

# REDUCING WASTE FROM MILITARY FACILITY PROGRAMS ... *SHED THOSE UGLY TONS*

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***Environment, Energy, Security  
and Sustainability Conference***

***9-12 May 2011***



# Report Documentation Page

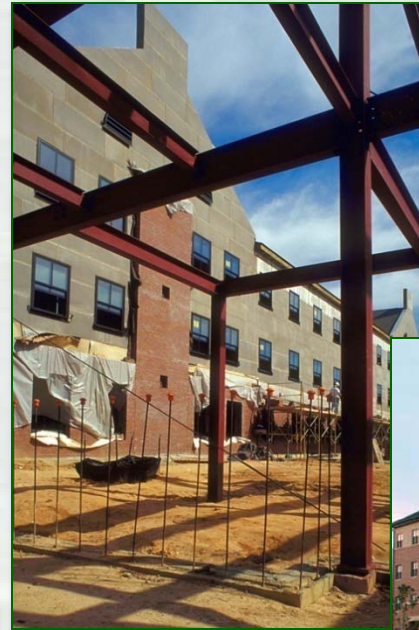
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# A Context

- **Response to a Mission**
  - *Upgrade capabilities & mission performance*
  - *Improve quality of life for soldiers & their families*
  - *Remove & replace obsolete infrastructure*
- **Debris is a byproduct of other mission-related activities**



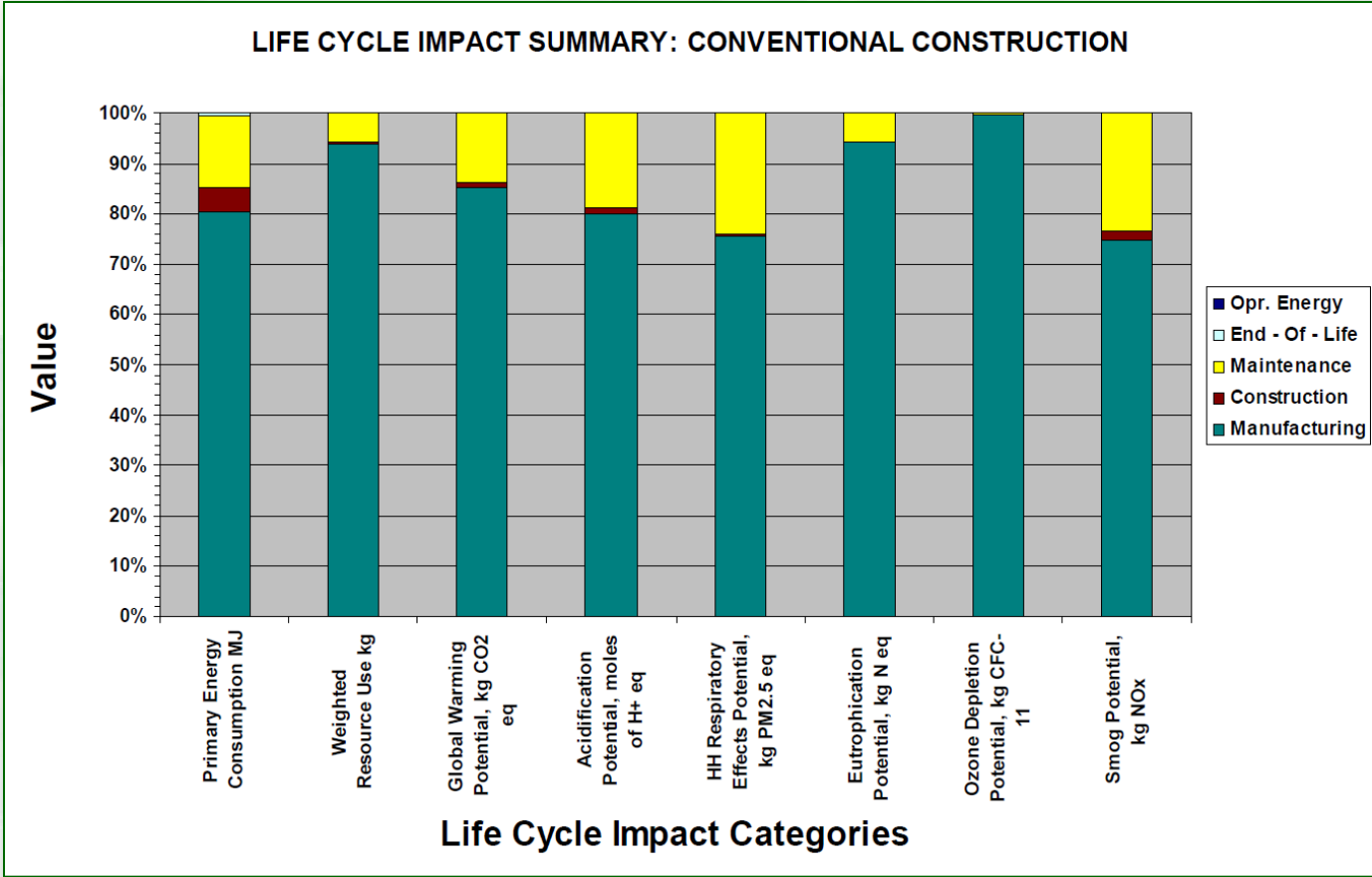
# A Problem

- **Over 600 million tons of C&D materials are generated in the US annually**
  - *62% of Army solid waste reported FY2010*
  - *Costly in first and life cycle costs*
  - *Consumes land*
  - *Creates environmental stressors*



# A Problem

- The vast majority of environmental stressors occur during materials manufacturing\*



\*Athena Sustainable Materials Institute, Environmental Impact Estimator

<<http://www.athenasmi.org/>>

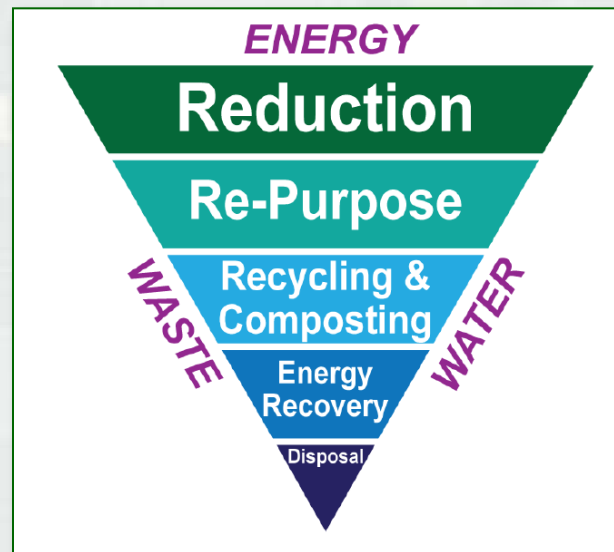




# Sustainability Drivers

- **Net Zero Waste**

- *Assistant Secretary of the Army for Installations, Energy and Environment*
- *“... disposal being non-existent”*
- *“A true cradle-to-cradle strategy considers the end state a the time the purchase decision is made”*



# Net Zero Program



- Fort Detrick, MD
  - Fort Hood, TX
  - Fort Hunter Liggett, CA
  - Fort Polk, LA
  - Joint Base Lewis-McChord, WA
  - U.S. Army Garrison Grafenwoehr, Germany.
  - Fort Bliss and Carson (energy, water, waste)
- “A net zero waste installation is an installation that reduces, reuses, and recovers waste streams, converting them to resource values with zero landfill over the course of a year.”



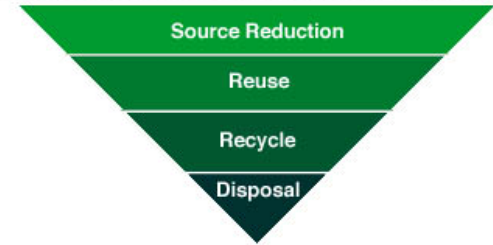


# Sustainability Drivers

- In a building context



## Waste Reduction Hierarchy



# Resources

- **Whole Building Design Guide / Construction Criteria Base**

— <http://www.wbdg.org/ccb/ccb.php>

WBDG a program of the National Institute of Building Sciences  
WHOLE BUILDING DESIGN GUIDE

HOME | ABOUT | CONTACT | SITE MAP | RSS | LOG IN | SEARCH

DESIGN GUIDANCE | PROJECT MANAGEMENT | OPERATIONS & MAINTENANCE | DOCUMENTS & REFERENCES | TOOLS | CONTINUING EDUCATION | BIM | APPLIED RESEARCH

FEDERAL HIGH PERFORMANCE AND SUSTAINABLE BUILDINGS

FEDERAL MANDATES

**CONSTRUCTION CRITERIA BASE**

- Specifications Library
- Regulations Library
- Standards Library
- Documents Library
- CAD Library
- Tools Library

PERIODICALS

CASE STUDIES

PARTICIPATING AGENCIES

INDUSTRY ORGANIZATIONS

Home > Documents & References > CCB

### Construction Criteria Base (CCB)

a library service of the Whole Building Design Guide

Construction Criteria Base (CCB) is an extensive electronic library of construction guide specifications, manuals, standards and many other essential criteria documents. Published and updated continuously, CCB contains the complete unabridged, approved, current electronic equivalents of over 10,000 documents direct from [participating federal agencies](#). CCB is the most effective tool available for finding and using current, approved U.S. construction criteria. Documents are available as Adobe® PDF files and some documents are also furnished by agencies in word-processing formats or in the SPECSINTACT specification processing program used by the Army, NAVFAC and NASA. Documents are organized first into Libraries, then by Source and Category.

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#### CONSTRUCTION CRITERIA BASE INDEX

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- [Unified Facilities Guide Specifications \(UFGS\)](#)
- [NAVFAC Specifications](#)
- [NAVFAC Standard Specifications](#)
- [NAVFAC Guide Performance Work Statements](#)
- [VA Master Specifications](#)
- [Federal Green Construction Guide for Specifiers](#)
- [DOE General Design Criteria](#)
- [NIBS Specifications](#)
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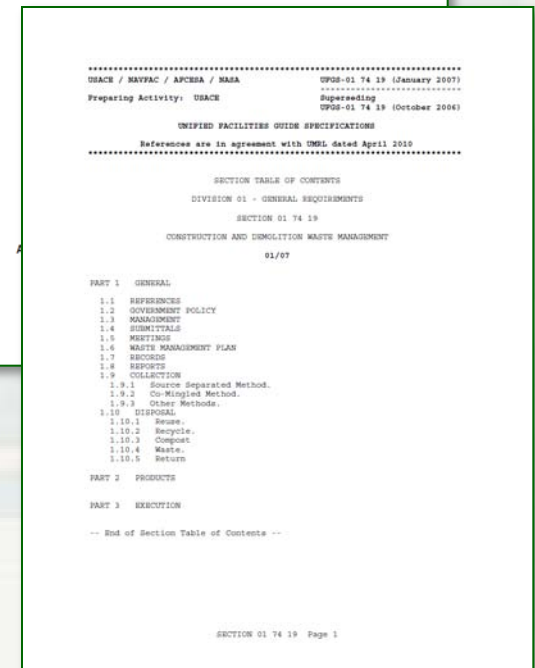
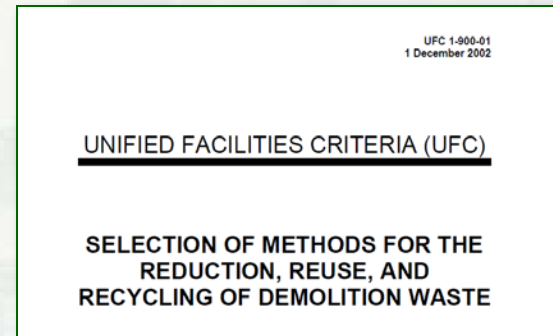
Search titles only

Advanced Search

# Resources

- **Federal UFC / UFGS**

- [http://www.wbdg.org/ccb/browse\\_cat.php?o=29&c=4](http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4)
- [http://www.wbdg.org/ccb/browse\\_org.php?o=70](http://www.wbdg.org/ccb/browse_org.php?o=70)
- *UFC 1-900-01 Selection of Methods for the Reduction, Reuse and Recycling of Demolition Waste*
- *UFGS 01 62 35 Recycled/Recovered Materials*
- *UFGS 01 74 19 Construction and Demolition Waste Management\**
- *UFGS 02 41 00 Demolition and Deconstruction\**



**\* SEE GREEN VERSION**



# Resources

- **Removing buildings**

- *PWTB 200-1-23 Guidance for the Reduction of Demolition Waste Through Reuse and Recycling*
- *PWTB 200-1-40 Characterizing Demolition Debris for Diversion Opportunities: WWII-Era and Korean War-Era Buildings*
- *PWTB 200-1-45 Deconstruction of WWII-Era Wood Framed Buildings*
- *PWTB 200-1-48 Opportunities for Reducing Construction and Demolition Waste from Residential Communities Initiative (RCI) Programs*
- *PWTB 200-1-73 Reuse of Materials from Modular Relocatable Facilities*
- *<[http://www.wbdg.org/ccb/browse\\_cat.php?o=31&c=215](http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215)>*




# Resources

- **Recycling building materials**
  - *PWTB 200-1-17, Recycling Interior Finish Materials - Carpet and Ceiling Tiles*
  - *PWTB 200-1-24, Quantifying Waste Generated From Building Remodeling*
  - *PWTB 200-1-26 Market Valuation of Demolition Salvage Materials*
  - *PWTB 200-1-27 Reuse of Concrete Materials From Building Demolition*
  - *PWTB 200-1-44 Recycling Exterior Materials*
  - *<[http://www.wbdg.org/ccb/browse\\_cat.php?o=31&c=215](http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215)>*



# Resources

- **USACE FRP Best Practices Toolbox**
  - <https://frptoolbox.erd.c.usace.army.mil/frptoolbox/>
  - *Interactive Instructional Guide (Under “CERL Library”)*



**Instructional Guide:**  
**Planning, Designing, and Executing Sustainable C&D Waste Management in Army Projects**

[Introduction](#)



# Resources

- **Whole Building Design Guide**
  - Construction Waste Management Resource Page
    - <http://www.wbdg.org/resources/cwmgmt.php>
  - Construction Waste Management Database
    - [<http://www.wbdg.org/tools/cwm.php>](http://www.wbdg.org/tools/cwm.php)

The screenshot shows the WBDG website's 'Construction Waste Management' resource page. The page features a navigation menu at the top with categories like 'DESIGN GUIDANCE', 'PROJECT MANAGEMENT', and 'OPERATIONS & MAINTENANCE'. The main content area includes an introduction to construction waste management, a list of related resource pages, and a sidebar with 'WITHIN THIS PAGE' links. Two images are included: one showing a pile of construction debris and another showing a vertical vent pipe.

The screenshot displays the 'Construction Waste Management Database' search interface. It includes a search bar, a 'SEARCH' button, and a list of materials to be processed. The materials list includes: Appliances, Metals: Ferrous, Asphalt, Metals: Non-ferrous, Cardboard, Mixed/Co-mingled Waste, Carpet, Plastic, Ceiling Tile, Roofing: Asphalt-based, Concrete, Roofing: EPDM, Gypsum Drywall, Salvaged/Plus Materials for Reuse, Land Clearing/Soil, Wood: Landwarming Debris, Lighting, Wood: Strap Lumber, and Masonry. There are also checkboxes for 'Pick Up' and 'Drop Off' services.



# Resources

- **Associated General Contractors of America**
  - *Recycling Toolkit* [www.agc.org/cs/recycling\\_toolkit](http://www.agc.org/cs/recycling_toolkit)

FIND A MEMBER FIND A CHAPTER  
LOGIN | CREATE A PROFILE

AGC of America  
THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA  
Quality People. Quality Projects.

SEARCH BOOKSTORE

ABOUT AGC ADVOCACY **INDUSTRY TOPICS** CONSTRUCTION MARKETS PROGRAMS & EVENTS CAREER DEVELOPMENT NEWS & MEDIA

## RECYCLING TOOLKIT

Home > Industry Topics > Environment > Recycling Toolkit > How do I...

### How do I...

#### Recycle the C&D Materials Generated at My Site?

-  [Start recycling](#)
-  [Do I have to separate?](#)
-  [Saving money](#)
-  [C&D materials of concern](#)

#### Use Recycled Industrial Materials in New Construction?

-  [In building construction](#)
-  [Getting green building certification points](#)
-  [In road construction](#)
-  [Finding a supplier](#)

CONSTRUCTION CONTRACTS  
SAFETY & HEALTH  
CONSTRUCTION ECONOMICS  
LABOR & HR  
ENVIRONMENT  
Environmental Resources  
Environmental Solutions Series  
Environmental Acronyms





# Resources

- *Find C&D materials recyclers & reuse stores*
  - *Building Materials Reuse Association: [www.bmra.org/directory](http://www.bmra.org/directory)*
  - *Construction Materials Recycling Association: [www.cdrecycling.org/find.html](http://www.cdrecycling.org/find.html)*
  - *Habitat for Humanity ReStores: [www.habitat.org/restores/](http://www.habitat.org/restores/)*
  - *Institutional Recycling Network WasteMiser service: <http://www.wastemiser.com/>*
  - *Contact your state: <http://www.cicacenter.org/solidregs.html>*
  - *Carpet: [www.carpetrecovery.org](http://www.carpetrecovery.org)*
  - *Online marketplaces:*
    - *[www.planetreuse.com](http://www.planetreuse.com)*
    - *[www.americanbuildersurplus.com](http://www.americanbuildersurplus.com)*
    - *<http://www.cmdepot.com/>*



# Examples



# Demolition & Recycling

- **Building 501, Tencza Terrace, Fort Myer, VA**
  - Facility Reduction Program, contracted by USACE
  - Contractor initiated recycling for cost savings
  - Salvaged & recycled prior to demolition
  - Imploded building & recycled rubble as aggregate
  - Total debris diversion: 91%
  - Contractor saved approx. \$1.1 Million



# Deconstruction & Reuse

- **Barracks, Fort Lewis WA**
  - *Demolition separated from Design/Build contract*
  - *USACE specified minimum 50% diversion, w/ contract options for diversion up to 75%*
  - *Environmental contractor & deconstruction subcontractor*
  - *“Hybrid” techniques; panelization, tipping*
  - *Total diversion: 95% for 52 buildings:*
  - *Cost & duration similar to conventional*
  - *(earlier demonstration at Fort McClellan, AL)*



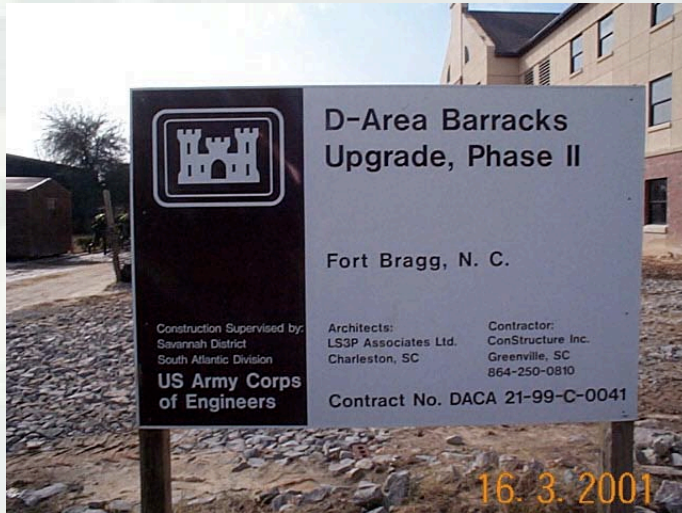
# Recycle Rights Sale

- **GP Warehouses, Fort Gordon**

- Sold “recycle rights” through QRP
- Extensive outreach was performed
- Auctioned 4 warehouse bays for \$4,300
- Deconstructors retrieved an estimated of \$50,000-worth (retail value) of lumber each bay
- Total diversion: 80%
- Total cost: 60% of conventional demolition cost
- (similar experience at Fort McCoy, WI, and Fort Knox, KY)




# Rebuild / Reconfigure



# New Construction

- MILCON new construction; LEED policy

**PROJECT PROFILE**



**NEW HAMPSHIRE NATIONAL GUARD JOINT COMMAND READINESS CENTER  
CONCORD, NEW HAMPSHIRE**


**25.0%** reduction in energy costs (LEED)  
**44.0%** reduction in water use  
**93.6%** of construction waste diverted from the landfill

**LEED Facts**  
 New Hampshire National Guard Joint Command Readiness Center  
 Concord, New Hampshire  
 LEED for New Construction Version 2.1  
 Certification awarded September 21, 2009

<b>Certified</b>	<b>30</b>
Sustainable Sites	8/14
Water Efficiency	4/5
Energy & Atmosphere	2/17
Materials & Resources	3/13
Indoor Environmental Quality	9/15
Innovation & Design	4/5

\*Out of a possible 69 points.  
 Photography Courtesy of: Oak Point Associates

**PROJECT PROFILE**



**MARSHALL ARMY AIRFIELD AND SOUTHSIDE FACILITIES  
FORT RILEY, KANSAS**

**17.7%** reduction in energy costs (LEED)  
**42.9%** reduction in water use  
**98.7%** of construction waste diverted from the landfill

**LEED Facts**  
 Marshall Army Airfield and Southside Facilities  
 Fort Riley, Kansas  
 LEED for New Construction Version 2.2  
 Certification awarded October 1, 2010

<b>Silver</b>	<b>33</b>
Sustainable Sites	8/14
Water Efficiency	4/5
Energy & Atmosphere	4/17
Materials & Resources	5/13
Indoor Environmental Quality	7/15
Innovation & Design	5/5

\*Out of a possible 69 points.  
 Photography Courtesy of: Burns & McDonnell

**PROJECT PROFILE**



**1ST BRIGADE, 4TH INFANTRY DIVISION COMPANY OPERATIONS FACILITIES  
FORT CARSON, COLORADO**


**30.4%** reduction in energy costs (LEED)  
**31.4%** reduction in water use  
**92.0%** of construction waste diverted from the landfill

**LEED Facts**  
 1st Brigade, 4th Infantry Division Company Operations Facilities  
 Fort Carson, Colorado  
 LEED for New Construction Version 2.2  
 Certification awarded April 30, 2009

<b>Silver</b>	<b>37</b>
Sustainable Sites	9/14
Water Efficiency	4/5
Energy & Atmosphere	6/17
Materials & Resources	6/13
Indoor Environmental Quality	8/15
Innovation & Design	4/5

\*Out of a possible 69 points.  
 Photography Courtesy of: Leo A Daly

**PROJECT PROFILE**



**CHILD DEVELOPMENT CENTER  
FORT IRWIN, CALIFORNIA**

**34.4%** reduction in energy costs (LEED)  
**52.1%** reduction in water use  
**96.5%** of construction waste diverted from the landfill

**LEED Facts**  
 Child Development Center  
 Fort Irwin, California  
 LEED for New Construction Version 2.2  
 Certification awarded January 24, 2014

<b>Gold</b>	<b>42</b>
Sustainable Sites	6/14
Water Efficiency	3/5
Energy & Atmosphere	10/17
Materials & Resources	7/13
Indoor Environmental Quality	11/15
Innovation & Design	5/5

\*Out of a possible 69 points.  
 Photography Courtesy of: American Pacific Properties

**PROJECT PROFILE**



**FAIRFAX VILLAGE  
FORT BELVOIR, NORTH CAROLINA**

**60.6%** reduction in energy costs (LEED)  
**43.0%** reduction in water use  
**89.8%** of construction waste diverted from the landfill

**LEED Facts**  
 Fairfax Village  
 Fort Belvoir, North Carolina  
 LEED for New Construction Version 2.2  
 Certification awarded April 24, 2009

<b>Platinum</b>	<b>55</b>
Sustainable Sites	10/14
Water Efficiency	4/5
Energy & Atmosphere	15/17
Materials & Resources	9/13
Indoor Environmental Quality	12/15
Innovation & Design	5/5

\*Out of a possible 69 points.  
 Photography Courtesy of: Clark Realty Capital, LLC



# Lessons Learned

- **C&D materials diversion is now common in the building industry**
  - *Army experience has been positive (72% C&D diversion reported Army-wide) although somewhat inconsistent*
  - *High rates of construction waste diversion are being achieved in the USACE MILCON program*
  - *There should be no reluctance to incorporate diversion requirements into project requirements in most cases*
- **Small projects (or in remote locations) may be an exception**





# Lessons Learned

- **Cost & schedule impacts associated with C&D materials diversion can be accommodated if addressed early in project planning**
  - *C&D waste management is typically a very small cost factor in a construction or design/build project*
  - *Adding a diversion requirement after budget & schedule are established is sub-optimal*
  - *Imposing a diversion requirement post-contract makes more enemies than friends*
  - *(construction guys vs. environmental guys)*
- **Artificial schedule constraints reduce opportunities for materials recovery**



# Lessons Learned

- **“Free” tipping at on-post landfills isn’t free**
  - *Building debris consumes finite landfill capacity that will not be replaced*
  - *Landfill operations cost the installation*
  - *Long term monitoring costs the installation*
  - *Charging for tipping\* will encourage contractors to increase diversion*

*\*Per ACSIM Policy “Memorandum Management of Waste in Military Construction, Renovation and Demolition Activities,” 11 July, 2006*



# Lessons Learned

- **Project personnel must familiarize themselves with the resources available in the region and exploit them to the greatest extent possible**
  - *Reusable & recyclable materials from buildings*
  - *Available services & material markets*
  - *Value of building materials*
  - *See “Resources” above*
- **Installations may need to perform outreach to ensure all necessary services are aware and can participate in building removal projects**
- *Especially as we push the Net Zero envelope*



# Lessons Learned

- **Project personnel should collaborate with their Contracting Office to develop the project delivery strategy best able to accomplish both project & C&D diversion requirements**
  - *Competitive bidding may not yield the best overall performance (price AND diversion)*
  - *Best value solicitation, negotiated IDIQ task, performance based contracting and other alternative strategies may achieve better overall cost and diversion performance*
- **Separating demolition from construction or design/build contracts has worked well**



# Lessons Learned

- **Including a 50% minimum C&D diversion requirement into project specifications or contract language does not, in and of itself, guarantee that performance will be achieved**
  - *A C&D Waste Management Plan must be required, diligently developed and diligently applied throughout the project (just like other required plans)*
  - *Contractor must include C&D diversion performance in their QC activities*
  - *Government must include C&D diversion performance as part of their QA system*
  - *Off-site C&D recycling facilities must be monitored*
  - *Government must enforce diversion criteria*



# Lessons Learned *(an editorial)*

- **C&D waste reduction Policy; letter or spirit?**
  - *50% demolition diversion criterion is typically met by virtue of concrete & metal recycling*
  - *Concrete is heavy, metals are valuable*
  - *Wood and other reusable materials and products are often dismissed as having no value; recycled as hog fuel or landfilled*



***A Liability ...***



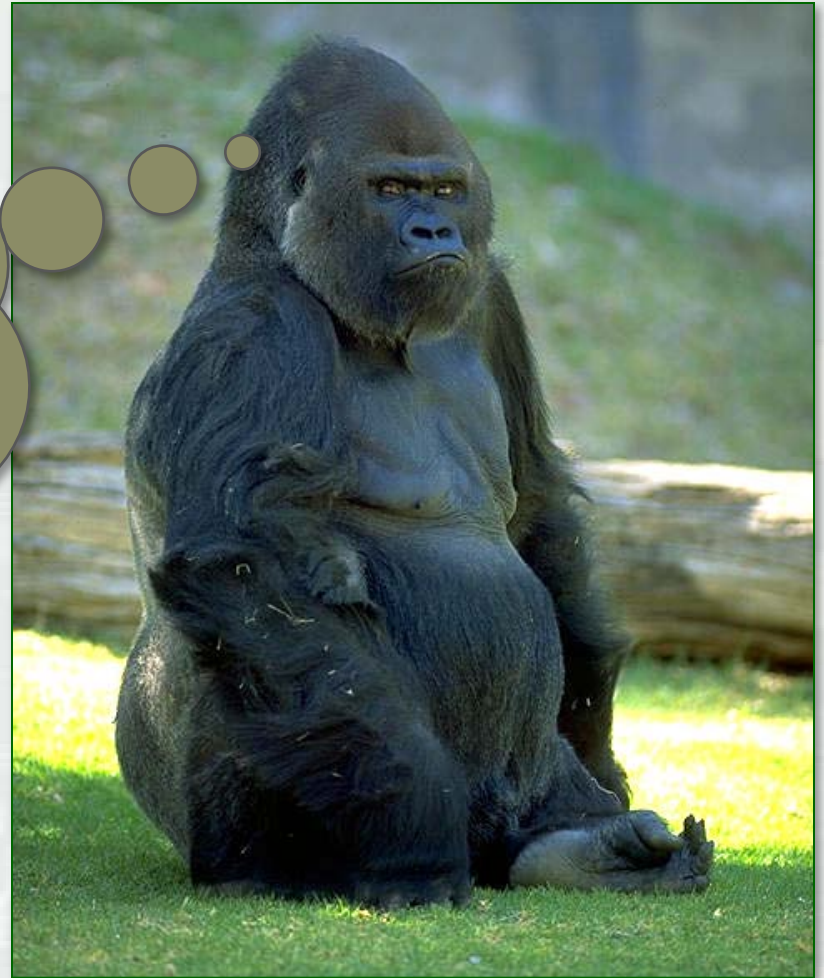
***... or a Resource ?***



# Challenges

## Inertia

*Noun.* The ability of a body to resist a change in its state of motion



# Conclusions

- **Shift the Paradigm**
  - *Remove ... instead of demolish*
  - *Resource ... instead of debris*
  - *Incentive ... instead of path of least resistance*
- **Acknowledge other economic factors**
  - *Cost avoidance, esp. gov't landfill*
  - *Value of recovered materials*
  - *Full cost / Life Cycle Cost impacts*





# Conclusions

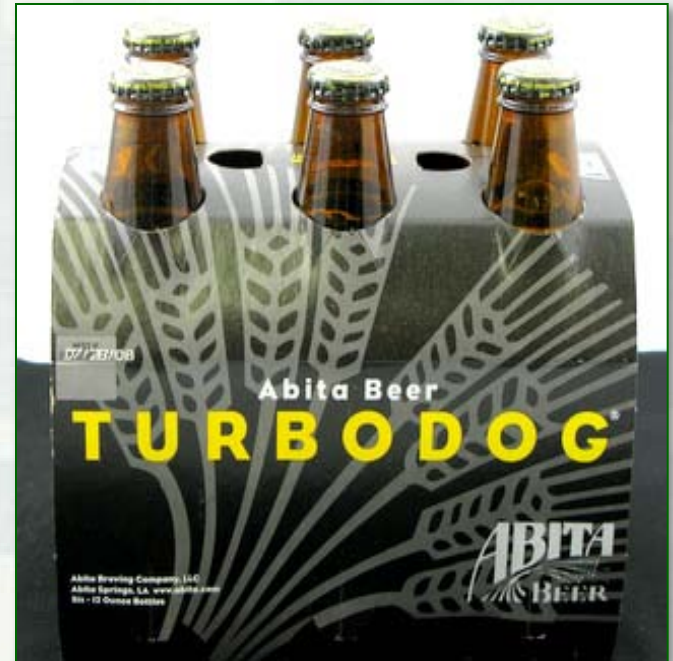
- **Accommodate Schedules**
  - *Plan ahead, incorporate diversion criteria up front*
  - *Evaluate alternative building removal strategies*
- **Take advantage of the marketplace**
  - *Research industry capabilities & practices*
  - *Evaluate “non-traditional” sources of services*
  - *Identify marketable materials*
  - *Know costs & values*
- **Adjust business practices**
  - *Plan*
  - *Incorporate contract & specification provisions*
  - *“Mainstream” the practice*



# Conclusions

One architect who wanted to sort and recycle construction waste met resistance from the construction workers. He motivated the crew in a time-honored fashion - with beer. On Fridays, he showed up with a case of beer. If the recyclables had been sorted, the carpenters got the beer: if not, they didn't. After the first time the architect left without giving the construction crew the beer, the recyclables were sorted every time.

-From "*A Primer on Sustainable Building*" Rocky Mountain Institute



# Questions / Comments?

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