Construction and Demolition Diversion Feasibility Report

December 2024

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Acknowledgements

Thank you to the City of Steamboat Springs and Alicia Archibald with the City of Steamboat Springs; Todd Carr with the Routt County Building Department and to Routt County for supporting this study.

Thank you to FCI Constructors, Fox Construction, and Mauer Construction for volunteering your time and project sites for the Study's Pilot.

Thank you, Twin Enviro and D&D Scrap Metal, for disposal site tours.

A warm thank you to the City of Steamboat Springs Police Department for the Study's Open House Space; and, lastly, thank you to all the general contractor survey participants.

Prepared By: VERT Sites, Sustainable Materials Management, Resource Recovery, Waste Diversion

Construction and Demolition Diversion Feasibility Report

Introduction

The City of Steamboat Springs (City) has a current landfill material diversion rate of 16.1%.[1] According to Routt County's Strategic Waste Diversion Plan, more than 10% of landfilled materials generated in Steamboat Springs comes from local Construction and Demolition (C&D) sites.[2]

Current and future successful C&D waste diversion requires learning what materials and material streams can reasonably be diverted from local C&D project sites. VERT Sites was contracted by the City to lead a C&D Diversion Feasibility Study (Study) to assess disposal at local area construction sites in order to learn some of the challenges and opportunities for local C&D debris diversion. Key study tasks included project management, stakeholder engagement, and local disposal research.

The Study's main objectives were to host a general contractor open house, generate a disposal assessment survey for general contractors, lead a 3-month waste diversion mini-pilot at 4 active construction sites, and provide potential C&D material diversion solutions that are currently feasible for the city, general contractors, and material haulers.

The Study initially kicked off in June 2024 and concluded in December 2024. Analysis and reporting took place November 2024 - January 2025. Figure 1 displays key project tasks.

Study Timeline

June: Study kick off, General Contractor Open House

July: General Contractor engagements, Materials Management Plans

August, September, October: Site Visits, Site Meetings, Materials Management Planning and Implementation, Disposal Site Visits

November, December: Data Review, Reporting

January 2025: Study results to be shared in 2025 Open House

Study Goals

The Study established three primary goals for the pilot

[1] Conversations with the City of Steamboat Springs Recycling Coordinator. July, 2024.
[2] Routt County Strategic Waste Diversion Plan. 2019. 5.:

Goal 1: Determine feasibility of recovering C&D materials from local C&D jobsites with a survey and pilot.

Goal 2: Target Ordinance 2899 materials (cardboard, plastic bottles, glass bottles, and aluminum cans) at pilot sites.

Goal 3: Generate a Materials Management Plan template the city can utilize.

The purpose of studying materials management collection and disposal systems at active local C&D project sites was to observe the day-to-day operations in C&D debris collections and disposal of materials and to strategize methods or systems for collections and possible material diversion.

The target collections of City Ordinance 2899 materials meant piloting a three-month collections program with the pilot's volunteered general contractors.[3] This entailed site visits, site meetings, and weekly collections and disposal observations along with the generation of materials management plans to target aluminum, glass, and plastic items for each site.

The objectives for weekly project site visits were to observe disposal and diversion behaviors from the general contracting team, on-site trade partners, and any site visitors and workers. Site visits typically lasted 45-75 minutes and site meetings were held once a month after a site visit. The pilot took place during the months of August, September, and October.

The participating general contractors in this study included a local general contractor while the other participants have office headquarters outside of Steamboat Springs. All study sites were new construction projects including a residential single-family home, a multi-family building, and 2 commercial buildings. The following bullets show additional general contractor information, and Section 5 of the report details each general contractor and their project sites.

Pilot General Contractor Information

- Fox Construction - Residential Contractor, Office Location: Steamboat Springs, CO. Project: Residential, Single-Family
- Mauer Construction Commercial General Contractor Office Location: Missoula, MT Project: Residential, Multi-Family
- FCI Constructors: Commercial General Contractor Location: Grand Junction, CO. Project: Commercial, City Hall
- FCI Constructors: Commercial General Contractor Location: Grand Junction, CO. Project: Commercial, City Fire Station

[3] Key Ordinance 2899 materials include: co-mingle items such as plastics, aluminum, glass, and paper products.

Lastly, the pilot established six Pilot Observation Indicators (POI) listed below:

- POI 1 Materials Collected: The collection of materials and items for material stream(s) disposal.
- POI 2 Material Streams Collected: The collection of landfill, recycle, and reuse streams.
- POI 3 Material Segregation: The separation of materials and items for material stream(s) disposal.
- POI 4 Material Volume: The amount of materials generated in the disposal and diversion streams.
- POI 5 Materials Management Plan: The active application and implementation of planned collection and disposal procedures.
- POI 6 Pilot Engagement: Active participation with the Consultant, site staff, and trade partners on study procedures.

The indicators were a set of criteria specifically used for site observations and operation monitoring. They also assisted in providing additional structure for project site collections and disposal.

The Report is concluded with pilot findings along with potential C&D programs that could potentially increase material diversion within the City of Steamboat Springs based on the Study's survey, pilot, and current collections and disposal capacities.

Local Collection and Disposal Systems

Material Haulers

There are two primary commercial material haulers in Steamboat Springs. Both organizations are privately-owned, and both have operations within city limits. One business is locally owned and operated and the other has additional Colorado operations outside of Steamboat Springs and Routt County.

Both haulers are equipped with dumpsters and collection containers, and both can provide trash and recycle services when requested. Both haul various C&D materials, e.g., concrete, aggregates, cardboard, MSW trash or recycling.

In addition to the commercial haulers in the area, it's important to mention that the area also has general contractors who self-haul landfill and recyclable items to disposal sites.

The benefits of self-hauling materials can include disposal cost savings, project space accommodations, and the collection of multiple materials and/or materials streams.

A consequence of self-hauling often leads to a lack of or limited disposal data from the general contractor, hauler, or the disposal facility.

Landfill(s)

There is one active landfill in Steamboat Springs. The facility is privately-owned and operated. The next nearest landfills are in Eagle and Summit Counties.

Recycling Facilities

There is one Material Recovery Facility (MRF) in Steamboat Springs, and it is also privately-owned and operated. The facility accepts MSW recyclables, i.e., cardboard, aluminum, plastic, paper, scrap metal, and glass (MSW Recyclables) from construction sites; in addition, it can accept clean concrete for on-site facility reuse purposes.

There are a couple additional recycling facilities in the area that also accept scrap metal and aggregates.

Recovery and Reuse Facilities

There is one privately owned and operated reuse center that accepts building materials and home-goods. The facility does not operate during winter months and it has limited operating hours during spring and fall months.

General Contractor Survey Results

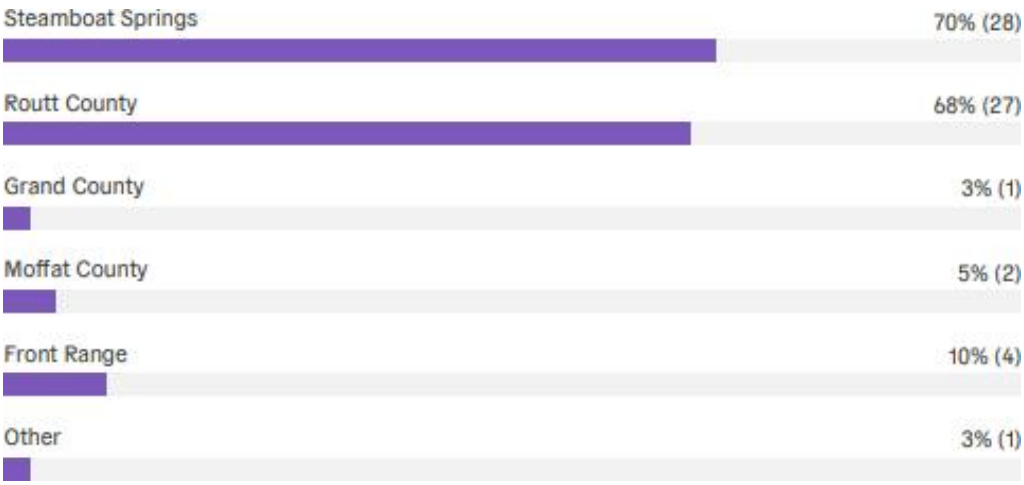
To better assess the local challenges of recovering C&D materials, a survey was generated for local and visiting area general contractors. The survey was introduced at the Study's Open House and dispersed digitally by the City of Steamboat Springs.

The main purposes of the survey were to identify barriers for C&D debris recovery, learn which materials general contractors are currently diverting at local project sites, and to learn of general contractor interest for C&D debris recycling and recovery in Steamboat Springs.

A total of 40 respondents participated in the survey, with 73% of respondents being general contractors, 23% being industry trade partners and specialty contractors, and 10% being local industry workforce.

The majority of survey participants were from the Steamboat Springs area followed by the greater Routt County area. Graph 1 displays additional survey participant locations.

Graph 1: Survey Participant Business Location

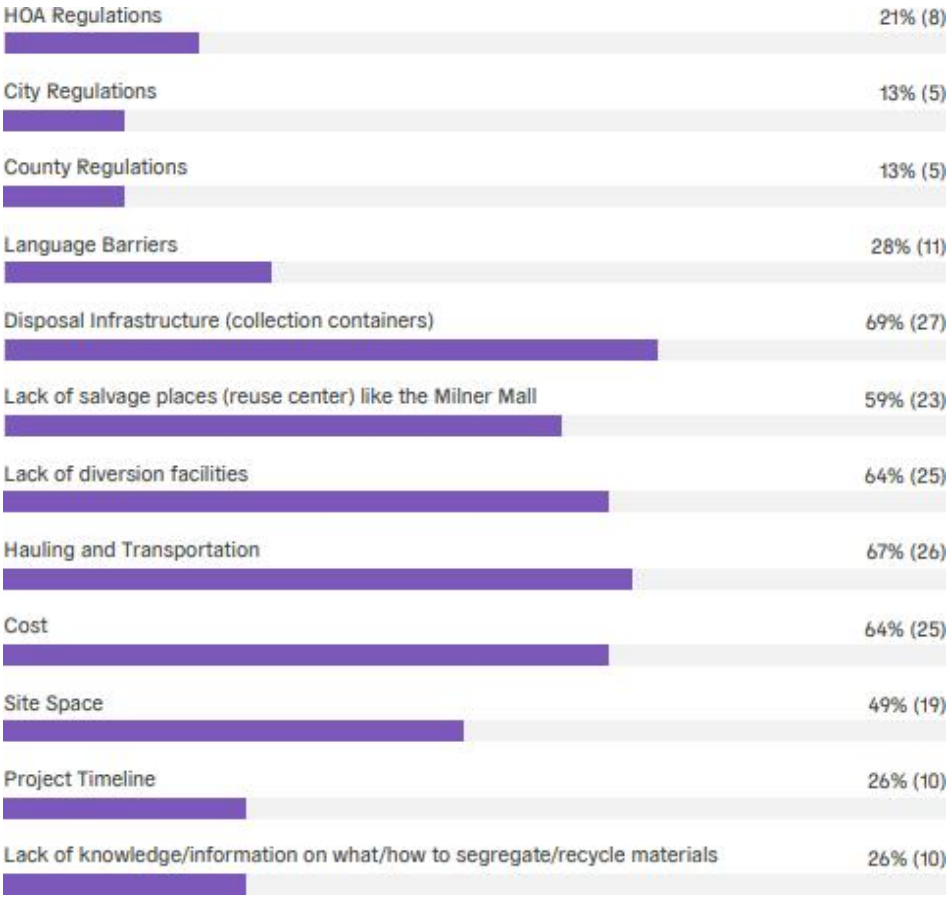


The value of learning where participants originated from provided some insight on whether local and visiting contractors might be familiar with waste diversion programs. For example, contractors from the Front Range areas might be familiar with and practice C&D waste diversion due to many municipal areas having active C&D policies and programs in place, e.g., City and County of Denver, Boulder, Lakewood, and Fort Collins.

C&D Debris Disposal and Diversion Challenges

When asked about current C&D material recovery challenges, collection containers, hauling and transportation, a lack of disposal and salvage places, training, and education barriers were the top concerns. Graph 2 displays the identified challenges with collection containers as the top challenge, and city and county regulations as the least.

Graph 2: Local C&D Material Recovery Challenges



When categorized, the survey results revealed 3 key challenge areas: disposal and diversion, site operations, and regulatory agencies. Disposal and diversion challenges were identified as the top concerns, followed by site operational challenges, then regulatory agency challenges.

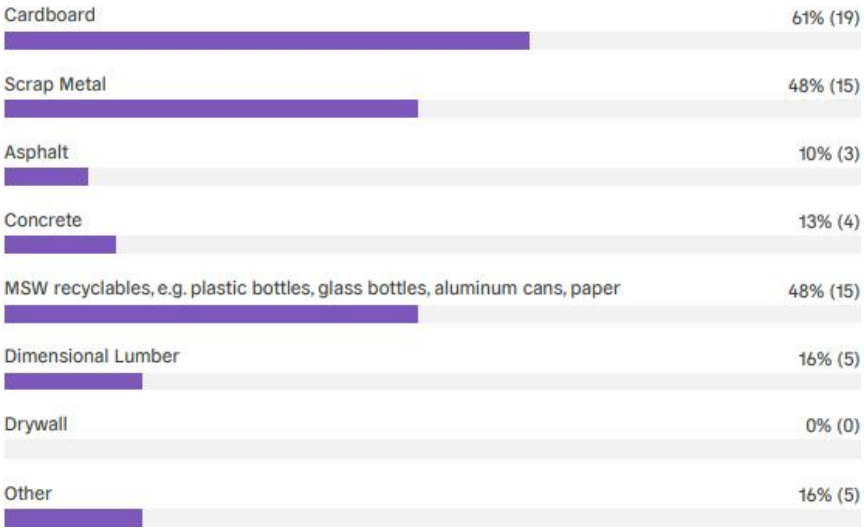
The most pressing disposal and diversion challenges were access to material collection containers, i.e., dumpsters, collection carts/totes, followed by hauling and transportation, then limited disposal sites, i.e., recycling and reuse centers. Given that haulers and disposal sites are privately-owned and operated, there is little the city can do to address collections, hauling, and disposal; however, public-private collaborations and partnerships can be formed.

The second challenge was site operations. These challenges included education, weather, cost, project timeline and space; in addition to site deliveries, site vendors, site material storage, site parking concerns and needs, and site access for haulers. Parking issues can be an extreme challenge for C&D projects especially with multiple trades, vendors, bodies, vehicles, and equipment on site; and, in some instances, the larger the site, the more space is needed for labor and vendor parking as well as material storage accommodations.

Lastly, regulatory agencies provided some material diversion hindrance but the least when compared to disposal and operational challenges. Regulatory challenge examples can include not being allowed to have a dumpster on the side of the road or a project being restricted to to one dumpster. These regulations can either come from a county or city agency or a Homeowner Association. Based on survey results, Homeowner Association regulations were identified as providing more barriers than city or county regulations.

When asked about current material diversion at job sites: cardboard, scrap metal, asphalt, concrete, MSW recyclables, and dimensional lumber were the top identified materials that are currently being generated and diverted from local project sites. Cardboard was the top material and drywall was at 0%. Graph 3 shows survey percentages of what participants are currently diverting from their project sites.

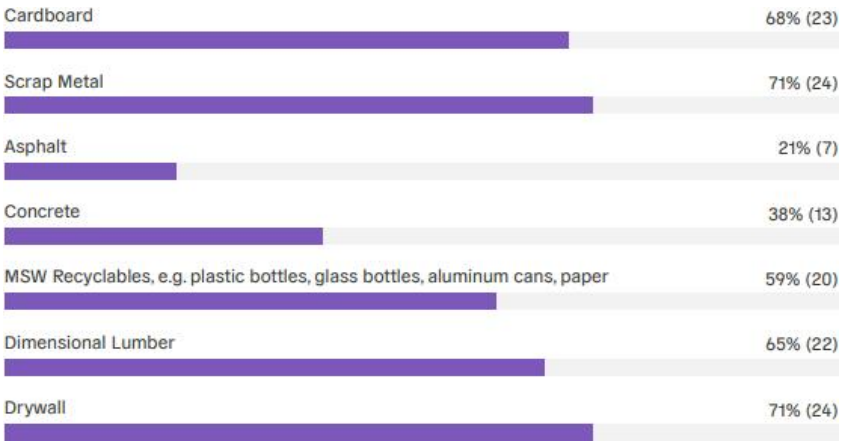
Graph 3: Current Materials Recycled at Local Project Sites



C&D Debris Disposal and Diversion Opportunities

In addition to inquiring about current material diversion from C&D project sites, the survey also asked participants about desired materials or future materials to divert from jobsites. Scrap metal and drywall are top two desired materials for diversion, followed closely by cardboard and dimensional lumber. Graph 4 further breaks down desired recyclability of materials, illustrating in order from most desired to least desired, as drywall, scrap metal, cardboard, dimensional lumber, MSW Recyclables, concrete, and asphalt.

Graph 4: Desired Materials for Diversion



Cardboard and scrap metal were identified as two of the easiest locally divertible materials in Steamboat Springs given that the area has established facilities that can accept and divert these materials. These materials are also typically desired by end- market producers which supports the needs for diversion of these materials.

The high interest in collecting and diverting dimensional lumber was promising for future diversion opportunities. The local landfill and recycle facility accepts the material, but it currently is utilized for internal road-base and use.[4] While the city cannot force the local

Material Resource Facility to begin collecting and finding additional resources to divert the material, it can begin an engagement process that could benefit the facility, city, and general contractors beyond what the facility currently does with the material.

Even though drywall diversion interest is high, unfortunately, the material is non- recoverable in Colorado and the collection and segregation of the material is futile at the moment. In fact, the 2019 Colorado End-Market Report addressed gypsum or drywall as a top 5 material to seek solutions for recovery and diversion. The most promising recovery would come from new construction sites where the material would have a lesser chance of material contamination concerns when compared to material recovery from demolition sites.

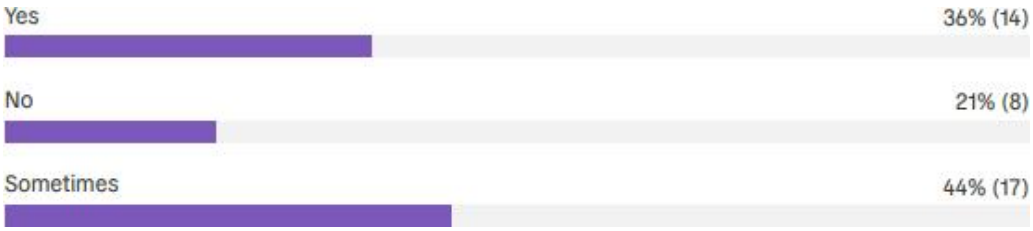
"The wallboard recycling recommendations described here focus on clean scrap material generated on construction sites and not post-consumer material removed during renovations or demolitions. For current end markets, wallboard that is contaminated in any way poses challenges for recycling and diminishes the quality of the final recycled product. Until end markets emerge that can handle post-consumer wallboard, it is recommended that Colorado focus on clean scrap material.[5]"

[4] Study conversations with Twin Enviro September 2024

[5] Colorado End-Markets Report 2019. 8.

When asked about the readiness of landfill diversion and material segregation at project sites, 36% of respondents believed they are in a position to segregate and divert materials such as scrap metal, cardboard, and other divertible materials, e.g., glass bottles, aluminum cans, and plastic bottles. 21% of respondents said they are not in a position to divert materials, and 44% feel they are sometimes in a position to divert materials from project sites. Graph 5 displays these statistics.

Graph 5: Material Segregation Site Readiness



Based on survey results, identified key opportunities included a desire to want to recycle and divert more at local C&D sites, a need for best practices education and training, and a lack of readiness to capture additional plastics, aluminum, and glass at C&D sites.

Even though the city has no control over the access to haulers, disposal facilities, and collection containers, it was identified that the city can address disposal and diversion site readiness and engage with the local building community by providing educational material and training support. Examples include to host trainings, provide material collection signage templates and disposal guidelines, and provide the resources in different languages. These methods will help address proper disposal and diversion and set local sites up for diversion readiness.

Key Survey Takeaways

The majority of participants would like to recycle and recycle more at their jobsites. Trainings and education for disposal and diversion should be a priority. More than half the survey participants do not feel equipped for Ordinance 2899 or were not aware of it.

General Contractor and Project Site Information

General Contractors

The study's disposal and diversion pilot had four active project sites and three general contractors. One of the general contractors was contracted for two of the four sites and those two sites were next to each other. One general contractor was a local business, another was a national builder with headquarters outside of Colorado, and the final one with headquarters in Grand Junction.

The pilot had two residential projects and two commercial projects. All projects joined the pilot during active build and during different project timelines from each other. FCI's projects, City Hall and the Fire Station, both began at the same time, with the hopes of both projects being completed at or around the same time in December 2024.

Table 1 below details additional general contractor business location, project timelines and descriptions, and site information.

Table 1: General Contractor and Site Information

General Contractor	Local Business	Project Start and Finish Dates	Project Description	Project Size (square feet)	Project Building Type
FCI Constructors	No	April 2023 – December 2024	Two commercial projects on the same property	City Hall 16,000 Fire Station 18,000	Commercial, offices, Government
Fox Construction	Yes	May 2024 - May 2025	New home construction plus 2-story garage with accessory dwelling unit	3,500 plus 750 (accessory dwelling unit)	Residential, single-family
Mauer Construction	No	April 2024 - May 2025	Four-story construction, new hotel	65,527	Residential, multi-family

Fox Construction initially demolished a home then followed with new construction. Demolition took place before the study and pilot initiated; and therefore, any and all prior activity and material generation and disposal was not taken into account. Mauer Construction was constructing a new 4-story hotel and joined the pilot during the project's framing phase

Materials

The pilot identified twenty-five common materials typically found at C&D sites. [6]The pilot requested all sites to consider the study's material list from project initiation to completion. This activity provided some understanding of each project's building phase along with having an idea of the specific trades that would be on site during the pilot. For Study purposes, only materials in the pilot months of August, September, and October were considered. These common materials include cardboard, boxes, plastic sheet/film, pallets, polystyrene, paint cans, plastic

[6] Construction Waste Identification Form: CWM-1. Accessed July 2024

pails, piping, electrical conduit, site-clearing waste, masonry, dimensional lumber (and cut offs), ferrous metals, non-ferrous metals, plywood/OSB, dirt, insulation, masonry, roofing (shingles), trash, MSW recyclables, wood forms and/or wood trim, concrete and pad, asphalt, and gypsum-board (drywall),

An awareness of the types of materials that were going to be generated at project sites was beneficial for disposal and potential diversion purposes for a few reasons. For one, it had the potential to provide better or more efficient site operations. By knowing which materials were going to be generated throughout the project lifecycle, planning to potentially divert materials was possible during certain building phases.

Another reason was to provide educational awareness around site materials at each site based on the site's material generation. These procedures were then shared by the general contracting team with their site staff and trade partners. The goal was to ensure that everyone on the job site was aligned with any waste diversion strategies that were to be tested and adopted in the pilot.

Lastly, an awareness of site materials also assisted with tracking and reporting efforts when material disposal estimates were needed.

Site Materials: FCI Constructors

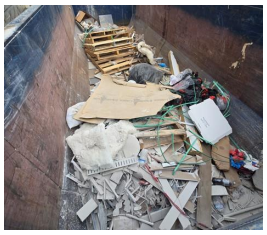
FCI had up to 18 material categories present at the site. These categories were equally shared between the Fire Station and City Hall buildings. The most generated material categories during the pilot included: drywall, pallets, plastic packaging, plastic wrap, trash, cardboard packaging, plastic pails, and siding and roofing materials. Site workers and trade partner staff mostly generated empty food packaging and empty beverage containers.

The site utilized a 30-yard dumpster for landfill disposal and various different kinds of collection containers to collect, transport, and dispose of materials to the dumpster. The site also had a 96-gallon collection container for MSW recyclables.

August Materials

Drywall, insulation, and pallets were the top three material categories disposed of during the month of August, as seen in Image 1. Packaged materials are also illustrated in Image 1 and include plastic wrap, brick, piping, and pallets.

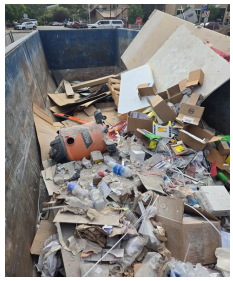
Image 1: FCI August Materials


September Materials

September saw drywall, side paneling, roofing materials, plastic and paper packaging, plastic wrap, plastic pails, twine and pallets both delivered and disposed. Images 2 provide images of the materials.

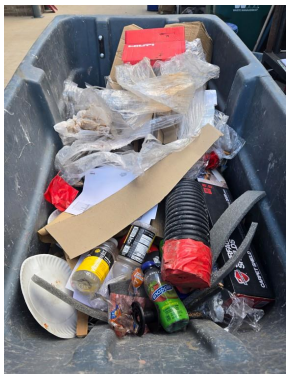
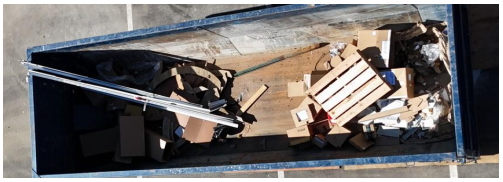
Image 2: FCI September Materials


October Materials

Mostly packaging materials such as plastic wrap and cardboard and pallets were genera ted in October, as seen in Image 3 below. Construction for both the Fire Station and City Hall were to end in December so material generation and disposal began slowing down in October.

Image 3: FCI October Materials


Site Materials: Fox Construction

Fox Construction's residential project had 12 material categories present during the pilot. The top generated material was dimensional lumber and about 95% of the project site's total landfilled material was dimensional lumber. Engineered lumber, e.g., plywood, was also

generated but not as significant as dimensional. With framing and roofing, the site saw two solid months of lumber generation.

The site utilized a 6-yard dumpster for material disposal and various 55-gallon collection containers throughout the project site to collect, transport, and dispose of materials in the dumpster.

August Materials

The site was going through excavation and foundation work for most of August. Concrete from site excavation and empty beverage containers from site workers were mostly generated during this month. Image 4 illustrates the project site with wood products delivered, equipment, and waste generated during this initial period.

Image 4: Fox August Materials

September Materials

Construction and framing kicked off toward the end of August and much of the debris generated during September was dimensional lumber. The Project Manager and VERT Sites agreed and estimated that 95% of the materials in the site's dumpster was clean dimensional lumber during the month of September, as seen in Image 5. A small quantity of empty beverage containers were also found in the dumpster.

Image 5: Fox September Materials

October Materials

Dimensional lumber was also generated during the month of October, with framing coming to completion toward the end of the month. Image 6 shows waste dumpsters with dimensional lumber and plastic film, as well as the project site and equipment.

Image 6: Fox October Materials

Site Materials: Mauer Construction

Mauer's project site was in the framing phase when it joined the pilot. Like Fox's project site, much of the debris that was found in the hotel's dumpster throughout the pilot was dimensional lumber and engineered wood. Other material debris included packaging such as cardboard, plastic wrap, plastic sheet, and pallets. All lumber arrived in non-recyclable plastic packaging. Plastic pails were also generated throughout the pilot and in various quantities. Site workers generated empty food packaging and empty beverage containers.

August Materials

The majority of debris found in the site's dumpster in August was dimensional and engineered lumber, as seen in Image 7 on the next page. It was estimated that each dumpster viewing for

August contained around 20-yards of clean, dimensional lumber in the site's 30-yard dumpster. Additional materials included packaging such as plastic wrap, cardboard, and pallets.

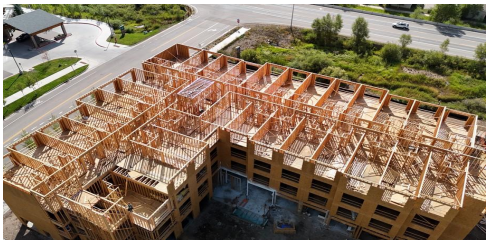
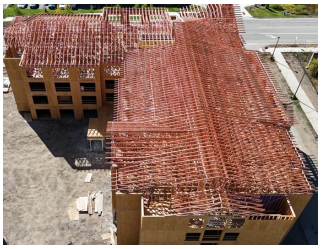
Image 7: Mauer August Materials


September Materials

September's generated materials included dimensional and engineered lumber, cardboard and paper packaging, plastic wrap and packaging, pallets, and gypsum, as shown in Image 8. All lumber still arrived in non-recyclable plastic packaging or with no packaging.

Image 8: Mauer September Materials



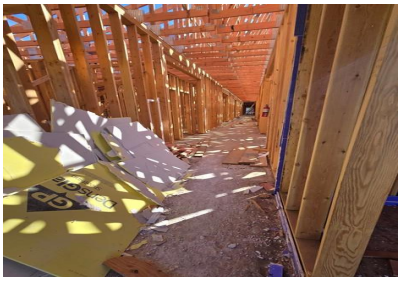




October Materials

October continued to see dimensional and engineered lumber, gypsum, and packaging materials such as cardboard, plastic wrap, and pallets. Image 9 on the next page show these materials as well as aerial views of the project from the October site visit.

Image 9: Mauer October Materials





Disposal and Diversion Pilot Results

Pilot Background

The pilot served as an observational tool within the Study. Its key objectives included the development of an applicable Materials Management Plan to be practiced at project sites, with an emphasis on certain City Ordinance 2899 materials; and to observe disposal habits, material generation, and material volume at sites among general contracting staff, trade partners, and site workers. The pilot did not establish disposal and diversion requirements nor request participants to alter their site operations or material disposal budget.

In addition to the two objectives, the pilot utilized the six Pilot Observation Indicators previously mentioned in Section 2 of this study. that were collaboratively considered by the City of Steamboat Springs, the Routt County Building Department and VERT Sites.

The POIs were used to establish measurements and baselines for material disposal, material diversion and segregation if applicable or possible, and to assist with site visits and documentation. They were not meant to penalize project sites nor general contractors, rather, they served as observational guiding posts at project sites.

Material collections and volume at project sites were extracted from disposal invoices provided by the site's project team or the site's material hauler.

The Environmental Protection Agency's "Volume-to-Weight Conversion Factors" worksheet was utilized to calculate FCI's recycle stream for the months of September and October[7]. Only cardboard was collected and diverted, and the site was able to divert 12 yards of it.

The pilot saw a total material generation of 234,202 pounds between all pilot sites. 232,930 pounds was trash and 1,272 pounds was recycled. Project site monthly generation and disposal can be found in Table 3 below.

Table 3: Pilot Material Generation and Disposal

[7]U.S. EPA. Standard Volume-to-Weight Conversion Factors. Last updated: February 28, 2016. 4.

FCIConstructors and Mauer Construction landfilled the most materials. FCI landfilled over 100,000 pounds more than Mauer even though Mauer's project site was almost twice the size of FCI's. The difference in disposal volume was due to each project's timeline and their build phases.

Mauer was in the hotel's framing phase from pilot initiation to completion. During pilot months, the site experienced a consistent generation of dimensional lumber and engineered wood. The site had no more than 3-5 trade partners, i.e., roofers, framers, electricians, etc. and no more than 25 site workers on site throughout the pilot. FCI, on the other hand, was in multiple building phases during the pilot and anywhere from 8-12 trade partners and 65-85 site workers on site.

Fox Construction generated the least amount of materials during the pilot. The site's material generation was similar to Mauer's. About 95% of the site's landfilled materials was dimensional lumber or wood product during August – October.

Targeted Material Collections and Materials Management Plans

General Contractor	August Material Generation (pounds)	September Material Generation (pounds)	October Material Generation (pounds)	Pilot Material Generation (pounds)
FCI Constructors	Trash: 81,960 Recycle: NA	Trash: 79,100 Recycle: 636	Trash: 13,520 Recycle: 636	Trash: 174,580 Recycle: 1,272
Fox Construction	Trash: 4,056 Recycle: NA	Trash: 3,040 Recycle: NA	Trash: 1,014 Recycle: NA	Trash: 8,110 Recycle: NA
Mauer Construction	Trash: 25,580 Recycle: NA	Trash: 23,080 Recycle: NA	Trash: 12,520 Recycle: NA	Trash: 50,240 Recycle: NA

Collections

One of the key objectives of the pilot was to test and see if sites could collect and possibly divert aluminum cans, plastic bottles, and glass bottles from their sites. The pilot specifically focused on empty beverage containers since these items are more typical for site workers to generate and produce in comparison to other Ordinance 2899 materials, i.e., paper products. The goal for empty beverage container collections was not to divert the materials, rather, it was to test the feasibility of material collection at each project site with the goal of not hindering or slowing down site operations.

To ensure each site was equipped to test collections, water-resistant custom Materials Management Plans and signage for material collection and disposal were provided along with

collapsible, portable collection containers.[8] Each project site received 2 blue collection containers and 2 green ones except for Fox's site. Given Fox's project size and limited site space, the site only received one collection container. Image 10 below depicts the collection containers as blue for recycling and dark green for trash. You can also see how the containers collapse when not in use as well as the signage provided.

Image 10: Pilot Collection Containers

The placement of containers was at the daily discretion of each pilot site, but sites were encouraged to utilize containers in high-traffic site worker areas.

Allowing each site to make the daily choice of container placement empowered the general contracting project team to explore different collection points as their daily operations and site footprints changed. FCI is a great pilot example that tested out various collection points at City Hall and the Fire Station. Image 11 below illustrates the placement of the trash and recycling containers inside the fire station bay, outside the general contractors trailer, inside City Hall, and in City Hall's entryway.

Image 11: FCI Collection Container Areas

[8] Pilot Collection Containers at Amazon

Since one of the key pilot objectives was to not hinder daily site operations with the collection and implementation of targeted recyclables, collection areas varied daily and from site to site. What made sense at one site might not have made sense at another. Fox only used one container and kept the container inside of the home throughout the pilot. Image 12 below shows Fox's collection container inside home in a hallway and another near the site's Materials Management Plan and microwave (site "breakroom").

Image 12: FOX Collection Container Area

Mauer's site was ready to collect beverage containers mid-October but unfortunately the site was not able to successfully implement collections before the pilot ended at the end of the month. Image 13 shows that Mauer 55- gallon collection containers for various materials and items to landfill, along with 4 pilot collection containers.

Image 13: Mauer Collection Containers

Even though the site couldn't implement targeted material collections in time, it was promising to see the potential of material diversion for beverage containers during the project's pilot participation. Based on observational views, it was estimated that 1-3 yards of aluminum and plastic bottles were generated each month during the pilot. You can see in Image 14 that Mauer's site workers produced a steady amount of beverage containers, mostly plastic water bottles. These water bottles (circled in red) were mingled with clean engineered and dimensional lumber and drywall.

Image 14: Mauer Construction Beverage Containers

Another diversion potential at Mauer's site was cardboard. Given the scale of the project and the site's footprint, it was estimated that cardboard generation was 2-4 yards a month during pilot months. The material was generated from trade partner packaging and building materials. In some instances, materials and items were simply stored until needed. Images 15, 16, and 17 below show how packaged items were on site from pilot initiation to completion, with boxes of materials stacked in various areas of the project site.

Image 15: August Mauer Construction Cardboard Generation



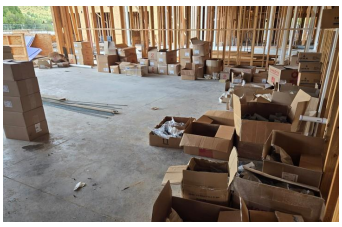



Image 16: September Mauer Construction Cardboard Generation


Image 17: October Mauer Construction Cardboard Generation

The site had intentions of collecting cardboard in November and created areas for material collections on all floors of the hotel (Image 18). Image 19 (next page) shows the collection signs that would've been used had the site been able to implement cardboard collections during the pilot.

Image 18: Mauer Construction Floors 2 & 3 trash and cardboard areas


Image 19: Cardboard Recycle Signage

Given the consistent generation of cardboard but not necessarily a high monthly volume amount, a 6-yard dumpster for disposal would have been sufficient for the site and would not have taken away site space for material storage, equipment, or other site needs.

Lastly, it is estimated that 120-150 yards of clean dimensional lumber was landfilled from the project. The local recycle facility does accept clean dimensional lumber but currently does not divert the material other than for internal operational use.[9] Dimensional lumber is a material stream that potentially can be collected separate from local C&D project sites if adequate material diversion operations become accessible in the area. Pitkin County Solid Waste Center is a great example of dimensional lumber diversion. The facility only accepts untreated and unpainted lumber and pallets for recycling. It then turns the material into colored mulch products that it sells back to the local community for use.[10]

Materials Management Plans

FCI Constructors

Two pilot sites successfully adopted and applied pilot Materials Management Plans: FCI Constructors and Fox Construction.

FCI Constructors adopted a site Materials Management Plan mid-August. Collection and disposal signage, guidelines, and a plan were provided for the pilot's targeted materials. For FCI, the site had access to the old City Hall and the Fire Station's 96-gallon recycle container that still had an active weekly service. The pilot was able to utilize the weekly service and incorporate it in the site's Materials Management Plan. When the site's pilot collection containers were full, general contracting staff were instructed to dump materials in the recycle cart. After this step, designated personnel, in this instance, the site's Project Team designated the Site Superintendent or the Project Manager, would take the recycle container to the service area

[9] Conversations with Twin Enviro/Apex Waste Solutions. August 2024

[10] Pitkin County Solid Waste Center

location. Following service, the team would bring the recycle cart back the following day. The site's Materials Management guidelines can be found in Appendix A.

A key focus for FCI's site was the potential for contamination of recycle materials. On any given day, anywhere from 65-85 site workers were on site. For material collection and possible diversion success, it was crucial to have a thorough collection Plan in place and that it was voiced to site workers and trade partners. Easy, identifiable collection labeling was also utilized.

Initially, the site tested out one label created with on-site materials of cardboard and tape but eventually utilized the same label that was found on the site's pilot collection containers.

The project started out with a simple recycle label written in English and Spanish on cardboard. After two weeks with a cardboard recycle sign, the site transitioned to using the same recycle sign found on the pilot collection containers.

Image 20: FCI Construction Recycle Disposal Cart

Materials Management Plans

Fox Construction

Having only one pilot collection container on-site proved to be sufficient for the project and site team. The site began its Materials Management Plan mid-August, and all pilot recyclables were disposed off-site at the organization's office, where they have a 6-yard recycle dumpster that received weekly service at the time.

Image 21: Fox Construction Site Materials Management Plan (August)

Fox's Materials Management Plan, collection guidelines and collection container.

Image 22: Fox Construction September Pilot Collections

Images of a collection container were taken a week apart, showing the can with similar contents. The superintendent reported emptying the container 2-3 times a week during September.

Image 23: Fox Construction October Pilot Collections

Images of a collection container were taken a week apart. With framing and roofing phases almost completed in October, it was reported the site began to experience less pilot collection material generation during October.

Observed Pilot Challenges

All sites experienced challenges during the pilot. The common challenges that all sites experienced were space constraints and material contamination concerns. Project timelines and deadlines also contributed some challenges, however, much, if not all, operations that were impacted by project timelines were out of daily scheduling control. For example, when a waste hauler might show to provide disposal services, or when materials will be delivered, or if a trade partner had to reschedule their work.

Space

The two sites that experienced consistent space challenges were FCI and Fox Construction. Though both projects were completely different in regard to size, type, and trade partners and bodies on site, the space hardships the two experienced were comparable.

Both sites had limited parking availability making it difficult for staff, trade partners, and vendors to navigate the daily challenge, and both sites had to accommodate having a dumpster on the site and not outside of it, i.e., on the street.

Fox Construction had limited space for dumpster placement and had the space for only a 6 or 8-yard dumpster. Anything larger than a 6 or 8-yard container would have added additional challenges while managing site materials, parking, machinery, and other equipment.

The images below show the street view of what the site typically looked like during the months of August and half of September. The site was in the framing and roofing phases and needed to accommodate trailers, vehicles, materials, equipment, and machinery.

Image 24: Fox Construction August Site Space, street view of construction site.

Images show vehicles to either side of the project site along with the lack of space in front of the project site. The street and front site space is boxed in red. The below right image shows framing and parts of roofing completion toward the end of September.

Image 25: Fox Construction September Site Space

Fox's site began to experience some open site space once framing and roofing were coming to completion mid-October. The below image shows how the site's space transitioned from to having additional space capacity once the early building phases of the project were complete. The site's 6-yard dumpster is placed on site, near the front porch, circled in red.

Image 26: Fox Construction October 2024 Site

FCI Constructors

FCI utilized a 30-yard dumpster for trash and the City's 96-gallon recycle cart for pilot recycle collections. The site experienced rapid site footprint changes throughout the pilot and building phases of City Hall and the Fire Station. The images below show footprint changes from July through October.

Image 27: July FCI Project Site Footprint and Space Issues. Both projects were getting ready for concrete pouring to happen in August.

Image 28: August FCI Project Site Footprint and Space Issues. City Hall and Fire Station in August. While the sites have space, much of it is inaccessible for multiple dumpsters.

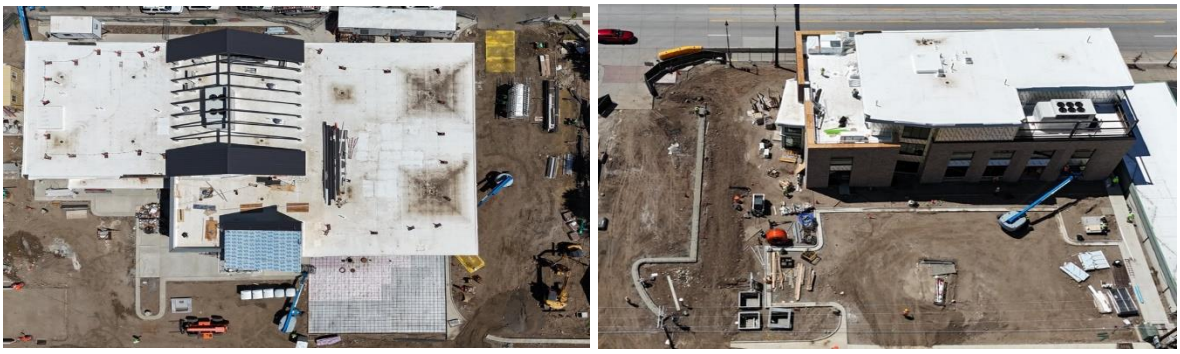


Image 29: September FCI Project Site Footprint and Space Issues. Aerial views of City Hall and Fire Station in September 2024 during concrete pouring. Additional space has been lost.

Image 30: October FCI Project Site Footprint and Space Issues, with concrete complete.

Material Contamination

When different types of waste are not properly separated, it can lead to contamination that diminishes the overall value of recyclable materials. This sometimes can cause more materials to be landfilled rather than diverted in waste diversion programs.

The final common challenge sites experienced was material contamination and the potential for it with diversion efforts. Out of the sites that were able to implement pilot collections, FCI experienced consistent material contamination in the pilot's recycle collections. Even though contamination was consistent in site observations, material contamination was at a minimum according to industry standards.

Pictured below are examples of site contamination. Observed contaminated items include plastic wrap, coffee cups, non-recyclable plastic cups, some food wrappers and food scraps.

Image 31: FCI Pilot Contamination, September 2024: Plastic wrap, coffee cups, non-recyclable plastic cups. Material contamination, October 2024: plastic wrap and coffee cups.

During site visits, contaminated materials or items were removed from the collection containers and the moments were used as opportunities to educate the site's Project Manager and Site Superintendent to share with staff and trade partners.

It was later learned that the site contracted a temporary 6-yard dumpster for cardboard collections twice during the pilot. However, both the Project Manager and Site Superintendent expressed difficulties of keeping contamination out of the dumpster due to not having educational materials and material collection signage.

The lack of educational resources for cardboard collection versus the collections of other MSW recyclables, e.g., pilot collections was strong proof, that, by having site signage, site guidelines (in multiple languages) and materials management trainings, material separation was more manageable and material contamination issues had to the potential to be addressed when compared to managing and diverting a material stream without those resources.

Possible Construction and Demolition Diversion Programs

Based on pilot and survey results, the Study identified four possible C&D program options for addressing local C&D debris recycling and recovery options in Steamboat Springs: Materials Management Plans, C&D Diversion Ordinance, Resource Recovery Grants, and Material Disposal Bans.

Potential Material Recovery Programs

Materials Management Plans: A strategic approach to minimize waste and optimize the use of materials. It outlines C&D jobsite procedures for sourcing, using, storing, and disposing of materials in an efficient and environmentally responsible manner

Diversion Ordinance: A waste diversion ordinance applied to C&D materials would require that a specific percentage of this waste or material categories be diverted from landfills through various means like recycling, reusing, or donating materials.

Resource Recovery Grants: Monetary incentives and financial means to assist general contractors with site waste diversion, contamination, and education and training assistance.

Materials Disposal Ban: A ban would prohibit the disposal of specific types of materials in landfills, with the goal of diverting them from material streams and encouraging recycling, reuse, or other waste diversion methods.

Materials Management Plans

A strategic approach to minimize waste and optimize the use of materials. It outlines C&D jobsite procedures for sourcing, using, storing, and disposing of materials in an efficient and environmentally responsible manner.

An effective way to encourage waste diversion and to record and monitor C&D material disposal from project sites is the use of a Materials Management Plan. A Materials Management Plan assigns waste diversion accountability to general contractors with a group of standards or requirements that must be accomplished in order to proceed with a new construction, addition, remodel, or demolition permit or, sometimes, a Certificate of Occupancy.

A Materials Management Plan can be an effective “starting point” to address C&D debris in the area and be a contributing foundation to other waste diversion programs. However, initial implementation can come with challenges.

Challenges:

- Project Timeline
- Site Logistics

- Collection Containers
- Market Demand

Benefits:

- Regulatory Compliance
- Resource Efficiency
- Waste Diversion
- Site Efficiencies

Challenges

Managing waste diversion on a C&D jobsite can be logistically complex, especially with larger projects that can generate diverse types of materials. Often times parking, dumpster placement, material piling, and vendors can lead to logistical site problems. While a plan is meant to provide general contractors with "waste management blueprint" of their site, a site's project timeline can interfere with the site's Materials Plan, too. Flexible use and planning will benefit local and area general contractors.

Collection containers and a market demand for materials can also be a concern. Waste haulers must be able to accommodate the possible increase in need of containers and there must be a demand for the materials created at jobsites.

Benefits

While implementing the use of a C&D Materials Management Plan can introduce initial administrative challenges, once in place and a possible template provided, general contractors can be more pro-active in their material generation as well as active in their site's disposal and diversion of materials. This not only encourages resource efficiency but also better site efficiencies around disposal and diversion. In addition, adhering to waste diversion practices can ensure compliance with local regulations and capture more materials for diversion. Plan use will also encourage better management of materials by having general contractors actively manage and monitor material generation.

Diversion Ordinance

A material diversion ordinance applied to C&D materials would require that a specific percentage of waste or material categories be diverted from landfills through various means like recycling, reusing, or donating materials.

A material diversion ordinance entails that contractors and project sites will have to divert a certain percentage of project materials or types of materials from being landfilled. Additional requirements such as Materials Management Plans can also be tied to diversion ordinances.

A local C&D ordinance may establish specific waste diversion targets, such as requiring construction and demolition projects to divert a certain percentage (e.g., 50%, 75%, or 90%) of the total waste produced from landfills. It may require that contractors sort construction and demolition waste on-site to separate recyclables (like metals, wood, concrete) from non- recyclables (like certain plastics or contaminated materials) as well as require the tracking and reporting of generated and diverted materials during a project and report this information to local authorities.

To serve the local building community, the city may provide guidance, training, or resources for contractors to help them understand how to comply with the ordinance and how to successfully capture divertible materials at their project sites. This can also include creating partnerships with recycling centers or material recovery facilities. In addition, C&D ordinances might encourage or require deconstruction (carefully dismantling buildings to salvage materials) rather than traditional demolition, thus allowing for a higher volume of reusable materials.

Challenges:

- Compliance and Enforcement
- Operational Disruption
- Lack of Infrastructure
- Market Demand

Benefits:

- Resource Conservation
- Waste Diversion
- Regulatory Compliance
- Site Efficiencies

Challenges

Compliance and enforcement for waste diversion ordinances can be challenging, especially if they require significant changes in behavior. Without proper monitoring and penalties for non-compliance, diversion ordinances may not be as effective.

Another concern would be infrastructure limitations and access. A lack of local recycling facilities, inadequate collection systems, or limited processing capabilities can hinder the effectiveness of

disposal ordinances. Given that the only local disposal site is privately-owned, the business may not be adequately equipped to handle the increase in recyclable materials. In order for a local diversion ordinance to be successful, disposal facilities, regardless if they are private, public, or municipal, need to meet the demands of an ordinance. The challenge with having one solid waste and recovery center in the area and it being privately owned and operated is that the business does not have to agree to accommodate local waste and diversion ordinances. The city can encourage the business and engage in partnership strategies, though.

Lastly, sufficient market demand for materials is a necessity. If there's limited market demand or infrastructure to process certain recyclables, it may lead to stockpiling or downgrading the quality of the recycled products.

Benefits

When a disposal ordinance matches an area's local disposal landscape and industry material generation, and local facilities can accommodate materials and haulers can accommodate transportation and containers, diversion ordinances can often lead to an increase in material recovery and waste diversion.

Pitkin County, Colorado as well as the City of Aspen have construction and demolition waste diversion requirements. Builders within the City of Aspen and Unincorporated Pitkin County are required to divert up to 35% of materials from project sites.

The Pitkin County Solid Waste Center can accept 10 different C&D material streams and has a reuse center on site. There are additional reuse centers in the area, too. Since the ordinance's adoption in 2020, both unincorporated and incorporated Pitkin County have seen a diversion increase from 32% to 46%, and the county's C&D diversion rate was 64% in 2024.[12]

Resource Recovery Grants

Monetary incentives or financial means to assist general contractors with site waste diversion, contamination, and education and training assistance.

A C&D Resource Recovery Grant can come from the City of Steamboat Springs, Routt County, or another entity. These types of grants support initiatives that reduce the amount of waste sent to landfills by financially assisting qualifying projects with waste diversion and materials management education efforts. Examples of assistance include site collections and segregation, trainings, and diversion costs. By incentivizing waste diversion and education at C&D project sites through grant funding, local general contractors and developers are encouraged to adopt waste diversion strategies rather than being told to.

Challenges:

- Funding Source
- Administrative Oversight
- Material Market Demand
- Disposal Infrastructure

Benefits:

- Cost Savings (to C&D projects)
- Waste Diversion
- Sustainable Site Practices Compliance

Challenges

Initial funding or limited budget challenges is one of the immediate tasks to address in waste diversion grants. Allocating funds for construction waste recovery programs could reduce resources available for other public services and maintaining consistent funding for these grants over time could be challenging. Grant program administrative oversight can also present challenges on accepting, reviewing, and managing applications along with monitoring qualifying project sites. It's imperative grant contributors are equipped with the proper staff and department(s) to ensure a successful program and compliance at project sites.

Local disposal infrastructure is also needed to ensure any materials that are being collected at qualifying grant project sites are being diverted. Material market demand must also be present for recovery facilities to sufficiently collect and process materials.Benefits

Waste diversion programs and policies can incur additional or new expenses in the first year or two of their implementations for general contractors. To aid in waste diversion change, general contractors and developers can benefit from diversion grants by offsetting additional containers, transportation, disposal, and materials management trainings.

Grants can also produce more widespread adoption of waste reduction building practices and promote efficient site operations around material generation and disposal. By providing some or full financial assistance, waste diversion is incentivized, and general contractors are encouraged to implement diversion at sites in order to receive grant funds.

Material Disposal Ban

A ban would prohibit the disposal of specific types of materials in landfills, with the goal of diverting them from material streams and encouraging recycling, reuse, or other waste diversion methods.

The core idea behind a Material Disposal Ban is to reduce the environmental impact of materials being sent to landfills by ensuring the recovery of locally divertible materials. For example, a disposal ban might include materials such as plastic bottles, glass containers, aluminum and other metals, or paper products such as cardboard. For Steamboat Springs, cardboard and scrap metal are two readily divertible materials in the area. However, since the local landfill and Material Resource Recovery Facility are privately-owned and operated by the same organization and the local scrap metal facility is private as well, implementing and enforcing a material ban will require heavy public-private partnership between the organization and city.

Challenges:

- Enforcement Infrastructure
- Limitations
- Contamination Risks
- Market Demand

Benefits:

- Increase recycling rates
- Waste Diversion
- Public Engagement
- Improved Resource Efficiency

Challenges

A material disposal ban can help with contamination and ensure one or more materials from C&D jobsites is diverted from the landfill.

Initial funding or limited budget challenges is one of the immediate tasks to address in waste diversion grants. Allocating funds for construction waste recovery programs could reduce resources available for other public services and maintaining consistent funding for these grants over time could be challenging. Grant program administrative oversight can also present challenges on accepting, reviewing, and managing applications along with monitoring qualifying project sites. It's imperative grant contributors are equipped with the proper staff and department(s) to ensure a successful program and compliance at project sites.

Local disposal infrastructure is also needed to ensure any materials that are being collected at qualifying grant project sites are being diverted. Material market demand must also be present for recovery facilities to sufficiently collect and process materials.

Benefits

A ban would prevent highly valuable and divertible materials from being landfilled. Instead of being thrown away, materials must be diverted which can potentially increase the city's overall diversion rate depending on possible materials to be banned.

A ban essentially reduces the amount of waste being buried, and, by restricting materials from being landfilled, landfill space will be extended. Lastly, a ban can motivate and encourage the community to engage more with local recycle and diversion programs.