# TAKING CONSTRUCTION SITE WASTE MANAGEMENT TO THE NEXT LEVEL

Joseph Laquatra[1] and Mark Pierce[2]

## INTRODUCTION

*Building a single family home in the United States typically produces between three to five pounds of waste per square foot (SIH). Costs of disposing this waste are mounting throughout the country, and environmental aspects of this issue are receiving heightened scrutiny. Although research on this topic has shown that 80 percent of waste generated during the construction of a home can be recycled (Laquatra and Pierce 2004; SBIC 2007), less than 30 percent actually is (Martin 2007). This is likely to change as state and local government regulations of construction waste increase, with some mandating waste recycling. In addition, builders who participate in green building programs are learning that reducing the amount of waste generated during construction, and recycling waste that is produced, earns points toward certification.*

*This paper describes elements of a successful waste management plan for home builders. Issues specific to each type of waste are examined, and ideas for improving recycling at construction sites are presented.*

## GETTING STARTED

The first step for a builder to take in developing a construction waste management program is to examine current waste management practices. One way to do this is to conduct a waste cost audit on current waste generation and disposal procedures. This involves investigating current disposal costs, state and local regulations, and available alternatives to disposal, including reduction and reuse.

Currently, the most common method for handling construction waste is for builders to contract with a waste hauling service to provide containers at the construction site. Waste materials are placed in the containers, which are transported by the hauler to a landfill or incinerating facility. The waste hauler charges the builder a fee that includes the cost of his or her services plus tipping fee costs that the waste hauler must pay at the landfill or incinerating facility. Additional charges may include a fee to deliver containers to the construction site, a fee each time containers are emptied, and a monthly rental fee for the containers.

Builders should understand regulations concerning construction waste, most of which is classified as solid waste. In general, three subcategories of waste within the larger general category of solid waste are typically defined. These are inert waste, putrescible waste, and chemical waste. Inert waste is chemically stable, and does not decompose, form a gas or odor, or burn. Bricks, masonry, and concrete are examples of materials that fall within this category. Putrescible waste is solid waste that contains organic matter capable of decomposition by microorganisms, which then form gases. Putrescible wastes may also form contaminated leachate from biodegradation, chemical processes, and physical processes. Chemical waste refers to materials that are capable of forming a contaminated leachate through chemical or physical processes.

The federal Resource Conservation and Recovery Act (RCRA) of 1976 forms the basis for federal laws and regulations that set minimum standards for the handling and disposal of solid waste. Although states may enact more stringent regulations, they must use the regulations outlined within RCRA as minimum standards. As a result, each state will have classifications similar to the three categories mentioned earlier. But the definitions for each category may vary significantly from state to state. For example, some states classify gypsum as an inert waste,

[1]Joseph Laquatra, Ph.D., Professor, Department of Design and Environmental Analysis, Cornell University, JL27@cornell.edu.
[2]Mark Pierce, M.S., Extension Associate, Department of Design and Environmental Analysis, Cornell University, MRP6@cornell.edu.

whereas others classify it as a putrescible waste. It is important that builders know and understand the definitions for each classification within their particular states. The definitions will have a major impact on the guidelines they are required to follow at their construction sites.

Awareness of regulations concerning disposal of construction waste is important knowledge for builders, but more important is knowledge about alternatives to disposal, namely reduction and reuse. A starting point for reducing waste is to decrease the amount of building materials that are purchased. Advanced framing, otherwise referred to as optimum value engineering, is a method for the design and construction of wood-framed homes that minimizes the use of framing members without sacrificing structural integrity. Vertical studs are placed at 24 inches on-center instead of 16 inches. They are lined up with roof rafters, trusses, and joists, so that loads are transferred directly. This eliminates the need for double top plates. Headers for windows and doors are sized correctly instead of being over-built; and corners use two instead of three studs. These and other features of advanced framing result in substantial savings in the use of wood (NAHB Research Center 2008).

In a case study of a 1,894 square feet single-family home that was under construction, Cornell University researchers noted a large number of 12-inch pieces of 2×4s that were being discarded (Laquatra and Pierce 2004). These were recognized as jack stud cut-offs (see Figure 1). Jack studs are used in wood framing to provide a bearing, or resting seat, for headers that are placed over window and door openings. While typical studs are 92 5/8 inches long, jack studs are 80 1/2 inches long. Using conservative assumptions, these researchers calculated that in the years from 1997 to 2001, when 6,211,700 single-family homes were built in the United States, 101,910,703 board feet of lumber from jack stud cut-offs were treated as scrap lumber and most likely landfilled. That is the equivalent of 304,211 14-inch Diameter at Breast Height (DBH) trees. Another way to think about that amount of lumber is to picture those cut-offs laid end-to-end, which would equal 232,900,800 linear feet or 44,110 miles. That is the same as circling the Earth at the equator one and three-quarter times.

**FIGURE 1.** Jack stud cut-offs.

## USE OF SCRAP LUMBER AT CONSTRUCTION SITES

When a builder collects information to formulate a waste management program, one area to assess is whether some materials can legally be disposed of on-site, specifically whether wood wastes can be chipped and used as ground cover. Some states allow what is known as beneficial use deployment, which permits the processing of certain waste materials on the construction site and their application in a useful way. Chipping of untreated wood scraps to be used as landscape mulch, for example, can fall into this category. Some states allow only clean solid wood scraps to be used for mulch; others allow both clean solid wood and manufactured wood scraps for this purpose.

Some recycling companies accept scrap wood for a fee, which may be cheaper than what a builder currently pays to a waste hauler. When investigating this option, it is useful to ascertain whether recycling companies pick up scrap at the building site or if it is the builder's responsibility to deliver it. Other opportunities for wood reuse include donating the scraps to schools for use in wood shop classes or to non-profit organizations. Wood waste comprises between 30 and 40 percent of waste produced at the residential construction site, so it is in a builder's interest to reduce and reuse this waste to the extent that it is possible.

## GYPSUM WASTE

Gypsum board, or drywall, is usually the largest single item of waste produced during the construction of a house. In the Cornell study referenced above, 1,788 pounds of gypsum waste was generated. In the process of cutting drywall to fit around windows, doors, and other openings, about one pound of waste for every square foot of house area is produced. The reason that so much gypsum waste is produced is because it is easier to finish (apply tape and joint compound) drywall if it is installed in large pieces with as few joints as possible. This also results in fewer cracks that can develop over time.

An environmental concern with disposing drywall waste in landfills is that under anaerobic conditions, sulfate-reducing bacteria produce hydrogen sulfide gas from the sulfate in gypsum. Over 350 landfills in the U.S. participate in gas recovery operations for electricity generation and other purposes (Heguy and Bogner 2008). Hydrogen sulfide lowers the quality of gas recovered and necessitates sulfur abatement systems. For this reason, some landfills do not accept gypsum waste.

An alternative to landfilling gypsum waste is grinding it on site and applying it as a soil amendment in states that permit this. In its study of construction site waste management, the NAHB Research Center recommended cutting waste gypsum into small pieces and stacking it between studs in interior wall partitions, but this option proved to be unpopular. The technology for gypsum board recycling is now at a point where a builder can stack gypsum waste in one spot on a construction site and have a gypsum recycler remove the waste for about the same cost as landfilling. Uses for gypsum waste include the manufacturing of new drywall, as an ingredient in cement production, as a stucco additive, for sludge drying, for settling dirt and clay particles in turbid water, for athletic field marking, and others (Roskoskey 2007).

**FIGURE 2.** Gypsum waste.

## PACKAGING WASTE

The amount of cardboard waste produced at a construction site varies from 2 to 10 percent of total waste generated. This material is the easiest construction waste material to dispose of, and many county solid waste facilities around the U.S. accept it at no charge. Softwood pallets can be recycled as wood waste. Hardwood, plastic, or metal pallets can be returned to the sender. Plastic packaging materials may be easier to recycle in some markets than others. Other packaging waste includes containers for paint, joint compound, adhesives, and other materials. Recycling these materials may be a challenge in some areas, but some plastics recycling companies will work with clients to identify whether particular materials are recyclable. Recycling packaging materials is likely to become easier. The European Union currently has aggressive policies for recycling packaging waste materials, and some companies are switching to plant-based plastic. Figure 3 shows relative amounts of packaging waste from a typical construction site. If specific packaging materials are difficult to recycle, builders can ask that suppliers provide products with minimal or no packaging.

**FIGURE 3.** Packaging waste.

## OTHER MATERIALS

Recycling options also exist for metal, asphalt shingles, and scrap vinyl siding. Scrap metal can usually be dropped off at a county solid waste facility at no charge. In some areas of the United States, companies specialize in recycling asphalt shingles and scrap vinyl siding. Hazardous waste materials comprise a special area of waste management because of laws regulating them. To the extent possible, builders can switch to non-hazardous materials. Water-based paint and low-VOC emitting caulking compounds are examples of these.

## EDUCATING WORKERS AT THE SITE

Involving everyone on a job site is crucial to the success of an on-site waste management plan. A problem noted early in the Cornell study was contamination of waste materials with lunch trash, such as soda, ketchup, and other food wastes. This was a problem because some materials are not accepted for recycling if they are contaminated. The researchers spoke to workers during a lunch break about the waste management plan that was underway and asked that any food or beverage debris be placed in a special bin that was made from scrap wood. In addition, recycling posters were posted around the site (see Figure 4). This educational effort was a success, as no further contamination occurred, and all lunch and break debris was deposited in the special bin. Another strategy is to appoint one worker on the site to be in charge of overseeing a waste management effort. If subcontractors are used, they can be part of the overall waste management program, or they can be required to remove all of their waste from the site.

**FIGURE 4.** Educational poster.


## CONCLUSIONS

As green building practices become more commonplace, construction site waste management practices will become routine. Builders can distinguish themselves from their competitors by becoming familiar with waste minimization now. As they continue in such efforts, their knowledge and skills in the area will increase and their profit margins will most likely improve. Construction site waste recycling is now mandated in some municipalities in the U.S. and Europe, which is a likely indicator of a long-term trend. In 2008 in the United Kingdom, waste management plans became compulsory for all construction projects costing over £300,000 ($493,280). Increasing awareness of environmental aspects of construction site waste and its recycling potential will further initiatives for reducing its disposal in landfills. Resources are available for builders to educate themselves about this issue and to assist them in developing waste management plans that follow the "Reduce, Reuse, Recycle" hierarchy.

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