Contractor's Report to the Board

Targeted Statewide Waste Characterization Study:

Detailed Characterization of Construction and Demolition Waste

June 2006

Produced under contract by:

Cascadia Consulting Group

CASCADIA
CONSULTING GROUP

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
INTEGRATED WASTE
MANAGEMENT BOARD

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Executive Summary

Introduction

In 2004, the California Integrated Waste Management Board (CIWMB) commissioned this study, which quantifies and characterizes four specific waste streams:

1. Disposal and diversion from specific major waste generators in the commercial sector (Task 1);

2. Residuals from materials recovery facilities (MRF) and municipal solid waste processing facilities (clean and dirty MRFs) (Task 2);

3. Disposal from the construction and demolition (C&D) waste stream (Task 3); and

4. Disposal from the commercial self-haul and drop-box waste stream (Task 4).

In contrast to recent statewide studies the CIWMB commissioned in 1999 and 2003, this portion of the current study includes only C&D waste, rather than the commercial, residential, and self-haul waste streams. Also in contrast to the previous studies, the current study focused on waste from four metropolitan areas of the state instead of the entire state.

This report presents the results of the analysis of the C&D waste stream (Task 3). The objectives of this portion of the study were to develop reliable estimates of the quantity and composition of California's C&D waste stream. In addition, a modified version of the C&D visual estimating method used in this study was developed for use by local government staff and published under a separate cover.

Study Methodology

This portion of the study included waste from construction and demolition loads. Disposal facilities were eligible to participate in the study if they were located in one of the four major metropolitan areas: the San Diego area, Southern California/Los Angeles Basin, the San Francisco Bay area, and the Central Valley. Sampling events were divided between the four areas across two seasons (December 2004 and June 2005), so that two sampling days were held in each area in each season. An additional day was added in both the winter season and summer seasons.

The C&D waste stream was divided into seven subsectors based on the type of activity (new construction, remodel, demolition, roofing, and other) and building type (residential, non-residential, and other) that generated the waste. A total of 622 loads of C&D waste were visually characterized according to 86 material types as described in Appendix B. Approximately equal numbers of waste samples were characterized in each metropolitan area.

Concurrent with waste sampling, vehicle surveys were conducted at participating facilities. Data from the surveys were analyzed to estimate the portion of each metropolitan area's waste that corresponds to each waste sector.

Results

Sampling data was compiled to generate composition estimates, while the survey data was used to generate tonnage estimates and to compile overall results for each subsector and metropolitan area. Composition results are presented according to the *divertibility* of the materials in question. Material types were assigned to a divertibility category based on available recycling technologies and markets (see Appendix B). Divertibility categories of material include **Recyclable**

Aggregates; **Recyclable Wood**; **Rock, Dirt, & Sand**; **Recyclable Metal**; **Other Recoverable Material;** and **Other MSW**.

The final report includes detailed findings for the following areas:

- Composition and tonnage by material and divertibility category for overall C&D waste.

- Composition and tonnage by material and divertibility category for all seven activity and building type subsectors.

- Composition and tonnage by material and divertibility category for C&D waste in each metropolitan area.

The findings show that approximately 3.1 million tons of C&D waste were disposed in 2004 in the four metropolitan areas (Table 1). The amount of C&D waste disposed was highest in the San Francisco Bay Area, about 1.4 million tons, followed by the Southern California/L.A. Basin, which had an estimated 1.1 million tons disposed in 2004. The largest amount of C&D waste in the San Diego and San Francisco Bay Area was estimated to be residential remodel, although demolition was almost as large in the Bay Area. In the Central Valley, the greatest amount of C&D waste was attributed to new residential construction, followed closely by residential remodel. Other C&D was the largest substream in the Southern California/L.A. Basin.

Table 1. Metropolitan Area Tonnages by Subsector, 2005

Subsector	San Diego	Southern California/ L.A. Basin	San Francisco Bay Area	Central Valley	Total
New residential construction	51,515.87	65,416.61	146,049.99	48,835.16	**311,817.64**
New non-residential construction	20,847.16	72,248.53	140,779.24	20,216.50	**254,091.43**
Residential remodel	123,615.00	136,367.12	300,169.61	44,475.53	**604,627.27**
Non-residential remodel	53,053.94	68,362.69	196,488.90	23,202.63	**341,108.15**
Demolition	76,899.84	243,261.99	289,004.55	23,556.01	**632,722.40**
Roofing	26,030.84	182,720.34	209,666.54	34,050.08	**452,467.80**
Other C&D	62,306.77	344,838.60	106,778.00	20,167.38	**534,090.76**
Total	**414,269.43**	**1,113,215.88**	**1,388,936.83**	**214,503.30**	**3,130,925.43**

The above tonnages were calculated by applying 2005 field percentages of each subsector to 2004 Disposal Reporting System tonnage data.

Figure A shows the contribution of each subsector to the overall C&D waste stream. Demolition (21 percent) and residential remodel (19 percent) made up the largest portions of the waste stream. The two new construction categories, new residential and new non-residential, made up the smallest portions of the overall C&D waste stream at 10 percent and 8 percent, respectively.

Figure A. Overview of California's C&D Waste Stream by Subsector, 2005

New residential
construction
10%

New Non-
residential
construction
8%

Other C&D
17%

Roofing
14%

Residential
remodel
19%

Demolition
21%

Non-Residential
remodel
11%
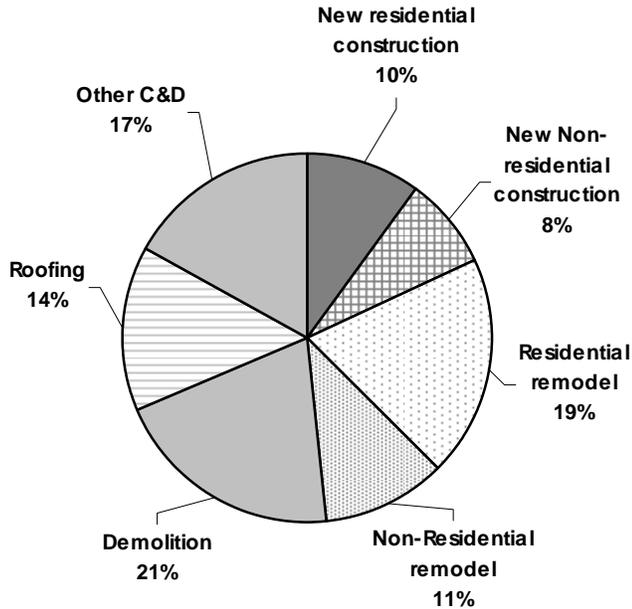
The composition results for the overall C&D waste stream are shown in Figure B, Table 2, and Table 3. This data reflects the aggregated results from all four metropolitan areas. In terms of the six divertibility categories, recyclable aggregates was calculated to compose about 27 percent of this waste stream. Approximately 74 percent of the total waste stream was estimated to be divertible. The most prominent individual material types were determined to be composition roofing (10.2 percent), remainder/composite C&D (8.3 percent), and large asphalt pavement without re-bar (8.1 percent).

Figure B. Overview of Waste Divertibility: Overall C&D in Four Metropolitan Areas of California, 2005

Other MSW
26%

Recyclable
Aggregates
27%

Rock, Dirt, &
Sand
8%

Recyclable
Wood
15%

Other
Recoverable
Material
20%

Recyclable
Metal
4%
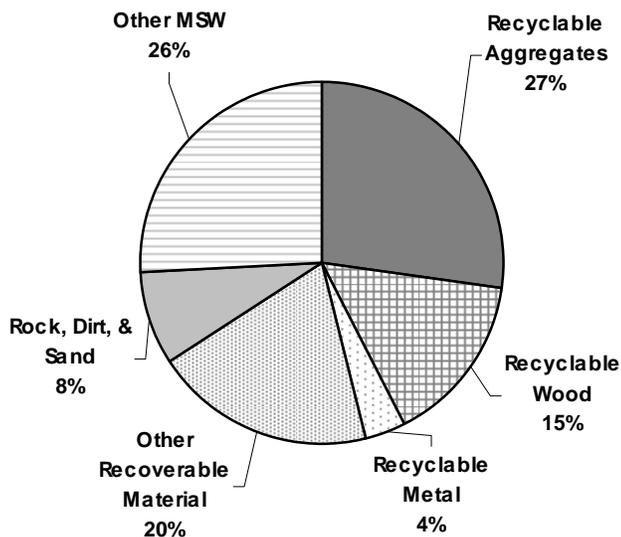
Table 2. Top Ten Disposed Materials: Overall C&D in Four Metropolitan Areas of California, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Composition Roofing	yes	10.2%	10.2%	318,494
Remainder/Composite C&D	no	8.3%	18.5%	261,161
Large Asphalt Pavement without Re-bar	yes	8.1%	26.6%	253,286
Dirt & Sand	yes	6.6%	33.2%	206,729
Other Aggregates	yes	6.4%	39.6%	199,544
Clean Dimensional Lumber	yes	5.9%	45.5%	185,276
Large Concrete without Re-bar	yes	5.2%	50.7%	163,483
Painted/Stained Wood	no	4.6%	55.4%	145,333
Clean Gypsum Board	yes	4.5%	59.8%	140,348
Clean Engineered Wood	yes	4.5%	64.3%	139,975
Total		**64.3%**		**2,013,629**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 3. Detailed Waste Composition: Overall C&D in Four Metropolitan Areas of California, 2005

Material	Est. Percent	+ / -	Est. Tons	Material	Est. Percent	+ / -	Est. Tons
Paper	**3.2%**		**101,750**	**Organic**	**3.0%**		**92,557**
Uncoated Corrugated Cardboard	0.8%	0.2%	24,368	Food	0.0%	0.0%	709
Paper Bags/Kraft	0.1%	0.2%	3,826	Leaves & Grass	0.5%	0.2%	17,065
Newspaper	0.2%	0.1%	5,664	Prunings & Trimmings	0.4%	0.2%	13,838
White Ledger	0.1%	0.1%	2,705	Branches & Stumps	0.1%	0.0%	2,513
Colored Ledger	0.1%	0.1%	2,795	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	336	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	576	Textiles	0.2%	0.1%	4,716
Phone Books/Directories	0.0%	0.0%	29	Carpet	1.0%	0.4%	32,000
Other Misc. Paper	0.7%	0.2%	22,393	Carpet Padding	0.2%	0.1%	6,766
Remainder/Composite Paper	1.2%	0.5%	39,057	Remainder/Composite Organic	0.5%	0.4%	14,950
Glass	**1.1%**		**34,054**	**Construction & Demolition**	**86.7%**		**2,714,783**
Clear Glass Bottles & Containers	0.1%	0.0%	1,760	Lg Concrete with Re-bar	0.6%	0.3%	19,309
Green Glass Bottles & Containers	0.0%	0.0%	738	Lg Concrete without Re-bar	5.2%	1.8%	163,483
Brown Glass Bottles & Containers	0.0%	0.0%	852	Sm Concrete with Re-bar	0.7%	0.6%	23,132
Other Colored Glass Bottles & Containers	0.0%	0.0%	3	Sm Concrete without Re-bar	4.3%	1.2%	134,597
Flat Glass	0.6%	0.5%	19,615	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	719
Remainder/Composite Glass	0.4%	0.2%	11,087	Lg Asphalt Pav. without Re-bar	8.1%	3.0%	253,286
				Sm Asphalt Pav. with Re-bar	0.7%	0.9%	22,022
Metal	**4.0%**		**124,719**	Sm Asphalt Pav. without Re-bar	1.2%	1.3%	36,115
Tin/Steel Cans	0.0%	0.0%	645	Composition Roofing	10.2%	2.0%	318,494
Major Appliances	0.7%	0.8%	20,486	Other Asphalt Roofing	4.4%	1.8%	136,756
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	6.4%	2.4%	199,544
HVAC Ducting	0.1%	0.1%	3,568	Clean Dimensional Lumber	5.9%	1.0%	185,276
Other Ferrous	2.4%	0.6%	75,108	Clean Engineered Wood	4.5%	0.8%	139,975
Aluminum Cans	0.0%	0.0%	161	Pallets & Crates	1.8%	0.6%	55,436
Other Non-Ferrous	0.4%	0.1%	11,593	Other Recyclable Wood	3.1%	1.2%	95,533
Remainder/Composite Metal	0.4%	0.2%	13,158	Painted/Stained Wood	4.6%	1.2%	145,333
				Treated Wood	0.3%	0.2%	8,254
Electronics	**0.2%**		**5,666**	Clean Gypsum Board	4.5%	1.3%	140,348
Brown Goods	0.0%	0.0%	389	Painted/Demolition Gypsum Board	3.6%	1.2%	111,960
Computer-related Electronics	0.0%	0.0%	828	Large Rock	0.9%	0.6%	28,063
Other Small Consumer Electronics	0.0%	0.0%	1,388	Small Rock/Gravel	0.7%	0.4%	23,234
TV's & Other CRTs	0.1%	0.1%	3,062	Dirt & Sand	6.6%	3.0%	206,729
				Fiberglass Insulation	0.2%	0.1%	6,025
Plastic	**0.8%**		**24,611**	Remainder/Composite C&D	8.3%	1.9%	261,161
PETE Containers	0.0%	0.0%	363				
HDPE Containers	0.0%	0.0%	1,135	**Household Hazardous Waste**	**0.4%**		**11,459**
Misc. Plastic Containers	0.0%	0.0%	172	Paint	0.1%	0.1%	1,912
Trash Bags	0.0%	0.0%	1,064	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	73	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.1%	0.0%	2,255	Batteries	0.3%	0.5%	9,532
Film Products	0.1%	0.0%	2,654	Remainder/Composite HHW	0.0%	0.0%	15
Other Film	0.0%	0.0%	428				
Durable Plastic Items	0.2%	0.1%	7,270	**Special Waste**	**0.6%**		**19,446**
Expnd. Polystyr. Packaging/Insulation	0.1%	0.0%	2,024	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.2%	0.1%	7,174	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.6%	0.3%	17,974
				Tires	0.0%	0.0%	1,214
				Remainder/Composite Special	0.0%	0.0%	258
Totals	**100.0%**		**3,130,925**	**Mixed Residue**	**0.1%**		**1,880**
Sample Count	**622**			Mixed Residue	0.1%	0.1%	1,880

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Introduction and Overview

The California Integrated Waste Management Board (CIWMB) commissioned Statewide Waste Disposal Characterization Studies in 1999 and in 2003. Both studies were comprehensive in nature and characterized residential, commercial, and self-haul waste disposed throughout California. In 2004, the CIWMB commissioned the present study which quantifies and characterizes four specific waste streams:

1. Disposal and diversion from specific major waste generators in the commercial sector (Task 1);

2. Residuals from materials recovery facilities (MRF) and municipal solid waste processing facilities (clean and dirty MRFs) (Task 2);

3. Disposal from the construction and demolition (C&D) waste stream (Task 3); and

4. Disposal from the commercial self-haul and drop-box waste stream (Task 4).

This report presents the results of this study's analysis of the construction and demolition waste stream (Task 3).

Background and Objectives

The objectives of this task were to develop reliable estimates of the quantity and composition of California's C&D waste stream. Data gathered during this study provides estimates of the types and quantities of waste from this waste stream in California's urban areas. In commissioning this characterization study, the CIWMB intended to obtain a complete picture of the disposal and recovery potential for this highly recyclable waste stream, and information about the sources and activities generating this waste.

Targeted Waste

The focus of this study was on C&D waste, meaning any waste that results from construction or demolition activities as defined below[1]:

- "Construction" means the building of any facility or structure or any portion thereof including any tenant improvements to an existing facility or structure.

- "Demolition" means the decimating, razing, ruining, tearing down, or wrecking of any facility, structure, pavement or building, whether in whole or in part, whether interior or exterior.

Furthermore, by regulation, "Construction and Demolition Wastes" include the waste building materials, packaging and rubble resulting from construction, remodeling, repair and demolition operations on pavements, houses, commercial buildings and other structures (Title 14 of the California Code of Regulations, Division 7, Chapter 3, Section 17225.15).

Contributing Consultants

This study was managed by Cascadia Consulting Group, Inc., an environmental consulting firm based in Seattle, Washington. It relied on data collection activities conducted by Sky Valley Associates. The distribution of responsibilities was as follows.

Cascadia Consulting Group, Inc. .... Project management
Study design
Coordination of data collection

Development of Visual Estimating Method and Associated Conversion Factors

As a precursor to the effort to gather data on C&D waste, an investigation was conducted to determine the best visual characterization method and associated conversion factors to be used for the study. A literature review revealed several important findings about the current visual estimating practices including the two most commonly used visual-sampling methods for C&D waste: volume-based and weight-based visual estimating. In order to test the two methods, a field test was conducted in November 2004 at Miramar Landfill in San Diego. Seventy-five loads were included in the field test. The resulting data showed that the volume-based visual estimating method was slightly more accurate at characterizing C&D waste. Additionally, the data was evaluated to create conversion factors based on the volume-based visual method. The development of the method and conversion factors are described in detail in Appendix C.[*]

Description and Development of Study Design

The study design and separate field plan for this task outlined a research plan including targeted waste sectors, vehicle selection and surveying methods, sampling methods, preliminary identification of sites, and general contingency measures. The plan included a target of 640 samples of C&D waste to be sampled over the course of the study. The samples were to be evenly divided between 16 sites, 4 sites in each of the 4 metropolitan areas. Sample targets by subsector were listed in the field plan. Samples were to be visually characterized according to 86 material types. Appendix A contains a detailed description of all aspects of the study methodology.

Urban Areas Included in Study

The purpose of the study was to obtain data on targeted waste sectors and focused on the four major metropolitan areas of the state: the San Diego area, Southern California/L.A. Basin, the San Francisco Bay Area, and the Central Valley. These areas represent common demographic and geographic characteristics of California.

While these areas represent a cross-section of the state, the disposal facilities in these areas also receive the majority of the waste disposed in the state. Facilities in these metropolitan areas, which were eligible for sampling, receive about 71 percent of the total waste disposed in California.

C&D Sectors Examined in this Study

Definition of Sectors

For the purposes of this study, the C&D waste stream was divided into two sectors:

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[*] C&D waste in this study was characterized according to 86 material types, as listed in Appendix B. Volume data was converted to weights using densities developed in the current study for 32 of the material types, while published sources were used for the remaining material types.

- **Commercially Hauled Waste** — Waste that is collected and transported by contracted or franchised haulers. In general, vehicles that haul C&D waste include loose roll-offs, end dumps, and other large vehicles, such as large pick-up trucks.

- **Self-haul Waste** — Waste hauled by individuals, businesses, or government agencies that haul their own garbage, for example, contractors, roofers, and landscapers. This subsector includes waste delivered by anyone other than a contracted or franchised hauler.

For a more detailed accounting of these sectors, the waste stream was then further divided into seven subsectors according to activity and building type. The subsectors are defined as follows:

1. **New residential construction** — Construction materials generated from the construction of new residential structures including single-family and multi-family residences.

2. **New non-residential construction** — Construction materials generated from the construction of new non-residential buildings, such as businesses, government offices, and schools.

3. **Residential remodel** — Construction or demolition materials generated from the remodeling of residential structures including single-family and multi-family residences.

4. **Non-residential remodel** — Construction or demolition materials generated from the remodeling of non-residential buildings, such as businesses, government offices, and schools.

5. **Demolition** —Materials generated from the tearing down of any facility, structure (e.g., a wall or fence), pavement or building, whether in whole or in part, whether interior or exterior.

6. **Roofing** — Construction or demolition materials generated from the new construction, remodeling, and/or demolition of residential or non-residential roofs.

7. **Other C&D activities** — Construction or demolition materials generated from activities not otherwise classified, such as the building, repair, and/or demolition of roads, bridges and other public infrastructure.

Selection and Recruitment of Participating Sites

Disposal facilities throughout each metropolitan area were randomly selected for inclusion in the study from a comprehensive list of facilities within each area. For each metropolitan area, sites were eliminated from the list if they did not meet the minimum criteria required for sampling sites. The minimum criteria were: (1) the facility received an adequate number of C&D loads each day; and (2) management was willing to accommodate the expected waste sampling activities.

Sampling was conducted over two seasons: winter (wet) and summer (dry). Facilities were recruited prior to each sampling season. During each season, sampling was conducted over eight weekdays, two days in each metropolitan area. An additional day was added for the winter season in March 2005 at Puente Hills Landfill, and the summer season included an additional day of sampling on a weekend day. The detailed schedule is shown in Table 4. Because most of the selected facilities also received an adequate amount of non-C&D self-haul and loose drop-box waste (Task 4), scheduling and sampling efforts were coordinated with Task 4 activities to allow sampling for both tasks to occur simultaneously.[†]

[†] Del Norte Transfer Station in Ventura County, visited on Saturday, June 25, 2005, was selected to have a self-haul sampling event on a weekend day for Task 4, though it did not meet the criteria for Task 3.

Table 4. Schedule of Sampling Events

Site	Metropolitan Area	Date
Miramar Landfill	San Diego	12/7/2004
Miramar Landfill	San Diego	12/8/2004
Antelope Valley Landfill	L.A. Basin	12/9/2004
Colton Landfill	L.A. Basin	12/10/2004
Guadalupe Landfill	Bay Area	12/13/2004
Sonoma Disposal Site	Bay Area	12/14/2004
L & D Landfill	Central Valley	12/15/2004
Sacramento County Landfill	Central Valley	12/16/2004
Puente Hills	L.A. Basin	3/2/2005
Miramar Landfill	San Diego	6/21/2005
Otay Landfill	San Diego	6/22/2005
Chiquita Canyon Landfill	L.A. Basin	6/23/2005
Puente Hills Landfill	L.A. Basin	6/24/2005
Del Norte Transfer Station	L.A. Basin	6/25/2005
West Contra Costa Landfill	Bay Area	6/27/2005
Vasco Road	Bay Area	6/28/2005
L & D Landfill	Central Valley	6/29/2005
Western Regional Landfill	Central Valley	6/30/2005

Appendix A contains a thorough description of the site selection and recruitment procedures.

Capture and Characterization of Samples

Samples of disposed waste were obtained from C&D loads, and were characterized using a volume-based visual estimating method. Samples were apportioned between disposal facilities and regions in a way that ensured representation during each season of the study. Table 5 shows the number of samples that were collected for each subsector by metropolitan area. The goal for each metropolitan area was 160 samples.

Table 5. Sample Count by Subsector and Metropolitan Area

Subsector	San Diego	Los Angeles	Bay Area	Central Valley	Total
New residential construction	25	20	20	32	**97**
New non-residential construction	10	20	10	19	**59**
Residential remodel	36	60	41	30	**167**
Non-residential remodel	20	17	19	30	**86**
Demolition	26	32	13	9	**80**
Roofing	22	30	17	26	**95**
Other	13	4	9	12	**38**
Total	**152**	**183**	**129**	**158**	**622**

Vehicle Surveys

To quantify the amounts of C&D waste associated with the seven subsectors and the four urban areas, surveys were conducted at the entrance of each participating facility. The surveys were administered to the drivers of all vehicles bringing C&D waste for disposal at the gate where the surveyor was posted. A total of approximately 1,700 vehicles were surveyed. Information on weekend disposal patterns was gathered to supplement survey data for weekdays and adjust data to better reflect overall disposal at the facility. The surveys were conducted at each participating disposal facility on the same days that waste samples were obtained. Please see Appendix A for information gathered through the driver survey, and Appendix D for a copy of the vehicle survey form.

Results

Interpreting the Results

Results for overall C&D waste, each subsector, and each metropolitan area are presented in three ways:

- First, a summary of waste composition by divertibility category is presented in a pie chart.

- Next, the ten most prevalent material types, by weight, are shown in a table.

- Last, a detailed table lists the full composition and quantity results for the 86 material types.

Means and Error Ranges

The data from the sorting process was treated with a statistical procedure that provided two kinds of information for each of the material types:

- The percent-by-weight estimated composition of waste represented by the samples examined in this study, and

- The degree of precision of the composition estimates.

All estimates of precision were calculated at the 90 percent confidence level. The equations used in these calculations appear in Appendix A.

The example below illustrates how the results can be interpreted. The example indicates that the best estimate of the amount of *leaves and grass* present in the universe of waste sampled is 5.2 percent. The figure 1.2 percent reflects the precision of the estimate. When calculations are performed at the 90 percent confidence level, we are 90 percent certain that the true percent of the waste stream that is *leaves and grass* is between 5.2% + 1.2% and 5.2% - 1.2%. In other words, we are 90 percent certain that the actual amount lies between 6.4% and 4.0%.

Waste Material	Est. Pct.	+ / -
Leaves and grass	5.2%	1.2%

Rounding

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 exactly match the

subtotals and totals shown. Similarly, the **percentages**, when added together, may not exactly match the subtotals or totals shown. Also, percentages less than 0.05 percent are shown as 0.0 percent.

Determining Divertibility of Materials

Pie charts in this report are based on the divertibility of the material types. The "top ten" material tables also list whether material types are considered divertible. All 86 material types were classified according to the following divertibility categories (please see Table 38 in Appendix B for more detail).

- Divertible material is defined as material for which technologies and markets exist in California to recover the material from the waste stream through recycling or composting. Divertible categories of material included **Recyclable Aggregates**; **Recyclable Wood**; **Rock, Dirt, & Sand**; **Recyclable Metal**; and **Other Recoverable Material**.

- Non-divertible material is defined as material for which technologies and markets have not been adequately developed to permit recovery of these materials from the waste stream. All non-divertible materials are categorized as **Other MSW**.

Metropolitan Area Tonnages by Sector

Vehicle surveys were used at each facility to estimate the proportion of waste received for disposal that was generated by each of the seven C&D subsectors. The fractions of waste associated with each subsector on sampling days were used to estimate the relative proportion of each subsector on a regional basis, as described in Appendix A. Table 6 shows the estimated tonnage for each of the subsectors according to metropolitan area. The total tons for each subsector represent the total within the four metropolitan regions.

Table 6. Metropolitan Area Tonnages by Subsector, 2005

Subsector	San Diego	Southern California/L.A. Basin	San Francisco Bay Area	Central Valley	Total
New residential construction	51,515.87	65,416.61	146,049.99	48,835.16	**311,817.64**
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Other C&D	62,306.77	344,838.60	106,778.00	20,167.38	**534,090.76**
Total	**414,269.43**	**1,113,215.88**	**1,388,936.83**	**214,503.30**	**3,130,925.43**

The above tonnages were calculated by applying 2005 field percentages of each subsector to 2004 Disposal Reporting System tonnage data.

Overall C&D Waste

The purpose of this portion of the study was to characterize the overall C&D waste stream for all four metropolitan areas. A total of 622 samples were characterized to produce the composition estimates in this section.

Figure C illustrates composition estimates by divertibility category for the overall C&D waste stream. Almost three-fourths of this waste was estimated to be recoverable. The largest recoverable category was recyclable aggregates, which made up about 27 percent. Other recoverable material, which includes items such as cardboard, composition roofing, and compostable materials, accounted for about 20 percent, and recyclable wood made up approximately 15 percent.

Figure C. Overview of Waste Divertibility: Overall C&D in Four Metropolitan Areas of California, 2005
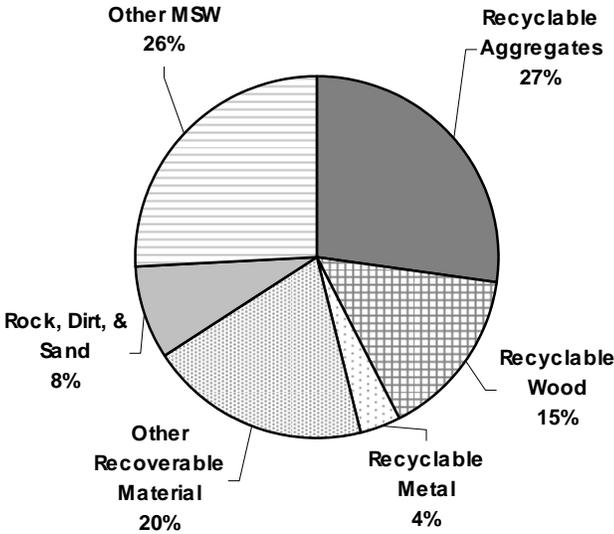
As seen in Table 7, composition roofing was the largest individual material type, making up about 10 percent of overall C&D waste. Remainder/composite C&D, which is not divertible, and large asphalt pavement without re-bar, which is divertible, composed about 8 percent each, by weight. The ten most prevalent materials in this waste stream made up about 64 percent of overall C&D waste, while the eight divertible material types in the top ten list made up 50 percent of overall C&D waste. Full composition results for all 86 material types are listed in Table 8.

Table 7. Top Ten Disposed Materials: Overall C&D in Four Metropolitan Areas of California, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Composition Roofing	yes	10.2%	10.2%	318,494
Remainder/Composite C&D	no	8.3%	18.5%	261,161
Large Asphalt Pavement without Re-bar	yes	8.1%	26.6%	253,286
Dirt & Sand	yes	6.6%	33.2%	206,729
Other Aggregates	yes	6.4%	39.6%	199,544
Clean Dimensional Lumber	yes	5.9%	45.5%	185,276
Large Concrete without Re-bar	yes	5.2%	50.7%	163,483
Painted/Stained Wood	no	4.6%	55.4%	145,333
Clean Gypsum Board	yes	4.5%	59.8%	140,348
Clean Engineered Wood	yes	4.5%	64.3%	139,975
Total		**64.3%**		**2,013,629**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 8. Detailed Waste Composition: Overall C&D in Four Metropolitan Areas of California, 2005

Material	Est. Percent	+ / -	Est. Tons	Material	Est. Percent	+ / -	Est. Tons
Paper	**3.2%**		**101,750**	**Organic**	**3.0%**		**92,557**
Uncoated Corrugated Cardboard	0.8%	0.2%	24,368	Food	0.0%	0.0%	709
Paper Bags/Kraft	0.1%	0.2%	3,826	Leaves & Grass	0.5%	0.2%	17,065
Newspaper	0.2%	0.1%	5,664	Prunings & Trimmings	0.4%	0.2%	13,838
White Ledger	0.1%	0.1%	2,705	Branches & Stumps	0.1%	0.0%	2,513
Colored Ledger	0.1%	0.1%	2,795	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	336	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	576	Textiles	0.2%	0.1%	4,716
Phone Books/Directories	0.0%	0.0%	29	Carpet	1.0%	0.4%	32,000
Other Misc. Paper	0.7%	0.2%	22,393	Carpet Padding	0.2%	0.1%	6,766
Remainder/Composite Paper	1.2%	0.5%	39,057	Remainder/Composite Organic	0.5%	0.4%	14,950
Glass	**1.1%**		**34,054**	**Construction & Demolition**	**86.7%**		**2,714,783**
Clear Glass Bottles & Containers	0.1%	0.0%	1,760	Lg Concrete with Re-bar	0.6%	0.3%	19,309
Green Glass Bottles & Containers	0.0%	0.0%	738	Lg Concrete without Re-bar	5.2%	1.8%	163,483
Brown Glass Bottles & Containers	0.0%	0.0%	852	Sm Concrete with Re-bar	0.7%	0.6%	23,132
Other Colored Glass Bottles & Containers	0.0%	0.0%	3	Sm Concrete without Re-bar	4.3%	1.2%	134,597
Flat Glass	0.6%	0.5%	19,615	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	719
Remainder/Composite Glass	0.4%	0.2%	11,087	Lg Asphalt Pav. without Re-bar	8.1%	3.0%	253,286
				Sm Asphalt Pav. with Re-bar	0.7%	0.9%	22,022
Metal	**4.0%**		**124,719**	Sm Asphalt Pav. without Re-bar	1.2%	1.3%	36,115
Tin/Steel Cans	0.0%	0.0%	645	Composition Roofing	10.2%	2.0%	318,494
Major Appliances	0.7%	0.8%	20,486	Other Asphalt Roofing	4.4%	1.8%	136,756
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	6.4%	2.4%	199,544
HVAC Ducting	0.1%	0.1%	3,568	Clean Dimensional Lumber	5.9%	1.0%	185,276
Other Ferrous	2.4%	0.6%	75,108	Clean Engineered Wood	4.5%	0.8%	139,975
Aluminum Cans	0.0%	0.0%	161	Pallets & Crates	1.8%	0.6%	55,436
Other Non-Ferrous	0.4%	0.1%	11,593	Other Recyclable Wood	3.1%	1.2%	95,533
Remainder/Composite Metal	0.4%	0.2%	13,158	Painted/Stained Wood	4.6%	1.2%	145,333
				Treated Wood	0.3%	0.2%	8,254
Electronics	**0.2%**		**5,666**	Clean Gypsum Board	4.5%	1.3%	140,348
Brown Goods	0.0%	0.0%	389	Painted/Demolition Gypsum Board	3.6%	1.2%	111,960
Computer-related Electronics	0.0%	0.0%	828	Large Rock	0.9%	0.6%	28,063
Other Small Consumer Electronics	0.0%	0.0%	1,388	Small Rock/Gravel	0.7%	0.4%	23,234
TV's & Other CRTs	0.1%	0.1%	3,062	Dirt & Sand	6.6%	3.0%	206,729
				Fiberglass Insulation	0.2%	0.1%	6,025
Plastic	**0.8%**		**24,611**	Remainder/Composite C&D	8.3%	1.9%	261,161
PETE Containers	0.0%	0.0%	363				
HDPE Containers	0.0%	0.0%	1,135	**Household Hazardous Waste**	**0.4%**		**11,459**
Misc. Plastic Containers	0.0%	0.0%	172	Paint	0.1%	0.1%	1,912
Trash Bags	0.0%	0.0%	1,064	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	73	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.1%	0.0%	2,255	Batteries	0.3%	0.5%	9,532
Film Products	0.1%	0.0%	2,654	Remainder/Composite HHW	0.0%	0.0%	15
Other Film	0.0%	0.0%	428				
Durable Plastic Items	0.2%	0.1%	7,270	**Special Waste**	**0.6%**		**19,446**
Expnd. Polystyr. Packaging/Insulation	0.1%	0.0%	2,024	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.2%	0.1%	7,174	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.6%	0.3%	17,974
				Tires	0.0%	0.0%	1,214
				Remainder/Composite Special	0.0%	0.0%	258
Totals	**100.0%**		**3,130,925**	**Mixed Residue**	**0.1%**		**1,880**
Sample Count	**622**			Mixed Residue	0.1%	0.1%	1,880

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Composition by Activity and Building Type Subsector

This section presents results for each of the seven subsectors.

New Residential Construction

Figure D presents the results for the new residential construction waste subsector. A total of 97 samples were characterized for this subsector. The portion of new residential construction waste that was found to be divertible was about 76 percent. Recyclable wood and other recoverable material each composed approximately 28 percent of this waste subsector, by weight. Recyclable aggregates; rock, dirt & sand; and recyclable metal were each 10 percent or less of the total, by weight.

Figure D. Overview of Waste Divertibility: New Residential Construction, 2005
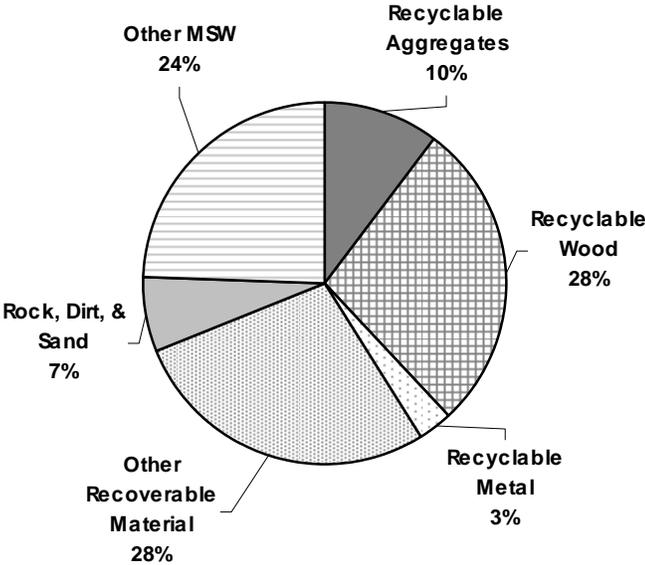
The top three individual materials in this waste subsector were divertible materials (Table 9). Clean gypsum board was the material that made up the largest percentage, accounting for nearly 17 percent of new residential construction waste, followed by clean engineered wood, and clean dimension lumber. Remainder/composite C&D made up approximately 9 percent of this waste, by weight. Remainder/composite C&D includes items such as synthetic counter tops, ceiling tiles, and mixtures of other C&D materials. Table 10 details the full composition results for the new residential construction waste subsector.

Table 9. Top Ten Disposed Materials: New Residential Construction, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Clean Gypsum Board	yes	16.5%	16.5%	51,555
Clean Engineered Wood	yes	13.0%	29.6%	40,684
Clean Dimensional Lumber	yes	11.3%	40.9%	35,139
Remainder/Composite C&D	no	9.1%	50.0%	28,481
Dirt & Sand	yes	6.3%	56.2%	19,522
Other Aggregates	yes	5.3%	61.6%	16,674
Remainder/Composite Paper	no	4.4%	66.0%	13,855
Composition Roofing	yes	4.0%	70.0%	12,451
Other Asphalt Roofing	no	3.0%	73.1%	9,435
Small Concrete without Re-bar	yes	2.8%	75.9%	8,719
Total		**75.9%**		**236,516**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 10. Detailed Waste Composition: New Residential Construction, 2005

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**8.6%**		**26,664**	**Organic**	**4.0%**		**12,429**
Uncoated Corrugated Cardboard	2.1%	0.7%	6,661	Food	0.0%	0.0%	105
Paper Bags/Kraft	0.1%	0.1%	377	Leaves & Grass	1.0%	0.7%	3,239
Newspaper	0.1%	0.1%	311	Prunings & Trimmings	0.6%	0.4%	1,967
White Ledger	0.0%	0.0%	115	Branches & Stumps	0.1%	0.1%	374
Colored Ledger	0.1%	0.1%	431	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	70	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	139	Textiles	0.2%	0.1%	525
Phone Books/Directories	0.0%	0.0%	0	Carpet	0.4%	0.3%	1,270
Other Misc. Paper	1.5%	0.8%	4,704	Carpet Padding	0.1%	0.0%	174
Remainder/Composite Paper	4.4%	2.8%	13,855	Remainder/Composite Organic	1.5%	1.2%	4,775
Glass	**0.3%**		**849**	**Construction & Demolition**	**82.2%**		**256,220**
Clear Glass Bottles & Containers	0.1%	0.1%	293	Lg Concrete with Re-bar	0.2%	0.3%	612
Green Glass Bottles & Containers	0.0%	0.0%	9	Lg Concrete without Re-bar	1.7%	1.1%	5,347
Brown Glass Bottles & Containers	0.0%	0.0%	97	Sm Concrete with Re-bar	0.2%	0.2%	604
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	2.8%	2.4%	8,719
Flat Glass	0.1%	0.1%	254	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	0.1%	0.1%	196	Lg Asphalt Pav. without Re-bar	0.0%	0.0%	0
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**3.1%**		**9,740**	Sm Asphalt Pav. without Re-bar	0.0%	0.0%	0
Tin/Steel Cans	0.1%	0.1%	231	Composition Roofing	4.0%	1.7%	12,451
Major Appliances	0.0%	0.1%	136	Other Asphalt Roofing	3.0%	4.0%	9,435
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	5.3%	3.5%	16,674
HVAC Ducting	0.1%	0.1%	167	Clean Dimensional Lumber	11.3%	3.4%	35,139
Other Ferrous	2.2%	0.7%	6,993	Clean Engineered Wood	13.0%	3.2%	40,684
Aluminum Cans	0.0%	0.0%	30	Pallets & Crates	2.4%	1.0%	7,429
Other Non-Ferrous	0.6%	0.6%	1,814	Other Recyclable Wood	1.2%	1.8%	3,860
Remainder/Composite Metal	0.1%	0.1%	368	Painted/Stained Wood	2.6%	1.6%	8,021
				Treated Wood	0.2%	0.2%	688
Electronics	**0.0%**		**42**	Clean Gypsum Board	16.5%	7.6%	51,555
Brown Goods	0.0%	0.0%	42	Painted/Demolition Gypsum Board	1.7%	1.7%	5,343
Computer-related Electronics	0.0%	0.0%	0	Large Rock	0.1%	0.1%	265
Other Small Consumer Electronics	0.0%	0.0%	0	Small Rock/Gravel	0.3%	0.3%	1,074
TV's & Other CRTs	0.0%	0.0%	0	Dirt & Sand	6.3%	4.4%	19,522
				Fiberglass Insulation	0.1%	0.0%	317
Plastic	**1.7%**		**5,443**	Remainder/Composite C&D	9.1%	3.9%	28,481
PETE Containers	0.0%	0.0%	76				
HDPE Containers	0.1%	0.0%	220	**Household Hazardous Waste**	**0.1%**		**167**
Misc. Plastic Containers	0.0%	0.0%	42	Paint	0.1%	0.1%	158
Trash Bags	0.1%	0.0%	206	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	24	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.2%	0.1%	773	Batteries	0.0%	0.0%	0
Film Products	0.2%	0.1%	551	Remainder/Composite HHW	0.0%	0.0%	9
Other Film	0.0%	0.0%	77				
Durable Plastic Items	0.6%	0.3%	1,977	**Special Waste**	**0.1%**		**263**
Expnd. Polystyr. Packaging/Insulation	0.2%	0.2%	738	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.2%	0.1%	759	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.1%	0.1%	236
				Tires	0.0%	0.0%	28
				Remainder/Composite Special	0.0%	0.0%	0
Totals	**100.0%**		**311,818**	**Mixed Residue**	**0.0%**		**0**
Sample Count	**97**			Mixed Residue	0.0%	0.0%	0

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

New Non-residential Construction

As presented in Figure E, roughly 86 percent of the material in the new non-residential construction waste subsector was estimated to be divertible. Most of this divertible material was recyclable aggregates (31 percent) and recyclable wood (24 percent). Other recoverable material made up about 17 percent of the total, by weight. Fifty-nine samples were characterized to calculate estimates for this waste subsector.

Figure E. Overview of Waste Divertibility: New Non-Residential Construction, 2005
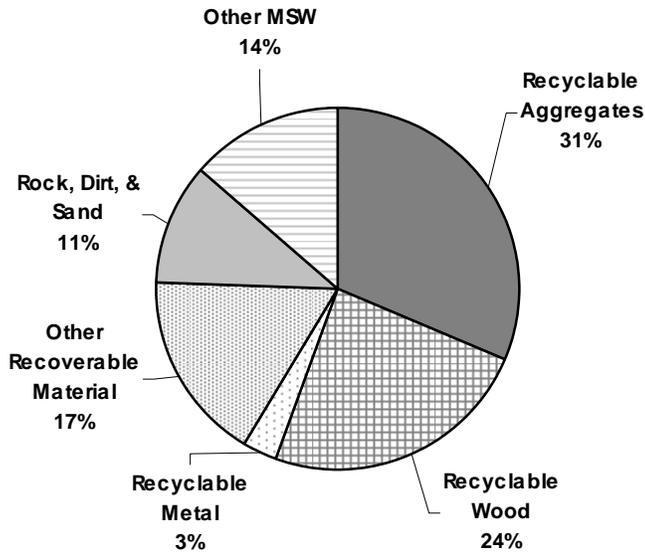
Table 11 lists the ten most prevalent individual materials in the new non-residential construction waste subsector. Other aggregates, clean dimensional lumber, and large concrete without re-bar each made up at least 10 percent of the total, by weight. All but one of the top ten materials, remainder/composite C&D, was considered to be divertible. Together, the nine divertible materials in the top ten list, when combined, composed approximately 73 percent of this waste subsector, by weight. Table 12 presents the composition results for all 86 material types for this waste subsector.

Table 11. Top Ten Disposed Materials: New Non-Residential Construction, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Other Aggregates	yes	11.5%	11.5%	29,258
Clean Dimensional Lumber	yes	10.9%	22.5%	27,804
Large Concrete without Re-bar	yes	10.8%	33.3%	27,560
Dirt & Sand	yes	9.2%	42.5%	23,273
Small Concrete without Re-bar	yes	8.7%	51.2%	22,177
Clean Engineered Wood	yes	7.4%	58.5%	18,681
Remainder/Composite C&D	no	7.0%	65.5%	17,671
Clean Gypsum Board	yes	6.6%	72.1%	16,709
Pallets & Crates	yes	5.4%	77.5%	13,791
Composition Roofing	yes	3.2%	80.7%	8,160
Total		**80.7%**		**205,083**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 12. Detailed Waste Composition: New Non-Residential Construction, 2005

Material	Est. Percent	+ / -	Est. Tons	Material	Est. Percent	+ / -	Est. Tons
Paper	**5.3%**		**13,414**	**Organic**	**2.7%**		**6,810**
Uncoated Corrugated Cardboard	1.7%	1.2%	4,333	Food	0.0%	0.0%	92
Paper Bags/Kraft	0.1%	0.1%	272	Leaves & Grass	0.9%	0.7%	2,247
Newspaper	0.1%	0.1%	177	Prunings & Trimmings	0.6%	0.5%	1,440
White Ledger	0.1%	0.1%	152	Branches & Stumps	0.2%	0.3%	390
Colored Ledger	0.0%	0.0%	87	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	79	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	42	Textiles	0.2%	0.2%	431
Phone Books/Directories	0.0%	0.0%	0	Carpet	0.7%	0.6%	1,683
Other Misc. Paper	1.2%	0.8%	3,034	Carpet Padding	0.1%	0.1%	215
Remainder/Composite Paper	2.1%	0.9%	5,237	Remainder/Composite Organic	0.1%	0.1%	313
Glass	**0.9%**		**2,247**	**Construction & Demolition**	**85.9%**		**218,383**
Clear Glass Bottles & Containers	0.2%	0.3%	564	Lg Concrete with Re-bar	0.2%	0.3%	404
Green Glass Bottles & Containers	0.2%	0.3%	632	Lg Concrete without Re-bar	10.8%	5.4%	27,560
Brown Glass Bottles & Containers	0.2%	0.3%	466	Sm Concrete with Re-bar	0.0%	0.0%	0
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	8.7%	4.9%	22,177
Flat Glass	0.1%	0.1%	232	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	0.1%	0.2%	353	Lg Asphalt Pav. without Re-bar	0.2%	0.2%	458
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**3.6%**		**9,256**	Sm Asphalt Pav. without Re-bar	0.0%	0.0%	0
Tin/Steel Cans	0.0%	0.0%	19	Composition Roofing	3.2%	4.6%	8,160
Major Appliances	0.0%	0.0%	0	Other Asphalt Roofing	0.0%	0.0%	0
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	11.5%	11.8%	29,258
HVAC Ducting	0.0%	0.1%	97	Clean Dimensional Lumber	10.9%	4.9%	27,804
Other Ferrous	3.1%	1.6%	7,887	Clean Engineered Wood	7.4%	2.8%	18,681
Aluminum Cans	0.0%	0.0%	11	Pallets & Crates	5.4%	2.2%	13,791
Other Non-Ferrous	0.0%	0.0%	76	Other Recyclable Wood	0.4%	0.5%	894
Remainder/Composite Metal	0.5%	0.4%	1,166	Painted/Stained Wood	2.1%	1.6%	5,387
				Treated Wood	0.3%	0.2%	637
Electronics	**0.3%**		**675**	Clean Gypsum Board	6.6%	3.8%	16,709
Brown Goods	0.0%	0.0%	0	Painted/Demolition Gypsum Board	0.3%	0.3%	776
Computer-related Electronics	0.0%	0.0%	49	Large Rock	0.9%	1.1%	2,396
Other Small Consumer Electronics	0.2%	0.3%	541	Small Rock/Gravel	0.6%	0.7%	1,519
TV's & Other CRTs	0.0%	0.1%	85	Dirt & Sand	9.2%	9.2%	23,273
				Fiberglass Insulation	0.3%	0.4%	831
Plastic	**0.8%**		**2,044**	Remainder/Composite C&D	7.0%	2.9%	17,671
PETE Containers	0.0%	0.0%	41				
HDPE Containers	0.1%	0.0%	134	**Household Hazardous Waste**	**0.0%**		**48**
Misc. Plastic Containers	0.0%	0.0%	19	Paint	0.0%	0.0%	0
Trash Bags	0.0%	0.0%	108	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	33	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.1%	0.1%	222	Batteries	0.0%	0.0%	48
Film Products	0.2%	0.1%	429	Remainder/Composite HHW	0.0%	0.0%	0
Other Film	0.0%	0.0%	48				
Durable Plastic Items	0.2%	0.1%	536	**Special Waste**	**0.5%**		**1,214**
Expnd. Polystyr. Packaging/Insulation	0.0%	0.0%	83	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.2%	0.1%	393	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.3%	0.3%	797
				Tires	0.2%	0.3%	417
				Remainder/Composite Special	0.0%	0.0%	0
Totals	**100.0%**		**254,091**	**Mixed Residue**	**0.0%**		**0**
Sample Count	**59**			Mixed Residue	0.0%	0.0%	0

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Residential Remodel

Figure F presents the results for residential remodel waste according to divertibility category. A total of 167 loads were visually characterized to calculate the waste composition estimates shown below. Approximately 36 percent of the waste in this waste subsector was estimated to be other MSW. Of the material that was found to be divertible, recyclable aggregates (19 percent), other recoverable material (18 percent), and recyclable wood (12 percent) were the largest categories.

Figure F. Overview of Waste Divertibility: Residential Remodel, 2005
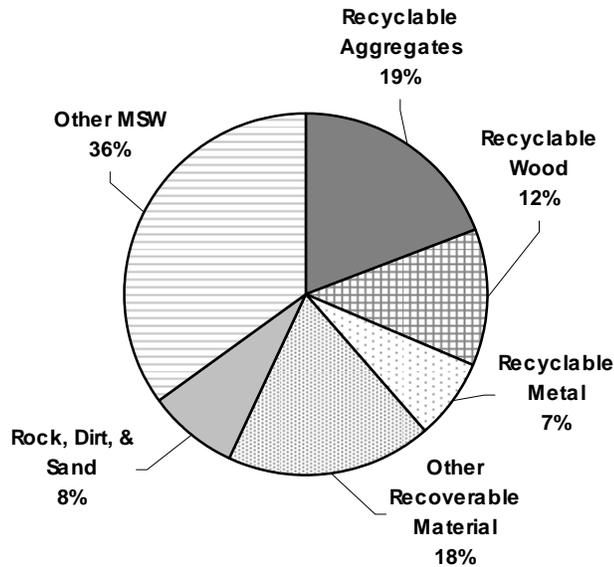
Three of the top five individual materials in the top ten table for residential remodel were not divertible: painted/stained wood (9.6 percent), remainder/composite C&D (8.9 percent), and painted/demolition gypsum board (6.9 percent). Other aggregates and clean dimensional lumber each accounted for between 7 percent and 8 percent of the total, by weight. Table 14 presents the full composition results for this waste subsector.

Table 13. Top Ten Disposed Materials: Residential Remodel, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Painted/Stained Wood	no	9.6%	9.6%	57,775
Remainder/Composite C&D	no	8.9%	18.5%	53,795
Other Aggregates	yes	7.5%	25.9%	45,080
Clean Dimensional Lumber	yes	7.0%	32.9%	42,177
Painted/Demolition Gypsum Board	no	6.9%	39.8%	41,843
Clean Gypsum Board	yes	6.6%	46.4%	39,607
Composition Roofing	yes	4.9%	51.3%	29,756
Dirt & Sand	yes	4.5%	55.8%	27,424
Small Concrete without Re-bar	yes	4.3%	60.1%	25,762
Large Concrete without Re-bar	yes	4.2%	64.2%	25,116
Total		**64.2%**		**388,335**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 14. Detailed Waste Composition: Residential Remodel, 2005

| Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**3.8%**		**23,018**	**Organic**	**4.2%**		**25,642**
Uncoated Corrugated Cardboard	0.6%	0.2%	3,362	Food	0.1%	0.1%	383
Paper Bags/Kraft	0.0%	0.0%	94	Leaves & Grass	0.7%	0.5%	4,368
Newspaper	0.2%	0.1%	1,079	Prunings & Trimmings	0.5%	0.2%	3,307
White Ledger	0.0%	0.0%	104	Branches & Stumps	0.2%	0.2%	1,217
Colored Ledger	0.0%	0.0%	160	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	82	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.1%	0.1%	379	Textiles	0.4%	0.2%	2,403
Phone Books/Directories	0.0%	0.0%	27	Carpet	1.7%	0.7%	10,523
Other Misc. Paper	1.1%	0.7%	6,699	Carpet Padding	0.4%	0.2%	2,687
Remainder/Composite Paper	1.8%	2.1%	11,031	Remainder/Composite Organic	0.1%	0.1%	754
Glass	**2.7%**		**16,420**	**Construction & Demolition**	**77.1%**		**466,272**
Clear Glass Bottles & Containers	0.1%	0.0%	308	Lg Concrete with Re-bar	1.3%	1.2%	8,065
Green Glass Bottles & Containers	0.0%	0.0%	82	Lg Concrete without Re-bar	4.2%	2.5%	25,116
Brown Glass Bottles & Containers	0.0%	0.0%	146	Sm Concrete with Re-bar	0.5%	0.7%	2,975
Other Colored Glass Bottles & Containers	0.0%	0.0%	3	Sm Concrete without Re-bar	4.3%	2.0%	25,762
Flat Glass	1.1%	1.4%	6,517	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	1.5%	1.0%	9,364	Lg Asphalt Pav. without Re-bar	1.0%	1.1%	5,756
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**8.3%**		**50,459**	Sm Asphalt Pav. without Re-bar	0.6%	0.8%	3,696
Tin/Steel Cans	0.0%	0.0%	185	Composition Roofing	4.9%	2.0%	29,756
Major Appliances	3.2%	3.9%	19,362	Other Asphalt Roofing	0.2%	0.1%	1,054
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	7.5%	4.0%	45,080
HVAC Ducting	0.1%	0.1%	794	Clean Dimensional Lumber	7.0%	1.8%	42,177
Other Ferrous	3.5%	2.6%	20,945	Clean Engineered Wood	3.9%	1.2%	23,643
Aluminum Cans	0.0%	0.0%	15	Pallets & Crates	0.9%	0.6%	5,451
Other Non-Ferrous	0.5%	0.2%	3,048	Other Recyclable Wood	0.3%	0.4%	1,881
Remainder/Composite Metal	1.0%	0.7%	6,111	Painted/Stained Wood	9.6%	3.0%	57,775
				Treated Wood	0.3%	0.2%	1,585
Electronics	**0.6%**		**3,600**	Clean Gypsum Board	6.6%	4.0%	39,607
Brown Goods	0.1%	0.0%	318	Painted/Demolition Gypsum Board	6.9%	2.7%	41,843
Computer-related Electronics	0.0%	0.0%	34	Large Rock	2.5%	2.1%	15,201
Other Small Consumer Electronics	0.1%	0.2%	824	Small Rock/Gravel	1.1%	0.9%	6,674
TV's & Other CRTs	0.4%	0.6%	2,424	Dirt & Sand	4.5%	5.2%	27,424
				Fiberglass Insulation	0.3%	0.2%	1,956
Plastic	**1.0%**		**6,086**	Remainder/Composite C&D	8.9%	2.2%	53,795
PETE Containers	0.0%	0.0%	49				
HDPE Containers	0.1%	0.0%	317	**Household Hazardous Waste**	**0.2%**		**918**
Misc. Plastic Containers	0.0%	0.0%	65	Paint	0.1%	0.1%	692
Trash Bags	0.0%	0.0%	192	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	7	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.0%	0.0%	222	Batteries	0.0%	0.1%	221
Film Products	0.1%	0.0%	459	Remainder/Composite HHW	0.0%	0.0%	6
Other Film	0.0%	0.0%	144				
Durable Plastic Items	0.4%	0.2%	2,252	**Special Waste**	**2.0%**		**12,185**
Expnd. Polystyr. Packaging/Insulation	0.0%	0.0%	293	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.3%	0.3%	2,086	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	1.9%	1.5%	11,210
				Tires	0.1%	0.2%	761
				Remainder/Composite Special	0.0%	0.1%	213
Totals	**100.0%**		**604,627**	**Mixed Residue**	**0.0%**		**28**
Sample Count	**167**			Mixed Residue	0.0%	0.0%	28

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Non-residential Remodel

Figure G presents the composition results for non-residential remodel according to divertibility category, which resulted from the characterization of 86 loads. About two-thirds of the non-residential remodel waste was found to be divertible. Recyclable aggregates and other recoverable material each made up between 23 percent and 24 percent of the total.

Figure G. Overview of Waste Divertibility: Non-residential Remodel, 2005
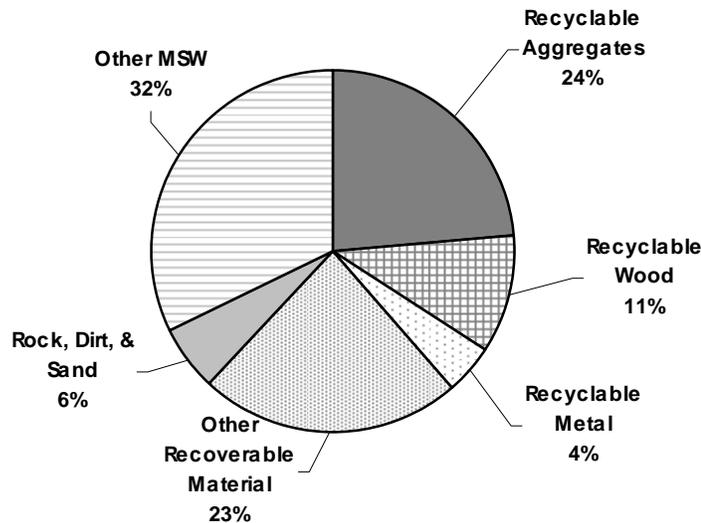
As seen in Table 15, the ten most prevalent individual material types made up approximately 76 percent of the non-residential remodel waste. The most prevalent material was a divertible material, other aggregates, accounting for about 19 percent, followed by a non-divertible material, remainder/composite C&D waste, which made up about 16 percent of the total, by weight. Clean gypsum board, composition roofing, and dirt & sand were each between 6 percent and 8 percent. Full composition results for this subsector can be found in Table 16.

Table 15. Top Ten Disposed Materials: Non-Residential Remodel, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Other Aggregates	yes	19.0%	19.0%	64,863
Remainder/Composite C&D	no	15.8%	34.8%	53,821
Clean Gypsum Board	yes	8.1%	42.9%	27,524
Composition Roofing	yes	6.1%	48.9%	20,730
Dirt & Sand	yes	5.9%	54.8%	20,053
Clean Dimensional Lumber	yes	5.3%	60.1%	18,174
Other Asphalt Roofing	no	4.7%	64.9%	16,202
Painted/Demolition Gypsum Board	no	4.7%	69.6%	15,906
Clean Engineered Wood	yes	3.6%	73.2%	12,424
Other Ferrous Metal	yes	3.1%	76.3%	10,635
Total		**76.3%**		**260,333**

The figures, when added together, may not exactly match the totals shown, due to rounding.

**Table 16. Detailed Waste Composition: Non-Residential Remodel, 2005**

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**4.2%**		**14,399**	**Organic**	**3.2%**		**10,976**
Uncoated Corrugated Cardboard	1.1%	0.7%	3,777	Food	0.0%	0.0%	9
Paper Bags/Kraft	0.0%	0.0%	90	Leaves & Grass	0.7%	1.1%	2,348
Newspaper	0.7%	0.9%	2,257	Prunings & Trimmings	0.1%	0.1%	415
White Ledger	0.0%	0.0%	28	Branches & Stumps	0.1%	0.1%	300
Colored Ledger	0.0%	0.0%	38	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	7	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	1	Textiles	0.3%	0.3%	872
Phone Books/Directories	0.0%	0.0%	0	Carpet	1.7%	0.9%	5,636
Other Misc. Paper	0.8%	0.6%	2,718	Carpet Padding	0.3%	0.3%	866
Remainder/Composite Paper	1.6%	1.7%	5,482	Remainder/Composite Organic	0.2%	0.2%	530
Glass	**0.2%**		**712**	**Construction & Demolition**	**82.2%**		**280,517**
Clear Glass Bottles & Containers	0.1%	0.1%	292	Lg Concrete with Re-bar	0.3%	0.3%	1,103
Green Glass Bottles & Containers	0.0%	0.0%	15	Lg Concrete without Re-bar	0.7%	0.6%	2,282
Brown Glass Bottles & Containers	0.0%	0.0%	24	Sm Concrete with Re-bar	0.9%	1.1%	3,067
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	1.2%	0.9%	4,107
Flat Glass	0.0%	0.0%	0	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	0.1%	0.1%	381	Lg Asphalt Pav. without Re-bar	1.3%	2.0%	4,494
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**4.9%**		**16,708**	Sm Asphalt Pav. without Re-bar	0.2%	0.2%	635
Tin/Steel Cans	0.0%	0.0%	7	Composition Roofing	6.1%	5.1%	20,730
Major Appliances	0.2%	0.3%	735	Other Asphalt Roofing	4.7%	7.2%	16,202
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	19.0%	16.1%	64,863
HVAC Ducting	0.1%	0.1%	236	Clean Dimensional Lumber	5.3%	1.9%	18,174
Other Ferrous	3.1%	1.0%	10,635	Clean Engineered Wood	3.6%	1.5%	12,424
Aluminum Cans	0.0%	0.0%	17	Pallets & Crates	1.4%	0.7%	4,907
Other Non-Ferrous	1.0%	0.8%	3,554	Other Recyclable Wood	0.2%	0.3%	783
Remainder/Composite Metal	0.4%	0.3%	1,524	Painted/Stained Wood	2.5%	0.9%	8,538
				Treated Wood	0.0%	0.0%	75
Electronics	**0.0%**		**133**	Clean Gypsum Board	8.1%	6.2%	27,524
Brown Goods	0.0%	0.0%	0	Painted/Demolition Gypsum Board	4.7%	3.5%	15,906
Computer-related Electronics	0.0%	0.0%	133	Large Rock	0.0%	0.0%	0
Other Small Consumer Electronics	0.0%	0.0%	0	Small Rock/Gravel	0.1%	0.1%	292
TV's & Other CRTs	0.0%	0.0%	0	Dirt & Sand	5.9%	4.3%	20,053
				Fiberglass Insulation	0.2%	0.1%	538
Plastic	**1.3%**		**4,476**	Remainder/Composite C&D	15.8%	5.4%	53,821
PETE Containers	0.0%	0.0%	87				
HDPE Containers	0.1%	0.0%	171	**Household Hazardous Waste**	**3.0%**		**10,318**
Misc. Plastic Containers	0.0%	0.0%	4	Paint	0.3%	0.5%	1,055
Trash Bags	0.0%	0.0%	161	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	7	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.2%	0.2%	698	Batteries	2.7%	4.3%	9,263
Film Products	0.2%	0.2%	545	Remainder/Composite HHW	0.0%	0.0%	0
Other Film	0.0%	0.0%	33				
Durable Plastic Items	0.1%	0.1%	379	**Special Waste**	**0.8%**		**2,869**
Expnd. Polystyr. Packaging/Insulation	0.2%	0.2%	663	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.5%	0.5%	1,728	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.8%	0.9%	2,869
				Tires	0.0%	0.0%	0
				Remainder/Composite Special	0.0%	0.0%	0
Totals	**100.0%**		**341,108**	**Mixed Residue**	**0.0%**		**0**
Sample Count	**86**			Mixed Residue	0.0%	0.0%	0

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Demolition

The results for demolition waste are presented by divertibility category in Figure H. Eighty loads of demolition waste were characterized for the study. Other MSW made up about 31 percent of this waste. Divertible materials consisted mostly of recyclable aggregates (23 percent) and recyclable wood (18 percent).

Figure H. Overview of Waste Divertibility: Demolition, 2005
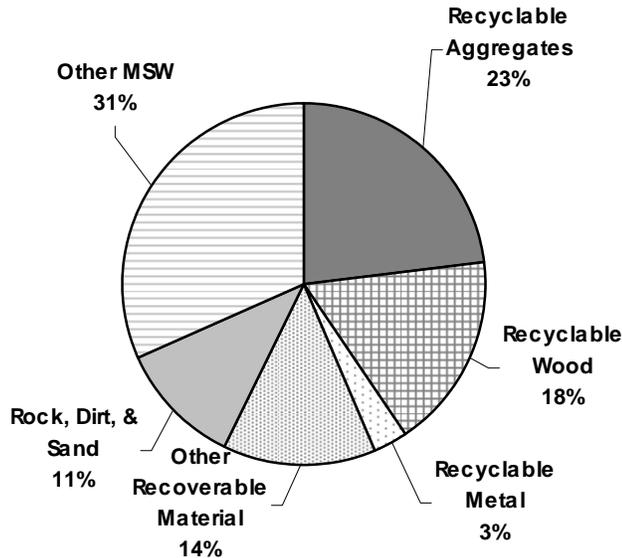
Table 17 shows the composition results for the top ten materials in the demolition waste subsector. Remainder/composite C&D (12.0 percent) was the single most prominent material type, followed by dirt & sand (10.6 percent). Painted/stained wood and large concrete without re-bar each made up between 8 percent and 9 percent of the total, by weight. The top ten material types made up approximately 75 percent of all demo waste, while the divertible material types in this list accounted for 49 percent. Table 18 presents the full composition results for the demolition waste subsector.

Table 17. Top Ten Disposed Materials: Demolition, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Remainder/Composite C&D	no	12.0%	12.0%	75,944
Dirt & Sand	yes	10.6%	22.6%	67,340
Painted/Stained Wood	no	8.9%	31.5%	56,046
Large Concrete without Re-bar	yes	8.2%	39.7%	51,791
Composition Roofing	yes	7.0%	46.7%	44,303
Other Recyclable Wood	yes	6.8%	53.5%	43,136
Small Concrete without Re-bar	yes	6.3%	59.8%	39,632
Clean Dimensional Lumber	yes	6.3%	66.0%	39,624
Painted/Demolition Gypsum Board	no	5.5%	71.5%	34,660
Other Aggregates	yes	3.8%	75.3%	23,805
Total		**75.3%**		**476,279**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 18. Detailed Waste Composition: Demolition, 2005

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**3.0%**		**18,990**	**Organic**	**4.6%**		**28,903**
Uncoated Corrugated Cardboard	0.8%	0.7%	5,126	Food	0.0%	0.0%	119
Paper Bags/Kraft	0.5%	0.8%	2,917	Leaves & Grass	0.1%	0.1%	586
Newspaper	0.3%	0.4%	1,753	Prunings & Trimmings	0.7%	0.8%	4,544
White Ledger	0.3%	0.5%	2,077	Branches & Stumps	0.0%	0.0%	149
Colored Ledger	0.3%	0.5%	2,056	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	65	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	6	Textiles	0.0%	0.0%	260
Phone Books/Directories	0.0%	0.0%	2	Carpet	1.9%	2.0%	12,217
Other Misc. Paper	0.6%	0.5%	3,956	Carpet Padding	0.4%	0.5%	2,590
Remainder/Composite Paper	0.2%	0.1%	1,032	Remainder/Composite Organic	1.3%	2.1%	8,438
Glass	**0.5%**		**2,866**	**Construction & Demolition**	**87.5%**		**553,612**
Clear Glass Bottles & Containers	0.0%	0.1%	284	Lg Concrete with Re-bar	1.0%	0.9%	6,214
Green Glass Bottles & Containers	0.0%	0.0%	0	Lg Concrete without Re-bar	8.2%	5.0%	51,791
Brown Glass Bottles & Containers	0.0%	0.0%	120	Sm Concrete with Re-bar	2.2%	2.8%	13,755
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	6.3%	3.3%	39,632
Flat Glass	0.3%	0.4%	1,670	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	0.1%	0.1%	792	Lg Asphalt Pav. without Re-bar	1.4%	2.2%	8,714
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**3.2%**		**20,400**	Sm Asphalt Pav. without Re-bar	0.4%	0.7%	2,614
Tin/Steel Cans	0.0%	0.0%	53	Composition Roofing	7.0%	5.1%	44,303
Major Appliances	0.0%	0.0%	223	Other Asphalt Roofing	0.4%	0.5%	2,428
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	3.8%	3.7%	23,805
HVAC Ducting	0.0%	0.0%	42	Clean Dimensional Lumber	6.3%	2.6%	39,624
Other Ferrous	2.5%	1.0%	16,090	Clean Engineered Wood	2.8%	1.5%	17,980
Aluminum Cans	0.0%	0.0%	48	Pallets & Crates	1.6%	1.2%	10,178
Other Non-Ferrous	0.2%	0.2%	1,447	Other Recyclable Wood	6.8%	5.5%	43,136
Remainder/Composite Metal	0.4%	0.5%	2,498	Painted/Stained Wood	8.9%	4.9%	56,046
				Treated Wood	0.8%	0.7%	5,066
Electronics	**0.2%**		**1,010**	Clean Gypsum Board	0.7%	0.5%	4,493
Brown Goods	0.0%	0.0%	29	Painted/Demolition Gypsum Board	5.5%	3.3%	34,660
Computer-related Electronics	0.1%	0.1%	611	Large Rock	0.0%	0.0%	0
Other Small Consumer Electronics	0.0%	0.0%	0	Small Rock/Gravel	0.6%	0.9%	3,849
TV's & Other CRTs	0.1%	0.1%	370	Dirt & Sand	10.6%	12.7%	67,340
				Fiberglass Insulation	0.3%	0.4%	2,041
Plastic	**0.4%**		**2,837**	Remainder/Composite C&D	12.0%	7.9%	75,944
PETE Containers	0.0%	0.0%	32				
HDPE Containers	0.0%	0.0%	179	**Household Hazardous Waste**	**0.0%**		**0**
Misc. Plastic Containers	0.0%	0.0%	14	Paint	0.0%	0.0%	0
Trash Bags	0.0%	0.0%	268	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	1	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.0%	0.0%	69	Batteries	0.0%	0.0%	0
Film Products	0.0%	0.0%	286	Remainder/Composite HHW	0.0%	0.0%	0
Other Film	0.0%	0.0%	59				
Durable Plastic Items	0.1%	0.1%	655	**Special Waste**	**0.4%**		**2,252**
Expnd. Polystyr. Packaging/Insulation	0.0%	0.0%	47	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.2%	0.2%	1,226	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.3%	0.4%	2,207
				Tires	0.0%	0.0%	0
				Remainder/Composite Special	0.0%	0.0%	45
Totals	**100.0%**		**632,722**	**Mixed Residue**	**0.3%**		**1,852**
Sample Count	**80**			Mixed Residue	0.3%	0.3%	1,852

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Roofing

The overview of composition results by divertibility category are presented in Figure I. Ninety-five loads of roofing waste were visually sampled for the study. Slightly more than two-thirds of this waste is estimated to be divertible. The largest divertibility category was other recoverable material, which made up about 45 percent of the total. Recyclable wood accounted for approximately 13 percent of roofing subsector waste.

Figure I. Overview of Waste Divertibility: Roofing, 2005
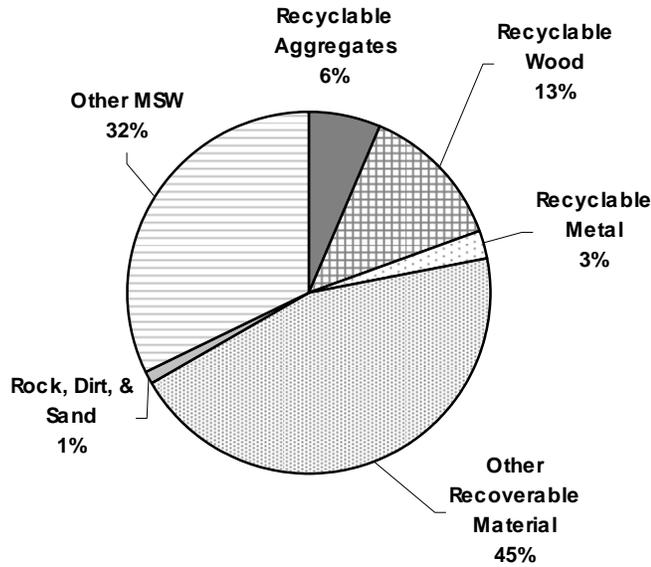
The ten most prevalent material types are presented below in Table 19. Composition roofing was the single most common material, accounting for approximately 44 percent of the total, by weight. The second most prevalent material type, other asphalt roofing, made up about 24 percent of this waste, by weight. The remainder of the materials each made up less than 10 percent of the total. When combined, the top ten materials made up almost 96 percent of the roofing waste. Full composition results are presented on the following page in Table 20.

Table 19. Top Ten Disposed Materials: Roofing, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Composition Roofing	yes	43.5%	43.5%	196,664
Other Asphalt Roofing	no	23.8%	67.2%	107,464
Other Recyclable Wood	yes	9.3%	76.5%	41,900
Remainder/Composite C&D	no	5.0%	81.5%	22,619
Small Concrete without Re-bar	yes	3.4%	84.8%	15,170
Other Aggregates	yes	2.7%	87.6%	12,412
Clean Engineered Wood	yes	2.6%	90.2%	11,842
Flat Glass	no	2.4%	92.6%	10,942
Other Ferrous Metal	yes	1.9%	94.6%	8,811
Small Rock/Gravel	yes	1.0%	95.6%	4,600
Total		**95.6%**		**432,422**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 20. Detailed Waste Composition: Roofing, 2005

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**0.5%**		**2,417**	**Organic**	**0.9%**		**4,284**
Uncoated Corrugated Cardboard	0.0%	0.0%	209	Food	0.0%	0.0%	0
Paper Bags/Kraft	0.0%	0.0%	10	Leaves & Grass	0.4%	0.7%	1,997
Newspaper	0.0%	0.0%	31	Prunings & Trimmings	0.4%	0.6%	1,881
White Ledger	0.0%	0.0%	2	Branches & Stumps	0.0%	0.0%	63
Colored Ledger	0.0%	0.0%	2	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	1	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	9	Textiles	0.0%	0.0%	128
Phone Books/Directories	0.0%	0.0%	0	Carpet	0.0%	0.1%	153
Other Misc. Paper	0.2%	0.1%	723	Carpet Padding	0.0%	0.0%	29
Remainder/Composite Paper	0.3%	0.4%	1,429	Remainder/Composite Organic	0.0%	0.0%	34
Glass	**2.4%**		**10,959**	**Construction & Demolition**	**93.1%**		**421,282**
Clear Glass Bottles & Containers	0.0%	0.0%	17	Lg Concrete with Re-bar	0.0%	0.0%	0
Green Glass Bottles & Containers	0.0%	0.0%	0	Lg Concrete without Re-bar	0.2%	0.2%	977
Brown Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete with Re-bar	0.0%	0.0%	0
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	3.4%	4.3%	15,170
Flat Glass	2.4%	3.1%	10,942	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	0.0%	0.0%	0	Lg Asphalt Pav. without Re-bar	0.0%	0.0%	0
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**2.6%**		**11,642**	Sm Asphalt Pav. without Re-bar	0.0%	0.0%	0
Tin/Steel Cans	0.0%	0.0%	138	Composition Roofing	43.5%	10.3%	196,664
Major Appliances	0.0%	0.0%	30	Other Asphalt Roofing	23.8%	10.8%	107,464
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	2.7%	3.4%	12,412
HVAC Ducting	0.5%	0.5%	2,234	Clean Dimensional Lumber	1.0%	0.5%	4,319
Other Ferrous	1.9%	1.3%	8,811	Clean Engineered Wood	2.6%	1.6%	11,842
Aluminum Cans	0.0%	0.0%	25	Pallets & Crates	0.2%	0.2%	924
Other Non-Ferrous	0.1%	0.0%	322	Other Recyclable Wood	9.3%	3.3%	41,900
Remainder/Composite Metal	0.0%	0.0%	82	Painted/Stained Wood	0.5%	0.4%	2,260
				Treated Wood	0.0%	0.0%	26
Electronics	**0.0%**		**206**	Clean Gypsum Board	0.0%	0.0%	37
Brown Goods	0.0%	0.0%	0	Painted/Demolition Gypsum Board	0.0%	0.0%	27
Computer-related Electronics	0.0%	0.0%	0	Large Rock	0.0%	0.0%	0
Other Small Consumer Electronics	0.0%	0.0%	22	Small Rock/Gravel	1.0%	1.4%	4,600
TV's & Other CRTs	0.0%	0.1%	184	Dirt & Sand	0.0%	0.0%	18
				Fiberglass Insulation	0.0%	0.0%	24
Plastic	**0.3%**		**1,288**	Remainder/Composite C&D	5.0%	3.3%	22,619
PETE Containers	0.0%	0.0%	20				
HDPE Containers	0.0%	0.0%	48	**Household Hazardous Waste**	**0.0%**		**7**
Misc. Plastic Containers	0.0%	0.0%	2	Paint	0.0%	0.0%	7
Trash Bags	0.0%	0.0%	27	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	1	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.0%	0.0%	187	Batteries	0.0%	0.0%	0
Film Products	0.0%	0.0%	152	Remainder/Composite HHW	0.0%	0.0%	0
Other Film	0.0%	0.0%	58				
Durable Plastic Items	0.0%	0.0%	19	**Special Waste**	**0.1%**		**383**
Expnd. Polystyr. Packaging/Insulation	0.0%	0.0%	123	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.1%	0.1%	649	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.1%	0.1%	383
				Tires	0.0%	0.0%	0
				Remainder/Composite Special	0.0%	0.0%	0
Totals	**100.0%**		**452,468**	**Mixed Residue**	**0.0%**		**0**
Sample Count	**95**			Mixed Residue	0.0%	0.0%	0

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Other C&D

The overview of composition results for the waste generated by the other C&D subsector is presented in Figure J. Thirty-eight samples were characterized from this waste subsector. Examples of these activities include building, remodeling, and/or demolition of roads and bridges. Approximately 93 percent of this material was estimated to be divertible. The vast majority of this waste, about 69 percent, was composed of recyclable aggregates.

Figure J. Overview of Waste Divertibility: Other C&D, 2005
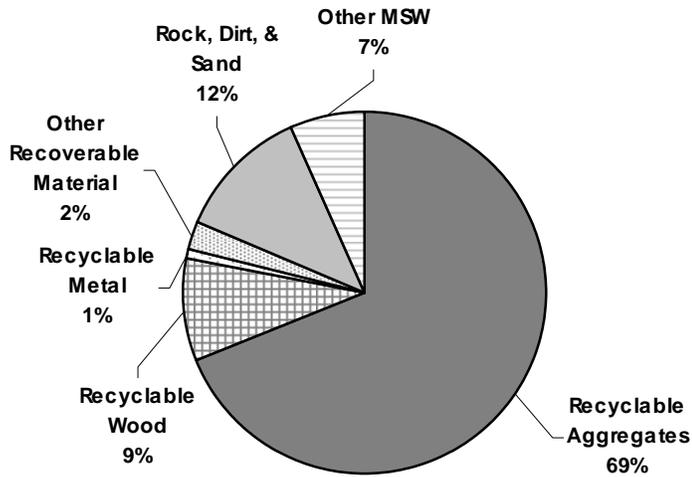
The ten most prevalent materials for other C&D are shown in Table 21. Nine of the top ten materials for other C&D waste were considered divertible; only painted/demolition gypsum board (2.5 percent) was not. The most prominent single material type, accounting for about 44 percent of the total, was large asphalt pavement without re-bar. All other material types in this waste subsector accounted for less than 10 percent of other C&D waste.

Table 22 presents the detailed waste composition results for the other C&D subsector.

Table 21. Top Ten Disposed Materials: Other C&D, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Large Asphalt Pavement without Re-bar	yes	43.8%	43.8%	233,864
Large Concrete without Re-bar	yes	9.4%	53.2%	50,410
Dirt & Sand	yes	9.2%	62.4%	49,099
Small Asphalt Pavement without Re-bar	yes	5.5%	67.9%	29,170
Small Asphalt Pavement with Re-bar	yes	4.1%	72.0%	22,022
Small Concrete without Re-bar	yes	3.6%	75.6%	19,031
Clean Dimensional Lumber	yes	3.4%	78.9%	18,039
Clean Engineered Wood	yes	2.8%	81.7%	14,721
Painted/Demolition Gypsum Board	no	2.5%	84.2%	13,405
Pallets & Crates	yes	2.4%	86.6%	12,756
Total		**86.6%**		**462,517**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 22. Detailed Waste Composition: Other C&D, 2005

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**0.5%**		**2,848**	**Organic**	**0.7%**		**3,513**
Uncoated Corrugated Cardboard	0.2%	0.2%	900	Food	0.0%	0.0%	0
Paper Bags/Kraft	0.0%	0.0%	66	Leaves & Grass	0.4%	0.5%	2,282
Newspaper	0.0%	0.0%	55	Prunings & Trimmings	0.1%	0.0%	284
White Ledger	0.0%	0.1%	226	Branches & Stumps	0.0%	0.0%	21
Colored Ledger	0.0%	0.0%	21	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	32	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	0	Textiles	0.0%	0.0%	97
Phone Books/Directories	0.0%	0.0%	0	Carpet	0.1%	0.2%	519
Other Misc. Paper	0.1%	0.1%	558	Carpet Padding	0.0%	0.1%	206
Remainder/Composite Paper	0.2%	0.1%	990	Remainder/Composite Organic	0.0%	0.0%	105
Glass	**0.0%**		**1**	**Construction & Demolition**	**97.1%**		**518,497**
Clear Glass Bottles & Containers	0.0%	0.0%	1	Lg Concrete with Re-bar	0.5%	0.7%	2,910
Green Glass Bottles & Containers	0.0%	0.0%	0	Lg Concrete without Re-bar	9.4%	7.5%	50,410
Brown Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete with Re-bar	0.5%	0.6%	2,732
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	3.6%	3.2%	19,031
Flat Glass	0.0%	0.0%	0	Lg Asphalt Pav. with Re-bar	0.1%	0.2%	719
Remainder/Composite Glass	0.0%	0.0%	0	Lg Asphalt Pav. without Re-bar	43.8%	17.3%	233,864
				Sm Asphalt Pav. with Re-bar	4.1%	5.6%	22,022
Metal	**1.2%**		**6,515**	Sm Asphalt Pav. without Re-bar	5.5%	7.3%	29,170
Tin/Steel Cans	0.0%	0.0%	12	Composition Roofing	1.2%	1.5%	6,432
Major Appliances	0.0%	0.0%	0	Other Asphalt Roofing	0.0%	0.1%	172
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	1.4%	1.8%	7,452
HVAC Ducting	0.0%	0.0%	0	Clean Dimensional Lumber	3.4%	2.7%	18,039
Other Ferrous	0.7%	0.9%	3,748	Clean Engineered Wood	2.8%	2.8%	14,721
Aluminum Cans	0.0%	0.0%	15	Pallets & Crates	2.4%	2.6%	12,756
Other Non-Ferrous	0.2%	0.4%	1,331	Other Recyclable Wood	0.6%	0.9%	3,081
Remainder/Composite Metal	0.3%	0.3%	1,408	Painted/Stained Wood	1.4%	1.5%	7,306
				Treated Wood	0.0%	0.1%	177
Electronics	**0.0%**		**0**	Clean Gypsum Board	0.1%	0.1%	424
Brown Goods	0.0%	0.0%	0	Painted/Demolition Gypsum Board	2.5%	4.7%	13,405
Computer-related Electronics	0.0%	0.0%	0	Large Rock	1.9%	2.2%	10,201
Other Small Consumer Electronics	0.0%	0.0%	0	Small Rock/Gravel	1.0%	0.8%	5,228
TV's & Other CRTs	0.0%	0.0%	0	Dirt & Sand	9.2%	4.8%	49,099
				Fiberglass Insulation	0.1%	0.1%	318
Plastic	**0.5%**		**2,437**	Remainder/Composite C&D	1.7%	1.8%	8,829
PETE Containers	0.0%	0.0%	57				
HDPE Containers	0.0%	0.0%	66	**Household Hazardous Waste**	**0.0%**		**0**
Misc. Plastic Containers	0.0%	0.0%	25	Paint	0.0%	0.0%	0
Trash Bags	0.0%	0.0%	102	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	0	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.0%	0.0%	84	Batteries	0.0%	0.0%	0
Film Products	0.0%	0.1%	231	Remainder/Composite HHW	0.0%	0.0%	0
Other Film	0.0%	0.0%	8				
Durable Plastic Items	0.3%	0.3%	1,452	**Special Waste**	**0.1%**		**279**
Expnd. Polystyr. Packaging/Insulation	0.0%	0.0%	77	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.1%	0.1%	334	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.1%	0.1%	271
				Tires	0.0%	0.0%	8
				Remainder/Composite Special	0.0%	0.0%	0
Totals	**100.0%**		**534,091**	**Mixed Residue**	**0.0%**		**0**
Sample Count	**38**			Mixed Residue	0.0%	0.0%	0

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Comparison of C&D Waste between C&D Subsectors

Twenty-one material types appeared in the top ten tables for the seven subsectors. Several material types appeared in all but one of the subsectors: clean dimensional lumber, composition roofing, dirt & sand, other aggregates, remainder/composite C&D. Conversely, several materials are unique to one C&D subsector. Flat glass and small rock/gravel only appeared in the top ten materials for roofing. Large asphalt pavement without re-bar, small asphalt pavement with re-bar, and small asphalt pavement without re-bar were unique to other C&D. Remainder/composite paper appeared in the top ten list only for new residential construction.

In terms of divertibility categories, the divertible portion of most of the subsectors ranged from 64 percent in residential remodel to 76 percent in new residential construction. Other C&D contained the greatest portion of divertible material (93 percent), followed by new non-residential construction (86 percent).

Composition by Metropolitan Area

This section presents the composition findings for C&D waste in each metropolitan area. Each metropolitan area profile includes all C&D waste sampled in that area.

San Diego Area C&D Waste

Figure K presents the overview of composition results for C&D waste in the San Diego area. The largest sector in this area is residential remodel. One hundred fifty-two samples were characterized for this metropolitan area. Approximately 76 percent of the material in this waste substream was estimated to be divertible. The largest divertible category, recyclable aggregates, accounted for about 24 percent of the total, by weight. Rock, dirt, & sand; other recoverable material; and recyclable wood each made up between 14 percent and 18 percent of this waste.

Figure K. Overview of Waste Divertibility: San Diego Area C&D Waste, 2005

33
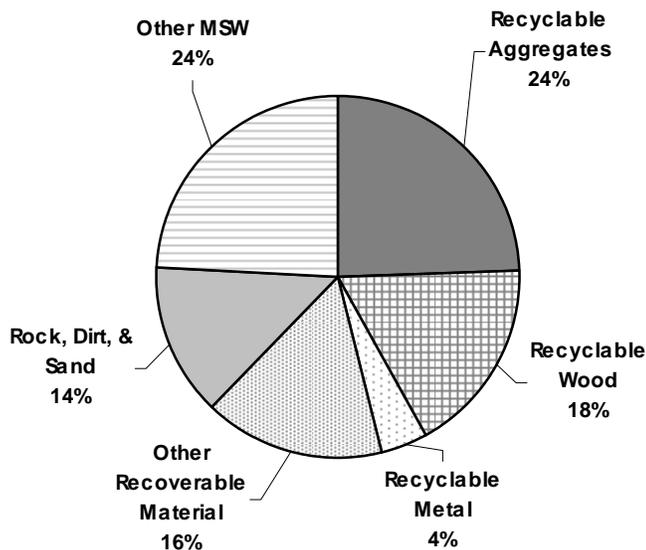
As seen in Table 23, the ten most prevalent materials make up about 64 percent of this waste substream. None of the individual material types made up more than 9 percent of this waste substream. Dirt & sand, large concrete without re-bar, clean dimensional lumber, painted/demolition gypsum board, clean engineered wood, and composition roofing each made up more than 6 percent of the total, by weight.

The detailed composition results for this waste substream are presented in Table 24.

Table 23. Top Ten Disposed Materials: San Diego Area C&D Waste, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Dirt & Sand	yes	8.8%	8.8%	36,567
Large Concrete without Re-bar	yes	8.5%	17.3%	35,252
Clean Dimensional Lumber	yes	7.6%	24.9%	31,382
Painted/Demolition Gypsum Board	no	6.9%	31.8%	28,443
Clean Engineered Wood	yes	6.4%	38.2%	26,590
Composition Roofing	yes	6.1%	44.3%	25,204
Clean Gypsum Board	yes	5.7%	49.9%	23,423
Remainder/Composite C&D	no	5.2%	55.1%	21,526
Painted/Stained Wood	no	5.2%	60.3%	21,438
Other Aggregates	yes	3.9%	64.2%	16,105
Total		**64.2%**		**265,932**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 24. Detailed Waste Composition: San Diego Area C&D Waste, 2005

Material	Est. Percent	+ / -	Est. Tons	Material	Est. Percent	+ / -	Est. Tons
Paper	**2.1%**		**8,540**	**Organic**	**2.5%**		**10,330**
Uncoated Corrugated Cardboard	0.8%	0.3%	3,294	Food	0.0%	0.0%	92
Paper Bags/Kraft	0.0%	0.0%	197	Leaves & Grass	0.5%	0.5%	1,898
Newspaper	0.0%	0.0%	203	Prunings & Trimmings	0.6%	0.3%	2,375
White Ledger	0.0%	0.0%	158	Branches & Stumps	0.3%	0.3%	1,425
Colored Ledger	0.1%	0.0%	241	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	27	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	95	Textiles	0.1%	0.1%	506
Phone Books/Directories	0.0%	0.0%	2	Carpet	0.7%	0.4%	3,079
Other Misc. Paper	0.4%	0.1%	1,617	Carpet Padding	0.2%	0.1%	633
Remainder/Composite Paper	0.7%	0.3%	2,706	Remainder/Composite Organic	0.1%	0.1%	321
Glass	**1.0%**		**4,332**	**Construction & Demolition**	**88.1%**		**364,890**
Clear Glass Bottles & Containers	0.0%	0.0%	57	Lg Concrete with Re-bar	2.9%	2.1%	12,003
Green Glass Bottles & Containers	0.0%	0.0%	50	Lg Concrete without Re-bar	8.5%	4.2%	35,252
Brown Glass Bottles & Containers	0.0%	0.0%	135	Sm Concrete with Re-bar	1.5%	1.3%	6,358
Other Colored Glass Bottles & Containers	0.0%	0.0%	3	Sm Concrete without Re-bar	3.7%	1.9%	15,181
Flat Glass	0.4%	0.6%	1,860	Lg Asphalt Pav. with Re-bar	0.2%	0.3%	719
Remainder/Composite Glass	0.5%	0.3%	2,227	Lg Asphalt Pav. without Re-bar	2.4%	2.1%	9,749
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**4.5%**		**18,717**	Sm Asphalt Pav. without Re-bar	1.3%	1.4%	5,499
Tin/Steel Cans	0.1%	0.0%	224	Composition Roofing	6.1%	2.0%	25,204
Major Appliances	0.2%	0.2%	1,004	Other Asphalt Roofing	2.6%	1.2%	10,564
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	3.9%	2.0%	16,105
HVAC Ducting	0.2%	0.3%	814	Clean Dimensional Lumber	7.6%	2.4%	31,382
Other Ferrous	2.6%	1.0%	10,795	Clean Engineered Wood	6.4%	2.0%	26,590
Aluminum Cans	0.0%	0.0%	15	Pallets & Crates	2.7%	1.5%	10,993
Other Non-Ferrous	1.2%	0.8%	5,062	Other Recyclable Wood	0.9%	0.7%	3,577
Remainder/Composite Metal	0.2%	0.1%	803	Painted/Stained Wood	5.2%	1.7%	21,438
				Treated Wood	0.9%	0.9%	3,612
Electronics	**0.1%**		**565**	Clean Gypsum Board	5.7%	2.7%	23,423
Brown Goods	0.0%	0.0%	96	Painted/Demolition Gypsum Board	6.9%	3.4%	28,443
Computer-related Electronics	0.0%	0.0%	76	Large Rock	2.7%	3.0%	11,246
Other Small Consumer Electronics	0.0%	0.0%	22	Small Rock/Gravel	2.1%	1.6%	8,812
TV's & Other CRTs	0.1%	0.1%	370	Dirt & Sand	8.8%	3.9%	36,567
				Fiberglass Insulation	0.2%	0.1%	647
Plastic	**0.8%**		**3,119**	Remainder/Composite C&D	5.2%	1.6%	21,526
PETE Containers	0.0%	0.0%	54				
HDPE Containers	0.0%	0.0%	152	**Household Hazardous Waste**	**0.1%**		**334**
Misc. Plastic Containers	0.0%	0.0%	12	Paint	0.1%	0.1%	319
Trash Bags	0.0%	0.0%	48	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	4	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.1%	0.0%	352	Batteries	0.0%	0.0%	0
Film Products	0.0%	0.0%	199	Remainder/Composite HHW	0.0%	0.0%	15
Other Film	0.0%	0.0%	59				
Durable Plastic Items	0.2%	0.2%	1,022	**Special Waste**	**0.8%**		**3,435**
Expnd. Polystyr. Packaging/Insulation	0.1%	0.1%	468	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.2%	0.2%	749	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.8%	0.7%	3,291
				Tires	0.0%	0.1%	144
				Remainder/Composite Special	0.0%	0.0%	0
Totals	**100.0%**		**414,269**	**Mixed Residue**	**0.0%**		**7**
Sample Count	**152**			Mixed Residue	0.0%	0.0%	7

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Southern California/Los Angeles Basin C&D Waste

A total of 183 samples were visually estimated to obtain results for C&D waste in the L.A. Basin. The largest sector in this area is other C&D. An overview of the waste composition results by divertibility category are presented in Figure L. Approximately 78 percent of this waste was estimated to be divertible. The largest divertible category was recyclable aggregates (41 percent). Recyclable wood and other recoverable material each made up between 16 percent and 17 percent of the total, by weight.

Figure L. Overview of Waste Divertibilty: Southern California/Los Angeles Basin C&D Waste, 2005
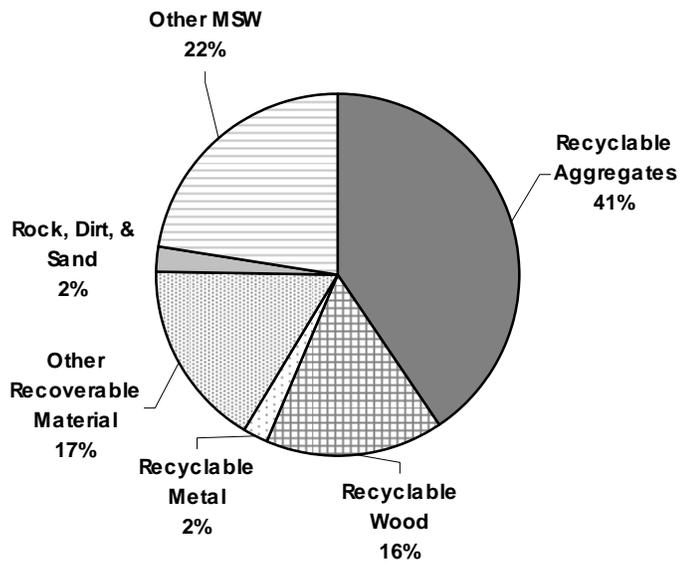
Table 25 presents the ten most prevalent materials for C&D waste in the L.A. Basin. The most common individual material type, large asphalt pavement without re-bar, accounted for nearly 21 percent of the C&D waste in this area. All other material types made up less than 10 percent of this waste, by weight. The top ten materials, when combined, accounted for about 70 percent of this area's C&D waste. Table 26 lists the full composition results for this waste substream.

Table 25. Top Ten Disposed Materials: Southern California/Los Angeles Basin C&D Waste, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Large Asphalt Pavement without Re-bar	yes	20.8%	20.8%	231,071
Composition Roofing	yes	9.2%	29.9%	102,034
Remainder/Composite C&D	no	7.8%	37.7%	86,761
Small Concrete without Re-bar	yes	5.9%	43.7%	66,148
Clean Dimensional Lumber	yes	5.0%	48.6%	55,117
Other Recyclable Wood	yes	4.6%	53.2%	51,468
Clean Engineered Wood	yes	4.5%	57.7%	50,187
Painted/Stained Wood	no	4.1%	61.9%	46,172
Other Aggregates	yes	4.1%	66.0%	45,235
Painted/Demolition Gypsum Board	no	4.1%	70.0%	45,181
Total		**70.0%**		**779,375**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 26. Detailed Waste Composition: Southern California/Los Angeles Basin C&D Waste, 2005

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**1.4%**		**15,633**	**Organic**	**2.5%**		**28,379**
Uncoated Corrugated Cardboard	0.3%	0.1%	3,811	Food	0.0%	0.0%	122
Paper Bags/Kraft	0.0%	0.0%	184	Leaves & Grass	0.7%	0.4%	7,703
Newspaper	0.1%	0.0%	646	Prunings & Trimmings	0.4%	0.3%	4,355
White Ledger	0.0%	0.0%	319	Branches & Stumps	0.0%	0.3%	247
Colored Ledger	0.0%	0.0%	48	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	49	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	37	Textiles	0.1%	0.1%	860
Phone Books/Directories	0.0%	0.0%	0	Carpet	1.1%	0.5%	12,279
Other Misc. Paper	0.8%	0.4%	8,497	Carpet Padding	0.2%	0.1%	2,692
Remainder/Composite Paper	0.2%	0.1%	2,042	Remainder/Composite Organic	0.0%	0.0%	119
Glass	**1.1%**		**12,338**	**Construction & Demolition**	**91.3%**		**1,016,061**
Clear Glass Bottles & Containers	0.0%	0.0%	142	Lg Concrete with Re-bar	0.2%	0.2%	2,608
Green Glass Bottles & Containers	0.0%	0.0%	23	Lg Concrete without Re-bar	4.0%	3.1%	45,072
Brown Glass Bottles & Containers	0.0%	0.0%	23	Sm Concrete with Re-bar	1.2%	1.6%	13,394
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	5.9%	2.5%	66,148
Flat Glass	1.0%	1.2%	11,122	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	0.1%	0.1%	1,028	Lg Asphalt Pav. without Re-bar	20.8%	8.3%	231,071
				Sm Asphalt Pav. with Re-bar	2.0%	2.7%	22,022
Metal	**2.5%**		**27,771**	Sm Asphalt Pav. without Re-bar	2.4%	3.5%	26,570
Tin/Steel Cans	0.0%	0.0%	318	Composition Roofing	9.2%	2.6%	102,034
Major Appliances	0.1%	0.1%	775	Other Asphalt Roofing	3.8%	2.2%	41,747
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	4.1%	2.4%	45,235
HVAC Ducting	0.1%	0.2%	1,550	Clean Dimensional Lumber	5.0%	1.4%	55,117
Other Ferrous	1.8%	0.5%	20,201	Clean Engineered Wood	4.5%	1.6%	50,187
Aluminum Cans	0.0%	0.0%	13	Pallets & Crates	1.6%	1.2%	17,307
Other Non-Ferrous	0.2%	0.1%	2,062	Other Recyclable Wood	4.6%	3.0%	51,468
Remainder/Composite Metal	0.3%	0.1%	2,851	Painted/Stained Wood	4.1%	1.1%	46,172
				Treated Wood	0.0%	0.0%	180
Electronics	**0.1%**		**630**	Clean Gypsum Board	3.6%	1.4%	40,075
Brown Goods	0.0%	0.0%	149	Painted/Demolition Gypsum Board	4.1%	2.7%	45,181
Computer-related Electronics	0.0%	0.0%	181	Large Rock	0.1%	0.1%	734
Other Small Consumer Electronics	0.0%	0.0%	0	Small Rock/Gravel	0.0%	0.0%	0
TV's & Other CRTs	0.0%	0.0%	301	Dirt & Sand	2.3%	1.4%	25,662
				Fiberglass Insulation	0.1%	0.1%	1,316
Plastic	**0.4%**		**4,401**	Remainder/Composite C&D	7.8%	1.7%	86,761
PETE Containers	0.0%	0.0%	52				
HDPE Containers	0.0%	0.0%	183	**Household Hazardous Waste**	**0.1%**		**1,428**
Misc. Plastic Containers	0.0%	0.0%	39	Paint	0.1%	0.2%	1,428
Trash Bags	0.0%	0.0%	150	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	3	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.0%	0.0%	401	Batteries	0.0%	0.0%	0
Film Products	0.1%	0.0%	628	Remainder/Composite HHW	0.0%	0.0%	0
Other Film	0.0%	0.0%	81				
Durable Plastic Items	0.1%	0.0%	1,307	**Special Waste**	**0.4%**		**4,703**
Expnd. Polystyr. Packaging/Insulation	0.0%	0.0%	375	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.1%	0.1%	1,182	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.3%	0.2%	3,805
				Tires	0.1%	0.1%	641
				Remainder/Composite Special	0.0%	0.0%	258
Totals	**100.0%**		**1,113,216**	**Mixed Residue**	**0.2%**		**1,873**
Sample Count	**183**			Mixed Residue	0.2%	0.2%	1,873

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

San Francisco Bay Area C&D Waste

An overview of the C&D waste composition results for the San Francisco Bay Area is shown in Figure M. The largest sector in this area is residential remodel. One hundred twenty-nine visual samples were completed for this waste substream. An estimated 70 percent of this waste substream was calculated to be divertible. Other recoverable material (23 percent) was the largest divertible category of materials, followed by recyclable aggregates (19 percent).

Figure M. Overview of Waste Divertibility: San Francisco Bay Area C&D Waste, 2005
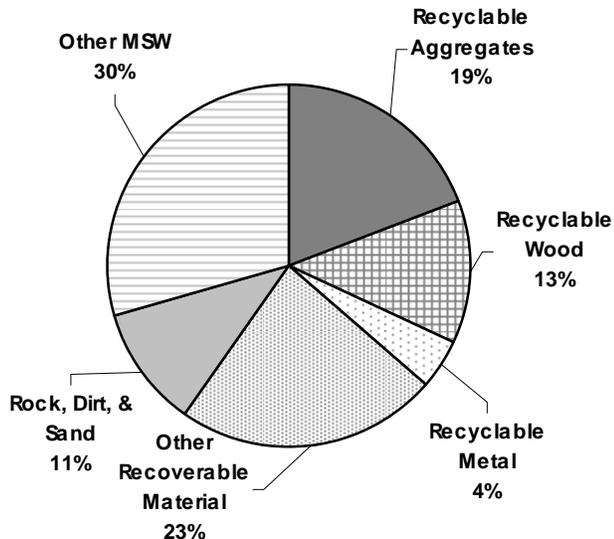
Table 27 lists the ten most prevalent materials for C&D waste in the Bay Area. The most common material, composition roofing, accounted for 12 percent of this area's waste, by weight. Dirt & sand, other aggregates, and remainder/composite C&D made up between 8 percent and 10 percent of this waste. The composition estimates for all 86 material types are listed in Table 28.

Table 27. Top Ten Disposed Materials: San Francisco Bay Area C&D Waste, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Composition Roofing	yes	12.0%	12.0%	166,060
Remainder/Composite C&D	no	9.5%	21.5%	132,479
Other Aggregates	yes	9.4%	30.9%	130,934
Dirt & Sand	yes	8.9%	39.9%	124,234
Other Asphalt Roofing	no	6.1%	45.9%	84,170
Large Concrete without Re-bar	yes	5.6%	51.6%	78,307
Clean Dimensional Lumber	yes	5.4%	57.0%	75,173
Clean Gypsum Board	yes	4.8%	61.8%	67,099
Painted/Stained Wood	no	4.5%	66.3%	62,983
Clean Engineered Wood	yes	3.5%	69.9%	48,901
Total		**69.9%**		**970,339**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 28. Detailed Waste Composition: San Francisco Bay Area C&D Waste, 2005

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**5.1%**		**70,959**	**Organic**	**3.3%**		**46,140**
Uncoated Corrugated Cardboard	1.1%	0.4%	15,750	Food	0.0%	0.0%	220
Paper Bags/Kraft	0.2%	0.3%	3,334	Leaves & Grass	0.5%	0.3%	6,785
Newspaper	0.3%	0.3%	4,698	Prunings & Trimmings	0.5%	0.4%	6,385
White Ledger	0.2%	0.2%	2,166	Branches & Stumps	0.0%	0.1%	650
Colored Ledger	0.2%	0.2%	2,276	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.0%	0.0%	131	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	356	Textiles	0.2%	0.1%	2,741
Phone Books/Directories	0.0%	0.0%	27	Carpet	1.1%	0.9%	14,943
Other Misc. Paper	0.8%	0.3%	10,486	Carpet Padding	0.2%	0.2%	3,168
Remainder/Composite Paper	2.3%	1.2%	31,736	Remainder/Composite Organic	0.8%	1.0%	11,247
Glass	**1.1%**		**15,231**	**Construction & Demolition**	**82.6%**		**1,147,801**
Clear Glass Bottles & Containers	0.1%	0.1%	1,295	Lg Concrete with Re-bar	0.1%	0.2%	1,421
Green Glass Bottles & Containers	0.0%	0.0%	607	Lg Concrete without Re-bar	5.6%	2.8%	78,307
Brown Glass Bottles & Containers	0.0%	0.1%	625	Sm Concrete with Re-bar	0.2%	0.2%	2,934
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	2.8%	1.6%	38,525
Flat Glass	0.4%	0.6%	5,707	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	0.5%	0.4%	6,996	Lg Asphalt Pav. without Re-bar	0.9%	1.1%	11,883
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**5.1%**		**70,153**	Sm Asphalt Pav. without Re-bar	0.3%	0.3%	3,723
Tin/Steel Cans	0.0%	0.0%	87	Composition Roofing	12.0%	3.9%	166,060
Major Appliances	1.3%	1.7%	18,032	Other Asphalt Roofing	6.1%	3.6%	84,170
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	9.4%	5.0%	130,934
HVAC Ducting	0.1%	0.1%	1,011	Clean Dimensional Lumber	5.4%	1.7%	75,173
Other Ferrous	2.8%	1.3%	38,236	Clean Engineered Wood	3.5%	1.0%	48,901
Aluminum Cans	0.0%	0.0%	75	Pallets & Crates	1.7%	0.7%	22,976
Other Non-Ferrous	0.3%	0.2%	3,819	Other Recyclable Wood	2.2%	1.4%	29,974
Remainder/Composite Metal	0.6%	0.4%	8,893	Painted/Stained Wood	4.5%	2.4%	62,983
				Treated Wood	0.3%	0.2%	3,893
Electronics	**0.3%**		**4,085**	Clean Gypsum Board	4.8%	2.6%	67,099
Brown Goods	0.0%	0.0%	42	Painted/Demolition Gypsum Board	2.3%	1.4%	32,497
Computer-related Electronics	0.0%	0.0%	485	Large Rock	1.1%	0.9%	15,745
Other Small Consumer Electronics	0.1%	0.1%	1,327	Small Rock/Gravel	0.7%	0.6%	10,233
TV's & Other CRTs	0.2%	0.2%	2,231	Dirt & Sand	8.9%	6.6%	124,234
				Fiberglass Insulation	0.3%	0.2%	3,658
Plastic	**1.1%**		**14,933**	Remainder/Composite C&D	9.5%	4.0%	132,479
PETE Containers	0.0%	0.0%	239				
HDPE Containers	0.1%	0.0%	716	**Household Hazardous Waste**	**0.7%**		**9,263**
Misc. Plastic Containers	0.0%	0.0%	110	Paint	0.0%	0.0%	0
Trash Bags	0.1%	0.0%	768	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	57	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.1%	0.0%	1,272	Batteries	0.7%	1.1%	9,263
Film Products	0.1%	0.1%	1,656	Remainder/Composite HHW	0.0%	0.0%	0
Other Film	0.0%	0.0%	260				
Durable Plastic Items	0.3%	0.1%	4,643	**Special Waste**	**0.7%**		**10,372**
Expnd. Polystyr. Packaging/Insulation	0.0%	0.0%	584	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.3%	0.2%	4,628	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.7%	0.6%	9,964
				Tires	0.0%	0.0%	408
				Remainder/Composite Special	0.0%	0.0%	0
Totals	**100.0%**		**1,388,937**	**Mixed Residue**	**0.0%**		**0**
Sample Count	**129**			Mixed Residue	0.0%	0.0%	0

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Central Valley C&D Waste

A total of 158 samples were characterized at facilities in the Central Valley. The largest sector in this area is new residential construction. About three-quarters of this waste was estimated to be divertible. Recyclable wood (24 percent) and other recoverable material (21 percent) were the largest divertible categories for this waste substream.

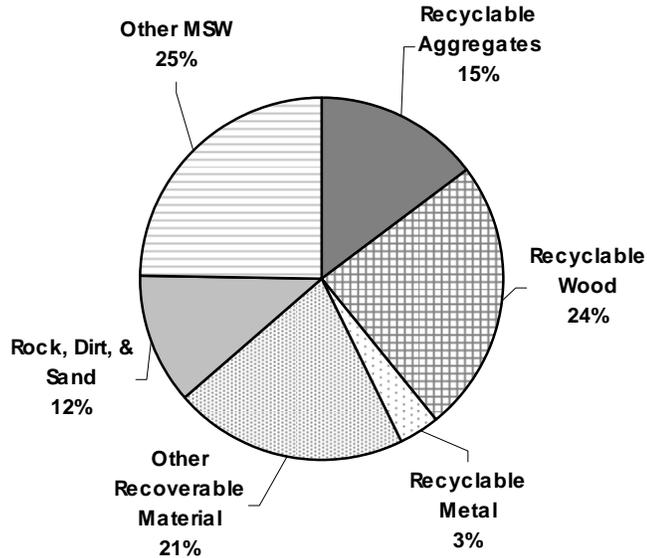**Figure N. Overview of Waste Divertibility: Central Valley C&D Waste, 2005**

Table 29 presents the ten most prevalent materials found in the Central Valley C&D waste substream. These ten materials, when summed, made up about 75 percent of the total, by weight. The most common two materials, composition roofing and clean dimensional lumber, were each between 11 percent and 12 percent of this waste. The next material types, by composition percentage, were remainder/composite C&D (9.5 percent) and dirt & sand (9.4 percent). The detailed composition results for this waste substream are shown in Table 30.

Table 29. Top Ten Disposed Materials: Central Valley C&D Waste, 2005

Material	Divertible	Est. Percent	Cum. Percent	Est. Tons
Composition Roofing	yes	11.7%	11.7%	25,196
Clean Dimensional Lumber	yes	11.0%	22.8%	23,604
Remainder/Composite C&D	no	9.5%	32.3%	20,395
Dirt & Sand	yes	9.4%	41.7%	20,265
Small Concrete without Re-bar	yes	6.9%	48.6%	14,743
Painted/Stained Wood	no	6.9%	55.5%	14,739
Clean Engineered Wood	yes	6.7%	62.1%	14,297
Other Recyclable Wood	yes	4.9%	67.0%	10,514
Clean Gypsum Board	yes	4.5%	71.6%	9,752
Other Aggregates	yes	3.4%	75.0%	7,270
Total		**75.0%**		**160,775**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Table 30. Detailed Waste Composition: Central Valley C&D Waste, 2005

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	**3.1%**		**6,618**	**Organic**	**3.6%**		**7,708**
Uncoated Corrugated Cardboard	0.7%	0.2%	1,512	Food	0.1%	0.1%	275
Paper Bags/Kraft	0.1%	0.0%	111	Leaves & Grass	0.3%	0.2%	678
Newspaper	0.1%	0.0%	118	Prunings & Trimmings	0.3%	0.2%	722
White Ledger	0.0%	0.0%	62	Branches & Stumps	0.1%	0.1%	190
Colored Ledger	0.1%	0.1%	230	Agricultural Crop Residues	0.0%	0.0%	0
Other Office Paper	0.1%	0.0%	129	Manures	0.0%	0.0%	0
Magazines/Catalogs	0.0%	0.0%	88	Textiles	0.3%	0.2%	609
Phone Books/Directories	0.0%	0.0%	0	Carpet	0.8%	0.4%	1,698
Other Misc. Paper	0.8%	0.4%	1,793	Carpet Padding	0.1%	0.1%	273
Remainder/Composite Paper	1.2%	0.6%	2,574	Remainder/Composite Organic	1.5%	1.5%	3,263
Glass	**1.0%**		**2,152**	**Construction & Demolition**	**86.7%**		**186,031**
Clear Glass Bottles & Containers	0.1%	0.1%	265	Lg Concrete with Re-bar	1.5%	1.9%	3,278
Green Glass Bottles & Containers	0.0%	0.0%	57	Lg Concrete without Re-bar	2.3%	1.0%	4,852
Brown Glass Bottles & Containers	0.0%	0.0%	69	Sm Concrete with Re-bar	0.2%	0.3%	447
Other Colored Glass Bottles & Containers	0.0%	0.0%	0	Sm Concrete without Re-bar	6.9%	4.4%	14,743
Flat Glass	0.4%	0.4%	926	Lg Asphalt Pav. with Re-bar	0.0%	0.0%	0
Remainder/Composite Glass	0.4%	0.4%	835	Lg Asphalt Pav. without Re-bar	0.3%	0.2%	583
				Sm Asphalt Pav. with Re-bar	0.0%	0.0%	0
Metal	**3.8%**		**8,078**	Sm Asphalt Pav. without Re-bar	0.2%	0.1%	324
Tin/Steel Cans	0.0%	0.0%	15	Composition Roofing	11.7%	2.3%	25,196
Major Appliances	0.3%	0.3%	675	Other Asphalt Roofing	0.1%	0.2%	275
Used Oil Filters	0.0%	0.0%	0	Other Aggregates	3.4%	1.5%	7,270
HVAC Ducting	0.1%	0.1%	193	Clean Dimensional Lumber	11.0%	2.4%	23,604
Other Ferrous	2.7%	0.7%	5,876	Clean Engineered Wood	6.7%	2.3%	14,297
Aluminum Cans	0.0%	0.0%	58	Pallets & Crates	1.9%	0.6%	4,160
Other Non-Ferrous	0.3%	0.2%	650	Other Recyclable Wood	4.9%	2.1%	10,514
Remainder/Composite Metal	0.3%	0.1%	611	Painted/Stained Wood	6.9%	4.5%	14,739
				Treated Wood	0.3%	0.1%	569
Electronics	**0.2%**		**387**	Clean Gypsum Board	4.5%	2.1%	9,752
Brown Goods	0.0%	0.1%	102	Painted/Demolition Gypsum Board	2.7%	1.3%	5,838
Computer-related Electronics	0.0%	0.0%	85	Large Rock	0.2%	0.2%	337
Other Small Consumer Electronics	0.0%	0.0%	38	Small Rock/Gravel	2.0%	1.3%	4,189
TV's & Other CRTs	0.1%	0.1%	161	Dirt & Sand	9.4%	4.6%	20,265
				Fiberglass Insulation	0.2%	0.1%	404
Plastic	**1.0%**		**2,159**	Remainder/Composite C&D	9.5%	2.7%	20,395
PETE Containers	0.0%	0.0%	17				
HDPE Containers	0.0%	0.0%	85	**Household Hazardous Waste**	**0.2%**		**434**
Misc. Plastic Containers	0.0%	0.0%	12	Paint	0.1%	0.1%	165
Trash Bags	0.0%	0.0%	99	Vehicle & Equip. Fluids	0.0%	0.0%	0
Grocery/ Merch. Bags	0.0%	0.0%	9	Used Oil	0.0%	0.0%	0
Non-Bag Comm./Ind.Packaging Film	0.1%	0.1%	230	Batteries	0.1%	0.2%	269
Film Products	0.1%	0.0%	170	Remainder/Composite HHW	0.0%	0.0%	0
Other Film	0.0%	0.0%	28				
Durable Plastic Items	0.1%	0.0%	297	**Special Waste**	**0.4%**		**936**
Expnd. Polystyr. Packaging/Insulation	0.3%	0.2%	598	Ash	0.0%	0.0%	0
Remainder/Composite Plastic	0.3%	0.2%	616	Sewage Solids	0.0%	0.0%	0
				Industrial Sludge	0.0%	0.0%	0
				Treated Medical Waste	0.0%	0.0%	0
				Bulky Items	0.4%	0.3%	914
				Tires	0.0%	0.0%	22
				Remainder/Composite Special	0.0%	0.0%	0
Totals	**100.0%**		**214,503**	**Mixed Residue**	**0.0%**		**0**
Sample Count	**158**			Mixed Residue	0.0%	0.0%	0

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Comparison of C&D Waste between Metropolitan Areas

Fourteen materials appeared in the top ten tables for the four metropolitan areas. Several materials appeared in the top ten lists for all four metropolitan areas: clean dimensional lumber, clean engineered wood, composition roofing, other aggregates, remainder/composite C&D. Large asphalt pavement without re-bar was unique to the top ten list for the Southern California/L.A. Basin, and other asphalt roofing was a common material only for the San Francisco Bay Area's C&D waste.

By divertibility category, C&D waste was fairly similar between the four metropolitan areas. Approximately 70 percent to 78 percent of the material in these waste substreams was estimated to be divertible. Recyclable aggregates was the largest divertibile category for the San Diego Area and the Southern California/L.A. Basin. In the Central Valley, recyclable wood (24 percent) was the largest divertibile category, while other recoverable material (23 percent) was the largest divertibile category for C&D waste in San Francisco Bay Area.

Factors Affecting Recycling Findings

To advance the study's goal of gathering information about the highly recoverable C&D waste stream, the reasons why drivers chose not to recycle their loads were investigated. All surveyed drivers of self-haul vehicles were asked why they did not choose to recycle their load. Drivers' responses were categorized as "don't know where/how to recycle," "recycling is too difficult/far away," "recycling is too costly", "the load is not recyclable", or a mix of these.

Participating disposal sites were asked whether recycling opportunities for C&D materials were available within 20 miles. Based on these responses, facilities were divided into those with and those without recycling opportunities nearby. Of the 14 sites visited for the study, nine were considered to have recycling nearby.

The results of the driver survey are presented in Table 31 and Table 32. A total of 381 drivers were interviewed at facilities with recycling options nearby compared to 83 drivers at facilities without recycling nearby. For facilities with recycling nearby and those without, the most common response was "the load is not recyclable": 283 responses when recycling was available nearby and 65 responses when recycling was not available. The second most common response for drivers at both types of facilities was "don't know where/how to recycle": 65 responses when recycling was available nearby and 13 responses when it was not available. Waste generating activity and building type did not appear to contribute to driver preference.

Table 31. Summary of Driver Responses at Facilities with Recycling Opportunities Nearby

	Don't know where/how to recycle	Recycling is too difficult/far away	Recycling is too costly	The load is not recyclable	Other	Mix of reasons
Sum of Load Net Weights (tons)	102	10	24	742	62	4
Total Responses	65	5	12	283	15	1
Number of Responses by Activity Type						
Demolition	7	0	1	33	1	0
New Construction	6	1	0	38	6	0
Other C&D	2	0	0	17	1	1
Remodel	44	4	11	160	7	0
Roofing	6	0	0	33	0	0
Don't Know	0	0	0	0	0	0
No Response	0	0	0	2	0	0
Number of Responses by Building Type						
Non-residential	9	2	2	55	5	1
Other Structure	1	0	0	5	1	0
Residential	53	3	10	216	9	0
No Response	2	0	0	7	0	0

Table 32. Summary of Driver Responses at Facilities without Recycling Opportunities Nearby

	Don't know where/how to recycle	Recycling is too difficult/far away	Recycling is too costly	The load is not recyclable	Other	Mix of reasons
Sum of Load Net Weights (tons)	20	0	4	271	4	0
Total Responses	13	0	2	65	3	0
Number of Responses by Activity Type						
Demolition	1	0	0	5	0	0
New Construction	0	0	0	14	1	0
Other C&D	0	0	0	2	0	0
Remodel	8	0	2	31	2	0
Roofing	4	0	0	11	0	0
Don't Know	0	0	0	2	0	0
No Response	0	0	0	0	0	0
Number of Responses by Building Type						
Non-residential	0	0	0	16	0	0
Other Structure	0	0	0	1	0	0
Residential	13	0	2	48	3	0
No Response	0	0	0	0	0	0

Abbreviations and Acronyms

C&D — Construction and Demolition

CIWMB — California Integrated Waste Management Board

CRV — California Redemption Value

HHW — Household Hazardous Waste

MSW — Municipal Solid Waste

Glossary of Terms

Construction — the building of any facility or structure or any portion thereof including any tenant improvements to an existing facility or structure.

Commercially Hauled Waste — waste that is collected and transported by contracted or franchised haulers.

Compostable — describes organic waste material that under the right conditions can be turned in to soil amendment (compost).

Demolition — materials generated from the tearing down of any facility, structure, pavement or building, (wall, fence) whether in whole or in part, whether interior or exterior.

Disposal — refers to waste materials that are sent to landfills.

Divertible — material for which technologies and markets exist in California to recover these materials from the waste stream, through recycling or composting.

Municipal Solid Waste (MSW) — means all solid wastes generated by residential, commercial, and industrial sources, and all solid waste generated at construction and demolition sites, at food-processing facilities, and at treatment works for water and waste water, which are collected and transported under the authorization of a jurisdiction or are self-hauled.

Non-residential new construction — construction materials generated from the construction of new non-residential buildings, such as businesses, government offices, and schools.

Non-residential remodel — construction or demolition materials generated from the remodeling of non-residential buildings, such as businesses, government offices, and schools.

Other C&D activities — construction or demolition materials generated from activities not otherwise classified, such as the building, repair, and/or demolition of roads, bridges and other public infrastructure.

Residential new construction — construction materials generated from the construction of new residential structures including single-family and multi-family residences.

Residential remodel — construction or demolition materials generated from the remodeling of residential structures including single-family and multi-family residences.

Roofing — construction or demolition materials generated from the new construction, remodeling, and/or demolition of residential or non-residential roofs.

Self-haul Waste — waste hauled by individuals, businesses, or government agencies that haul their own garbage; this subsector includes waste delivered by anyone other than a contracted or franchised hauler.

Waste Density — unit of measurement calculated by dividing the weight of waste material by the volume of waste material and expressed in pounds/cubic yard.

Waste Sector — the division of the overall waste stream into segments. The waste stream can be divided according to activity that generated the waste, vehicle type delivering the waste, geographic region, etc.

Waste Stream — in this context, refers to the entire stream of construction and demolition wastes that are sent to landfill.

Waste Substream — a portion of the disposal waste stream.

Appendix A:
Detailed Methodology

Overview

This appendix describes the major elements of the methodology of the study, from sampling and surveying, site selection to sorting methods, to the calculations and analysis. A precursor to the study was the analysis of visual estimating methods that was used for sampling. That process is described in Appendix C.

Targeted Waste

The focus of this study was construction and demolition (C&D) waste, meaning any waste that results from construction or demolition activities as defined below[2]:

- "Construction" means the building of any facility or structure or any portion thereof including any tenant improvements to an existing facility or structure.

- "Demolition" means the decimating, razing, ruining, tearing down or wrecking of any facility, structure, pavement or building, whether in whole or in part, whether interior or exterior.

Furthermore, by regulation, "Construction and Demolition Wastes" include the waste building materials, packaging and rubble resulting from construction, remodeling, repair and demolition operations on pavements, houses, commercial buildings and other structures (Title 14 of the California Code of Regulations, Division 7, Chapter 3, Section 17225.15).

Selection of Regions and Disposal Facilities

Data collection was focused on the four major metropolitan areas of the state: the San Diego area, Southern California/L.A. Basin, the San Francisco Bay Area, and the Central Valley. These areas represent common demographic and geographic characteristics of California.

Sampling was conducted at disposal facilities such as landfills and transfer stations within the four regions. Disposal facilities were selected using a random selection method as described below. Equal numbers of disposal facilities were planned for each region. The process included the steps below:

- Assembly of list — CIWMB staff assembled a complete list of disposal facilities in each of the four urban areas that were believed to handle an adequate number of C&D loads that had not already passed through a waste transfer station.

- The list of facilities within each region was placed in random order, using a random number generator.

- Then, Cascadia phoned the candidate facilities, starting with the first facility appearing on the random-ordered list, to recruit participation in the study. In each season, when two sampling days were confirmed in each region, the recruitment process was considered to be complete.

- When the facilities were contacted by telephone, two screening criteria were applied: (1) the facility had to receive an adequate number of C&D loads each day; and (2) management had to be willing to accommodate the expected waste sampling activities.

- Because most of the selected facilities also received an adequate amount of non-C&D self-haul and loose drop-box waste, scheduling and sampling efforts were coordinated with Task 4 activities to allow sampling for both tasks to occur simultaneously.[‡]

If a site met the qualification criteria, a questionnaire was used during the remainder of the telephone interview to obtain essential information for the prospective surveying and sampling. An example of the questionnaire used for interviews with personnel at each selected disposal facility can be found in Appendix D. In addition to obtaining contact information for the staff that were able to assist in making arrangements for data collection at each facility, the questionnaire and interview process collected the following information:

- The facility's days and hours of operation.

- The vehicle traffic expected for each sector on each day of the week, and the estimated peak time of day for each type of load.

- The number of scalehouses, and if specific types of vehicles were directed to different scalehouses. For example, did commercial haulers use a separate gate from self-haulers or cash customers?

- Any rules that might have been used for recording the net weight of vehicles and for recording alternate minimum weights for small vehicles.

- Unusual conditions (e.g., weather, anomalies in traffic patterns, etc.) that might have affected data collection and necessitate special logistical arrangements.

- Recycling activities conducted at the facility, such as a green waste drop-off area.

While administering the questionnaire, the study team communicated the data collection crew's needs for space, their need for the assistance of a vehicle spotter, loader and operator, and the need for access to restrooms and shelter at the facility.

After a disposal facility was recruited for participation in the study, a letter of confirmation was sent to the facility's management via fax or e-mail. The letter summarized the information that had been obtained through the recruitment and interview process, including the approximate dates of data collection activities, arrangements for the use of equipment such as a loader, or arrangements for assistance in the use of a loader, arrangements for space in which to work, etc. The management of each facility was asked to verify verbally the information summarized in the letter. Approximately 2 weeks prior to the scheduled visit, the management of each site was contacted by phone to remind them of the visit and their role in the sampling activities. Each facility was also contacted by phone one or two days prior to the actual visit.

C&D Sectors Examined in This Study

Definition of Sectors

For the purposes of this study, the C&D waste stream was divided into two sectors:

[‡] Del Norte Transfer Station in Ventura County, visited for the study on Saturday, June 25, 2005, was selected as a Task 4 weekend sampling event, even though it did not meet the criteria for receiving approximately 40 C&D loads daily, as required for Task 3. However, the sampling crew was able to capture 20 C&D samples from this site.

- **Commercially Hauled Waste** — Waste that is collected and transported by contracted or franchised haulers. In general, vehicles that haul C&D waste include loose roll-offs, end dumps, and other large vehicles, such as large pick-up trucks.

- **Self-haul Waste** — Waste hauled by individuals, businesses, or government agencies that haul their own garbage. This subsector includes waste delivered by anyone other than a contracted or franchised hauler. For this study, residential self-haulers were surveyed, but excluded from sampling. Commercial self-haulers were both surveyed and considered for sampling.

For a more detailed accounting of these sectors, the waste stream was then further divided into seven subsectors, which are defined as follows:

1. **New residential construction** — Construction materials generated from the construction of new residential structures including single-family and multi-family residences.

2. **New non-residential construction** — Construction materials generated from the construction of new non-residential buildings, such as businesses, government offices, and schools.

3. **Residential remodel** — Construction or demolition materials generated from the remodeling of residential structures including single-family and multi-family residences.

4. **Non-residential remodel** — Construction or demolition materials generated from the remodeling of non-residential buildings, such as businesses, government offices, and schools.

5. **Demolition** —Materials generated from the tearing down of any facility, structure (e.g., a wall or fence), pavement or building, whether in whole or in part, whether interior or exterior.

6. **Roofing** — Construction or demolition materials generated from the new construction, remodeling, and/or demolition of residential or non-residential roofs.

7. **Other C&D activities** — Construction or demolition materials generated from activities not otherwise classified, such as the building, repair, and/or demolition of roads, bridges and other public infrastructure.

Schedule of Field Work Activities and Sample Allocation

Sampling took place over eight weekdays during each season of the study. An additional day was added for the winter season in March 2005 at Puente Hills Landfill, and the summer season included an additional day of sampling on a weekend day. The study design included the target of approximately five to nine samples per sector, for a total of 40 loads at each of 16 C&D disposal facilities. Table 33 presents the schedule of field work and the number of samples obtained at each site.

Table 33. Schedule of Field Work and Number of Samples by Site

Date	Day	Site	Sample Count
12/7/2004	Tuesday	Miramar Landfill	30
12/8/2004	Wednesday	Miramar Landfill	29
12/9/2004	Thursday	Antelope Valley Landfill	23
12/10/2004	Friday	Colton Landfill	31
12/13/2004	Monday	Guadalupe Landfill	36
12/14/2004	Tuesday	Sonoma Disposal Site	23
12/15/2004	Wednesday	L & D Landfill	43

Table 33 (cont'd.) Schedule of Field Work and Number of Samples by Site

Date	Day	Site	Sample Count
12/16/2004	Thursday	Sacramento County Landfill	32
3/2/2005	Wednesday	Puente Hills Landfill	42
6/21/2005	Tuesday	Miramar Landfill	51
6/22/2005	Wednesday	Otay Landfill	42
6/23/2005	Thursday	Chiquita Canyon Landfill	16
6/24/2005	Friday	Puente Hills Landfill	51
6/25/2005	Saturday	Del Norte Landfill	20
6/27/2005	Monday	West Contra Costa Landfill	25
6/28/2005	Tuesday	Vasco Road Landfill	45
6/29/2005	Wednesday	L & D Landfill	49
6/30/2005	Thursday	Western Regional Landfill	34
Total			**622**

Sample Allocation

Cascadia conducted visual characterizations of 622 loads. Based on previous visual characterization studies, we anticipated that a target of 640 loads would yield composition data with error rates within plus or minus two percentage points for most recoverable materials.

Samples were allocated approximately equally between the two seasons and among the four major metropolitan areas of the state: San Diego area; Southern California/L.A. Basin; San Francisco Bay area; and Central Valley. Following this plan ensured that seasonal, geographic, and hauler type differences were adequately represented in the overall results and that comparable data were obtained for each sector. We also expected to apportion 80 to 100 samples to each of the primary subsectors: residential remodel, residential new construction, non-residential remodel, non-residential new construction, and demolition. Fewer samples, from 60 to 80, were allocated to roofing, because roofing loads are less variable. Similarly, fewer samples, from 60 to 80, were allocated to the "other" subsector, since fewer "other" loads were expected to arrive at C&D facilities. It was expected that roofing loads sampled would be a relatively even mix of residential and non-residential projects, although no quotas were assigned.

After the first (winter) season sampling was complete, sample numbers were tallied and reviewed. Many more residential remodel samples were characterized than anticipated (111 samples, even more than the maximum number planned). In order to capture any seasonal differences in composition that may exist in this sector, additional samples were targeted for this sector in the summer sampling, rather than considering sampling to be complete for this sector. This meant that sampling goals were revised.

In Table 34, the number of samples completed is compared to the original planned number of samples, as well as to the revised mid-study sampling goals following the winter season. The actual number of samples was similar to the planned number for the residential new construction and non-residential remodel subsectors. Fewer samples than anticipated were obtained for non-residential new construction, demolition, and other construction and demolition. In the remaining subsectors, residential remodel and roofing, more samples than planned were obtained. The variance from the planned targets was due to the available mix of loads at the facilities on the days that sampling occurred.

In comparison to the revised sampling goals, the actual number of samples more closely matched the goals. The actual number of samples for residential new construction, non-residential remodel, and other C&D were all within 7 of the revised goals. The largest difference between the revised targets and the final counts was for non-residential new construction (a difference of 31 samples). New non-residential construction loads were rare except at a few facilities that had an office building, a shopping center, or a school in construction nearby.

Table 34. Number of Waste Samples by Subsector: Planned vs. Actual

Subsector	Planned Number of Samples	Revised Sampling Goals following Winter Season	Actual Number of Samples
New residential construction	80-100	90	97
New non-residential construction	80-100	90	59
Residential remodel	80-100	150	167
Non-residential remodel	80-100	90	86
Demolition	160-200	100	80
Roofing	60-80	80	95
Other C&D	60-80	40	38
Total	**640**	**640**	**622**

Vehicle Surveys

In order to quantify the portion of waste within the four urban areas that was C&D waste, surveys were conducted at the entrance of each participating facility. The surveys were administered to the drivers of all vehicles bringing C&D waste for disposal at the gate where the surveyor was posted. Information on weekend disposal patterns was gathered to supplement survey data for weekdays and to adjust data to better reflect overall disposal at the facility.

The surveys were conducted at each participating disposal facility on the same days that waste samples were obtained. On each survey day, the surveyor was on-site for an eight-hour period. The survey times at each site were chosen such that the 8-hour window encompassed the busiest times of the day, in terms of vehicle traffic at the facility.

Information that was obtained through the survey process includes:

- The type of vehicle (small vehicle, drop-box, end-dump, or other large vehicle).

- The sector (commercial self-hauled, residential self-hauled, or commercially/franchised hauled).

- The subsector (residential remodel, residential new construction, non-residential remodel, non-residential new construction, demolition, roofing, or other).

- The jurisdiction from which the load originated.

- Factors affecting recovery (don't know where/how to recycle, recycling is too difficult/far away/costly, the load is not recyclable, or other).

- Net weight of the load.

If there was more than one vehicle entrance at a particular facility, then a survey plan was constructed that allowed collection of representative tonnage data from each entrance. In most cases, this involved constructing a schedule in which the surveyor rotated from entrance to entrance, in sequence every hour, starting with a randomly chosen entrance. If the multiple entrances at a facility each received a different mix of vehicle types or waste types, then a plan was developed that corrected for the differences across entrances and allowed the survey data from each entrance to be "scaled up" to reflect the total mixture of waste arriving at the facility.

The Cascadia project manager trained the surveyor and vehicle selector in the use of the Sample Selection Form and the Vehicle Survey Form prior to the beginning of the first sampling season (see Appendix D for forms).

Capture and Characterization of Samples

Diverting Selected Loads

Vehicles were selected for sampling as they arrived at the facilities through interviews to determine whether they met the criteria for the study. If the vehicle met the criteria for sampling, the driver's answers were recorded on the Sample Selection Form. Then the staff member assigned a unique sample ID number to the load and recorded that sample ID number on the Sample Selection Form. Vehicles were selected for sampling until each sector's quota for that day was reached. The number of vehicles sampled each day was tracked on the Sample Tracking Form. The weight of each sampled load was captured as part of the vehicle survey.

The vehicle selector then placed a Sample Placard on the vehicle's windshield or dashboard to identify it as a vehicle intended for sampling, and directed the driver to the sampling area. Please see Appendix D for examples of the above mentioned forms.

Visually Characterizing Loads

A professional visual estimator used a field-tested, six-step visual estimating method to estimate the composition of selected C&D loads. Each sample consisted of the entire load. Visual estimates were recorded on the Sample Tally Sheets, examples of which are presented in Appendix D. Originals were delivered by the sorting crew supervisor to Cascadia's home office for entry into a database. Random spot checks were conducted to ensure the accuracy of the data entry process. The visual estimating method is described below.

Step 1. Record the sample number and date. This information was recorded on the Sample Tally Sheet.

Step 2. Measure load volume. The estimator measured and recorded the length, width, and height of the load while it was still in the vehicle (if possible). The measurements were recorded on the Sample Tally Sheet.

Step 3. Note which major classes of material are present. After the driver dumped the load onto the ground, the estimator walked entirely around the load and indicated on the sampling form which major material classes were present in the load. Major material classes include paper, glass, metal, electronics, plastic, organic, construction and demolition, household hazardous waste, and special waste.

Step 4. Estimate composition by volume for each major material class. Beginning with the largest major material class present by volume, the estimator recorded the percentage by volume of this material class. This process was repeated for the next most common material class, and so

forth, until the volumetric percentage of every material class was estimated. Then the total for this step was calculated, ensuring that it totaled 100 percent.

Step 5. Estimate composition by volume for each specific material component. Each major material class was considered separately, and the estimator recorded the percentage by volume of the major class that was made up of each specific material component. An example of a specific material component within the major material class of metal is other ferrous metal.

While considering only the major material class, the volumetric percentage of each material type was estimated. The total of percentages for all of the material components was verified to equal 100 percent. This process was repeated for the other major classes, with all the material components in each major material class totaling 100 percent.

Step 6. Check and reconcile percentage data. The estimator verified that the percentage estimates for the major material classes added up to 100 percent. Also, the percentage estimates for the material components within each major class were confirmed to total 100 percent.

Description of Calculations and Statistical Procedures Used

Quantifying Waste

Data from vehicle surveys and facility tonnage reports were analyzed to yield estimates of percentages and tonnages of material types for each subsector and metropolitan area. The calculation method is described below.

Step 1. Aggregating survey records to produce findings at the facility level. For a given facility on a given day, each vehicle that was surveyed had its net weight of waste assigned to one of the seven waste sectors, in accordance with the response of the driver. The net weights were summed within each sector on each sampling day. If a site had more than one scale, estimates were derived for each scale first.

For each scale, the sum of net weights was "scaled up" to match the number of hours the facility was open. For instance, in the example below, 4.8 tons of material was delivered by new residential construction loads at that scale in 2 hours. The facility was open for 9.5 hours, so the tons at Scale 1 were scaled up by a factor of 9.5/2, or 4.75. The estimate for that scale for the day for that subsector was 4.8 multiplied by 4.75, or 22.8 tons. If there were multiple scales, each scale's total (22.8, 0, 37.05, 0 tons) was summed for all scales to produce a daily estimate (59.9 tons).

Scale	1		2		3		4		Daily Total
	Hours at scale	*Hours in day*	*Hours at scale*	*Hours in day*	*Hours at scale*	*Hours in day*	*Hours at scale*	*Hours in day*	
	2	**9.5**	**2**	**9.5**	**2**	**9.5**	**1**	**9.5**	
New Residential Construction	4.8	22.8	0	0	7.8	37.1	0	0	59.9

The figures, when added together, may not exactly match the totals shown, due to rounding.

Next, the projection of waste tonnage for a weekday, based on the vehicle survey, was "scaled up" by a factor of five to produce an estimate of tonnages for each type of waste for all weekdays for a period of one week. Data from the study was not used to estimate weekend activity, since the one site that was visited on a weekend day, Del Norte Transfer Station, was not typical of the other participating facilities, which were all landfills that received a greater amount of

construction and demolition waste. To create estimates for weekend activity, data was analyzed from a similar study, conducted on waste at three Orange County landfills.[3] Based on vehicle activity during the Orange County study, Saturday was estimated to represent 0.5 of a weekday for all subsectors, and Sunday was assumed to have no C&D activity. Most facilities were open Monday through Saturday. If they were only open on weekdays, no weekend estimates were included. In the following example, 59.9 tons in one weekday was calculated to correspond to 17,117.1 tons for the entire year for that facility.

	Daily Total	Weekend Days	Weekdays	Scaling factor	Days per Year	Annual Total
New Residential Construction	59.9	1	5	5.5	286	17,117.1

The figures, when added together, may not exactly match the totals shown, due to rounding.

Step 2. Aggregating tonnage from facilities to produce findings for each metropolitan area.
Tonnage estimates for each subsector's waste were combined for participating facilities within each metropolitan area, using a weighted averaging method. The tonnage estimates for each subsector at all participating facilities within each area were aggregated, and relative proportions were calculated for each sector. The aggregated proportions for each subsector were then applied to the total 2004 combined disposal figure for all disposal sites within that metropolitan area, as drawn from the CIWMB Disposal Reporting System.

If a facility was visited more than once, the annual estimates derived from each day's surveys were averaged as follows. In this example, the estimate of 31,759.2 tons was used for this facility to determine area estimates.

Date	Annual Estimate for New Residential Construction (tons)
12/7/2004	33,493.1
12/8/2004	17,117.1
6/21/2005	44,667.5
Average	**31,759.2**

The figures, when added together, may not exactly match the totals shown, due to rounding.

Tonnage estimates for each metropolitan area were calculated as illustrated in the following example. Between two and five sites were visited in each metropolitan area. For each site, annual tonnage estimates were summed by sector. In the following example, 39,084 tons of new residential construction was the combined annual estimate for the two sites visited in that area. Estimates for the other C&D sectors were calculated in the same manner, and are combined for the sake of simplicity for this example into one total: 275,214 tons. The total tonnage, as reported to the CIWMB, for each site was summed (2,909,609 tons). The percentage of this total was calculated for each sector. This percentage, which was estimated to be about 1 percent for new residential construction, was applied to the total disposal reported for all sites in that area (3,835,091 tons). The resulting figure, 51,516 tons, was the annual disposal estimate for this C&D sector for this area.

	New Residential Construction (annual tons)	Other C&D Sectors Combined (annual tons)	Other Waste (annual tons)	Total (annual tons)
Miramar Landfill	31,759	240,494	1,206,609	1,478,863
Otay Landfill	7,325	34,720	1,388,701	1,430,746
Total estimated for sites visited in San Diego area	39,084	275,214	2,595,311	2,909,609
% by sector for San Diego area	1%	9%	89%	100%
Total reported to CIWMB for all sites in San Diego area	3,835,091			
Quantity by sector for San Diego area	51,516	362,754	3,420,822	3,835,091

The figures, when added together, may not exactly match the totals shown, due to rounding.

Estimating Waste Composition

Visual estimates from sampling, in the form of percentages, were converted first to volume estimates and second to weights using material-specific densities. Densities used for these calculations are presented in Table 37.

Converting Volumes to Weights

The composition calculations rely on the availability of individual material weights for each sample. As described above in the section "Visually Characterizing Loads," the data that was collected to characterize each sample in this study included volume estimates. Cascadia converted volume estimates to weights using accepted waste density conversion factors. These factors are listed in Table 37, and data sources accompany the table. For this study, densities for 32 specific, targeted C&D types were developed from field data. Volume data was converted to weights using this data for those 32 types, while published sources were used for the remaining material types. See Appendix C for more information.

Using the volume-to-weight conversion factors and the volume estimates obtained during the characterization of each sample, individual material weights were calculated using the following formula:

$$c = m \times s \times v \times d$$

where:

c = the total weight of the specific material in the sample

m = percentage estimate of the material, as a portion of material class (e.g., the extent to which *newspaper* constitutes all of the *paper* in the sample)

s = percentage estimate of the material class, as a portion of all of the material in the sample (e.g., the extent to which *paper* constitutes all of the material in the sample)

v = total volume of the sample (in cubic yards)

d = density conversion of the material (in pounds/cubic yard)

Composition Calculations

The composition estimate, denoted by r_j, represents the ratio of the material's weight to the total sample weight for each noted group. It is derived by summing each material's weight across all of the selected samples and dividing by the sum of the total sample weight, as shown in the following equation:

$$r_j = \frac{\sum_i c_{ij}}{\sum_i w_i}$$

where:

c = weight of particular material

w = sum of all material weights

for $i = 1$ to n, where n = number of selected samples

for $j = 1$ to m, where m = number of materials

The confidence interval for this estimate is derived in two steps. First, the variance around the estimate is calculated, accounting for the fact that the ratio includes two random variables (the material and total sample weights).[§] The variance of the ratio estimator equation follows:

$$\mathrm{Var}(r_j) \approx \left(\frac{1}{n}\right)\left(\frac{1}{\overline{w}^2}\right)\left(\frac{\sum_i \left(c_{ij} - r_j w_i\right)^2}{n-1}\right)$$

where:

$$\overline{w} = \frac{\sum_i w_i}{n}$$

[§] For more information regarding the variance calculation, please refer to William G. Cochran, *Sampling Techniques, 3rd Edition*, John Wiley & Sons, Inc., Indianapolis, Indiana, 1977.

Second, precision levels at the 90 percent confidence interval are calculated for a component's mean as follows:

$$r_j \pm \left(z \sqrt{\mathrm{Var}(r_j)} \right)$$

where z = the value of the z-statistic (1.645) corresponding to a 90 percent confidence level

Weighted Averages

For all the composition profiles in this report, composition data from the four metropolitan areas and the seven subsectors was combined in a weighted fashion, as described below. Tonnages calculated from the vehicle surveys and facility disposal figures were used to create weighting factors.

For the composition estimates reported in the section Composition by Activity and Building Type Subsector, the mean percent estimate for a material reflects a weighted average of the percent estimates for the metropolitan areas. The tonnages and associated weighting factors for each subsector by metropolitan area are listed below, in Table 35.

Table 35. Weighting Factors for C&D Subsector Composition Profiles

Sector	*Units*	San Diego	Southern California/ L.A. Basin	San Francisco Bay Area	Central Valley	Total
New residential construction	*Tons*	51,515.87	65,416.61	146,049.99	48,835.16	**311,817.63**
	Weighting factors	17%	21%	47%	16%	**100%**
New non-residential construction	*Tons*	20,847.16	72,248.53	140,779.24	20,216.50	**254,091.43**
	Weighting factors	8%	28%	55%	8%	**100%**
Residential remodel	*Tons*	123,615.00	136,367.12	300,169.61	44,475.53	**604,627.26**
	Weighting factors	20%	23%	50%	7%	**100%**
Non-residential remodel	*Tons*	53,053.94	68,362.69	196,488.90	23,202.63	**341,108.16**
	Weighting factors	16%	20%	58%	7%	**100%**
Demolition	*Tons*	76,899.84	243,261.99	289,004.55	23,556.01	**632,722.39**
	Weighting factors	12%	38%	46%	4%	**100%**
Roofing	*Tons*	26,030.84	182,720.34	209,666.54	34,050.08	**452,467.80**
	Weighting factors	6%	40%	46%	8%	**100%**
Other C&D	*Tons*	62,306.77	344,838.60	106,778.00	20,167.38	**534,090.75**
	Weighting factors	12%	65%	20%	4%	**100%**

The figures, when added together, may not exactly match the totals shown, due to rounding.

For the composition estimates reported in the section Composition by Metropolitan Area, the mean percent estimate for a material reflects a weighted average of the percent estimates for the subsectors. The tonnages and associated weighting factors for each metropolitan area by subsector are listed below, in Table 36.

Table 36. Weighting Factors for Metropolitan Area Composition Profiles

Sector	San Diego		Southern California/ L.A. Basin		San Francisco Bay Area		Central Valley	
	tons	weighting factor	tons	weighting factor	tons	weighting factor	tons	weighting factor
New residential construction	51,515.87	12%	65,416.61	6%	146,049.99	11%	48,835.16	23%
New non-residential construction	20,847.16	5%	72,248.53	6%	140,779.24	10%	20,216.50	9%
Residential remodel	123,615.00	30%	136,367.12	12%	300,169.61	22%	44,475.53	21%
Non-residential remodel	53,053.94	13%	68,362.69	6%	196,488.90	14%	23,202.63	11%
Demolition	76,899.84	19%	243,261.99	22%	289,004.55	21%	23,556.01	11%
Roofing	26,030.84	6%	182,720.34	16%	209,666.54	15%	34,050.08	16%
Other C&D	62,306.77	15%	344,838.60	31%	106,778.00	8%	20,167.38	9%
Total	414,269.42	100%	1,113,215.88	100%	1,388,936.83	100%	214,503.29	100%

In the equation below, O_j represents the mean percent estimate for material j in the overall, or weighted, sector profile. The mean percent for the material in each subsector is numbered 1, 2, 3, etc. The relative weighting factors for each subsector (for example, the subsectors in each metropolitan area), expressed as percentages of total tonnage disposed for a larger "overall" waste stream (for example, all of the C&D waste disposed in the area), are represented by the variables $p_1, p_2, p_3,$ etc. The mean estimate of the percent of the disposed waste stream corresponding to the material j for each subsector is represented by the variables $r_{j1}, r_{j2}, r_{j3},$ etc.

$$O_j = (p_1 * r_{j1}) + (p_2 * r_{j2}) + (p_3 * r_{j3}) + ...$$

where:

p = the proportion of disposed waste contributed by a given subsector in relation to the quantity of waste associated with the larger overall, or weighted, sector profile

r = ratio of material weight to total waste weight for the subsector or the metropolitan area, as applicable

for j = 1 to m, where m = number of materials

The below equation is used to calculate the mean percent estimate of uncoated corrugated cardboard, using the sector Other C&D waste as an example. The equation includes two sets of numbers:

- The relative proportion (*p*) of the sector Other C&D waste in each metropolitan area. For example, the San Diego Area Other C&D waste proportion is 62,306.77 tons/534,090.75 or about 12%.

- The composition percentage (*r*) of uncoated corrugated cardboard in each area. Uncoated corrugated cardboard was estimated to be 0.55% of the Other C&D waste in the San Diego Area, 0.11% in the Southern California/L.A. Basin, 0.13% in the San Francisco Bay Area, and 0.16% in the Central Valley.

The weighted combination of the composition findings for uncoated corrugated cardboard would be performed as follows:

$O_{\text{cardboard}} = (12\% * 0.55\%) + (65\% * 0.11\%) + (20\% * 0.13\%) + (4\% * 0.16\%) = \mathbf{0.2\%}$

The variance of the weighted average is calculated:

$$VarO_j = (p_1^2 * \hat{V}_{r_{j1}}) + (p_2^2 * \hat{V}_{r_{j2}}) + (p_3^2 * \hat{V}_{r_{j3}}) + ...$$

where:

$\hat{V}_{r_j}$ = variance associated with the composition estimate for a given material in a given substream

Table 37. Volume-to-weight Conversion Factors Used in Composition Calculations

Material Class	Material	Density (lbs/cubic yard)	Source
Paper	Uncoated Corrugated Cardboard	53.00	Current Study
Paper	Paper Bags	108.00	San Diego County
Paper	Newspaper	360.00	U.S. EPA
Paper	White Ledger	158.00	U.S. EPA
Paper	Colored Ledger	158.00	U.S. EPA
Paper	Other Office Paper	158.00	U.S. EPA
Paper	Magazines/Catalogs	363.50	U.S. EPA
Paper	Phone Books and Directories	250.00	U.S. EPA
Paper	Other Miscellaneous Paper	363.50	U.S. EPA
Paper	Remainder/Composite Paper	363.50	U.S. EPA
Glass	Clear Glass Bottles and Containers	600.00	U.S. EPA
Glass	Green Glass Bottles and Containers	600.00	U.S. EPA
Glass	Brown Glass Bottles and Containers	600.00	U.S. EPA
Glass	Other Colored Glass Bottles and Containers	600.00	U.S. EPA

Table 37 (cont'd.) Volume-to-weight Conversion Factors Used in Composition Calculations

Material Class	Material	Density (lbs/cubic yard)	Source
Glass	Flat Glass	1,400.00	U.S. EPA
Glass	Remainder/Composite Glass	1,400.00	U.S. EPA
Metal	Tin/Steel Cans	150.00	U.S. EPA
Metal	Major Appliances	145.00	Current Study
Metal	HVAC Ducting	47.00	Current Study
Metal	Other Ferrous	225.00	Current Study
Metal	Aluminum Cans	65.00	U.S. EPA
Metal	Other Non-Ferrous	225.00	Current Study
Metal	Remainder/Composite Metal	142.83	Average of metals, without Used Oil Filters
Electronics	Brown Goods	343.17	CIWMB Staff Measurement
Electronics	Computer-related Electronics	354.08	CIWMB Staff Measurement
Electronics	Other Small Consumer Electronics	438.00	CIWMB Staff Measurement
Electronics	Televisions and Other Items with CRTs	405.00	CIWMB
Plastic	PETE Containers	35.00	U.S. EPA
Plastic	HDPE Containers	24.00	U.S. EPA
Plastic	Miscellaneous Plastic Containers	29.50	Average of *PETE Containers* and *HDPE Containers*
Plastic	Trash Bags	35.00	Current Study
Plastic	Grocery and Other Merchandise Bags	35.00	Current Study
Plastic	Non-Bag Commercial and Industrial Packaging Film	35.00	Current Study
Plastic	Film Products	22.55	Tellus
Plastic	Other Film	22.55	Tellus
Plastic	Durable Plastic Items	50.00	U.S. EPA
Plastic	Expanded Polystyrene Packaging and Insulation	32.00	Current Study
Plastic	Remainder/Composite Plastic	50.00	U.S. EPA
Other Organic	Food	486.00	FEECO, Tellus
Other Organic	Leaves & Grass	312.50	U.S. EPA
Other Organic	Prunings & Trimmings	127.00	Current Study
Other Organic	Branches & Stumps	127.00	Current Study
Other Organic	Agricultural Crop Residues	312.50	U.S. EPA

Table 37 (cont'd.) Volume-to-weight Conversion Factors Used in Composition Calculations

Material Class	Material	Density (lbs/cubic yard)	Source
Other Organic	Manures	675.00	FEECO
Other Organic	Textiles	225.00	Tellus
Other Organic	Carpet	147.00	Current Study
Other Organic	Carpet Padding	62.00	Current Study
Other Organic	Remainder/Composite Organic	224.88	Average of all organics materials, except *Manure*
C&D	Large Concrete with Re-bar	860.00	Current Study
C&D	Large Concrete without Re-bar	860.00	Current Study
C&D	Small Concrete with Re-bar	860.00	Current Study
C&D	Small Concrete without Re-bar	860.00	Current Study
C&D	Large Asphalt Paving with Re-bar	772.80	Tellus scaled down by factor from Florida C&D study
C&D	Large Asphalt Paving without Re-bar	772.80	Tellus scaled down by factor from Florida C&D study
C&D	Small Asphalt Paving with Re-bar	772.80	Tellus scaled down by factor from Florida C&D study
C&D	Small Asphalt Paving without Re-bar	772.80	Tellus scaled down by factor from Florida C&D study
C&D	Composition Roofing	731.00	Current Study
C&D	Other Asphalt Roofing	731.00	Current Study
C&D	Other Aggregates	860.00	Current Study
C&D	Clean Dimensional Lumber	169.00	Current Study
C&D	Clean Engineered Wood	268.00	Current Study
C&D	Pallets and Crates	169.00	Current Study
C&D	Other Recyclable Wood	169.00	Current Study
C&D	Painted/Stained Wood	169.00	Current Study
C&D	Treated Wood	169.00	Current Study
C&D	Clean Gypsum Board	467.00	Current Study
C&D	Painted/Demolition Gypsum	467.00	Current Study
C&D	Large Rock	999.00	Current Study
C&D	Small Rock/Gravel	999.00	Current Study
C&D	Dirt and Sand	929.00	Current Study
C&D	Fiberglass insulation	17.00	Tellus
C&D	Remainder/Composite Construction and Demolition	416.53	Current Study
HHW	Paint	1,836.00	Tellus
HHW	Vehicle & Equip. Fluids	1,653.00	Tellus

Table 37 (cont'd.) Volume-to-weight Conversion Factors Used in Composition Calculations

Material Class	Material	Density (lbs/cubic yard)	Source
HHW	Used Oil	1,524.94	Tellus
HHW	Batteries	2,400.00	CIWMB Staff Estimate
HHW	Remainder/Composite Household Hazardous	1,671.31	Average of HHW liquids
Special Waste	Ash	1,012.50	FEECO
Special Waste	Sewage Solids	945.00	FEECO
Special Waste	Industrial Sludge	1,418.00	Tellus
Special Waste	Treated Medical Waste	64.33	Cascadia and CIWMB
Special Waste	Bulky Items	80.00	Tellus
Special Waste	Tires	200.00	CIWMB Staff Estimate
Special Waste	Remainder/Composite Special Waste	140.00	Average of *Bulky Waste* and *Tires*
Mixed Residue	Mixed Residue	999.00	FEECO

Data Source Abbreviations

CIWMB refers to *Conducting a Diversion Study — A Guide for California Jurisdictions*, California Integrated Waste Management Board, 2001.

CIWMB Staff Estimate refers to estimates provided by CIWMB personnel with expertise in specific materials.

U.S. EPA refers to two sources. 1) *Business Waste Prevention Quantification Methodologies - Business Users Guide*: Washington, D.C. and Los Angeles: U.S. Environmental Protection Agency, Municipal and Industrial Solid Waste, and University of California at Los Angeles Extension, Recycling and Municipal Solid Waste Management Program: Grant Number CX 824548-01-0, 1996. 2) U.S. Environmental Protection Agency's "Measuring Recycling: A Guide for State and Local Governments," document no. EPA530-R-97-011, published September 1997.

FEECO refers to FEECO International, *Complete Systems and Equipment Handbook*, 9th printing.

Florida C&D Study refers to *Converting C&D Debris from Volume to Weight: A Fact Sheet for C&D Debris Facility Operators*, University of Florida, 2000.

Harvard refers to Harvard University, *CURC Campus Refuse Profile: Volume to Weight Conversion Guide*, 2005.

San Diego County refers to conversion factors used in *Waste Composition Study 1999-2000: Final Report,* prepared by Cascadia Consulting Group for the City of San Diego's Environmental Services Department, 2000.

Tellus refers to the Tellus Institute, Boston, Massachusetts.

Changes to Study Design

The main variation from the study design was in numbers of samples characterized for each subsector and metropolitan area. As described in the section Sample Allocation, the anticipated incidence of different subsectors of C&D waste was very different from the actual frequency as encountered in the study. In particular, demolition and non-residential new construction loads were much less common than expected. In addition to varying from the subsector goals, the overall total samples obtained was 18 fewer than planned due to low numbers of C&D loads at some facilities visited. Table 34 shows the planned versus actual samples obtained for this study.

Appendix B:
List and Definitions of Material Types

List of Material Types

The list below shows a hierarchy of material classes and subclasses. As part of this task of the Statewide Waste Characterization Study, solid waste was sorted into the 86 specific material types shown, and composition percentages were calculated for these material types.

California's standard list of material types contains 67 types, as defined in the 2004 Statewide Study. This list was modified somewhat to capture data on specific types for this study only. All the modified types can be re-combined to be consistent with the 67 standard types (referred to below as the CIWMB material index).

Material ID #	Material Type Name
PAPER	
1	Uncoated Corrugated Cardboard
2	Paper Bags
3	Newspaper
4	White Ledger
5	Colored Ledger
6	Other Office Paper
7	Magazines and Catalogs
8	Phone Books and Directories
9	Other Miscellaneous Paper
10	Remainder/Composite Paper
GLASS	
11	Clear Glass Bottles and Containers
12	Green Glass Bottles and Containers
13	Brown Glass Bottles and Containers
14	Other Colored Glass Bottles and Containers
15	Flat Glass
16	Remainder/Composite Glass
METAL	
17	Tin/Steel Cans
18	Major Appliances
19	Used Oil Filters
20	HVAC Ducting
21	Other Ferrous
22	Aluminum Cans
23	Other Non-Ferrous
24	Remainder/Composite Metal

Material ID #	Material Type Name
ELECTRONICS	
25	Brown Goods
26	Computer-related Electronics
27	Other Small Consumer Electronics
28	Televisions and Other Items with CRTs
PLASTIC	
29	PETE Containers
30	HDPE Containers
31	Miscellaneous Plastic Containers
32	Trash Bags
33	Grocery and Other Merchandise Bags
34	Non-Bag Commercial and Industrial Packaging Film
35	Film Products
36	Other Film
37	Durable Plastic Items
38	Expanded Polystyrene Packaging and Insulation
39	Remainder/Composite Plastic
OTHER ORGANIC	
40	Food
41	Leaves and Grass
42	Prunings and Trimmings
43	Branches and Stumps
44	Agricultural Crop Residues
45	Manures
46	Textiles
47	Carpet
48	Carpet Padding
49	Remainder/Composite Organic
CONSTRUCTION & DEMOLITION	
50	Large Concrete with Re-bar
51	Large Concrete without Re-bar
52	Small Concrete with Re-bar
53	Small Concrete without Re-bar
54	Large Asphalt Paving with Re-bar
55	Large Asphalt Paving without Re-bar
56	Small Asphalt Paving with Re-bar
57	Small Asphalt Paving without Re-bar

Material ID #	Material Type Name
58	Composition Roofing
59	Other Asphalt Roofing
60	Other Aggregates
61	Clean Dimensional Lumber
62	Clean Engineered Wood
63	Pallets and Crates
64	Other Recyclable Wood
65	Painted/Stained Wood
66	Treated Wood
67	Clean Gypsum Board
68	Painted/Demolition Gypsum Board
69	Large Rock
70	Small Rock/Gravel
71	Dirt and Sand
72	Fiberglass insulation
73	Remainder/Composite Construction and Demolition
HOUSEHOLD HAZARDOUS WASTE	
74	Paint
75	Vehicle and Equipment Fluids
76	Used Oil
77	Batteries
78	Remainder/Composite Household Hazardous
SPECIAL WASTE	
79	Ash
80	Sewage Solids
81	Industrial Sludge
82	Treated Medical Waste
83	Bulky Items
84	Tires
85	Remainder/Composite Special Waste
MIXED RESIDUE	
86	Mixed Residue

Definitions of Material Types

ID #	Material Type Name	Definition
PAPER		
1	**Uncoated Corrugated Cardboard**	**Uncoated Corrugated Cardboard** usually has three layers. The center wavy layer is sandwiched between the two outer layers. It does not have any wax coating on the inside or outside. Examples include entire cardboard containers, such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. This type does not include chipboard.
2	**Paper Bags**	**Paper Bags** means bags and sheets made from Kraft paper. Examples include paper grocery bags, fast food bags, department store bags, and heavyweight sheets of Kraft packing paper.
3	**Newspaper**	**Newspaper** means paper used in newspapers. Examples include newspaper and glossy inserts, and all items made from newsprint, such as free advertising guides, election guides, plain news packing paper, stapled college schedules of classes, and tax instruction booklets.
4	**White Ledger**	**White Ledger** means uncolored bond, rag, or stationary grade paper. It may have colored ink on it. When the paper is torn, the fibers are white. Examples include white photocopy, white laser print, and letter paper.
5	**Colored Ledger**	**Colored Ledger** means colored bond, rag, or stationery grade paper. When the paper is torn, the fibers are colored throughout. Examples include colored photocopy and letter paper. This subtype does not include fluorescent dyed paper or deep-tone dyed paper such as goldenrod colored paper.
6	**Other Office Paper**	**Other Office Paper** means other kinds of paper used in offices. Examples include manila folders, manila envelopes, index cards, white envelopes, white window envelopes, notebook paper, carbonless forms, computer printout paper, and junk mail. This subtype does not include "white ledger" or "colored ledger ."
7	**Magazines and Catalogs**	**Magazines and Catalogs** means items made of glossy coated paper. This paper is usually slick, smooth to the touch, and reflects light. Examples include glossy magazines, catalogs, brochures, and pamphlets.
8	**Phone Books and Directories**	**Phone Books and Directories** means thin paper between coated covers. These items are bound along the spine with glue. Examples include whole or damaged telephone books, "yellow pages", real estate listings, and some non-glossy mail order catalogs.
9	**Other Miscellaneous Paper**	**Other Miscellaneous Paper** means items made mostly of paper that do not fit into any of the above subtypes. Paper may be combined with minor amounts of other materials such as wax or glues. This subtype includes items made of chipboard, groundwood paper, and deep-toned or fluorescent dyed paper. Examples include cereal and cracker boxes, unused paper plates and cups, goldenrod colored paper, school construction paper/butcher paper, milk cartons, ice cream cartons and other frozen food boxes, unopened junk mail, colored envelopes for greeting cards, pulp paper egg cartons, unused pulp paper plant pots, and hardcover and softcover books.

ID #	Material Type Name	Definition
10	**Remainder/ Composite Paper**	**Remainder/Composite Paper** means items made mostly of paper but combined with large amounts of other materials such as wax, plastic, glues, foil, food, and moisture. Examples include waxed corrugated cardboard, cellulose insulation, aseptic packages, waxed paper, tissue, paper towels, blueprints, sepia, onion skin, fast food wrappers, carbon paper, self-adhesive notes, and photographs.
GLASS		
11	**Clear Glass Bottles and Containers**	**Clear Glass Bottles and Containers** means clear glass beverage and food containers with or without a CRV label. Examples: This type includes whole or broken clear soda and beer bottles, fruit juice bottles, peanut butter jars, whole or broken clear wine bottles, and mayonnaise jars.
12	**Green Glass Bottles and Containers**	**Green Glass Bottles and Containers** means green-colored glass containers with or without a CRV label. Examples: This subtype includes whole or broken green soda and beer bottles, and whole or broken green wine bottles.
13	**Brown Glass Bottles and Containers**	**Brown Glass Bottles and Containers** means brown-colored glass containers with or without a CRV label. Examples: This subtype includes whole or broken brown soda and beer bottles, and whole or broken brown wine bottles.
14	**Other Colored Glass Bottles and Containers**	**Other Colored Glass Bottles and Containers** means colored glass containers and bottles other than green or brown with or without a CRV label. Examples: This subtype includes whole or broken blue or other colored bottles and containers.
15	**Flat Glass**	**Flat Glass** means clear or tinted glass that is flat. This type does not include any subtypes. Examples: This type includes glass window panes, doors, and table tops, flat automotive window glass (side windows), safety glass, and architectural glass. This subtype does not include windshields, laminated glass, or any curved glass.
16	**Remainder/ Composite Glass**	**Remainder/Composite Glass** means glass that cannot be put in any other type or subtype. It includes items made mostly of glass but combined with other materials. This type does not include any subtypes. Examples: This type includes Pyrex, Corningware, crystal and other glass tableware, mirrors, non-fluorescent light bulbs, and auto windshields.
METAL		
17	**Tin/Steel Cans**	**Tin/Steel Cans** means rigid containers made mainly of steel. These items will stick to a magnet and may be tin-coated. This subtype is used to store food, beverages, paint, and a variety of other household and consumer products. Examples include canned food and beverage containers, empty metal paint cans, empty spray paint and other aerosol containers, and bimetal containers with steel sides and aluminum ends.
18	**Major Appliances**	**Major Appliances** means discarded major appliances of any color. These items are often enamel-coated. Examples include washing machines, clothes dryers, hot water heaters, stoves, refrigerators, furnaces and heating and cooling equipment. This subtype does not include electronics, such as televisions and stereos.

ID #	Material Type Name	Definition
19	**Used Oil Filters**	**Used Oil Filters** means metal oil filters used in motor vehicles and other engines, which contain a residue of used oil.
20	**HVAC Ducting**	**HVAC Ducting** means sheet metal tubing, typically galvanized, used for conveying ventilation air. (This material would be considered *Other Ferrous* in the CIWMB material index.)
21	**Other Ferrous**	**Other Ferrous** means any iron or steel that is magnetic or any stainless steel item. This subtype does not include "tin/steel cans." Examples include structural steel beams, boilers, metal clothes hangers, metal pipes, stainless steel cookware, security bars, and scrap ferrous items and galvanized items such as nails and flashing.
22	**Aluminum Cans**	**Aluminum Cans** means any food or beverage container made mainly of aluminum. Examples: This subtype includes aluminum soda or beer cans, and some pet food cans. This subtype does not include bimetal containers with steel sides and aluminum ends.
23	**Other Non-Ferrous**	**Other Non-Ferrous** means any metal item, other than aluminum cans, that is not stainless steel and that is not magnetic. These items may be made of aluminum, copper, brass, bronze, lead, zinc, or other metals. Examples include aluminum window frames, aluminum siding, copper wire, shell casings, brass pipe, and aluminum foil.
24	**Remainder/ Composite Metal**	**Remainder/Composite Metal** means metal that cannot be put in any other type or subtype. This type includes items made mostly of metal but combined with other materials and items made of both ferrous metals and non-ferrous metal combined. Examples include small non-electronic appliances such as toasters and hair dryers, motors, insulated wire, and finished products that contain a mixture of metals, or metals and other materials, whose weight is derived significantly from the metal portion of its construction.
ELECTRONICS		
25	**Brown Goods**	**Brown Goods** means generally larger, non-portable electronic goods that have some circuitry. Examples include microwaves, stereos, VCRs, DVD players, radios, audio/visual equipment, and non-CRT televisions (such as LCD televisions).
26	**Computer-related Electronics**	**Computer-related Electronics** means electronics with large circuitry that is computer-related. Examples include processors, mice, keyboards, laptops, disk drives, printers, modems, and fax machines.
27	**Other Small Consumer Electronics**	**Other Small Consumer Electronics** means portable non-computer-related electronics with large circuitry. Examples include personal digital assistants (PDAs), cell phones, phone systems, phone answering machines, computer games and other electronic toys, portable CD players, camcorders, and digital cameras.
28	**Televisions and Other Items with CRTs**	**Televisions and Other Items with CRTs**. Examples include televisions, computer monitors, and other items containing a cathode ray tube (CRT).

ID #	Material Type Name	Definition
		PLASTIC
29	**PETE Containers**	**PETE Containers** means clear or colored PETE (polyethylene terephthalate) containers. When marked for identification, it bears the number 1 in the center of the triangular recycling symbol and may also bear the letters PETE or PET. The color is usually transparent green or clear. A PETE container usually has a small dot left from the manufacturing process, not a seam. It does not turn white when bent. Examples: This subtype includes soft drink and water bottles, some liquor bottles, cooking oil containers, and aspirin bottles.
30	**HDPE Containers**	**HDPE Containers** means natural and colored HDPE (high-density polyethylene) containers. This plastic is usually either cloudy white, allowing light to pass through it (natural) or a solid color, preventing light from passing through it (colored). When marked for identification, it bears the number 2 in the triangular recycling symbol. Examples: This subtype includes milk jugs, water jugs, detergent bottles, some hair-care bottles, empty motor oil, empty antifreeze, and other empty vehicle and equipment fluid containers.
31	**Miscellaneous Plastic Containers**	**Miscellaneous Plastic Containers** means plastic containers made of types of plastic other than HDPE (high-density polyethylene) or PETE (polyethylene terephthalate). Items may be made of PVC (polyvinyl chloride), LDPE (low-density polyethylene), PP (polypropylene), PS (polystyrene), or mixed resins. When marked for identification, these items may bear the number 3, 4, 5, 6, or 7 in the triangular recycling symbol. Examples: This subtype includes food containers such as bottles for salad dressings and vegetable oils, flexible and brittle yogurt cups, syrup bottles, margarine tubs, microwave food trays, and clamshell-shaped fast food containers. This subtype also includes some shampoo containers, vitamin bottles, foam egg cartons, and clamshell-like muffin containers.
32	**Trash Bags**	**Trash Bags** means plastic bags sold for use as trash bags, for both residential and commercial use. Does not include other plastic bags like shopping bags that might have been used to contain trash.
33	**Grocery and Other Merchandise Bags**	**Grocery and Other Merchandise Bags** means plastic shopping bags used to contain merchandise to transport from the place of purchase, given out by the store with the purchase. Includes dry-cleaning plastic bags intended for 1-time use.
34	**Non-Bag Commercial and Industrial Packaging Film**	**Non-Bag Commercial and Industrial Packaging Film** means film plastic used for large-scale packaging or transport packaging. Examples include shrink-wrap, mattress bags, furniture wrap, and film bubble wrap.
35	**Film Products**	**Film Products** means plastic film used for purposes other than packaging. Examples include agricultural film (films used in various farming and growing applications, such as silage greenhouse films, mulch films, and wrap for hay bales), plastic sheeting used as drop cloths, and building wrap/Tyvek packaging.

ID #	Material Type Name	Definition
36	**Other Film**	**Other Film** means all other plastic film that does not fit into any other type. Examples include other types of plastic bags (sandwich bags, zipper-recloseable bags, newspaper bags, produce bags, frozen vegetable bags, bread bags), food wrappers such as candy-bar wrappers, mailing pouches, bank bags, X-ray film, metallized film (wine containers and balloons), and plastic food wrap.
37	**Durable Plastic Items**	**Durable Plastic Items** means plastic objects other than containers and film plastic. This type also includes plastic objects other than containers or film that bear the numbers 1 through 7 in the triangular recycling symbol. These items are usually made to last for more than one use. Examples: This type includes plastic outdoor furniture, plastic toys and sporting goods, CD's, and plastic housewares, such as mop buckets, dishes, cups, and cutlery. This type also includes building materials such as house siding, and window sashes and frames; housings for electronics such as computers, televisions and stereos; and plastic pipes (e.g., PVC pipes) and fittings.
38	**Expanded Polystyrene Packaging and Insulation**	**Expanded Polystyrene Packaging and Insulation** means items marked with a PS or a #6. Examples include packaging peanuts, meat and vegetable packaging trays, and clamshell containers. This type also includes expanded polystyrene packaging blocks and insulation. (This material would be considered *Remainder/Composite Plastic* in the CIWMB material list.)
39	**Remainder/ Composite Plastic**	**Remainder/Composite Plastic** means plastic that cannot be put in any other type or subtype. They are usually recognized by their optical opacity. This type includes items made mostly of plastic but combined with other materials. Examples include auto parts made of plastic attached to metal, plastic drinking straws, foam drinking cups, produce trays, foam packing blocks (not including expanded polystyrene blocks), plastic strapping, new plastic laminate (e.g., Formica), vinyl, linoleum, plastic lumber, imitation ceramics, handles and knobs, plastic lids, some kitchen ware, toys, plastic string (as used for hay bales), and plastic rigid bubble/foil packaging (as for medications).
OTHER ORGANIC	
40	**Food**	**Food** means food material resulting from the processing, storage, preparation, cooking, handling, or consumption of food. This type includes material from industrial, commercial, or residential sources. Examples include discarded meat scraps, dairy products, egg shells, fruit or vegetable peels, and other food items from homes, stores, and restaurants. This type includes grape pomace and other processed residues or material from canneries, wineries, or other industrial sources.
41	**Leaves and Grass**	**Leaves and Grass** means plant material, except woody material, from any public or private landscapes. Examples include leaves, grass clippings, sea weed, and plants. This subtype does not include woody material or material from agricultural sources.
42	**Prunings and Trimmings**	**Prunings and Trimmings** means woody plant material up to 4 inches in diameter from any public or private landscape. Examples include prunings, shrubs, and small branches with branch diameters that do not exceed 4 inches. This subtype does not include stumps, tree trunks, or branches exceeding 4 inches in diameter. This subtype does not include material from agricultural sources.

ID #	Material Type Name	Definition
43	**Branches and Stumps**	**Branches and Stumps** means woody plant material, branches, and stumps that exceed four inches in diameter from any public or private landscape.
44	**Agricultural Crop Residues**	**Agricultural Crop Residues** means plant material from agricultural sources. Examples include orchard and vineyard prunings, vegetable by-products from farming, residual fruits, vegetables, and other crop remains after usable crop is harvested. This subtype does not include processed residues from canneries, wineries, or other industrial sources.
45	**Manures**	**Manures** means manure and soiled bedding materials from domestic, farm, or ranch animals. Examples include manure and soiled bedding from animal production operations, racetracks, riding stables, animal hospitals, and other sources.
46	**Textiles**	**Textiles** means items made of thread, yarn, fabric, or cloth. Examples include clothes, fabric trimmings, draperies, and all natural and synthetic cloth fibers. This subtype does not include cloth-covered furniture, mattresses, leather shoes, leather bags, or leather belts.
47	**Carpet**	**Carpet** means flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material. Does not include carpet padding.
48	**Carpet Padding**	**Carpet Padding** means plastic, foam, felt, and other materials used under carpet to provide insulation and padding. (This material would be considered *Remainder/Composite Organic* in the CIWMB material index.)
49	**Remainder/ Composite Organic**	**Remainder/Composite Organic** means organic material that cannot be put in any other type or subtype. This type includes items made mostly of organic materials but combined with other materials. Examples include leather items, cork, hemp rope, garden hoses, rubber items, hair, cigarette butts, diapers, feminine hygiene products, wood products (Popsicle sticks and toothpicks), wood chips, sawdust, and animal feces.
	CONSTRUCTION & DEMOLITION	
50	**Large Concrete with Re-bar**	**Large Concrete with Re-bar** means a hard material made from sand, gravel, aggregate, cement mix, and water containing steel mesh and/or reinforcement bars, or "rebar." Large pieces are defined as being greater than one foot in its largest dimension. Examples include pieces of building foundations, concrete paving, and cinder blocks. (This material would be considered *Concrete* in the CIWMB material index.)
51	**Large Concrete without Re-bar**	**Large Concrete without Re-bar** means a hard material made from sand, gravel, aggregate, cement mix, and water. Large pieces are defined as being greater than one foot in its largest dimension. Examples include pieces of building foundations, concrete paving, and cinder blocks. (This material would be considered *Concrete* in the CIWMB material index.)

ID #	Material Type Name	Definition
52	**Small Concrete with Re-bar**	**Small Concrete with Re-bar** means a hard material made from sand, gravel, aggregate, cement mix, and water containing steel mesh and/or reinforcement bars, or "rebar." Small pieces are defined as being less than one foot in its largest dimension. Examples include pieces of building foundations, concrete paving, and cinder blocks. (This material would be considered *Concrete* in the CIWMB material index.)
53	**Small Concrete without Re-bar**	**Small Concrete without Re-bar** means a hard material made from sand, gravel, aggregate, cement mix, and water. Small pieces are defined as being less than one foot in its largest dimension. Examples include pieces of building foundations, concrete paving, and cinder blocks. (This material would be considered *Concrete* in the CIWMB material index.)
54	**Large Asphalt Paving with Re-bar**	**Large Asphalt Paving with Re-bar** means a black or brown, tar-like material mixed with aggregate used as a paving material containing steel mesh and/or reinforcement bars, or "rebar." Large pieces are defined as being greater than one foot in its largest dimension. (This material would be considered *Asphalt Paving* in the CIWMB material index.)
55	**Large Asphalt Paving without Re-bar**	**Large Asphalt Paving without Re-bar** means a black or brown, tar-like material mixed with aggregate used as a paving material. Large pieces are defined as being greater than one foot in its largest dimension. (This material would be considered *Asphalt Paving* in the CIWMB material index.)
56	**Small Asphalt Paving with Re-bar**	**Small Asphalt Paving with Re-bar** means a black or brown, tar-like material mixed with aggregate used as a paving material containing steel mesh and/or reinforcement bars, or "rebar." Small pieces are defined as being less than one foot in its largest dimension. (This material would be considered *Asphalt Paving* in the CIWMB material index.)
57	**Small Asphalt Paving without Re-bar**	**Small Asphalt Paving without Re-bar** means a black or brown, tar-like material mixed with aggregate used as a paving material. Small pieces are defined as being less than one foot in its largest dimension. (This material would be considered *Asphalt Paving* in the CIWMB material index.)
58	**Composition Roofing**	**Composition Roofing** means composite shingles composed of fiberglass or organic felts saturated with asphalt and covered with inert aggregates as well as attached roofing tar and tar paper. Does not include built-up roofing. Commonly known as three tab roofing. Examples include asphalt shingles and attached roofing tar and tar paper. (This material would be considered *Asphalt Roofing* in the CIWMB material index).
59	**Other Asphalt Roofing**	**Other Asphalt Roofing (Built-up Roofing)** means other roofing material made with layers of felt, asphalt, aggregates, and attached roofing tar and tar paper normally used on flat/low pitched roofs usually on commercial buildings. (This material would be considered *Asphalt Roofing* in the CIWMB material index).

ID #	Material Type Name	Definition
60	**Other Aggregates**	**Other Aggregates** means aggregates other than concrete and asphalt paving such as bricks, masonry tile, ceramics, porcelain toilets, and clay roofing tiles. (This material would be considered *Remainder/Composite Construction and Demolition* in the CIWMB material index).
61	**Clean Dimensional Lumber**	**Clean Dimensional Lumber** means unpainted new or demolition dimensional lumber. Includes materials such as 2 x 4s, 2 x 6s, 2 x 12s, and other residual materials from framing and related construction activities. May contain nails or other <u>trace</u> contaminants. (This material would be considered *Lumber* in the CIWMB material index).
62	**Clean Engineered Wood**	**Clean Engineered Wood** means unpainted new or demolition scrap from sheeted goods such as plywood, particleboard, wafer board, oriented strand board, and other residual materials used for sheathing and related construction uses. May contain nails or other <u>trace</u> contaminants. (This material would be considered *Lumber* in the CIWMB material index).
63	**Pallets and Crates**	**Pallets and Crates** means unpainted wood pallets, crates, and packaging made of lumber/engineered wood. (This material would be considered *Lumber* in the CIWMB material index).
64	**Other Recyclable Wood**	**Other Recyclable Wood** means recyclable wood not included in any other category. This may include scrap from production of prefabricated wood products such as wood furniture or cabinets that have not been treated with paint, stain, or other chemical finish. This category also includes recyclable demolition wood and untreated or unpainted wood roofing and siding as long as the wood material is not contaminated with another material (i.e. tar). May be recycled into ethanol, adhesives, or other engineered wood products. (This material would be considered *Lumber* in the CIWMB material index).
65	**Painted/Stained Wood**	**Painted/Stained Wood** means wood that has had an external coating applied like handrails or finished furniture. (This material would be considered *Remainder/Composite Construction and Demolition* in the CIWMB material index).
66	**Treated Wood**	**Treated Wood** means wood that has been treated with a chemical preservative for purposes of protecting the wood against attacks from insects, microorganisms, fungi, and other environmental conditions that can lead to decay of the wood and the chemical preservative is registered pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Sec. 136 and following). This includes wood that has been pressure treated, chemically treated (with copper etc.) or treated with creosote (e.g. railroad ties, marine timbers and pilings, landscape timbers, and telephone poles). (This material would be considered *Remainder/Composite Construction and Demolition* in the CIWMB material index).
67	**Clean Gypsum Board**	**Clean Gypsum Board** means <u>unpainted</u> gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples: This type includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard. (This material would be considered *Gypsum Board* in the CIWMB material index).

ID #	Material Type Name	Definition
68	**Painted/Demolition Gypsum Board**	**Painted/Demolition Gypsum Board** means <u>painted</u> gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples: This type includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard. (This material would be considered *Gypsum Board* in the CIWMB material index).
69	**Large Rock**	**Large Rock** means large pieces of mineral matter or rock greater than 1 foot. Examples include landscaping rock and paving stones. (This material would be considered *Rock, Soil, and Fines* in the CIWMB material index).
70	**Small Rock/Gravel**	**Small Rock/Gravel** means rock pieces less than 1 foot. Examples include pathway gravel and other natural or mechanically crushed materials. (This material would be considered *Rock, Soil, and Fines* in the CIWMB material index).
71	**Dirt and Sand**	**Dirt and Sand** means nutrient rich decayed organic matter and fine pieces of mineral matter, often left over from land clearing activities. This subtype also includes non-hazardous contaminated soil. (This material would be considered *Rock, Soil, and Fines* in the CIWMB material index).
72	**Fiberglass insulation**	**Fiberglass insulation** means any of the various types of synthetic fiber insulation including both faced and unfaced batts and rigid board types. Used in ceilings, walls and around ducting for both thermal insulation and sound attenuation. (This material would be considered *Remainder/Composite Construction and Demolition* in the CIWMB material index).
73	**Remainder/ Composite Construction and Demolition**	**Remainder/Composite Construction and Demolition** means construction and demolition material that cannot be put in any other type or subtype. This type may include items from different categories combined, which would be very hard to separate. This type may also include demolition debris that is a mixture of materials such as non-porcelain sinks, synthetic counter tops, fiber or composite acoustic ceiling tiles, plate glass, wood, tiles, gypsum board, and aluminum scrap.
	HOUSEHOLD HAZARDOUS WASTE	
74	**Paint**	Paint means containers with paint in them. Examples include latex paint, oil based paint, and tubes of pigment or fine art paint. This type does not include dried paint, empty paint cans, or empty aerosol containers.
75	**Vehicle and Equipment Fluids**	**Vehicle and Equipment Fluids** means containers with fluids used in vehicles or engines, except used oil. Examples include used antifreeze and brake fluid. This type does not include empty vehicle and equipment fluid containers.
76	**Used Oil**	**Used Oil** means the same as defined in Health and Safety Code section 25250.1(a). Examples include spent lubricating oil such as crankcase and transmission oil, gear oil, and hydraulic oil.
77	**Batteries**	**Batteries** means any type of battery including both dry cell and lead acid. Examples include car, flashlight, small appliance, watch, and hearing aid batteries.

ID #	Material Type Name	Definition
78	**Remainder/ Composite Household Hazardous**	**Remainder/Composite Household Hazardous** means household hazardous material that cannot be put in any other type or subtype. This type also includes household hazardous material that is mixed. Examples include household hazardous waste which if improperly put in the solid waste stream may present handling problems or other hazards, such as fluorescent light bulbs, pesticides, and caustic cleaners.
	SPECIAL WASTE	
79	**Ash**	**Ash** means a residue from the combustion of any solid or liquid material. Examples include ash from structure fires, fireplaces, incinerators, biomass facilities, waste-to-energy facilities, and barbecues.
80	**Sewage Solids**	**Sewage Solids** means residual solids and semi-solids from the treatment of domestic waste water or sewage. Examples include biosolids, sludge, grit, screenings, and septage. This category does not include sewage or waste water discharged from the sewage treatment process.
81	**Industrial Sludge**	**Industrial Sludge** means sludge from factories, manufacturing facilities, and refineries. Examples include paper pulp sludge, and water treatment filter cake sludge.
82	**Treated Medical Waste**	**Treated Medical Waste** means medical waste that has been processed in order to change its physical, chemical, or biological character or composition, or to remove or reduce its harmful properties or characteristics, as defined in Section 25123.5 of the California Health and Safety Code.
83	**Bulky Items**	**Bulky Items** means large hard to handle items that are not defined separately, including furniture, mattresses, and other large items. Examples include all sizes and types of furniture, mattresses, box springs, and base components.
84	**Tires**	**Tires** means vehicle tires. Examples include tires from trucks, automobiles, motorcycles, heavy equipments, and bicycles.
85	**Remainder/ Composite Special Waste**	**Remainder/Composite Special Waste** means special waste that cannot be put in any other type. Examples include asbestos-containing materials, such as certain types of pipe insulation and floor tiles, auto fluff, auto-bodies, trucks, trailers, truck cabs, untreated medical waste/pills/hypodermic needles, and artificial fireplace logs.
	MIXED RESIDUE	
86	**Mixed Residue**	**Mixed Residue** means material that cannot be put in any other type or subtype in the other categories. This category includes mixed residue that cannot be further sorted. Examples include residual material from a materials recovery facility or other sorting process that cannot be put in any of the previous remainder/composite types. It also includes clay and other fines.

Divertibility of Material Types

Each of the 86 material types presented in the previous section were classified according to the following divertibility categories: Recyclable Aggregates; Recyclable Wood; Rock, Dirt & Sand; Recyclable Metal; Other Recoverable Material, and Other MSW. Table 38 presents the 86 material types according to these divertibility categories.

Table 38. Characterization of Material Type Divertibility

Recyclable Aggregates	Other Recoverable Material	
Const/Demo	**Paper**	**Plastic (cont.)**
Lg Concrete with Re-bar	Uncoated Corrugated Cardboard	Grocery/ Merch. Bags
Lg Concrete without Re-bar	Paper Bags/Kraft	Non-Bag Comm./Ind.Packaging Film
Sm Concrete with Re-bar	Newspaper	Film Products
Sm Concrete without Re-bar	White Ledger	**Organics**
Lg Asphalt Pav. with Re-bar	Colored Ledger	Food
Lg Asphalt Pav. without Re-bar	Other Office Paper	Leaves & Grass
Sm Asphalt Pav. with Re-bar	Magazines/Catalogs	Prunings & Trimmings
Sm Asphalt Pav. without Re-bar	Phone Books/Directories	Branches & Stumps
Other Aggregates	Other Misc. Paper	Agricultural Crop Residues
Recyclable Wood	**Glass**	Manures
Const/Demo	Clear Glass Bottles & Containers	Textiles
Clean Dimensional Lumber	Green Glass Bottles & Containers	Carpet
Clean Engineered Wood	Brown Glass Bottles & Containers	**Const/Demo**
Pallets & Crates	Other Colored Glass Bottles & Containers	Composition Roofing
Other Recyclable Wood	**Electronics**	Clean Gypsum Board
Rock, Dirt, & Sand	Brown Goods	**HHW**
Const/Demo	Computer-related Electronics	Paint
Large Rock	Other Small Consumer Electronics	Vehicle & Equip. Fluids
Small Rock/Gravel	TV's & Other CRTs	Used Oil
Dirt & Sand	**Plastic**	Batteries
Recyclable Metal	PETE Containers	**Special**
Metal	HDPE Containers	Sewage Solids
Tin/Steel Cans	Misc. Plastic Containers	Tires
Major Appliances	Other MSW	
Used Oil Filters	**Paper**	**Const/Demo**
HVAC Ducting	Remainder/Composite Paper	Other Asphalt Roofing
Other Ferrous	**Glass**	Painted/Stained Wood
Aluminum Cans	Flat Glass	Treated Wood
Other Non-Ferrous	Remainder/Composite Glass	Painted/Demolition Gypsum Board
	Metal	Fiberglass Insulation
	Remainder/Composite Metal	Remainder/Composite C&D
	Plastic	**HHW**
	Trash Bags	Remainder/Composite HHW
	Other Film	**Special**
	Durable Plastic Items	Ash
	Expnd. Polystyr. Packaging/Insulation	Industrial Sludge
	Remainder/Composite Plastic	Treated Medical Waste
	Organics	Bulky Items
	Carpet Padding	Remainder/Composite Special
	Remainder/Composite Organic	**Mixed Residue**
		Mixed Residue

Appendix C:
Development of Visual Estimating Method

Development of Visual Estimating Method and Associated Conversion Factors

Although visually estimating construction and demolition waste is not a new concept, one objective of this study was to review and evaluate current methods, so that the most accurate method was found and associated conversion factors were calculated to create the most representative results. The following method describes this process.

Visual Estimating Method Literature Review

To develop a new standard visual characterization method for C&D waste, current methods were reviewed. The literature search focused on the following studies:

- Various studies conducted by Cascadia and R.W. Beck to characterize C&D waste in California, Washington, and Florida

- "Solid Waste Analysis Protocol" (New Zealand Ministry for the Environment, 2002)

- "Solid Waste Management Coordinating Board Construction Waste: Project Memo #1" (Twin Cities, Minnesota, 2000)

- "Methodology for Conducting Composition Study for Discarded Solid Waste" (Florida Center for Solid and Hazardous Waste Management, 1996)

- "Humboldt State University Waste Characterization Study" (1992)

- "Converting C&D Debris from Volume to Weight: A Fact Sheet for C&D Debris Facility Operators" (University of Florida, 2000)

- "Construction, Renovation and Demolition (CRD) Waste Characterization Study" (CH2M Gore & Storrie Limited, 2000)

In addition, new and innovative methods such as using digital photography as well as visual estimating methods used outside the solid waste arena were considered. These methods were documented and discussed with CIWMB staff during a half-day workshop in order to develop a set of specifications for a new standard method.

The literature review resulted in the following findings.

- In general, visual estimating methods for C&D wastes were found to be either weight-based or volume-based. These two methods are described as follows:

  - In **volume-based visual estimating**, the estimator records what portion of the overall volume belongs to each material type present. The percentages are multiplied by the total volume. The volume estimates are then converted to weights using material-specific volume-to-weight conversion factors.

  - **Weight-based estimating** entails recording the portion of weight that belongs to each material present. The resulting percentages are multiplied by the total weight to calculate the weight of each material present. This method requires the estimator be very knowledgeable about densities of materials in the load. Since these estimates are already in weight units, the units do not need to be converted.

- Existing volume-to-weight conversion factors come from a variety of organizations such as US Environmental Protection Agency, Tellus Institute, and FEECO International, among

others. In these published sources, the volume-to-weight conversion factors for many materials vary widely and/or are presented as a wide range even within one source.

- Volume-to-weight factors were not found in published sources for some materials commonly found in C&D waste.

- Traditional density measurements have been calculated from pure loads or packaged and condensed material. However, the "as disposed" form of C&D materials is typically a mix of materials and may include air spaces, irregular stacks, and materials randomly dispersed throughout the load. Compared to pure loads, materials fit together differently, and, therefore, have different densities in "as disposed" loads.

- It may be that some materials appear to take up more or less space than they actually do. Research suggests that estimators systematically over-estimate heavier materials and under-estimate lighter materials.

- Both traditional density figures and estimator bias contribute to an overall weight that often exceeds, but can also be far less than, the actual total weight. Each individual material estimate must then be scaled up or down to account for these differences. For example, if the sum of the estimates is twice as much as the actual total weight, all of the individual material estimates are divided by two.

- In weight-based estimating, it may be that certain materials are consistently over or under-estimated.

Based on the above considerations, the research design for the field test incorporated the following elements.

- Testing volume-based and weight-based visual estimating methods.

- Developing "as-disposed" volume-to-weight conversion factors based on estimated volume and actual weight to correct for estimator bias.

Field Testing Conversion Factors and Characterization Methods

The field test for testing conversion factors and characterization methods used the following list of materials, as defined in the section List and Definition of Material Types Used for Testing Visual-Estimating Method. These materials were chosen based on recoverability and marketability as well as common occurrence in the C&D stream.

- Uncoated Corrugated Cardboard/Kraft Paper
- Major Appliances
- HVAC Ducting
- Other Ferrous Metal
- Plastic Film
- Polystyrene Packaging & Insulation
- Carpet

- Carpet Padding
- Prunings, Branches, & Stumps
- Large Concrete
- Small Concrete
- Large Asphalt Paving
- Small Asphalt Paving
- Composition Roofing
- Other Aggregates

- Dimensional Lumber and Pallets
- Engineered and Other Recyclable Wood
- Painted/Stained Wood
- Gypsum Board
- Large Rock
- Small Rock/Gravel
- Dirt and Sand

Data was collected by: 1) conducting visual volume-based composition estimates on 75 loads of C&D waste; 2) conducting visual weight-based composition estimates on those same 75 loads; 3) sampling of randomly selected 200 lb. samples from each load; and 4) hand-sorting of the entire load of all 75 loads. To test and determine the accuracy of these methods, results of each method was compared to results from sorting the complete contents of the 75 loads. The 75 C&D loads were selected over five days at Miramar Landfill in San Diego in November 2004.

The field crew performed four analyses on each selected C&D load:

1. Volume-based visual estimations of the vehicle's composition

2. Weight-based visual estimations of the vehicle's composition

3. Hand-sorted and weighed composition of a randomly selected 200 pound sample from the load

4. Hand-sorted and weighed composition of the entire load

The key objectives in performing all four of these analyses were to:

1. Calculate volume-based visual conversion factors for the principal material types in C&D waste based on observations, and analyze the variability of observations among multiple observers.

2. Calculate weight-based visual correction factors for the principal material types in C&D waste based on observations, and analyze the variability of observations among multiple observers.

3. Determine and evaluate the "most accurate" process for visual characterization.

4. Determine whether visual characterizations or hand-sorts more accurately predict the composition of C&D waste.

5. Compare the results of the 200 lb samples to those from sorting the entire load.

6. Test the proposed visual estimation protocol.

Following this data collection effort, Cascadia analyzed the results and documented findings for discussion with CIWMB staff. These documented findings and subsequent discussion provided the bases for choosing the visual method, and for determining the volume-to-weight conversion factors used throughout the remainder of the study.

Analysis of Field Test Data

The comparison between volume-based estimating and weight-based estimating was set up by first establishing a "composite" estimate from all the estimators that reflected the amount of each material that was perceived in a given load, based on weight and separately based on volume.

1. For each sample record (i.e., for each weight-based or volume-based composition estimate by an individual researcher), the estimates for material classes and specific material types within classes were used to calculate the percentage of the load's entire weight or volume associated with each specific material type.

Table 39. Combining of Materials for Visual Method Comparison

Material ID #	Material Name		Material ID #	Material Name
1	Uncoated Corrugated Cardboard		1	Uncoated Corrugated Cardboard
2	Other Paper		2	Major Appliances
3	Major Appliances		3	HVAC Ducting
4	HVAC Ducting		4	Other Ferrous
5	Other Ferrous		5	Film
6	Other Metal		6	Polystyrene Packaging and Insulation
7	Film		7	Carpet
8	Polystyrene Packaging and Insulation		8	Carpet Padding
9	Other Plastic		9	Prunings, Branches, & Stumps
10	Carpet		10	Large Concrete
11	Carpet Padding		11	Small Concrete
12	Prunings, Branches, & Stumps		12	Large Asphalt Paving
13	Other Organic		13	Small Asphalt Paving
14	Large Concrete		14	Composition Roofing
15	Small Concrete		15	Other Aggregates
16	Large Asphalt Paving		16	Dimensional Lumber and Pallets
17	Small Asphalt Paving		17	Eng and Other Recyclable Wood
18	Composition Roofing		18	Painted/Stained Wood
19	Other Aggregates		19	Gypsum Board
20	Dimensional Lumber and Pallets		20	Large Rock
21	Eng and Other Recyclable Wood		21	Small Rock/Gravel
22	Painted/Stained Wood		22	Dirt and Sand
23	Gypsum Board		23	All Other
24	Large Rock			
25	Small Rock/Gravel			
26	Dirt and Sand			
27	Other C&D			
28	GLASS			
29	ELECTRONIC WASTE			
30	HHW			
31	SPECIAL			
32	MIXED RESIDUE			

2. For each sample record, the percentage estimates were converted into weights. With composition estimates that were originally weight-based, this was done by multiplying the percentage estimate for each specific material type by the load's known net weight. With composition estimates that were volume-based, this was done by multiplying the percentage estimate by the load's calculated volume, and then multiplying that product by the material-specific density factor that was calculated during this study. The density factors that were used are shown in Table 41.

In order to simplify the analysis, certain material types that were observed in loads less frequently were combined in each record to form a new material type called "all other." Table 39 shows which material types were combined in this manner.

1. For each material type in each sample record, a ratio was calculated to express the estimated weight (from visual observation) associated with the material divided by the actual weight (from hand sorting and weighing) of the material. Thus, if the estimated weight was greater than the actual weight, this process resulted in a number greater than 1. If the actual weight was greater, the process resulted in a number between 0 and 1.

Table 40. Comparison of Weight-Based and Volume-Based Visual Estimating Methods

	Weight estimates compared to actual weights	Volume estimates compared to actual weights
Uncoated Corrugated Cardboard	239%	92%
Major Appliances	117%	79%
HVAC Ducting	304%	110%
Other Ferrous	124%	93%
Film	154%	62%
Polystyrene Packaging and Insulation	358%	80%
Carpet	166%	108%
Carpet Padding	233%	91%
Prunings, Branches, & Stumps	146%	86%
Large Concrete	73%	122%
Small Concrete	149%	110%
Asphalt Paving[**]	705%	78%
Composition Roofing	138%	526%
Other Aggregates	80%	128%
Dimensional Lumber and Pallets	151%	93%
Engineered and Other Recyclable Wood	119%	132%
Painted/Stained Wood	140%	82%
Gypsum Board	71%	132%
Large Rock	121%	186%
Small Rock/Gravel	67%	299%
Dirt and Sand	108%	216%
Average of other materials	99%	168%

Color key:	Results are clearly better than alternative method
	Results are marginally better than alternative method

2. An averaging process was used to determine the average extent to which estimators overshot or undershot the actual weight for each material type with their estimates. The results are shown in Table 40. Numbers greater than 100 percent indicate that the average estimate for a given material exceeded the actual weight of that material. Numbers less than 100 percent indicate the opposite, that the average estimates were less than the actual weight. A result that is close to 100 percent indicates that the researchers, on average, produced estimates that were close to the actual weight of the material for all samples they observed.

In general, the volume-based approach produced estimates that, on average, were closer to the actual material weights in the loads. This is indicated by the greater number of material comparisons (shaded grey and yellow in the table above) for which the volume-based approach produced the closer estimate.

[**] Large asphalt paving was only found in one sample, as shown in Table 41. Because the density calculated from this sample was not believable (55 lbs/cubic yard), small and large asphalt paving data were combined to calculate one density factor.

The reason that the weight-based approach resulted in estimates that, on average, were higher than the actual weights across the board is that in most cases, one or more of the researchers greatly overestimated the weight of the given material.

This analysis indicates that the volume-based approach to visual composition estimation generally produces estimates that are more accurate than the corresponding weight-based approach.

List and Definition of Material Types Used for Testing Visual-Estimating Method

The following abbreviated list of 22 materials was used for testing the visual estimating methods.

Material ID #	Material Type Name
PAPER	
1	Uncoated Corrugated Cardboard
METAL	
2	Major Appliances
3	HVAC Ducting
4	Other Ferrous
PLASTIC	
5	Film
6	Polystyrene Packaging and Insulation
OTHER ORGANIC	
7	Carpet
8	Carpet Padding
9	Prunings, Branches, & Stumps
CONSTRUCTION & DEMOLITION	
10	Large Concrete
11	Small Concrete
12	Large Asphalt Paving
13	Small Asphalt Paving
14	Composition Roofing
15	Other Aggregates
16	Dimensional Lumber and Pallets
17	Engineered and Other Recyclable Wood
18	Painted/Stained Wood
19	Gypsum Board
20	Large Rock
21	Small Rock/Gravel
22	Dirt and Sand

The above listed materials are defined below. For some material types listed, two more specific types were combined because the conversion factor for both of the specific materials would be

similar. For example, even though "Other Ferrous" and "Other Non-ferrous" are two different material types in the California standard list, they were combined for the testing phase only.

ID #	Material Type Name	Definition
PAPER		
1	**Uncoated Corrugated Cardboard**	**Uncoated Corrugated Cardboard** usually has three layers. The center wavy layer is sandwiched between the two outer layers. It does not have any wax coating on the inside or outside. Examples include entire cardboard containers, such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. This type does not include chipboard. And **Paper Bags** means bags and sheets made from Kraft paper. Examples include paper grocery bags, fast food bags, department store bags, empty Kraft cement bags (without plastic liners), and heavyweight sheets of Kraft packing paper.
METAL		
2	**Major Appliances**	**Major Appliances** means discarded major appliances of any color. These items are often enamel-coated. Examples include washing machines, clothes dryers, hot water heaters, stoves, refrigerators, furnaces and heating and cooling equipment. This subtype does not include electronics, such as televisions and stereos.
3	**HVAC Ducting**	**HVAC Ducting** means sheet metal tubing, typically galvanized, used for conveying ventilation air. (This material would be considered *Other Ferrous* in the CIWMB material index.)
4	**Other Ferrous**	**Other Ferrous** means any iron or steel that is magnetic or any stainless steel item. This subtype does not include "tin/steel cans." Examples include structural steel beams, boilers, metal clothes hangers, metal pipes, stainless steel cookware, security bars, and scrap ferrous items and galvanized items such as nails and flashing. And **Other Non-Ferrous** means any metal item, other than aluminum cans, that is not stainless steel and that is not magnetic. These items may be made of aluminum, copper, brass, bronze, lead, zinc, or other metals. Examples include aluminum window frames, aluminum siding, copper wire, shell casings, brass pipe, and aluminum foil.
PLASTIC		
5	**Film**	**Non-Bag Commercial and Industrial Packaging Film** means film plastic used for large-scale packaging or transport packaging. Examples include shrink-wrap, mattress bags, furniture wrap, and film bubble wrap. And **Film Products** means plastic film used for purposes other than packaging. Examples include agricultural film (films used in various farming and growing applications, such as silage greenhouse films, mulch films, and wrap for hay bales), plastic sheeting used as drop cloths, and building wrap/Tyvek packaging.

ID #	Material Type Name	Definition
6	**Polystyrene Packaging and Insulation**	**Expanded Polystyrene Packaging and Insulation** means items marked with a PS or a #6. Examples include packaging peanuts, meat and vegetable packaging trays, and clamshell containers. This type also includes expanded polystyrene packaging blocks and insulation. (This material would be considered Remainder/Composite Plastic in the CIWMB material list.) And **Fiberglass insulation** means any of the various types of synthetic fiber insulation including both faced and unfaced batts and rigid board types. Used in ceilings, walls and around ducting for both thermal insulation and sound attenuation. (This material would be considered Remainder/Composite Construction and Demolition in the CIWMB material index.)
OTHER ORGANIC		
7	**Carpet**	**Carpet** means flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material. Does not include carpet padding.
8	**Carpet Padding**	**Carpet Padding** means plastic, foam, felt, and other materials used under carpet to provide insulation and padding. (This material would be considered Remainder/Composite Organic in the CIWMB material index.)
9	**Prunings and Trimmings, Branches and Stumps**	**Prunings and trimmings, Branches, and Stumps: Prunings and trimmings** means woody plant material up to 4 inches in diameter from any public or private landscape. Examples: This subtype includes prunings, shrubs, and small branches with branch diameters that do not exceed 4 inches. This subtype does not include stumps, tree trunks, or branches exceeding 4 inches in diameter. This subtype does not include material from agricultural sources. **Branches and Stumps** means woody plant material, branches, and stumps that exceed 4 inches in diameter from any public or private landscape.
CONSTRUCTION & DEMOLITION		
10	**Large Concrete**	**Large Concrete** means a hard material made from sand, gravel, aggregate, cement mix, and water. Large pieces are defined as being greater than one foot in its largest dimension. Examples include pieces of building foundations, concrete paving, and cinder blocks. This category includes concrete with a steel internal structure composed of reinforcing bars (re-bar) or metal mesh. (This material would be considered Concrete in the CIWMB material index.)
11	**Small Concrete**	**Small Concrete** means a hard material made from sand, gravel, aggregate, cement mix, and water. Small pieces are defined as being less than one foot in its largest dimension. Examples include pieces of building foundations, concrete paving, and cinder blocks. This category includes concrete with a steel internal structure composed of reinforcing bars (re-bar) or metal mesh. (This material would be considered Concrete in the CIWMB material index.)
12	**Large Asphalt Paving**	**Large Asphalt Paving** means a black or brown, tar-like material mixed with aggregate used as a paving material. Large pieces are defined as being greater than one foot in its largest dimension. (This material would be considered Asphalt Paving in the CIWMB material index.)

ID #	Material Type Name	Definition
13	**Small Asphalt Paving**	**Small Asphalt Paving** means a black or brown, tar-like material mixed with aggregate used as a paving material. Small pieces are defined as being less than one foot in its largest dimension. (This material would be considered Asphalt Paving in the CIWMB material index.)
14	**Composition Roofing**	**Composition Roofing** means composite shingles composed of fiberglass or organic felts saturated with asphalt and covered with inert aggregates as well as attached roofing tar and tar paper. Commonly known as three tab roofing. Examples include asphalt shingles and attached roofing tar and tar paper. Does not include built-up roofing. (This material would be considered Asphalt Roofing in the CIWMB material index.)
15	**Other Aggregates**	**Other Aggregates** means aggregates other than concrete and asphalt paving such as bricks, masonry tile, ceramics, porcelain toilets, and clay roofing tiles. (This material would be considered Remainder/Composite Construction and Demolition in the CIWMB material index.)
16	**Dimensional Lumber and Pallets**	**Clean Dimensional Lumber** means unpainted new or demolition dimensional lumber. Includes materials such as 2 x 4s, 2 x 6s, 2 x 12s, and other residual materials from framing and related construction activities. May contain nails or other <u>trace</u> contaminants. (This material would be considered Lumber in the CIWMB material index.) And **Pallets and Crates** means unpainted wood pallets, crates, and packaging made of lumber/engineered wood. (This material would be considered Lumber in the CIWMB material index.)
17	**Engineered and Other Recyclable Wood**	**Clean Engineered Wood** means unpainted new or demolition scrap from sheeted goods such as plywood, particleboard, wafer board, oriented strand board, and other residual materials used for sheathing and related construction uses. May contain nails, paint, or other <u>trace</u> contaminants. (This material would be considered Lumber in the CIWMB material index.) And **Other Recyclable Wood** means recyclable wood not included in any other category. This may include scrap from production of prefabricated wood products such as wood furniture or cabinets that have not been treated with paint, stain, or other chemical finish. This category also includes recyclable demolition wood and untreated/unpainted wood roofing and siding as long as the wood material is not contaminated with another material (i.e., tar). May be recycled into ethanol, adhesives, or other engineered wood products. (This material would be considered Lumber in the CIWMB material index.)
18	**Painted/Stained Wood**	**Painted/Stained Wood** means wood that has had an external coating applied like handrails or finished furniture. (This material would be considered Remainder/Composite Construction and Demolition in the CIWMB material index.) And **Treated Wood** is wood that has been treated with a chemical preservative for purposes of protecting the wood against attacks from insects, microorganisms, fungi, and other environmental conditions that can lead to decay of the wood and the chemical preservative is registered pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Sec. 136 and following). This includes wood that has been pressure treated, chemically treated (with copper etc.) or treated with creosote (e.g. railroad ties, marine timbers and pilings, landscape timbers, and telephone poles). (This material would be considered Remainder/Composite Construction and Demolition in the CIWMB material index.)

ID #	Material Type Name	Definition
19	**Gypsum Board**	**Clean Gypsum Board** means <u>unpainted</u> gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples: This type includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard. (This material would be considered Gypsum Board in the CIWMB material index.) And **Painted/Demolition Gypsum Board** means <u>painted</u> gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples: This type includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard. (This material would be considered Gypsum Board in the CIWMB material index.)
20	**Large Rock**	**Large Rock** means large pieces of mineral matter or rock greater than 1 foot in its longest dimension. Examples include landscaping rock and paving stones. (This material would be considered Rock, Soil, and Fines in the CIWMB material index.)
21	**Small Rock/Gravel**	**Small Rock/Gravel** means rock pieces less than 1 foot in its longest dimension. Examples include pathway gravel and other natural or mechanically crushed materials. (This material would be considered *Rock, Soil, and Fines* in the CIWMB material index.)
22	**Dirt and Sand**	**Dirt and Sand** means nutrient rich decayed organic matter mixed with very fine pieces of mineral matter, often left over from land clearing activities. This subtype also includes non-hazardous contaminated soil. (This material would be considered *Rock, Soil, and Fines* in the CIWMB material index.)

Development of Visual-Based Volume-to-Weight Conversion Factors

Development of material density standards for key materials was accomplished by using data from 75 loads of construction and demolition waste that were obtained at Miramar Landfill in November 2004. Each load was observed by four visual estimators, who recorded their estimates of the percent volume associated with each material. The following data collection and calculation steps were used.

First, the volume of each load was measured.

Second, the volume estimates for each material, as recorded by all four observers, were applied to the total load volume. This resulted in four sets of estimates of the percent of the load's volume that was associated with each material.

The data from this step was subjected to a screening process that removed or corrected outlier data points. To the extent possible, all cases of estimators completely overlooking a material were corrected. It sometimes happened that different estimators would classify the same material differently, and in such cases, the analysts referred to photographs of the samples to determine the correct material assignment. For example, if one researcher classified a large amount of material in a sample as *painted wood*, and the other researchers classified a similar large amount of material from the same sample as *dimensional lumber and pallets*, then the difference was examined and corrected based on photographic evidence or based on the majority of researchers' estimates.

The four sets of estimates were then averaged together to produce a single composite estimate of the load, in terms of percent by volume for each material. This process is illustrated in the simplified example below.

	Material A	Material B	Material C	Total for Load
Observer 1	30%	40%	30%	100%
Observer 2	25%	50%	25%	100%
Observer 3	20%	60%	20%	100%
Observer 4	30%	50%	20%	100%
Average Percent Volume	**26.25%**	**50%**	**23.75%**	**100%**

Third, the volume percents were converted to actual volumes for each load by multiplying the average estimated percent for each material by the total measured volume of the load. This resulted in an estimate of the volume of each material for each load, as shown below.

	Material A	Material B	Material C	Total for Load
Average Percent Volume	26.25%	50%	23.75%	100%
Estimated Volume	18.375 c.y.	35 c.y.	16.625 c.y.	70 c.y.

Fourth, the volumes of the materials were added together across all 75 loads, as shown in the table below.

	Material A	Material B	Material C
Load #1	18.375 c.y.	35 c.y.	16.625 c.y.
Load #2	3.025 c.y.	0 c.y.	65.705 c.y.
…	…	…	…
Load #75	13.050 c.y.	35.665 c.y.	20.900 c.y.
Total Volume	**34.45 c.y.**	**70.665 c.y.**	**103.23 c.y.**

Fifth, the total weight of each material was determined by adding together the results of the hand-sorting and weighing of materials in complete loads. This process is shown in the table below.

	Material A	Material B	Material C
Load #1	6431.25 lbs.	9100 lbs.	2061.5 lbs.
Load #2	1058.75 lbs.	0 lbs.	8147.42 lbs.
…	…	…	…
Load #75	4567.5 lbs.	9272.9 lbs.	2591.6 lbs.
Total	**12057.5 lbs.**	**18372.9 lbs.**	**12800.52 lbs.**

Finally, the total weight for each material was divided by the total estimated volume for the material, resulting in standard densities for the materials. This calculation is shown below.

	Material A	Material B	Material C
Total Weight	12057.5 lbs.	18372.9 lbs.	12800.52 lbs.
Total Volume	34.45 c.y.	70.665 c.y.	103.23 c.y.
Density	**350 lbs./c.y.**	**260 lbs./c.y.**	**124 lbs./c.y.**

Table 41. Visual-based Volume-to-Weight Conversion Factors Developed for Study

Material	Number of Samples Containing Material	Density Calculated from Current Study (lbs/cubic yard)
Uncoated Corrugated Cardboard	54	53
Major Appliances	6	145
HVAC Ducting	10	47
Other Ferrous	57	225
Film	45	35
Polystyrene Packaging and Insulation	35	32
Carpet	30	147
Carpet Padding	22	62
Prunings, Branches, & Stumps	19	127
Combined Concrete	36	860
Combined Asphalt Paving	1	55
Composition Roofing	26	731
Other Aggregates	33	780
Dimensional Lumber and Pallets	60	169
Engineered and Other Recyclable Wood	52	268
Painted/Stained Wood	58	169
Gypsum Board	43	467
Small Rock/Gravel	5	999
Dirt and Sand	6	929
Average of other materials	70	417

In addition to determining the method for characterizing samples in the current study, the analysis of visual methods produced a step-by-step tool for use by jurisdictions to visually characterize their own C&D waste streams. This tool is available from the CIWMB.

Field Forms Used to Test Visual Method

The following field forms were used during the visual method test in November 2004, and are presented in this section.

- Vehicle Selection Form

- Sample Placard

- Sample Tally Sheet: Volume-based

- Sample Tally Sheet: Weight-based

- Sample Tally Sheet: Subsample

- Sample Tally Sheet: Entire Load

Vehicle Selection Form

DATE: 11/8/2004

Surveyor _____

Page _____ of _____

This sheet started at _____ am pm

	All Vehicles		Vehicles without Tare Weight	Surveyor's NOTES
	Sample Number	Transaction Number	Gross Weight of Load	
			Circle units if they aren't all the same. *Default units* tons lbs	
1			tons lbs	
2			tons lbs	
3			tons lbs	
4			tons lbs	
5			tons lbs	
6			tons lbs	
7			tons lbs	
8			tons lbs	
9			tons lbs	
10			tons lbs	
11			tons lbs	
12			tons lbs	
13			tons lbs	
14			tons lbs	
15			tons lbs	
16			tons lbs	
17			tons lbs	
18			tons lbs	
19			tons lbs	
20			tons lbs	

RO-1

DATE___/___

☐ **Photo**
☐ **Visual VOLUME**
☐ **Visual WEIGHT**

☐ **SUB-SORT**
☐ **FULL SORT**

Sample Tally Sheet: Volume-Based

Volume-based Visual Estimating Form (CIWMB04)

Step 1:
Site: Miramar Landfill

Date: _____

Sample No: _____

Your initials: _____

Step 2: Measure and record the load volume.
(Include trailer dimensions if applicable.)

Dimensions:

_____ft x _____ft x _____ft

_____ft x _____ft x _____ft

Step 2: Identify and record all main material classes (in bold) that appear in the load.

Step 3: Estimate composition of load by volume for each main material class (in bold).

Step 4: For each material class, estimate composition by volume of each specific material component (in plain text).

Step 5: Make sure main material class estimates AND material component estimates EACH total 100%.

Recoverable Materials

☐ **Paper: _____%**

	Unwax OCC/Kraft paper bags
	Other Paper
%	*Subtotal (must equal 100%)*

☐ **Metal: _____%**

	Major Appliances
	HVAC Ducting
	Other Ferrous
	Other Metal
%	*Subtotal (must equal 100%)*

☐ **Plastic: _____%**

	Film
	Polystyrene Packaging & Insulation
	Other Plastic
%	*Subtotal (must equal 100%)*

☐ **Glass: _____%**

☐ **E-waste: _____%**

☐ **HHW: _____%**

☐ **Special: _____%**

☐ **Mixed Residue including small amounts of MSW: _____%**

☐ **Organics: _____%**

	Carpet
	Carpet Padding
	Prunings, branches, & stumps
	Other organic
%	*Subtotal (must equal 100%)*

☐ **C&D: _____%**

	Large Concrete
	Small Concrete
	Large Asphalt Paving
	Small Asphalt Paving
	Composition Roofing
	Other Aggregates
	Dim. Lumber and Pallets
	Eng and Other Recyclable Wood
	Painted/Stained Wood
	Gypsum Board
	Large Rock
	Small Rock/Gravel
	Dirt and Sand
	Other C&D
%	*Subtotal (must equal 100%)*

Grand Total:_____%
(Must equal 100%)

---

and Types of Appliances _____

HDPE Buckets _____

Pallets _____

Sample Tally Sheet: Weight-Based

Weight-based Visual Estimating Form (CIWMB04)

Step 1:
Site: Miramar Landfill

Date: _____

Sample No: _____

Your initials: _____

Step 3: Identify and record all main material classes (in bold) that appear in the load.

Step 4: Estimate composition of load by weight for each main material class (in bold).

Step 5: For each material class, estimate composition by weight of each specific material component (in plain text).

Step 6: Make sure main material class estimates AND material component estimates EACH total 100%.

Recoverable Materials

☐ **Paper: _____%**

	Unwax OCC/Kraft paper bags
	Other Paper
%	*Subtotal (must equal 100%)*

☐ **Metal: _____%**

	Major Appliances
	HVAC Ducting
	Other Ferrous
	Other Metal
%	*Subtotal (must equal 100%)*

☐ **Plastic: _____%**

	Film
	Polystyrene Packaging & Insulation
	Other Plastic
%	*Subtotal (must equal 100%)*

☐ **Glass: _____%**

☐ **E-waste: _____%**

☐ **HHW: _____%**

☐ **Special: _____%**

☐ **Mixed Residue including small amounts of MSW: _____%**

☐ **Organics: _____%**

	Carpet
	Carpet Padding
	Prunings, branches, & stumps
	Other organic
%	*Subtotal (must equal 100%)*

☐ **C&D: _____%**

	Large Concrete
	Small Concrete
	Large Asphalt Paving
	Small Asphalt Paving
	Composition Roofing
	Other Aggregates
	Dim. Lumber and Pallets
	Eng and Other Recyclable Wood
	Painted/Stained Wood
	Gypsum Board
	Large Rock
	Small Rock/Gravel
	Dirt and Sand
	Other C&D
%	*Subtotal (must equal 100%)*

Grand Total:_____%
(Must equal 100%)

Sample Tally Sheet: Subsample

Construction And Demolition				
Large Concrete				
Small Concrete				
Large Asphalt Paving				
Small Asphalt Paving				
Composition Roofing				
Other Aggregates				
Dim. Lumber and Pallets				
Engineered / Other Recyclable Wood				
Painted / Stained Wood				
Gypsum Board				
Large Rock				
Small Rock/Gravel				
Dirt and Sand				
Paper				
Corrugated / Kraft, Unwaxed				
Metal				
Major Appliances				
HVAC Ducting				
Other Ferrous				
Plastic				
Film				
Styro Packaging & Fiberglass Insulation				
Other Organic				
Carpet				
Carpet Padding				
Prunings, branches, & stumps				
Other Materials				
Mixed Residue / MSW				

Sorting Date:　　　　　　　　**Sample ID:**

Sample Tally Sheet: Entire Load

Construction And Demolition													
Large Concrete													
Small Concrete													
Large Asphalt Paving													
Small Asphalt Paving													
Composition Roofing													
Other Aggregates													
Dim. Lumber and Pallets													
Engineered / Other Recyclable Wood													
Painted / Stained Wood													
Gypsum Board													
Large Rock													
Small Rock/Gravel													
Dirt and Sand													
Paper													
Corrugated / Kraft, Unwaxed													
Metal													
Major Appliances													
HVAC Ducting													
Other Ferrous													
Plastic													
Film													
Styro Packaging & Fiberglass Insulation													
Other Organic													
Carpet													
Carpet Padding													
Prunings, branches, & stumps													
Other Materials													
Mixed Residue / MSW													

Sorting Date:　　　　**Sample ID:**

Appendix D:
Field Forms and Databases Used During the Study

Examples of forms that were used in the study are included in the following order:

- Facility Questionnaire
- Scale Tracking Form
- Sample Tracking Form
- Vehicle Survey Form
- Sample Selection Form
- Sample Placard
- Sample Tally Sheet
- Database Screens for Entering Sample Data
- Vehicle Data Entry From

Facility Questionnaire

Name of site:

1. SCHEDULE

Range of dates for sampling and surveying:

☐ San Diego Region: Tuesday and Wednesday, June 21 & 22
☐ Los Angeles Region: Thursday and Friday, June 23 & 24
☐ Bay Area Region: Monday and Tuesday, June 27 & 28
☐ Sacramento Region: Wednesday and Thursday, June 29 & 30

Dates that definitely will not work:

Can we have access to a loader? Would it be available throughout the day?

2. TONNAGE & VEHICLE QUANTITIES

Does the facility have a MRF? What types of loads are processed?

How many total tons does the facility receive daily? _____

How many vehicles with trash (not exempt loads) enter on a weekday, on average?

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
End-dumps (not exempt loads)							
Roll-offs							
Self-haul vehicles with accounts (including large other or flatbed)							
Self-haul vehicles without accounts (including passenger cars,							

pick-up, SUV, or van)						
Other vehicles?						
Transfer trucks?						
Packers – Front loaders or rear loaders?						
Total Vehicle Count						

Peak times of day on a weekday?

       For end-dumps:

       For roll-offs:

       For self-haul vehicles with accounts, including contractors and landscapers:

       For self-haul vehicles without accounts:

Can we have one weekday's transaction records for the day we are there?

Do you have a sense of how many roll-offs might be open vs. compactor?

3. CONTACT INFORMATION

Physical address:

City, Zip:

Site owner/operator:

Person approving use of the site:

Mailing address:

City, Zip:

Phone:

Person with data about the site:

| Phone: |
| Email: |
| Fax: |

| On-site manager or supervisor (primary contact for logistics): |
| Phone: |
| Email: |
| Will this person be available on the indicated dates? |

| Contact person for crew when they arrive the morning of sampling: |
| Phone: |

| Backup contact: |
| Phone: |

| Scalehouse contact: |
| Phone: |

Correspondence should be sent to:

4. SITE TRAFFIC INFORMATION

Facility's hours of operation:

M _____

T _____

W _____

Th _____

F _____

Sat _____

Sun_____

Do you accept vehicles before opening the gate to the public?

If so, what hours and what kinds of vehicles?

5. Site Information

Are there site conditions we need to be aware of such as high winds, snakes or other animals, other special circumstances?

How many gatehouses does your facility have? _____

How many scales? _____

Do different types of vehicles go to different gatehouses/scales – i.e., all self-haul going to one scale? If yes, please explain.

6. Net Weight Procedures
Do all vehicles get weighed? If not, which vehicles don't get weighed?

Drivers of loads will be surveyed at the entrance throughout the day. The survey is very brief, involving just a few questions. We also will need to learn the net weight of each vehicle that we survey. We may give the driver of each vehicle a numbered card to hand to your gatehouse staff when the driver leaves the facility. Can your gatehouse staff write the net weight of each vehicle on each card?

7. MATERIAL HANDLING

Other than MRFing, what materials are recovered at this site? How and when are vehicles diverted so that recovered materials can be separated from disposed waste?

Material	How and when diverted

The purpose of the study is to take samples of disposed wastes only. How can we sample from vehicles after they have had materials recovered?

8. Recycling Barriers and Opportunities
Are there any recycling facilities nearby? What materials do they recycle?

9. SAMPLING AND SORTING PROCEDURES

We need an area for the sorting crew to work, for the entire time we will be at the site. It should be about the size of 9 or 10 truck bays. Can the site accommodate this? Where do you think that will be?

Crews have hardhats, orange vests, coveralls, boots, and gloves. Are there any other safety equipment or special procedures you want them to use?

We will need to have the loads cleared once or twice each day, probably by a bulldozer or cat. Is this okay?

10. FINAL LOGISTICS

Can you please send me a plan or map of area where we could sample (taken from permit)

Please remember to notify gate personnel.

The CIWMB may wish to set up site visits during sorting for Board staff to observe fieldwork for the project. Is this okay?

We will send you a copy of our insurance policy. Is there anything else you need from us?

Scale Tracking Form

Date:_____

Site: _____

Number of incoming scales at this facility: _____

Number of outgoing scales at this facility: _____

Draw a diagram of the scale layout, including directions (N,S,E,W) and roads.

Briefly identify/name and describe of the types of loads that go across each incoming or outgoing scale. If applicable, indicate the time you started and stopped surveying at each of the scales.

Scale name/location:	Description of loads:	Start Survey	End Survey
1)			
2)			
3)			
4)			
5)			
6)			

Sample Tracking Form

Site: _____   Date: _____/_____/_____

C&D SAMPLES

Sector/Subsector	Targets Optimal	Revised	Tally Using Hash Marks
NEW R	6		
NEW NR	8		
NEW COMBINED	**14**		
REMOD R	5		
REMOD NR	7		
REMOD COMBINED	**12**		
DEMO	9		
ROOF	5		
OC&D	5		
DEMO, ROOF, OC&D	**19**		
DAILY GOAL:	**45**		

NON-C&D SAMPLES

Sector/Subsector	Targets Optimal	Range	Tally Using Hash Marks
NON-SH	9	8 to 10	
NON-DB	7	6 to 8	
DAILY GOAL:	**16**		

Vehicle Survey Form (front)

SAMPLE ID	VEHICLE				HAULER			NET WT	NOTES	JURISDICTION	FROM CONST. SITE?	ACTIVITY									BUILDING TYPE			C&D SH ONLY: Why Dispose				
	SM=small vehicles DB=drop-box ED=end dump LG=other large vehicle				HSH=homeowner self-haul BSH=business self-haul COM=commercial hauler			Net weights only Record gross weights in NOTES	Record the following, if applicable: 1) Comments 2) Weigh Back Transaction #'s 3) Min. Vehicle Gross Weights 4) Min. Vehicle Make & Model 5) Weigh back card ID	City or unincorporated area the waste comes from	Y=yes→ N=no →	N=new construction R=remodel D=demolition RF=roofing OC=other c&d → L=landscaping / landclearing ON=other non-c&d DK=don't know									R=residential buildings N=non-residential buildings OS=other structures			Why did you bring this load here rather than recycling it? 1=don't know where/how to recyc. 2=recyc. is too difficult/far away 3=recyc. is too costly 4=the load is not recyclable 5=other reason not incl. above				
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS	1	2	3	4	5

Vehicle Survey Form (back)

Surveyor: _____   Survey Sheet _____ of _____

Date: _____

Site: _____

Weather: _____

Sample Selection Form

SAMPLE ID	VEHICLE				HAULER			NET WT	NOTES	JURISDICTION	FROM CONST. SITE?	ACTIVITY								BUILDING TYPE		
	SM=small vehicles DB=drop-box ED=end dump LG=other large vehicle				HSH=homeowner self-haul BSH=business self-haul COM=commercial hauler			Net weights only Record gross weights in NOTES	Record the following, if applicable: 1) Comments 2) Weigh Back Transaction #'s 3) Min. Vehicle Gross Weights 4) Min. Vehicle Make & Model 5) Weigh back card ID	City or unincorporated area the waste comes from	Y=yes → N=no →	N=new construction R=remodel D=demolition RF=roofing OC=other c&d L=landscaping / landclearing ON=other non-c&d DK=don't know								R=residential buildings N=non-residential buildings OS=other structures		
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS
	SM	DB	ED	LG	HSH	BSH	COM				Y N	N	R	D	RF	OC	L	ON	DK	R	N	OS

12/8

NEW

NR - 1

New Const - Non-res Buildings

Sample Tally Sheet

Date: _____

Sample ID: _____

Measure and record the load volume. (Include trailer dimensions if applicable.)

_____ft x _____ft x _____ft & _____ft x _____ft x _____ft

☐ **Paper:** _____%	
	Cardboard
	Paper Bags
	Newspaper
	White Ledger
	Colored Ledger
	Other Office Paper
	Magazines/Catalogs
	Phone Book/Directory
	Other Misc. Paper
	R/C Paper
%	*Subtotal (must equal 100%)*

☐ **Glass:** _____%	
	Clear
	Green
	Brown
	Other Color
	Flat Glass
	R/C Glass
%	*Subtotal (must equal 100%)*

☐ **Metal:** _____%	
	Tin/Steel Cans
	Major Appliances
	Used Oil Filters
	HVAC Ducting
	Other Ferrous
	Aluminum Cans
	Other Non-Ferrous
	R/C Metal
%	*Subtotal (must equal 100%)*

☐ **HHW:** _____%	
	Paint
	Vehicle & Equip. Fluids
	Used Oil
	Batteries
	R/C HHW
%	*Subtotal (must equal 100%)*

☐ **E-waste:** _____%	
	Brown Goods
	Computer-related
	Other Small Consumer
	TV's & Other CRTs
%	*Subtotal (must equal 100%)*

☐ **Organics:** _____%	
	Food
	Leaves & Grass
	Prunings & Trimmings
	Branches & Stumps
	Agricultural Crop Residues
	Manures
	Textiles
	Carpet
	Carpet Padding
	R/C Organic
%	*Subtotal (must equal 100%)*

☐ **Plastic:** _____%	
	PETE Containers
	HDPE Containers
	Misc. Plastic Containers
	Trash Bags
	Grocery/ Merch. Bags
	Non-Bag Packaging Film
	Film Products
	Other Film
	Durable Plastic Items
	Exp. #6 Packaging/Insulation
	R/C Plastic
%	*Subtotal (must equal 100%)*

and type of appliances

_____

# of pallets   # of HDPE 5-gallon buckets

_____   _____

Check box & make notes if find:

☐ **C&D:** _____%	
	Lg Concrete w/Re-bar
	Lg Concrete w/o Re-bar
	Sm Concrete w/ Re-bar
	Sm Concrete w/o Re-bar
	Lg Asphalt Pav. w/ Re-bar
	Lg Asphalt Pav. w/o Re-bar
	Sm Asphalt Pav. w/ Re-bar
	Sm Asphalt Pav. w/o Re-bar
	Composition Roofing
	Other Asphalt Roofing
	Other Aggregates
	Clean Dimensional Lumber
	Clean Engineered Wood
	Pallets and Crates
	Other Recyclable Wood
	Painted/Stained Wood
	Treated Wood
	Clean Gypsum Board
	Painted/Demolition Gypsum
	Large Rock
	Small Rock/Gravel
	Dirt and Sand
	Fiberglass insulation
	R/C C&D
%	*Subtotal (must equal 100%)*

☐ **Special:** _____%	
	Ash
	Sewage Solids
	Industrial Sludge
	Treated Medical Waste
	Bulky Items
	Tires
	Mixed Residue
	R/C Special
%	*Subtotal (must equal 100%)*

Notes on any Hazards:

☐ Asbestos-containing waste: ☐ Excessive fines (i.e. from sand blasting):

☐ Solvent-soaked rags: ☐ Dead animals:

Database Screens for Entering Sample Data

Database Screens for Entering Sample Data

Database Screens for Entering Sample Data

Vehicle Data Entry From

	ID	DATE	VEHICLE	HAULER	NetWtTons	NetWtPound	NOTES	JURISDICTION	CONST.	ACTIVITY	BLDG TYPE	SURVEYOR	D SH ON	NOTES
							ANTELOPE VALLEY LANDFILL - 12/9/04							
G	DEMO 1	12/9/04	DB	COM	9.63	19250		PALMDALE	Y	OC	OS	Kaye	4	3 OF 3
G	NEW NR 1	12/9/04	LG	BSH	4.76	9520		PALMDALE	Y	N	N	Kaye		7:00 AM
G	NEW NR 2	12/9/04	DB	COM	5.12	10240		PALMDALE	Y	N	N	Kaye	4	8:00 AM
G	NEW NR 3	12/9/04	DB	COM	2.75	5500		PALMDALE	Y	N	N	Kaye		9:15 AM
G	NEW R 1	12/9/04	LG	BSH	3.63	7260		PALMDALE	Y	N	R	Kaye	4	10:00 AM
G	NEW R 2	12/9/04	LG	BSH	1.87	3740		PALMDALE	Y	N	R	Kaye	5	3 OF 3
G	NON DB 1	12/9/04	DB	COM	1.85	3700		PALMDALE	N	ON		Kaye		7:00 AM
G	NON DB 10	12/9/04	DB	COM	2.20	4400		PALMDALE	N	ON		Kaye		3 OF 3
G	NON DB 2	12/9/04	DB	COM	4.50	9000		LANCASTER	N	ON		Kaye		8:00 AM
G	NON DB 3	12/9/04	DB	COM	2.24	4480		PALMDALE	N	ON		Kaye		9:15 AM
G	NON DB 4	12/9/04	DB	COM	2.12	4240		PALMDALE	N	ON		Kaye		10:00 AM
G	NON DB 5	12/9/04	DB	COM	2.57	5140		PALMDALE	N	ON		Kaye		3 OF 3
G	NON DB 6	12/9/04	DB	COM	1.45	2900		LITTLE ROCK	N	ON		Kaye		3 OF 3
G	NON SH 1	12/9/04	LG	BSH	4.62	9240		PALMDALE	N	ON		Kaye		9:00 AM
G	NON SH 10	12/9/04	LG	BSH	1.71	3420		PALMDALE	N	L		Kaye		3 OF 3
G	NON SH 11	12/9/04	SM	BSH	1.05	2100	W/ TRAILER	SIMI VALLEY	Y	R	R	Kaye	5	3 OF 3
G	NON SH 2	12/9/04	LG	BSH	1.33	2660	(MISSED)	PALMDALE	N	L		Kaye		10:00 AM
G	NON SH 3	12/9/04	SM	BSH	0.68	1360	(STAGE SET) VOUCHER	PALMDALE	N	ON		Kaye		10:00 AM
G	NON SH 4	12/9/04	SM	BSH	0.22	440	DUMPED -GREEN WASTE	PALMDALE	N	L		Kaye		10:00 AM
G	NON SH 5	12/9/04	LG	BSH	2.69	5380		PALMDALE	N	L		Kaye		10:00 AM
G	NON SH 6	12/9/04	LG	BSH	1.83	3660		PALMDALE	N	L		Kaye		10:00 AM
G	NON SH 7	12/9/04	LG	BSH	4.04	8080		PALMDALE	N	L		Kaye		10:00 AM
G	NON SH 8	12/9/04	SM	BSH	0.02	40		LANCASTER	N	ON		Kaye		3 OF 3
G	NON SH 9	12/9/04	LG	BSH	2.81	5620		PALMDALE	N	ON		Kaye		3 OF 3
G	REMOD NR	12/9/04	LG	BSH	2.51	5020		PALMDALE	Y	R	N	Kaye	4	8:00 AM
G	REMOD R 1	12/9/04	SM	BSH	0.49	980		PALMDALE	Y	R	R	Kaye	1	8:00 AM
G	REMOD R 1	12/9/04	SM	BSH	0.65	1300	VOUCHER #33	PALMDALE	Y	R	R	Kaye	4	8:00 AM
G	REMOD R 1	12/9/04	SM	BSH	0.97	1940		COURT HILLS	Y	R	R	Kaye	5	10:00 AM
G	REMOD R 1	12/9/04	DB	COM	4.31	8620		QUARTZ HILL	Y	R	R	Kaye	4	3 OF 3
G	ROOF 1	12/9/04	LG	BSH	4.65	9300	ROOF 1	PALMDALE	Y	RF	R	Kaye	1	8:00 AM
G	ROOF 2	12/9/04	LG	BSH	4.23	8460	ROOFING? (NO RECEIPT)	PALMDALE	Y	RF	R	Kaye	4	9:15 AM
G	ROOF 3	12/9/04	LG	BSH	1.19	2380		LANCASTER	Y	RF	R	Kaye	4	10:00 AM
G		12/9/04	DB	COM	1.45	2900		PALMDALE	N	ON		Kaye		6:00 AM
G		12/9/04	DB	COM	1.56	3120		PALMDALE	N	ON		Kaye		6:00 AM
G		12/9/04	DB	COM	2.05	4100		PALMDALE	Y	R	N	Kaye		7:00 AM
G		12/9/04	DB	BSH	2.41	4820	PALLETS	PEARBLOSSOM	N	ON		Kaye		8:00 AM
G		12/9/04	DB	COM	4.19	8380		PALMDALE	N	L		Kaye		7:00 AM
G		12/9/04	LG	BSH	0.17	340	PENSKE TRUCK used by W	PALMDALE	N	ON		Kaye		7:00 AM
G		12/9/04	LG	BSH	1.78	3560		PALMDALE	N	L		Kaye		3 OF 3
G		12/9/04	LG	COM	3.05	140	*average LG	PALMDALE	N	ON		Kaye		6:00 AM
G		12/9/04	LG	BSH	3.11	6220	CITY STREET SWEAPING	PALMDALE	N	ON		Kaye		3 OF 3

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Bibliography

Business Waste Prevention Quantification Methodologies — Business Users Guide: Washington, D.C. and Los Angeles: U.S. Environmental Protection Agency, Municipal and Industrial Solid Waste, and University of California at Los Angeles Extension, Recycling and Municipal Solid Waste Management Program: Grant Number CX 824548-01-0, 1996.

City of Santa Rosa: C&D Debris Ordinance NO. 3586, Section 3, November 5, 2002, http://ci.santa-rosa.ca.us/City_Hall/City_Council/Documents/2002/cco3586.htm (April 7, 2006).

Complete Systems and Equipment Handbook, 9th printing, FEECO International, Green Bay, Wisconsin, .

Conducting a Diversion Study - A Guide for California Jurisdictions, California Integrated Waste Management Board, Sacramento, California, 2001.

Construction, Renovation and Demolition (CRD) Waste Characterization Study, CH2M Gore & Storrie Limited, Edmonton, Alberta Canada, 2000.

Converting C&D Debris from Volume to Weight: A Fact Sheet for C&D Debris Facility Operators, University of Florida, Gainesville, Florida, 2000.

CURC Campus Refuse Profile: Volume to Weight Conversion Guide, Harvard University, Cambridge, Massachusetts, 2005.

Humboldt State University Waste Characterization Study, Humboldt State University, Arcata, California, 1992.

Measuring Recycling: A Guide for State and Local Governments, document no. EPA530-R-97-011, U.S. Environmental Protection Agency, Washington, D.C., 1997.

Methodology for Conducting Composition Study for Discarded Solid Waste, Florida Center for Solid and Hazardous Waste Management, Gainesville, Florida, 1996.

Solid Waste Analysis Protocol, New Zealand Ministry for the Environment, Wellington, New Zealand, 2002.

Solid Waste Management Coordinating Board Construction Waste: Project Memo #1, URS Corporations, Twin Cities, Minnesota, 2000.

Waste Characterization Study at Three Active Landfills, prepared by Cascadia Consulting Group, Inc. for County of Orange, California Integrated Waste Management Department, 2004.

Waste Composition Study 1999 – 2000: Final Report, prepared by Cascadia Consulting Group for the City of San Diego, California Environmental Services Department, 2000.

Source Reference Notes

[1] City of Santa Rosa: C&D Debris Ordinance NO. 3586, Section 3, November 5, 2002, http://ci.santa-rosa.ca.us/City_Hall/City_Council/Documents/2002/cco3586.htm (April 7, 2006).

[2] Ibid.

[3] Cascadia Consulting Group, Inc. for County of Orange, California Integrated Waste Management Department, *Waste Characterization Study at Three Active Landfills*, 2004, pp. C-1 – C-5.