of the overall tonnage for this substream.

Figure 2-16. Overview of Waste Composition – Dump Trucks



- *Mineral aggregates* comprise about 28% of the waste brought in dump trucks.
- *Recyclable wood* at about 24% and *non-recyclable wood* at about 23% together account for nearly half of the substream.
- The remaining nine main material classes – *other materials*, *metals*, *paper*, *plastics and laminates*, *other organics*, *yard waste*, *glass*, *MSW*, and *hazardous waste* – together comprise about one-quarter of the dump truck substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-17 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the dump truck substream, arranged in descending order of weight.

Table 2-17. Top 10 Materials with Largest Percentage of Tonnage – Dump Trucks

Component	Mean	Cum. %	Tons
New/Demo. Engineered Wood	12.3%	12.3%	6,433
Painted/Stained Wood	11.8%	24.1%	6,150
Composition Shingles	11.0%	35.1%	5,739
New/Clean Used Lumber	10.2%	45.3%	5,299
Wood Roofing and Siding	5.3%	50.6%	2,775
Mixed/Demo. Gypsum Scrap	4.7%	55.3%	2,463
Built-Up Roofing	3.8%	59.1%	1,991
Mixed Demo. Wood	3.5%	62.6%	1,845
New Gypsum Scrap	3.2%	65.9%	1,689
OCC/Kraft Bags or Paper	3.0%	68.9%	1,588
Subtotal	**68.9%**		**35,970**
All Other Materials Combined	*31.1%*		*16,228*
Total	**100.0%**		**52,198**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

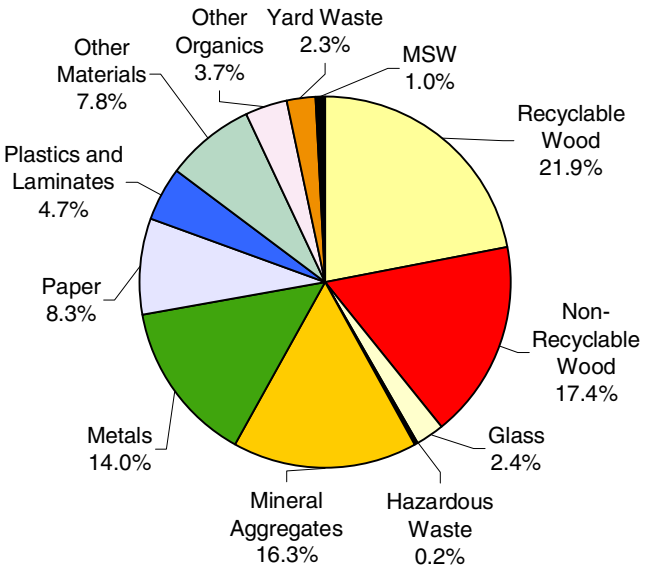
- *New/demolition engineered wood*, *painted/stained wood*, *composition shingles*, and *new/clean used lumber* each accounts for more than 10% of the waste stream brought in dump trucks for disposal.
- Each of the remaining materials listed in Table 2-17 – *wood roofing and siding*, *mixed/demolition gypsum scrap*, *built-up roofing*, *mixed demolition wood*, *new gypsum scrap*, and *OCC/Kraft bags or paper* – accounts for about 5% or less of the dump truck substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-14 in the appendix.

Roll-Off Containers

About 18,800 roll-off containers, carried on specialized trucks, delivered approximately 59,000 tons of C&D waste to the four private facilities in 2001. Figure 2-17 shows the proportion of the 12 main classes of material in the roll-off container substream, based on their percentage of the overall tonnage for this substream.

Figure 2-17. Overview of Waste Composition – Roll-Off Containers



- As with dump trucks, *recyclable wood* at about 22%, *non-recyclable wood* at about 17%, and *mineral aggregates* at about 16% represent the three largest main material classes in the roll-off container substream.
- *Metals* account for about 14% of roll-off loads, while *paper* and *other materials* represent about 8% each.
- Each of the remaining six main material classes – *plastics and laminates*, *other organics*, *glass*, *yard waste*, *MSW*, and *hazardous waste* – represents less than 5% of the roll-off substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-18 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the roll-off container substream, arranged in descending order of weight.

Table 2-18. Top 10 Materials with Largest Percentage of Tonnage – Roll-Off Containers

Component	Mean	Cum. %	Tons
New/Demo. Engineered Wood	10.2%	10.2%	5,993
Painted/Stained Wood	8.5%	18.8%	4,998
Other Ferrous Metals	6.7%	25.5%	3,938
New/Clean Used Lumber	5.7%	31.2%	3,343
Pallets and Crates	5.5%	36.6%	3,203
Galvanized Steel	5.4%	42.0%	3,162
OCC/Kraft Bags or Paper	4.9%	46.9%	2,877
Mixed/Demo. Gypsum Scrap	4.4%	51.4%	2,608
Wood Roofing and Siding	3.7%	55.1%	2,196
Other Paper	3.4%	58.5%	1,978
Subtotal	**58.5%**		**34,295**
All Other Materials Combined	*41.5%*		*24,317*
Total	**100.0%**		**58,612**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

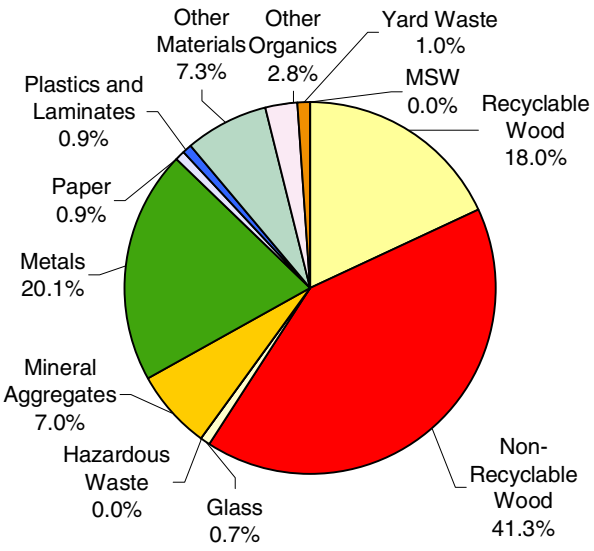
- The three largest components – *new/demolition engineered wood*, *painted/stained wood*, and *other ferrous metals* – together account for about one-quarter of the materials in roll-off loads.
- Each of the remaining materials listed in Table 2-18 – *new/clean used lumber*, *pallets and crates*, *galvanized steel*, *OCC/Kraft bags or paper*, *mixed/demolition gypsum scrap*, *wood roofing and siding*, and *other paper* – accounts for less than 6% of the roll-off container substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-15 in the appendix.

End-Dump Tractor Trailers

In 2001, about 1,200 end-dump tractor trailers delivered approximately 15,000 tons of C&D waste to the four private facilities. Figure 2-18 shows the proportion of the 12 main classes of material in the end-dump tractor trailer substream, based on their percentage of the overall tonnage for this substream.

Figure 2-18. Overview of Waste Composition – End-Dump Tractor Trailers



- *Non-recyclable wood* accounts for about 41% of the end-dump tractor trailer substream, while *metals* and *recyclable wood* represent about 20% and 18%, respectively.
- *Other materials* and *mineral aggregates* each represent about 7%.
- The remaining 6% of this substream consists of seven material classes: *other organics*, *yard waste*, *paper*, *plastics and laminates*, *glass*, *MSW*, and *hazardous waste.*

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-19 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the end-dump tractor trailer substream, arranged in descending order of weight.

Table 2-19. Top 10 Materials with Largest Percentage of Tonnage – End-Dump Tractor Trailers

Component	Mean	Cum. %	Tons
Painted/Stained Wood	26.2%	26.2%	3,848
Galvanized Steel	16.6%	42.8%	2,436
New/Clean Used Lumber	16.2%	58.9%	2,376
Mixed Demo. Wood	11.3%	70.2%	1,654
Dirt	3.5%	73.7%	518
Mixed/Demo. Gypsum Scrap	3.5%	77.2%	512
Other Miscellaneous Fines	2.7%	79.9%	396
Creosote/Pressure Treated	2.6%	82.5%	375
Other Ferrous Metals	2.3%	84.8%	343
New/Demo. Engineered Wood	1.8%	86.6%	270
Subtotal	**86.6%**		**12,727**
All Other Materials Combined	*13.4%*		*1,964*
Total	**100.0%**		**14,691**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

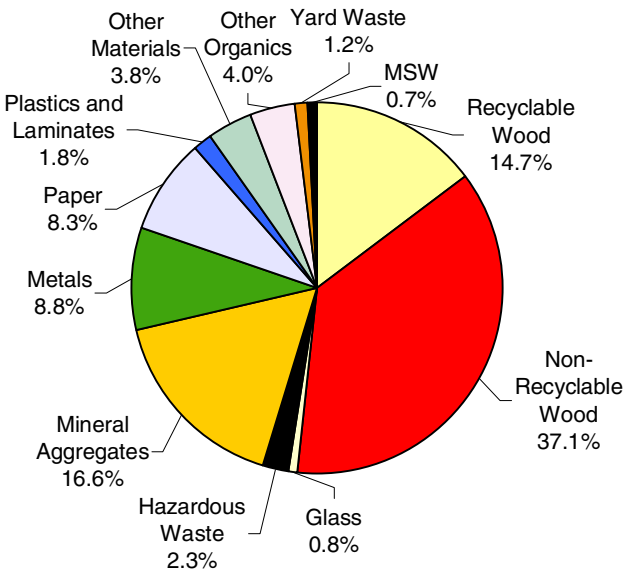
- The top 10 materials comprise about 87% of the end-dump tractor trailer tonnage.
- At about 26%, *painted/stained wood* comprises the largest portion of this substream, followed by *galvanized steel* at about 17%, *new/clean used lumber* at about 16%, and *mixed demolition wood* at about 11%.
- Each of the remaining materials listed in Table 2-19 – *dirt*, *mixed/demolition gypsum scrap*, *other miscellaneous fines*, *creosote/pressure-treated wood*, *other ferrous metals*, and *new/demolition engineered wood* – comprises less than 4% of the end-dump tractor trailer substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-16 in the appendix.

Other Large Vehicles

The other large vehicle category primarily consists of flatbed trucks without a dumping mechanism and includes large vehicles not classified in any other way. About 3,500 of these vehicles brought approximately 3,000 tons of C&D waste to the four private facilities in 2001. Figure 2-19 shows the proportion of the 12 main classes of material in the other large vehicle substream, based on their percentage of the overall tonnage for this substream.

Figure 2-19. Overview of Waste Composition – Other Large Vehicles



- *Non-recyclable wood* represents about 37% of the other large vehicle substream and constitutes the largest main material class.
- *Mineral aggregates* at about 17% and *recyclable wood* at about 15% together account for almost one-third of the substream.
- *Metals* at about 9% and *paper* at about 8% represent the next two largest material classes.
- Each of the remaining seven material classes – *other organics*, *other materials*, *hazardous waste*, *plastics and laminates*, *yard waste*, *glass*, and *MSW* – contributes about 4% or less to the other large vehicle substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-20 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the other large vehicle substream, arranged in descending order of weight.

Table 2-20. Top 10 Materials with Largest Percentage of Tonnage – Other Large Vehicles

Component	Mean	Cum. %	Tons
Wood Roofing and Siding	15.1%	15.1%	513
Painted/Stained Wood	10.4%	25.5%	354
New/Clean Used Lumber	8.8%	34.3%	298
Mixed/Demo. Gypsum Scrap	8.4%	42.7%	287
Other Ferrous Metals	5.8%	48.5%	198
Other Paper	5.7%	54.2%	193
Concrete With/Without Rebar	5.1%	59.2%	172
Finished Furnishings	4.5%	63.8%	154
New/Demo. Engineered Wood	3.9%	67.7%	132
Other Miscellaneous Fines	3.4%	71.1%	116
Subtotal	**71.1%**		**2,417**
All Other Materials Combined	*28.9%*		*983*
Total	**100.0%**		**3,400**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

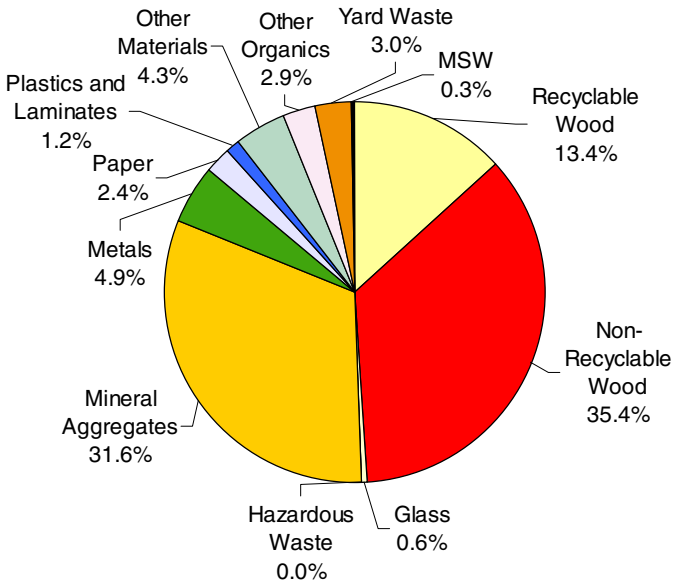
- *Wood roofing and siding* accounts for about 15% of the other large vehicle substream, while *painted/stained wood*, *new/clean used lumber*, and *mixed/demolition gypsum scrap* account for about 10%, 9%, and 8%, respectively.
- Each of the remaining materials listed in Table 2-20 – *other ferrous metals*, *other paper*, *concrete with/without rebar*, *finished furnishings*, *new/demolition engineered wood*, and *other miscellaneous fines* – accounts for less than 6% of the other large vehicle substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-17 in the appendix.

Small Vehicles

Small vehicles accounted for approximately 6,000 tons of C&D waste disposed at the four private facilities in 2001. About 9,700 small vehicles delivered this tonnage. Figure 2-20 shows the proportion of the 12 main classes of material in the small vehicle substream, based on their percentage of the overall tonnage for this substream.

Figure 2-20. Overview of Waste Composition – Small Vehicles



- *Mineral aggregates* and *non-recyclable wood* each comprises more than 30% of the small vehicle substream, while *recyclable wood* accounts for about 13%.
- Each of the remaining nine main material classes – *metals*, *other materials*, *yard waste*, *other organics*, *paper*, *plastic and laminates*, *glass*, *MSW*, and *hazardous waste* – accounts for less than 5% of the substream.

Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Table 2-21 shows the top 10 materials – out of the 70 total materials sampled – comprising the largest percentage of tonnage in the small vehicle substream, arranged in descending order of weight.

Table 2-21. Top 10 Materials with Largest Percentage of Tonnage – Small Vehicles

Component	Mean	Cum. %	Tons
Mixed Demo. Wood	20.2%	20.2%	1,260
Composition Shingles	15.7%	35.9%	977
New/Demo. Engineered Wood	8.1%	44.1%	507
Tarpaper/Asphalt Felt	6.9%	51.0%	429
Painted/Stained Wood	6.7%	57.7%	420
Creosote/Pressure Treated	5.9%	63.6%	365
New/Clean Used Lumber	4.6%	68.2%	287
Other Ferrous Metals	4.1%	72.3%	254
Mixed/Demo. Gypsum Scrap	3.1%	75.4%	196
Carpeting	2.8%	78.2%	174
Subtotal	**78.2%**		**4,870**
All Other Materials Combined	*21.8%*		*1,357*
Total	**100.0%**		**6,227**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

- The top 10 materials combined account for about 78% of the small vehicle substream.
- *Mixed demolition wood* and *composition shingles* comprise about 20% and 16% of the substream, respectively.
- Each of the remaining materials listed in Table 2-21 – *new/demolition engineered wood*, *tarpaper/asphalt felt*, *painted/stained wood*, *creosote/pressure-treated wood*, *new/clean used lumber*, *other ferrous metals*, *mixed/demolition gypsum scrap*, and *carpeting* – contributes about 8% or less to the small vehicle substream.

For more information about all 70 sampled materials and the 12 main classes in this waste substream, please refer to Table F-18 in the appendix.

2.8 INTERMODAL CONTAINERS

Intermodal containers refer to containers that can be used interchangeably in different modes of transportation. In this context, the C&D industry uses intermodal boxes, like the one shown in Figure 2-21, at large construction and demolition job sites. Haulers then bring the containers by truck to one of three intermodal and spot rail transfer facilities in King County: Argo Yard, Black River, or Third & Lander. Typically, these facilities then transfer the shipping container directly onto a rail line for transport to a landfill.

Figure 2-21. Sample Photograph of Intermodal Container

In 2001, the C&D industry in King County used intermodal containers to transport and dispose about 54,000 tons of C&D material. From reports submitted monthly to King County, Argo Yard accounted for about 28,200 tons, or about 52% of the intermodal C&D substream. Third & Lander accounted for about 23,200 tons, while Black River accounted for about 2,300 tons.[12] Because of the nature of intermodal disposal and the smaller amount of C&D material disposed using this method, this study did not characterize the C&D waste in intermodal loads.

[12] Argo Yard reported tons of intermodal C&D waste by origin (Seattle, King County, and other counties) while the Rabanco facilities – Black River and Third & Lander – did not. Therefore, Cascadia examined the C&D tonnage data provided in flow reports to estimate the intermodal tonnage originating in King County (excluding Seattle), which was delivered to the Rabanco facilities. For both facilities, Cascadia calculated the proportion of C&D tonnage brought by vehicles (other than intermodal shipments) from King County as compared to the total tonnage (excluding intermodal shipments). Cascadia then applied the resulting ratio, calculated for each month, toward the total reported intermodal tonnage for the same month. For example, in January 2001, excluding intermodal shipments, Black River received 6,275.55 tons of C&D from King County and 7,639.66 total tons. In other words, about 82% of the C&D material at Black River in January 2001 originated in King County. Black River accepted 278.55 tons of waste in intermodal containers in January 2001. This tonnage, multiplied by 82%, yields an estimated 228.41 tons of C&D waste in intermodal shipments that originated in King County in January 2001.

2.9 C&D WASTE TO KING COUNTY FACILITIES

In 1999-2000, the King County Waste Monitoring Program conducted a waste characterization study of materials brought to King County's eight transfer stations and two drop boxes. These facilities transferred about 905,000 tons of waste, consisting mainly of mixed municipal solid waste (MMSW).[13]

Since 1993, King County has banned construction, demolition, and land clearing (CDL) waste at its facilities, except for small amounts delivered in vehicles of pick-up truck size or smaller.[14] The 1999/2000 waste characterization study captured the composition of these self-hauled loads, which contained about 75,000 tons of C&D material. This section of the report presents composition data and vehicle counts from the 1999/2000 study as they relate to the C&D waste stream.

Table 2-22. Self-Hauled Detailed Waste Composition – C&D Materials Only[15]

Calculated at a 90% confidence interval

	Tons	Mean	+/-
Dimension Lumber	21,060	11.6%	3.7%
Treated Wood	10,730	5.9%	2.6%
Contaminated Wood	4,670	2.6%	1.1%
Roofing/Siding	680	0.4%	0.4%
Stumps	270	0.2%	0.2%
Large Prunings	210	0.1%	0.1%
Other Wood	3,190	1.8%	0.7%
Carpet/Upholstery	11,000	6.0%	2.7%
Other Ferrous	8,680	4.8%	0.9%
Other Nonferrous	320	0.2%	0.1%
Const/Demo Wastes	9,780	5.4%	2.4%
Gypsum Wallboard	4,790	2.6%	1.6%

Number of Samples	**189**
Total C&D in Self-Hauled Loads	**75,380**
Total Self-Hauled Disposed Tonnage	**182,000**

Table 2-22 shows the waste composition of *only* the C&D materials found in self-hauled loads brought to the County's facilities. These 12 C&D materials accounted for about 75,000 tons, or about 41%, of the total self-hauled tonnage. Appendix G includes detailed definitions for these material types.

Note: Estimated tonnages, mean percentages and error ranges are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

[13] Cascadia Consulting Group,*Waste Monitoring Program: 1999/2000 Comprehensive Waste Stream Characterization and Transfer Station Customer Surveys – Final Report*, August 2000.

[14] King County Solid Waste Division, *Final 2001 Comprehensive Solid Waste Management Plan*, November 2001, page 8-4. More specifically, King County has banned construction, demolition, and land clearing (CDL) waste at its facilities since 1993, except for small quantities transported by private vehicles with gross weights not exceeding 8,000 pounds, or CDL waste contained in loads of mixed municipal solid waste that do not exceed 10% of the load by weight.

[15] As discussed in Chapter 1, land clearing debris was excluded from the current study. However, land clearing materials such as stumps and large prunings were included in the material definitions so that these materials could be quantified if found in the sampled loads. To be consistent, stumps and large prunings appear in Table 2-.

Excerpted from the 1999-2000 study, Table 2-23 lists the top 10 materials – out of a total of 63 materials sampled – comprising the largest percentage of tonnage in self-hauled loads delivered to the County's facilities, arranged in descending order of weight. Five C&D materials made the top 10: *dimension lumber*, *carpet/upholstery*, *treated wood*, *construction/ demolition wastes*, and *other ferrous metals*. *Dimension lumber* accounted for about 21,000 tons, or about 12%, of the entire self-hauled substream, followed by *carpet/upholstery* and *treated wood* at about 6% each, and *construction/ demolition wastes* and *other ferrous metals* at about 5% each.

Table 2-23. Self-Hauled Top 10 Components, with C&D Materials Highlighted

Note: Estimated tonnages and mean percentages are rounded. Therefore, the tonnages and mean percentages as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

Component	Mean	Cum. %	Tons
Yard Wastes	17.0%	17.0%	30,880
Dimension Lumber	11.6%	28.5%	21,060
Furniture/Mattresses	6.8%	35.3%	12,370
Carpet/Upholstery	6.0%	41.4%	11,000
Treated Wood	5.9%	47.3%	10,730
Const/Demo Wastes	5.4%	52.6%	9,780
Mixed Metals/Materials	4.9%	57.6%	8,980
Other Ferrous	4.8%	62.3%	8,680
Food Wastes	3.2%	65.5%	5,770
Low Grade Recyclable	2.8%	68.3%	5,120
Subtotal	68.3%		**124,370**
All Other Materials Combined	*31.7%*		*57,630*
Total	**100.0%**		**182,000**

During the 1999/2000 study, the customer survey asked drivers what type of waste the load consisted of: *yard waste*, *construction/demolition*, *mixed garbage*, or *special waste.* Table 2-24 shows the types of vehicles that brought *construction/demolition* waste loads to the County's facilities. This information was extracted from the County's 1999/2000 customer survey database. As shown in the table, about 95% of the vehicles were cars or large automobiles, such as sport-utility vehicles, vans, or trucks.

Table 2-24. Types of Self-Haul Vehicles Bringing C&D to King County Facilities

	Algona		Bow Lake		Cedar Falls		Enumclaw		Factoria	
Dropbox/Packer	1	1%	0	0%	0	0%	0	0%	0	0%
Large Other	10	7%	6	6%	1	6%	0	0%	12	6%
Car	2	1%	2	2%	0	0%	0	0%	4	2%
Large Auto	125	91%	101	93%	16	94%	49	100%	174	92%
Total	**138**	**100%**	**109**	**100%**	**17**	**100%**	**49**	**100%**	**190**	**100%**

	First NE		Houghton		Renton		Skykomish		Vashon		Total
Dropbox/Packer	0	0%	1	0%	1	1%	0	0%	0	0%	3
Large Other	6	3%	9	4%	0	0%	0	0%	4	12%	48
Car	3	2%	2	1%	0	0%	0	0%	0	0%	13
Large Auto	169	95%	204	94%	70	99%	6	100%	30	88%	944
Total	**178**	**100%**	**216**	**100%**	**71**	**100%**	**6**	**100%**	**34**	**100%**	**1,008**

Note: Estimated percentages are rounded and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

2.10 CUSTOMER SATISFACTION

During the third and fourth quarters of 2001, the surveyor for this C&D study asked each vehicle, "On a scale of 1 to 5, with 1 meaning extremely dissatisfied and 5 meaning extremely satisfied, how satisfied are you with the current C&D disposal system in King County?" This section of the report analyzes the survey data related to the origin of the load and the facility used for disposal.

With survey data on each load's city of origin, a cross-tabulation analysis was conducted to compare the satisfaction of visitors originating in north King County and south King County. That analysis considered the I-90 corridor as the dividing line between north and south King County, with the exception of Issaquah, which was included in the north.

As shown in Table 2-25, about 37% of customers originating in the south gave the highest level of satisfaction (a score of 5) with the C&D disposal system, compared with about 27% in the north. Combining the satisfaction rankings of 4 and 5 together, about 61% of surveyed customers from the south gave a satisfaction ranking of 4 or 5, compared with about 45% in the north.[16]

Table 2-25. Customer Satisfaction by Geographic Area

	One		Two		Three		Four		Five		No Response		Total
North	27	11%	12	5%	47	20%	43	18%	64	27%	45	19%	238
South	20	7%	15	5%	56	19%	72	24%	111	37%	23	8%	297

Note: Estimated percentages are rounded and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 2-5.*

With the limited scope of the satisfaction survey, field staff members were not able to gather the number of survey responses from customers at Third & Lander, Eastmont, and Recycling Northwest that would allow for statistically significant comparisons among the four private facilities. Even with this limitation, however, the data suggest that customers of the Black River facility expressed higher levels of satisfaction with the C&D disposal system than visitors to any other private facility. With a larger sample size, Recycling Northwest may have shown similarly high levels of satisfaction. Table 2-26 presents the satisfaction data by facility.

[16] The geographical analysis of the customer satisfaction data excluded seven survey responses from customers originating in unincorporated King County. The survey did not detail the area, north or south, for those seven responses, and seven surveys would not reflect statistically significant results.

Table 2-26. Customer Satisfaction by Site

	One		Two		Three		Four		Five		No Response		Total
Black River	19	6%	12	4%	66	19%	82	24%	138	41%	22	6%	339
Third & Lander	13	18%	8	11%	12	17%	16	22%	9	13%	14	19%	72
Eastmont	16	16%	7	7%	24	23%	10	10%	17	17%	29	28%	103
Recycling Northwest	1	4%	1	4%	2	7%	7	25%	13	46%	4	14%	28

Note: Estimated percentages are rounded and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results on page 2-5.

Chapter 3
C&D Recycling Stream

This chapter of the report summarizes current activities surrounding the recycling of construction and demolition (C&D) materials in King County. The materials covered include debris generated from new construction, renovation, and demolition. Land clearing waste was not included, as the flow of this material is directed toward specific facilities that process green wood and yard waste. The aim of this study was to identify the types and volumes of recyclable construction materials generated in King County and learn where the barriers and opportunities lie for increased recycling of C&D debris.

The flow of C&D materials through the waste stream system in King County is a complex story. For each type of business that handles C&D material, several major considerations drive their management choices, as noted below.

- **Generators** of C&D materials first must decide to recycle, and then decide on which materials to sort and recycle. This decision is based on such factors as the convenience of on-site sorting versus disposal, the distance from the job site to recycling or disposal facilities, the overall savings gained through recycling versus disposal, and the company's policy on recycling.
- **Haulers** transport C&D materials for disposal and recycling, and they must remove waste from job sites in a timely and cost-effective manner. Generators typically hire haulers; and customer preferences, along with the hauler's desire to offer optimal service, drive the choice of recycling or disposal for C&D materials.
- **Processors** of recyclable C&D materials must contend with fluctuating markets for recyclables, changing demand, and shortages of materials. Additional perceived challenges reported by processors include difficulties with the permitting process for handling and processing materials in King County as well as construction material specifications that may preclude the use of recycled C&D materials.

For this study, 15 generators, 10 haulers, and 30 processors of C&D materials from King County and surrounding counties were interviewed to provide an overview of how C&D waste is handled in King County.[17] The aim was to contact generators, haulers, and processors that handled the majority of C&D waste in the county. A list of companies was compiled from several sources: King County's Construction Recycling Directory; city, county, and association Web sites; the Yellow Pages; and King County staff.

To assure that this study captured an accurate picture of the C&D waste stream, the generators, haulers, and processors interviewed were asked to identify other

[17] Staff members or managers at a total of 48 companies were interviewed. Six of the generators fit into more than one category: five generators were also haulers, and one generator was also a processor. One company was both a hauler and processor of C&D materials

firms they considered to be the major companies in the region. Any companies mentioned that were not already in the database were added to the list of targeted study participants.

Most of the companies interviewed were located within King County. Additional facilities outside of the county were included only if a significant portion of the C&D material they handled originated in King County.

Interviews with generators, haulers, and processors addressed the following broad questions (the complete questionnaires are available in Appendix H):

- **What types of C&D materials are recycled or disposed?**
- **What factors drive the decision to recycle or dispose?**
- **What is the volume of material currently being recycled, and what is the capacity of existing facilities?**
- **What are the markets for the materials that are recycled?**
- **What are the barriers to and opportunities for C&D recycling in King County?**

The following section presents key findings on C&D recycling in King County. The subsequent sections of this chapter provide summaries of the activities of C&D generators, haulers, and processors.[18]

3.1 KEY FINDINGS

➢ Most types of C&D materials from King County can be recycled, but the amounts currently collected and processed for recycling vary greatly by material.

The C&D materials handled by generators, haulers, and processors include wood, concrete, metal, gypsum wallboard, roofing, glass, and carpet. Of these, wood and concrete are the largest components, representing the vast majority of the reported tonnage that is recycled. Most metal also appears to be recycled, although metal processors are unable to identify the sources of metal and, therefore, unable to estimate the amount of metal processed from King County. Based on the interviews, much of the gypsum wallboard, roofing, glass, and carpet waste is typically disposed.

[18] The information contained in this chapter is solely derived from responses to questions posed of C&D generators, haulers, and processors in King County and surrounding counties and does not reflect opinions or positions of the King County Solid Waste Division.

- **About 510,000 tons of C&D materials from King County were recycled in 2001.**

The processors interviewed in this study reported recycling about 510,000 tons of C&D materials from King County, outside of Seattle, in 2001. This estimate is based on tonnages reported by major processors of the materials from King County. It should be noted, however, that (1) not all processors could provide tonnage data for material originating exclusively from King County because the origins of loads were not always identified; (2) not every processor of C&D materials in the King County region was contacted or available for interviews for this study; and (3) not all participating processors were willing or able to provide tonnage data. However, the total estimated tonnage of material recycled provides a meaningful approximation.

Table 3-1 lists the reported tonnages processed in 2001 for each material handled by processors, based on responses from those companies that were interviewed and that agreed to furnish data for the study. The processing and capacity numbers provided are estimates and as such do not represent all materials that are recycled in the King County region. Not included in these estimates are tonnages from smaller operations, from additional facilities outside of King County, and from processors that were not included in the study or declined to provide data for this report. Accordingly, these figures are conservative estimates, and the actual recycling totals may be higher. Reported tons processed from King County are intended to exclude any quantities originating from Seattle, though some processors had difficulty distinguishing quantities from Seattle and King County from their overall processing levels.

Table 3-1. Reported Annual C&D Processing and Facility Capacity[19]

Material Type	Material from King County Processed *tons/year*	Total C&D Material Processed[20] *tons/year*	Estimated Capacity[21] *tons/year*
Wood[22]	210,000	370,000	780,000
Concrete	290,000	980,000	1,980,000
Gypsum Wallboard	7,000	47,000	96,000
Roofing	1,000	10,000	21,000
Glass	<50	<200	7,000
Carpet/Padding	<2,000[23]	4,000	N/A[24]
Metal[25]	—	—	800,000[26]
Total	**510,000**	**1,400,000**	**2,900,000**

Note: Tonnages are rounded. Totals differ from the sum of individual materials due to rounding, which reflects the level of uncertainty associated with data from the processors. The total for material processed from King County is rounded to the nearest 10,000; the totals for C&D material processed and estimated capacity are rounded to the nearest 100,000. The estimated capacity total excludes metals, and no estimate is available for the amount of metal processed from King County because metal processors are unable to identify the sources of the metals they process. For more information about rounding, please see Interpreting the Results *on page 2-5.*

[19] Because loads are not always tracked from generator to processing facility, it is difficult to follow materials through the waste stream and, therefore, the tonnage figures reported are estimates.

[20] These estimates represent the total amount of C&D materials that the facilities interviewed reported processing, regardless of whether the material originated from Seattle, King County, or other cities and counties.

[21] These estimates are the approximate capacities of all facilities interviewed to process each category of materials. For some processors, such as metal recyclers, the capacity may include materials from non-C&D sources.

[22] The quantity of processed wood includes wood from pallets, crates, and other items not necessarily generated by construction or demolition. Wood processors could not separate the C&D and non-C&D materials for these categories of clean wood.

[23] Carpet facilities interviewed process only the material they replace, and they do not accept carpet from other sources for recycling. The figures reported include tonnages of carpet and carpet padding recycling from King County and Seattle; processors could not provide estimates that excluded Seattle's contributions from the total amounts.

[24] Carpet material is shipped via rail to other regions in the country for processing. The two carpet processors interviewed cite the high cost of recycling (including transportation, carpet deconstruction, and reprocessing) as the main obstacle to recycling. At present, it costs more to recycle carpet than to manufacture new carpet from virgin materials. Both companies are committed to recycling as a company policy; however, both will only accept material that they replace with new carpet. As a result, their recycling capabilities are not accessible to any C&D generator or hauler. For carpet padding, the cost of processing is not an impediment. Local capacity (including Seattle and King County) for carpet padding recycling is estimated at between 2,000 and 3,000 tons per year.

[25] No estimate is available for the amount of metal processed from King County annually because metal processors are unable to identify the sources of the metals they process.

[26] This value is for all metal, including C&D metal, appliances, and other scrap metal.

- **Capacity for processing C&D materials well exceeds current recovery rates in King County.**

The interviews with C&D processors provided information on the capacity of processing facilities available. Estimated capacity is based on information from the C&D processor interviews in this study, so they do not reflect the processing capacity of additional smaller facilities operating in and adjacent to King County that were not interviewed. With this caveat, the estimated capacity for processing wood, concrete, gypsum wallboard, roofing, and glass totals nearly three million tons. Capacity for processing metal is about 800,000 tons, but this figure includes capacity for the many recycled metals that are not from C&D activities. Table 3-1 provides further detail on processing capacity. Estimates reported include the overall capacity of processors, regardless of the geographic origin of the material.

- **Cost and convenience largely drive decisions about whether to recycle C&D materials.**

Cost and convenience are the primary factors that determine whether C&D materials are recycled. Space availability on the job site and distance to recycling facilities can also dictate whether a generator will recycle C&D materials. Additional considerations include whether the client (e.g., building owner or developer) has a preference for recycling and whether the particular company has a specific policy regarding recycling.

- **Perceived barriers to recycling include limited collection facilities, a limited supply of materials reaching processors, and insufficient use of recycled-content materials in construction projects.**

Generators, haulers, and processors were asked to identify significant barriers to recycling in their business as well as opportunities that might exist for overcoming those barriers. The anonymity of the interviews allowed respondents to provide direct and honest responses to the questions. The most frequently perceived barriers included:

- An insufficient number of C&D recycling collection facilities in King County,
- Processors unable to capture a larger portion of the C&D waste stream, thus operating under capacity, and
- Recycled-content materials not always included in specifications for public and private jobs.

Table 3-2 provides a complete list of perceived barriers and opportunities that generators, haulers, and processors provided during interviews. These perceived obstacles to recycling, as well as much of the information in this report, came directly from the individuals being interviewed and have been grammatically but not substantively altered for readability. They also reflect the views of the generators, haulers, and processors and do not reflect opinions or positions of the King County Solid Waste Division.

Table 3-2. Summary of Perceived Barriers and Opportunities for C&D Recycling in King County as Reported by Survey Respondents

Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Ease of disposal	Increase fees for disposal or ban C&D materials from landfills
Difficulty obtaining permits in King County for a facility to sort and process mixed C&D materials	Review and revise the permitting process so that facilities can handle mixed C&D materials in the county
Inconvenience of on-site sorting of materials	Encourage and permit more sorting facilities that will accept commingled loads
Distance to recycling facilities often further than distance to disposal sites	Place additional transfer facilities for recyclable materials throughout King County
Inconvenience of recycling facilities, particularly a lack of sites on the Eastside	Additional recycling facilities needed outside of the Seattle and south King County areas
County will not use recycled materials	Educate County engineers and permitting officers on the quality of recycled materials and promote their use in public-sector jobs
Weak market for recycled products	Encourage use of recycled material in all jobs
Few incentives to recycle materials or use recycled materials	Create recognition programs and tax deductions for jobs that recycle, use recycled materials, or both
Difficult to know if material is being recycled	Require third-party certification on recycled loads (proof would provide incentive to recycle)
Insufficient flow of materials to processors	Encourage more recycling through tax deductions and other incentives

- **Processors reported that end markets exist for wood, concrete, metal, and gypsum wallboard, but markets for roofing, glass, and carpet are limited.**

Market destinations and prices fluctuate, but processors are usually able to find buyers for recycled wood, concrete, metal, and gypsum wallboard. Significant barriers, including ease of disposal and lack of end uses, apparently limit the recycling of roofing, glass, and carpet from C&D sources, according to those interviewed.

3.2 GENERATORS

Fifteen generators of C&D waste were interviewed. Nine were general contractors in the King County area, including seven commercial and two residential contractors. Six were demolition contractors. Five of the demolition companies also haul C&D materials, and one company also processes C&D materials.

Initial phone calls soliciting participation were directed toward individuals with involvement in the waste management decisions for their company. These individuals included project managers, site superintendents, and company principals. Once the appropriate individual was contacted, an interview was scheduled. All interviews with generators took place in person. (Appendix H contains a copy of the interview guide.)

Material Types Disposed and Recycled

The companies interviewed generate all major types of C&D waste. The materials generated include wood, concrete, asphalt, gypsum wallboard, roofing, siding, glass, metal, carpet, carpet padding, cardboard, and acoustical ceiling tile. Many of these materials are recyclable, but they may be disposed if the cost to recycle the material exceeds disposal cost or if the job site does not allow sufficient space for collection containers for recyclables.

Concrete and asphalt are most likely to be recycled, as they are heavy materials and, therefore, cost significantly more to dispose than to recycle. Glass and roofing materials (particularly composite roofing tiles) are seldom recycled. Glass is difficult to separate from other materials and is often easier to dispose. Lack of awareness among roofing contractors and the distance to recycling facilities seem to prevent more roofing materials from being recycled.

Amount of Material Recycled or Disposed

The amounts and types of material that are recycled or disposed vary among job sites.

Job Site Influences

Each job site has different site configurations and space limitations, so contractors select a hauler and disposal system that works best for each particular project. Subcontractors may be responsible for their own waste, in which case the contractor may have little influence over whether subcontractors dispose or recycle materials from their portion of the project. In space-restricted locations, the contractor may have space for only one container, and thus all material is disposed. When more space is available, contractors may opt for a commingled container that accepts all recyclable materials, or they may choose to use multiple recycling containers for designated recyclable materials.

How Hauled and Where

The generators interviewed typically contract with a hauler for material to be disposed or recycled. Several options are available to generators for hauling C&D materials, including WUTC certificated haulers, C&D haulers, and self-hauling their own waste. None of the general contractors interviewed rely solely on self-haul, but they may remove small amounts of materials from job sites in this manner. The six demolition contractors interviewed typically self-haul materials from their own job sites. These self-hauled materials were disposed in private and public waste disposal facilities, hauled to recycling centers, or transported to processing facilities.

Price

Generators seek the lowest-cost method for handling their waste. If it costs less to recycle on a given job, more material is likely to be recycled. If the cost for disposal is lower, the generator will often favor this option to save money. For both recycling and disposal, the following factors seem to drive the total cost of C&D waste management:

- Tipping fees for transfer stations, recycling facilities, and landfills,
- Transportation costs (distance to facilities from job site),
- Whether recyclable material is separated on-site or commingled,
- Whether the contractor has regular hauling agreements with one hauling company, which may result in reduced or discounted rates, and
- Additional fees, including container delivery, rental, hauling, and other incidental charges.

Decision Factors

Space limitations, cost, and the service provided by their hauler are often the main factors that generators consider when deciding whether to recycle C&D materials. Often the space on job sites is constrained, especially in downtown areas. Contractors are typically on a tight schedule and need to have material removed from the job site promptly and efficiently. In some cases, when waste can be removed from the site quickly, contractors may opt for disposal even when the cost exceeds recycling. Some contractors reported that they recycle because it is “the right thing to do,” and they may make every effort to reduce the amount of waste going to landfills. However, even generators dedicated to recycling may still dispose rather than recycle when it costs significantly more to recycle.

When asked about the amount of savings they would require to recycle instead of dispose C&D materials, the generators interviewed reported that a range in savings of 20% to 50% over disposal costs would probably motivate them to recycle.

Additional considerations for whether or not to recycle include the following issues:

- Volume of recyclable versus non-recyclable materials,
- Whether the construction project must meet environmental or other standards requiring specific recycling achievements, such as the LEED (Leadership in Energy and Environmental Design), Construction Works, or BUILT GREEN™ Programs,
- Convenience of transporting materials for disposal or recycling. (This issue was of particular concern to companies with projects on the Eastside. For them, traffic and congestion associated with the I-90 and SR-520 bridges and Seattle often discourage these businesses from trying to reach recycling facilities in the Seattle vicinity),
- Whether subcontractors are willing to recycle their material, and
- Whether the project client has requested or specified the recycling of materials.

Perceived Barriers and Opportunities for Recycling

For generators, barriers to recycling appear to include ease of disposal and job-site constraints, such as space limitations and difficult access to the job site. Other perceived barriers include insufficient facilities for recycling in parts of King County and lack of knowledge among contractors on options for recycling C&D materials. More detail on the perceived barriers and opportunities reported by the generators in interviews appears in Table 3-3.

Table 3-3. Perceived Barriers and Opportunities for C&D Recycling as Reported by Surveyed Generators

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Job Site Constraints	Insufficient space on job site for containers	Reduced fees from cities or County for curbside lease if containers are used for recycling
	Job site mentality	Educate superintendents on recycling options Create a pamphlet or flier for superintendents on reasons to recycle and how to choose a vendor
	Ease of disposal	Increase tipping fees for disposal Ban disposal of C&D to encourage recycling
	Inconvenience of on-site sorting	Develop sorting facilities that will accommodate commingled containers and loads
	Subcontractors take care of their own waste and decide whether to recycle or dispose	Create educational resources for subcontractors on where to recycle drywall, wood, and other materials Encourage contractors to maintain long-term relationships with subcontractors so that recycling continues
	Additional management cost of on-site waste sorting	Encourage haulers to offer commingled containers
Transportation	Distance to recycling facility often further than distance to disposal site	Place additional C&D transfer sites throughout King County, particularly on the Eastside
	Inconvenience of recycling facilities, particularly the lack of Eastside sites	Additional recycling facilities needed outside of the Seattle area, especially on the Eastside
Education	Public projects do not always use recycled materials	Educate city, county, and state inspectors on the quality and use of recycled materials
	Small market for recycled materials	Provide information to builders on recycled materials Reward projects that reach a certain documented recycling percentage Revise specifications on recycled products
	No incentive, other than cost, to recycle; if cost is negligible, need additional encouragement to recycle	Increase awareness among builders of recognition programs such as the LEED (Leadership in Energy and Environmental Design) Green Building Rating System™
Regulatory	Builders are not required to recycle C&D materials	King County should ban C&D materials from disposal
	Difficult to know if material is being recycled	Require certification for recycling of loads (proof would provide incentive to recycle)
	Raw materials are cheaper to use than recycled materials	Provide tax deduction on building materials made from recycled C&D materials

3.3 HAULERS

Ten haulers of C&D materials were interviewed. They included three WUTC certificated haulers and seven C&D haulers. Of the C&D haulers, five are also demolition contractors involved in both demolition and hauling activities.[27] (Appendix H contains a copy of the interview guide.)

Haulers reported a wide range of recycling rates. Slightly less than half of the haulers claimed that 90% or more of the material they haul is recycled, while others stated they typically recycled only 10% or less of the material they haul . Of those haulers recycling 90% or more, some reported they collect commingled loads.[28]

Material Types Disposed and Recycled

The companies surveyed haul the major C&D materials, including wood, concrete, asphalt, gypsum wallboard, roofing, glass, metal, and carpet. They also report hauling additional materials such as rock, dirt, and porcelain, but these substances represent only a small fraction of the C&D waste stream.

Collection/Hauling Methods

Some haulers interviewed collected only commingled loads, while most haulers collected either commingled containers or containers with separate materials, which had been sorted at the site. The choice of commingled or separated loads depends on whether the generator has the space and staff resources to sort materials at the site and whether the company uses separate containers for materials or prefers one container for all materials.

How Hauled and Where

Most haulers report disposing of C&D waste either at private facilities operated by Allied or Waste Management or at King County transfer stations. Haulers collecting materials outside of the urban area typically use the closest transfer station or disposal facility to the job site. According to the haulers interviewed, 40 miles was the furthest distance traveled to dispose material, and 80 miles was the furthest distance traveled to recycle material.

Price

Haulers interviewed charge a disposal fee of $70 to $90 per ton for disposal. This price does not include other fees for transportation, box rental and drop-off, or other incidental expenses, which can vary by hauler and job site conditions.

[27] These five hauling companies are also included in the generator category.

[28] These haulers deliver commingled loads to a processing facility that reports 90% or greater recovery rates.

Decision Factors

For many haulers, the most significant factor affecting their decision to recycle or dispose a load is cost. In some cases, recycling costs less than disposal. In other situations, the reverse is true. In determining which loads are recycled or disposed, haulers also consider several other factors that affect costs:

- Proximity of job site to recycling and disposal facilities,
- Logistics of hauling loads through traffic in the urban areas where facilities are located,
- Purity of loads (most recycling facilities have stringent quality requirements), and
- Size of loads.

Haulers reported that some clients are becoming more conscious of recycling, and this awareness has driven an increase in requests for recycling. It was noted that most customers want to recycle if it saves money, yet few are willing to pay more to recycle.

Perceived Barriers and Opportunities for Recycling

In the interviews, haulers reported a range of perceived barriers to recycling, including regulatory challenges such as difficulty in obtaining permits for handling and sorting materials on their sites. The limited number of transfer facilities, especially outside of the Seattle area, also appears to pose a major obstacle to recycling. Worker perception that recycling is a "curbside" activity, not something that takes place on a job site, also potentially reduces the amount of material collected for recycling.

Table 3-4 lists additional perceived barriers to and opportunities for recycling that waste haulers reported during the interviews.

Table 3-4. Perceived Barriers and Opportunities for C&D Recycling as Reported by Surveyed Haulers

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Regulatory	Regulations from County Health Department restrict permitting of recycling processing facilities in the county	Review restrictions on permitting new recovery facilities in King County
	Difficulty of transportation to urban transfer facilities	Place additional transfer facilities outside of urban areas
	Many recycling haulers are illegally hauling disposable materials	Need more policing by County of illegal hauling by non-WUTC certificated haulers
	Clients do not have proof that material is being recycled (proof would provide incentive to recycle)	Require third-party verification of haulers so clients know the material is being recycled
	Only one facility accepts commingled loads, creating a monopoly and potentially unstable market	Encourage development of new recycling and sorting facilities
	Haulers are not permitted to sort materials, which limits how they can handle commingled loads	Allow haulers to sort recyclable materials in their own yards
Transportation	Traffic congestion	Place additional transfer facilities outside of urban areas and offer special hours for WUTC certificated haulers
	Distance to facilities – the further the job site is from Tacoma or Seattle, the less economical it is to recycle	Place additional transfer facilities in north and south locations of the Puget Sound region as well as east of the I-5 corridor
Education	Public projects do not always use recycled materials	Educate city, county, and state inspectors on the quality and use of recycled materials
	Contractors do not view recycling as a construction site activity	Provide information to general contractors and superintendents on recycling C&D materials
	Bias for commingled loads	Promotion of commingled loads “only” is not efficient because many recycling businesses are set up to receive and process specific materials
Other	Monopoly by WUTC certificated haulers	Allow for more partnership with public and private sector and encourage market forces to drive the recycling business
	No civic recognition of C&D recycling	Encourage use of recycled materials in public projects and reward their use in private projects
	Difficult to keep loads clean and pure in sorted bins	Create incentives for generators to make sure loads are free from contaminants

3.4 PROCESSORS

This section provides detailed information on the recycling activities of 30 C&D processors interviewed for this study.[29] The processing facilities are located in King, Pierce, and Snohomish counties, and all process material from King County.

All but four interviews with processors were held in person. Interviews lasted approximately one hour and were organized around questions in the Processor Interview Guide. (Appendix H contains a copy of the interview guide.)

The materials covered in detail in this section are listed below, along with an indication of the number of the 30 C&D processors interviewed that process those materials. Because several companies process more than one material, they appear multiple times in the list below:

- **Wood** (12 processors),
- **Concrete**, **Asphalt**, **Rock**, and **Brick** (9 processors),
- **Gypsum Wallboard** (2 processors),
- **Roofing** (2 processors),
- **Glass** (1 processor),
- **Carpet** and **Carpet Padding** (3 processors), and
- **Metal** (11 processors).

[29] A total of 40 interviews were conducted; several companies interviewed process more than one category of material.

The summary for each C&D material type includes information on the following topics:

- **Types of Materials** – Categories of C&D materials typically accepted for processing, and general specifications for those materials.
- **Source** – Activity and geographic area that generated the C&D waste.
- **Quantity** – Amount of material processed from King County outside of Seattle, as reported by processors. Amounts are derived from the total quantity processed at each facility and the estimated portion of material originating from King County.
- **Price** – The fee that processors charge haulers, contractors, and others for C&D materials delivered to their facility. Metal is the only C&D material for which processors may pay, rather than charge, haulers or generators for the materials.
- **Processing** – The activities that take place in transforming the C&D material into a marketable end product.
- **Capacity** – The quantity of material that facilities could process if operating at maximum levels.
- **End Markets** – Outlets, uses, and buyers for material from processing facilities.
- **Perceived Barriers and Opportunities for Recycling** – Perceived obstacles to recycling and potential solutions to increase recycling, as reported by C&D processors.

Wood

Wood is processed by 12 of the 30 C&D processors interviewed for this study. Nine are in King County, and three are in Pierce County. All these facilities handle C&D wood waste or what is commonly called "urban wood." The 12 processors interviewed represent the larger wood recycling facilities in the area, but one company did not have tonnage data available for this study. Because of time and budget limitations, this study does not include the annual tonnage of material processed at or the processing capacity of the smaller facilities in the region.

Types of Materials

Some of the processors interviewed handle a variety of wood materials, including lumber and processed woods as well as land clearing material, such as stumps, logs, and associated wood debris. For these facilities, the quantities of land clearing materials were excluded from the analysis.

Other facilities process only wood from sources that do not include land clearing material. This wood, often referred to as urban wood, includes materials from construction and demolition activities as well as from non-C&D sources, such as pallets and crates from warehouse operations. Most processors interviewed, however, were not able to distinguish how much of the urban wood they process originated from C&D activities.

The facilities surveyed accepted the following types of urban wood for recycling:

- Pallets and crates,
- Clean dimensional lumber,
- Plywood, and
- Oriented strand board (OSB).

In wood recycling, the quality of the material is a primary concern. Wood processors will not accept wood that has been treated or painted with lead-based paint. Treated wood contains chemicals, such as arsenic, which are toxic when incinerated or used as mulch. Unless the loads are clean and free from contaminants, the loads are usually rejected.

In the interviews with facilities that handle C&D wood as well as land clearing material, processors reported that wood from land clearing activities appears to be on the decline in King County. Instead, a growing proportion of the recycled wood feedstock comes from urban sources, including C&D activities.

Source

The majority of wood acceptable for recycling consists of waste from new construction and pallets. Several processors report that nearly 90% of the urban wood they accept is from these sources. Other sources include demolition waste

that is not chemically treated or contaminated with potentially lead-containing paint.

Quantity

Wood waste in the disposed and recycled C&D waste stream in King County originates from three primary sources: (1) construction and demolition activities; (2) discarded industrial packaging, including pallets and crates; and (3) manufacturing scrap.

The total amount of C&D wood that is processed by the facilities interviewed is approximately 370,000 tons per year, based on combined tonnage estimates provided by the processors interviewed. Of this, about 210,000 tons come from King County, with the remaining 160,000 tons coming from Seattle and surrounding counties. Some of the wood that processors recycle includes pallets and crates originating from commercial sources rather than from construction or demolition sites.

Based on an analysis of local and national data, it appears likely that construction activities contribute around 60% of the wood waste stream in King County, while the remaining 40% comes from non-construction sources, including manufacturing scrap and industrial packaging, such as pallets and crates. Appendix I provides more detail on the assumptions and calculations used in deriving these estimates.

Price

The prices that wood processors charge to haulers, contractors, and others vary widely depending on a number of factors, including the type of wood, the mixture of wood types, the amount of other waste material in the wood, and the processor's desired end use. For example, a processor might not charge a hauler anything or might pay for extremely clean wood if that wood requires very little processing and can be sold to higher-end wood or composite markets. Table 3-5 lists the range of prices that processors typically charge for accepting different wood materials.

Table 3-5. Prices Charged by Wood Processors

Quality of Wood	Price Charged per Ton
Clean lumber, pallets, and crates	$0-76
Scrap wood from demolition and other sources	$20-70

Processing

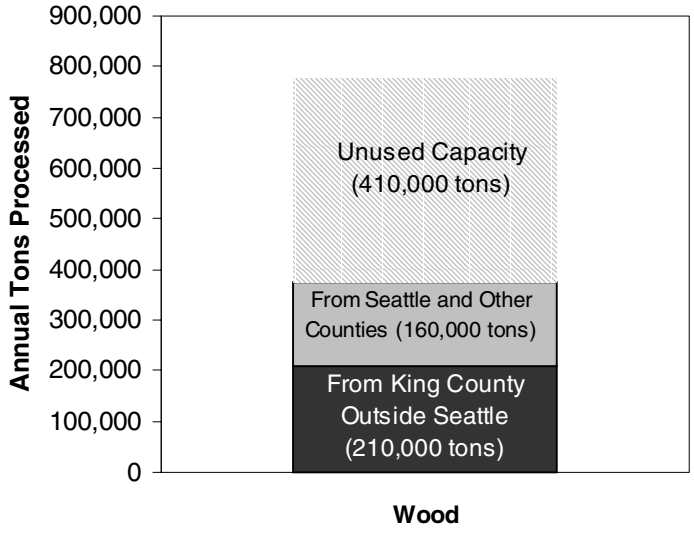
Processors handle C&D wood according to its quality and end use. Lower-quality wood, mainly from demolition, may contain small amounts of contaminants, such as paper, but lead-based paints or preservatives are not allowed. This material is usually ground for hogged fuel and incinerated for energy production.[30] Because King County considers material used to produce hogged fuel to be recyclable C&D waste, hogged fuel tonnages are included in the recycling figures for this study. Uncontaminated lower quality wood is also ground for mulch, compost, and landscaping chips. Several processors interviewed separate higher-quality C&D wood (such as clean lumber from pallets and new construction) from low-grade wood and grind it for pulp.

Capacity

Currently, local wood processors are operating at between 30% and 70% of their capacity. If all facilities interviewed were operating at full capacity, the amount of C&D wood processed could approach about 800,000 tons per year. Several facilities reported that they had no limit on the amount they could process; they could operate 24 hours a day if needed to keep material moving through their facilities. Figure 3-1 illustrates the annual processing capacity of facilities interviewed compared with the volumes of C&D wood currently being processed.

[30] Hogged fuel is ground-up or shredded wood, sometimes mixed with other materials, that is burned as boiler fuel.

Figure 3-1. Annual Processing and Capacity for C&D Wood



Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

End Markets

An estimated 90% of recycled C&D wood is sold into the hogged fuel market. Hogged fuel is incinerated to create energy for paper mills and electric power plants. Tacoma's electric power plant was one of the largest buyers of hogged fuel in the region until it closed in the fall of 2001; nearly all of the wood processors interviewed sold their hogged fuel to this power plant. Currently, Kimberly-Clark is the main buyer for hogged fuel from King County. Other purchasers include the Simpson Tacoma Kraft Company, along with smaller mills and power-generating plants in nearby counties.

A small portion of high-quality C&D wood material, consisting of wood from new construction and pallets, is ground for pulp. The main user of pulp from the King County area is Longview Fibre Company.

Compost and landscaping mulch also represent a small but growing market for clean, lower-grade C&D wood. Some processors interviewed sell their wood material directly to composting facilities. The market for compost and mulch materials has steadily grown in the past few years, as awareness has grown regarding the role these products play in enhancing water quality and water conservation. Architects and landscape designers are more frequently including the use of compost and mulch in specifications for installations of new landscaping.

Boise Cascade is also developing a new product using recycled wood. This wood/polymer siding product uses clean recycled wood, which is ground as part of the feedstock material. The specifications for this product require that no painted or treated wood be used and that the wood mix not exceed 6% oriented

strand board (OSB) or plywood material due to the laminates contained in these materials.

Perceived Barriers and Opportunities for Recycling

Wood processors reported a range of perceived barriers to recycling, including the difficulty of obtaining permits for processing facilities, ease of disposal over recycling, and insufficient supply of material. More detail on the barriers and opportunities that C&D wood processors often cited during interviews is listed in Table 3-6.

Table 3-6. Perceived Barriers and Opportunities for C&D Recycling of Wood as Reported by Surveyed Processors

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Regulatory	Difficulty of obtaining a permit for processing mixed wood loads	Streamline the permitting process to encourage, rather than discourage, new wood recycling facilities
	Stringent requirements on handling wood	Loosen requirements that prevent wood processors from on-site sorting and processing of material (if wood has metal and other demolition debris associated with it, it requires a different permit, making it difficult to collect commingled loads for sorting and processing) Allow for processing of C&D wood, land clearing debris, and green waste in the same facility
	King County is allowing too much wood to end up in the landfill	Ban wood in landfills
	Regulatory agencies involved in permitting are not communicating with each other effectively	Permitting process involves at least three regulatory bodies; the goals of each agency are often in conflict
	Demolition wood waste not permitted in processing facilities	County needs to understand current issues facing wood processors; concerns about asbestos and lead are less of a focus now, but they are being replaced with concerns about treated wood
	Processors want an opportunity to provide input to the County's decision-making process to ensure that policies address changing industry conditions and needs	County needs to talk with wood processors to obtain current information on processing and end markets, which can change rapidly; for effective business assistance to processors, the County needs a better understanding of current issues

Concrete, Asphalt, Rock, and Brick

Concrete is processed by nine of the 30 C&D processors interviewed for this study. Six are in King County, and three are in the Tacoma area of Pierce County. The facilities interviewed are among the larger processors in the area, though one company declined to provide tonnage data for this study. Because of time and budget limitations, this study does not include the annual tonnage of material processed at or the processing capacity of the smaller facilities in the region.

All the facilities recycle concrete from road and structure demolition, and most accept additional materials along with concrete, including asphalt, rock, and brick. In most cases, these additional materials constitute only a small fraction of loads (less than 5%), and they are usually ground with the concrete to form a mixed aggregate.

Recycling is a common way to handle C&D concrete materials for the following reasons:

- **Concrete is heavy** and, therefore, expensive to dispose or transport over large distances,
- **Concrete is 100% recyclable** (it can be crushed into aggregates that can be mixed with new concrete), and
- **Concrete is simple to process** (the material is typically ground or crushed to a specific size or grade for a particular use, and portable grinders make on-site processing possible).

Types of Materials

The concrete processors interviewed accept concrete that is either clean or embedded with wire, rebar, or other metal. Some processors also accept mixes of concrete, asphalt, rock, and brick. In those cases, the different materials may be sorted out, but more often they are crushed together to create a mixed aggregate.

Source

Because concrete is heavy and expensive to transport, most of the concrete processed at the facilities interviewed originates within 20 miles of the facility. Of the six concrete processors interviewed in King County, all received concrete from sources within the county, and they may also receive some material from adjacent counties.

Quantity

Total annual tonnage processed by the facilities interviewed is about 980,000 tons per year. This amount includes material processed on-site at various demolition sites as well as at the processing facilities. The interviewed facilities estimate the amount processed from King County to be about 290,000 tons per

year. The remaining 690,000 tons of processed concrete comes from Seattle and surrounding counties.

Price

The price that processors charge for concrete varies depending on the quality of the material, including how pure it is (free from asphalt, dirt, rocks, and other debris) and whether it contains any metal. The range of cost for recycling concrete at the eight concrete-processing facilities that provided cost information appears in Table 3-7.

Table 3-7. Prices Charged by Concrete Processors[31]

Concrete Quality	Price Charged per Ton
Clean concrete	$1 to $6
Concrete with rebar	$3 to $12
Concrete with fine wire	$6 to $12
Concrete/asphalt/rock/brick mix	$2 to $3

Processing

Concrete is crushed into various grades for road construction (primarily roadbed subsurface and road shoulder fill), as backfill in new construction (such as pipe bedding), or as a component of new concrete. Some processors offer mobile crushing to eliminate the need to transport the material from the site for recycling.

Capacity

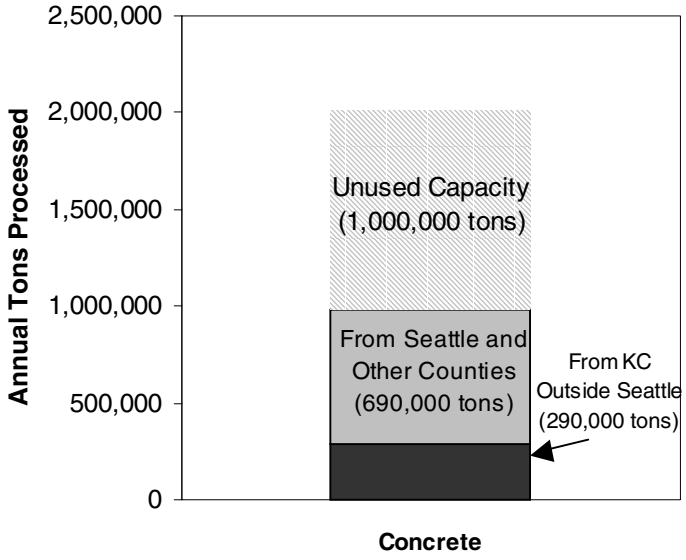
All processors interviewed are operating at moderate capacity levels for concrete, ranging from 30% to 75% of full capacity. At full capacity, the processing facilities together could handle up to 2 million tons of concrete per year. However, the processors interviewed offered two explanations for why their facilities are not operating at full capacity:

- The current market for recycled concrete is weak, with only a few counties or cities using the material in specifications for new public construction or road projects, and
- The market for recycled concrete is still contending with a glut following the 2001 earthquake in Seattle (the excess of material led to a drop in price, making it difficult to earn a significant return after the expense of processing the material).

[31] For comparison purposes, these figures have been converted to prices per ton, rounded to the nearest dollar. Concrete processors, however, typically quote prices per cubic yard, which range from $1 to $16, depending on the quality of the material and the processor.

Figure 3-2 shows the annual processing capacity for C&D concrete, compared with the estimated tonnage currently processed.

Figure 3-2. Annual Processing and Capacity for C&D Concrete



Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

End Markets

The majority of recycled concrete is used in road construction. The crushed concrete is used in roadbed subsurface and on adjacent shoulders and road banks. Several counties and cities in the Puget Sound region have included recycled concrete in specifications for new roadbeds or selected construction uses. The percentage of recycled concrete that is acceptable content for those uses varies depending on the specific application. For roadbed applications, the maximum acceptable proportion of recycled concrete is less than 20%. Other end markets include home construction, usually as backfill for house foundations, and use as gravel on driveways.

At present, little attention is devoted to new markets for recycled concrete, and the main focus currently is on expanding the existing markets in the King County region.

Perceived Barriers and Opportunities for Recycling

For concrete processors, perceived barriers to recycling include limited specification of recycled concrete in construction projects and lack of incentives for using recycled concrete. Additional perceived barriers and opportunities reported by processors interviewed are listed in Table 3-8.

Table 3-8. Perceived Barriers and Opportunities for C&D Recycling of Concrete as Reported by Surveyed Processors

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Regulatory	Permits for on-site processing are expensive and difficult to obtain	Simplify permitting to allow for processing of recyclable materials and selling of materials retail/wholesale (e.g., at Pacific Topsoils)
	Specifications of King County and several cities indicate no recycled material in jobs where recycled concrete could be used	Offer incentives for recycling and recognize those jobs that use recycled materials
	Permitting process limits processors from handling multiple materials	Offer permits that allow processors to handle and process a variety of materials
	No incentive to use recycled concrete	Offer tax incentives for projects that exceed a specific percentage of recycled materials
Market	Decline in market for recycled concrete	Encourage the use of recycled concrete, whenever possible, to increase the demand and help raise the price
	No financial incentive to use recycled concrete as aggregate (still cheaper in most cases to use 100% virgin material, such as rock, rather than a percentage of recycled concrete mixed with virgin material)	Provide financial incentives for the use of recycled aggregates
Education	Lack of knowledge among engineers and contractors regarding the use of recycled concrete	Education regarding recycled materials needed for inspectors, contractors, and general public Training courses through the Washington State Recycling Association or other organizations on the benefits and uses of recycled concrete
	Disconnect between processors and end users	Forge partnerships among processors and local and state agencies to market recycled products

Gypsum Wallboard

Gypsum wallboard is processed by two of the 30 C&D processors interviewed for this study. One is in King County, and one is in Pierce County. At present, these are the only facilities processing gypsum wallboard, or drywall, in the Puget Sound region, and they handle nearly all of the material that is recycled in the area. One additional facility in Snohomish County collects drywall but does not process the material. That company declined to participate in this study, but all of its drywall material is delivered for recycling to one of the two processors interviewed.

Types of Materials

Processors accept gypsum wallboard that consists of a gypsum mineral core sandwiched between layers of paper backing. Both the gypsum and paper materials are recyclable. Gypsum processors do not currently accept other types of drywall, including cement board and green board, both of which contain other materials in addition to gypsum and paper.

Source

Nearly 70% of recycled drywall material comes from new construction. The remainder originates from demolition. Drywall contractors are the primary source of this material to C&D processors. Only a small amount of material is recovered from commingled C&D loads.

Quantity

The processors interviewed reported recycling approximately 47,000 tons of drywall annually. That includes about 7,000 tons from King County, with the remaining 40,000 tons coming from Seattle and neighboring counties.

Price

The price charged for processing recyclable drywall ranges from $45 to $55 per ton.

Processing

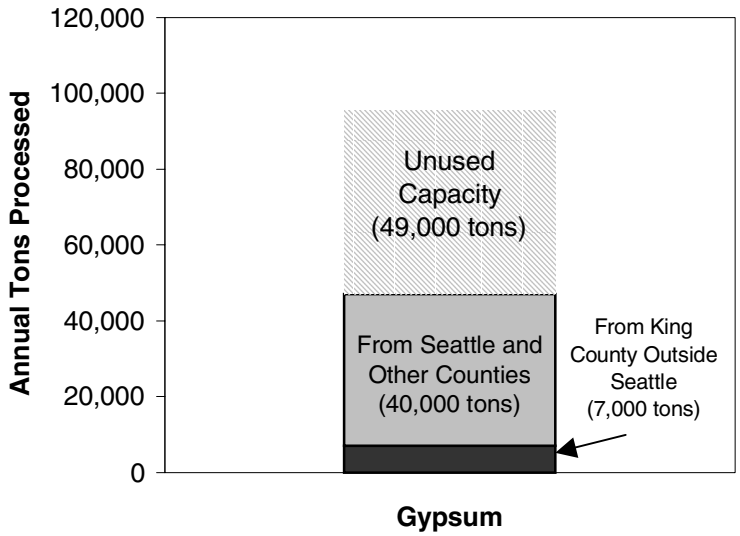
Drywall processing involves separating the paper backing from the gypsum core. The paper can be recycled, though few facilities exist that will recycle drywall paper. Gypsum is ground into powder and used directly in the formation of new drywall. Drywall recycling generates little waste, as the material is nearly 100% recyclable.

Capacity

Both facilities interviewed are operating at 50% to 70% of their capacity. At full capacity, the two facilities combined could process around 96,000 tons per year.

Figure 3-3 shows local capacity for C&D gypsum processing compared with current tonnages.

Figure 3-3. Annual Processing and Capacity for C&D Gypsum Wallboard



Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

End Markets

Gypsum is recycled directly into new wallboard. The local gypsum processors recycle C&D materials from King County into new drywall products, which are sold locally, nationally, and internationally.

Perceived Barriers and Opportunities for Recycling

Drywall processors reported several perceived barriers to increased gypsum wallboard recycling, including the current ease of disposal, low cost of raw materials, and insufficient number of facilities for sorting and processing. Table 3-9 lists perceived barriers to and opportunities for recycling of C&D gypsum wallboard as reported during interviews.

Table 3-9. Perceived Barriers and Opportunities for C&D Recycling of Gypsum as Reported by Surveyed Processors

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Market	No market for paper backing	Encourage market for recycling drywall paper
	Cost of transporting material long distances to processing facility	Need more transfer stations to accept gypsum for recycling
	Not enough material reaching recycling facilities	Encourage more recycling of drywall through placement of collection facilities at transfer stations throughout the county
Cost	Recycled gypsum costs more than raw material	Extract gypsum from the waste stream, which may help lower the cost of recycling
	Convenience and low cost of disposal	Ban drywall from landfills

Roofing

Roofing material is processed by two of the 30 C&D processors interviewed for this study. One is in Snohomish County, and one is in Pierce County. Currently, no other facilities in the Puget Sound region collect roofing material for recycling. In King County, only about 5% to 10% of the roofing material is being recycled.

Types of Materials

Roofing waste consists of one or more of the following materials:

- Cedar shakes and shingles,
- Composition roofing, made from asphalt and cement,
- Tar paper, and
- Plywood and other wood roof decking.

Source

Roofing contractors and self-haulers bring most of the roofing material to processing facilities for recycling. The roofing processors interviewed obtain an estimated 10% to 15% of their material from King County. The remaining amount comes from Seattle and surrounding counties.

Quantity

The processing facilities interviewed process approximately 1,000 tons annually of composite roofing material (roofing shingles and tar paper) from King County outside of Seattle. The total quantity of plywood, other wood and shakes processed is less than 500 tons. The interviewed facilities reported overall processing of about 10,000 tons of roofing material in 2001.

Price

Processors charge $55 to $65 per ton for composite roofing material and $65 to $72 per ton for wood, including shingles, shakes, and plywood.

Processing

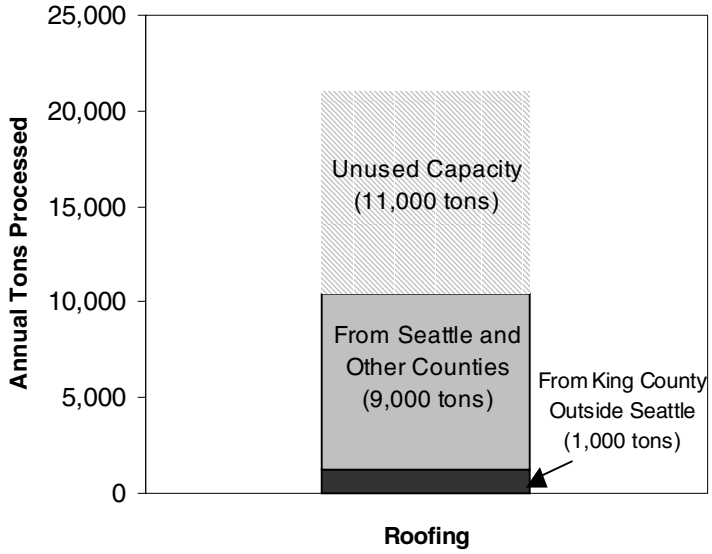
According to the two processors interviewed, composite roofing material and wood (the main components of roofing waste) are primarily processed for hogged fuel.[32] Because King County considers material used to produce hogged fuel to be recyclable C&D waste, hogged fuel tonnages are included in the recycling figures for this study. Wood material is chipped, and composite material is shredded.

[32] Hogged fuel is ground-up or shredded wood, sometimes mixed with other materials, that is burned as boiler fuel.

Capacity

The combined capacity of the two facilities that process composite roofing material is about 21,000 tons per year. Figure 3-4 shows the large unused capacity for roofing materials compared with the amount that is currently being processed.

Figure 3-4. Annual Processing and Capacity for C&D Roofing Materials



Note: Tonnage estimates are rounded. For more detail, please see Interpreting the Results *on page 2-5.*

End Markets

Until its closure in the fall of 2001, the Tacoma steam plant was the sole purchaser of roofing material for use as hogged fuel. Both recycling facilities interviewed are looking elsewhere for buyers in the hogged fuel market; no end market currently exists for composite roofing material.

Tests have been conducted on asphalt paving that contains ground composite roofing material. While roofing processors are encouraged by the apparent success of the trials, concerns remain regarding oil leaching through the pavement from the composite roofing material. Tests are not conclusive, and currently no market exists for using processed roofing material in pavement.

Another product being researched is a soil amendment made from ground composite material. In an informal trial, composite granules raised soil temperature slightly, which increased the growth rate of tomato plants. However, no such market for using roofing materials in soil amendments currently exists.

Perceived Barriers and Opportunities for Recycling

The major perceived barriers that roofing processors reported are a lack of strong end markets for the material and only limited acceptance of roofing material in products such as asphalt.

Table 3-10 lists additional perceived barriers to and opportunities for C&D recycling as reported by roofing processors during interviews.

Table 3-10. Perceived Barriers and Opportunities for C&D Recycling of Roofing as Reported by Surveyed Processors

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Market	No encouragement by agencies to use recycled materials in public jobs	Develop regulations for using recycled materials to increase the demand for materials
	Not enough end uses for recycled materials	Encourage development of new uses for recycled roofing materials
	Bias against recycled materials	Educate regulatory agencies, inspectors, and public on the quality and use of recycled-content materials
Education	Not enough approved end uses for recycled roofing materials	Educate solid waste management board on merits of recycled roofing materials in pavement

Glass

Less than 1% of the "window" glass, known as plate glass, from construction and demolition in King County is recycled. It is difficult to handle at the job site, and it must be removed from metal framing and other materials. In addition, it must be free of adhesives. Only one of two local facilities that recycle plate glass agreed to participate in this study, and all data presented in this section are from this processor.

Types of Materials

The processor interviewed accepts all plate glass that is free of metal and other construction waste. Glass that is coated with lead is not accepted. An important factor in accepting glass for recycling is the quality, or purity, of the material.

Source

Most of the C&D plate glass that the processor accepts comes from manufacturing scrap, and only a small percentage originates from demolition projects. According to the processor interviewed, approximately 75% of the material the company handles is from King County, including Seattle, and about 25% comes from Pierce and Snohomish counties. The processor was not able to estimate the amount of material obtained from King County and Seattle separately.

Quantity

According to only one processor's activities, approximately 3,200 tons of plate glass are recycled annually in King County. However, most of the recycled plate glass is manufacturing scrap. It is estimated that less than 200 tons of this material originates from construction or demolition projects, and less than one-quarter of that material likely comes from King County outside of Seattle.

Price

The processor interviewed charges from $5 to $12 per ton for recycled glass, depending on the quality and quantity of glass available.

Processing

The majority of plate glass is crushed and ground into an abrasive material by this processor. Other processing includes grinding for use in water filtration and coloring for use in composite floor products and craft applications. According to the facility interviewed, the majority of plate glass from this area goes to California for processing.

Capacity

The capacity for processing at the facility interviewed is about 7,000 tons per year.

End Markets

The processor interviewed grinds 80% of plate glass to make abrasive products and uses most of the remaining 20% to manufacture filtration products. A much smaller percentage is processed for arts and crafts materials that are sold nationally. These figures include plate glass recycling from non-C&D sources.

Perceived Barriers and Opportunities for Recycling

Perceived barriers to recycling plate glass include the difficulty of handling the material at the job site and lack of incentives to recycle. Additional perceived barriers and opportunities reported by the processor are provided in Table 3-11.

Table 3-11. Perceived Barriers and Opportunities for C&D Recycling of Glass as Reported by the Surveyed Processor

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Regulatory	Little incentive for procurement offices to purchase recycled materials	Procurement of recycled products in city, county, and state governments would increase the demand for recycled products Encourage regulation that would require the use of recycled products
Market	Weak market for end products	Create incentives for the use of recycled products, such as recognition programs or tax rebates
Education	Lack of knowledge among business, government, and the public on the uses of recycled products	Educate the public and companies on the uses of recycled materials to overcome biases against recycled products Educate policymakers and solid waste managers on recycled-content materials
	Poor quality of feedstock materials when collected by contractors	Encourage contractors to sort materials at the job site and place screens over collection containers to minimize contamination problems

Carpet and Carpet Padding

Less than 11% of the carpet in the King County waste stream is being recycled due, in part, to the closure of one of the major processing facilities in the nation, Honeywell-Allied in Georgia. Currently, only two facilities collect and recycle carpet in King County, and only one facility in Washington state collects and recycles carpet padding. The two carpet processors and one carpet padding processor were interviewed to learn what volume of carpet and carpet padding from the King County area is currently being collected and processed.

Types of Materials

Two national companies with operations in Washington collect carpet from within King County. They process the material in facilities outside of the region. The carpet processors interviewed recycle carpet only from customers that are purchasing new carpet installation service, and they do not accept carpet from other sources for recycling.

One firm in Washington collects and recycles polyurethane carpet padding. The company also accepts polyurethane foam padding used in packaging.

Source

Demolition, renovation, and remodeling projects are the major sources of carpet and carpet padding. Most of the carpet that is recycled originates from hotels, apartment complexes, and corporations. Materials must be source-separated for recycling. Carpet installers collect the old material during the installation of new carpet and carpet padding, and they deliver the material to the processors. For carpet padding, self-haul contractors typically bring the material to processors.

Quantity

One carpet processor ships about 150 to 200 tons of carpet per year from King County, including Seattle, to its processing facility; perhaps half that amount comes from King County outside of Seattle. The other processor handles about 2,000 tons annually, but the company was unable to estimate the King County share.

The carpet padding processor handles an estimated 1,500 to 2,000 tons of padding annually, with a little more than half coming from King County, including Seattle.

Price

Because both carpet processors interviewed include the cost of recycling in their installation price for new carpet, the amount that customers pay to recycle depends on the job. Carpet processors estimate the cost for recycling carpet to range from $30 to $300 per ton.

Carpet padding processors charge approximately $100 per ton for recycling.

Processing

Carpet processing involves removing the fiber surface from the backing material and separately recycling those nylon and vinyl materials back into carpet or other products. Local processors typically bale carpet and ship the materials to facilities in the southeastern United States for processing.

Currently, no recycling facilities in the Pacific Northwest remanufacture polyurethane foam padding into new products. The one facility interviewed typically collects, cleans, and bales carpet padding from the King County region and ships it by rail to processing facilities in the Midwest for recycling. Carpet padding may be recycled up to five times. With each cycle through the recycling loop, which involves grinding the material into chunks and adhering the pieces together, the padding loses some quality. After the fifth time through the process, older foam becomes too filled with adhesives to be acceptable for reuse and is discarded.

Capacity

The two carpet processors report unlimited capacity for handling materials, as long as an end market exists for the products. However, one company reported having a three-year backlog of material stockpiled and waiting to be processed.

The one carpet padding processor interviewed operates at between 60% and 100% of its capacity, depending on the season. If operating at full capacity, this facility could collect and ship between about 2,000 and 3,000 tons of carpet padding annually.

End Markets

Most of the carpet currently recycled is remanufactured into the following types of products:

- Carpet,
- Curb blocks for parking lots,
- Automobile parts,
- Synthetic wood products,
- Soundproofing panels, and
- Padding for weight rooms.

Foam carpet padding is 100% recyclable, and it can be remanufactured into padding up to five times before it loses its quality and is discarded. No other end uses exist for carpet padding.

Perceived Barriers and Opportunities for Recycling

For carpet processors, perceived barriers include shipping and supply concerns, market limitations, and cost issues. Table 3-12 lists specific perceived barriers to and opportunities for recycling reported by the carpet and carpet padding processors during interviews.

Table 3-12. Perceived Barriers and Opportunities for C&D Recycling of Carpet/Padding as Reported by Surveyed Processors

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
General	Ease of disposal	Ban carpet from disposal at transfer stations and landfills
	Not enough material reaching processors to make collection worthwhile, as material needs to fill a railroad boxcar for efficient shipping	Processors could partner with large hauling companies such as ReNu, Democon, Waste Management, and Allied to increase flow of material to recycling facilities
Education	Demand for non-carpet, recycled plastic products is limited	Work with other processors of nylon materials to develop higher-value uses of recycled carpet fiber
Market	Markets for recycled-content carpet are limited	Expand marketing activities to broaden awareness of recycled-content carpet and carpet padding
	It costs more to recycle old carpet into new carpet; "down-cycling" into other products is cheaper	Expand the supply of recovered materials to help lower the price of recyclable fiber, making recycling into new carpet a more viable alternative to "down-cycling" or disposal

Metal

Metal is processed by 11 of the 30 C&D processors interviewed for this study. Seven are from King County, and four are from Tacoma. These 11 processors represent the dominant metal processors in the region, those that capture the majority of recyclable metals in the waste stream. Six of the processors provided tonnage data for this study, whereas five declined to provide data. Because of time and budget limitations, this study does not include the annual tonnage of material processed at or the processing capacity of the smaller facilities in the region.

In King County, most of the metal from C&D sources is recycled because a market for the material exists, and metal is highly recyclable. Most metal processors do not charge customers to recycle but pay for metal based on market rates, which are highly volatile. The market price largely determines the degree to which generators or haulers separate metal from other materials. Multiple facilities typically process (clean, sort, cut, bale) metal before it reaches an end market.

Types of Materials

The metal processors interviewed accept metal in a variety of forms. Most loads delivered to these facilities are mixed to some degree, such as a mix of ferrous and nonferrous metals or a mix of alloys of the same type of metal. All processors interviewed accept at least some contamination in loads brought to their facility.

Source

Of the seven metal recyclers located in King County and interviewed for this study, all receive most of their metal from sources within the county, and some receive materials from adjacent counties. Processors located in Tacoma receive a portion of their material from King County, but they could not specify exactly how much; estimates ranged from about 15% to 40% per facility.

In addition to commercial businesses, manufacturers, and self-haulers, the processors interviewed identified the following as sources of metal:

- Inter-company (metal previously handled by a separate processor), and
- Self-haul demolition (metal from a processor's own demolition job).

Metal is transported either by truck, rail, or barge from a variety of sources both inside and outside of King County. All processors interviewed receive loads from trucks. Larger facilities also receive loads delivered by rail or barge.

Quantity

Five companies among the 11 interviewed received a total of 220,000 tons of metal in 2001 from King County sources, excluding Seattle.[33] This total includes C&D metal as well as automotive scrap, appliances, and other metals. Processors were unable to estimate the portion from only C&D sources.

Price

Unlike most processing markets that charge for handling material, metal processors pay their suppliers. Yet metal markets are highly volatile, and prices fluctuate daily. Current prices for almost all types of metal are extremely low. Several processors commented that metal prices have not been this low since the 1920s.

Metal prices vary depending on the type (e.g., aluminum versus scrap steel), alloy (a combination of two or more metals), and purity (i.e., level of contaminants). Because a nearly infinite number of metal alloys exist, and both the type and level of contaminants vary per load brought to metal processors, the price ranges vary greatly. Table 3-13 lists price ranges for common metals. (This table reflects the range of metal prices in 2001, as estimated by those processors interviewed.)

Table 3-13. Prices Paid by Metal Processors[34]

Metal Type	Price Paid per Ton
Copper (wiring, tubing)	$0 to $4,000
Brass (plumbing accessories)	$100 to $900
Aluminum (sheet, wiring)	$40 to $1,000
Stainless steel (nonferrous)	$200 to $500
Stainless steel (ferrous)	$0 to $60
Scrap iron (rebar)	$0 to $80

[33] Six of the 11 companies interviewed declined to provide annual tonnage estimates, mostly due to confidentiality reasons.

[34] Processors typically report prices per pound, but these figures were converted to per-ton prices for the comparison purposes of this report.

Processing

Three steps are required for processing metal before it reaches an end market or mill, as described below:

1. **Clean and sort** – Cleaning involves removing contaminants from loads and cleaning metal surfaces through processes such as buffing. Metals are then separated by grade.
2. **Cut to size** – Cutting can be accomplished using devices such as torch cutters or shredding machines. These devices range in size and, therefore, can process variable amounts of material.
3. **Package** – Packaging means baling in most cases. Smaller processors may "package" their metal in containers and transport it to a larger facility for baling. Some processors offer mobile baling to reduce the need to move material before packaging.

Metal generally passes through several facilities before reaching an end market. Most of the metal processors interviewed indicated that they sell their product to other processors instead of selling it directly to an end market. For example, one facility receives a load of C&D metal and then cleans, sorts, and packages this material. Some of this metal is sold to a separate handler for further processing, such as sorting and cutting. Then, another processor is required for shredding the same metal before it can be melted by a mill.

Capacity

All processors interviewed are operating at moderate capacity levels for metal, ranging from 50% to 80% of full capacity. At full capacity, facilities interviewed could process approximately 800,000 tons per year. All the processors interviewed are eager to expand their capacity, but they expressed unease about the current condition of metal markets. In fact, one facility reported that a significant number of domestic steel mills are currently operating in a state of bankruptcy.

When asked why metal prices have decreased dramatically in recent years, several responses were given. A few of the suggested reasons include:

- Development of more efficient processing equipment,
- Local industry and construction sluggish over the past year,
- Economic crisis in Asia, resulting in a decrease in demand for U.S. metals, especially ferrous,
- Economic instability in Eastern Europe, particularly in the Ukraine and Russia, resulting in an increase in U.S. import of new steel from these countries and in downward pressure on the price of scrap metal,
- New steel influx from countries with relatively inexpensive labor, such as Indonesia, Malaysia, Brazil, Korea, and, to a lesser extent, Mexico, and
- Increasing surplus of metals across the globe.

End Markets

Metal processed by the processors interviewed is either shipped to local handlers for further processing, or to local, domestic, or international mills. According to the interviewed processors, most nonferrous metals are exported to mills in Asia. Of the ferrous metal, about 90% to 95% of all steel is sent to a mill within King County. Generally, metal is recycled back into the same kinds of products it came from before processing, such as copper wiring and structural steel products.

The metal processors interviewed also suggested the following new and emerging metal markets:

- Structural steel in residential buildings, especially in warm, moist climates and earthquake-prone areas,
- High-grade aluminum, such as automobile engines and frames, and
- Grape posts in vineyards (previously made of wood).

Perceived Barriers and Opportunities for Recycling

For metal processors, current perceived barriers to recycling include weak markets for metal, regulatory constraints, and an insufficient number of sorting facilities. A detailed list of perceived barriers and opportunities as reported by the processors is provided in Table 3-14.

Table 3-14. Perceived Barriers and Opportunities for C&D Recycling of Metal as Reported by Surveyed Processors

	Perceived Barrier to Recycling	Perceived Opportunity to Reduce Barrier
Regulatory	Excessive government regulation	Let the market run itself
	Trade legislation	Provide positive incentives for metal to be recycled and sold locally
Market	Low price of the finished product Cost-effectiveness (if a site has a large amount of metal, then it makes sense to sort it, but if only trace amounts are present, companies usually do not bother unless the "price is right")	Encourage development of nearby facilities, like Recovery 1, that accept commingled C&D loads, as it is not cost-effective for C&D materials from King County to be transported to Tacoma for this type of processing
Education	Contamination of scrap metal, especially with hazardous materials and fluids	Increase public education and provide hazardous collection sites that are easily accessible to the public
Other	Limited space at C&D sites for source-separated containers	Encourage development of nearby facilities, like Recovery 1, that accept commingled C&D loads