REDUCE – REUSE – RECYCLE

The design team took every opportunity to develop plans and specifications that would achieve the mission-sensitive goals of reducing waste, reusing materials, recycling waste and using as much recycled material in the construction as the budget would allow. Specifications were developed for every aspect of reducing, reusing and recycling throughout the project to reflect the commitment of the state to meet the core values of the Missouri Department of Natural Resources.

Prior to the demolition of the old women's prison, the Missouri Department of Corrections collected as much reusable material as possible. Metal and other recyclable materials not taken by DOC were sold for scrap as they were extracted from the building.

The primary goals of reducing, reusing and recycling during building construction are reflected in the following concepts employed by the building design team throughout the entire planning, design and construction process.

- reducing the amount of packaging waste
- reducing toxic chemicals in the waste generated
- reusing resources multiple times
- recycling 50-75 percent of all waste generated
- purchasing specified recycled products containing pre- or post-consumer recycled content except due to budget constraints

Prison Demolition

Preparation of the site required demolition of a former women's prison that had recently been used as a training academy for Missouri Department of Corrections officers.

The prison was made of one layer of portland cement blocks and three layers of soft and hard red brick originally manufactured in central Missouri. Some of the brick was used in the short height wall with a portland cement cap along and under the plastic polycarbonate wall on the first floor food court area protruding outside along the patio.

Essentially, most of the material extracted from the demolished building was either reused or recycled to reduce the material that was landfilled. Wood and gypsum wall board were the only materials landfilled with masonry and portland cement debris being used as fill material on the construction site as needed.

The demolition contractor carefully extracted brick from the old prison for use in the new Lewis and Clark State Office Building and other potential future construction projects.

The following quantities were diverted from landfill disposal by either recycling or reuse:

- 2,629 tons concrete, used as on-site fill
- 131,360 tons ferrous metal, sold as scrap (Scrap-All, Holts Summit, Mo.)
- 150 cubic yards red clay brick, used on-site for actitectural features in building or planned for future use
- 49 – 8-ft. fluorescent lamps sold to Hood's (North Jefferson City, Mo.)
- 262 lbs fluorescent lamp ballasts sold to Hood's (North Jefferson City, Mo.)

- Only 50.9 tons of plaster and other wood debris was landfilled.

Construction Waste Management Plan:

Specifications within the bid documents and throughout the design phase reflected the project commitment for the collection, transportation and disposal of all waste generated at the construction site.

The selected prime construction contractor was to submit a construction waste management plan, as was required in bid documents for this particular LEED-certified building project. Bid documents indicated the plan was due within 45 days after the bid opening. However, the winning bid construction company president presented bid officials with a completed construction waste management plan along with their bid documents. The company's commitment to the mission and specific objectives of the project was quickly evident and gave project planners and architects an immediate indication that the selected contractor had done the appropriate research prior to the bid opening. The construction contractor became mission driven and a collaborative member of the design and construction team. The contractor's dedication led to the ultimate success of the entire project.

The construction waste management plan stipulated that the following measures be taken to assure material was reused, recycled or landfilled properly:

- Recycle bins were constructed on site for all paper, cardboard, plastic, primarily plastic buckets, polystyrene, aluminum (primarily cans), scrap ferrous metal, glass (primarily beverage containers) and scrap electrical conduit and wire.
- Markets needed to be located for some of the recycled material. The department's project planning and management team worked with the construction contractor to find recyclers such as disabled workshops that would accept the materials that had not previously existed locally. Additional containers were located onsite for gypsum wallboard and other non-recyclable waste to be landfilled.
- Untreated wood was mulched by a local contractor in the Jefferson City area.
- Materials, such as carpet and raised flooring tiles, were delivered on special pallets requiring monetary redemption to the construction contractor on their return.
- Used treated wood and portland cement cast-in-place forms were stored and reused multiple times until they became unsafe for use or were removed by the contractor for use on other projects.
- Exact-sized material was ordered to eliminate the generation of onsite scrap.
- Concrete, masonry and other inert material was used onsite as fill material.
- Salvaged materials, including carpet tiles were removed by the contracor or subcontractors for reuse on other projects or donated to agencies such as Habitat for Humanity.

• Partnering sessions were held with subcontractors to explain the project goals for material reuse, reduction and recycling.
• All material quantities were recorded for use as documentation for the LEED certification.

The project contractor diverted 92 percent, or 8,745 cubic yards of all waste materials from the landfill. Materials consisted of recyclable material, onsite fill and items sold or donated in the following amounts:

Recycling bins and piles were plentiful during the preparation and construction phases of the Lewis and Clark State Office Building project.

Concrete as fill 634 cubic yards
Ferrous metal 124.5 cubic yards
Non-ferrous metal (aluminum cans) 11 cubic yards
Copper wire 1000 pounds
Wood 611 cubic yards
Debris as fill 576 cubic yards
Red clay brick 105 cubic yards
Bond paper 500 pounds
Cardboard 45 cubic yards
Plastic 6 cubic yards

LEED certification levels for recycling require at least 50 percent of all materials be diverted from being landfilled. The project exceeded the 50 percent level but did not receive full credit for all the fill material diverted from the project to reach the 75 percent level and receive an additional point. Certification of the 50 percent level was verified by the USGBC from documentation received from the construction contractor through those receiving recycled or used material and scrap.

Also, some materials such as the raised access flooring tiles were delivered on special pallets that received a deposit when returned to the manufacturer.

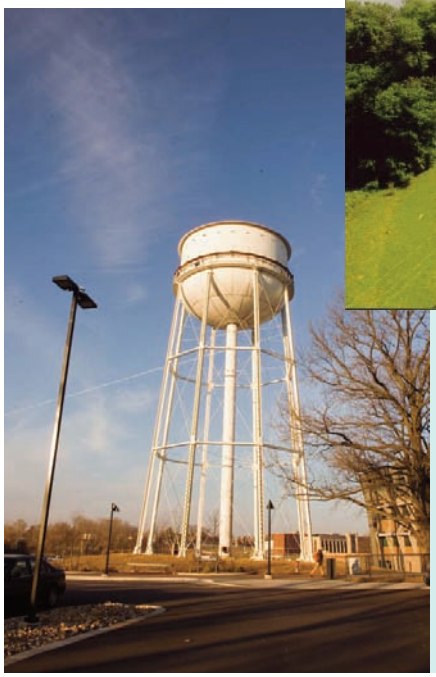
Site Preparation

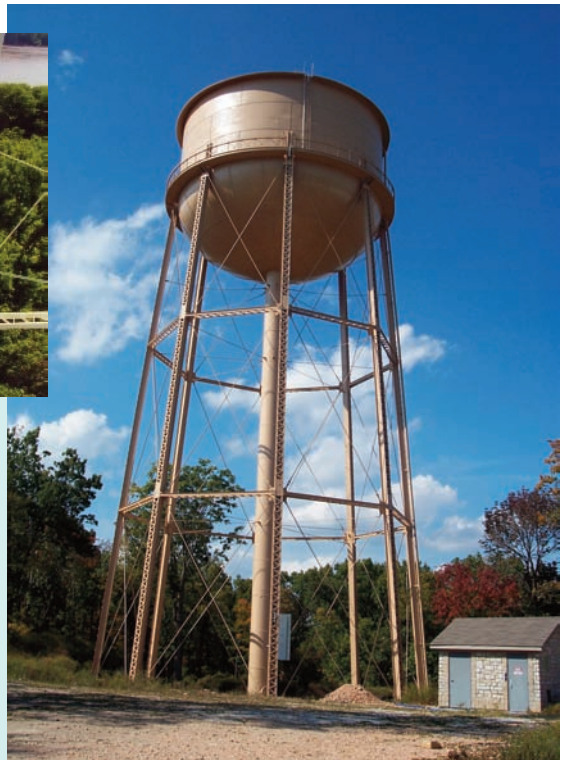
Topsoil excavated from the building site was taken to a collection area for reuse on-site for roadway construction and grounds and landscaping development.

Two debris fields were discovered in the southwest and northwest portions of the construction site. Most of the material discovered was heavy ferrous metals from years of burial by the Department of Corrections. The material was source seperated by heavy machinery and sold as scrap metal. Concrete from the previously demolished prison was also used as fill for roadways and the parking lot.

Missouri State Penitentiary Water Tower

During 1938, shortly after the women's prison was constructed, a 500,000 gallon water tank was erected on the property southwest of the women's prison. The "witches hat" designed water tower provided 700,000 to 1 mil-





Above: a view of the soon-to-be demolished women's prison from the soon-to-be recycled water tower.

Left: MSP water tower during construction of the Lewis and Cark State Office Building.

Right: the freshly repainted tower at its new home in Branson West.

lion gallons of water to the Missouri State Penitentiary daily from two wells, one with high iron content. During building design, the water tower was considered a source for potable drinking water to the new building. However, the Office of Administration, Division of Facilities Management, Design and Construction did not want responsibility for operating a water system on state property. There were several factors for not wanting to operate a water system, most notably, the lack of trained personnel, liability issues of maintaining water quality, compatibility issues between the large size of the tank pump and the building equipment, and the funding required to operate and maintain the tower and tank.

A decision was made to salvage the tower and tank by surplussing them to State Surplus Property and hopefully finding a community that could reuse them. Fortunately, the city of Branson West contacted the state and felt that the tower and tank design would fit well within their community master plan. In November, 2005, contractors for the city of Branson West began dismantling the tower and tank. By the end of spring 2006, it was re-assembled for use off State Highway 265.

The tower and tank existed for many years and served as a noticeable landmark in Jefferson City. However, the surplus, disassembly and reuse of the water tower and tank is mission-sensitive to the department and exemplifies a critical aspect of sustainable design.

Building Construction Material Specifications

Recycled Content and Local/Regional Materials

Environmental requirements for the project were developed within the project manual for each product or material used in the construction of the Lewis and Clark State Office Building. Certification was required by the manufacturer or fabricator indicating the percentage of post-consumer and post-industrial recycled content, by weight, for each building product specified. No specific percentage of post-consumer and post-industrial recycled content was pre-specified, requiring the construction contractor to make choices of building products based upon the greatest amount of recycled materials and their cost. However, there were certain expectations that the construction contractor purchase an amount of products and materials meeting the lowest level (50 percent), and possibly the next highest level (75 percent) of recycled materials meeting the LEED requirements established for the project during early partnering sessions.

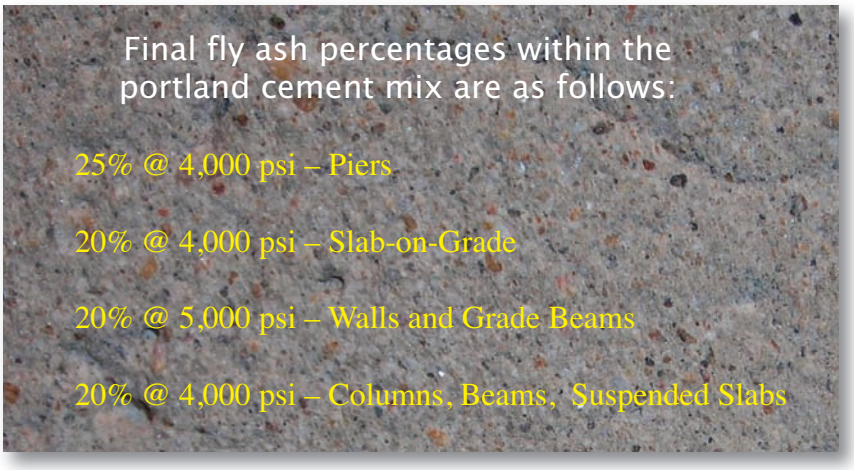
LEED certification levels require 25 percent to 50 percent of all materials be from recycled content. The project exceeded the 50 percent level through certifications by the construction contractor as verified by the U.S. Green Building Council. Seventy-six percent of all materials were manufactured locally, or within 500 miles of the project and 53 percent of that level was harvested within Missouri.

Notably, fly ash in the portland cement, ferrous metal and aluminum in most metal products purchased for the project, as well as Trex recycled plastic lumber, carpet, insulation and ceiling tile were among the products with the greatest amount of post-consumer and post-industrial recycled content. The recycled content of polyester fabric, plastic, wood (Medite II) and metal within the systems furniture manufactured and harvested locally also was considered in the final tabulations of recycled content submitted to the USGBC for consideration.

Recycled Products of Particular Importance to the Project

Coal Fly Ash:

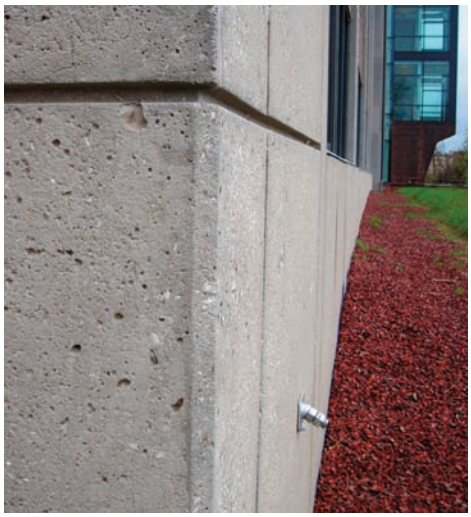
Coal fly ash is a byproduct of coal combustion and can be added to concrete for construction in typical structural concrete applications. The Missouri Department of Natural Resources' Green Building will contain a mix of between 20 percent to 25 percent recycled coal fly ash in the portland cement used in the construction of concrete piers, slab-on-grade spread footing foundations, walls, beams and columns.



The use of fly ash in construction is not a new idea. The Greeks and Romans of ancient time used volcanic ash in their concrete, as the materials in the ash added strength to the resulting concrete structures. The Romans used volcanic ash in the construction of both the Pantheon and Coliseum – built around the year 75 A.D. These buildings are still standing today as testament to the benefits of fly ash used in construction concrete.

Concrete made with coal fly ash is of equal or less total cost than concrete made with only cement, while still maintaining or improving concrete performance. In many cases, because concrete with coal fly ash is equal to or significantly higher in quality than concrete without coal fly ash, it is advantageous to use. This makes the addition of coal fly ash a better value for the user. It is less susceptible to attack from chemicals in the environment, including sulfate-containing soils and water. Coal-fly-ash concrete also is better at protecting embedded steel from corrosion from externally applied de-icing salts. A denser, more watertight concrete also is less susceptible to damage caused by freezing and thawing. The strength and durability of concrete is improved with the addition of coal fly ash. The rate of strength gain as the concrete cures will depend on the particular coal fly ash and cement used, but concrete made with coal fly ash will gain more strength over time than concrete made with only cement.

Fly ash was shipped from the Ameren UE Labadie, Mo. coal-fired power plant to central Missouri where it was mixed with portland cement for use in the building by Farmer's Concrete of Jefferson City.



Northeast view of the foundation using portland cement with recycled coal fly ash

Ultra Touch Natural Blue Denim Insulation

Ultra Touch natural blue denim cotton fiber insulation by Bonded Logic Inc. was used as the primary insulation in the building. The product is a class A building material made of post-industrial denim and cotton fibers that are primarily sourced from denim manufacturing facilities.
Contains over 85 percent recycled denim and cotton fibers consists almost entirely of natural denim and cotton fibers that are 100 percent recyclable, reducing landfill waste, and, the denim and cotton are 100 percent post-industrial.

Ultra Touch contains no fiberglass or other airborne particulates and does not itch or cause skin irritation. Each fiber is individually treated with an EPA-registered anti-microbial fungal inhibitor that protects it from mold, mildew, fungi and pests, as well as being boron-based fire retardant treated.

Above: The primary insulation used in the facility is post-industrial blue denim and cotton fibers.

Below: One of the contruction contractors cuts the product into oversized widths to assure a tight, compacted fit for optimum insulation performance.

Ultra Touch requires a minimal amount of energy to manufacture, aiding the environment with energy conservation and reduction in pollution when compared to other types of traditional insulation.

The product is manufactured in oversized widths to ensure a tight friction fit-and-fill capacity and offers excellent thermal and acoustical performance. The R-26 wall and R-30 ceiling insulation was covered by a 6-mil-thick poly sheeting applied across the insulated surface.

On the Web, go to www.bondedlogic.com/ for more information on Ultra Touch natural blue denim insulation, as well as other products from Bonded Logic Inc.

InterfaceFLOR Carpet Tile

Carpet tile specification comparisons were based upon InterfaceFLOR's Interface Happening #14632025000 and comparable lines by Bigelow Commercial, Collins & Aikman Floor Coverings and Lee's carpet. The product selected by the design contractor was the Interface Happening carpet tile. A special design feature of the InterfaceFLOR Happening carpet tiles is that it is manufactured using clear, post-industrial plastic polyethylene terephtalate (PET) bottles.

The environmental approach to carpet manufacturing by InterfaceFLOR began in the 1990s with the introduction of recycled nylon face fiber and the Glas-Bac recycled vinyl material backing. The InterfaceFLOR company's environmental philosophy was on track to design and produce carpet based upon biomimicry. Biomimicry is the philos-

Specifications of the InterfaceFLOR carpet tile:

- Product Number: 14632
- Color: Repetitions (2974)
- Size: 19.69 in x 19.69 in (50 cm x 50 cm)
- Soil/Stain Protection: Protekt
- Antimicrobial Treatment: (AATCC 138 Washed) (AATCC 174 Parts 2&3) Intersept
- Yarn System: Blue Chip solution-dyed type 6, 6 nylon
- Post-Industrial: 49% - 52%
- Post-Consumer: 0%
- Total Recycled Content: 49% - 52%
- Tufted Yarn Weight: 17 oz./yd. (576 g/m)
- Machine Guage: 1/12 in. (47.2 ends/10 cm)
- Pile Height: 0.15 in. (3.8 mm)
- Pile Thickness: 0.11 in. (2.8 mm)
- Stitches: 8.66/in. (34.09442 ends/10 cm)
- Pile Density: 0.5564 in
- Total Thickness: 0.27 in (6.858 mm)
- Radiant Panel: ASTM E-648, Class 1
- Smoke Density: ASTM E-662
- Lightfastness: AATCC 16 – E

ophy that the natural world can teach and guide us in designing man-made products and systems. Janine M. Benyus, the author of, *"Biomimicry: Innovation Inspired by Nature,"* explains how present-day researchers are using the inspirations found in nature to emulate "life's genius" for the purpose of improving manufacturing processes, creating new medicines, changing the way people grow food and harnessing energy. The environmental philosophy of InterfaceFLOR is presently unequaled by any other carpet manufacturer.

In the past, designers and facility professionals have failed to realize that making the right choice of interior finishes, such as carpet, upholstery, wall coverings or paint, can improve the indoor environment. Not only is the indoor environmental quality of the InterfaceFLOR Happening carpet good for building occupants, it also is a product that helped the LEED certification process in the area of recycled content of building furnishings.

For more information on InterfaceFLOR products, visit the Web at:
www.interfaceflorcommercial.com/index.htm

Building Recycling Efforts

Individual recycling rooms were designed on each floor of the building. The primary feature of these rooms is a paper chute, much like a laundry chute. On floors 2 through 4, the chutes allow employees to empty their small recycled paper boxes into the fire-rated paper chute. Paper falls through the chute to the first floor where it is collected in 30 gallon bins that are exchanged throughout the day by building janitorial staff.

The recycling rooms also accommodate cardboard, rechargeable batteries and ink jet printer cartridges. The rechargeable batteries and ink jet printer cartridges are wrapped for shipment by employees and placed in the building mail stream. Aluminum cans, PET (polyethylene terephtalate) plastic #1 and HDPE (high density polyethylene) plastic #2 bottles are also collected in special side hallway and kitchenette areas hidden behind cabinets located throughout the building. Cardboard, aluminum cans and plastic bottles are all recycled through the State Recycling Program contract through Kingdom Projects, but the initial efforts to recycle plastic bottles was undertaken by employee volunteers. These are taken to the dock and collected by Kingdom Projects, an extended-employment sheltered workshop that employs disabled citizens specializing in the packaging, assembly and processing of recycled materials.

Food waste is collected in each kitchenette for composting. Each day, employee volunteers take vegetative wastes and other non-meat waste such as coffee grounds to compost bins located behind the building. Wood shavings or other carbon-rich materials are brought in by employees to mix with the food waste. Finished compost is either used on the building grounds when needed or given to the volunteers for use in their home gardens.

The project received five LEED credits for efforts made in purchasing recycled materials, materials that were manufactured within 500 miles from the construction site or harvested locally and diverting construction waste. Additional LEED credits in this category were possible but design planners determined during cost-benefit analyses that energy efficiency and indoor environmental quality were more important factors in long-term cost savings and occupant comfort than additional expenditures on recycled materials, including certified wood.

MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Missouri Lewis & Clark State Office Building
D N R

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