Paper 198: Pioneering the 2010 Imperative in Studio: Carbon-Neutral Studios 2006 and 2007

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Abstract

This paper examines two successive fall studios aimed to teach carbon-neutral design strategies. The first of the two, the 2006 interdisciplinary Carbon-Neutral McCall Field Campus project, was relatively successful, while the second, the 2007 Integrating Habitats design competition, was less successful. The Fall 2006 studio was an term-long project for graduating students in Architecture, Interior Design, and Landscape Architecture comprehensive design studios who worked as interdisciplinary teams during the eight-week master planning phase and individually (with team consultation) to develop comprehensive projects for the balance of the semester. The studio work led to the award of an EPA P3 grant to further develop the project in conjunction with Bioregional Planning and Conservation Social Sciences students and faculty. While the Fall 2007 Integrating Habitats competition had an interdisciplinary agenda, we were able to attract neither the Interior Design nor Landscape Architecture studios to the project. Disappointingly, the development sites proved to be generic rather than actual. Although ecologists and landscape architects were enlisted as studio critics, the master planning and comprehensive design were completed in the disciplinary silo of architecture. Four teams of architecture students submitted competition entries—one was awarded an Honourable Mention on February 26, 2008. Analysis and comparison of the two studios offers valuable lessons learned in going forward with successive studios.

Keywords: carbon-neutral design, architecture studio, campus planning, integrated design

1. Introduction

Ed Mazria and Architecture2030 have challenged architects, through enlightened practice, to reduce the carbon emissions from the built environment to zero by 2030. The Architecture2030°Challenge has been accepted by the American Institute of Architects, Royal Architecture Institute of Canada, and US Conference of Mayors among many others. Subsequently, Architecture2030 launched the 2010 Imperative, calling on schools of architecture to teach carbon-neutral design strategies throughout their curricula and pledge to attain a carbon-neutral campus by 2010. [1] Surprisingly, this imperative has been less widely accepted. However, our architecture faculty voted unanimously to adopt it after my demonstration interdisciplinary carbon-neutral graduate studio projects in Fall 2006 and 2007. Moreover, our campus provides both top-down and bottom-up support for sustainable practices. The university president has committed to the Talloires Declaration, the American College and University Presidents' Climate Commitment, and the Chicago Climate Exchange; while students, faculty, and staff have gained funding for the UI Student Sustainability Center (with self-imposed student fee monies) and the Sustainable Idaho and Building Sustainable Communities Initiatives (funded as a university strategic initiatives).

2. The Carbon-Neutral Studios

2.1 Intent and Structure

The carbon-neutral studios were designed to fulfil the NAAB requirement for comprehensive design from planning to programming to design and systems integration. The architecture students involved were first semester graduate students in our professional M.Arch. program. Each studio employed a two-phase approach to their project: 1.) a half-term research, planning, and programming phase, during which students worked in teams, and 2.) a half-term design and development phase, during which students worked individually on segments of their team's master plan. How do you teach carbon-neutral design? As with most studios the learning is project-based, but the two requirements that we stressed were 1.) research of carbon-neutral materials, methods, design strategies, and technologies and 2.) accountability for design decisions. Each student had a research assignment and reported their findings. Students used a variety of software tools and hand methods from carbon calculators to daylighting and thermal performance evaluators, to cistern and PV sizing routines, to Malcolm Wells' Wilderness-Based Checklist for Design and Construction for assessing their design work.

2.2 McCall Field Campus Project

The fall 2006 studio topic was planning and designing a new carbon-neutral field campus for

the McCall Outdoor Science School (MOSS). The existing 11-acre site in a mature Ponderosa pine forest on the shores of Payette Lake would be redeveloped to provide year round learning opportunities for elementary school children. The forest, the lake, and the buildings would all play a role in teaching them environmental stewardship. About 40 students participated in the design studio—the 16 architecture graduate students were joined by seniors in Landscape Architecture and in Interior Design, who were also taking their required comprehensive studio, so all three studios' objectives were in alignment.

During the first phase (research, planning, and programming), students worked in seven interdisciplinary teams, with each discipline represented on each team. In this phase the students bonded and performed transdisciplinary work. We knew we had buy-in when in the first group at the first critique a Landscape Architect presented architectural concepts, an Architect presented interiors concepts, and an Interior Designer presented landscape concepts.

The site and the client also inspired and motivated the students. While visiting the site, students were stunned by its natural beauty and rustic buildings, but also became aware of the potentials and limitations of the setting. The mature forest limits the use of active solar systems and wind turbines for producing energy, but provides opportunity for gathering building materials and on-site biofuel-powered energy generation. The forest and mountain location also dictates fire-safe construction and respect for deep snow. The client (MOSS) convinced the students that their work was valued and that eventually a carbon-neutral campus, inspired by their efforts, would be built. They were committed to David Orr's concept of architecture as pedagogy and wanted the master plan to show an integrated design approach. MOSS faculty and students served as tour guides during the site visit and critics during the planning and design phases.

2.3 Integrating Habitats Competition

The fall 2007 studio project was based on the Integrating Habitats (IH) competition sponsored by Portland Metro, which "calls for innovative, visionary proposals that combine design excellence, ecological stewardship, and economic enterprise." [2, 3] *Metropolis Magazine* publisher Susan Szenasy declared, "The Portland effort seems light-years ahead of the usual beauty contests, where architects and designers muse over last year's projects produced by their peers and then award the best-looking pictures. In its name as well as its mission, Integrating Habitats feels fresh, hopeful, and open to possibilities. It is an ideas competition meant to create a dialogue on ways humans can live in harmony with nature—arguably, the most important topic of our time." [4] However, carbon-neutrality wasn't a specific requirement stated in the competition brief, but it was a studio-wide goal. The students were responsible for both fulfilling the requirements for comprehensive design studio and submitting projects to the competition. Although IH had an interdisciplinary agenda, we were able to attract neither the Interior Design nor Landscape Architecture studios to the project. Ecologists and landscape architects were enlisted as studio critics, but the master planning and comprehensive design were completed in the disciplinary silo of architecture, informed by others, but not truly discussed and dissected by an interdisciplinary group.

During the first phase, architecture students worked in teams of three or four. They added to the research and resources gleaned by the 2006 studio, but were spared the experience of developing architectural programs for the site and buildings—these were specified in the competition booklet.

We made a field trip to Portland to familiarize ourselves with its context and inspirational green architecture, but were disappointed to learn that no actual sites for the competition existed. They were all generic, based on conditions found in Portland. Due to the nature of the competition we had no real client to interact with and knew that our projects would only be academic in value and that a well-executed project could gain recognition and be rewarded with a monetary prize.

2.4 Studio Comparison

Although both studios had the same basic two phase structure, studio requirements, and time allocation, there were some significant differences that affected the students' engagement in the projects. The students on the McCall project formed strong relationships with their interdisciplinary partners which motivated them to broaden their perspective and led to synergy in the master planning, while the IH competition students had no strong interdisciplinary ties. The compelling site and encouraging client in McCall also motivated the students far more than Portland's ersatz sites and anonymous client. The opportunity for fame and reward didn't outweigh the site and client weaknesses. It seems that the McCall project offered the best opportunity for learning.

As an instructor who has been teaching passive and low energy architecture studios for over twenty years, I found an exceptional willingness among the students in both studios to analyse building performance during design and to choose materials and construction techniques carefully. And neither creativity nor aesthetic impact was compromised (Fig. 1). *[Note: Complete, larger scale representations of all the students' work can be found on the studio web site http://www.caa.uidho.edu/arch553haglund/description.htm and full Integrating Habitats competition results at http://www.integratinghabitats.org/.]*

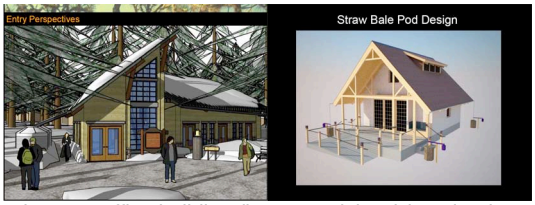

Fig 1. An office building (by Sara Richards) and a dorm (by Paul Marx) for the McCall Field Campus

3. Studio Outcomes

Both studios resulted in immediate outcomes in the form of master plans and building design development; and both realised longer term outcomes—eventually winning awards, inspiring further work (McCall only), and providing material for papers, talks, and discussions on carbon-neutral design.

3.1 McCall Field Campus Project

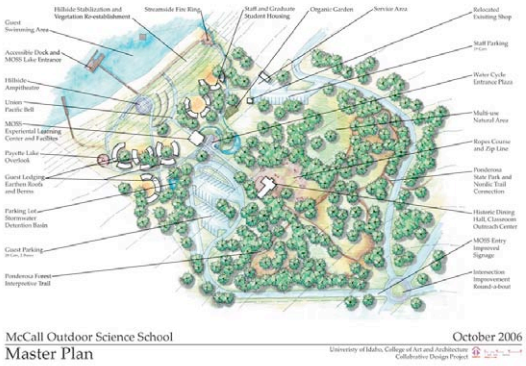

Fig 2. One of the seven McCall Master Plans (by A. Engel, J. Hatch, A. Morgan, M. Puddy, D. Woodruff)

Phase one resulted in seven master plans that demonstrated solid integration of site and program and were well-received by the client. The students' exploration and documentation of the feasibility of their master plans inspired MOSS personnel to successfully apply for a $10,000 US EPA P3 grant to help fund the development of the project. In true interdisciplinary fashion, I was named PI for the grant which was awarded for the 2007-08 academic year. The interdisciplinary grant team (Architecture, Bio-Regional Planning, and Conservation Social Sciences) conducted a series of charettes to evaluate the seven master plans and resolve them into a single plan. Their work was displayed and presented at the EPA Sustainability Expo on the National Mall in April 2008. Their project which incorporated the finalized master plan received three awards at the Expo—The Green Building Initiative Award of $1,000 for "the most innovative sustainable commercial design project at the EPA's P3 Award Competition;" the AIChE's Youth Council for Sustainable Science and Technology (YCOSST) Design Award of $1,000 for "the project that best exemplifies research involving interdisciplinary collaboration, using novel, innovative technologies to facilitate distance communication during research and employs sustainable practices and use of sustainable materials that are locally produced and available to the general population and enables the device/invention to be maintained locally;" and the EPA People, Prosperity, and the Planet (P3) Honorable Mention "for the quality of their design and proposal."

While the team-developed master plans gave an outline for a carbon-neutral campus, the individual students' design development projects aimed to prove the feasibility and buildability of elements of the plan. Students investigated a variety of building systems based on locally available materials (straw bales, cord wood, rammed and poured earth, and grid shells) and studied ways to integrate them into assembled buildings. Their projects were strong in showing construction methods, systems integration, and building performance. Having no specific tool for assessing carbon neutrality proved to be no barrier, as they used multiple tools for different aspects and invented means to demonstrate relative carbon impacts. The result was buildings that were well-documented, well-analyzed, and beautiful. The MOSS grant writer used their work as 'proof of concept' for the master plan in the EPA grant application. Obtaining the EPA P3 grant afforded the opportunity to apply for a larger P3 phase two grant. Writing this proposal forced us to imagine what would come next. Of course the next logical step would be to build the new campus, so we have recruited another architecture faculty member to initiate a design/build studio for fall 2008. We intend to have students on-site in McCall next summer building the first module of the project, 1,500 square feet of carbon-neutral housing for elementary school children who visit the site for a week of environmental science learning, where the architecture will become part of the pedagogy.

Fig 3. Straw bale cabin roof materials and construction detail (by Paul Marx)

3.2 Integrating Habitats Competition

The four teams of architecture students were responsible for presenting their master plans at midterm, but their competition entries which were also essentially master plans weren't due until the

last week of studio, when the students' individual comprehensive design development projects were also due to be critiqued. This overlapping of schedules and responsibilities proved to hinder both submitted master plan development and the individuals' final designs (Fig. 4). The level of project development was not as complete as the McCall studio projects. Nonetheless one of the four team entries won an honourable mention in the competition, open to both students and professionals.

Fig 4. Section through an infill housing scheme for I.H. (by J. Andrysiak, C. Harrison, R. Stuki)

"As jurors of the Metro-sponsored Integrating Habitats competition, we have been invited to the table to share our observations with the council. We're an interdisciplinary group representing architecture, landscape design, conservation, watershed protection, development, and the media. Coming off a full day of reading, analyzing, and discussing a large number of entries from six countries, we are welcomed as trusted experts in the areas of design, ecology, and development. The group is asked, for instance, how local codes need to change in order to realize the best proposals and what the council should do to make this happen. As the conversation gains momentum, I realize that we're witnessing a breakthrough in the annals of design competitions." [4] Our award-winning group proposed a business plan for a big box store that reduced parking and made transit use attractive and feasible. These changes reflect an interdisciplinary attitude and are planning level steps toward carbon neutrality. (Fig. 5)

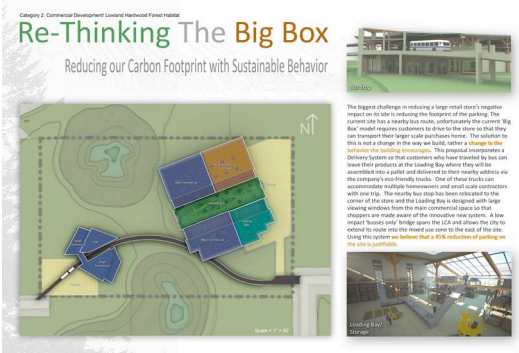

Fig 5. Honorable Mention Award-Winning project. [3] (by J. Brajkich, B. Ferguson, P. Sullivan)

4. Conclusion—Lessons Learned

At the onset of this set of design studios I thought that the biggest barrier to teaching carbon-neutral design would be the lack of a robust tool for determining carbon consequences. Personal carbon footprint calculators based on Mathis Wackernagel's work on ecological footprints [5] have been in existence for a long time, but are not suited to analysis of building construction or performance. EPA's Energy Star targets [6] are set for a limited range of building types and sizes, which the students found difficult to apply to their particular small buildings. Like competent designers, they improvised, constructing a subjective tool that examined carbon output for each material used in their buildings (Fig. 6), and they used familiar computer-based tools (Ecotect, HEED) for analysing building performance. (Fig. 7) ***I was wrong***. Lack of robust, well-established tools was not a barrier. Now these tools are becoming available. Mithūn Architects has developed a construction carbon calculator for buildings [7]; DOE's EnergyPlus now interfaces with Sketch-Up to perform performance analysis during design; and HEED has incorporated a carbon calculator, so it gives carbon as well as energy performance. Will these advances help future studios?

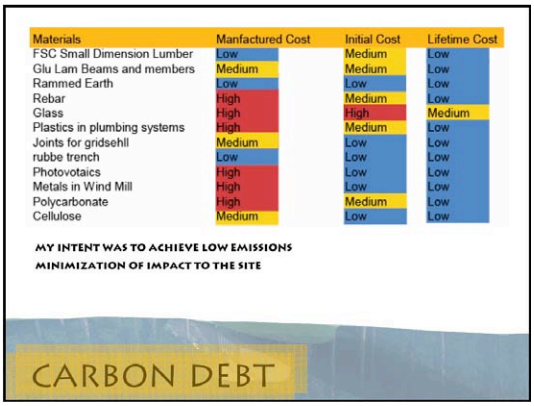

Fig 6 Improvised subjective carbon impact rating system for building materials. (by Jeff Hatch)

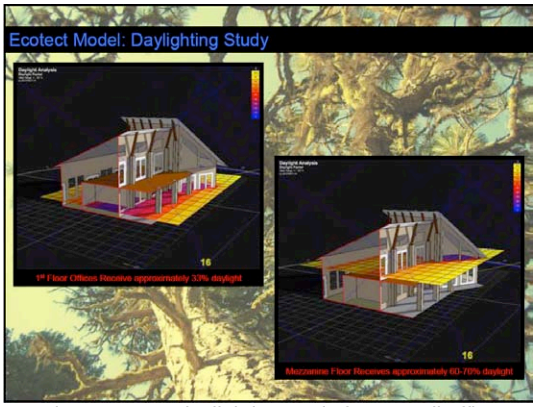

Fig 7. Ecotect daylighting study for a small office building. (by Sara Richards)

The determining differences that I found between a successful studio (fall 2007) and an exceptionally successful studio (fall 2006) were project selection and studio collaborators. The McCall Field Campus project captured the imagination of the students. Its potential was palpable…a realistic project, a willing client, and a beautiful setting. Moreover, they were able to address the programming and planning phases in a manner similar to integrated design practice in

professional offices. The interdisciplinary teams also stayed in contact during the design development phase. The resultant projects were thorough and well-considered. Although the Integrating Habitats competition posed a set of intriguing problems and detailed site and programmatic requirements, the students were frustrated by its ersatz, academic nature. Also, while there was some interdisciplinary consultation, the level of collaboration was far less than in the McCall project.

The model of a well-conceived, compelling project assigned to interdisciplinary teams should be applied to future carbon-neutral studios. Stepping outside the disciplinary silos is the way to teach and seek solutions to the pressing problem of global warming.

5. Acknowledgements

The success of these studios was abetted by SBSE colleagues who provided support and insight into resources available; by my teaching colleagues who collaborated enthusiastically; and to the students willing and eager to meet the 2010 Imperative. The studios' syllabi, resources, and outcomes can be examined in detail online. [8]

6. References

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