



# **HOLIDAY CONSTRUCTION WASTE DIVERSION PROJECT**

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## **Final Report to the EPA**

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## The Holiday Neighborhood

The Holiday Neighborhood is a 27-acre “new urban” community located in Boulder, Colorado. The Holiday Neighborhood is located on the former Holiday Drive-In movie theatre site. Holiday was targeted for development for nearly 20 years before a compromise between all interested parties (City of Boulder, building community, affordable housing organizations) could be reached and the development started. Development on the Holiday Neighborhood began in the summer of 2003. It will continue through the year 2005.

The Holiday Neighborhood land generated interest because it was the last major developable piece of land in the City of Boulder. For that reason, the City of Boulder was interested in maximizing the utility of the land by finding space for affordable housing, retail and commercial development, and some community open spaces. To accomplish these goals consensus among the many groups interested in these issues had to be reached.

To accommodate all associated with the Holiday Drive-In site’s development and their concerns, a one-of-a-kind community was envisioned and ultimately designed. Generally, on a 27-acre site like Holiday’s, a single builder or developer will purchase the land and build as many homes as they determine to be cost effective. This process yields many different visions depending on the circumstances, from low density developments of large homes with large lots, to high density development of condominiums and townhomes with little green space or yard.

Another variable is cost. Homes are generally divided into high, medium, and low price categories. These categories are determined by the local real estate market. Generally development falls into a cost category, but rarely do those categories actually mix. Finally, it is unusual to see more than one or two developers working on a single small to medium size jobsite. Smaller sites tend to be developed by one developer, which is the trend with larger sites as well.

The Holiday Neighborhood project didn’t follow the typical path and is unique in many respects.

- The Holiday Neighborhood will fit over 350 residences on its’ 27-acres.
- There is a high concentration of affordable housing. 40% of the housing units were reserved for permanently affordable housing<sup>1</sup>.

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<sup>1</sup> "Permanently affordable unit" means a dwelling unit that is pledged to remain affordable forever to households earning no more than the HUD low income limit for the Boulder Primary Metropolitan Statistical Area, or, for a development with two or more permanently affordable units, the average cost of such units to be at such low income limit, with no single unit exceeding ten percentage points more than the HUD low income limit.

- The homes, condos, townhomes, retail and commercial spaces were developed by 5 different developers and built by 6 contractors. The result of this was an unusually high concentration of building professionals on a relatively small building project.
- The Holiday Neighborhood also has a large co-housing development<sup>2</sup>.

The Center for ReSource Conservation in partnership with the City of Boulder’s Office of Environmental Affairs recognized that the Holiday Neighborhood offered a unique opportunity to explore innovative efforts to reduce the waste stream associated with typical construction projects.

Although construction waste recycling has been identified as an area of potential impact on the City of Boulder’s waste stream, construction waste recycling on any large scale had yet to be implemented and demonstrated. The City of Boulder has a community-wide goal of 50% waste diversion through recycling or reuse by 2005. It is presently diverting less than 40%. A recent study in Larimer County found that

***The City of Boulder has a community-wide goal of 50% waste diversion of recycling or reuse, and is presently diverting less than 40%***

building materials and construction related waste made up 50% of the waste stream in the County.



*Construction recycling bins are arranged at the site in a manner most conducive to effective recycling efforts*

For these reasons, and because the Holiday Neighborhood was going to be the focus of the building community for several years, the neighborhood was targeted by both the Center for ReSource Conservation and the City of Boulder’s Office of Environmental Affairs as a pilot construction waste recycling project. Holiday offered a model opportunity to demonstrate to building professionals construction waste recycling as a viable and effective alternative to traditional construction waste disposal methods.

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<sup>2</sup> Cohousing developments are designed, planned, and managed with a high degree of resident participation. Most major decisions are arrived at through a consensus decision-making process. These developments are based on democratic principles that espouse no ideology other than the desire for more practical and social home environments. Communities often include a diverse mix of people, including singles, couples, families with children, and elders. Most communities strive for a multi-generational, pedestrian-oriented neighborhood that encourages frequent interaction with neighbors.



## Construction Waste Recycling

Construction waste recycling is the practice of separating the waste materials generated from the construction of a building into different categories. Not unlike recycling done in the home or office, non-recyclable materials are put in the trash, and recyclable materials are put in separate containers to be recycled.

The waste stream is generally reflective of the actual components of the building. In the instance of wood framed buildings, a large component of the waste is wood. Aside from the structural materials that compose the building's frame, there are additional materials that are recyclable like cardboard and metal. When combined with wood these components make up over half of the waste created. These materials, once separated, can be recycled. The most common materials recycled, because the ability to recycle them is usually available: wood, cardboard, and metal.

To have a successful construction waste recycling project, the recycling containers must be as conveniently located as the typical trash container. Ideally all containers are located together to make recycling as easy as possible. At the Holiday Neighborhood, smaller containers were used. These small containers are ideal because they could be placed close to the buildings under construction. Another benefit of smaller containers is their modest height; the wood inside them remains visible. Their small size was also helpful because Holiday is a dense construction site.

Another key to successful construction waste recycling is training. Everyone working at the Holiday Neighborhood was trained by either the builder or a member of the CRC staff. This training is bilingual and all handouts<sup>3</sup> and signage were written in both English and Spanish. Constant education is required to have a successful construction waste recycling program.

## Construction Waste Recycling in Colorado

*Colorado's tipping fees are some of the lowest...this is common in states with wide-open spaces*

The challenge in a waste market like Colorado's is the low cost alternative to recycling: the landfill. In the instance of construction waste, it is still perceived to be less expensive to simply landfill all waste coming from a construction site. Though it is counter-intuitive to think this way, it is still perceived to be the case. Colorado has low tipping fees (the cost of taking waste to the landfill). Those low fees (which do not address the environmental impacts and greenhouse gas contributions created by landfills) actually encourage the disposal of materials that could otherwise be recycled, in some cases at no cost.

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<sup>3</sup> Training materials in appendix

## **Challenges to Construction Waste Recycling**

Construction waste recycling faces some challenges. Similar to when household recycling was initially implemented, it takes time for the process to become second nature for the end user. The time associated with this learning curve is considered a potential liability for many building professionals.

*The transportation challenge may be the primary roadblock to construction waste recycling in Colorado.*

There is a certain amount of labor and attention that is necessary to separate materials for recycling. Other costs generally involve the need to transport different materials to different places. The transportation challenge may be the primary roadblock to construction waste recycling in Colorado. From the contractor's perspective, it may be easier to simply have one company leave one large container for waste, and have that one container picked up when full and taken to landfill.

In a recycling scenario, non recyclable waste, which may be less than half of the waste generated on site, needs to be picked up and moved to the landfill, usually by a local trash hauling company. The materials to be recycled need to be removed from the site and taken to the recycling facility, in some cases this takes several different companies; one to remove wood, another for cardboard, still another for waste.

## **The Economics of Construction Waste Recycling**

One of the interesting aspects of waste hauling as it pertains to the construction industry is the way in which waste's removal is paid for. Traditionally the construction industry looks for fixed costs to help them bid their projects. Fixed costs are perceived to be a benefit in the price volatile construction industry. Contractors prefer to know what their waste disposal costs will be at the onset of construction. To accommodate this, the waste haulers bid the jobs on a per square foot basis.

### **How Waste Hauling costs are determined**

The price of waste hauling is usually determined by taking the total amount of indoor space in terms of square footage and multiplying that times their waste disposal and removal fee. Boulder's fee averages approximately \$.25 per square foot. For \$.25 per square foot, a contractor is provided with a container, generally a large roll-off (also known as a 30-yard container), to dispose of all waste in. The waste hauler picks it up when it is full and replaces it with an empty container.

*Community waste can easily account for 10% of the waste gathered on a jobsite*

This process benefits the contractor in several ways. The first is the fixed expense that is given to the contractor, a cost that is consistent as other building related variables change. Another benefit for the contractor is that they are not penalized for accumulation of community waste. Trash containers collect trash. People who don't want to pay to dispose of their trash, can't transport their waste the landfill, or don't know it is illegal to use a private trash container are prone to dump waste in the containers

found on construction sites. Community waste can easily account for 10% of the waste gathered on a jobsite. Because the contractor has paid by the square foot, the onus is on the trash hauler to deter community waste; not the contractor. The trash hauler must pay the additional disposal fees whereas the contractor has a fixed expense. Clearly the contractor is in the best position to stem the flow of community waste, but there is no incentive for them to do so because they pay no penalty for this additional waste generation.



From the builder's perspective, there is benefit in not having to manage their trash. By paying by the square foot, if a container that is picked up from the site is not full, there is no financial penalty. This is a significant issue because when trash service is billed by the pull, the builder has a financial incentive to guarantee that no container is pulled from the jobsite that is not full. This is because they are charged by the pull and not by the pound. The more waste in the container the better. This requires some supervision by the builder.

## ***Developing Recycle Market Opportunities***

The very issues that obscure the clear path towards comprehensive construction waste recycling in Colorado are the keys to solutions.

The fixed cost scenario typically seen in the building industry where the contractor pays by the square foot is expensive. In our research, we found it to be significantly more expensive before waste saving recycling is taken into consideration.

### ***Example 1 (Square Foot):***

*Using the example of ten 2,000 square foot homes being built at a Colorado average of \$.25 a square foot for waste removal:*

*Number of Homes (10) \* Size of Homes (2,000) = 20,000 Square Feet*

***Total Square Feet (20,000) \* \$.25 = \$5,000***

**Example 2 (By the Pull):**

*Using the example of paying by the pull for a 30-yard container (assuming 5 tons of waste per pull):*

*Number of Homes (10) \* Size of Homes (2,000) = 20,000*

*Total Square Feet (20,000) \* Average Waste per Square Foot (5lbs) = 100,000lbs*

*Total Waste (100,000lbs) / Capacity of Container (10,000lbs) = 10 Pulls Required*

**Number of Pulls required (10) \* Price per pull (\$350) = \$3,500**

It should be evident that there is significant cost saving by having waste removed by the pull. It should also be clear that in **Example 1** there is no incentive to recycle, and in **Example 2** there are considerable cost savings by simply changing the pricing mechanism, and even more potential saving realized by recycling. Having the trash removed by the pull is 30% less expensive.

What is not considered in these examples is the potential impact of construction waste, or reducing the waste going to landfill. In **Example 1** there are no cost savings created by recycling. When the cost of trash removal is fixed; producing less waste is of no economic value. In fact, more trash is theoretically less expensive. If community waste is dropped on the site, the builder pays no penalty; its disposal is “free.”

In **Example 2**, the contractor has a cost incentive to reduce the waste generated on the site because they are essentially paying by the pound. In **Example 2**, which is a lower cost option to start, costs can be lowered further by applying the most basic construction waste recycling technique which guarantees diversion of 50%, effectively cutting the waste removal cost by 50% or from \$3,500 to \$1,750.

***When the cost of trash removal is fixed; producing less waste is of no economic value.***

There are costs associated with removing recyclable materials, and those costs vary depending on the community. In many communities in Colorado, cardboard and wood can be recycled for free. There is still the cost to transport these materials to the recycling site, but there is often no or little cost associated with their disposal. Furthermore, the recycling of these materials keeps them out of the landfill and provides feed stock for new products. Wood is generally recyclable, usually at a cost below the fee to dispose of it at landfill. In some cases it is free. There are markets developing for dimensional lumber. Recently we have started seeing manufacturers using dimensional lumber as a material. They pick up clean dimensional lumber for free. The same is true of scrap metal; the cost of having a container delivered to the job site and picked up is fully mitigated by the value of the metal. In other words scrap metal disposal is free or even a revenue generator. Cardboard can be recycled for free in many communities in Colorado.

When there are costs associated with recycling, the costs vary depending on the contractors approach to the issue. One common and seemingly cost effective way to recycle is to create a low cost bin to store recyclables like metal, cardboard and wood. The materials are transported by the contractor to the local recycling facility. This method is often used by contractors

interested in being efficient, cost conscious and in avoiding unnecessary contributions to the local landfill.

### **Additional Benefits of Construction Waste Recycling**



Aside from the reduced waste removal expense and the civic responsibility met by not filling local landfills with recyclable materials, our project consistently demonstrated additional benefits from construction waste recycling.

The largest benefit and the one likely to impact a builder's bottom line is the reduction in materials required on the project. By separating the wood from the waste, and creating a culture of reuse, the wood's value is better appreciated by builders. The result of this, and this was consistently seen across the spectrum of our project, which involved many developers and different building projects, was the use of "waste" wood in the project. When waste wood is readily available, it is incorporated into the building.

In the traditional building scenario, wood is simply combined with waste in a large trash container. The value of that wood is no longer appreciable. The wood is commingled with waste and is no longer accessible and the wood is often contaminated. With a separate receptacle for wood waste, the wood remains clean and uncontaminated; it is readily accessible. These things combine to encourage the contractors to reuse the wood in their projects. The wood's value as a building material is maintained.

Another benefit that has been consistently observed on this project is the community benefit of having waste wood separated and available to the community. Having waste wood available encourages community members to come to the construction site to gather wood for their home projects and even for firewood. Having the community interacting with the construction site in this way may not be perceived of as a benefit in all instances, but it is demonstrative of the value of getting wood out of the trash. Using wood to heat homes as opposed to putting it in landfill has resource conservation value.

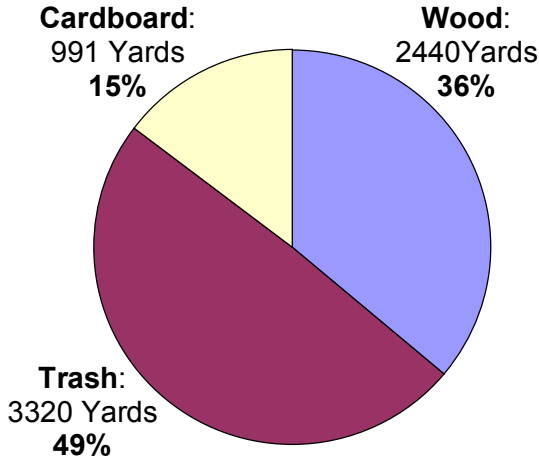
### **Results at the Holiday Neighborhood**

To date we have diverted 50% of the Holiday Neighborhood's waste by volume, or approximately 3,500 yards of wood and cardboard have been recycled. By weight we have diverted nearly 800,000lbs of waste from landfill to recycling. We anticipate reaching over 1,000,000lbs of waste avoided during 2005 with support from **The Home Depot Foundation**.

### **Waste Distribution**

The following graphs outline waste distribution over the entire project, and also by month for one year. It is interesting to note

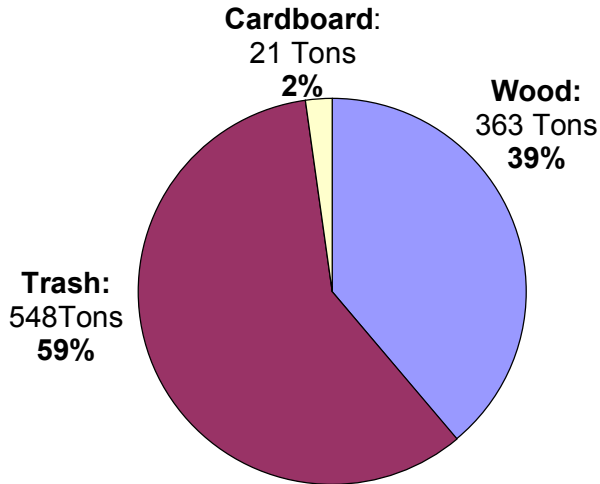
**Holiday waste by volume Aug 03- Sept 04**



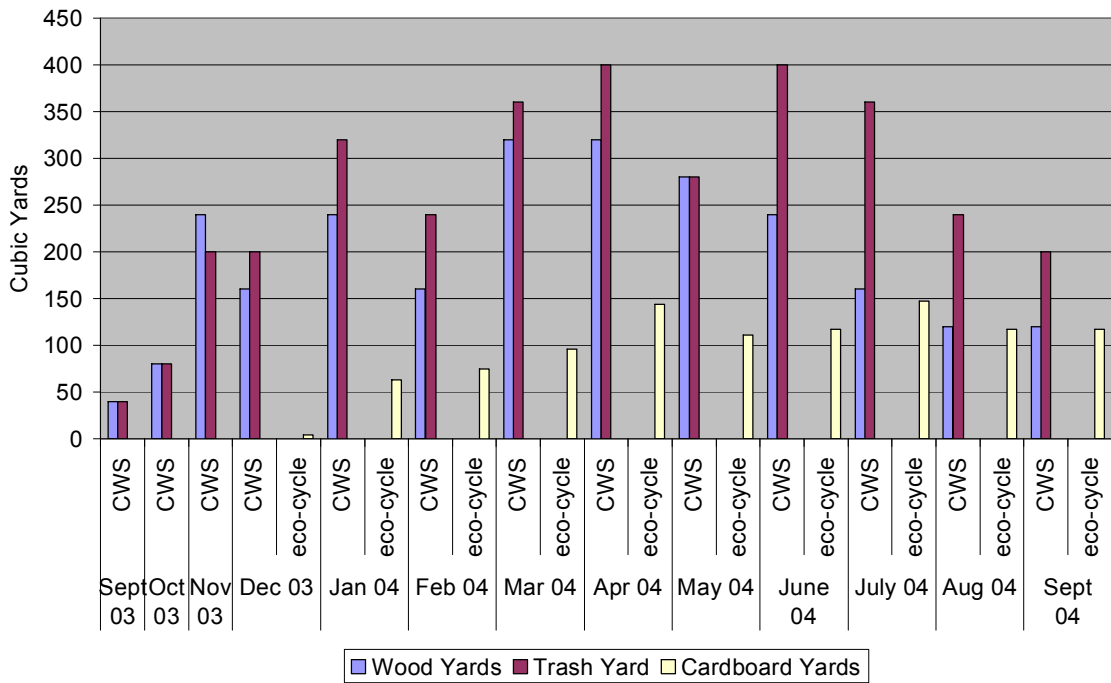
how waste is distributed during the construction process. Wood is more prevalent during framing, cardboard more common as the homes near completion. The wood to waste ratio climbs as the home nears completion and wood is no longer used in the process.

*To date the holiday project has diverted 50% of the Holiday Neighborhood's waste and over 800,000 lbs of debris from landfills to recycling*

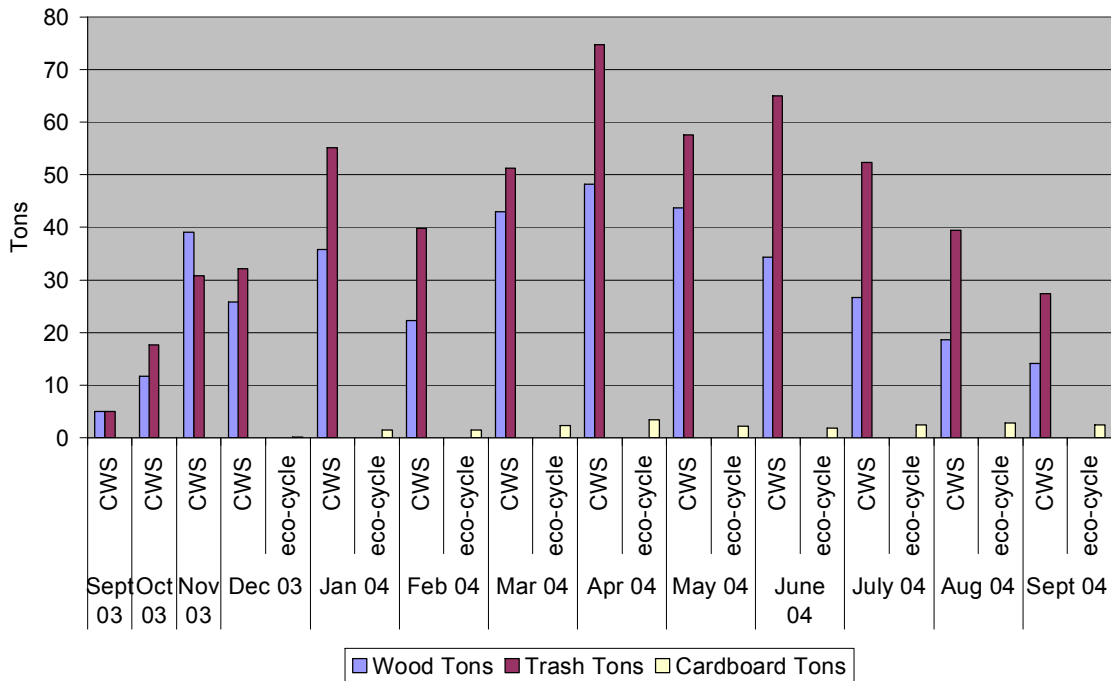
**Holiday waste by weight Aug 03- Sept 04**



Monthly Totals of Waste, Wood and Cardboard by Volume



Monthly Totals of Waste, Wood and Cardboard



## Factors Impacting the Results

For the fourteen months that the EPA provided funding for the Center for ReSource Conservation to be working with the developers and contractors at the Holiday Neighborhood we have tracked all of the waste leaving the site. However, there are several factors that can significantly impact the actual results of a construction waste recycling project.

- **Community waste-** We estimate that at least 10% of the overall waste stream at the Holiday Neighborhood is non-construction related community waste. This waste is generally waste that is dropped in the waste, wood or cardboard receptacles set up for the construction crews to use for the construction waste. This stream is especially high when containers are visible from major streets. The Holiday Neighborhood has significant traffic on three sides.

Community waste is increased when construction is still in progress while portions of the community are accepting occupants. In the case of Holiday, where construction lasts for several years, and people moved in after the first 8 months, the construction waste containers unfortunately are used as community trash containers. This is especially evident when people first move in and all of the packing materials and furniture find their way into to containers. The impact of this waste is an increase in overall non-recyclable waste, which lowers the diversion percentages.

*“a recycling ethic has started to take hold at Holiday...”*

*Daily Camera*

- **Materials reused on-site-** It is estimated that the reuse of materials when made available can lower the overall project material needs by 10%. We have seen direct evidence of this process happening, yet it is still difficult to quantify. Quoted in the Daily Camera, Kristi Howard, a construction supervisor working at Holiday said “a recycling ethic has started to take hold at Holiday...If someone needs a two-by-four, they’ll come over here (gesturing to a nearby wood bin) rather than using a fresh piece of lumber.”<sup>4</sup>

Clearly, separating the wood from the waste increases its perceived value to the employees. The wood is not contaminated in any way, is visible to the builders and is easily accessible. The impact on a project like Holiday is two-fold. It lowers the materials required to do the job, and it also lowers the diversion or recycling percentage as materials that are slated for recycling are actually reused and therefore not measured.

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<sup>4</sup> Daily Camera, December 14, 2003

- **Materials taken from site-** When wood is removed from the site for reuse by the community, it is not measured. This happens with great frequency in a construction waste recycling situation because the wood is separated, accessible and “clean.” The impact of this is lowered diversion numbers, but the wood is going to reuse which is a higher resource conservation value. It is simply not measured.



## **Public Recognition of the Holiday Project**

- **Community Foundation’s Nova Award- Winner- Best Environmental Project 2004**
- **Daily Camera, December 14, 2003 *Holiday from Construction Trash***
- **Boulder County Business Report, February, 2004 *Holiday Neighborhood project pilot for environmental efficiency***
- **Colorado Daily, December 12, 2003 *Holiday Neighborhood Recycles Large Amount of Construction Waste***