Sustainable Design
INT D270 Spring 2011

Final Project

We emphasize a holistic approach in Sustainable Design, which balances needs of Society, Environment and Economics. We examine all facets of a system or product for selection, and how each of these elements functions within the overall project, as there is interdependence between all of the building parts. A building and site function somewhat like an ecosystem ideally – if there is perfect balance, it will have the ideal quantity and quality of natural resources. It would also ideally create no waste and leave no problems for future generations to contend with.

While our focus in this class is to study all aspects of Sustainable Design in the built environment on a "macro" scale, we will use a specific case study which focuses primarily on one aspect of sustainability for a focused study, on a "micro" scale.

Our subject for the Final Project will be the **Passive House** which is on exhibit at the Phinney Neighborhood Association, in Seattle. A "Passive House" is intended to function independently, ideally: using no more energy than it creates. While this project's focus is primarily on energy use reduction, we will be exploring as much as we can about all aspects of its sustainable design for this assignment.

You will be required to submit to me a disk or thumb-drive with a Word file for the report, as well as an Excel file of the Built Green checklist. The image files required should be inserted into your report and should relate to the text they are adjacent to. The final presentation you will be required to make in class will focus on part 6 below.

Your report should be organized as follows:

I. Introduction to the Passive House
- A. Significance in current building industry
- B. Names of key professionals and their roles in the project
- C. Basic facts (size, costs to build or to buy, etc.)
- D. List of resources where you got information from (websites, etc.)
- E. Describe the design features that make this house special: i.e. rain screen system, Super-insulation, air tightness, etc.

II. Analyze the house using the Built Green Single Family New Construction checklist. (www.builtgreen.net) In the column for Comments, explain why you believe the project deserved the point or why not in one sentence.

III. Summarize how the house has generally fulfilled requirements in each of the sections of the Built Green checklist, and how it could be improved upon in the next project of its kind.

A. Energy Efficiency:
Describe how the building generates and/or uses power.

B. Indoor Air Quality:
Describe how the building is ventilated, heated and cooled.

C. Conserving Natural Resources:

Describe how materials and resources were used in the building, how they were installed, any waste we can assume from packaging and transport, etc.

D. Water Quality:
   Describe the use of water in the building and any reclamation strategies that are implemented.
E. Can we predict what life cycle costs might be on a specific product? i.e. Windows
   Has the project utilized long lasting products at the expense of environmental concerns?

IV. Photos (minimum 5)

V. Sketches (to scale)

A. section of wall showing rain screen system and insulation
B. section of roof showing insulation
C. section of floor showing insulation

VI. Your individual research: for this section (so that no two papers are alike) you will take one aspect of the Passive House that interests you the most, or one sustainable design practice in general, and research it thoroughly. You are required to provide at least two written pages of information as well as references from the internet, sketches, diagrams, etc. This will be the basis for your ten minute long in-class presentation during the last week of class.

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Sustainability Module - BASELINE

On the first day of class, I asked the students to

1. define sustainability,
2. define sustainable design,
3. and answer the question: how do you think we currently practice sustainable design in the building industry?

This was not a take home assignment, but rather a gauge of what they knew and thought to begin with. Here are the answers I received:

1. **Define sustainability:**
   Being sustainable means not being wasteful.
   The ability to keep using a resource indefinitely.
   Not depleting the environment of its resources.
   Finding ways to use or sustain resources without jeopardizing or depleting them.
   Sustainability is the way that we, as interior designers, architects, etc. do things in sustainable ways.
   Sustainability is the ability to sustain our natural resources. In other words, using resources in a way that does not deplete them.
   To make use of environment friendly things / materials to make new projects. Using environment friendly resources.
   For something to function on its own and/or either create a profit and no loss. Runs itself.
   Sustainability is the choice humans make to live by recycling, reusing and reducing their needs/wants.
   Being able to run/operate on its own without taking up more resources.
   The ability to last with min. environmental impact.
   Something we can use again and again. Not just for one moment. We might use after many years. Or the thing we can reproduce. It means the thing we can stretch more, things we can add.
   Sustainability is the things that can be kept and good for the environment.
   Saving money and energy while helping the environment in a long-term period.
   Wise use of materials and resources in a way that will at minimal effect or not at all effect the environment surrounding the design.
   A belief and process to build our new buildings and structures in a way that does not destroy the resources the materials come from. Sustainability should also make buildings that are healthier for people to live in and do not pollute the earth.
   How a product or material is used to complement the environment it's going to be a part of. Also, it describes how that certain material or product is long lasting.

2. **Define sustainable design:**
   Sustainable design is designing a structure that is energy efficient.
   Designing a building that is self-sufficient in using power and other resources.
   Designs that have the least harmful effect on the environment.

Incorporating environmentally friendly resources into the design process that helps achieve the goal of sustainability.
Sustainable design is when you are more eco-friendly for the environment.
Sustainable design is the design process used to provide humans (us) with living environments that do not deplete the natural resources around us.
To develop a project or a building using natural resources while taking in the effect that our building resources have on the air, water, and surrounding environment.
Creating something that helps itself or helps who it was created for.A design that functions itself and/or reuses or creates its own materials.
A further step taken to save the planet by building homes, office buildings, hotels, buildings in general, with safe, recycled materials.
Building or designing that will be efficient. Maximize resources that are given.
Min/maxing sustainability vs. cost in construction.
In my view is someone think about when we are building something. We also should think after few years, around the building, environment, terrain and resources.
The simplest and inconvenient design so far. It should be the simplest so that we don't waste many resources. It should be made by renewable materials.
Design that saves money / energy for clients and helps serve the e nvironment with efficient products and objects.
Design that has minimal to no effects on every aspect of the environment, as well as people and economics. It's being able to design buildings that could last a longer time using an amount of materials that doesn't affect the eco-system.
The design process to get the most advantages for the client to maximize green technology the enhance health of the building and thus the health of the occupants in the building. Also, sustainable design is good for the health of the planet.
Uses culmination of materials and/or products that are proven to last long in its environment. It could be a product that is designed to be eco-friendly.

3. **How do you think we currently practice sustainable design in the building industry?**
We practice sustainable design today by using renewable energy sources.
We do that by understanding the relationships between our designs and the surrounding environment and developing systems around them.
By incorporating green building products with sustainable designs.
We educate everyone involved in a design project and utilize sustainable concepts throughout the team to make the best decisions for the project.
We do that by trying to help our client get more bang for their buck!
By being aware of how the materials we use are produced, what materials are used, how it affects the environment, and can it be reintegrated into the environment safely.
We should work on plans in which to complete a project we can make as much possible use of sustainable materials without affecting the environment.
We do that by reusing materials, recycling, and by creating self-sufficient buildings/cars/etc.
First, by educating people on their choices to build sustainably. Second, to make the choice yourself to build with recycled renewable material.
Technology and natural resources.
Research and magic?
Because the resources we use are limited, whenever we use, we should choose the limitation of maximum to use.

We'd better look at the old way again. Our lives became really convenient recently, but we waste so many things.

By creating and building energy efficient objects like solar heating to save money and the constant use of energy. Also creating special windows and insulation to prevent heat loss in the winter and keep heat out in the summer.

Becoming more popular than non-sustainable design, being used more in residential home design versus commercial design. Also driving around you see solar panels on stop signs, and bus stops sometimes, which is sustainable design.

We have to research the latest "green" technologies and communicate this information to the client.

In today's world, it is currently changing to become more concern with the environment. Even ordinary people who aren't a part of the industry would think green. Now, we are concerned for our future and for the next generation to live better. Sustainable design allows us to become aware of the positive and negative effects of certain materials or process one uses to the environment.

In summary, I believe generally students come into the class with some understanding of sustainability, but assume it can be applied to a project on a two-dimensional level. The object of the class is to expand their understanding of the interdependence of all parts and systems of a building, as well as to expand their knowledge of available sustainably designed products, certification systems, and the applications of sustainable design throughout the various phases of the design process. Ideally they will learn to think holistically about the projects they are involved with as a whole, in order to design carefully.

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Sustainability Module – MID-QUARTER ASSESSMENT

At first, the students believed sustainable design to be an added layer to the design process. Since the object of the class is to expand their understanding of the interdependence of all parts and systems of a building, as well as to expand their knowledge of available products, certification systems, and the applications of sustainable design throughout the various phases of the design process, I had them each attempt a design problem about half way through the quarter to test their design skills from a sustainable perspective.

Problem: The students received a blank floor plan of a typical office building shell and were asked to lay out the space for the following spaces, using as many sustainable strategies as possible:

- (3) offices at 120 square feet each
- office at 200 square feet
- conference room at 240 square feet
- Reception desk and waiting area
- As many 8 foot by 8 foot cubicles as possible

Students were to show doors and windows but no furniture. They were to draw a reflected ceiling plan as well, keeping in mind what orientation the building had in relation to north, and which were exterior walls.

Solutions: Generally I believe the students rose to the challenge.
Lighting: Most of them utilized the exterior walls for day-lighting and showed windows along the perimeter. They showed skylights over open office areas and listed occupancy sensor-controlled lighting. They showed transom glass units high on interior office walls. They showed light shelves on the southern exterior wall to bounce light deep into the space. Some showed photo-sensors on lighting near the perimeter wall. There were a few schemes that utilized LED lighting for energy savings. One student noted that light colors should be used on walls. They tried to align cubicles as well as offices with south facing windows. Some showed glass walls.
Furnishings: Students showed cubicle walls and listed recycled content potential for all furniture. They showed recycling and waste collection areas.
Air Quality: Students showed ventilated copy rooms.
Views: One student thought to locate a wildlife sanctuary directly outside to give occupants a nice view of the outdoors.

Students were mostly concerned with the programmatic requirements at this stage, but there is some evidence that the seeds of ideas for sustainable design have been planted.

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Sustainability Module – FINAL ASSESSMENT:
Results of the Final Project, the Passive House report

As part of the Final Project to analyze the Passive House, the students were asked to use the Built Green checklist to assess the house on all levels of sustainable design. Despite a very large disparity between high and low scores, the comments the students made regarding the success or failure of the house to achieve certain points on the checklist were very reassuring. While they disagreed often on whether or not the house should receive a certain point, they were thorough in their arguments, which proves to me that they understand the concepts of sustainable design in those categories. I think the main reason for confusion was that the house is an exhibit piece and is not installed in a permanent location, so issues around site location and related systems were sometimes answered hypothetically if at all. The students also showed that they understand the procedures around the certification process in order to perform that service in the industry if asked.

The reports that the students were asked to write were very well done for the most part. They could describe in their own words all of the features that make this particular project unique and successful.

Beyond the Passive House, the Final Project also required each student to research in depth a specific sustainable design strategy and present it to the class. These components were the most successful parts of their work, probably because the topics were of their own choosing. The topics included radiant floor heating, negative impacts of the use of leather, rain screen wall systems, and wind power. The presentations gave students a chance to sell a design concept to the group.