BRUCE HAGLUND

University of Idaho

McCall Field Campus Studio

Fall 2006 Arch. 553 Comprehensive Design Studio

Summary of Studio Work Here

PROGRAM STATEMENT

F2006 from small living pods of 800 to 1500 square feet to larger institutional buildings. Program developed with client. F2007 From small infill units of 800 sq ft to big box of over 75,000 sq ft. Program specified in design competition document.

Graduate Architecture students in both, undergraduate Landscape Architecture and Interior Design students plus Graduate Conservation Social Sciences students in F2006.

Rocky Mountain climate, Idaho

Special Focus: Affordable Housing

One of the studio foci was affordable housing. F2006 affordable carbon neutral student housing to serve as an example to Idaho residents. F2007 affordable infill housing as specified in competition brief.

Special Focus: Energy Simulation

Yes, we used Ecotect to study thermal and lighting issues and HEED to study thermal and energy cost issues. Opaque was used to study thermal properties of walls. Revit used in F2007 for sun and material studies. Sketch-up also used for sun penetration and material use studies.

climate + type PROFILE

Special Topic: Energy Simulation

One of the studio foci was affordable housing. F2006 affordable carbon neutral student housing to serve as an example to Idaho residents.

The following software was utilized in this project:

Used Ecotect to study thermal and lighting issues and HEED to study thermal and energy cost issues. Opaque was used to study thermal properties of walls. Sketch-up used for sun penetration and material use studies.

Parallel Course Description

Included a paper that reviews pros and cons of interdisciplinary work comparing a collaborative to non-collaborative studio.

Studio KEY

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TEACHING TOPICS PROFILED

1. Integrated Master Plan

Prepare a well-integrated master plan for the site. Form a collaborative team to set goals and create the plan. The final master plan is presented by the team in a studio critique.

2. Daylighting Performance

Design for good daylighting performance. Use Ecotect software to predict daylight levels for morning, noon, and afternoon for all seasons. Document the investigation. Make sure daylight levels are adequate and cooling season sunlight penetration is controlled.

3. Integrated Building Enclosure

Design an integrated building enclosure that uses appropriate materials and model the enclosure in three dimensions, develop connection details, and make sure that the envelop is fully insulated, daylighting and natural ventilation are allowed, and appropriate materials are used.

4. Integration of Systems

Design for integration of systems, opting for passive systems first with active/mechanical systems as well-integrated back-ups. Use sectional drawings to demonstrate strategies. Ecotect was used to model thermal and lighting systems and procedures from The Green Studio Handbook were used to size the cistern.

5. Sustainable Building

Design a sustainable building. Analyze the strengths and weaknesses of twenty-two facets of the design. Use the SBSE Regeneration-Based Checklist for Design and Construction as the evaluation tool.

6. Complimentary Daylighting and Ventilation System

Design complementary daylighting and ventilation systems. Model the proposed design iteratively in HEED to refine its thermal and lighting strategies. Use HEED to compare the performance of the proposed design to a similar design that simply meets code.

7. Storm Water Management

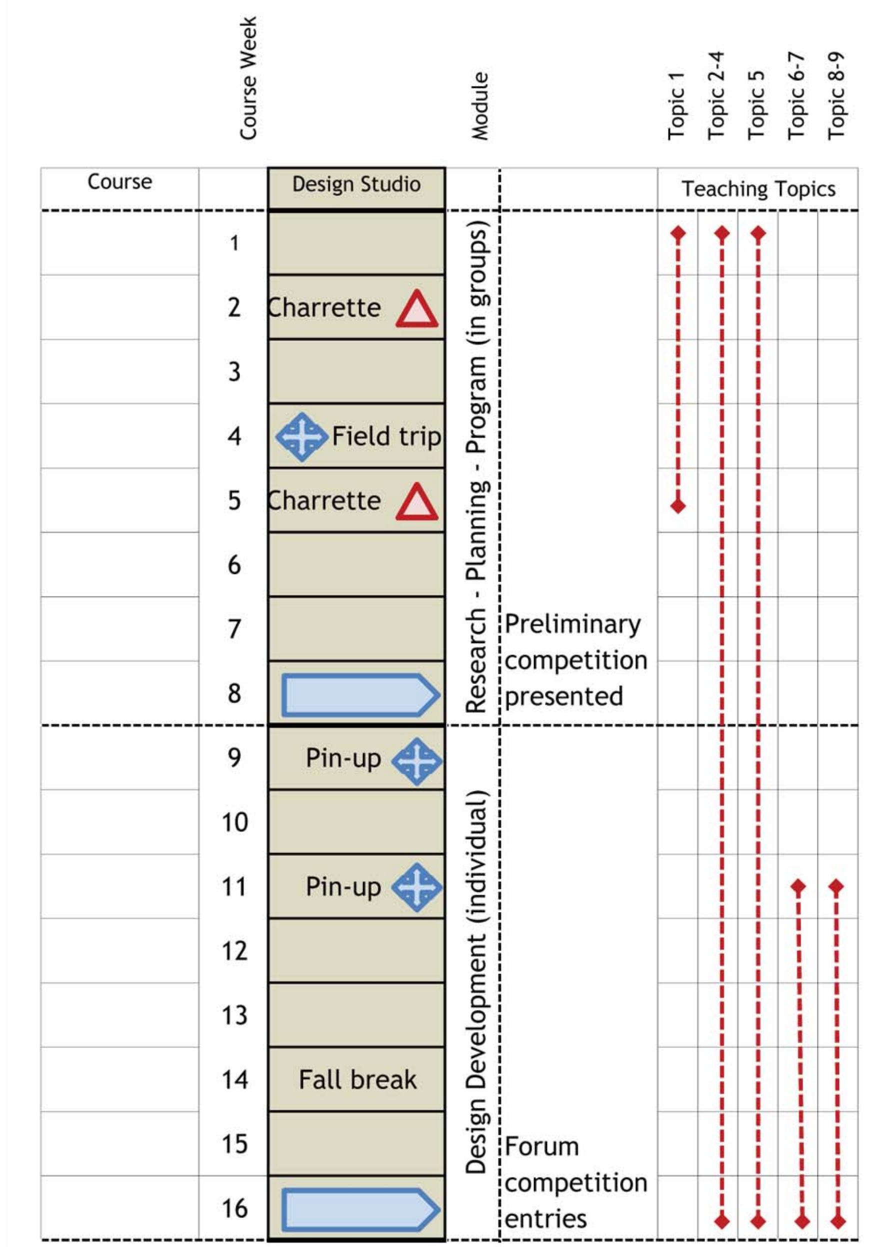
Design for responsible storm water management. Design roofs to drain to cisterns. The building's metal roof was designed to make the water collection apparent and an aesthetic statement. Perform cistern sizing calculations using techniques in InsideOut or The Green Studio Handbook. Show how the system is integrated with other technical systems and design aesthetics.

8. Affordable Housing: Local Underutilized Materials

Use local and underutilized materials to reduce cost and carbon. Research availability of local underutilized materials. Opaque software from UCLA was used to model the thermal properties of the wall, while HEED was used to model the thermal performance of the building.

9. Affordable Housing: Small Lots/Small Enclosures

Develop a master plan that doubles the density of an existing neighborhood while holding individual floor plans to 800 sq.ft. or less.



Philosophy of CND Studio Instruction

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F2006 McCall Field Campus Studio

Carbon Neutral Design Requirements

What is your carbon emissions intent for this project? How do you define success relative to this intent? What evidence that this intent has been successfully met can be found in this project? Show how your project meets Mazria's requirements in all phases of the construction process.... (course syllabus)

What is your philosophy of Carbon Neutral Design Studio Instruction?

Graduate level carbon-neutral design studio requires a trans-disciplinary approach to design similar to integrated practice. It should be stressed that designers need to put simple and effective passive strategies into place before considering active and mechanical solutions. The designer needs to take responsibility for the ultimate performance of the project, so should extensively model and refine the design using many available and appropriate tools. All scales must be considered from regional to site, to building, to detail. And all building systems must be integrated. A beautiful result should be achieved, otherwise it isn't loved or sustainable.

Any detail on multi-disciplinary group process that would be wisdom to pass on?

I find that these projects work best when interdisciplinary respect is encouraged. Master planning, programming, site analysis and conceptual design (all the early on activities) are best for interdisciplinary teams… sorta like integrated design in practice. In the 2006 studio teams developed program, did research and site analysis, and created a master plan during the first 8 weeks of the studio. During the later 8 weeks each individual developed a bit of the master plan as his/her comprehensive design project. This studio was exceptionally successful. I wrote a PLEA paper about the comparison of the studios, which I up loaded to your site earlier this fall. (see Resources)

Toward a Carbon Neutral Future: McCall Field Campus
(SYLLABUS excerpt)

This project is undertaken in response to Ed Mazria's challenge to the architecture profession to produce carbon neutral buildings by 2030. His case is well-articulated on his web site www.architecture2030.com. Both the AIA and the Association of US Mayors have endorsed Mazria's challenge. Mazria reckons that each year in the U.S. we tear down about 1.75 billion square feet; renovate 5 billion, and build 5 billion. Therefore, in 30 years 300 billion square feet will be renovated or built new; about 75% of the built environment. If this is accomplished with carbon in mind, global warming can be controlled.

Our studio will be one of the first in the country to take up Mazria's challenge. In the recently released AIA COTE report Ecology and Design, when asked by students to recommend a place to study green architecture, Randy Croxton FAIA noted, "I can only give partial recommendations since the progress that has been made is usually in partial content of the main design studio, or more likely, a separate course or activity. Until there are faculty who have fully integrated sustainability as a central design value, an inherent dimension of design excellence in the design studio, there will be no good answer to this request." ...

Synoptic View

"To affect the quality of the day, that is the highest of arts." (Henry David Thoreau).

Increasingly, designers are engaged in projects that transcend the specificity of the projects themselves in their impact. We are becoming progressively more aware of the mutual global, cultural, economic, environmental, and technological impacts of and on our design and planning decisions. We are also gaining perspective and momentum as we respond to the complexity inherent in real design scenarios. This complexity demands that we become intentional in our interdisciplinary pursuits as we approach a design problem, define and articulate it, explore its depths and expanses, and envision alternative solutions. Through this engagement with a problem, care must be taken not to become hindered by boundaries of disciplinary knowledge and expertise, but rather allow the freedom of exploration to emerge from an integrated open systems approach; conceptualizing the work of the team as a whole as an eco-system, where boundaries become blurred, interdependencies abound, and a dynamic and flexible reconfiguration of roles occur.

Of particular interest at this point of time are issues dealing with our sense of place, place identity, security, access, sustainability, and participation. This semester we will explore ways to create places that enrich the soul and imagination while simultaneously solving real design problems, be cognizant of regenerative design schemes, and employ an interdisciplinary perspective to address contemporary societal concerns. At this point of your academic journey, you have acquired skills and perspective that will assist you in lending expertise to and learning from an interdisciplinary conversation.

This phase simulates the work of an integrated practice where architects, interior designers, and landscape architects and their clients and consultants initiate a project and develop its master plan. We'll work with Steve Drown's LArch459 students and Rula Awwad-Rafferty's ID451 students as well as with our client group and carbon-neutral collaborators. ...

10 Critical Issues / 10 Common Mistakes

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10 Critical Issues in Teaching Carbon-Neutral Design

1. *Develop an interdisciplinary design project.*
2. *Consider site scale planning issues first.*
3. *Fit program to site.*
4. *Discover local resources for materials and construction methods.*
5. *Use low-carbon materials.*
6. *Design for passive heating/cooling/lighting/water systems first.*
7. *Specify a well-insulated building envelope.*
8. *Ensure that thermal/structural/spatial/lighting/materials/water/accessability/aesthetic systems are appropriate and well-integrated.*

10 Student Design Mistakes that Undermine the Goal of Carbon-Neutral Design

1. *Solving the wrong problems based on lack of analysis.*
2. *Tacking energy systems onto a preconceived design notion.*
3. *Lack of integration of site and building design.*
4. *Not thinking holistically.*
5. *Little consideration for the user.*
6. *No modeling of design performance to prove the concept.*

Supporting Material

COURSE MATERIALS

The syllabus and annotated resource list for my two carbon-neutral studios are web-based at http://www.caa.uidaho.edu/arch553haglund/description.htm

PAPERS

(PDF) (verify use) Haglund, B. *Pioneering the 2010 Imperative in Studio: Carbon-Neutral Studios 2006 and 2007.* PLEA 2008 – 25th Conference on Passive and Low Energy Architecture, Dublin, 22nd to 24th October 2008

STUDENT WORK

(PDF) The Druk White Lotus School case study draft.

Integrated Master Plan

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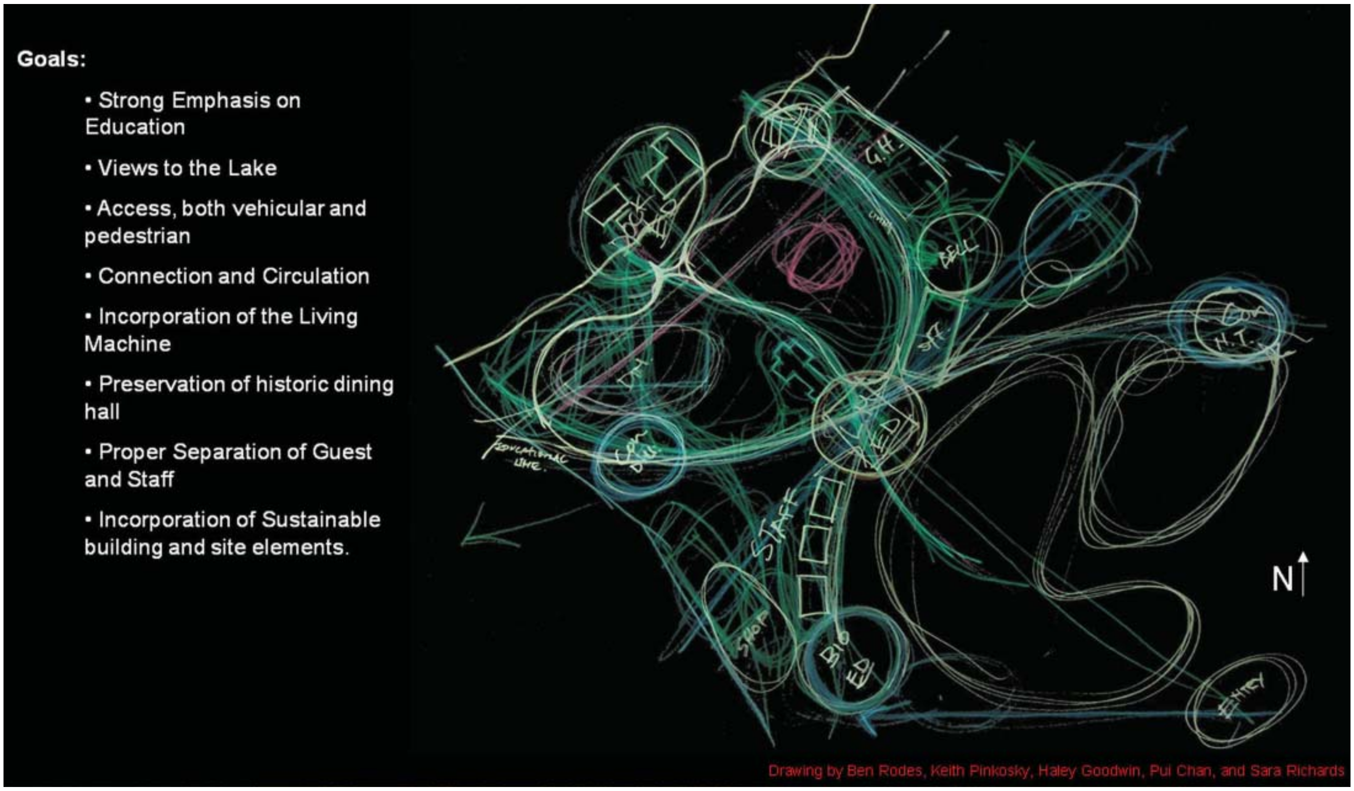
University of Idaho

F2006 McCall Field Campus Studio



Sketch Master Plan and Goals

Ben Rodes, Keith Pinkowsky, Haley Goodwin, Pui Chan and Sara Richards

Plan and goals developed by an interdisciplinary team after a site visit and program development based on the client's documents and interviews with users.

Design/Performance Objective

Prepare a well-integrated master plan for the site.

Investigative Strategy

Form collaborative teams to set goals and create the plan. In this instance the initial drawing with goals articulated was made by Ben Rodes & Keith Pinkosky (Landscape Architecture), Haley Goodwin (Interior Design), and Pui Chan & Sara Richards (Architecture). A more refined drawing that was embraced by the design team ensued.

Evaluation Process

This process drawing and the final master plan were presented by the team in a studio critique.

Evaluative Criteria

The final master plan was evaluated for conformation to goals and fit with the site. The client group was included in the critique.

Cautions- Possible Confusions

Be critical in articulating goals. Edit client's laundry list of goals to a handful of over arching goals. Too many goals makes master planning difficult.

Duration of Exercise

The goals and master plan were developed during the first eight weeks of the studio.

Degree of Difficulty

This work was undertaken by final year students in comprehensive studios in architecture, interior design, and landscape architecture.

References

Client documents and interviews.

Daylighting Performance

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F2006 McCall Field Campus Studio

Figure 1: Ecotect Model: Daylighting Study

Sara Richards

The office design shows adequate daylight levels on the first-floor workplane in office spaces for an overcast day at the winter solstice, the worst case scenario for illumination levels. Yellow squares in the grid indicate the highest illumination levels, blue the lowest. The building was zoned to place work spaces at the edges and conference rooms and service spaces in the interior.

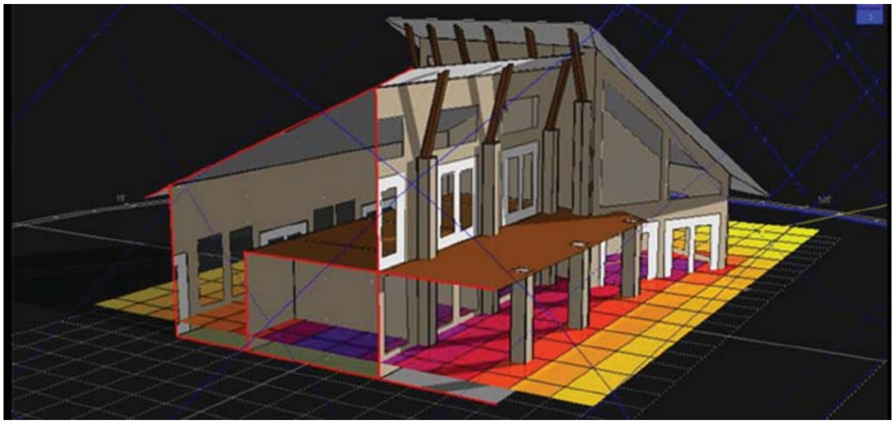
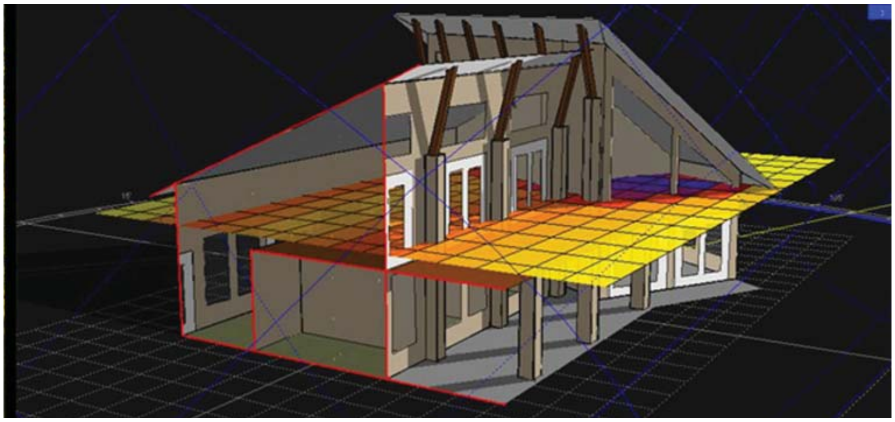


Figure 2: Ecotect Model: Daylighting Study

Sara Richards

The office design shows adequate daylight levels on the second-floor work plane in office spaces for an overcast day at the winter solstice. Note 3-D sun path diagram (blue grid) superimposed over building model.



Design/Performance Objective

Design for good daylighting performance.

Investigative Strategy

Use *Ecotect* software to predict daylight levels and sun penetration for morning, noon, and afternoon for all seasons. Document the investigation. Sara Richard's office design shows adequate daylight levels for an overcast day at the winter solstice. The building was also modeled for other times of year and for sunlight penetration using *Ecotect*.

Evaluation Process

This analysis model was presented at the final studio critique. The *Ecotect* model was built and used during the design development phase.

Evaluative Criteria

Make sure daylight levels are adequate for each space's needs (e.g., 30 fc for office work) and cooling season sunlight penetration is controlled (minimal), especially in spaces where glare and/or overheating is at issue.

Cautions- Possible Confusions

Ecotect models are most useful when made early in the design process so that they can be used to test design options for window size and placement. *Ecotect* also models multiple thermal zones for passive and active system performance. Outputs are graphic and clearly show the relationship between performance and space.

Duration of Exercise

This work was presented at the culmination of an eight-week comprehensive design phase. *Ecotect* models require a sustained effort to generate and use.

Degree of Difficulty

This is work assigned to a graduate student in her penultimate studio taken after all of the basic technical courses on structures and environmental systems. The student was also concurrently taking a graduate seminar on building integration.

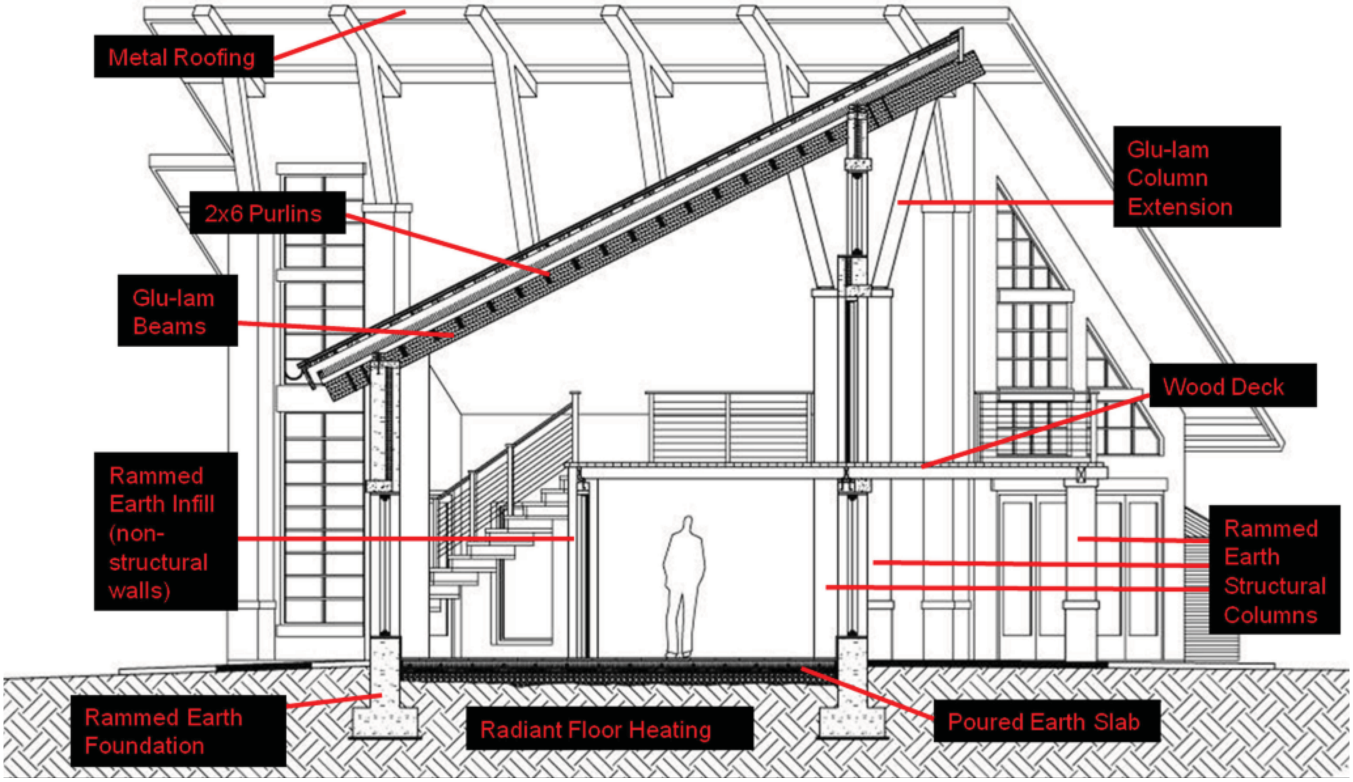
References

The Green Studio Handbook, Kwok & Grondzik
Ecotect web <http://www.squ1.com>

Integrated Building Enclosure

Bruce Haglund
University of Idaho

F2006 McCall Field Campus Studio



Building Cross Section
Sara Richards

This north-south section effectively demonstrates both the material palette and the construction details of the building envelop.

Design/Performance Objective

Design an integrated building enclosure that uses appropriate materials and moderates the environmental forces to the occupants' advantage.

Investigative Strategy

Model the enclosure in three dimensions, develop connection details, and specify materials. For Sara's high country office a well-insulated skin with a steel cold roof that sheds snow, resists forest fire, and is appropriate for integration with photovoltaics and water collection was developed. Rammed and poured earth (to minimize Portland cement use) and engineered and small dimension lumber (locally available materials) were used to minimize the carbon footprint for construction.

Evaluation Process

Make sure that the envelop is fully insulated, daylighting and natural ventilation are allowed, and appropriate low-carbon and local materials are used.

Evaluative Criteria

The drawing was presented as part of the studio's final critique. Evaluation was based on appropriate low-carbon material choices and feasibility of construction as well as integrity of the building envelop.

Cautions- Possible Confusions

The aim of the studio was to design a building that was near zero carbon in both construction and operation. Material choices affect the former and enclosure details affect the latter. It's important to keep both in mind while designing and to manage the trade-offs well.

Duration of Exercise

This work was presented at the culmination of an eight-week comprehensive design phase.

Degree of Difficulty

This is work assigned to a graduate student in her penultimate studio taken after all of the basic technical courses on structures and environmental systems. The student was also concurrently taking a graduate seminar on building systems integration.

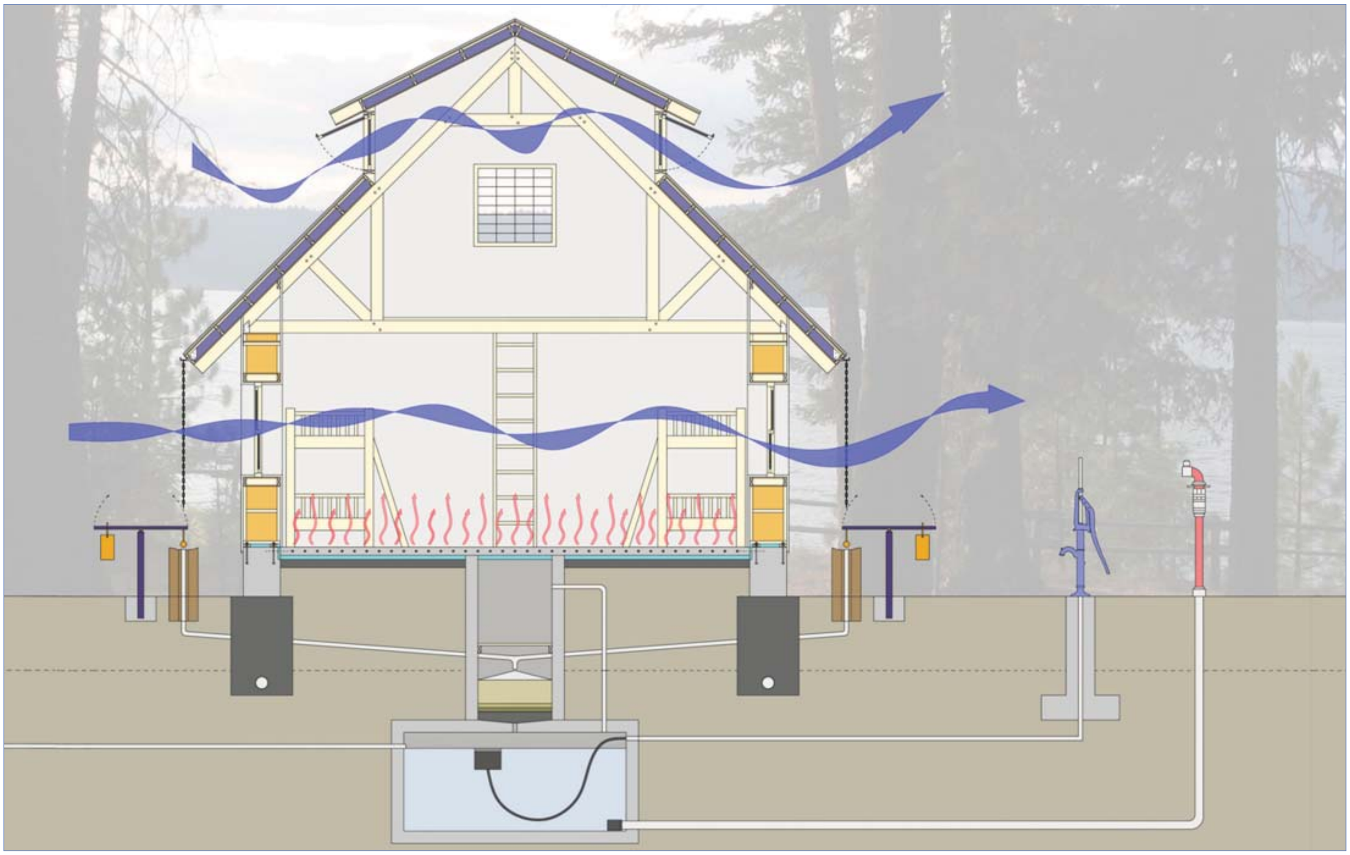
References

The Green Studio Handbook, Kwok & Grondzik
Sun Wind and Light, Brown & DeKay

Integration of Systems

Bruce Haglund
University of Idaho

F2006 McCall Field Campus Studio



Building Systems Integration
Paul Marx

This cross-section demonstrates several interdependent passive and active systems—well-insulated straw bale walls and SIP roofs; clerestory windows for stack and cross-ventilation as well as daylighting; lower windows for cross-ventilation, daylighting, and views; metal cool roofs for summer comfort, prevention of icicles, rainwater collection, and fire resistance; passive systems for selecting, filtering, and drawing cistern water; and a hydronic radiant floor for heating.

Design/Performance Objective

Design for integration of systems, opting for passive systems first with active/mechanical systems as well-integrated back-ups.

Investigative Strategy

Use sectional drawings to demonstrate strategies. Paul Marx's cabin demonstrates a reliance on passive systems for controlling heat flow (super insulation), ventilation (operable windows), lighting (adequate fenestration), and water catchment (for drinking and fire safety). Mechanical hydronic radiant floor heating (with a bio-fuel central power and heat plant) is used to augment modest solar gains. No mechanical cooling is specified. *Ecotect* was used to model thermal and lighting systems and procedures from *The Green Studio Handbook* were used to size the cistern.

Evaluation Process

This cross-section was presented at the final studio critique. The *Ecotect* model was built and used during design development.

Evaluative Criteria

Check for the primacy of passive systems, their integration, and use of complementary mechanical systems.

Cautions- Possible Confusions

Ecotect models are most useful when made early in the design process so that they can be used to test design options. Outputs are graphic and clearly show the relationship between performance and space.

Duration of Exercise

This work was presented at the end of an eight-week comprehensive design phase.

Degree of Difficulty

This is work assigned to a graduate student in his penultimate studio taken after all of the basic technical courses on structures and environmental systems.

References

The Green Studio Handbook, Kwok & Grondzik
Ecotect web <http://www.squ1.com>

Sustainable Building

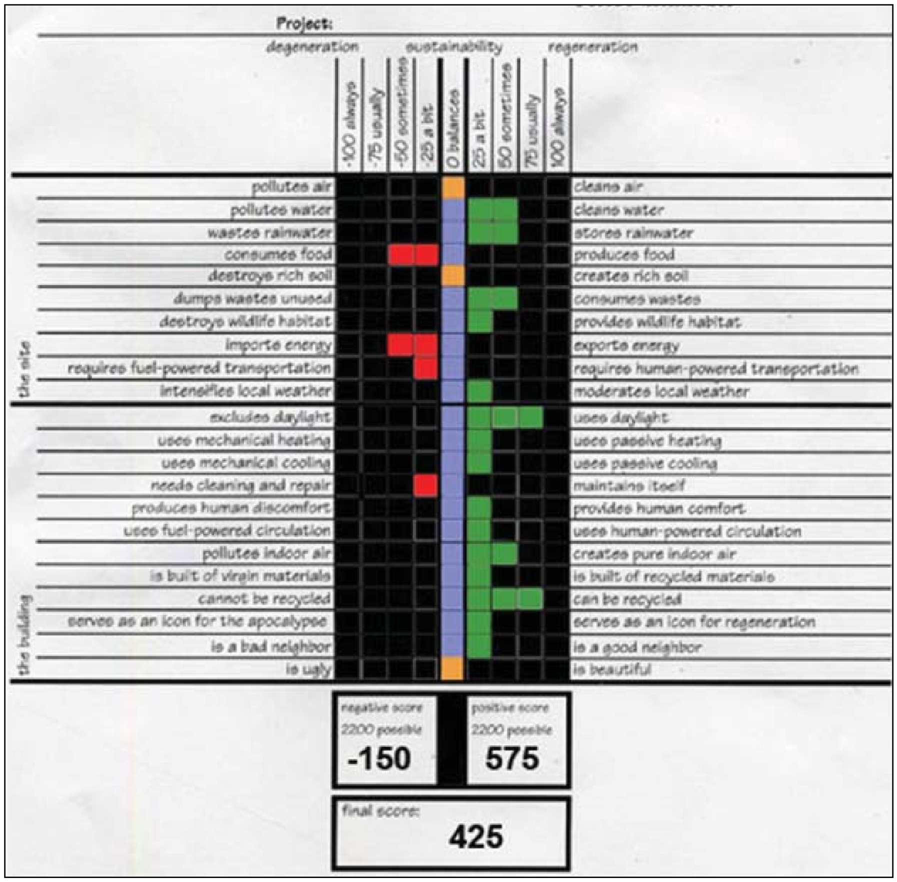
Bruce Haglund
University of Idaho

F2006 McCall Field Campus Studio

University of Idaho
McCall Field Campus

SBSE Checklist for Regenerative Design and Construction
Ed Ostrom

The checklist (based on Malcom Wells' earlier version) demonstrates the strengths and weaknesses of Ed's proposed building. Overall, it's rated as sustainable, but not regenerative.



Design/Performance Objective

Design a sustainable building.

Investigative Strategy

Analyze the strengths and weaknesses of twenty-two facets of the design. Ed Ostrom's classroom building has weaknesses in food production, transportation, energy source, and repair and cleaning; yet has strengths in many other areas, so is considered sustainable, but not regenerative.

Evaluation Process

Use the *SBSE Regeneration-Based Checklist for Design and Construction* for evaluation.

Evaluative Criteria

A successful project has more positive ratings than negative ones. A balanced rating of zero is considered sustainable.

Cautions- Possible Confusions

The checklist is subjective in nature. It is best used to compare design alternatives during the design process because it presents a full range of issues. Its most effective use as an evaluation tool is by having the entire class discuss each item for a design and come to a consensus on its value. Alternatively, each student can rate a project after it's presented. Then their ratings can be compiled to show consensus. The checklist doesn't evaluate carbon used in construction, so Mithūn Architects' carbon calculator can be used in augmentation.

Duration of Exercise

This work was presented at the culmination of an eight-week comprehensive design phase. The rating itself can be done in a short time.

Degree of Difficulty

This is work assigned to a graduate student in his penultimate studio taken after all of the basic technical courses on structures and environmental systems.

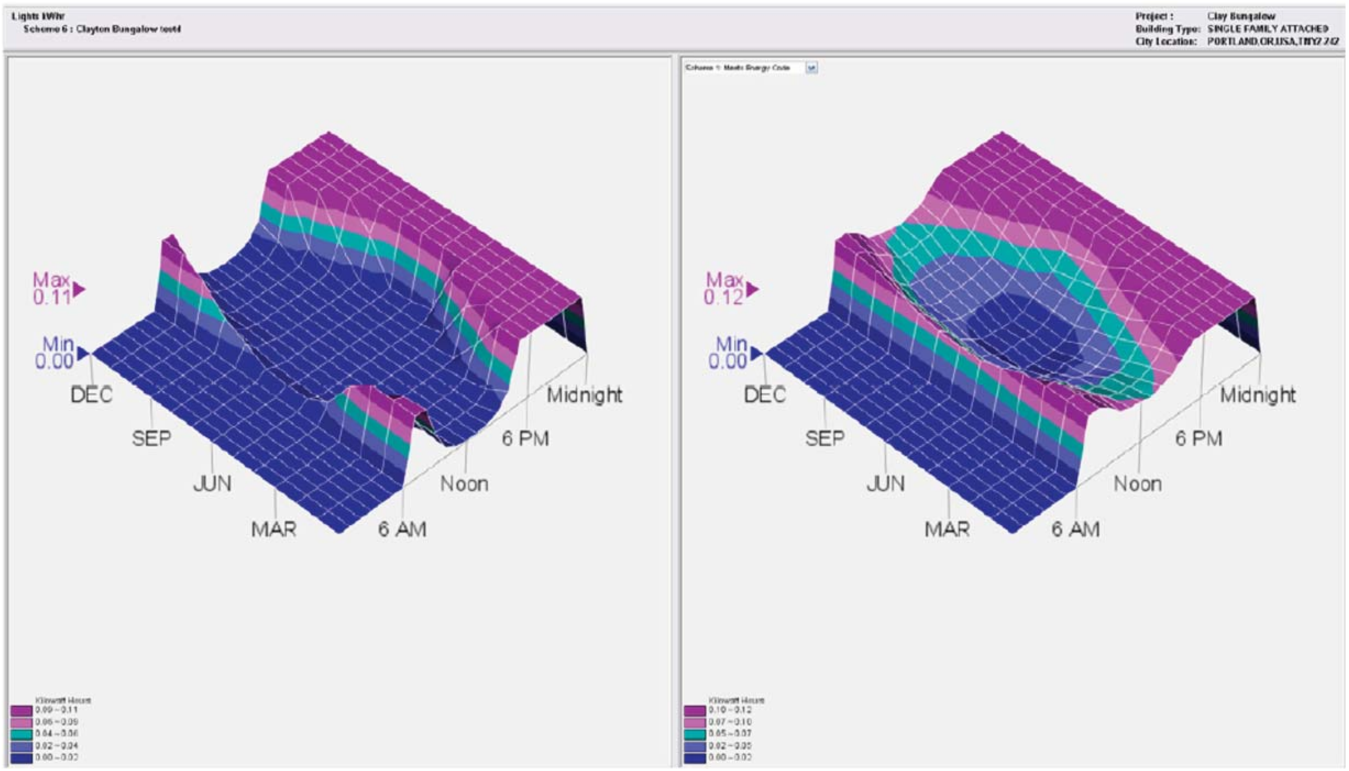
References

The SBSE Checklist for Regenerative Design and Construction and instructions on the SBSE web <http://www.sbse.org/resources/>
Mithūn Architects, "Construction Carbon Calculator (beta)," <http://buildcarbonneutral.org/>

Complementary Daylighting and Ventilation System

Bruce Haglund
University of Idaho

F2007 Integrated Habitats Studio



HEED Analysis: Daylighting
Clayton Harrison

"The glazing system that helped with ventilation also allows an efficient daylighting design."

These side-by-side charts compare electric lighting required (kwhrs) during occupied hours for the daylighted building (left) and the built-to-code building (right). The daylighted building uses much less electric lighting.

Design/Performance Objective

Design complementary daylighting and ventilation systems.

Investigative Strategy

Model the proposed design iteratively in *HEED* to refine its thermal and lighting strategies. Clayton Harrison's 600+ sq.ft. infill unit shows that the operable windows for ventilation also enhance its daylighting abilities.

Evaluation Process

Use *HEED* to compare the performance of the proposed design to a similar design that simply meets code.

Evaluative Criteria

Check for reduced carbon emissions and energy use as well as effectiveness of daylighting and passive strategies. *HEED* models all of these and provides side-by-side graphic comparisons of each system or component's performance as well as whole building performance.

Cautions- Possible Confusions

HEED automatically calculates the performance of a code compliant building (Scheme 1) and a better-than-code model (Scheme 2) based on appropriate strategies for the climate. Students can model their buildings (Schemes 3 thru 9) and investigate various design possibilities. *HEE*D uses *Energy Plus* weather files available at no cost from the DOE *Energy Plus* web site, which include stations for over 1000 U.S. locations and for major cities worldwide.

Duration of Exercise
This work was presented at the end of an eight-week comprehensive design phase. *HEED* models can be created in less than an hour.

Degree of Difficulty

This is work assigned to a graduate student in his penultimate studio taken after all of the basic technical courses on structures and environmental systems.

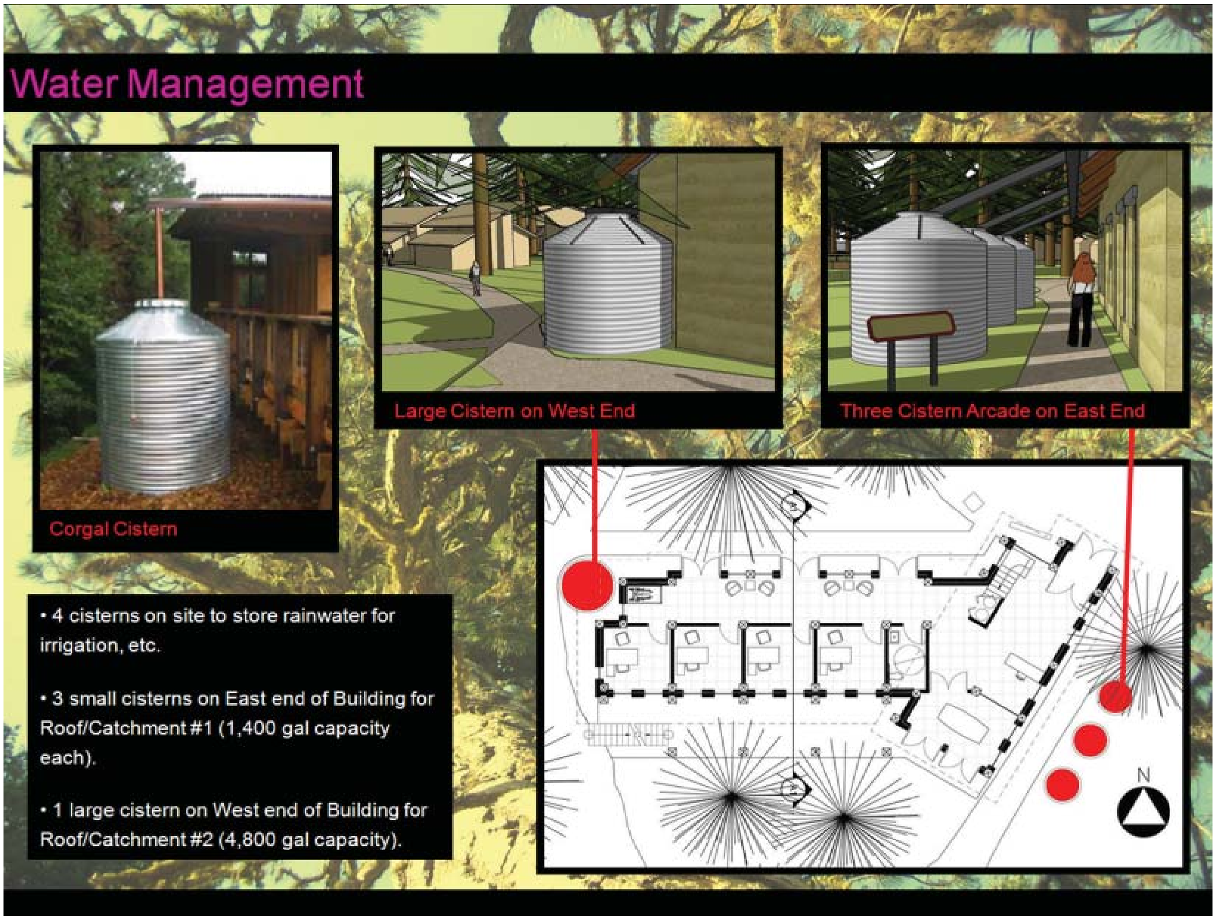
References

HEED web <http://www2.aud.ucla.edu/energy-design-tools/>
Energy Plus web <www.energyplus.gov>

Storm Water Management

Bruce Haglund
University of Idaho

F2006 McCall Field Campus Studio



Storm Water Management
Sara Richards

This presentation slide shows a design precedent, the plan relationship between building and cisterns, and the aesthetic effect of cisterns (especially successful—the use of cisterns to form an arcade).

Design/Performance Objective

Design for responsible storm water management.

Investigative Strategy

Design roofs to drain to cisterns. The building's metal roof was designed to drain to a series of corrugated metal cisterns that enhanced the design intent of 'architecture as pedagogy' by making the water collection apparent and an aesthetic statement.

Evaluation Process

Perform cistern sizing calculations using techniques in *InsideOut* or *The Green Studio Handbook*. Show how the system is integrated with other technical systems and design aesthetics. Collected water can be used for drinking, toilet flushing, landscape irrigation, and forest fire protection

Evaluative Criteria

Make sure cisterns are sized correctly and well-integrated technically and aesthetically.

Cautions- Possible Confusions

Roof materials should be selected for compatibility with cistern use. For this project fire-resistance and snow loads also need to be considered.

Duration of Exercise

This work was presented at the culmination of an eight-week comprehensive design phase.

Degree of Difficulty

This is work assigned to a graduate student in her penultimate studio taken after all of the basic technical courses on structures and environmental systems. The student was also concurrently taking a graduate seminar on building integration.

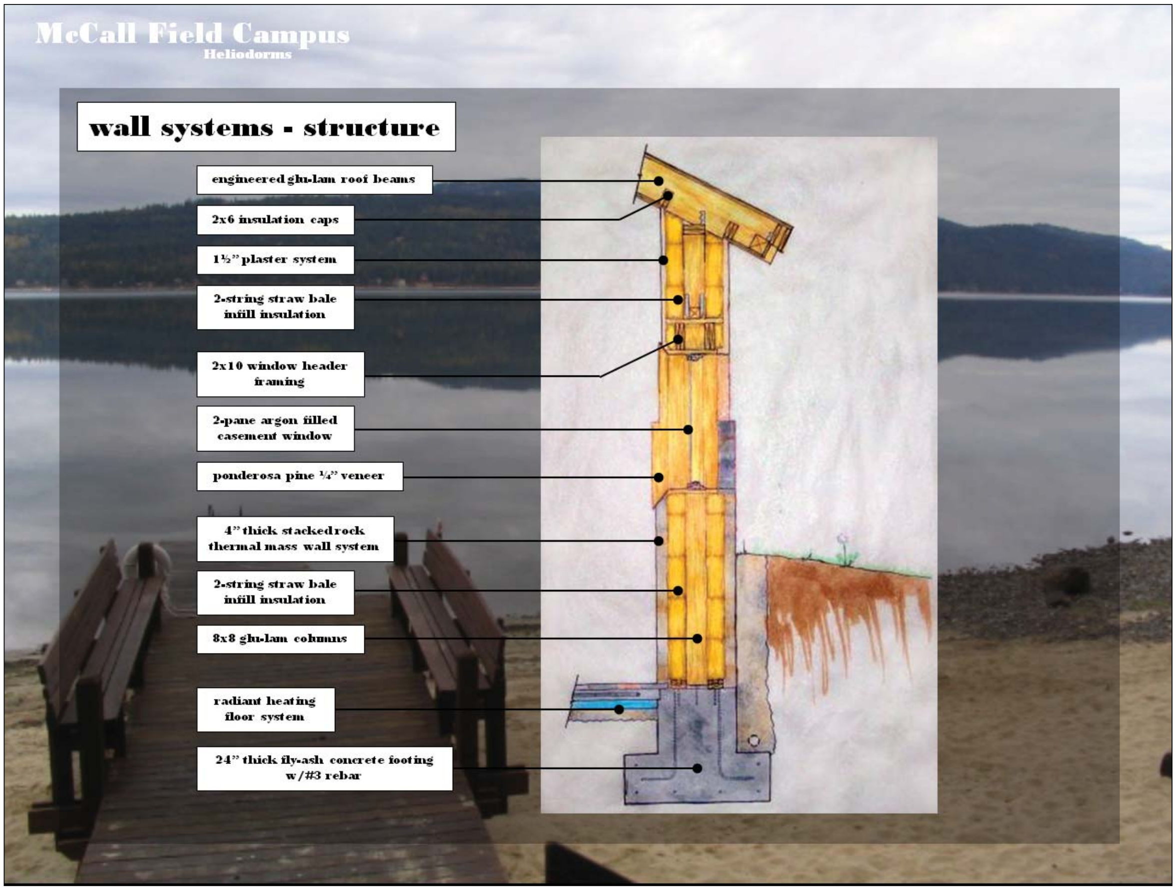
References

The Green Studio Handbook, Kwok & Grondzik

Affordable Housing: Use Local Underutilized Materials

Bruce Haglund
University of Idaho

F2006 McCall Field Campus Studio



Wall Systems - Structure
Mark Weagel

The wall section illustrates the use of locally produced straw bales and lumber as well as flyash and windows produced regionally.

Design/Performance Objective

Use local and underutilized materials to reduce cost and carbon emissions.

Investigative Strategy

Research availability of local underutilized materials. Mark Weagel's wall section shows the use of straw bales from nearby farming operations, glu-lam beams from a regional manufacturer in Boise (ID), windows from a factory in Bend (OR), flyash from Montans coal-fired power plants (ugh!) and ponderosa pine from the local mill. The wall is a super-insulated composition that will minimize energy used for heating, especially since the building features sufficient thermal mass and a wide southern aperture.

Evaluation Process

Opaque software from UCLA was used to model the thermal properties of the wall, while *HEED* was used to model the thermal performance of the building.

Evaluative Criteria

A successful project uses far more local materials than exotic ones and exploits at least one under-used material. The materials are combined to create a high-performance wall as demonstrated by the *HEED* and *Opaque* analyses.

Cautions- Possible Confusions

Research is necessary to determine the availability and suitability of local and regional products, recycled components, and under-used materials.

Duration of Exercise

This work was presented at the culmination of an eight-week comprehensive design phase.

Degree of Difficulty

This is work assigned to a graduate student in his penultimate studio taken after all of the basic technical courses on structures and environmental systems.

References

HEED and *Opaque* web <http://www2.aud.ucla.edu/energy-design-tools/>

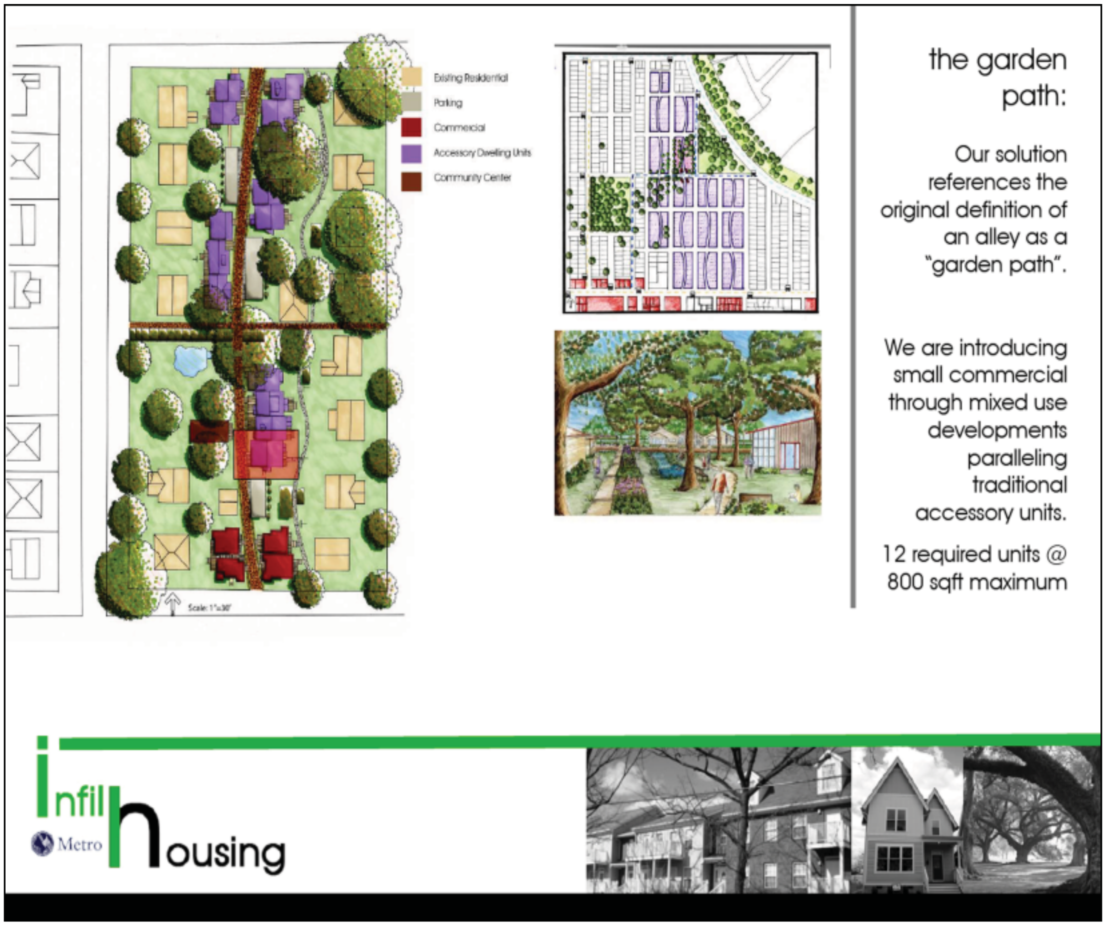
Affordable Housing: Small Lots/Small Enclosures

Bruce Haglund
University of Idaho

F2007 Integrating Habitats Studio

High Density/Small Lot Masterplanning
Clayton Harrison

The masterplan shows how in-fill housing can densify a typical mid-twentieth century single family occupancy residential block; and by extension, how it can transform the neighborhood.



Design/Performance Objective

Design small enclosures that reduce both first and operational costs. Design for increased density and small lot sizes.

Investigative Strategy

Develop a master plan that doubles the density of an existing neighborhood while holding individual floor plans to 800 sq.ft. or less. Clayton Harrison's master plan shows fifteen new units, four with small commercial or workplaces on the ground floor, arranged as in-fill units along the redesigned alley of an existing urban single-family occupancy neighborhood.

Evaluation Process

Evaluation Process. Design typical units to prove livability and rate the plan with the *SBSE Checklist for Regenerative Design and Construction*.

Evaluative Criteria

Compare before and after densities and check building size. Evaluate livability and sustainability with the SBSE checklist.

Cautions- Possible Confusions

Forming a local improvement zone can be a way of avoiding the restrictions caused by simply subdividing existing lots.

Duration of Exercise

This work was presented at the culmination of an eight-week comprehensive design phase.

Degree of Difficulty

This is work assigned to a graduate student in his penultimate studio taken after all of the basic technical courses on structures and environmental systems.

References

SBSE Checklist for Regenerative Design and Construction on the SBSE web <http://www.sbse.org/resources/>
Integrating Habitats web <http://www.integratinghabitats.org/>