Grant Proposals Selected for Award – August 2008

Note: Yellow highlight indicates K-12 occupant impact research (reference #s 98, 147, 291)

A Green Roof Energy Calculator (reference # 218)

Principal Investigator: David Sailor, PhD., Portland State University
Key Research Personnel: Graig Spolek, PhD., Portland State University
                          Brad Bass, PhD., University of Toronto
                          Steven Peck, Green Roofs for Healthy Cities
Partner Organizations: Oregon BEST Signature Research Center
                        Environment Canada
USGBC Funds: $149,909
Matching Funds: $113,165 from Oregon Built Environment & Sustainable Technologies Center, Portland State University and Environment Canada

ABSTRACT
This project will create an easy-to-use design tool- the Green Roof Energy Calculator- to assess the building energy use implications of green roof design decisions. The calculator will be based on output from numerous, detailed building energy simulations. This project will have two key outcomes. First, it will develop refined green roof energy models for use by the building energy modeling community. Second, it will create a stand-alone Green Roof Energy Calculator integrated with an existing, web-enabled life cycle assessment framework developed for the industry association– Green Roofs for Healthy Cities. The release of a quantitative, user-friendly green roof energy modeling tool for use by non-energy experts will break down barriers to market penetration and efficient design of green roof technologies. The result also has potential to inform technical advisory groups at USGBC with respect to LEED credits for implementation of green roofs.

An Open Source Searchable Database to Assess the Impact of Environmental Strategies on Outcomes in Healthcare Facilities (reference # 189)

Principal Investigator: Anjali Joseph, PhD., The Center for Health Design
Key Research Personnel: Xiaobo Quan, PhD., The Center for Health Design
                        Amy Keller, The Center for Health Design
                        Donna Deckard, The Center for Health Design
Partner Organizations: Kaiser Permanente
                        Pebble Project Partner Hospitals
ABSTRACT
The forecast of annual capital spending on health facilities rising from $15 billion today to $25 billion in the year 2010 presents a rare opportunity to build better, healthier, healthcare buildings that improve patient care, staff recruitment/retention, medical outcomes, institutional productivity, and financial performance while decreasing medical errors and waste. However, it is critical to be able to quantify results related to better building design. The USGBC grant funds will support the development of content for an open-source searchable database. Specifically, objectives include:

- To develop a robust framework for understanding the relationship between sustainable design strategies and desired outcomes
- To identify and clearly define standard existing metrics that should be tracked across multiple healthcare organizations
- To develop standard protocols for collecting data on sustainable design strategies and related outcomes from healthcare organizations
- To promote evaluation and comparison of performance outcomes between different healthcare organizations.

Design for Reuse Primer (reference # 129)
Principal Investigator: Liz Ogbu, Public Architecture
Key Research Personnel: Brad Guy, Building Materials Reuse Association
Partner Organizations: California Integrated Waste Management Board
U.S. Environmental Protection Agency, Region 9
San Francisco Department of the Environment
StopWaste.org
USGBC Funds: $97,533
Matching Funds: $22,395 from Public Architecture

ABSTRACT
Public Architecture will work with the Building Materials Reuse Association and local, state and federal agencies to increase the rate of reuse existing building materials in construction projects. Material reuse provides an opportunity to reduce energy associated with manufacturing and transporting raw materials and the amount of waste disposed in U.S. landfills. This Design for Reuse Primer project builds on Public Architecture’s work with ScrapHouse and other projects. The primer will involve process-oriented case studies documenting reuse efforts, suggestions for improving LEED credits for reuse, and other topics. The practice-based tools regarding material reuse yielded through these efforts will be disseminated widely. Overall, the project seeks to increase rates of material reuse and encourage integration of material reuse within the sustainable design agenda.
Development and Implementation of a New Protocol for Testing the Ability of Building Materials to Passively Reduce Indoor Ozone and Its Reaction Products (reference # 332)

Principal Investigator: Richard Corsi, PhD., University of Texas at Austin
Co-Investigator: Glenn Morrison, PhD., Missouri University of Science & Technology
USGBC Funds: $149,769
Matching Funds: $44,160 from Missouri University of Science & Technology

ABSTRACT
To improve indoor air quality, green buildings are often constructed out of “low emitting” materials. These materials emit unwanted contaminants into indoor air at low rates. Some pollutants, such as ozone in smog, enter buildings from outdoor air. But energy intensive active filtration is usually required to remove ozone. Some green building materials may be able to BOTH reduce pollutant emissions AND control ozone by passively removing ozone from indoor air. Occupants of buildings outfitted with these materials will inhale much less ozone than those in traditional buildings. To help professionals in the green building industry, this project will develop a novel test protocol and grading scale that characterizes green materials for their ozone removal capacity. In addition, a variety of green building materials will be tested to provide an initial listing of materials that will provide this zero-energy air cleaning for buildings.

HVAC Control Algorithms for Mixed-Mode Buildings (reference # 81)

Principal Investigator: Gregor Henze, PhD., University of Colorado at Boulder
Co-Investigators: Clemans Felsmann, PhD., Technical University of Dresden
Jens Pfafferott, PhD., Fraunhofer Institute for Solar Energy Systems
Key Research Personnel: J. Fergus Nicol, PhD., London Metropolitan University
Richard de Dear, PhD., Macquarie University
USGBC Funds: $249,915
Matching Funds: $213,548 from Technical University of Dresden and Fraunhofer Institute for Solar Energy Systems

ABSTRACT
The primary purpose of HVAC systems is to provide acceptable indoor air quality and thermal comfort. Hybrid or mixed-mode ventilation systems provide good indoor air quality and thermal climate using natural ventilation whenever the outdoor weather conditions are favorable, but revert to mechanical systems for HVAC whenever external conditions are too harsh. A hybrid building should switch between these two modes of operation according to seasonal and diurnal variations in the indoor thermal conditions and the outdoor environment. Such a hybrid building requires an intelligent control system that can switch automati-cally between natural and mechanical modes in such a way that minimizes energy consumption without compromising indoor air quality or the thermal comfort of its occupants. We will develop a control strategy for mixed-mode buildings, which minimizes site energy consumption by means of an optimal ventilation and HVAC strategy using both mechanical cooling as well as ambient energy sources such as groundwater, ground, or cool nighttime air.
Improvement of Porous Pavement System for On-site Stormwater Management
(reference # 168)

Principal Investigator: Yuhong Wang, PhD., PE, East Carolina University
Co-Investigator: George Wang, PhD., PE, East Carolina University
Key Research Personnel: David Batie, PhD., NCARB, RA, East Carolina University
USGBC Funds: $90,842
Matching Funds: $131,172 from East Carolina University and Barnhill Contracting Company

ABSTRACT
Porous pavement is an alternative to impermeable pavement. It allows stormwater to drain through the pavement and infiltrate into the soils. The benefits of using porous pavement include reduction in peak flows and volumes of runoff, removal of pollutants from stormwater, reduction in soil erosion, and others. The purpose of this study is to address some concerns on porous pavement and to make further improvements. The study will attempt to optimize the proportioning of pavement materials and to use fibers from recycled materials to improve its strength. In addition, waste or recycled materials will be tested for their potential use as base materials. The study will also try to modify pavement surface color to improve its solar reflectance index. Based on the study, the researcher will develop guidance on porous pavement design, maintenance, and disposal. It is anticipated that this study will make porous pavement more affordable and environmentally friendly.

Integrated Building Water Management (IBWM) Modeling - A Proposed Tool for LEED Assessment & Education (reference # 230)

Principal Investigator: Daniel Yeh, PhD., PE, University of South Florida
Key Research Personnel: Caryssa Joustra, University of South Florida
Partner Organization: Learning Gate Community School
USGBC Funds: $149,525

ABSTRACT
University of South Florida researchers Dr. Daniel Yeh and Caryssa Joustra propose the development, testing and implementation of a computer model, based on STELLA, as a powerful decision-making and educational tool for sustainability. The integrated building water management (IBWM) model employs a systems approach, taking into consideration water from multiple indoor and outdoor sources. In addition to tracking water budget (quantity), the proposed model will also include water quality (Q), energy (E) and costs (C). The finished IBWM-QEC model will be a comprehensive model useful for building or campus water management that cuts across LEED credit categories. The model will be developed in partnership with Learning Gate Community School, a LEED platinum registered K-8 green school, which will serve as a test site for model development as well as a forum for teaching water management, green design, systems thinking and sustainability. Other potential test sites may also be examined.
Investigating Opportunities for Improving Building Performance Through Simulation of Occupant and Operator Behavior (reference # 201)

Principal Investigator: Clinton Andrews, PhD., Rutgers Center for Green Building
Key Research Personnel: Uta Krogmann, PhD., Rutgers Center for Green Building
Lisa Rodenburg, PhD., Rutgers Center for Green Building
Richard Wener, PhD., Rutgers Center for Green Building
Jennifer Senick, Rutgers Center for Green Building
Maren Haus, MEM, LEED AP, Rutgers Center for Green Building

Partner Organizations: U.S. Green Building Council, New Jersey Chapter
Liberty Property Trust
Re:Vision Architecture
New Jersey Economic Development Authority
PNC Real Estate Finance

USGBC Funds: $150,001
Matching Funds: $50,001 from Liberty Property Trust

ABSTRACT
This project has two goals: (1) improve the usability of green buildings, and (2) improve our ability to model human-technology interactions in design tools. Its motivation is the documented prevalence of buildings failing to perform as designers intended, in part because operators do not (or cannot) operate the building as intended, and because occupants often behave differently than designers expect. The empirical foundation for this project is a set of case studies of LEED-certified commercial buildings that include both user-oriented post-occupancy evaluation and engineering evaluation. A novel agent-based computer simulation-modeling framework will generalize the case study findings and allow systematic investigations of interactions between a building’s technological systems and its human occupants and operators. Activities that translate the scientific findings for practical use include a downloadable simulator, a roll-out workshop, a plain-English report, and suggested revisions to the LEED rating system.

Multi-Variate Study of Stormwater BMPs (reference # 293)

Principal Investigator: Jim Schuessler, BNIM Architects
Key Research Personnel: Stacy Hutchinson, PhD., Kansas State University
Tim Keane, PhD., Kansas State University
David Dods, URS Corporation
Mark O’Hara, BNIM Architects

Partner Organizations: Mid-America Regional Council
Johnson County Public Works, Stormwater Management Program

USGBC Funds: $149,768
Matching Funds: $17,692 from BNIM Architects, Kansas State University and URS Corporation

ABSTRACT
Recent estimates indicate that less than 1% of fresh water is available for use and consumption with no new water being produced. With increasing demand from growing populations, fresh water is expected to become a valuable commodity. This grant proposal includes the collection
of stormwater quantity and quality data as runoff enters and exits BMPs from a range of city-wide locations. Analysis from 22 months will be documented with the intent of confirming the current LEED rating credits. The document will also recommend modifications for future credits (including chemical pollutant, heavy metal and snow melt chemical removal). This grant would be in association with Johnson County, Kansas Public Works and Mid-America Regional Council to expand the number of monitored sites. The project has the potential to influence building and site design as well as development policy and standards, facility operations and maintenance standards, all of which contribute to better, more livable communities and neighborhoods.

**Quantifying the Impact of Daylight and Electric Lighting on Student Alertness, Performance, and Well-Being in K-12 Schools (reference # 98)**

Principal Investigator: Mariana Figueiro, PhD., Rensselaer Polytechnic Institute  
Co-Investigators: Russell Leslie, AIA, FIES, LC, Rensselaer Polytechnic Institute  
Mark Rea, PhD., Rensselaer Polytechnic Institute  
Key Research Personnel: Mary Carskadon, PhD., Brown University  
Partner Organizations: Brown University Medical School  
USGBC Funds: $249,998  
Matching Funds: $251,636 from Rensselaer Polytechnic Institute and National Institutes of Health

**ABSTRACT**

The Lighting Research Center (LRC) of Rensselaer Polytechnic Institute, the world's leading research organization dedicated to lighting and daylighting research, proposes to work in partnership with the researchers from the Department of Psychiatry and Human Behavior at Brown University Medical School, to scientifically quantify the impact of electric lighting and daylighting on psychosocial stress, mood, sleep quality, and performance of students in K-12 schools. It is hypothesized that those who are not exposed to enough daylight will show a delayed circadian phase and therefore, increased sleep problems and more severe stress symptoms. We will, for the first time, link actual circadian light exposures experiences by students in schools to these outcome measures. This research will serve as a basis for the development of guidelines that can be used by interested parties to enable the development of designs to maximize students' health, well-being, and performance.

**The Evaluation of Green School Building Attributes and Their Effect on the Health and Performance of Students and Teachers in NY State (reference # 147)**

Principal Investigator: Shao Lin, PhD., Health Research Inc., New York State Department of Health  
Key Research Personnel: Christine Kielb, New York State Department of Health  
Neil Muscatello, New York State Department of Health  
Syni-An Hwang, PhD., New York State Department of Health  
Ronald DePersis, New York State Department of Health
Partner Organizations: New York State Education Department  
New York State United Teachers  
New York State Asthma Initiative  
Bureau of Occupational Health  

USGBC Funds: $150,000  
Matching Funds: $142,919 from New York State Department of Health  

ABSTRACT
This study will assess the impact of green school building attributes on occupant health and performance. This will be achieved by 1) developing a “Green School Index” from individual building attributes in NYS public schools using existing building survey data; 2) relating these individual and aggregate measures to statewide indicators of occupant performance and health; 3) validating the above environmental data in a sub-sample of schools using objective measurements and analyzing these measurements in relation to occupant health and performance. Two types of analyses will be conducted. A statewide ecologic analysis will examine the greenness of schools in relation to student and teacher performance and health outcomes, controlling for socio-demographics and outdoor environmental factors. In a sub-sample of schools, objective measurements from walkthroughs will be obtained to validate the database-derived green indicators, and then analyzed in relation to measures of student and teacher health, comfort and performance obtained through surveys.

Transportation Energy Intensity Index (reference # 296)

Principal Investigator: Peter Haas, PhD., Center for Neighborhood Technology  
Key Research Personnel: Scott Bernstein, Center for Neighborhood Technology  
Jen McGraw, Center for Neighborhood Technology  
Albert Benedict, Center for Neighborhood Technology  
Linda Young, Center for Neighborhood Technology  

Partner Organizations: University of Minnesota Center for Sustainable Building Research  
USGBC Funds: $149,469  
Matching Funds: $69,188 from Center for Neighborhood Technology  

ABSTRACT
The Center for Neighborhood Technology (CNT) will conduct research on transportation energy intensity (TEI) building performance metrics and develop a TEI Index to measure predictive transportation energy intensity of LEED buildings. The index will be based on location characteristics of buildings; physical transportation-related characteristics of the buildings (i.e. bike amenities, etc.); transportation behavior incentives (i.e. transit passes, etc.); and building establishment type. Additionally, the research will consider the merits of a carbon-based measurement, either as the TEI, or in addition to it. Finally, the research will develop data collection tools and whenever possible, consider TEI as compared to the building energy use intensity (EUI). CNT will build upon the expertise of national and international experts, through the establishment of a Transportation Metrics Advisory Committee. CNT will develop a common analytic method and compile baseline data on measured TEI of specific buildings. The tools created will overcome barriers to performances evaluation for a variety of building types, and the research will inform policy development and future LEED standards development.
Using a New Application of Existing Monitoring Technology to Quantify the Relationship between Classroom Ventilation and Student Performance
(reference # 291)

Principal Investigator: Mark Mendell, PhD., Lawrence Berkeley National Laboratory
Key Research Personnel: Michael Apte, PhD., Lawrence Berkeley National Laboratory
Agnes Lobscheid, PhD., Lawrence Berkeley National Laboratory
Partner Organizations: California Energy Commission
PureChoice, Inc.
USGBC Funds: $100,000

ABSTRACT
Goals of this project are to: (1) investigate associations between classroom ventilation rates (VRs) and student performance on standardized tests in elementary schools in a range of California climate zones, and (2) provide information to help identify VRs above which additional ventilation provides limited performance benefits related to increased energy costs. This is an expansion of an approved California Energy Commission study to quantify association of VRs with student absence in California elementary schools and estimate costs and benefits of changing classroom VR standards. For the overall project, we will study 80+ classrooms within multiple climate zones over two years, and another 80+ for one year. Web-connected sensors in classrooms will collect real-time CO2 data, allowing estimation of daily VR/person per classroom. School/school district staff will provide non-identified data on student absence and test scores. Findings will help support scientifically defensible school VR standards, including criteria for sustainable school buildings.