

## **AC 2007-2521: TEACHING BEYOND SUSTAINABLE AWARENESS: GRADUATING LEED-ACCREDITED PROFESSIONALS**

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# Teaching Beyond Sustainable Awareness: Graduating LEED Accredited Professionals

## Introduction

The built environment has a profound impact on our natural environment, economy, health and productivity. Based on this impact, the design, creation, and maintenance of the built environment presents both challenges and opportunities for design professionals. Sustainable design and green design have become everyday terminology in the design field and involve using methods and products that cause the lowest possible impact upon the ability of the natural environment to maintain its natural balance. However, the practice of sustainable design can be difficult and complex. It is no longer debatable that architects and interior designers should practice in an environmentally responsible manner, and progress has been made by academy and the professions to begin preparing designers for this responsibility. We are at the pinnacle of basic understanding and awareness of sustainable design principles, and must now advance our knowledge and application of sustainable design in order to advance sustainable practice.

## Context

Sustainability is a term that can be defined in various ways, and it is this issue that can cause ambiguity and “greenwashing” (a term used to denote entities that proclaim they practice sustainability without any clear definition of the term). In its broadest terms, sustainability “represents a balance that accommodates human needs without diminishing the health and productivity of natural systems.”<sup>1</sup> Additionally, sustainability can be defined as “...providing equitably for the needs of the present generation without jeopardizing the needs of future generations.”<sup>2</sup> In order to accomplish the above tasks, we must redesign the way human nature exists with the natural earth and redesign our processes and automated, thoughtless actions. Therefore, sustainable design can be defined as a “strategic approach to the design of the built environment which does not diminish the health and productivity of natural systems.”<sup>3</sup> Although these definitions do not give specific items, “...they do offer an approach which recognizes the imperative that we must *redesign* the design process itself to be compatible with the natural systems which define the ‘web of life’ on earth.”<sup>4</sup>

The goal of sustainable design is to prevent the environmental damage inherent in traditional processes of building or remodeling. As Architect Sim Van der Ryn said “In many ways, the environmental crisis is a design crisis. It is a consequence of how things are made, buildings are constructed, and landscapes are used.”<sup>5</sup> In an attempt to produce a new generation of buildings that deliver high performance inside and out, the U.S. Green Building Council (USGBC) has coordinated the establishment and evolution of a national consensus effort to provide the industry with tools necessary to design, build and operate buildings that support sustainable design and building practices.

Within the architecture, engineering, and interior design fields, designers have the ability to make major impacts on the lives of people. Designers additionally have the ability to impact the environment around every building and space they construct. However, these impacts are not

always positive. In the United States alone, the buildings constructed used one-third of our total energy, two-thirds of our total electricity, and one-eighth of our total water (LEED-NC, 2005). All of that is used by the structure itself, which is where the LEED rating system comes in. LEED (Leadership in Energy and Environmental Design) is a rating system developed by the United States Green Building Council (USGBC) to provide a framework for the design, construction, and operation of green buildings (USGBC website, 2006). This rating system strives to improve not only the quality of the nation's buildings, but also to reduce the negative impacts on the surrounding environments and resources. Green design is not just for the environment; it can have positive impacts on the health and well-being of people, reduce operation costs, increase productivity, and creates a sustainable community. Recently, the General Services Administration (GSA) issued a report that stated the U.S. Green Building Council's (USGBC) system for rating the environmental performance of a building, known as LEED, is the most credible out of five systems that were rated. This announcement will no doubt directly impact the sustainable and green design building market, as the GSA serves as a landlord to the federal government and the federal government is one of the largest owners and operators of commercial buildings.

The LEED rating system allows building owners and operators to have tools to measure the sustainability of their building and provides a framework for what constitutes a green building. Performance is measured in five main areas: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. Additionally, LEED has six different rating systems based on the nature of the project. These are LEED-EB (Existing Building), LEED-NC (New Construction), LEED-CI (Commercial Interiors), LEED-Cs (Core and Shell), LEED-H (Homes), and LEED-ND (Neighborhood Development).

The main sections of the rating system for LEED-NC (New Construction) are as follows:

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovation & Design Process

Sustainable Sites (14 possible points) - seeks to protect the natural habitat of the site and surrounding land. Points are given for the actual location of the site, whether it is located near mass transit systems to cut down on pollution or redeveloping a previously contaminated site. Controlling stormwater run-off is also a big part of this section, as a building can disrupt the natural flow of water causing sedimentation and erosion. Reducing heat island effects is another part of sustainable sites, because mass amounts of asphalt and pavement can absorb the sun and increase temperatures of surrounding areas, thereby disrupting the natural ecosystem.

Water Efficiency (5 possible points)- seeks to limit the amount of water consumption within a building, through both landscaping and plumbing systems. Two of credits are achieved by reducing irrigation water consumption by 50% (compared to a baseline standard) and either not using potable (fresh) water for irrigation or not using an irrigation system at all. According to LEED, the United States has a 3,700 billion gallon water deficit, which means we are using

3,700 billion gallons more than we are putting back into natural water systems. Additional credits in the Water Efficiency section can be gained through using low-flow plumbing systems and reducing the water consumption by either 20%, or 30% for an additional credit.

Energy and Atmosphere (17 possible points) - is designed to limit the strain on our resources by reducing energy and electricity consumption. Electricity from fossil fuels (oil and coal) puts numerous strains on our environment, starting from their extraction to refining to distribution (LEED-NC, 2005). Credits are achieved in this section by implementing a commissioning plan and continually monitoring the buildings systems' performance. Additionally, use of refrigerants, which deplete the ozone and cause global warming, are limited to specific types and require proper maintenance and disposal. However, the majority of points in this section are achieved by lowering the building's energy consumption, as shown by comparison to a baseline building standard. Up to ten points can be achieved if the building's energy performance is reduced by 42%. The remaining credits can be gained through using Green Power, which is grid-source energy or produced by renewable sources.

Materials and Resources (13 possible points) - strive to reuse and recycle materials, manage construction site waste, and utilize local and regional manufacturers to cut down on transportation of items. Credits can be achieved by reusing existing portions of the building, which include both exterior and interior elements. Reusing materials accounts for two additional credits depending on the amount (5% or 10%). The use of recycled materials is a different credit, for which the actual percentage of recycled material within the product must be calculated. Construction waste management is the other main part to this section, as points are achieved by diverting construction waste from landfills by either recycling it or donating it to another community. Points are also earned by using local or regional materials, manufactured within a 500-mile radius of the project site. This cuts down on the resources needed to transport materials from far locations.

Indoor Environmental Quality (15 possible points) - seeks to improve the quality of the interior of the building for its occupants. Within the United States, people spend almost 90% of their time indoors, so the building itself can greatly impact the quality of life of the people inside. At times, the levels of pollutants inside can be five times higher than the level of pollutants outside. To gain points in this section, emphasis is placed on using efficient ventilation systems to improve the air quality inside. Credits are also achieved in several areas by using low-emitting materials, from carpets to adhesives, paints, sealants, and composite wood. Up to six credits pertain to the comfort of the occupants, with individual thermal control, individual lighting controls, use of daylight, and providing views to the exterior for the occupants.

Innovation and Design Process (5 possible points) – is the last section of LEED-NC and awards credits in green building design that have not been addressed by LEED. Projects also gain a point if they employ a LEED Accredited Professional.

There are 69 possible points for each project. The LEED-NC ratings are awarded according to the following scale:

- Certified      26-32 points
- Silver         33-38 points
- Gold            39-51 points
- Platinum      52-69 points

The USGBC will recognize buildings that achieve one of these rating levels with a formal letter of certification and a mountable plaque.

### **Development of Advanced Sustainable Knowledge**

As sustainable and green design become the future for projects and for those in the design field, it is inevitable that educators will be faced with the task of incorporating these concepts into curriculums to teach the design professionals of tomorrow. As interior designer and educator, Cathy Steig, states “After more than 10 years of teaching and diligently attempting to practice sustainable design, I have found that there exists what I refer to as the ‘sustainability gap.’ It is the gap that exists between *theory* and *practice*; between what we believe to be right and what we *know* to be right; between how we *should* practice sustainable design and how we are *able* to practice.”<sup>6</sup> Ms. Steig goes on to identify five phases of a sustainable interior design practice and how each phase would help to bridge the sustainability gap. She suggests that it will take the collaborative effort of the academy, the profession, and industry to affect significant change.

At Purdue University in the Interior Design program, an archetype course was developed to go beyond a mere awareness of basic concepts and principles of sustainable design. We (the authors) believe that by having students become involved in the LEED rating system process that we can bridge the sustainability gap and produce environmentally responsible designers for the future.

The course, *Sustainability and LEED*, was implemented in the fall of 2006 and included both undergraduate and graduate students. The course was developed as a graduate level course, but allowed undergraduate students at the senior level in good academic standing to register as well. The first time the class was offered in the fall of 2006, it included three graduate students and three undergraduate students. The time the course was offered in the spring of 2007, it consisted of twelve undergraduate students, with nine at the senior level and three at the junior level. As the format of the course was geared towards graduate students, the course sought to cover the LEED-NC version 2.2 (New Construction) rating system through a variety of lectures, reference manuals, class field trips, and case studies of LEED certified projects within the area. The class met once a week for a three-hour period. While the graduate students were comfortable with the format of the class and the amount of work involved (as most graduate courses follow a similar format), the undergraduate students had to adjust to the amount of material covered each week in an intense three-hour discussion. In both semesters, the undergraduate students were able to adjust to the format within the first three weeks of the course.

#### Goals of the Course

Goals of the course were for all the students to become LEED Accredited Professionals, to promote a higher understanding of the LEED rating system, and support USGBC’s mission of

transforming the built environment. The goals were to be achieved through developing a working knowledge, through research and application, of how sustainable design principles, processes, and products may be integrated effectively into the design of the built environment. Another goal of the course was for all the students to become LEED Accredited Professionals prior to their graduation, however this was not realistic for all students due to financial constraints. As the LEED AP exam costs \$350.00, it is difficult for the instructor to expect the students to take the exam within a specified time period. At this time, compensation for students passing the LEED exam is being sought through the department. A formal system will be in place within the next year to reward those students who pass the exam as a student (undergraduate or graduate) before graduation.

### Course Requirements

After an introduction and discussion of the William McDonough & Michael Braungart's book *cradle to cradle, Remaking the Way We Make Things*; and the history of how the LEED rating system was developed and why; each week the students were assigned a specific credit within the five sections of LEED-NC. The requirements then were arranged in the following format:

- All the students had to read each section of the reference guide prior to class. Then the student responsible for a specific credit presented a synopsis of the credit in terms of its 1) Intent, 2) Requirements, and 3) Potential Technologies & Strategies. Each student also had to investigate the resources listed at the end of each credit and led the discussion on any considerations, such as, environmental issues, economic issues, regional issues, etc. Students also filled out some of the Letter Templates that are provided through the LEED project resources webpage. These templates contain embedded calculators, and are instrumental in documenting fulfillment of credit requirements and prompting for correct and complete supporting information.
- Students were also required to keep an organized Green Design File and to choose one topic from this file to research one of the topics in-depth and present a 10 minute presentation with examples and/or illustrations.
- Two guest speakers presented to the class; one was an architect who just completed a building that received a Silver USGBC Certification and the other was from a manufacturer of a sustainable structural wall system.
- At the end of the course a "Practice Exam" was given to the students. The exam closely followed the actual LEED exam format and was administered in the same time-frame.

### Case Studies

In addition to the research of the LEED rating system, students participated in two informal case studies of local LEED certified projects. The two case studies were from a LEED-CI rated facility and a LEED-NC rated facility.

The first project site that was examined was the newly renovated corporate showroom for Kimball International, located in Jasper, Indiana. The facility is located at the company's headquarters and recently received LEED-CI Gold Certification. The tour of the facility was beneficial to see, however, the design firm, TVS Interiors, was not present to discuss the certification process with the students. On-site employees were limited in their LEED knowledge and could not provide the students with the level of detail they were expecting after the intense studying from the course. The main points Kimball received appeared to be from diverting construction waste with the Materials and Resources section. They diverted 99% of their waste by sending items to their own recycling center and then selling or donating other items to the community. Kimball actually makes about \$1.3 million off of their recycling center alone, so they are obviously highly proficient in this area.

During the construction phase, Kimball also implemented an Indoor Air Quality Management Plan to help the comfort and well-being of the construction workers. Another major area that Kimball received points was in the Materials and Resources section dealing with local/regional building materials. The other main points were from Low-Emitting Materials, another credit within the Materials and Resources section. Also, Kimball achieved credits using lighting controls with occupancy sensors, water efficient restroom fixtures, Energy Star rated equipment, and GREENGUARD certified furniture.

The second location examined for an informal case study was the new airport in Indianapolis, Indiana. The site, located between the two existing runways, is currently under construction and will be seeking LEED-NC certification at the completion of the project in 2008. The original intent of the Indianapolis Airport Authority was to implement an Environmental Management Plan, at which point it was deemed that the LEED-NC process was the best way to document the project for the plan.

For the actual site, the new Indianapolis Airport (called Midfield), will gain credits for controlling the disruption of the site both during construction and after occupancy. During construction, the site has been designed to control sedimentation and dust contamination. The landscaping has been designed to not attract rodents or birds, and to use a limited irrigation system. Site lighting has been reduced to provide enough for safety, but does not cause light pollution. After occupancy, the de-icing systems used on the airplanes will also be control, as the chemical run-off will be collected separately and then treated for eventual re-use.

Over 76% of the construction waste from the site has been diverted from landfills through recycling practices. The project also reduced water use by 35%, and energy use was reduced by 20%. An under floor cooling system had been installed in the base of the floor of Civic Plaza – which is a two hundred foot diameter plaza in the main terminal. The vertical space is up to seventy-five feet, so the cooling system in the floor is more efficient to cool the people at floor level, rather than wasting energy to cool from the top down. Natural light provides approximately 75% of the lighting before dusk, reducing the strain on electrical resources for interior lighting. In the Materials and Resources section, Midfield should gain points for the materials manufactured locally. Additionally, for the Low-Emitting Materials credit, the Midfield project is seeking an Innovation & Design credit as they implemented low VOC paints

in both the interior and exterior, whereas LEED-NC only mandates having interior low VOC paints.

Both case studies and site visits provided the students invaluable information concerning the LEED certification process, as they were able to physically see the LEED resources in action. Additionally, project architects and engineers from the Indianapolis Airport were able to specifically discuss the documentation process of LEED, which has proven to be the most difficult area for the students to grasp. However, neither project was able to share the LEED point sheet, where information concerning what specific points were obtained. This knowledge was estimated by the students based on the information provided from each project.

### **Conclusion and Future Implications**

The course, *Sustainability and LEED*, which was first offered at Purdue University in the fall of 2006 to Interior Design students, was so popular that it was offered again in the spring 2007 semester with a 50% enrollment increase. The course was developed to not only advance the students knowledge of sustainable design in order to apply it to their design projects, but to teach them the LEED rating system in an attempt to produce LEED Accredited Professionals prior to their graduation. As the demand for LEED certified buildings increase, so does the demand for LEED educated and accredited professionals.

All of the students who have either taken this course, or are currently in it, had a basic knowledge of what sustainability meant. However, as all the students were interior design majors, this knowledge was mainly in the form of products, materials and finishes. By going through the LEED rating system and the five areas of application, the students expanded their knowledge of the natural ecosystems and the state of the global environment. Additionally, they expressed a desire to become more active in the community in relation to recycling, reducing waste, conserving resources, and educating others.

At this point in time, two students have attempted to take the LEED exam, based on LEED-NC v.2.2. One student passed and the other is scheduled to take the exam again in March 2007. Three more students are scheduled to take the exam within the month of April 2007. Financial constraints have been the main identifying factor as to why the examination has been delayed for a majority of the course participants, and current measures are in place to remedy this as mentioned previously.

The environmental responsibilities that have been added to the practice of all the design disciplines, including interior design, have resulted in a need for academy to step up the pace and to consciously work towards advancing our knowledge and application of sustainable design in order to advance sustainable practice. Students are aware of sustainability, but the need to increase their knowledge so that they may be prepared immediately upon entering the profession is vital. Additionally, for interior design students, using LEED-NC has been beneficial by incorporating all areas of building and site design; to not only increase their knowledge of LEED but also their understanding of the complete building systems and their impact on the environment.



The benefits for using the LEED rating system, whether New Construction (NC) or Commercial Interiors (CI) is evident both for environmentally sensitive issues and for the well-being of a building's occupants. As people continue to deplete the earth's natural resources, architects, engineers, and interior designers have the ability to lead the movement towards reinventing the concept of a building and the way it impacts the environment. The development of the LEED rating system is the first step towards this, and it is now up to the professionals in the field to implement sustainable design into every aspect of their projects, as well as the educators who are teaching the professionals of the future.

## **Bibliography**

<sup>1</sup>Sandra F. Mendler and William Odell, *The HOK Guidebook to Sustainable Design* (New York: John Wiley & Sons, Inc., 2000), 1.

<sup>2</sup>United Nations, *Report of the World Commission on Environment and Development*, 42/187, December 11, 1987.

<sup>3</sup>See note 1 above.

<sup>4</sup>“Web of life” is a frequently used term in a variety of contexts. Here it refers to the intricate interconnectedness and diversity of nature, of which we are inextricably a part.

<sup>5</sup>Sim Van der Ryn, and S. Cowar, . *Ecological Design*. (Washington, D.C.: Island Press, 1996).

<sup>6</sup>U.S. Green Building Council, *LEED-NC for New Construction Reference Guide*, Version 2.2, First Edition, October 2005.

<sup>7</sup>Cathy Stieg, “The Sustainability Gap,” *Journal of Interior Design*, 32(1) 2006.