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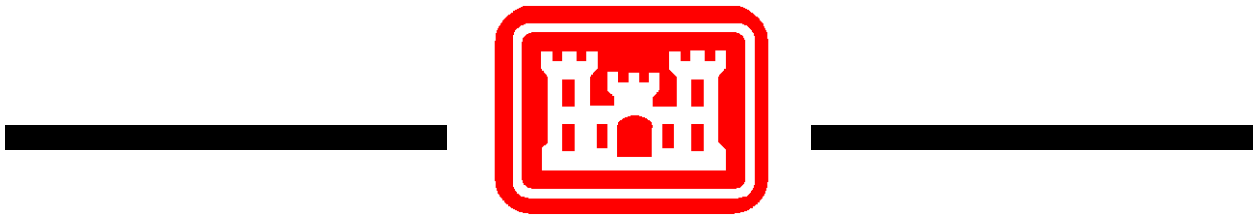
UPDATE OF MARKET VALUE FOR DEMOLITION SALVAGE MATERIALS



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UPDATE OF MARKET VALUE FOR DEMOLITION SALVAGE MATERIALS

1. Purpose

a. This Public Works Technical Bulletin (PWTB) evaluates salvaging building materials for recycle or reuse. This guidance provides Army installations with updated procedures, information, and resources to plan and manage building removal projects that involve construction and demolition (C&D) activities, as an alternative to conventional demolition and landfilling.

b. The U.S. Army engages in a great number of construction projects on installations across the nation, generating a significant amount of waste. According to fiscal 2013 figures from the Solid Waste Annual Reporting (SWAR) website,[1] C&D debris comprised 68% of the total Army solid waste generation. This PWTB helps military installations meet waste diversion goals, preserve natural resources, reduce waste volume, and reduce demolition costs. It also helps to potentially generate revenue for the installation by identifying opportunities and market resources for reusable and recyclable materials generated from C&D projects.

c. This PWTB updates PWTB 200-1-26 which is now obsolete.

[1] https://www.us.army.mil/suite/page/550262

d. All PWTBs are available electronically at the National Institute of Building Sciences' Whole Building Design Guide webpage, which is accessible through this link:

http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215

2. Applicability

This PWTB applies to all U.S. Army facilities' engineering activities.

3. References

a. Army Regulation (AR) 200-1, "Environmental Protection and Enhancement," 13 December 2007.

b. AR 420-1, "Army Facilities Management," Rapid Action Revision issue date: 24 August 2012.

c. Unified Facilities Guide Specifications[2] (UFGS) 01 74 19, "Construction and Demolition Waste Management," January 2007.

d. DoD Strategic Sustainability Performance Plan (SSPP), FY2012. OSD-ATL. 20 September 2012.

4. Discussion

a. AR 200-1 (Section 10-2) contains policy for solid waste management, including participation in recycling programs and the sale of recyclables.

b. AR 420-1 (Chapter 23, "Utility Services;" Section III, "Non-Hazardous Solid Waste Management") establishes policy and criteria for "efficient and economical non-hazardous solid waste management including source reduction, resource recovery, reuse, recycling, composting, collection, transport, storage, and treatment of solid waste." It also calls for the garrison "to determine what markets exist" (for waste) and the "costs and prices associated with the markets." It also states, "All military construction, renovation and demolition projects shall include performance requirements for a 50 percent minimum diversion of construction and demolition (C&D) waste by weight, from landfill disposal."

[2] www.wbdg.org/ccb/DOD/UFGS/UFGS%2001%2074%2019.pdf

c. UFGS-01 74 19 offers example, standard contract language for including waste diversion requirements in construction contracts.

d. The DoD SSPP[3] calls for 60% diversion of C&D wastes from landfills by FY2015.

e. Appendix A of this PWTB contains procedures, information, and resources to implement alternatives to conventional demolition and landfilling.

f. Appendix B lists associations, publications, websites, and other available resources to help installations locate recycling opportunities.

g. Appendix C contains a list of references used in this PWTB and Appendix D provides a list of abbreviations used, along with their meanings.

h. In summary, this document:

- Provides a roadmap to identify markets for salvageable materials generated from C&D projects on Army installations.
- Describes the parameters involved in creating a successful marketing plan for salvaged materials.
- Provides enough information to start researching and developing a marketing plan.
- Shows how to assess current markets and values for a particular building material. (Appendix B includes organizations to contact for additional information regarding the deconstruction of buildings for reuse and recycling.)
- Enables installation managers to make better, more informed decisions about deconstruction.

[3] http://www.acq.osd.mil/ie/download/green_energy/dod_sustainability/2012/DoD%20SSPP%20FY12-FINAL.PDF

5. Points of Contact

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APPENDIX A:
MARKET VALUATION OF DEMOLITION SALVAGE MATERIALS

Introduction

Disposing demolition debris in landfills is both economically and environmentally costly because it wastes both natural resources and valuable landfill space. The U.S. Army engages in many construction and demolition (C&D) projects on installations across the nation, generating a significant amount of waste in the process (Figure A-1). In FY2013, the Army generated 1.3 million tons of C&D debris per the Solid Waste Annual Report (SWARWeb).

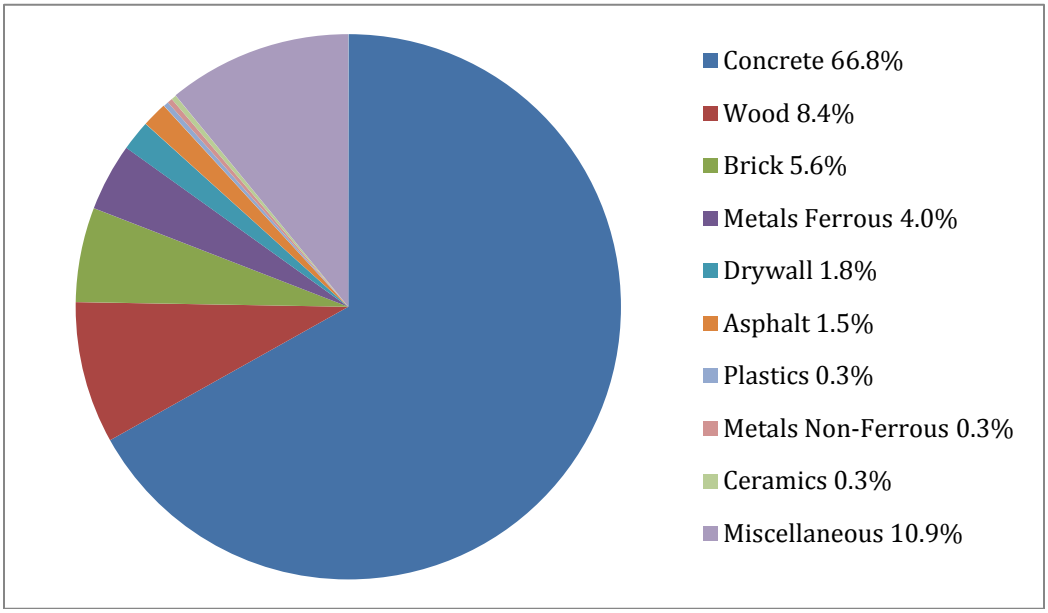

Figure A-1. The inferred composition of Army-wide C&D waste (2002–2017) which totals over 1 million tons per year (chart recreated from Concurrent Technologies 2003, 25). [4]

One way to meet Department of Defense (DoD) diversion goals is to identify market sources for reusable and recyclable materials generated from C&D projects. Private-sector experience has successfully demonstrated that deconstruction and salvage of building materials is a viable alternative to demolition and landfill in many commercial markets. Under the appropriate conditions, it is realistic to expect that more than 75% of a building's content can be salvaged for reuse or recycling.

[4] The Concurrent Technologies Corp. work done in 2002 predicted that over 15 years, total waste of 16 million tons would occur from demolition, renovation, and construction of buildings at CONUS Army installation, for an average of 1.08 million tons annually (Concurrent Technologies 2003, 25).

Benefits

Salvaged building materials offer many opportunities to owners, consultants, and contractors for reuse or recycling, including:

- lower material costs than virgin (e.g., crushed concrete in place of virgin aggregate),
- source of high-quality building materials,
- materials that may match historic building elements, and
- reduced waste disposal costs.

Reuse includes the removal and recovery of materials or components so that their original form and identity is retained and to be used again in the same or similar form. Many items removed during a demolition project have not exhausted their useful life and can be reused either on-site or through transfer to others.

Recycling transforms discarded materials into useful products. It involves the collection of recyclable materials from the demolition, construction, or recycling of a building. After collection, these materials must be processed or prepared to specifications to meet market requirements. This stage of processing and brokering is referred to as the secondary-market stage. Following the secondary-market stage, the materials move on to the manufacturer or end-user where they are used as raw materials to produce new products. Note that using recycled materials on the installation will yield a greater return by eliminating transportation costs for hauling away materials.

Developing a Salvage Plan

It is very important to establish a salvage plan for all materials before starting a project. The project manager should consult a demolition and salvage contractor experienced in salvaging structural and nonstructural building materials. UFGS 01 74 19, “Construction and Demolition Waste Management”[5] gives a template for demolition waste management plans in contract requirements.

The contractor would work with installation personnel to develop diversion criteria, based on knowledge of the services and

[5] http://www.wbdg.org/ccb/browse_cat.php?c=3

markets available in the region. The agreed-upon salvage plan should require the following steps:

- Description of the method and approach taken to demolish buildings and to salvage or recycle materials.
- Participation by any nontraditional service such as nonprofit organizations or vocational training programs.
- Characterization of materials to be recycled by type and quantity.
- Assessment and abatement of hazardous and banned materials.
- Destination where recycled or salvaged materials will be taken and description of materials' end uses.
- Market demand and value for materials that are removed from buildings and salvaged for reuse.
- Market resources that accept the type of materials generated by the project (including names and addresses of used building materials yards and licensed recycling and disposal facilities).

Requiring salvage without these considerations can be counterproductive to the interests of both the installation and the contractor. Public Works personnel (or the project manager) must become familiar enough with the marketplace to specify salvage or recycling requirements that can be accomplished within the cost and time constraints of the project.

Building Removal

The most effective method of building removal depends on the size and conditions of the job site and the building construction type. It is important to note that no single strategy for waste diversion is applicable to all buildings, construction types, and locations. Additional PWTBs on the Whole Building Design Guide website.[6]

[6] http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215

Participation by Non-Traditional Processors

In addition to traditional processors, a number of businesses recover and resell used building materials including lumber, doors, windows, fixtures, whole bricks, and other materials.

Installations should evaluate the potential for using nonprofit organizations or vocational training programs to provide services to assist in recovering, processing, and reselling or reusing building materials. Be creative. Do not overlook any opportunity to educate or publicize and take advantage of unusual ways to solicit support from local recycling, environmental, or other organizations. These organizations may include housing providers (e.g., Habitat for Humanity [HfH]), national service organizations (e.g., AmeriCorps NCCC [National Civilian Conservation Corps]), academic institutions, community vocational and training programs, and similar potential sources of services.

More than 50 HfH affiliates across the United States and Canada have established ReStores[7]——retail stores that sell quality used and surplus building materials at a fraction of retail prices. Proceeds from ReStores fund the construction of HfH houses in the community. All materials sold by Habitat ReStores were donated for that purpose, often from demolition crews salvaging reusable materials. The donor receives a tax deduction in place of an invoice from a disposal company. The nonprofit organization gets stock for its warehouse, which in turn, supplies community groups with quality, affordable building materials. For very large projects, HfH offers a Nationwide Procurement and Logistics Team.[8]

Characterization of Materials

Any type of building can be disassembled, although deconstruction is most commonly associated with wood-framed buildings. The condition of a building and its components are important factors for salvage opportunities. For example, many of the Army's World War II (WWII)-era buildings were built during the decades when lumber was manufactured from old-growth timber harvest. Because of this, WWII-era buildings contain material largely unavailable from any other resource, making them good candidates for valuable deconstruction (Falk 2002).

[7] http://www.habitat.org/restores

[8] http://www.habitat.org/ReStores/donate_goods.aspx

The type and condition of the building materials vary greatly from one job to the next. Note that there is no single list of materials applicable to all demolition situations. All materials may not be present in any one building or group of buildings. The deconstruction contractor will have to perform a detailed inspection of the building, to understand the structural design and to estimate the quality and quantity of materials that can be salvaged. In general, buildings exhibiting one or more of the following characteristics are likely to be good deconstruction candidates.

- Wood-framed buildings with heavy timbers and beams, or with high-quality woods such as Douglas fir, American chestnut, and old-growth southern yellow pine.

- Buildings constructed with high-value specialty materials such as hardwood flooring, multi-paned windows, architectural molding, and unique doors or plumbing/electrical fixtures.

- Buildings constructed with high-quality brick that is laid with low-quality mortar (to allow relatively easy breakup and cleaning).

- Buildings constructed mainly of concrete and/or steel; may be good candidates for partial deconstruction or the “stripping” of salvageable material, followed by controlled demolition and recycling of the concrete.

- Buildings that are structurally sound (i.e., generally weather-tight to minimize rotted and decayed materials).

Other PWTBs available on the Whole Building Design Guide website contain a list of resources available in buildings.

Some materials are almost always recovered, while others are recovered when circumstances allow or not at all. Table A-1 provides general categories of materials that can be marketed successfully in a demolition project.

Table A-1. Salvage and recovery patterns in demolition projects (Fox et al. 1998).

Recovery Category	Potential Material Recovered
Typically recovered for reuse:	• large, heavy timbers • dimensional lumber (e.g., 2x10, 2x8, 2x6) • structural steel • ornamental stone work • brick/masonry • wood paneling, molding, and trim • hardwood flooring • siding • cabinets and casework • electric equipment and light fixtures • plumbing fixtures • windows, doors, and frames • heating ducts • architectural antiques
Potentially recovered for recycling:	• dimensional lumber (2x4 or smaller) • gypsum drywall • carpet /carpet pad • structural concrete • rebar • brick /masonry • roofing material • insulation • ceiling tiles • glass • fluorescent tubes • scrap metal • electrical cable • copper and metal pipe

Hazardous Materials

In general, C&D waste is considered nonhazardous. However, any hazardous materials must be identified before beginning any salvage or demolition work. Under state and federal statutes, the components of the C&D waste stream that are considered hazardous include waste solvents, paints and coatings, and adhesives. Other examples of potentially hazardous materials

include (but are not limited to): asbestos, lead-based paint (LBP), PCBs, Freon, and mercury.

Under the Resource Conservation Recovery Act (RCRA), waste generators are responsible for determining if their waste is hazardous. Any waste or by-product material that is being considered for use, regardless of whether or not the material is exempt from regulation under the RCRA, should be evaluated to fully assess the inherent hazard potential of the material. Hazardous materials such as friable asbestos insulation and siding must be properly removed and disposed of by a qualified professional before deconstruction (and associated reuse or recycling) can take place.

End Uses

Deconstruction requires either a ready market for the salvaged materials or the ability to warehouse the materials (on-site or off-site) until they are sold. It is important to ensure that the end markets exist to avoid stockpiling/storage problems.

In the context of building removal, some materials are better suited to recycling and some to reuse. When specifying salvage or recycle requirements, care must be taken to ensure that the materials are worthwhile. Large-volume materials, such as metals, are well suited to recycling and can be marketed to scrap metal dealers.

Consideration should be given to the way that recovered materials will be used once they are extracted from buildings. Reusing building materials and components in their existing condition, reconditioning materials to increase their resale value, or reprocessing materials into higher-value products are preferred over recycling.

Below is a summary of the markets for the major categories of salvageable material.

Aluminum: All aluminum is recyclable and can be separated easily at the source including siding, gutters, downspouts, storm door and window frames, and hundreds of other common consumer items. Most scrap metal processors are eager to handle this material due to its relatively high value and ease of segregation, both visually and magnetically (e.g., aluminum is non-ferrous and does not react to a sorting magnet).

Iron and Steel: Iron and steel are among the most efficient and beneficial materials to recycle, regardless of their form or

condition (i.e., whether they are bent, torn apart, or otherwise roughly treated). Steel should not be perceived as a waste but as a commodity of intrinsic value that is 100% recyclable. Even if it is intermixed with other materials, steel can be separated magnetically for recycling.

Glass: Although the United States has an abundant supply of the primary components of glass (sand, soda ash, and limestone), the use of crushed glass (cullet) in manufacturing offers economic advantages over virgin materials. Most significant is that cullet melts at a lower temperature than the raw materials, so energy use is reduced. Recycled glass is used as a direct substitute for raw materials in the production of new glass as well as in fiberglass, reflective beads in paint, and as an aggregate additive in asphalt pavements.

Wood: There are numerous possible uses for salvaged wood. Old-growth timber, especially, is of higher aesthetic quality (e.g., higher density, slower grown, fewer defects) than the lumber produced today, making it very valuable in the marketplace. Typically, prices for salvaged dimensional lumber are set at 50% of retail lumber prices. Large-sized salvaged timber can command higher prices depending on the quality, quantity, and species of wood. Remanufacturing can greatly increase the value of salvaged lumber. Pine flooring remanufactured from salvaged timbers commands a high price in the specialty building products market. Secondary, lower-value uses for wood include mulch, fuel, particleboard, or fiberboard. Wood fuel markets can also be volatile, with recyclers perhaps dependent on the demand of one major regional consumer.

Wood with LBP is often considered too expensive to prepare for salvage. Enforcement of rules governing removal/disposal of LBP waste is inconsistent between jurisdictions. Where such rules are strictly enforced, there is less incentive to remove LBP because special testing is too expensive. The high-end market for large timbers of specialty woods may be good enough to make LBP removal cost-effective, however. The U.S. Army Corps of Engineers laboratory at ERDC/CERL and the Forest Products Laboratory (FPL)[9] have looked at some innovative ways to remove LBP from the wood and to remill the lumber (Falk et al. 2005; Janowiak et al. 2005). This technology is considered very effective, despite being very time consuming and too costly to be used on low-value materials.

[9] http://www.fpl.fs.fed.us

Concrete: Waste concrete is the Army's single largest category of demolition waste by weight as reported annually through SWARWeb. Recycled concrete markets remain stable in most regions, although C&D recycling follows the economic fortunes of the broader construction industry. Crushed concrete can be used as an aggregate or as a base material in the construction of roads and parking lots, and for other applications like riprap used for slope stabilization. More information on concrete recycling is available in a recent PWTB available on the Whole Building Design Guide website (Rodriguez 2014).

Brick: Brick can be recovered from old buildings for reuse in exterior construction if it meets current specifications and code requirements. Brick also can be crushed to form aggregate for roadbeds and construction.

Gypsum Wallboard: Clean, scrap drywall from new construction projects can be used by drywall manufacturers, by Portland cement makers (who can accept up to 5% gypsum content), and by farmers seeking to enrich the gypsum content of their soil. Some states have banned landfilling of gypsum due to hazardous gases that could form. Perhaps as a result, there are few businesses that collect and recycle this material. It is possible to incorporate clean, scrap drywall into local soils; however, a soil scientist should make the determination of whether the soils could benefit.

Salvage Value

Salvage value is defined as the estimated value that an asset will realize from its sale at the end of its useful life. Salvage value can depend on the type, quantity, quality, and condition of the material removed as well as the market conditions and demand for the material. Selling recoverable materials can raise money, but may not always be cost-effective because the income from sales will be offset by labor costs for recovery and the costs of operating the program. A waste management plan should consider the following economic-feasibility analysis.

Calculating Salvage Value

Salvage of a material is economically feasible if:

$$\text{Added Costs} \leq \text{Avoided Costs} + \text{Revenue}$$

Added Costs

Added costs would include the expense of increased labor, coordination, and material storage and handling.

Avoided Costs

First estimate avoided costs by determining the quantity of each salvageable material diverted from the waste disposal stream. Then, calculate hauling cost and tipping fees saved by reusing or recycling that quantity of material instead of landfilling it. Savings also can be realized by less frequent waste pickups—perhaps once instead of twice per week.

Added Costs

Salvage projects may have higher (or at least different) costs than typical demolition. Added costs may include increases for labor, oversight, and material storage and handling.

Sales Revenue

For each recyclable material, estimate its sales revenue. As a rule of thumb, the salvage value of materials will be about 50% of retail price for the new item. Table A-2 lists a representative, approximate value of the materials once they are recovered. Note that salvage values fluctuate frequently and may vary significantly based on various economic factors. Whether a waste may or may not be cost-effectively recycled depends on local market conditions. Some areas may not have a market for certain materials, or an installation may not generate enough of a particular material to make recycling cost-effective.

Table A-2. Approximate value of recovered materials in 2013 (sources as footnoted).

Item	Description	Unit	Retail Unit Value	Estimated Salvage Value[10]
Metals[11],[12]	Aluminum Scrap	lb		82¢
	Brass Scrap	lb		$2.19
	Copper Scrap	lb		$3.27
	Lead Scrap	lb		45¢
	Steel Scrap	metric ton		$215
Oak Flooring	2-1/4″ wide	SF	$3-$4.00	$1.50-$2.00
	3-1/4″ wide	SF	$3-$4.00	$1.50-$2.00
Framing Lumber[13] “Higher” quality[4] (#2 grade)	2 x 4 (8′-10′)	EA	Approx. $3.00	$0.90-$1.10
	2 x 4 (12′-14′)	EA	Approx. $4.50	$2.00-$2.40
	2 x 8 (12′)	EA	Approx. $8.75	$3.90-$4.80
	2 x 8 (14′-15′)	EA	Approx. $10.00	$4.50-$5.50
Framing Lumber “Lower” quality[4] (Construction grade)	2 x 4 (8′-10′)	EA	Approx. $3.00	$0.30-$0.75
	2 x 4 (12′ x 14′)	EA	Approx. $4.50	$0.45-$1.10
	2 x 8 (12′)	EA	Approx. $8.75	$0.90-$2.20
	2 x 8 (14′-15′)	EA	Approx. $10.00	$1.00-$2.50
	2 x 12 (10′)	EA	Approx. $10.00	$1.00-$2.50
Brick[14]	Flush	EA	$0.70- $0.80	$0.20-$0.30
Doors	36″ ext. panel	EA		$0-$15
	18″ paneled	EA		$5-$10
	24″ paneled	EA		$5-$10
	30″ paneled	EA		$5-$10
Tubs/toilets/sinks	Cast iron tub/ stainless steel	EA		$5-$10
Stair units, treads	Oak treads/ units include stringers	EA		$25-$50
HVAC	Ductwork	JOB		$52-$420

[10] By default, salvage value is considered to be around 50% of new retail price.

[11] http://www.scrapmonster.com

[12] http://www.norcalrecycling.com

[13] http://www.acehardware.net/estimate/

[14] http://www.lowes.com

Marketing the Salvaged Materials

Researching Local Markets

It cannot be overemphasized that researching local markets can make the difference between a successful salvage operation that offsets project costs and an unprofitable, costly demolition that stockpiles unwanted materials.

Market research is the "systematic analysis of sales methods, market area, price trends, merchandising techniques, alternate usage data, and buyer interests for the purpose of improving scrap proceeds…" Market research also involves knowledge of the product, an understanding of the customer, and knowledge of the market" (U.S. DoD 1985, VII-4). There are different approaches to marketing recovered materials, including:

- direct marketing to retailers or end users,
- marketing through a materials broker,
- selling at regional or online used-materials auctions,
- conducting a site sale, and
- specifying reuse in new construction or rehabilitation projects.

Utilizing Contractors or Brokers

Installation planners may enlist others' expertise to find markets for salvageable material.

Commercial salvage and deconstruction contractors recover building materials for resale and reuse in their own businesses or through used building materials outlets. Becoming familiar with potential buyers and learning their supply needs, quality requirements, and material handling capability will help fine-tune recycling and salvage to the buyers' requirements.

Dealers and brokers act as "middlemen" between the recycling program and the end user. Brokers consolidate and then sell the debris to end markets or processors who first prepare the debris for end markets by various processes such as sorting, crushing, grinding, and/or chipping. Brokers have accumulated information about end users and available markets for used building materials. Brokers' services will be most useful to contractors

working on installations that are small, are geographically remote from end users, have a wide variety of materials, or have fluctuating generation rates (Cosper 2006). Scrap dealers will inspect the materials offered for sale and will determine their price based on what they can sell it for and what they believe their competitors will bid.

Onsite Reuse

High-quality salvaged building materials may be used on-site for a subsequent construction project by the contractor or government. Under certain circumstances, salvaged materials might be stored on-site in preparation for sale elsewhere. The materials can be advertised and made available through materials exchanges or through newspaper advertisements. PWTB 420-49-18, *Direct Sales of Recyclables*, includes information that helps in sales contracting and marketing of recyclables. This PWTB explains the policies and procedures of marketing recyclable materials directly to the private sector (Cosper 2006).

Market Area

Businesses in the region should be studied to determine the process structures for services that will influence the cost and viability of the recycling program. For example, the relative fees at landfills in close proximity are important factors. It is also important to survey and to understand the region’s needs for recycled products. For example, if wood is a plentiful C&D material from a project, then the markets for virgin and recycled wood chips should be explored. If recycled wood chips are more cost-effective or plentiful than virgin chips, then that fact indicates a potential market. If virgin wood chips are scarce and high-priced and it is cost-effective for you to recycle wood chips, then that would also indicate a good potential market.

Along the same lines, if there is going to be new construction taking place after the demolition, plan to use some of the salvaged building materials for that construction project. Concrete, for example, can be crushed and recycled for use as fill or stockpiled for future use on other installation projects.

While there are often substantial markets for salvaged concrete, metal, and high-quality wood, markets are often weak for other materials such as drywall, carpet, and mixed/composite materials. Lack of markets presents a significant barrier to the expansion of materials recovery.

Various websites contain links to regional material exchanges and specific information related to the reuse and recycling of C&D material. Table A-3 lists websites with direct links to material exchanges. Although the list is not exhaustive, it may serve as a good starting point to locate a material exchange near the location of the deconstruction. Advances in Internet search engine capabilities will produce a multitude of results for local installation planners, too.

Table A-3. Materials exchange websites.

Website	Description
California Materials Exchange (CalMAX) http://www.calrecycle.ca.gov/CalMAX/	CalMAX is a free service designed to help businesses find markets for nonhazardous materials they have traditionally discarded.
USEPA Office of Solid Waste http://www.epa.gov/epawaste/conserve/tools/exchange.htm	This site gives links to international, national, and state-by-state lists of materials exchanges. Regional EPA websites may have additional information and online directories on material exchanges locally or in neighboring states.
Recycler’s World http://www.recycle.net/	Recycler's World is a worldwide trading site for secondary or recyclable commodities, by-products, and used/surplus items or materials.
Southern Waste Information Exchange (SWIX) http://wastexchange.org/	SWIX has its own national online materials exchange and a list of additional domestic and foreign material exchanges.
Peaks to Prairies http://peakstoprairies.org/	In cooperation with EPA Region 8 states, Peaks to Prairies offers access to current information and contacts, encourages collaboration, and builds information systems to enhance information dissemination.
Northeast Recycling Council (NERC) http://nerc.org/	NERC's mission is to advance an environmentally sustainable economy by promoting source and toxicity reduction, recycling, and the purchasing of environmentally preferable products and services.
Rebuilding Exchange http://rebuildingexchange.org	The Chicago-based Rebuilding Exchange has a large retail warehouse for salvaged construction materials, and it also promotes the deconstruction industry through job training

Market Survey

Once a number of potential markets have been identified, conduct a market survey to determine which market is right for each of the salvaged materials. Some questions to ask during a market survey are outlined below.

- Where is the market located? (Remember, transportation costs can significantly affect the economics of salvage; therefore, the closer the market, the lower the transportation cost.)

- How long has the market been in business?

- Has the market worked with government agencies like yours before?

- How willing is the market to work with you to achieve quality material from your salvage project? (It may take some time to develop a system to recover clean material in sufficient quantities and of sufficient quality to meet the market's specifications.)

- What additional services, if any, will the market provide? (Will it provide technical assistance, training programs, collection containers, or other assistance?)

Once the market research is complete, narrow the list to the more likely markets. Some questions that will help you evaluate the practicality of salvage or recycling program are:

- What are the market's specifications, if any, for the material?

- What happens if the material does not meet the market's specifications? (Is the price reduced? If so, by how much and how are determinations made? Will the unsuitable material need to be landfilled? If so, who is responsible for transporting the material and who pays the transportation costs?)

- How should the materials be delivered to market? (Who is responsible for transporting the material? Who pays the transportation costs?)

- What quantities are required? (What is the minimum amount of material acceptable? Are there any maximum amount restrictions?)

- In what form should the material be?

- Are there any other requirements related to storing, shipping, and/or handling the material before marketing it?

- What is the current price for the recovered material? (How often is the price subject to change?)

- What has the price history been for the market? (Is data available showing the prices paid for the last year, 2 years, and/or 5 years?)

- What are the market's price projections for the short-term and long-term periods?

- What is the length of the contract offered by the market? (Is it willing to make a long-term agreement to help even out price fluctuations?)

Price Trends

Several factors drive the supply, demand, and pricing for recovered materials. According to Fickes (1997), six of these key factors are:

1. **Export markets**. The Far East represents a particularly strong export market for recycled materials including metals and paper fibers.

2. **Virgin capacities and recycled capacities**. When price and availability of virgin commodities change, the price and availability of recycled commodities follows.

3. **Geography**. A West Coast waste generator with access to markets in the Pacific Rim has different opportunities than a generator in the Midwest.

4. **Transportation costs**. The distance to market plays a role in the pricing of all commodities, whether recycled or virgin.

5. **End product demand**. Recycled materials serve three key sectors of the economy: automobiles, housing, and retail. When the auto industry booms, so do the steel and plastic industries. When housing booms, business increases for suppliers of steel,

paper, plastic, and other virgin and recycled materials. Likewise, when retail sales climb, so do paper and plastic packaging material sales.

6. **Natural disasters.** Significant natural disasters can affect both supply and demand around the world.

Summary and Conclusions

Salvage is a long-established form of recycling and material reuse. Salvage works because the byproducts of demolition are products of society—what becomes obsolete for one person is useful for another and therefore may be saved or salvaged. While idea of salvage is not new, large building C&D projects still pose unique challenges in the area of waste management; each project is different, generating its own unique combination of wastes. To deconstruct and salvage usable building materials demands flexibility, resourcefulness, and coordination by building professionals and the Army installation personnel. However, salvage projects have the potential to reduce waste volume, lower demolition costs, generate revenue, and achieve economic and environmental savings.

This document:

- provides a roadmap to identify markets for salvageable materials generated from C&D projects on Army installations;
- describes the parameters involved in creating a successful marketing plan for salvaged materials;
- provides enough information to start researching and developing a marketing plan;
- shows how to assess current markets and values for a particular building material;[15] and
- enables installation managers to make better, more informed decisions about deconstruction.

[15] Appendix B includes organizations to contact for additional information regarding the deconstruction of buildings for reuse and recycling.

APPENDIX B:
ASSOCIATIONS, PUBLICATIONS, AND RESOURCES

The information below is accurate at the time of publication. Inclusion in this listing does not represent an endorsement by the U.S. Army Corps of Engineers.

American Forest & Paper Association
1111 Nineteenth Street NW
Suite 800
Washington, DC 20036
800-878-8878
www.afandpa.org

Asphalt Recycling & Reclaiming Association
#3 Church Circle, Suite 250
Annapolis, MD 21401
410-267-0023
www.arra.org

Building Materials Reuse Association
1702 Walnut St.
Boulder, CO 80302
303-440-0703
www.bmra.org

C&D Recycler
Subscription Department
4012 Bridge Avenue
Cleveland, OH 44113-3399
www.cdrecycler.com

Carpet Cushion Council
P.O. Box 546
Riverside, CT 06878
203-637-1312
www.carpetcushion.org

Construction & Demolition Recycling Association
1585 Beverly Court
Suite 112
Aurora, IL 60502
www.cdrecycling.org

Habitat for Humanity International
121 Habitat St.
Americus, GA 31709-3498
229-924-6935 ext. 2551 or 2552
www.habitat.org
www.habitat.org/env/restore.html

Institute of Scrap Recycling Industries, Inc.
1325 G Street NW
Suite 1000
Washington, DC 20005-3104
202-737-1770
www.isri.org

National Demolition Association
16 N. Franklin Street
Suite 203
Doylestown, PA 18901-3536
215-348-4949
800-541-2412
www.demolitionassociation.com

Recycler's World
Help Line: 519-767-2913
www.recycle.net

Steel Recycling Institute
680 Andersen Drive
Pittsburgh, PA 15220-2700
412-922-2772
800-876-7274
www.recycle-steel.org

USDA Forest Service
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608) 231-9200
www.fpl.fs.fed.us

APPENDIX C: REFERENCES AND RESOURCES

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Resources

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Institute of Scrap Recycling Industries. n.d. “Recycling: The Economical and Environmentally Intelligent Alternative to Landfilling and Incineration.” Available through www.isri.org.)

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APPENDIX D: ABBREVIATIONS

Abbreviation	Spelled Out Meaning
AR	Army Regulation
CalMAX	California Materials Exchange
C&D	construction and demolition
CECW	Directorate of Civil Works, U. S. Army Corps of Engineers
CEMP	Directorate of Military Programs, U. S. Army Corps of Engineers
CERL	Construction Engineering Research Laboratory
CFR	Code of the Federal Regulations
CONUS	Continental United States
DPW	Directorate of Public Works
DoD	Department of Defense
EPA	Environmental Protection Agency; also USEPA
ERDC	Engineer Research and Development Center
FPL	Forest Products Laboratory
HfH	Habitat for Humanity
IWE	Inter-Continental Wood Exchange
HQUSACE	Headquarters, U.S. Army Corps of Engineers
LBP	lead-based paint
NERC	Northeast Recycle Council
POC	point of contact
PWTB	Public Works Technical Bulletin
RCRA	Resource Conservation Recovery Act
SSPP	Strategic Sustainable Performance Plan (Army)
SWAR	Solid Waste Annual Reporting (Army)
SWIX	Southern Waste Information Exchange
UFGS	Unified Facilities Guide Specifications
USACE	U.S. Army Corps of Engineers