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Sustainable Design and Development in the US Army Corps of Engineers

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ABSTRACT

The US Army Corps of Engineers is a world leader in efforts to plan, design and construct facilities that employ the highest principles of sustainable engineering. Sustainable Design and Development (SDD), as implemented at Corps projects, seeks to: (1) meet the needs of the present without compromising the quality of life of future generations; (2) maintain economic growth while producing an absolute minimum of pollution, repairing environmental damages of the past, producing less waste, and extending opportunities to live in a pleasant and healthy environment; (3) meet human needs by maintaining a balance between development, social equality, ecology, and economics; (4) demand systematic considerations of environmental impact, energy use, natural resources, economy, and quality of life; and (5) have optimal benefit when addressed at the inception of a project, and throughout the entire life cycle of a project.

INTRODUCTION

U.S. Army and Sustainability

The United States Army has long recognized that our mission is only accomplished because America entrusts us with its most precious resources – its sons and daughters. It is our obligation to ensure that our Soldiers today – and the Soldiers of the future – have the land, water, and air resources they need to train; a healthy environment in which to live; and the support of local communities and the American people.

The new Army Strategy for the Environment: Sustain the Mission – Secure the Future establishes a long-range vision that enables the Army to meet its mission today and into the future. Sustainability is the foundation for this Strategy and a paradigm that focuses our thinking to address both present and future needs while strengthening community partnerships that improve our ability to organize, equip, train, and deploy our Soldiers as part of the joint force. [Center for the Advancement of Sustainability Innovation Website, 2009]

Sustainability connects our activities today to those of tomorrow with sound business and environmental practices. We have learned over the past decades that simply complying with

environmental regulations will not ensure that we will be able to sustain our mission. We must strive to become systems thinkers if we are to benefit from the interrelationships of the *triple bottom line* of sustainability: mission, environment, and community. To sustain the future Army we must implement effective policies and practices that safeguard the environment and our quality of life in a manner that our nation expects of us.

The Army Strategy for the Environment does not pretend to dictate all the answers. It is only the starting point that commits Army leaders at all levels to certain goals and challenges them to develop innovative methods to achieve these goals. Achieving the vision outlined in this strategy will require a deep and personal commitment from every member of the Army team – every leader, every Soldier, every civilian, and every family member. For the Army to be successful on its quest toward sustainability we must all do our part to *Sustain the Mission, Secure the Future!* [Center for the Advancement of Sustainability Innovation Website, 2009]

U.S. Army Corps of Engineers (USACE)

The U.S. Army Corps of Engineers (USACE) has approximately 34,000 dedicated Civilians and Soldiers delivering engineering services to customers in more than 90 countries worldwide. The USACE Mission is to provide vital public engineering services in peace and war to strengthen our Nations security, energize the economy, and reduce risks from disasters. With environmental sustainability as a guiding principle, our disciplined Corps team is working diligently to strengthen our Nation's security by building and maintaining America's infrastructure and providing military facilities where our service members train, work and live. The USACE provides premier engineering, construction, real estate, stability operations, and environmental management products and services for the Army, Air Force, other assigned U.S. Government agencies and foreign governments.

What is the Army definition of Sustainability?

“A sustainable Army simultaneously meets current as well as future mission requirements worldwide, safeguards human health, improves quality of life, and enhances the natural environment.” *Army Strategy for the Environment, 2004*, [ERDC, CERL Website, 2009]

What is our definition of SDD?

From Engineer Construction Bulletin 2003-20, The Army Corps of Engineers definition of SDD is “Sustainable Design and Development is an integrated approach to planning, designing, building, operating and maintaining facilities in a collaborative and holistic manner among all stakeholders. It is meant to provide resource efficient, environmentally friendly and healthy facilities with emphasis on renewable energy and recycled materials.” [ERDC, CERL Website, 2009]

What is the Army's building footprint?

The Army owns 780 million square feet of buildings in the United States, 183 million square feet in Europe, 43 million square feet in Asia, and 7 million square feet in other locations (as of 30 Sep 2008). The US Army Corps of Engineers military construction program (MILCON) is projected to be \$69.6 Billion dollars between FY06 and FY13.

U. S. Army Requirements for New Construction

All Army military vertical building construction projects starting with the FY08 military construction program will achieve the SILVER level of LEED NC (New Construction). This policy includes all new construction projects regardless of fund source. Horizontal construction, such as ranges, roads and airfields, will continue to incorporate Sustainable Design and Development features to the maximum extent possible. [Army LEED Policy, 2009]

What Is LEED?

An emerging trend in the A/E/C industry today is creating sustainable, high performance buildings. The industry standard LEED® (Leadership in Energy and Environmental Design) assigns ratings of platinum, gold, silver or bronze in recognition of total credits earned by the project. LEED is a leading-edge system for certifying the greenest performing buildings in the world. LEED addresses the complete lifecycle of buildings: homes, neighborhood development, commercial interiors, core and shell, new construction, schools, healthcare, retail, and existing buildings operations and maintenance. Project teams using a LEED rating tool can earn credits if they meet technical requirements in the following topics: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design Process.

In October 2009, the Fort Hood Family Housing, the privatization partnership at Fort Hood between the U.S. Army and developer Actus Lend Lease, was recently awarded 26 LEED Silver certifications by the U.S. Green Building Council (USGBC) for achievement in green homebuilding and design. LEED for Homes is a green home certification system for ensuring homes are designed and built to be energy- and resource-efficient and healthy for occupants. LEED-certified homes complete a technically rigorous process that includes a home energy (HERS) rating and on-site inspections to verify that the homes are built to be energy and water efficient, environmentally sound and healthy places to live. This project is now the largest LEED Silver community development throughout all Army military installations and the largest in the state of Texas. [Wallace, 2009]

This initial batch of 26 certificates in Patton Park is the first of an anticipated 232 homes to be certified LEED Silver. Located on the main cantonment of the Fort Hood military installation, these first 26 Patton Park homes are within walking distance of public transportation, shops and other conveniences. The three- and four-bedroom homes focus heavily on reducing energy use by utilizing low-e3 windows, high-efficiency appliances and lighting fixtures, compact fluorescent bulbs and high-density, recycled newspaper cellulose insulation. Other energy-efficiency upgrades include instantaneous water heaters, programmable thermostats, high-efficiency gas furnaces and air conditioners, as well as mechanical ventilation. [Heckman, 2009]

Low VOC (volatile organic compounds) paint, recycled-fiber carpet, resilient plank flooring and 75-percent Forest Stewardship Council-certified sustainably harvested wood content mouldings have been used throughout the house. As a result of incorporating energy-saving products and technologies, these homes have achieved an average 74 score on the Home Energy Rating System. (Homes must achieve an average minimum score of 62 - on a 100-point scale - to be deemed certifiable at the Silver level of LEED for Homes.) Figure 1 shows the ribbon-cutting and an example of one of the new housing units. [Heckman, 2009]



Figure1. New LEED Certified Housing at Ft. Hood

USACE Adoption of LEED

Researchers from the USACE Construction Engineering Research Laboratory (CERL) initiated a team effort that led the Department of the Army to transition from the Sustainable Project Rating Tool (SPiRiT) to USGBC's Leadership in Environmental and Energy Design (LEED) for all Military Construction (MILCON) projects, and to establish a goal of achieving a Silver rating. The Army's adoption of, and commitment to, LEED has led to a revolution in the facility acquisition process and has a far-reaching impact on the multi-billion dollar annual MILCON program both in the U.S. and at overseas installations (\$69.6 billion worth of MILCON will be built between FY06 -13). For example, in fiscal year 2009, the Army built some 1,000 facilities for occupancy that achieved LEED Silver. The USGBC has certified a LEED Platinum project, the Fairfax Village Neighborhood Center at Fort Belvoir, Virginia and a LEED Gold project, the Brigade Battalion Headquarters at Fort Carson, Colorado.

Nearly 10 years ago the Army proposed the use of a rating tool to help shape the sustainability of its facilities at the design and development phases. The architectural/engineering/construction (AEC) industry was moving in this direction – most notably USGBC, which was developing a consensus-driven standard, LEED 2.0. To address military requirements for such a tool, ACSIM asked ERDC-CERL to customize LEED 2.0 and the result was SPiRiT, which debuted in 2001. [CERL Website, 2009]

As with LEED, the intent of SPiRiT was to seek “green” options for MILCON projects that would produce sustainable facilities over the entire life cycle, from master planning, design, construction and occupancy, through operation and maintenance (O&M) to environmentally

sound disposal. SPiRiT represented a critical step in helping participants in the facility delivery process gain comfort with using a rating tool to build sustainability into projects.

As USGBC's LEED tools evolved, researchers at CERL conducted an extensive study comparing the new LEED versions with SPiRiT and recommended the Army adopt LEED-NC (New Construction) and to establish the target rating at Silver. The Army Secretariat (Installations and Environment) and ACSIM concurred, and the Army issued a policy to this effect on Jan. 5, 2006. Through its follow-on LEED implementation policy letters, Army leadership provided guidance to appropriately capture MILCON language, directives, and additional requirements. Beginning with fiscal year 2008 new construction, all MILCON is required to achieve LEED Silver. In addition, all design teams are required to include at least one LEED Accredited Professional (AP); currently there are 159 LEED APs employed by the Corps of Engineers.

Effecting a change of culture in a long-standing, conservative facility acquisition process represents a major accomplishment by this Army team. By adopting LEED, the Army has demonstrated a commitment to align itself with this proactive approach to improving infrastructure now and for future generations.

A recent example of LEED accomplishment made by the Army was the opening of a Band Training Facility for the Ivy Division Band at Ft. Carson, Colorado. The 12,620-square foot band training facility, a joint venture of Mass Services and Supply, LLC and Main Electric, houses rehearsal spaces, locker rooms, offices, administrative space, a library, instrument storage and a break room/day room area.



Figure 2. – Ivy Band Training Facility, Ft. Carson, Colorado

Main/Mass exceeded the U.S. Army Corps of Engineers standard requirement for the Ivy Division Band's facility to attain a U.S. Green Building Council Leadership in Energy and Environmental Design Silver rating certification. The construction contractor achieved enough project points to pursue a Gold rating certification.

“Creating sustainable facilities matches the Corps of Engineers’ goals of providing high-quality products that have minimal impact on the environment, greatly reduced energy needs

and feature numerous user-friendly features,” said Greg Sipes, U.S. Army Corps of Engineers project engineer for the band training facility. [Galentine, 2009]

DLR Group, the architects of the band training facility, included a number of sustainable features in the design, including day lighting, use of materials that include a large amount of recycled content, low-flow water fixtures, water efficient landscaping and a high-efficiency ground-loop geothermal system.

“Acoustics, day lighting and sustainability were the overriding themes influencing the design of the facility,” said Tom Kapels, DLR Group project manager for the design of the facility. “Each of the main rehearsal spaces has acoustical wall panels, ceiling diffusers, variable acoustic curtains and cork flooring. Most of the materials have recycled content, and the cork flooring is a material that is from a rapidly renewable resource.”

“One new feature to Fort Carson is the use of geothermal heat pumps,” said Sipes. “This type of heating and cooling system has been used successfully around the world for many years. Various other Army posts have been using geothermal heating and cooling in both residential and commercial applications with great success.”[Galentine, 2009]

This ground source heating and cooling technology entailed drilling 40 wells, 400 feet to capture the relatively constant temperature of the earth. Water circulates through the wells and simply transfers heat to and from the earth to provide heating and cooling. In the summer the ground temperature is cooler than the outside air and in the winter the ground temperature is warmer than the outside air. Kapels estimates the payback on the cost of the geothermal heat pump system alone to be two-three years from the energy savings yielded from the system. “Historically, the increased costs associated with a LEED Silver certified building has been between 3 percent and 5 percent,” said Kapels. “That percentage has been decreasing rapidly due to the influx of sustainable technologies and products into the marketplace, and the increasing acceptance by the industry of sustainable practices.” [Galentine, 2009]

CONCLUSIONS

USACE is gaining momentum in the effort to build sustainable, energy efficient communities, facilities and civil works projects, but there is much more work to be done. Recent federal mandates require federal buildings to be fossil fuel free by 2030, and to use Low Impact Development techniques to manage storm water in an effort to restore the site to pre-development hydrology. Two Army installations have been designated to become net-zero communities, where they generate as much energy as they use over the duration of a year. We’re exploring the use of innovative materials and construction techniques, and are strongly encouraging the use of recycled materials from our deconstructed facilities. Renewable energy systems and district heating/cooling/power systems are being considered to achieve improved efficiencies. Other projects are being built to enhance and restore natural habitat and water systems. Twenty-two Army installations have conducted installation strategic sustainability visioning processes to set 25-year sustainability goals.

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