Executive Summary:

Construction and Demolition Recycling Inc. (CDR) is a construction and demolition recycling facility unlike almost any other. Upon recognizing the need for actual, quantifiable recycling of commercial interior construction and demolition debris to satisfy the burgeoning LEED and Green Building requirements, CDR was designed and built to maximize the diversion of materials that are traditionally not captured at standard C&D facilities. Founded in 2003 by the staff of Interior Removal Specialist, Inc. (IRS), CDR was tailor made to address the needs of contractors that work in the commercial interior environment. Processing more than 36,000 tons per year and keeping nearly 31,000 of those tons out of the landfill, CDR has pioneered the diversion of what is often considered to be the residual trash at the majority of C&D MRFs.
Overview:

Specializing in strictly interior construction and demolition debris generated through tenant improvement and remodeling projects, CDR processes tens of thousands of tons of interior C&D debris every year. With a facility average diversion rate of more than 84% of all incoming debris, CDR more than satisfies the stringent California Statewide 50% mandatory diversion rate for all solid waste generated in the state as mandated by the passage in 1989 of the Integrated Waste Management Act (AB 939).

It is well known that all C&D facilities operate using the time honored tradition of “Facility Averages” to compute diversion. For those that do not know this equation it is simply \textit{inbound tons minus tons sent to landfill equals diversion}. In round numbers, if you average 100 tons per day inbound and send 25 tons per day to the landfill your average works out to 75%. This method of measurement has been used because of the impossibility of tracking diversion based on individual projects unless you tip each project in their own areas, then sort and weigh the inbound materials from each project. The space, manpower, and equipment required to treat each project as a standalone waste stream is not sustainable economically, so facilities direct all inbound trucks to dump into one large pile for mixed debris, and usually several other piles for source separated materials to dump into.

The problem encountered by the staff of IRS was that this “facility average” paradigm treated dissimilar inbound loads exactly the same way, and did not provide quantifiable diversion for the interior debris that they were actually processing. Almost every facility in the world separates and recycles the same materials, and these just happen to be the heaviest, most valuable materials in the waste stream. While you can be assured in most markets that the
concrete, asphalt, metals, and dimensional lumber will be captured, along with some of the plastics, most facilities are not recycling the drywall, manufactured lumber (Particle board, plywood), carpet, acoustic ceiling tiles, and other materials derived from interior projects.

With this in mind, if a mixed load from a residential or small commercial building demolition comes into the standard C&D facility, they are going to recover the wood framing materials, bricks, concrete footings, asphalt driveway, and possibly stucco from the exterior (as fines for landfill cover). This material accounts for about 80% to 85% of the total weight of this structure, but with a facility average of 75% the reporting for this project would only show a 75% diversion rate. This leaves 5% to 10% of the project unaccounted for, but the project is still meeting the LEED requirements and/or city mandate that you would encounter in most of California’s cities.

Conversely, if a mixed commercial interior load came into that same facility they would recover the steel studs used for framing, copper pipes and wires, and aluminum door frames. The majority of the materials found in the project, the gypsum drywall, carpet, acoustic ceiling tiles, plywood and particle board doors and cabinets, vinyl flooring, ceramic tile and the like would be either crushed and sent to the landfill as “fines” or alternative daily cover, or would simply be sent as residual trash. To go back to the numbers, the facility would have recycled less than 30% by weight of this project, but would still bestow the same 75% facility average diversion that they granted to the more effectively handled loads.

With the obvious differences between the debris in what they classified as “hard” (full building) demolition and “soft” (commercial interior) demolition loads, CDR was designed to level the playing field and recover the materials that were being underutilized.
Design of Recycling System:

For debris loads, while relatively low-tech, it was determined that the best way to handle the materials that were being generated was to use skid steers and an excavator with a grapple to remove the large pieces from the incoming debris and then hand sort the medium sized materials. Once the majority of the large (+/- 8’) to medium (+/- 1’) debris was hand sorted on the tipping floor the material is taken to the sorting line where it is run over a 3” finger screen to remove the fines and then run across the belt where 6 to 8 workers remove the rest of the recyclable debris. Residual debris falls off the end of the belt and is piled up for disposal.

The reason for the labor intensive “hands on” approach is to capture the maximum amount of gypsum drywall for recycling and reuse. While many C&D recyclers benefit from size reduction of the materials at the front of the line, enabling more of the materials to go across the belt and decreasing the need for labor and equipment intensive pre-sorting, the interior commercial waste stream that CDR specializes in consists of nearly 27% gypsum drywall. To engage in any sort of mechanical size reduction at the front end of the system would turn that gypsum to dust and make it nearly impossible to recover. CDR recovers and ships more than 700 tons of gypsum drywall every month to be used in agricultural settings as a soil amendment, keeping the material out of landfills, reducing the amount of Hydrogen Sulfide gas produced, and extending the life of California gypsum mines.

Hand sorting at the front end of the system also allows CDR to recover and recycle more than 200 tons of Acoustic Ceiling Tile every year. This mineral fiber based product is used in drop ceilings in every high rise building in the country, and is possibly the best example of a closed
loop recycling system available in the commercial interior construction industry. Armstrong Ceilings will accept ceiling tiles, regardless of manufacturer, and process the fibers with new materials and make new ceiling tiles out of the mix. Because ceiling tiles are fragile they need to be stacked and palletized prior to going over the sorting line or pushed around with heavy equipment. Hand sorting was the only real option to recover this material. Because of this push to recover ceiling tile, Armstrong Ceilings has recognized CDR as the largest supplier of recyclable ceiling tiles in the Western United States.

By the same token, commercial carpet is removed from the debris pile early to avoid contamination. Commercial carpet is not regularly recycled due to the dense backing and low carpet nap utilized to extend the life of the carpet. After years of attempting to find financially viable outlets to recycle this material CDR began sending the material to local Waste to Energy facilities. These facilities will not accept carpet that is contaminated with gypsum as the gypsum causes spikes in the sulfur output of the facilities. To avoid contamination CDR requests that contractors bringing in these materials either place the carpet in dumpsters that do not contain gypsum drywall, or that the carpet is placed on the top of the dumpster to avoid contamination.

Also sent to Waste to Energy is the manufactured lumber recovered from the debris. While all facilities recycle unfinished dimensional lumber, only about 2% of all wood products that come into CDR fall into that category. Roughly 11% of all incoming debris to the facility is manufactured lumber, be it from doors, cabinets, desks or shelving. This material is laden with chemicals ranging from fungicides, pesticides, preservatives, adhesives, stains and varnishes.
This toxic mixture makes the material unsuitable for composting or for mulching so CDR segregates the material and ships it to the Waste to Energy facilities along with the commercial carpet. This keeps the chemicals from collecting in the leachate at the bottom of the landfill, keeps methane production down, and helps to provide energy to surrounding residential areas.

These measures give CDR a diversion rate in excess of 80% for a waste stream that is largely ignored, providing diversion in excess of that required by any State, City, County as well as greater than any USGBC Green Building requirements.

**Reuse Innovation/Donation:**

While nearly all recycling facilities have iron clad no salvaging rules, CDR was the logical extension of a commercial interior demolition contractor with intimate knowledge of the materials that come out of the high rise environment. Because of this knowledge, reuse was something that was incorporated into the planning of the facility from the beginning. The volume of furniture, doors and frames, kitchen cabinets, refrigerators, dish washers, sinks, file cabinets, lighting fixtures and many other items that are left behind by companies that vacate the tenant space is enormous. CDR was designed to capture and repurpose as much of the furniture, fixtures, and building elements as possible. Loads of furniture and fixtures that arrive at the facility are carefully unloaded at the adjoining 140,000 SF warehouse where they are made available to any nonprofit agency that can use the material.

From churches to children’s centers, homeless shelters to animal rescues, CDR donates between 125 and 200 tons of recovered furniture and fixtures every month. Materials salvaged
at the CDR facility have been shipped to Haiti for the Holy Family Church Mission Haiti project that was the recipient of 30 tons of construction materials and furniture, they have been sent to El Salvador where 22 tons of materials were sent to assist those actually living in landfills, and to Romania where a 10,000 SF industrial kitchen taken out of the cafeteria at 355 S Grand Ave in Los Angeles was repurposed and set up in a Romanian orphanage.

Local area Fire Departments are the recipients of roll-up security gates. The firefighters take the security gates back to the fire houses and hang them from the rafters, securing the bottom of the gate to the floor. Rookies are then supplied with angle grinders and given the opportunity to practice their forced entry into buildings, practice that can shave precious seconds off of actual emergency entries.

**Regulatory Compliance:**

CDR was permitted through the California Integrated Waste Management Board, not long before that board changed to the current incarnation known as Cal Recycle. The arduous permitting process took more than 3 years during which the facility was inspected and approved by virtually every state agency imaginable. After permitting was completed, oversight was turned over to the Los Angeles County Department of Toxic Substance Control. This Local Enforcement Agency (LEA) conducts monthly inspections of the facility, inspecting the Hazardous Waste Storage Area, the Load Check Logs, daily inspection reports and a myriad of other forms that detail the daily running of CDR.

In the 3 years that CDR operated under a “Registration Tier Permit” pending final permitting and the subsequent 5 years under a “Full Solid Waste Facility Permit” CDR has had only one violation report. Given a violation in 2008 for improper storage of gas (Oxygen, Acetylene)
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canisters, that violation was cleared on the very next inspection and the facility has had a clean bill of health since.

As discussed earlier, the diversion rate at CDR exceeds all State, County, and City diversion requirements.

Planning:

While some minor tweaking was needed in the early years of operation, CDR operates almost exactly as designed in the beginning. While trial and error caused certain activities to be moved from place to place to increase efficiency (baling, e-waste storage and donation storage) the early design stages proved to be very effective.

Trucks enter the facility from the north at Branyon Ave. Following a one way traffic pattern trucks weigh in at the scale, proceed to the tipping floor where they dump their loads, exit the tipping floor through a tire wash system designed to clean gypsum drywall dust and other contaminants from the tires, and proceed to the exit scale where their empty weight is calculated. Trucks then exit the property at Rayo Ave. and head 1/8 mile northeast towards Firestone Blvd. Heading east on Firestone trucks need to travel no more than 1/4 mile before entering the 710 Freeway. This one way traffic pattern minimizes the amount of time that trucks are on the City streets.
System down time at the facility is minimal due to the heavy reliance of manual sorting. Should the skid steers be down the facility can count on the excavator to pull the larger material out of the pre-sorting area, and vice versa should the excavator go down. In the past there have been issues with the sort line, but due to ample storage and the ability to operate 24 hours a day 7 days a week, any back log has been processed off hours until the need for second shifts decreases.

**Performance, Economics and Cost Effectiveness:**

Performance at CDR is measured not only by financial means but also by the diversion rate that the facility has been able to achieve. While the tipping fee remains at the upper end of local rates many haulers have embraced the unique offerings of CDR.

CDR began as a private facility to cater to the needs of a single contractor, but the facility rapidly became popular with small haulers that appreciated the flexible hours of operation and the exemplary diversion offered by the facility. Many small haulers that used to have to sit in line before the landfill or MRF opened in the morning so they would have an empty truck to work with suddenly had the opportunity to tip at 7:00 or 8:00 in the evening after a long day. This enabled them to start off the next day by going directly to the jobsite and bypassing a long wait to tip their loads. In order to facilitate these haulers, CDR scheduled an off hours Weighmaster and load checking staff to rapidly move these haulers through the system and get them home for the evening.

CDR has spent a great deal of time and money in putting together the proper checks and balances to create the proper load check program. While the Facility Plan on file with the State requires just two load checks per operating day based on tonnage, CDR has found that having
Operational performance at CDR was slow in reaching the original goals as the facility was dealing with an atypical waste stream and being run by staff that, while skilled in the art of commercial interior demolition, were novices at the recycling and recovery business. Because there were few ready-made markets for many of the materials CDR needed to recover, coupled with the fact that other facilities in the Los Angeles area were less than willing to share their end markets for these materials, CDR staff had to effectively start from scratch. While this delayed the eventual success of the facility, these early challenges were in fact beneficial to the end goal. Without a road map to work with CDR staff investigated roads that had long ago been abandoned by other facilities, finding that with advanced technologies and changing needs some of these materials that had long been considered non-recyclable actually had developed end markets in the intervening years. CDR found outlets for materials such as post-consumer gypsum drywall, acoustic ceiling tiles, and commercial carpet, as well as finding an enormous need for the furniture and fixtures that were routinely being sent to landfill. The CDR donation program boosted the facility diversion rate an additional 3 to 5 percent annually. Comparison to other facilities is difficult due to the unique nature of the CDR waste stream.

Downtime at the CDR facility is seldom a problem due to the heavy reliance of the facility on hand sorting, as well as the 24 hour per day nature of the facility. With the only piece of equipment that cannot be easily replaced with a rental being the sort line, most machines going
down cause only a few hours of delay. Should the sort line go down, additional manpower is brought in to augment the standard work force and keep the facility operating at full capacity.

Another advantage to the reliance on a larger staff is the customer service aspect. With CDR staff always available, customers tipping at the facility are never without the help they may need, both in the unloading of materials from their vehicles to assistance loading up donation items being repurposed back into the community.

CDR has a higher per ton cost than some other area C&D MRF systems, but the costs are appropriate for the waste stream and high rate of diversion achieved by the facility. Because CDR was created to service a single customer the decision was made early on that CDR must operate in the black, but the profit margin was always understood to be of lesser importance than the diversion of toxic materials from the landfill. Once other haulers began utilizing the facility profits increased beyond original calculations and helped to recoup the original costs a full year earlier than planned.

**Use of Equipment and Technologies:**

With California’s heavily regulated air quality issues CDR has utilized the latest technologies to comply with or exceed regulations. The Case 921 Wheel Loader that was purchased in 2012 was chosen not only for its ability to handle the work load at the facility but also because the Tier 4 engine produces fewer emissions than the State requirement.
The majority of the mechanical work is handled by skid steers and an excavator with a grapple to remove the large pieces from the incoming debris and then staff hand sorts the medium sized materials. Residual material from the machine sort is taken to the sorting line where it is run over a 3” finger screen to remove the fines and then run across the belt where 6 to 8 workers sort the rest of the recyclable materials. Residual debris falls off the end of the belt and is piled up for disposal. This has been found through trial and error to be the most effective method of achieving the required diversion.

**Worker Health and Safety:**

CDR staff is all provided with 8 hour OSHA emergency medical training, 8 hour Load Check training, and forklift training, renewed annually. In addition there are daily “Tailgate Topic” safety meetings with topics ranging from safe lifting, proper equipment usage, and traffic control to first aid topics and PPE. A safe working environment is maintained by keeping the equipment away from workers hand sorting the debris, only bringing in the equipment after hand workers have cleared the area. Once the equipment has done its job workers are allowed back onto the tipping floor to complete their duties. Workers in violation of this policy are written up on their first offense, and released from their duties if they are written up 3 times within a one year period.

The injury rate at CDR is surprisingly low considering the heavy reliance on hand sorting at the facility. In 2012 there was a streak of 322 days without a lost work injury, and 2013 only saw 3 minor lost work injuries for nearly 34,000 hours worked in the Yard.

**Public Acceptance, Appearance, and Aesthetics:**

The CDR facilities maintenance program was designed to no only keep the equipment and yard in good operating order, but with an eye towards being a good neighbor to the community as well. In addition to the best management practices of daily sweeping the 7 acre yard with a riding vacuum and sweeping compound to keep the drywall dust down, the facility voluntarily installed a tire wash that was not required by the Facility Plan to reduce tracking dust from the facility onto public streets.
The facility keeps its dumpsters presentable through the use of a State permitted enclosed 35’ paint booth, and trucks are washed as needed at the facilities truck wash station. This station utilizes an existing clarifier to remove solids from the water before it is released into the sewage system, and flocculants are used to minimize foam.

Public outreach and education have been a high priority for CDR since inception. The education of the public in general and the construction industry specifically has been a driving force for the company. There are tours held at the facility at least once a month, and the visitors range from contractors to architects to interior design students. Once a year CDR opens its donation center to the sculpture department of one of the local colleges and the students have the opportunity to create temporary sculptures from the materials in the donation area.

The outreach does not stop at the border of the facility. CDR makes their Director of Environmental Affairs available to local schools, associations, and businesses for educational presentations.

**Conclusion:**

While CDR is fairly unique in its business model, it is hoped that with publicity and a little luck the facility will be able to raise awareness of the fact that commercial interior construction and demolition debris is a stand-alone waste stream that needs to be recognized and treated accordingly. The results obtained at the CDR facility are easily repeatable at nearly any other facility that would take the step to process this debris as the separate waste stream that it is. Fostering this activity can make an appreciable difference to the amount of material diverted from landfills and reduce the toxicity of the C&D debris that eventually does make it to the landfill.