

CORR Protocol and Certification of Real Rates

A Method for the Verification of Facility C&D Recovery Rates at Combined C&D and MSW Materials Processing Facilities

Introduction and Objective

The objective of this protocol is to provide a statistically reliable and transparent method for measuring the recovery of mixed construction and demolition (C&D) materials at combined C&D/MSW processing facilities. To become Recycling Certification Institute (RCI) certified, combined C&D/MSW facilities must calculate a combined facility C&D recovery rate for mixed C&D materials using this protocol.

This document describes the protocol that RCI requires combined C&D/MSW facilities use to determine their C&D recovery rate. A facility must calculate its C&D recovery rate quarterly for three years to qualify for certification. The following nine sections present the detailed steps of the protocol:

1. Overview of Approach
2. Definitions
3. Eligible Facilities
4. Roles and Responsibilities
5. Operational Requirements
6. Sampling Frequency and Schedule

A sampling event will include: Collect a minimum of at least 100 tons of randomly selected mixed C&D loads; processing materials from the inbound loads; and weighing the recovered C&D material from these loads. The methodologies for each of these activities are described below in Section 0 Sampling and Weighing Methods.

7. Sampling and Weighing Methods
8. Analytical Methods
9. Facility Reporting

1. Overview of Approach

The method for determining an overall facility C&D recovery rate relies on periodic sampling. This data collection includes three main steps that are summarized below and in the following graphic:

Step 1	Collect a minimum of 100 tons of mixed C&D materials.
Step 2	Process material collected in Step 1.

Step 3 Weigh recovered C&D material.

Following data collection, the facility C&D recovery rate will be calculated by dividing the weight of the recovered C&D material by the total weight of inbound loads processed during the sampling event.¹

$$\frac{\textit{weight of recovered material}}{\textit{weight of incoming mixed C\&D loads}}$$

2. Definitions

Select terms used in this protocol are defined below. The definitions are not intended to supersede any other legal or regulatory definition and are used for the purposes of this protocol only.

- **Alternative Daily Cover (ADC):** Materials used for daily overlay on the exposed faces of landfills and for landfill road building, grading, and shaping. ADC may or may not be considered diverted or recycled materials based on local regulations.
- **Combined C&D/MSW Processing Facility:** Permitted facility where sorting and processing of loads of C&D and municipal solid waste (MSW) takes place for the purpose of recovering recyclable and reusable materials.
- **Construction and demolition (C&D) materials:** Building materials from the construction, renovation, or demolition of building structures (excluding land clearing, grubbing, and excavation materials).
- **Facility construction & demolition (C&D) recovery Rate:** The rate, as calculated from the adherence to this protocol, at which a facility recovers recyclable C&D materials from loads of inbound material.
- **Inbound loads:** Inbound loads of mixed C&D.
- **Mixed construction & demolition (C&D) loads:** Inbound loads of mixed C&D, for which at least 75% of the load consists of mixed C&D (based on visual estimate). These loads are not homogeneous and are mixed together, requiring sorting and processing prior to recycling into end products.
- **Municipal solid waste (MSW):** Solid waste including unsegregated garbage, refuse, and similar solid waste material that is discarded from residential, commercial, institutional, and industrial sources and community activities, including residue after recyclables have been separated. Does not include dangerous waste, hazardous waste, and recyclables that have been source-separated from garbage.

¹ The recovery rate can be calculated with or without ADC. Refer to Section 8. Analytical Methods for more information.

- **RCI Evaluator:** An independent third party who, using the Institute’s evaluation process, verifies the accuracy and reliability of the sampling event and reporting. An Evaluator may refer to the Certification Organization, a firm or team of firms, and/or a single employee within an Institute-approved firm who conducts the evaluation activities.
- **Recovered C&D material:** C&D material recovered by the processing facility from the inbound loads that will be recycled or reused.
- **Recycle:** Materials processed physically, chemically, or biologically into materials for the purpose of sale as feedstock for the processing or manufacture into end-products, including mulch, compost, and biofuel.
- **Reuse:** Materials sold for use as received, without chemical or mechanical alteration.

3. Eligible Facilities

This protocol is intended for facilities that are receiving C&D materials along with one or more non-C&D streams. Potential non-C&D inbound streams include dry loads and commercial recycling streams.

4. Roles and Responsibilities

The facility or its contractor will complete all activities outlined in this protocol, from sampling to final calculations. An RCI Evaluator will monitor the sampling process. (*Details of the monitoring process and responsibilities to be determined by RCI.*)

5. Operational Requirements

The protocol must be implemented under normal operating conditions. For example, the facility must operate at its specified flow rate during the certification sampling event. Other factors that should be consistent with normal operations include the number of sorting personnel, belt speed, and equipment configuration.²

² This information is also collected as part of the *Preliminary Application (Appendix A) for the CORR Protocol and Certification of Real Rates: A Method for the Verification of Reuse and Recycling Rates of Building Materials Reuse and Recycling Facilities*. In addition, the CORR protocol requires any changes in operational structure be reported within 30 days.

6. Sampling Frequency and Schedule

Certification will require one sampling event (SE) per quarter for three years and then Quarters 1 and 3 in years 4 and 5 for a total of 16 sampling events (see Table 1 below).³

Table 1. Sampling Schedule for Certification

Year 1	Q1	SE 1	Conditional Certification
	Q2	SE 2	
	Q3	SE 3	Full Certification
	Q4	SE 4	
Year 2	Q1	SE 5	Certification Continuation (Re-certification)
	Q2	SE 6	
	Q3	SE 7	
	Q4	SE 8	
Year 3	Q1	SE 9	Certification Continuation (Re-certification)
	Q2	SE 10	
	Q3	SE 11	
	Q4	SE 12	
Year 4	Q1	SE 13	Certification Continuation (Re-certification)
	Q2	X	
	Q3	SE 14	
	Q4	X	
Year 5	Q1	SE 15	Certification Continuation (Re-certification)
	Q2	X	
	Q3	SE 16*	
	Q4	X	

³ The number of truckloads that constitutes a sample and the frequency of sampling are based on the following rationale.

- Bootstrapping, a statistical method, was used to determine the total number of truckloads (30 loads) that make up a sample. Sampling data from studies in Seattle (WA) and King County (WA) on C&D waste was used as an input for the bootstrapping method. Operationally, the protocol could not practically require hundreds of samples. Bootstrapping showed that fewer, larger samples would still achieve a reasonable level of certainty.
- *The bootstrapping method also suggested that 16 samples would be acceptable. Increasing the sample size from four to 16 samples reduced the error rates by half, but increasing beyond 16 samples showed diminishing returns. Based on feedback from RCI, sampling would only be practical one time per quarter. The resulting schedule allows for sampling for certification and recertification to be conducted over five years with no more than one sampling event per quarter.

A sampling event will include: Collect a minimum of at least 100 tons of randomly selected mixed C&D loads; processing materials from the inbound loads; and weighing the recovered C&D material from these loads. The methodologies for each of these activities are described below in Section 0 **Error! Not a valid bookmark self-reference..**

7. Sampling and Weighing Methods

This section details the steps involved in 1) selecting and weighing inbound loads, 2) processing material collected in Step 1, and 3) weighing recovered C&D material. All three steps must be completed for each sampling event.

Step 1 Select and Weigh Inbound Loads

The purpose of this step is to select inbound mixed C&D loads for sampling and to determine the total weight of the mixed C&D loads selected for the certification sampling event. Weighing the inbound loads ensures that the material included in the sampling event is equivalent to at least 100 tons. The total weight of all the selected mixed C&D loads will also be used to calculate the facility C&D recovery rate. Use the following steps to obtain material for sampling and determine the weight of the material included in the sampling event. Sampling forms are attached at the end of this protocol.

1. At a selected start time, the RCI Evaluator will verify that the materials for the certification sampling process are comprised of mixed C&D materials.
2. The total net weight of all selected mixed C&D loads will be a minimum of 100 tons.

Step 2 Weigh Recovered C&D Material

The purpose of this step is to determine the weight of C&D material recovered through sorting/processing at the facility.

Use the following steps to prepare for and weigh recovered material.

1. Prior to processing the sample, clear processing equipment of all debris.
2. Clean bunkers, trucks, and containers that will be used to accumulate recovered material.
3. Identify containers and equipment that will be used to weigh recovered C&D. Suitable containers include roll-off containers and steel bins; facility equipment could be a truck or the bucket of a loader.
4. Weigh selected containers and equipment empty, and record tare weights (see sample form in Attachment A): *Material Weights*).
5. Process the mixed C&D material selected for the sampling event in Step 1. Continue processing until all of the selected material has been processed. If containers fill before processing of the

selected loads is complete, record the weight of the full containers as instructed in Step 6 and then empty the containers.

6. Weigh all recovered C&D material in the designated container or truck using a truck scale or commodity scale. If the facility separates ADC for recovery, keep it separate from other recovered materials for weighing. Record the material weights (see sample form in Attachment A: *Material Weights*).

8. Analytical Methods

This section describes how to enter data from the sample data collection form and calculate the facility C&D recovery rate.

Data entry

Follow the below steps to enter data from the sample data collection form.

1. Enter inbound load weights from sample data collection form into a blank spreadsheet.
2. Sum inbound load weights.
3. Enter container ID numbers from sample data collection form into a separate blank spreadsheet.
4. Enter container tare weights for each container ID from sample data collection form.
5. Enter gross material weights from sample data collection form non-ADC recovered material for each container ID.
6. Sum material weights for each container ID.
7. For each container ID, multiply the tare weight by the number of container weights.
8. For each container ID, subtract total container tare weights from total gross material weights to obtain net weights of recovered C&D material for each container ID.
9. Sum the net weights of recovered C&D material.
10. Repeat Steps 5 through 9 for ADC weights.

Calculate Facility C&D Recovery Rate

Use the following equations to calculate the facility C&D recovery rates with and without ADC.

The facility recovery weight without ADC is calculated as follows.

$$\frac{\text{weight of recovered C\&D material}}{\text{weight of incoming mixed C\&D loads}}$$

The facility recovery weight with ADC is calculated as follows.

$$\frac{\text{weight of recovered C\&D material} + \text{weight of ADC}}{\text{weight of incoming mixed C\&D loads}}$$

9. Facility Reporting

Certification is dependent upon submitting a sampling report following each sampling event. The summary report must include the following information.

- Date of sampling event
- Time period for certification
- Facility-specified flow rate and actual flow rate during test
- Weight of incoming loads for each sample
- Weights of recovered C&D material and ADC for each sample
- Calculated recovery rates with and without ADC for each sample

In addition, the facility must provide completed forms from the sampling event.

10. Example of Calculating the Facility Recovery Rate

This attachment describes how to calculate the facility recovery rate using an example scenario.

Step 1. Enter Data

Incoming Loads

Enter net weight of mixed C&D materials to be processed. A minimum of 100 tons must be processed for certification.

In this example, we assumed a combined net weight of 103.0 tons (206,000 lbs).

Recovered C&D Recyclables

Enter the weights of the recovered C&D material recorded into spreadsheet (see sample form in Attachment A) and sum the totals for each material (Table 1). In this example, the facility generates ADC as an output.

Table 1. Weight of Recovered C&D Recyclables

Recovered C&D Recyclables	Weight (lbs)
Non-ADC Recoverable C&D	145,000
ADC	35,000
Total	180,000

Step 2. Calculate Facility C&D Recovery Rate without ADC

To calculate the facility C&D recovery rate without ADC, divide the weight of recovered C&D material by the total net weight of incoming loads.

$$\frac{145,000}{206,000} = 0.704$$

The example facility has a C&D recovery rate without ADC of 70% based on the current sampling event.

Step 3. Calculate Facility C&D Recovery Rate with ADC

To calculate the facility C&D recovery rate with ADC, divide the weight of recovered C&D material, including ADC, by the total net weight of incoming loads.

$$\frac{145,000 + 35,000}{206,000} = 0.874$$

The example facility has a C&D recovery rate with ADC of 87% based on the current sampling event.

Attachment A: Material Weights**CORR Protocol for Certification of Facility C&D Recovery Rate**

Facility Name: _____

Date: _____

Start time: _____

Fill in Container Description and weigh empty containers prior to processing to obtain Container Tare Weights. Enter gross weights of materials collected in each container in Material Weight A through D columns, being careful to enter weights in the correct row. If more weighings are required, please use additional forms.

Enter weights for recoverable material other than ADC in the upper table and for ADC in the lower table.

Non-ADC Recovered Material

ID	Container Description	Container Tare Weight	Material Weight A	Material Weight B	Material Weight C	Material Weight D
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

ADC

1						
2						
3						
4						
5						
6						
7						
8						
9						
10						