

Construction Waste Reduction and Recycling Harley Davidson Motor Company Product Development Center Office Expansion 2002

April 2002 – March 2003

Final Report



Prepared by



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Introduction

In June, 2001, WasteCap Wisconsin conducted a site visit with Affiliated Construction Services, Inc. for the Harley Davidson Product Development Center Expansion. The site visit revealed many opportunities for waste reduction and recycling during construction of the Harley Davidson Product Development Center expansion.

Harley Davidson Motor Company decided to participate in the LEED (Leadership in Energy and Environmental Design) program administered by the US Green Building Council for the expansion of the office. This rating system includes points for various sustainable building techniques implemented on a construction site. There is one point available for diverting 50% of construction debris from landfills and a second point available for a 75% diversion rate.

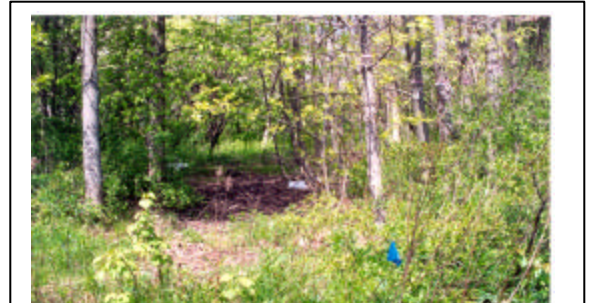


Figure 1. Harley Davidson tried to save as many trees on the site as possible. Their environmental commitment also led them to implement comprehensive construction waste recycling.

Affiliated Construction Services hired WasteCap Wisconsin to plan, implement and document construction waste management efforts at the site. WasteCap's scope of services included: develop a construction waste management plan; provide technical assistance, market information and research support; instruct and educate subcontractors about their role in the program; review status of construction waste management plan at meetings; conduct waste audits and monitor program; document construction waste management results; create summaries of waste; create a final construction waste management evaluation; report and share findings.

Affiliated Construction Services is the general contractor and Flad & Associates was the architect for this project. The Harley Davidson PDC Office building is a 75,000 ft², two-story, steel-framed building with a pre-cast concrete and aluminum curtain wall. The curtain wall is primarily glass with some insulated metal panel accents. The entire roof is flat with a rock ballasted single-ply membrane. On the inside, a central corridor bisects the building. One half is primarily enclosed offices, conference and support spaces. There is a central receiving and mechanical area on the first floor. The other half is open office subdivided by a drywall partition into three large areas that can each accommodate 45 – 60 people.



Figure 2. Crews reused and recycled 236 tons of material from the office expansion.

Summary of Results

Crews from all trades were extremely cooperative with the reuse and recycling program. Michele Erickson, Affiliated Construction Services, noted that she "couldn't say enough about how excellent the crews were on this site."

Crews diverted 236 tons of recyclables, saved over \$10,000 in avoided disposal costs, and diverted 76.4% of the construction waste – exceeding our goals.

This project:

- had the cooperation of hundreds of individuals on the project all working to separate their wastes and

recover resources that became new products instead of waste.

- received the second-ever exemption that the Wisconsin Department of Natural Resources has given to land apply Type X drywall.
- found a farmer willing to take and land apply drywall – turning a waste into a resource that is providing calcium and sulfur to soils and helping build the soil.
- Exceeded its recycling goal and saved over \$10,000 in avoided disposal costs.

1. Write construction waste management specifications

Flad & Associates included construction waste management in the specifications for this project. These specifications were important to the overall success of the project as they clearly outlined that all job site crews would be recycling on this job as a part of their contract. See www.wastecapwi.org for sample construction waste management specifications written by Flad & Associates.

2. Develop a Construction Waste Management Plan

With input and approval from Affiliated Construction Services, Inc. and utilizing the Construction Waste Management Plan Form included in the specifications, WasteCap Wisconsin developed a Construction Waste Management Plan. See Appendix A. The plan includes:

- A. Description of the project and identification of a construction waste management plan manager
- B. Reduce, reuse and buy recycled action items
- C. Recycling goal of 75% diversion with a minimum 50% diversion goal
- D. The name of the landfill where trash was disposed, the landfill tipping fee and the projected cost of disposing all Project waste in the landfill
- E. Recycling service provider and targeted materials for recycling
- F. Responsible parties for various recycling operations
- G. Communication plan
- H. Motivation plan
- I. Evaluation plan
- J. Analysis of the proposed jobsite waste to be generated, including types and quantities
- K. Materials-handling procedures for all targeted materials for recycling
- L. Description of meetings held to address waste management
- M. Description of waste auditing procedures



Figure 3. The construction waste management plan identifies materials to be separated for recycling.

3. Provide technical assistance, market information, and research support

Once we identified what materials we would recycle on this project and how, Affiliated Construction Services contracted with a hauler to provide collection and transportation services. Affiliated Construction Services switched haulers to Waste Management, Inc. during the course of this project due to lack of prompt service by the first hauler.

This project developed a new market for scrap drywall that hadn't existed previously. Also, we obtained the second ever exemption ever that the Wisconsin Department of Natural Resources has given to land apply Type X drywall.



Figure 4. The first load of drywall at the farm. The drywall was used as a soil amendment.

WasteCap Wisconsin identified and worked with a local farmer who was interested in taking the scrap drywall as a soil amendment. Drywall, like agricultural gypsum, provides calcium and sulfur to soils and helps break up clay soils. The farmer's property was closer than the landfill, providing a cost benefit, and the farmer charged a tipping fee much lower than that at the landfill, providing further cost savings. We asked Waste Management, the hauler, to weigh the drywall at a scale which was on the way to the farm and then drop off the drywall at the farm. The farmer then stored the drywall until spring when he ground and applied the drywall to his fields.

WasteCap Wisconsin wrote the application to the Wisconsin Department of Natural Resources and the farmer received a low hazard exemption for the storage and landspreading of waste 5/8" Type X drywall as a soil amendment at his farm.

For the first load of drywall that was dropped off, representatives from the hauling company, Waste Management, Affiliated Construction Services, WasteCap Wisconsin, Inc. followed the truck and made sure everything ran smoothly. In total, five 30 yard dumpsters of drywall representing over 30 tons were used as a soil amendment instead of thrown into the landfill.

4. Instruct and educate subcontractors about their role in the program and review status of construction waste management plan at meetings

On April 9 2002, Affiliated Construction Services and Flad & Associates held a kickoff meeting for all contractors about the Harley Davidson Product Development Center Office Expansion. In this meeting, WasteCap described our role in the project, the contractors' role and reviewed with each contractor what trash they would be generating so that we could research markets.

On July 31, 2002, Affiliated Construction Services held a contractor appreciation lunch. WasteCap thanked all of the crews and let them know what and why this job reused and recycled. We also reminded them of separation requirements. Initially, there was some confusion among crews about what they were supposed to separate, but after this and other education, all contractors and subcontractors did an excellent job of keeping recyclables clean and free from contamination and in considering waste reduction and recycling in their actions.



Figure 5. View of the dumpsters from the roof. WasteCap provided education to superintendents and foremen, on site staff including site superintendents and foremen provided day-to-day education and monitoring, and crews separated materials for reuse and recycling.

On January 22, 2003, Affiliated Construction Services held another contractor appreciation lunch. Several subcontractors had left and new ones were on the site at this point. WasteCap reviewed its role and the crews' role in this project, why reusing and recycling construction and

demolition debris is important, the economic and environmental results they had achieved so far, and reviewed the separation requirements.

Approximately once a month, we met with the foremen to update them on their progress, get their feedback and answer questions. The superintendents and foremen also updated us on the construction activities and notified us about new materials to be generated on the site.

Affiliated Construction Services educates employees on a daily basis and ensures that all employees know that it is their responsibility to separate recyclable materials and track any materials they take off site for reuse, recycling or disposal.

5. Conduct waste audits and monitor program



Figure 6. Concrete separated for recycling into new concrete. Waste audits identified need for new or different-sized containers, any contamination issues needing to be addressed, containers that needed to be moved or needed signs, etc.

We conducted site visits on a weekly basis at the beginning of the project and on a monthly basis later in the project once on site staff was familiar with the program.

These audits revealed any changes that needed to be made to the program including adding, removing or changing the size of containers – for example we initially only had a small, covered cardboard recycling container on site and we needed a 20 yard container for all of the material that was being generated. These audits also identified contamination issues that needed to be addressed, items to research for potential recyclability, and opportunities for reuse.

As we walked through the site, it was also extremely useful to talk to crews to find out if they understood the separation requirements, had any questions or concerns about the program, and if they had any ideas as to how we could improve the program. Crews are an excellent source of ideas and were key to

the success of this project.

The crews kept the dumpsters free of contamination. It was also helpful to place the trash dumpster nearest to the building and the recycling dumpsters slightly further away. This allowed the default option to be trash – keeping the recycling dumpsters uncontaminated. However, the crews were also very diligent about keeping recyclables out of the trash dumpster. One exception was that boxes were commonly used as trash receptacles and then thrown away with trash inside them. Also, crews didn't always separate the recyclables from their lunch wastes. We got small recycling bins to place next to trash bins in lunch areas and this improved recycling of bottles and cans.



Figure 7. Trash dumpsters were placed nearest to construction to keep recycling dumpsters uncontaminated.

6. Document Construction Waste Management Results

We collect records monthly from the hauler to document the weight and volume of trash and recyclable materials from the work site. All materials in rolloff containers are weighed and tonnages reported to us. For cans, bottles, and materials in small dumpsters, the materials are mixed in trucks with recyclables from other sites, so we use conversion numbers provided by Flad & Associates and our experience from other sites to determine their weight. Affiliated Construction Services faxed us their disposal invoices monthly and we used this data to track the cost of trash and recycling collection.

We wanted to track all materials leaving the site, whether they were in the dumpsters or taken by contractors, so that we could get an accurate accounting of total materials generated by this project. WasteCap created a Tracking Form for Materials Taken Off Site (see appendix B). All contractors were required to fill out this form and submit it monthly with their request-for-payment forms. Affiliated Construction Services then faxed the completed forms to WasteCap Wisconsin who tracked the results.



Figure 8. Spools and other items were sent back to suppliers and manufacturers for reuse. Contractors documented reuse on the Tracking Form for Materials Taken Off Site.

We created a spreadsheet from this data which documented all materials leaving the site, their weights, volume, cost, and included an analysis of results on an ongoing basis. We created monthly summaries to report the quantity of each material recycled and reused. We also documented the recycling process through photographs and monthly reports. This documentation was not only used to motivate crews and inform the public, but it was useful to closely track waste and recycling costs so that we and Affiliated Construction Services could follow up, for example, on financial credits that should be received for metal and cardboard recycling.

7. Submit summary of waste using the Waste Audit Tracking Form for Application for Progress Payments.

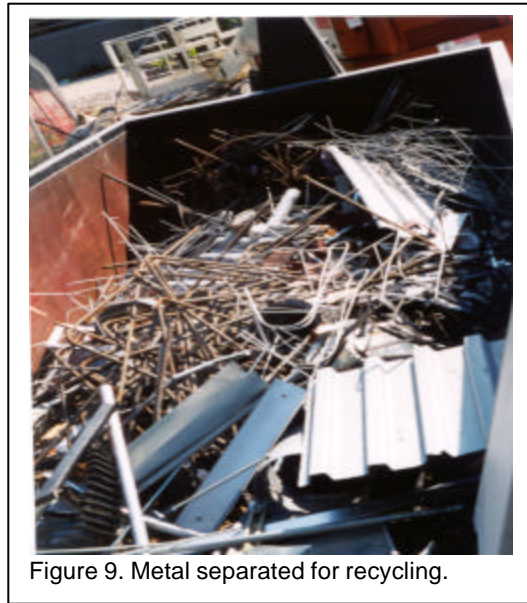


Figure 9. Metal separated for recycling.

We provided monthly reports to Affiliated Construction Services of our observations, improvements made or needing to be made, progress on issues such as market development, and a summary of waste.

The summary of waste listed each material reused, recycled and disposed, the total tons of each material generated to date, the total tons of each material generated for that month, and the diversion rate for that month and to date.

8. Create and Complete a Final Construction Waste Management Evaluation

We are pleased with methods we have developed to transfer, collect, and haul materials from the site. Overall, the recycling and reuse proceeded very smoothly in spite of challenges of crews that hadn't recycled this extensively before.

Table 1 shows a summary of waste and recycling results from April 2002 to March 2003. Concrete accounts for the highest proportion of recycled materials by weight and cardboard accounts for the highest proportion of recycled materials by volume. Wood also contributed significantly to the results.



Figure 10. 608 cubic yards and 21.26 tons of cardboard were recovered during this project.

Table 1. Summary of waste and recycling volume and weight

Material	Unit	Volume (cubic yards)	% of total volume	Weight (Tons)	% of total weight
Cardboard	30, 20 & 2 yd3	608	24.72%	21.26	6.89%
Scrap Metal	20 & 30 yd3	280	11.38%	30.05	9.74%
Untreated Wood	20 & 30 yd3	400	16.26%	31.56	10.23%
Commingled Recy.	95 gallon carts	62	2.52%	1.65	0.54%
Drywall	30 yd3	150	6.10%	30.55	9.91%
Concrete	12 yd3	216	8.78%	109.58	35.53%
Reuse	Various	60.79	2.47%	10.99	3.56%
Total Recyclables		1776.79	72.23%	235.64	76.40%
Total Trash	2 & 30 yd3	683	27.77%	72.77	23.60%
Total		2459.79	100.00%	308.41	100.00%

Table 2 describes what happens to the materials after they leave the site. Trash is taken to the landfill and buried but the rest of the materials were beneficially used to make into new products, build soils, etc.

Table 2. Summary of materials removed from site and how they were used

Material	Recipient
Cardboard	Waste Management, Inc. Menomonee Falls – sorted, sold to paper mills to make into new paper products
Scrap Metal	Miller Compressing – melted and made into new metal products
Untreated Wood	Metro Landfill – chipped and sold for landscape mulch
Commingled Recy.	Waste Management Inc. Menomonee Falls – sorted, sold to markets to make, for example, new aluminum cans, new glass bottles, carpeting from plastic bottles
Drywall	Local farmer for land application as a soil amendment for calcium & sulfur
Concrete	Various concrete recyclers in area for recycling back into concrete
Reuse	Various
Trash	Orchard Ridge Landfill

Table 3 summarizes the economic impact of reusing and recycling. Of course, reducing and reusing saves the entire cost of disposal or recycling, as it doesn't end up in a container at all. Recycling, on average, saved \$59.00 per ton. Overall, recycling and reusing saved over \$10,000 in avoided disposal costs – saving 40% on disposal costs. The more material generated, the higher the savings, so cardboard and concrete helped save the most, and cans and bottles collected saved the least.

Table 3. Economic Analysis

Material	Total Cost	Cost if disposed as trash*	Avoided Disposal Cost	Average Cost per Yard	Average Cost per Ton
Cardboard	\$2,230.00	\$4,830.02	\$2,600.02	\$3.67	\$104.89
Scrap Metal	\$1,256.13	\$2,771.35	\$1,515.22	\$4.49	\$41.80
Untreated Wood	\$1,870.00	\$3,652.12	\$1,782.12	\$4.68	\$59.25
Commingled Recy.	\$385.00	\$478.55	\$93.55	\$6.21	\$233.33
Drywall	\$900.00	\$1,874.85	\$974.85	\$6.00	\$29.46
Concrete	\$1,980.00	\$4,470.66	\$2,490.66	\$9.17	\$18.07
Reuse	\$0.00	\$722.26	\$722.26	\$0.00	\$0.00
Other charges	\$22.93		(\$22.93)		
Total Recyclables	\$8,644.06	\$18,799.81	\$10,155.75	\$4.86	\$36.68
Total Trash	\$6,971.64			\$10.21	\$95.80
Total	\$15,615.70	Savings:	\$10,155.75	\$5.35	\$59.12

* Calculated using actual trash cost charged for this job of \$27 per ton plus \$7 per cubic yard.

9. Report and Share Findings



Presentations:

WasteCap Wisconsin was a presenter at the following conferences in March, April and May, 2003 and highlighted the results of recycling at the Harley Davidson Motor Company Product Development Center Office Expansion Project: the National Green Building Conference, the 11th Rinker International Conference on Deconstruction & Materials Reuse, Keep Greater Milwaukee Beautiful's Annual Environmental Business, Industry & Government Seminar, and a "lunch and learn" for a local architecture firm.

Internet:

This project has been highlighted in WasteCap Wisconsin's email bulletin which goes to over 900 professionals throughout Wisconsin and this final report will be posted on WasteCap's web site www.wastecapwi.org.

Conclusion

Thanks to the team work of the architect, contractor, and crews, this project was a success. It recovered 236 tons of materials, saved over \$10,000 in avoided disposal costs, and was fairly simple for all crews. Congratulations to all on an economic and environmental success story.