Straw-Bale Eco-Center
Building Within the Academy: A Case Study

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Figure 1 : Eco-Center under construction sited at the south end of a restored prairie, Muncie, Indiana

DESIGN

The construction of the Eco Center was an ambitious project, begun with minimal funding and minimal loading supplemented with an abundance of good energy on the part of the students and faculty involved in the project. The first phase was funded through an $10,000 EPA P3 grant (with some local matching funds). The proposed project followed on a master plan for the property previously prepared by a colleague in the Department of Landscape Architecture.[1]

The project had three primary goals:

-To provide an immersive and comprehensive learning experience for the students involved.

-To provide education and community outreach to promote awareness of and highlight issues relating to sustainable building practices while demonstrating a viable alternative to local conventions.

-To serve as an ongoing research facility.

Due to the timing and conditions of the EPA grant that was used to initiate the project along with previous loading commitments on the part of the faculty, the course was not able to be offered as a studio and was instead offered as a three unit elective, setting up the first of our challenges. The amount of work required to design, document, obtain permits and build the first phase of the project bore no resemblance to the modest three unit load afforded the students, who were all managing the demands of their busy academic schedules which included design studio. At one point during the first semester of work this author proposed to scale back the scope of the project to address this disparity, postponing the actual construction to the start of the following semester. Surprisingly, this proposal met with the objections of the students who wanted to take on the full scope of work. *The students wanted to build.*

The first semester's class was composed of thirteen students, a mix of fourth year undergraduates and first year graduate students. In addition, fourteen third year architecture students were involved in the project, their studio being structured to allow for a two-week design charrette at the beginning of the semester and two weeks to participate in the

construction at the semesters end. The contributions of the third year studio proved a key to the projects success.

From the outset the project was thought of in terms of phases. Phase one would consist of researching, designing, permitting and building the project to the level of a watertight shell as well as documenting the sustainable features incorporated into the project. Phase two would consist of exterior claddings, railings, ramp and hardware. The plans for phase three consisted of completing the interior finishes and fit out, installing the alternative energy systems, and monitoring the performance of the systems. Phase one (the building shell) was to be completed by the semesters end with the relatively modest construction budget of $9,000. Funding for phases two and three was not in place and had to be obtained piecemeal throughout the process.

The third year students kicked off the design process working in teams to generate proposals for the building, finding their architectural expression in subtle design moves grounded in a creative manipulation of the building components. During this same period the elective class was broken into teams researching conventions of bale construction, sourcing and pricing local materials and researching the few local precedents we were able to find. At the end of this two-week "burst" the elective class participated in the review of the third year student's proposals and used the third year work as a point of departure to synthesize and develop their own designs.

Parallel to these activities another faculty led group was meeting with a variety of local officials (University Facilities Staff, County Building Department Inspectors, Property Governing Board, Bankers representing the Property Trust) to both determine the approval process required for the project and to produce the necessary documentation to obtain these approvals within the framework of our very ambitious schedule. We were fortunate to find that our plans were met, generally speaking, with enthusiasm and support by all parties involved.

As the design direction was narrowed student teams began sourcing straw and mocking up sections of the wall. Through hands-on experimentation students became familiar wit the bale module, the behavior of the material and methods of precompressing the bales. This directly informed the design work going on in studio.

The final design was simplified as a result of the hands–on experimentation, the student's exuberance grounded in a growing understanding of the behavior of the material and the realities of actually building the project. The main volume of the building is simply a rectangular room, room size and openings laid out on bale module and conforming to City of Austin, Texas building code requirements (there were no local codes available to help guide decisions). This main volume was raised approximately 30" above finished grade on an insulated platform in response to poor drainage and potentially wet site conditions. The simple design incorporated numerous passive strategies, sourced local materials, and incorporated a variety of sustainable features. Design decisions, documented through drawings and educational materials, were prepared by the students to communicate the thought process behind the design of the center (fig. 2). A website dedicated to the project was also set up for the purposes of documentation and educational outreach. Sustainable design was revealed as the sum total of a series of simple but smart decisions from start to finish.

PROCESS

The first semester's work saw the completion of the building shell complete with roofing, but no exterior finishes. The structure was wrapped in visquene and allowed to sit for a full (spring) semester as the faculty pursued additional funding for the project. Construction resumed the following academic year and saw similarly intensive efforts on the part of the project team, the course again offered as three unit electives in the Fall and Spring. This led to the substantial completion of the Eco Center in the Spring of 2008, although both construction work and research at the center are ongoing. The Fall Semester was focused on the completion of the exterior, including the application of earth stucco on the bale walls, a very labor-intensive process that involved a significant learning curve on the part of the participants. The third and final semester of construction saw the completion of the building's interior and the installation of the alternative energy systems. Although there was some overlap, for the most part each semester involved a separate group of students. In all, over sixty students were

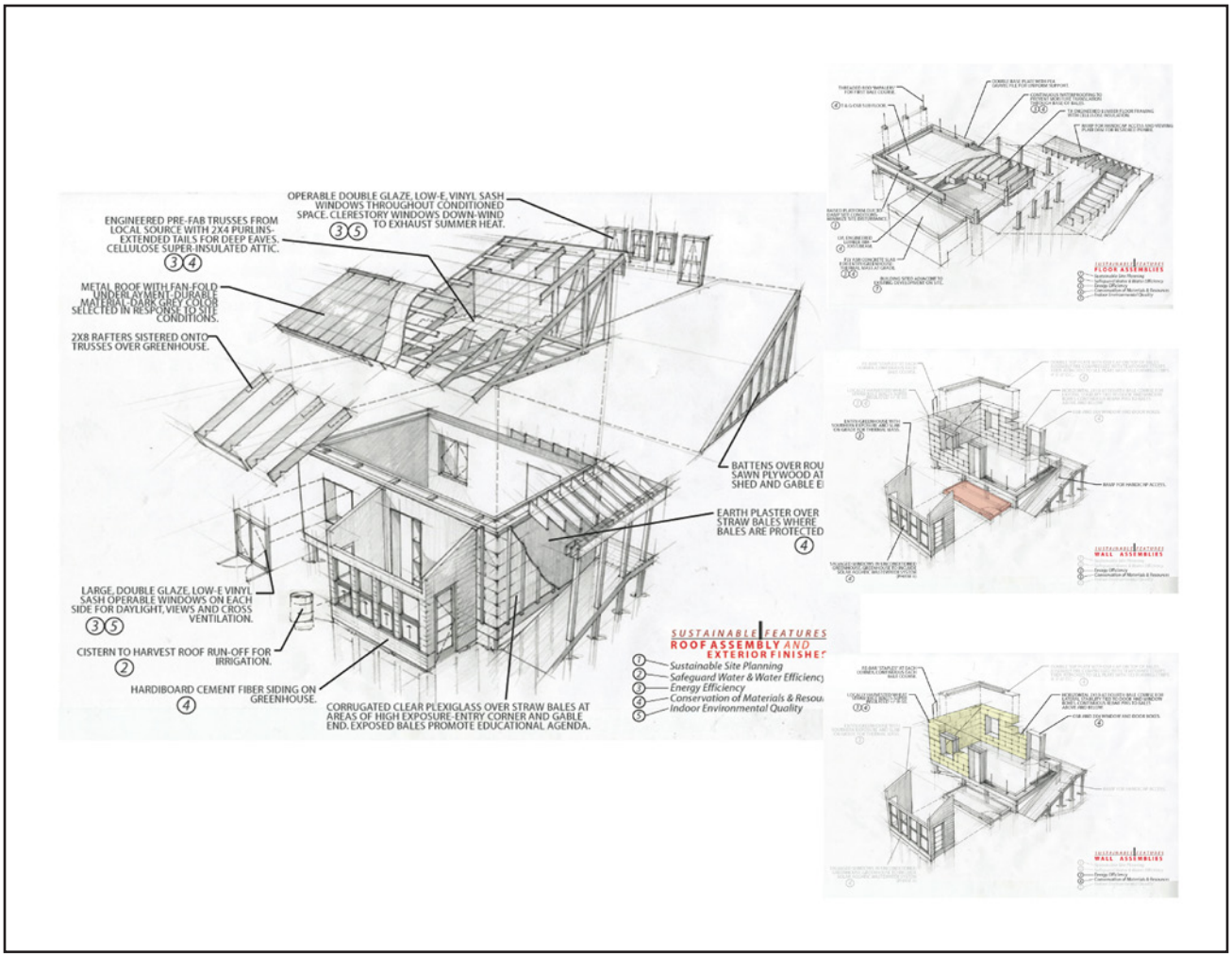

Fig. 2: One of a series of educational materials prepared for the project; drawing Dan Bajor

involved in some capacity, and over fifty thousand dollars was raised through a combination of grants, gifts and industry donations. Numerous professional consultants from outside the university worked with the students along the way and brought expertise required to realize the project. The weekly challenges, major crisis and minor triumphs are too numerous to list in the context of this paper, but the turbulent rhythms of a project such as this are well known to anyone involved in building projects with students. The path was challenging and at times exhausting, but rewarding as well.

At present, the Eco Center represents the first load bearing straw bale building in our region, the first "off the grid" public facility in the region, and is in use serving a variety of purposes. These purposes include use as a classroom, use as a demonstration project (tours of the facility are regularly given to a variety of user groups including University students and grade school children), and a staging area for tours of the adjacent restored prairie.

OUTCOMES

Students and faculty alike generally feel good about a project that results in something tangible, a project that grounds a student's sensibility in making, in the methods and means of architecture. This project was no exception; indeed it has been recognized with a number of awards to date. There are many reasons for students and faculty alike to embrace and feel good about learning experiences such as the design and construction of the Eco Center.

Fig. 3: A proud moment after the bales trusses were "raised" onto the bale wall

Projects such as this offer students the opportunity to present their work with the materials still under their finger nails; to inhabit their work at full scale and to celebrate the immediacy of architecture; important counterpoints to the "distance and disengagement"[3] often associated with virtual representation and the inherent abstraction of design studio. Students learn that materials seldom behave as anticipated, and that fabrication is an iterative process. Students learn that design intention must be informed by the materials and methods of production. Students learn, as they did through the construction of the Eco Center, that potential for meaningful expression exists at all levels throughout the course of a project. One student involved in the application of the earth stucco, asked to reflect on her experience writes poetically about the qualities of an unorthodox material:

> Earth stucco –MUD- is a sloppy material, which is delicious to handle. It is best to apply mud heartily, feeling every grain of sand that composes it, as it molds itself into the pores and cracks of a stucco wall.
> *-student participant Johanna Senott*

Many students reflected on an increased sense of responsibility and empowerment constructing full-scale work:

> The most beneficial component of working on the Eco-Center was the amount of responsibility placed on individual students. I feel that I was allowed to make many decisions alone, or with other students, that influenced the project.
> -student participant Adam Buente

Other valuable lessons surfaced in a round table discussion organized and led by the students themselves:

"The one thing that I didn't think I would get from it was patience. Patience with people, patience with a process" were things I learned doing this project.

"Straw bale was my first project working with everyone in the class on one combined effort… how you motivate people and organize into a group with leadership, how to keep the morale up" were important components of the process. *-comments from a round table discussion led by student participant Marty Merkel* [2]

Fig. 4: The Eco Center nearing completion with the alternative energy systems installed

CHALLENGES

I think most educators agree these are valuable lessons that can supplement a more traditional studio based design education. It has also been the experience of this author, however, that pride of accomplishment and recognition of the finished project can often obscure and diminish the significant challenges faced in the process. Most faculty that engage in these types of projects over a period of time face burn out if the institution is not structured to facilitate and encourage these types of experiences. The fact remains that even as programs move toward a more robust engagement of materiality through making in a variety of ways, structured and ongoing administrative and institutional support for this type of undertaking remains the exception rather than the norm. In the case of the Eco Center, these challenges were numerous and included the following:

-Obtaining required permits for the project. In some cases simply identifying the players and the permits that need to be obtained was a difficult and time-consuming process. Who signs off and takes responsibility? Liability issues on many different levels were often difficult to sort through and resolve. Many of the persons in authority voiced support for the project but were tentative to "sign off" on something that was clearly a departure from the norm, a hallmark of faculty led design / build.

-Finding funding to support the project, particularly funding that corresponds to the flow of work, was an ongoing challenge with the Eco Center. In the end, it took just in excess of $50,000 to complete the project, which was cobbled together on the part of the faculty from fourteen separate sources, each source requiring its own documentation and representation of its own agenda…an exhausting process perhaps equal to the actual construction.

-Finding loading which corresponds to the flow of work and supports faculty involvement is a challenge that was not met on this project. Of the three immersive semesters it took to complete the project, the faculty coordinator was loaded for only one of the three. Even when the loading was given, similar to the students, the three-unit faculty load was dramatically disproportionate to the amount of work involved.

-Liability of the students working on the project. University insurance companies get very nervous when considering the thought of students working with power tools off campus. A diligent faculty member runs the risk of stopping a project altogether if too many questions are asked at the outset, encouraging a "don't ask don't tell" modus operandi.

-Maintenance and ownership of a project once complete can often pose problems for the ongoing use and purpose of a student built project.

Dealing with these and other vexing issues can be exhausting for administrators and faculty alike if these types of projects are undertaken on an individual basis. Liability concerns, funding constraints

and other issues often make it difficult to formalize these types of activities. In addition, the lack of clarity with regard to these issues often requires the faculty member to proceed with some potential implications for personal liability unresolved, often a huge disincentive for faculty members to pursue this type of work.

This author has sought out advice from colleagues across the country known for exemplary design build work, and was alarmed to find that these issues still seem to exist even in some of the most highly recognized programs. The work of Andrew Freear, who is carrying the amazing work of the Rural Studio at Auburn to new levels, still faces a host of administrative frictions with the University. The outstanding work achieved by educators such as Dan Rockhill at Kansas and Bryan McKay Lions at Dalhousie is not free from the same issues and concerns experienced throughout the Eco Center project. These flagship programs have either found a way to divorce themselves altogether (Studio 804, Ghost Lab) or distance themselves from the many administrative overlays of the academy...no small task.

To take a closer look at one of these examples, Studio 804 at the University of Kansas provides an interesting model that addresses many of the challenges listed above and has a proven track record of success. In the words of program director Dan Rockhill, Studio 804 "is structured to rely on as few people as possible….avoiding situations where one needs to ask permission".[4] The program is self sustaining and financially independent, working as a non profit, often partnering with Community Development Corporations to build market rate and entry level housing. The proceeds from the sale of one project are used to fund the next.

The loading for Studio 804 is fixed, ongoing and immersive, allowing the students and faculty to plan ahead and anticipate opportunities. The students are immersed in the experience for a semester, receiving a full twelve-unit load and credit for design studio as well as practicum and professional practice electives. This allows the students to focus completely on the task at hand while remaining on track for graduation.

Since the projects built and sold by Studio 804 are typically market rate and privately owned, they exist outside the University and are maintained by the new owners. The cash flow generated by

Figure 5: The Eco Center; interior

the sale of the projects covers a certain amount of overhead including basic workers compensation insurance to cover the studio. In addition, each student is required to research and purchase an individual insurance policy which covers carpentry for a six-month period as a condition of the class.

Studio 804 is successful in many respects as an ongoing model for design-build precisely because it has, to great extent, removed itself from the University; a process which, oddly enough, required the enthusiastic support of the acting administrators. In the words of Rockhill, "a supportive Dean and Chair were central to the program's success".[5] The program is largely independent but is still able to offer students full credit for the experience.

This author continues to search for programs and precedents that my University and others can use as models as they move forward and strengthen commitments toward the integration of built work into architectural education.

ENDNOTES

1. Resource-balancing Design of the FSEEC-LandLab (Motloch 2002), Environmental Learning Center Strategic Planning and Charette (Badger, Brown and Motloch, 2005)
2. Excerpts from student round table discussion, 2009, published by graduate student Marty Merkel in Archifestos, BSU Architecture Library, 2009
3. Toshiko Mori; immaterial / ultramaterial, Harvard Design School, 2002 pp xiiv
4. Excerpt from phone interview with Dan Rockhill; 11-17-09
5. Excerpt from phone interview with Dan Rockhill; 11-17-09