

# EPA **Recover Your Resources**

*Reduce, Reuse, and Recycle  
Construction and Demolition Materials  
at Land Revitalization Projects*



*What's in Your Dumpster?*



# Don't waste your resources

*Sustainable reuse of brownfield properties includes efforts to reduce the environmental impact by reusing and recycling materials generated during building construction, demolition, or renovation. Typical construction and demolition (C&D) materials include wood, drywall, cardboard, brick, concrete, metal, insulation and glass.*



Preliminary estimates from the U.S. Environmental Protection Agency (EPA) show that the nation generated more than 160 million tons of building related construction and demolition (C&D) materials in 2003. According to the most recent data available (2003), nearly 53 percent of all building-related C&D materials are the result of demolition activities, 38 percent of the materials are produced by renovation activities, while approximately nine percent are the result of construction. Of the total building-related C&D materials generated, EPA estimates that only 40 percent were reused, recycled, or sent to waste-to-energy facilities, while the remaining 60 percent of the materials were sent to C&D landfills.

There are numerous opportunities to recover and use C&D materials at brownfields and land revitalization sites, including:

- Brownfields often have abandoned or unwanted buildings onsite in need of demolition. Materials recovered can be reused onsite, sold through local markets, or recycled offsite.
- Brownfields are frequently located in urban areas near transportation hubs. Being close to transportation corridors allows a developer to reuse current infrastructure and provides easy access to potential markets for C&D materials.
- Renovation or new construction on former brownfields provides owners/developers with an opportunity to buy recycled-content building products, return, sell or donate unused building materials, and send other materials for recycling.

Several brownfields and land revitalization projects have achieved significant C&D recovery rates through recycling, salvage for reuse or resale, composting, and other methods. These C&D material recovery activities are achieved at lower costs than landfilling, resulting in significant cost-savings and avoided associated environmental impacts. For example, the dismantlement of Nashville Thermal Transfer, a waste-to-energy facility in Nashville, TN, resulted in 98.5% reuse and recycling of its equipment and C&D materials. Over 100 internet auction events sold over 1,000 tons of equipment and materials, (bringing in over \$980,000 in revenue). In addition, thousands of tons of crushed aggregate were transferred off-site for use as backfill, and crushed asphalt was used off-site for a perimeter road.

## Generation of Construction and Demolition Waste Materials

C&D materials are generated during new construction, renovation, and demolition of buildings, roads, and other structures. C&D materials include brick, concrete, masonry, soil, rocks, lumber, paving materials,

## Integrate C&D Resource Recovery at Land Revitalization Projects

### Pre-planning

- Ensure local policies and regulations support and/or promote C&D materials reuse/recycling activities
- Use contractors experienced in C&D materials reuse/recycling activities
- Incorporate C&D materials reuse/recycling language in Request for Proposal (RFP) language and contract specifications



### Planning

- Develop C&D recycling plan
- State recycling goals
- Identify materials for recovery
- Assign roles and responsibilities (who, what, when, how)
- Identify markets for recovered materials



### Demolition

- Salvage materials
- Deconstruct structures to maximize quantity/quality of recoverable resources
- Link a deconstruction project with a current construction or renovation project to facilitate reuse of salvaged materials
- Sell or donate recovered materials
- Reuse recovered materials onsite
- Send materials for recycling offsite

# ... recover them.



shingles, glass, plastics, aluminum (including siding), steel, drywall, insulation, asphalt roofing materials, electrical materials, plumbing fixtures, vinyl siding, corrugated cardboard, and tree stumps. If properly planned, a vast majority of C&D materials can be recovered through reuse and recycling, which conserves resources and energy.

## What C&D Materials Cannot be Reused or Recycled?

A certain portion of the materials from construction and demolition projects are toxic or classified as hazardous waste. Materials generated in new construction that may require special handling include latex paint, chemical solvents and adhesives. The materials should be managed according to local regulations. Lead paint can be planed, removed, and recycled at a lead smelter or disposed of appropriately, while the remaining wood can also be reused or recycled.

The age of structures involved in demolition projects ranges considerably. Many older buildings may contain materials that are no longer allowed in new construction, such as asbestos and lead-based paint. Asbestos abatement is required prior to demolition. Asbestos must be handled appropriately and disposed in a landfill that accepts asbestos-containing material (ACM). Contact your landfill to find out if they accept ACM.

## Main C&D Recovery Project Types

**Deconstruction**—A “soft” demolition technique, in which workers dismantle a significant portion of a building in order to maximize recovery of materials for reuse and recycling. In order for materials to be reusable, they must be removed intact (e.g., windows and frames, plumbing fixtures, floor or ceiling tiles) or in large pieces (e.g., lumber).

**Demolition**—The complete removal of a building. Generally, after extracting easily removable materials for reuse or recycling, workers complete the demolition with heavy equipment. Additional recyclables are often sorted from the rubble generated during these demolition activities. In order to be recycled, materials must be separated from contaminants (e.g., trash, nails, broken glass).

**New Construction**—Putting together all or part of a structure. Most construction site debris is generated from packaging and when raw materials are cut or sized. Workers can save large scraps for use in other projects. Durable packaging and unused materials can be returned to suppliers. Smaller scraps and non-durable packaging can be source separated when produced and recycled.

**Renovation**—Partial removal of a building’s interior and/or exterior followed by construction. Contractors can adapt the same recovery techniques as above for renovation projects.

## Main C&D Recovery Streams

**Reuse**—Many materials can be salvaged from demolition and renovation sites and sold, donated, stored for later use, or reused on the current project. Typical materials suitable for reuse include plumbing fixtures, doors, cabinets, windows, carpet, brick, light fixtures, ceiling and floor tiles, wood, HVAC equipment, and decorative items (including fireplaces and stonework).

**Recycling**—Materials can either be recycled onsite into new construction or offsite at a C&D processor. Typical materials recycled from building sites include metal, lumber, asphalt, pavement (from parking lots), concrete, roofing materials, corrugated cardboard and wallboard.

### Construction/Renovation

- Design building to facilitate future changes including eventual deconstruction
- Reuse existing structure whenever possible
- Design for standard size building materials
- Buy environmentally preferable construction materials
- Sell or donate unused building supplies
- Contract with suppliers that will take back unused construction materials
- Send materials for recycling

### Results

- Identify/quantify materials diverted from the waste stream
- Calculate cost-savings and other benefits
- Collect tax credits, rebates, green building certifications, and other incentives if applicable
- Communicate/report results

# Commonly Recovered C&D Materials



## Asphalt Paving

Asphalt is crushed and recycled back into new asphalt. Markets for recycled asphalt paving include aggregate for new asphalt hot mixes and sub-base for paved road. For more information on recycling asphalt, visit [www.arra.org](http://www.arra.org)



## Land Clearing Residuals

Trees and brush—can be recycled as compost or mulch; soil can be reused as fill and cover



## Wood

Reuse timbers, large dimension lumber, plywood, flooring, molding, lumber longer than 6 feet. Clean, untreated wood can be recycled, re-milled into flooring, or chipped/ground to make engineered board, boiler fuel, and mulch.



## Gypsum Wallboard

Remove and recycle gypsum drywall. Markets include new drywall manufacture, cement manufacture, and agriculture. Unused drywall can be returned to a supplier, donated, or sold. For more information on recycling drywall visit, [www.drywallrecycling.org](http://www.drywallrecycling.org)



## Buildings

Reuse large portions of existing structures during renovation or redevelopment. Extending the life cycle of existing building stock will conserve resources, retain cultural resources, reduce waste, and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

What's in Your Dumpster?



## Metals

Recycle metals found at a construction, demolition, or renovation sites. Common metals include steel, aluminum, and copper. Local metal scrap yards or recyclers that accept metal materials are typically accessible. Metals are melted down and reformed into metal products. Markets are well established for metals. For more information on recycling metal visit [www.isri.org](http://www.isri.org) and [www.recycle-steel.org](http://www.recycle-steel.org).



For all C&D materials, hazardous



## Concrete

Concrete is commonly recycled. It is crushed, the reinforcement bar is removed, and the material is screened for size. Market outlets for recycled concrete include road base, general fill, pavement aggregate, and drainage media. For more information on recycling concrete visit [www.concreterecycling.org](http://www.concreterecycling.org)



## Roofing (non-asphalt shingles)

Reuse sheathing, terracotta, slate, or untreated cedar tiles. Metal materials can also be recycled.



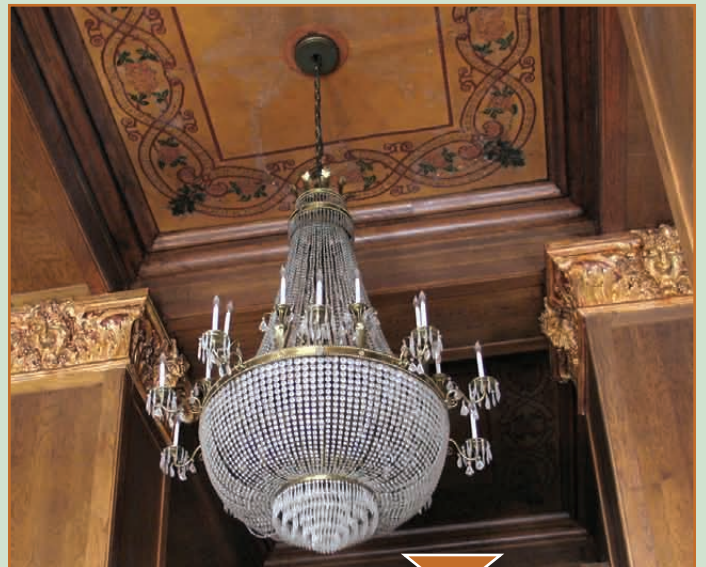
## Asphalt Shingles

Recycle asphalt shingles. After the removal of nails, asphalt shingles can be ground and recycled into asphalt mixes. For more information on recycling asphalt shingles, visit [www.shinglerecycling.org](http://www.shinglerecycling.org)



## Brick

Reuse clean brick in historical restoration projects. Recycle clean brick by crushing material. Market outlets for recycled brick include aggregate, drainage media, and general fill.



## Architectural Salvage

Salvage for resale and reuse, doors and door frames, windows, structural systems, millwork, fixtures, and other materials. Wood structural systems rate highly for end-of-life reuse potential. Old mill buildings framed with large wood timbers are now treasure troves of material for new construction. Markets are well established and easily accessible.

**or toxic materials should be removed and managed according to local regulations.**

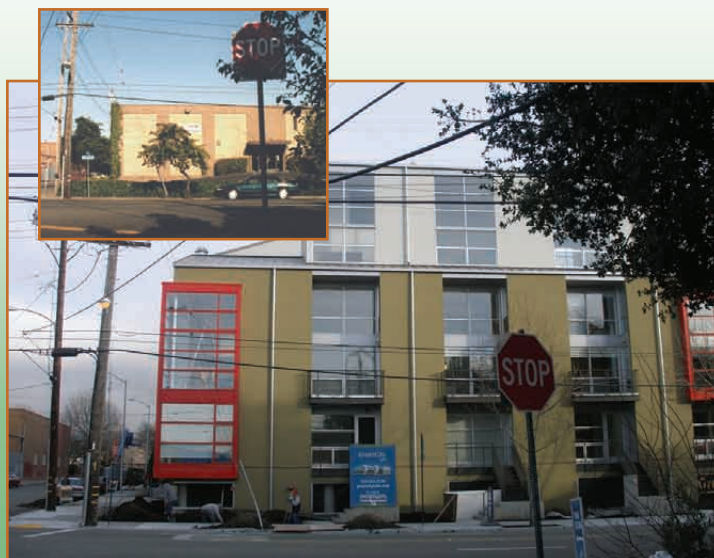
# EPA C&D Recycling Success Stories



## Richmond, VA

The former Lucent Richmond Works facility, a 120-acre RCRA facility, was fenced off and left idle, leaving behind over 700,000 square feet of old and dilapidated manufacturing buildings. With coordination between the developer, the previous site owner, EPA, and the Virginia Department of Environmental Quality, the property is being revitalized into *The Shops of White Oak Village*, a development that will feature several restaurants, a hotel, national retail stores, and several regional and local specialty shops. After demolishing the existing onsite buildings, the developer diverted 84,500 tons of material from landfills, achieving a 93 percent overall recycling rate. According to the project's demolition contractor, the amount of materials diverted from landfills could have filled two Richmond Coliseums. Cost-savings associated with recycling and reuse of demolition materials are estimated to be approximately \$3.6 million. The developer is now applying for Leadership in Energy and Environmental Design (LEED) certification from the U.S. Green Building Council, further demonstrating a commitment to sustainable development. For more information on this project, please visit:

[www.epa.gov/reg3wcmd/ca/va/pdf/vad066000993.pdf](http://www.epa.gov/reg3wcmd/ca/va/pdf/vad066000993.pdf)



## Emeryville, CA

In July 2003, the City of Emeryville provided \$1,175,000 in EPA Brownfields Revolving Loan funds to GreenCity LLC to assist with cleanup costs associated with the GreenCity Lofts property, a former paint factory. The GreenCity Lofts project team completed cleanup of the 0.9-acre property in December 2004 and 62 condominiums were constructed in 2005. Demolition of the former paint factory and warehouse buildings was necessary before construction of the lofts could begin. The project team employed C&D waste recycling practices including deconstructing (hand dismantling) the buildings on the former industrial property as an alternative to traditional demolition. *As a result, 94.6 percent of the demolition waste was recycled, exceeding the nearby City of Oakland's legal requirement by 45 percent.* In addition, 21,569 tons of excavated soil were diverted from disposal and used as Beneficial Cover at a local Class II Landfill reducing project cost by an estimated \$496,708 in eliminated tipping fees. For more information on this project, please visit:

[www.epa.gov/brownfields/success/emeryvilleca\\_cd\\_ss\\_final.pdf](http://www.epa.gov/brownfields/success/emeryvilleca_cd_ss_final.pdf)

## Brownfields Cleanup and Redevelopment

EPA's Brownfields Program empowers states, communities, and other stakeholders in economic redevelopment to work together to prevent, assess, safely clean up, and sustainably reuse brownfields. The Brownfields Program provides technical and financial assistance, including grants for environmental assessment, cleanup, and job training.

[www.epa.gov/brownfields/](http://www.epa.gov/brownfields/)

## Federal Facilities

The Federal Facilities Restoration and Reuse Program works with other Federal and state agencies to facilitate the cleanup and reuse of the nation's Superfund Federal facilities, including Base Realignment and Closure (BRAC) sites.

[www.epa.gov/fedfac/](http://www.epa.gov/fedfac/)

## Underground Storage Tanks

The Underground Storage Tanks Program supports States, territories, and other partners in the cleanup and reuse of properties contaminated by petroleum releases from underground storage tanks and works to better integrate eligible petroleum brownfields into ongoing restoration/revitalization activities.

[www.epa.gov/swerst1/](http://www.epa.gov/swerst1/)



## Detroit, MI

In December 2005, the cleanup of a two-acre former automotive property in Detroit, Michigan was made possible through the leadership of a local nonprofit organization and funding assistance provided by EPA, in-kind services, and C&D waste recycling activities. Working within a tight budget, Focus: HOPE Revitalization conducted demolition and cleanup activities on the brownfields property for its intended reuse as a parking lot for a planned mixed-use development on the adjacent property. Largely, the C&D waste recycling activities made the project feasible by reducing the total project cost by 20 percent, a savings of \$150,000, through the recycling of approximately 1,200 tons of materials and over 13,000 gallons of waste water. As a result, the property's reuse provided a catalyst to revitalization in the surrounding neighborhood. For more information on this project, please visit:

[www.epa.gov/brownfields/success/Detroit\\_MI\\_Success\\_012808.pdf](http://www.epa.gov/brownfields/success/Detroit_MI_Success_012808.pdf)



## Worcester, MA

In June 2003, EPA awarded Main South Community Development Corporation (CDC) in Worcester, Massachusetts a \$200,000 Brownfields Cleanup grant to address contamination discovered on 7.8 acres of the Gardner-Kilby-Hammond Neighborhood Revitalization Project—an ambitious \$32 million dollar, 30-acre inner city neighborhood redevelopment project. Cleanup of contamination present in the soil and the abandoned industrial buildings was completed in March 2006. To help keep cleanup costs within Main South CDC's budget, McConnell Enterprises recovered multiple construction and demolition (C&D) materials from the abandoned industrial buildings, including: 10,000 cubic feet of concrete, 200 tons of steel, 50,000 broad feet of hard yellow pine, and several hundred tons of brick and granite. Salvaged materials were sold through local and global markets, reused onsite for new construction, or recycled, strengthening the local market for C&D materials. Main South CDC was able to reduce project costs significantly as a result of its C&D waste reduction strategies. Early planning and a phased approach to the cleanup and development of the property also allowed for a major phase of the Gardner-Kilby-Hammond Neighborhood Revitalization Project to move forward: the construction of a Boys and Girls Club and affordable housing for first-time homebuyers. For more information on this project, please visit:

[www.epa.gov/brownfields/success/worcester050108.pdf](http://www.epa.gov/brownfields/success/worcester050108.pdf)

## RCRA Corrective Action

The Resource Conservation and Recovery Act (RCRA) Corrective Action Program requires the investigation and cleanup of hazardous releases at operating facilities. The RCRA Reuse and Brownfields Prevention Initiative encourages the reuse and revitalization of RCRA sites so that the land better serves the needs of the community through more productive use or as greenspace.

[www.epa.gov/swerosps/rcrabf/](http://www.epa.gov/swerosps/rcrabf/)

## Superfund

The Superfund Program manages cleanups of the nation's uncontrolled hazardous waste sites that pose a current or future threat to human health or the environment. EPA's Superfund Redevelopment Program encourages communities at every cleanup site to consider anticipated future reuses early so that cleanups can accommodate those uses, while maintaining standards that protect human health and the environment.

[www.epa.gov/superfund/programs/recycle/](http://www.epa.gov/superfund/programs/recycle/)

# Benefits to C&D Recycling



- Reduces the production of greenhouse gas emissions and other pollutants by reducing the need to extract raw materials and ship new materials long distances.



- Conserves landfill space, reduces the need for new landfills and their associated cost.



- Saves energy and reduces the environmental impact of producing new materials through avoided extraction and manufacturing processes.



- Creates employment opportunities and economic activities in recycling industries.



- Saves money by reducing project disposal costs, transportation costs, and the cost of some new construction materials by recycling old materials onsite.

## Expanding Markets for Deconstruction Materials

It's getting easier to find homes for your deconstruction materials and used equipment. Many deconstruction items can be reused "as is." Several cities now have stores that accept and resell donated surplus building materials and deconstruction materials. For instance Habitat for Humanity runs "Habitat ReStores" which are retail outlets where quality used and surplus building materials are sold at a fraction of normal prices. Many affiliates across the United States and Canada operate successful ReStores. There are several other independent stores as well. Some companies have found it useful to open up a building slated for demolition, partnering with non-profits or other groups to collect "deconstruction" items. There are also a number of auction or classified ad type websites where people can sell, donate, or advertise the need for materials and used industrial equipment. For more information on Habitat ReStores, please visit, [www.habitat.org/env/restores.aspx](http://www.habitat.org/env/restores.aspx). Other similar reuse stores and online materials exchanges can be found in the Building Materials Reuse Association's directory: [www.buildingreuse.org](http://www.buildingreuse.org).

## Resources

- EPA Construction and Demolition—[www.epa.gov/cdmaterials](http://www.epa.gov/cdmaterials)
- Construction Industry Compliance Assistance Center—[www.cicacenter.org](http://www.cicacenter.org)
- Building Material Reuse Association—[www.buildingreuse.org](http://www.buildingreuse.org)
- Construction Material Recycling Association—[www.cdrecycling.org](http://www.cdrecycling.org)
- National Recycling Coalition, Industrial Materials Recycling Council—[www.industrialresourcescouncil.org/](http://www.industrialresourcescouncil.org/)
- National Demolition Association—[www.demolitionassociation.com](http://www.demolitionassociation.com)
- EPA Industrial Materials Recycling—[www.epa.gov/industrialmaterials](http://www.epa.gov/industrialmaterials)



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