

Improving Visual Characterization for C&D and Bulky Wastes

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SWANA/RFT JOINT SUMMIT
LAKE BUENA VISTA, FL
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Introduction

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- **HQ: Orlando**
 - Offices: PA
 - Operations Centers: CA, MO

- **Consulting Services**
 - Collection Optimization
 - SWMPs
 - Material Characterization
 - Procurement Support
 - Cost/Rate Studies

Why Material Characterization?

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Who?	Why?
State Agencies	<ul style="list-style-type: none"> • Cost-effectively provide broad-based insights about waste stream characteristics and trends
Local Governments	<ul style="list-style-type: none"> • Evaluate the effectiveness of diversion programs and identify opportunities for new initiatives • Establish baseline for Zero Waste/SWMP
Technology Developers	<ul style="list-style-type: none"> • Confirm feedstock characteristics in advance of capital investment
Facility Owners	<ul style="list-style-type: none"> • Regulatory requirements, especially at Waste-to-Energy facilities
Processors/Recyclers/Composters	<ul style="list-style-type: none"> • Establish contractual basis for valuing supply • Fine tune processing operations

Why Not Material Characterization?

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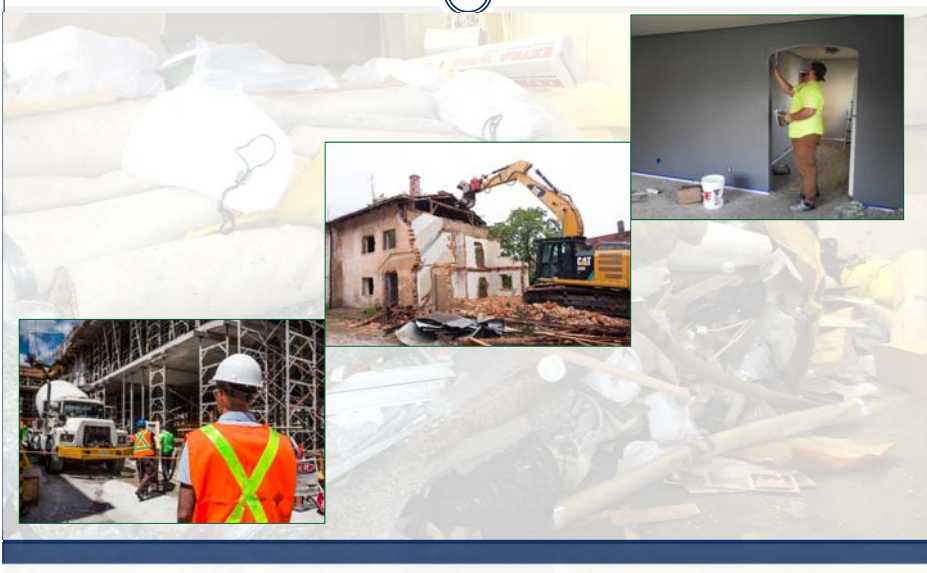
Presentation Objectives

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- **Provide an overview** into the science of material characterization for Construction & Demolition (C&D) and other bulky-type wastes
- **Propose improvements** to visual surveying methods for load-based characterization of these waste types

C&D Debris Defined

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Other Materials in “C&D” Characterization Studies

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Bulky/Clean-out



Pallets/Warehouse/Retail



Land Clearing/Brush



Characterization Methodologies

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US Environmental Protection Agency

CHARACTERIZATION OF BUILDING-RELATED
CONSTRUCTION AND DEMOLITION
DEBRIS IN THE UNITED STATES

Prepared for
The U.S. Environmental Protection Agency
Municipal and Industrial Solid Waste Division
Office of Solid Waste
Report No. EP-339-R-98-019

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- **Methodology:**
 - Estimates composition from limited C&D site sampling
 - ✦ Residential & Non-residential
 - ✦ Construction, Demolition and Renovation
 - Extrapolates based on Census Bureau data on construction permits and construction value

Hinkley Center for Solid and Haz. Waste Mgmt.

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- **Applies EPA Methodology to Florida data**
- **Composition Analysis**
 - Sorted C&D loads at 3 Florida landfills
 - Visual survey of C&D loads at 7 more landfills

Generation and Composition of Construction and
Demolition Debris in Florida

Submitted February 27, 2003

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Report #03-08

CalRecycle

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Contractor's Report to the Board

*Method of Visual
Characterization of Disposed
Waste from
Construction and Demolition
Activities*

October 2006

Produced under contract by:
Cascadia Consulting Group



- **Methodology for facility-based C&D composition analysis**
 - Random selection of inbound loads
 - Visual, volumetric surveying of tipped load
 - ✦ **Recommends 2 surveyors**
 - Recommends characterization of 100 loads
 - ✦ **Minimum of 40 loads**

Visual Characterization Steps

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Step 1: Estimate Volume of Full Load

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Step 2: Tip Load (and Spread)

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Step 3: Estimate Major Groups

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Step 3: Estimate Major Groups

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What percent is...

- Paper/ Cardboard
- Plastic
- Metal
- Wood
- Green Waste
- C&D Materials
- Dirt/Grit

Step 4: Estimate Materials in Each Group

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Wood Categories

- Dimensional Lumber
- Engineered Wood
- Pallets
- Furniture

Step 5: Review Data and Check Math

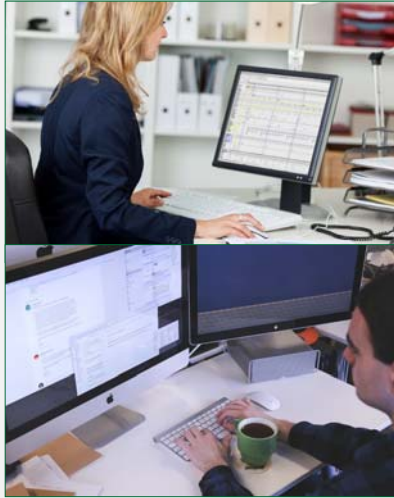
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- Make sure Material Groups sum to 100%
- Make sure Material Categories sum to 100% in each Group



Step 6: Process Data in the Office

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For each sample:

- Calculate volume of entire load
- Calculate volume of each Material Group and each Material Category
- Convert volumes to weight...using “industry standard” density factors
- Compare calculated weight to actual weight (if possible)

Limitations to Current Method

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- **Human Judgment:** Inherent estimation bias for percentage estimates
- **Imperfect Conversion:** Fixed values for density-to-weight conversion
- **Statistical Uncertainty:** Inherent uncertainty from limitations of statistical analysis

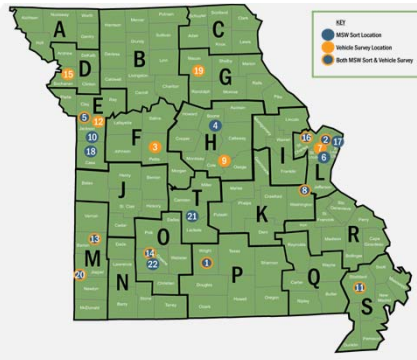
C&D Visual Characterization in 2017 Missouri Study

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2017 Missouri Waste Characterization Study

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- 2 Seasons (2016 & 2017)
- 22 Host Facilities
- Comprehensive definition of “waste”
 - Construction Wastes
 - Demolition Wastes
 - Industrial Wastes
- 1,255 loads surveyed



KEY

- MSW Sort Location
- Vehicle Survey Location
- Both MSW Sort & Vehicle Survey

1 Black Oak Recycling & Disposal Facility	10 EDI Cherry Landfill	19 Joseph City Sanitary Landfill
2 Brighton Transfer Station	11 Jefferson City Sanitary Landfill	20 City of O'Fallon Regional Waste Transfer Station
3 Central Missouri Landfill	12 Lee's Summit Sanitary Landfill	21 St. Louis Waste Transfer Station
4 City of Columbia Sanitary Landfill	13 Lennox Sanitary Landfill	22 Boone and Country Disposal Transfer Station
5 Courtyard Ridge Recycling & Disposal Facility	14 Park Hill Acres Demolition Landfill	23 Jamba ES Maple Hill Sanitary Landfill
6 FM Disposal Transfer Station	15 Franklin Park Regional Waste Facility	24 Waste Corp. of MO - Joplin Transfer Station
7 IED MO Champ Landfill	16 Springfield Sanitary Landfill	25 Waste Corp. of MO - St. Louis Transfer Station
		26 Springfield Relay Systems Transfer Station

Innovation: Real-time Weight Calculations

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- Incorporated Toughbook app that calculated weights in real time while load surveying was in progress
- Integrated scalehouse weight verification for each surveyed load

Volumetric Survey App: Sample Header

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MO - DNR Visual Survey



Sum of Class Percentages	100%
Total Volume (CY)	30
Actual Weight (tons)	6.9
Actual Sum of Lbs.	13,820
Sum of Estimated Lbs.	12,735
Variance	-8%


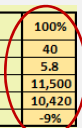
Date Sorted:	4/4/2017
Sample ID #:	CM - 11
Time:	11:33
Hauler:	wca
Truck #:	402233
Waste Type:	Industrial
Vehicle Type:	Roll-Off Open Top

Truck Container (CY)	30			
Container % Full	100%			
Total Volume (CY)	30.0			
Trailer Container (CY)				
Container % Full				
Total Volume (CY)	0.0			

Ticket Number	375905
Field Supervisor	CM

Volumetric Survey App: Estimation

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MO - DNR Visual Survey				Sum of Class Percentages		100%
				Total Volume (CY)	40	
				Actual Weight (tons)	5.8	
				Actual Sum of Lbs.	11,500	
				Sum of Estimated Lbs.	10,420	
				Variance	-9%	
Paper	2%	1 Flattened OCC	100%	106	85	
		2 Unflattened OCC	100%	45	-	
		3 R/C and Other Paper		157	-	
Plastic	2%	4 Plastic Bottles (Recyclable)		38	-	
		5 HDPE Buckets (Stacked)		70	-	
		6 HDPE Buckets (Unstacked)	50%	35	14	
		7 Clean Recoverable Film	20%	35	6	
		8 R/C and Other Plastic	30%	50	12	
Glass		9 All Glass	0%	400	-	
		10 Appliances		145	-	
Metal	2%	11 Other Ferrous Metals	100%	230	184	
		12 Other Non-ferrous Metal	100%	225	-	
		13 HVAC Ducting		47	-	
Organics		14 Leaves/Grass/Mixed Yard		250	-	
		15 Branches/Limbs		127	-	
		16 R/C and Other Organics		300	-	
Wood	3%	17 Pallets - Standard	100%	169	203	
		18 Pallets/Crates/Heavy		250	-	
		19 Untreated/Unpainted		169	-	
		20 Treated/Painted/Processed	100%	169	-	
		21 Engineered Wood		268	-	
		22 Wood Furniture		169	-	
		23 Other Wood		169	-	

Real-time Density Adjustment: Example 1

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Initial weight calculation was 50% low

Rubber defaulted to "Misc" category with low density

Density adjusted to reduce variance below 10%

Built-in Notification for Excessive Variance

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Unadjusted Estimate

Sum of Class Percentages	100%
Total Volume (CY)	30
Actual Weight (tons)	6.9
Actual Sum of Lbs.	13,820
Sum of Estimated Lbs.	6,975
Variance	-50%

Adjusted Density Estimate

Sum of Class Percentages	100%
Total Volume (CY)	30
Actual Weight (tons)	6.9
Actual Sum of Lbs.	13,820
Sum of Estimated Lbs.	12,735
Variance	-8%

Real-time Density Adjustment: Example 2

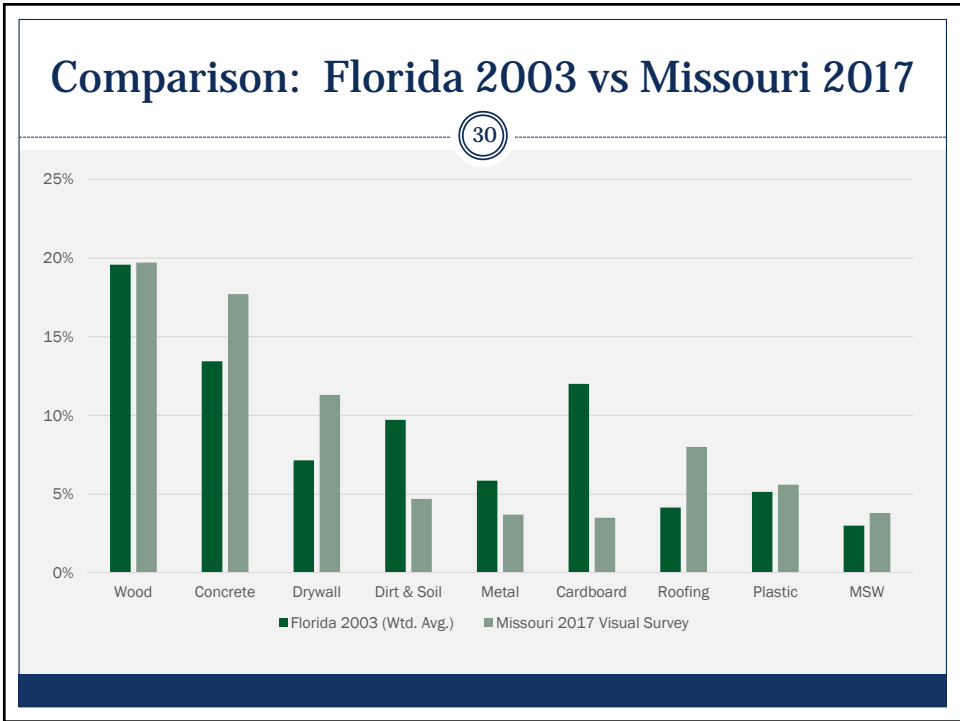
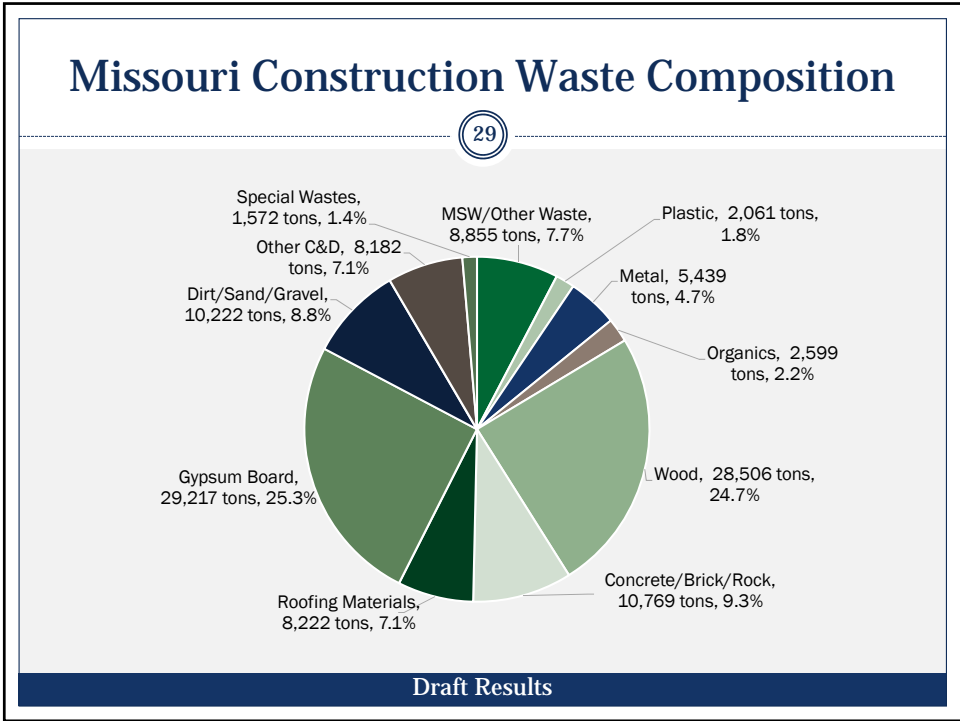
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Initial weight calculation was 80% low

Soaking wet plastic tarping defaulted to "Other Plastic" category with extremely low density

Density adjusted to better reflect unique load characteristics





Conclusions

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- Florida has long been at the forefront of C&D waste management
- Methods for characterization of C&D are conceptually well developed
 - Current visual survey methods at disposal sites are cost-effective and provide reasonable planning-level estimates, albeit with multiple levels of uncertainty
- Simple application of mobile technology improves the accuracy of facility-specific C&D and bulky waste composition analysis for facility-level planning

Thank You!

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Proposed Topic for Future Presentation



- **Composition Analysis for Curbside Recyclables: Available Data, Methods, Problems, and Solutions**

Questions

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