

Passive Design and Daylighting For Buildings

Course Outline September 19, 2011

Matthew Woodruff MAIBC

Who Am I?

- A teacher at the British Columbia Institute of Technology in Vancouver, Canada
- A registered Architect with an expertise in public buildings
- A principal in my own architectural firm



- 1. Vancouver- Noel, Justin + Matthew (Project Management + Documentation)
- 2. Gulf Islands - Claudia + Matthew (Administration + Design).
- 3. Rome - Jody (Writing + Promotion).
- 4. Mumbai - Gresh (Support + Research).
- Upcoming travels:
 - June -Justin to Ireland
 - July - Jody to Toronto
 - Sept - Matthew + Claudia to Ferrara

Matthew Woodruff Architecture Inc.

Project Name: **Gulf Islands House**
Location: Southern Gulf Islands, BC
Project Type: Private House
Architect: Matthew Woodruff Architecture
Role: Matthew Woodruff
Principal / Project Architect
Project Size: 1,100 sf
Project Budget: \$200,000 (\$175/sf)
Project Status: Construction completed 2007

Problem Statement

This is a project with a normal program, a normal budget, and a normal site for a normal family. The program is straightforward (a two bedroom holiday house for a family of four) and the budget modest (\$175/sf). The site is small (1/3 acre) and unremarkable except for a good aspect (lots of sun, and shelter from winter storms) and the presence of four old apple trees. Given these parameters, the objective was to derive maximum benefit from the sun and the site, so orientation to the existing trees, to the sun, and to cool breezes from the adjacent valley were carefully considered.

Design Solution

The design is simple, with a compact plan, and careful attention placed in the siting of windows, doors and skylights to take maximum advantage of views, daylight and the specifics of the site's micro-climate. From sunrise to sunset the sky is a constant presence, making everyone aware of the character of the day. Electric lights are needed only at night, and the house can be heated even in the deepest winter using just the wood stove. In the winter the house is very social, with all of the action happening in the main room. In the summertime, when the doors are open, it's as cool as sitting under a tree, and the light reflected off the dried grass outside is warm and even. The house is a pleasure to live in and is very cheap to operate, using less than half of the energy of a conventional house of the same size.

Recognition

The Gulf Islands House has been featured in a number of periodicals both nationally and internationally, and has received the following awards:

- 2008 Lieutenant Governor's Award of Merit
- 2008 AIA/Dwell "Greenest of the Green" Award
- 2009 WoodWorks Residential Design Award
- The project has also been featured in the "Building Green" exhibit on display at the Surrey Art Gallery and Nanaimo Art Gallery in 2008 and 2009



Project Name: **Surrey Nature Centre Education Building**
Location: Surrey, B.C.
Client: City of Surrey
Project Type: Nature Education Centre
Architect: Matthew Woodruff Architecture
Role: Matthew Woodruff
Principal / Project Architect
Project Size: 4000 sf
Project Budget: withheld at Owner's request
Project Dates: on going

Problem Statement

The challenge with this project was to develop a Nature Education Centre for a new outdoor nature facility in the Green Timbers Urban Forest in Surrey BC. The project was required to have a strong architectural identity that reflected the Client's goals of advancing nature education and the public understanding of sustainability. Only limited means were available, and the project was required to be housed in an existing light industrial building on the site that was to remain largely untouched.

Design Solution

The design resulted from a careful study of both the character of the existing building, and the master-plan for the entire site. The existing rooms were found to have good proportions, and remain largely untouched except for the addition of one large element, either a skylight or a window in each. The main classrooms are oriented to the sky or an existing arboretum, each of which is celebrated by the master-plan. To the exterior facade have been added seven full height windows each of which is protected by a pair of brightly coloured full height shutters which are to be opened during the day and closed at night. In addition all of the ancillary rooms are entirely daylight, and a new well insulated building envelope will substantially reduce the current energy consumption of the project.



Matthew Woodruff Architecture Inc.

Project Name: **Surrey Nature Centre Outdoor Classroom**
Location: Surrey, B.C
Client: City of Surrey
Project Type: Outdoor Classroom Structure
Architect: Matthew Woodruff Architecture
Role: Matthew Woodruff
Principal / Project Architect
Project Size: 600 sf
Project Budget: withheld at Owner's request
Project Dates: ongoing

Problem Statement

The assignment for this project was to provide a discrete outdoor classroom structure which was integrated with the master-plan for the new outdoor nature centre facility in the Green Timbers Urban Forest in Surrey, BC. General rain protection was required and cost and visual impact were to be minimized.

Design Solution

The design that has been developed involves reusing an existing concrete foundation wall which served as sand storage for protecting seedlings when the site was originally used as a tree nursery. This foundation has been covered by a new articulated metal roof which acts as a sunshade, and as a giant gutter to direct rainwater towards a collection tank for integration with the water management and reuse plan for the site. This roof teaches the lesson of reuse of both physical infrastructure and natural resources, at the same time as providing useful shelter from the elements for visiting students.



Matthew Woodruff Architecture Inc.

Project Name: **Courtyard House**
Location: Mayne Island, B.C
Client: Private Client
Project Type: Single Family House
Architect: Matthew Woodruff Architecture Inc.
Role: Matthew Woodruff
Principal in Charge/Project Architect

Project Size: 1,800 sf
Project Budget: \$600,000
Project Dates: Completed 2009

Problem Statement

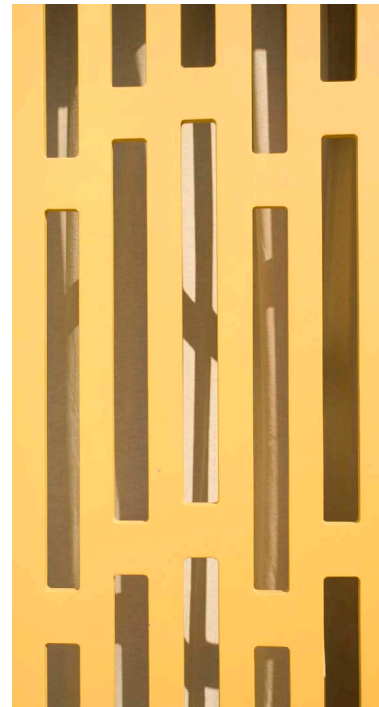
This house on a rural site, for a retired couple used to living in the city, was required to be cost effective, energy efficient, and easy to operate. The layout needed to accommodate two people living alone, and be expandable to suit visiting children and grandchildren for family holidays. The design brief required it address the natural beauty of the site but be internally self contained. Controlled spaces connected to the changes of the day and seasons were also requested, but clear instructions were given that these were to be beyond the vicissitudes of wild nature.

Design Solution

Three strategic decisions define the solution for this project. The first is that a full spectrum of environmental conditions should be available throughout the day and year. Thus, two insulated "shoeboxes", (one for living and one for sleeping) and two exterior courtyards (one facing northeast, the other southwest) were created. To further this goal, the plan of the house has been organized around a series of "temperature zones". The building envelope is well insulated, so that in winter the house can be heated entirely by the woodlots, while the large sliding doors support cross breezes that keep the house cool in summer. The floor to ceiling interior doors, and operable windows and skylights have been designed to encourage efficient airflow so that the temperature in any room can be expediently fine tuned.

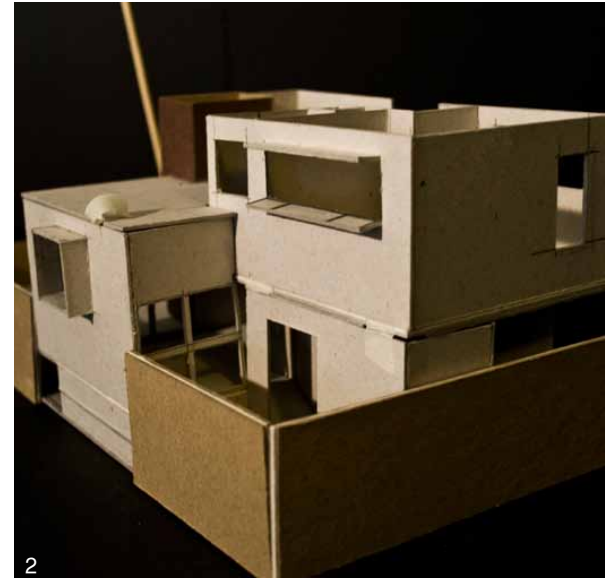
The second decision required that the entire building be naturally lit throughout the year whenever the sun is up. Thus great care has been taken in locating windows and skylights, and interior finishes have been chosen based on their reflective properties, and how they modulate the colour and character of the light. In tandem with the mutability of daylight, views from the interior spaces as well as the courtyards have also been carefully chosen to highlight the character of the site, with framed views of the water, forest and meadow all appearing at various points.

The third strategic decision involved the Client's request that they preferred to observe nature from a safe distance. Given this challenge it became important to bring the elements of nature indoors as much as possible. To this end, an emphasis has been placed on the use of natural materials, engagement with summer breezes, ensuring that changes in daylight can be observed indoors, and the collection of rainwater. Finally, the character of the front facades are defined by the presence of two pairs of sliding yellow screens, which manage the afternoon sun, and create a lively play of shadows inside.



From BCIT

EXAMPLES OF STUDENT WORK



16 Lane Way House 2

Preliminary Design Model

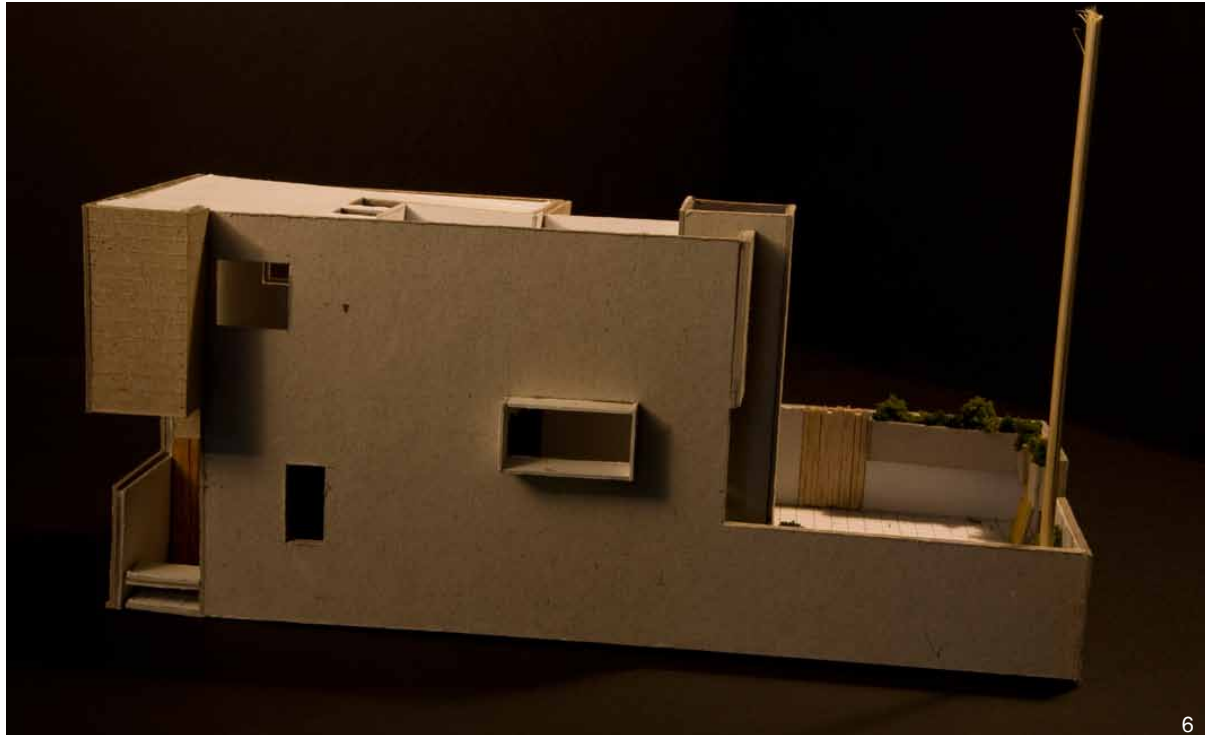
Lane view .1
East patio from garden .2
West patio from garden .3



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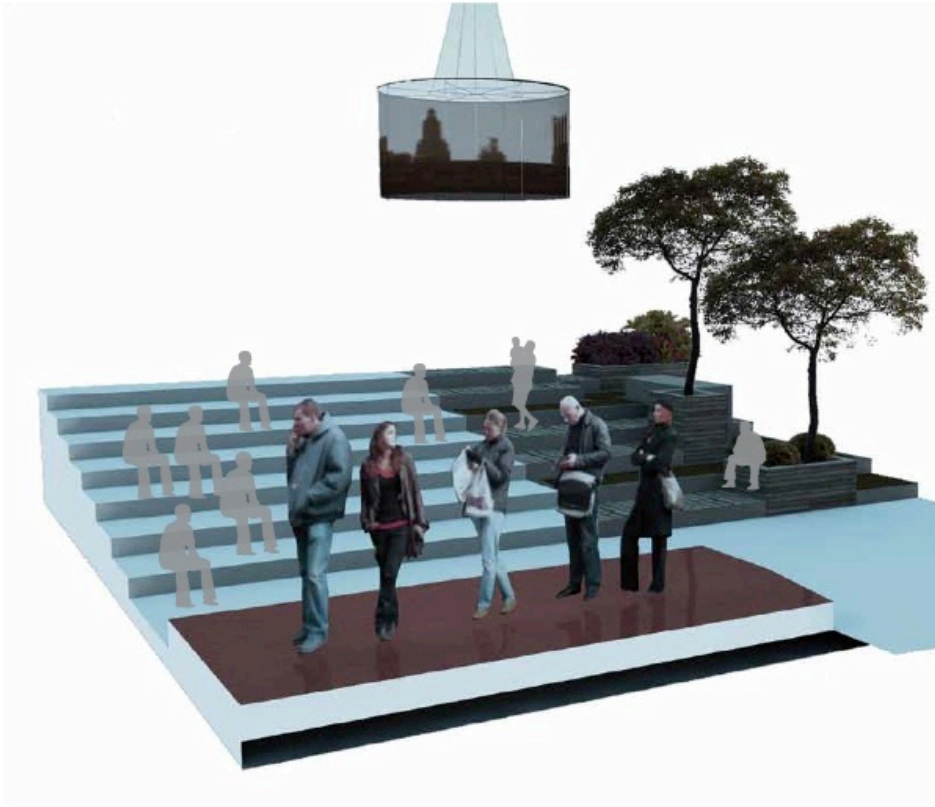
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6

- 4. Water feature on East patio
- 5. Sky lit Barragan steps in living room
- 6. Front (Lane) Elevation

theatre | urban steps | café



The public realm is also a theatre. It is a place for people to gather and show off talents and to exchange ideas and stories. In the summer time, the theatre stage extends to the outdoor. Small plays and music festivals happen on the stage and everyone in the community can participate.

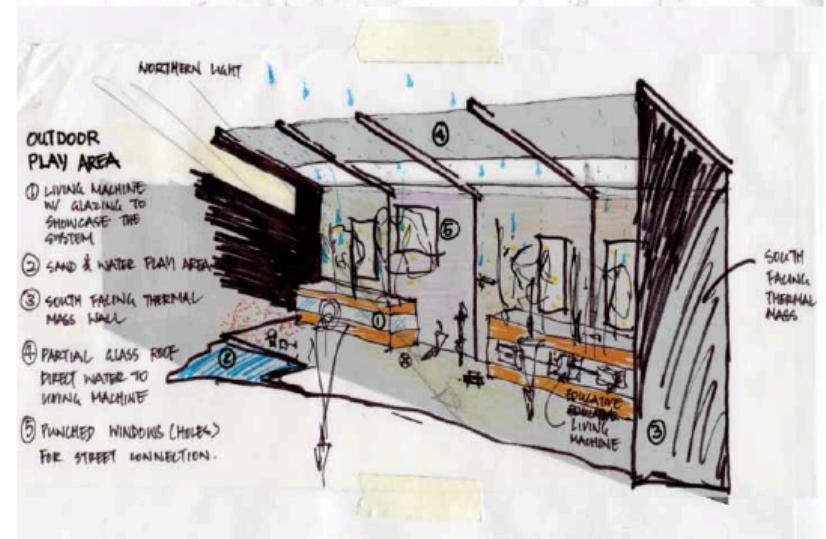
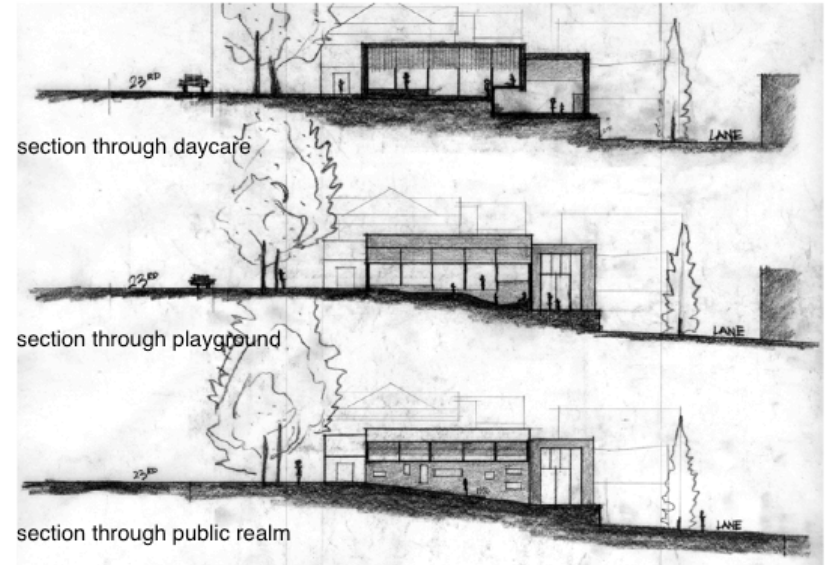
A retired couple operate the café serving bakery and coffee in the morning. The café also functions as a community kitchen for block parties and potluck dinners.



daycare

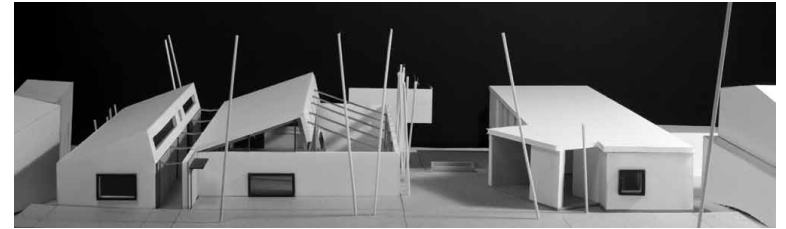
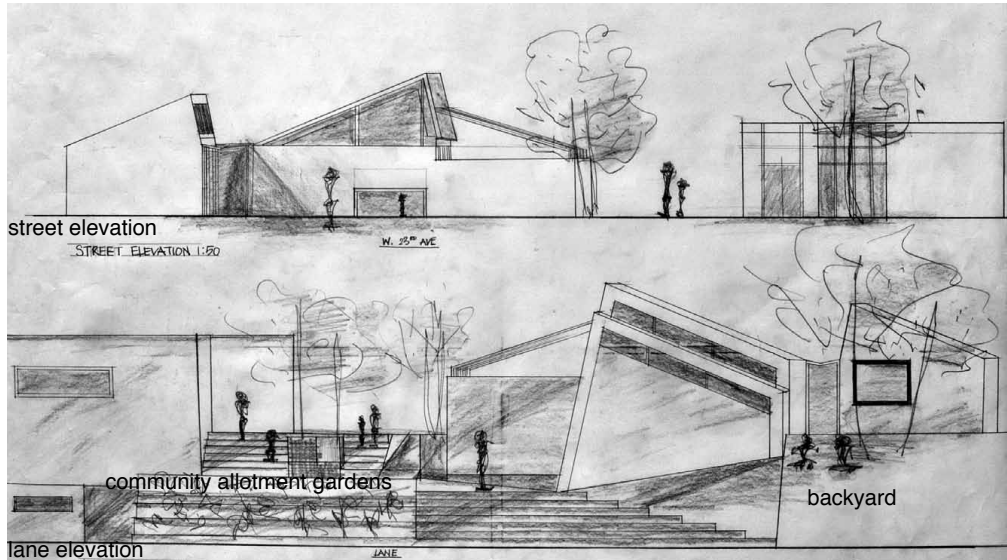


The form of the daycare is developed to receive the most sunlight as it is essential for the function of a daycare. It also generates the architectural language of the whole program: steel structure barn style construction with rainscreen technology clad with 13 mm thick fibre glass reinforced concrete panel system. The indoor spaces provide the necessary functions of a daycare while the exterior playground offers a didactic play experience. The punched windows along the south side provide the kids to have visual connection with the public realm, while security is achieved by the transparency of the whole building so both the public and the supervisors of the daycare can actively monitor the safety of th kids.



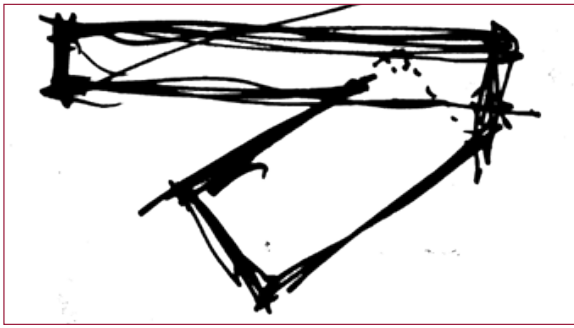
didactic play experience

elevation

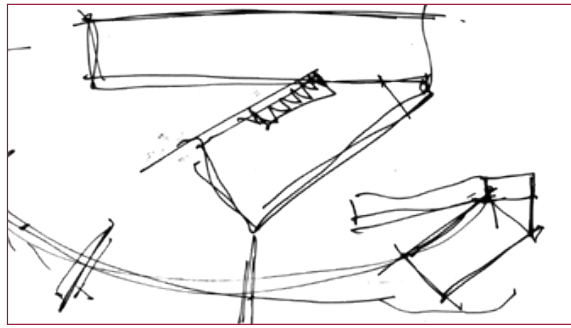


backyard

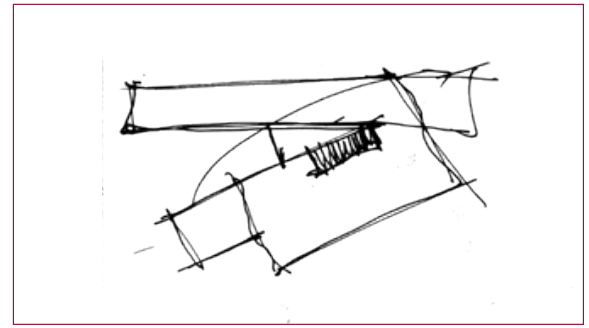
The stepped community allotment gardens animates the lane during the growing seasons. It is a place where the neighbour would exchange herbs and vegetables while exchanging stories in lives. The steps also allows for visual connection with the urban steps while providing a smooth transition from the street to the lane. The backyard is an open field for a place to play with the dogs and throw a frisbee while allowing air and light to get to the surrounding laneway houses.



Plan Concept



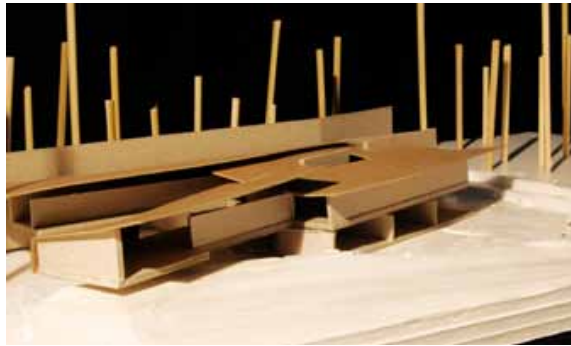
Furthered Plan Concept - Solar Access



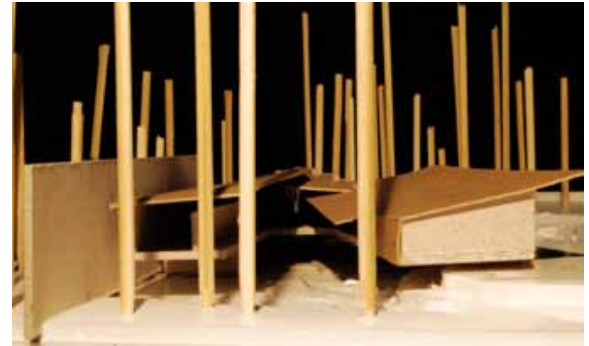
Changing Plan Concept



1:200 Study Model



1:200 Study Model



1:200 Study Model



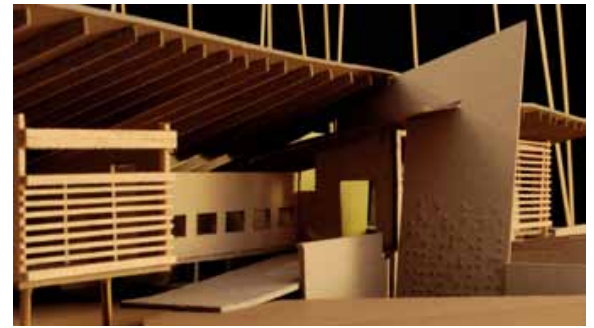
Lower Floor Plan - 1:100



Looking East to the Crotch



Looking Into the Marsh



Main Entrance



Exhibition and Classrooms



Looking West to Lower Entrance



Lower Entrance and Rain Triangle

Course Summary

Method

- The class will emphasize critical dialogue
- The class will develop tactile skills (modeling and drawing by hand)

- 20% of the assignments are collaborative
- 80% of the assignments are individual
- Readings each week are sections of the assigned texts (approximately 2 hours per week)

Assignments

- Assignment One: Case Study (10% of mark)
- Assignment Two: Analysis (10% of mark)
- Assignment Three: Design (60% of mark)
- Participation: Class Discussions and Presentations (20% of mark)

Course Schedule

WEEK	MONDAY	TUESDAY	READING (to be completed by the beginning of the week)
One (September 19-20)	<p>Course Introduction</p> <p>Lecture: <i>What Is Passive Design?</i></p> <p><u>Assignment One</u> distributed.</p>	<p>Work on Assignment One.</p> <p>In class study and individual consultation.</p>	<p>Sun, Wind and Light: selected exercises</p>
Two (September 26-27)	<p>Student presentations Site Visit</p> <p>Lecture: <i>Site Analysis</i></p> <p><u>Assignment Two</u> distributed.</p>	<p>Work on Assignment Two.</p> <p>In class study and individual consultation.</p>	<p>Experiencing Architecture (selection)</p>
Three (October 3-4)	<p>Student presentations (progress review)</p> <p>Lecture: <i>Daylighting</i></p> <p><u>Assignment Three</u> Distributed</p>	<p>Work on Assignment Three.</p> <p>In class study and individual consultation.</p>	<p>Thermal Delight and Architecture (selection)</p>
Four (October 10-11)	<p>Student presentations (progress review)</p> <p>Lecture: <i>Building Orientation and Designing for Temperature</i></p>	<p>Work on Assignment Three.</p> <p>In class study and individual consultation.</p>	<p>In Praise of Shadows (selection)</p>
Five (October 17-18)	<p>Student presentations (progress review)</p> <p>Lecture: <i>Design for Darkness</i></p>	<p>Work on Assignment Three.</p> <p>In class study and individual consultation.</p>	<p>Sun, Wind and Light (selection)</p>
Six (October 24-25)	<p>Submission of Final Project at end of class</p>	<p>Student Presentations</p>	