

# **AC 2010-493: INTEGRATING SUSTAINABILITY INTO STUDIO DESIGN CURRICULUM**

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# INTEGRATING SUSTAINABILITY INTO STUDIO DESIGN CLASS CURRICULUM

## **Abstract**

At the University of Hartford, we have established an architectural program founded on integration. Architecture by its very nature is connected to other disciplines, yet architectural education is often criticized for a lack of integration in the curriculum. By increasing the awareness of the interrelationship between different areas of study, we are attempting to strike a new and more effective balance.

Considering our mission of integration, we set out to incorporate sustainability into our curriculum. This paper will attempt to provide an overview of the need for, benefit of and cost of sustainable design and how it relates to architecture and engineering education at the University of Hartford. We have embarked on a 3 step process to bring sustainable design into the design studio curriculum.

## **Need for Sustainability**

Building construction and operation have extensive direct and indirect impacts on the environment. Buildings use resources such as energy, water, raw materials, generate waste (occupant, construction and demolition) and emit potentially harmful atmospheric emissions. Building owners, designers and builders face a unique challenge to meet demands for new and renovated facilities that are accessible, secure, healthy, and productive while minimizing their impact on the environment.

Recent answers to this challenge call for an approach that considers all phases of a facility's life cycle. This approach supports an increased commitment to environmental stewardship and conservation, and results in an optimal balance of cost, environmental, societal, and human benefits while meeting the mission and function of the intended facility or infrastructure.

Sustainable design is the philosophy of designing physical objects, the built environment, and services to comply with principals of economic, social, and ecological sustainability. (Wikipedia)

## **Benefits of green buildings**

The benefits of green buildings are many, some of which are listed below.

- Environmental benefits

- Enhance and protect ecosystems and biodiversity
- Improve air and water quality
- Reduce solid was
- Conserve natural resources
- Economic benefits
  - Reduce operating costs
  - Enhance asset value and profits
  - Improve employee productivity and satisfaction
  - Optimize life-cycle economic performance
- Health and community benefits
  - Improve air, thermal, and acoustical environments
  - Enhance occupant comfort and health
  - Minimize strain on local infrastructure
  - Contribute to overall quality of life

### **Cost of Sustainable Design**

There is a common misconception that sustainable design will make the building much more expensive to build and operate. However, sustainable design choices can range from no first-cost to high first-cost and from immediate payback to long-term payback. Many sustainable design features cost only pennies per square foot and have paybacks in less than ten years.

No first-cost with immediate payback:

- Orientation
- Native and drought resistant plantings
- Minimize site disturbance
- Building massing
- Window placement
- Efficient site usage

Low first-cost with short-term payback:

- Recycled content building materials
- Low volatile organic compounds products
- Increase building envelope insulation
- Glazing area and performance
- Optimize day-lighting
- Day-lighting controls
- Light shelves
- Solar shading
- Nighttime ventilation
- Mixed mode ventilation
- Reflective roofs

Medium first-cost with medium-term payback

- Low flow water fixtures
- Heat recovery
- Desiccant cooling
- Evaporative cooling
- Borehole cooling
- Wind tower/scoops
- Green roofs

High first-cost with long-term payback

- Photovoltaics
- Wind turbines
- Geothermal
- Double-skin facades

In the final analysis both first-cost and payback have to be considered.

### **Incorporating Green Building into the Curriculum**

In order to further this effort we needed to incorporate LEED and other ‘green building’ concepts into architectural and construction curriculum. While many programs have introduced environmental sustainability lecture courses into the curriculum, we have decided to make sustainability central to the mission of our upper level design classes. It is through problem solving design projects that students best learn to research, understand, analyze, and apply their knowledge of sustainable concepts. More than ever, leading design and construction firms are looking for recent graduates that can help them create the environmentally sensitive buildings the public demands.

This new focus on building better buildings has meant great potential for the design process. However, this potential has not realized. We found that requiring the students to fill out and design to the LEED checklist has not been very effective. The checklist, while efficiently organized, in 7 sections: 1.) Sustainable Sites, 2.) Water Efficiency, 3.) Energy and Atmosphere, 4.) Materials and Resources, 5.) Indoor Environmental Quality, 6.) Innovation and Design Process, and 7.) Regional Priority Credits, is somewhat restrictive, narrowly focused, and limits integration.

In architecture, sustainable design should not be an afterthought or a supplement of the architectural design, it should be a part of the design process. The integration we were hoping for was not happening.

### **Design Studio**

The Carnegie Report "Building Community: A New Future for Architecture Education and Practice" by Ernest Boyer and Lee Mitgang criticized architecture programs for lack of integration of the curriculum. At the University of Hartford's Department of Architecture we have been challenged by this criticism and have developed our curriculum in response. The

uniqueness of architectural education lies in its combination of theory and technology courses in the lecture/seminar format within the design studio.

Architecture by its very nature is connected to other disciplines, however architectural education is often criticized for a lack of integration in the curriculum. We hope that the architectural program at the University of Hartford will successfully integrate other disciplines (such as sustainability) with architecture. By increasing the awareness of the interrelationship between different areas of study, we are attempting to strike a new and more effective balance in the curriculum.

The design studio has traditionally been the hallmark of architectural education, the place for integrative learning to take place. Schools throughout the country have been criticized for not living up to their goals. At the University of Hartford we have been challenged by this criticism and in response have redeveloped our design studio curriculum.

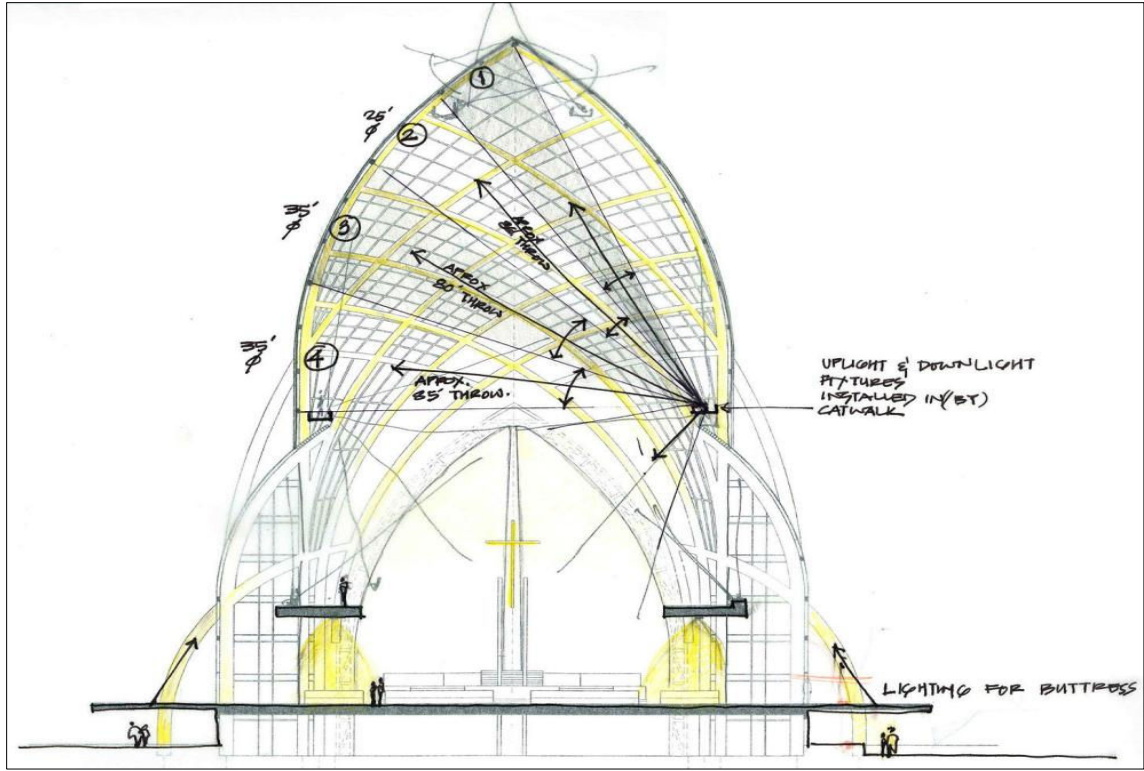
The knowledge introduced and the skills developed in these classes include:

- Critical thinking – using knowledge base to evaluate design solutions;
- Problem definition – the ability to clearly understand and define what the problem is;
- Problem solving – the ability to understand a given problem and develop appropriate solutions;
- Presentation - emphasis is placed on communication, both oral and written;
- Creativity – thinking beyond the ordinary and given path; to use your background and personal interpretation to put things together in new ways;
- History/Theory – through lectures and exercises to explore precedence and understand the ideas behind them;
- Documentation – further develop both traditional and technological documentation methods and explore multiple ways to express ideas graphically;
- Design – the process of coalescing and blending the above important skills.
- Sustainable/Energy Conscious – recent trends and advancements.

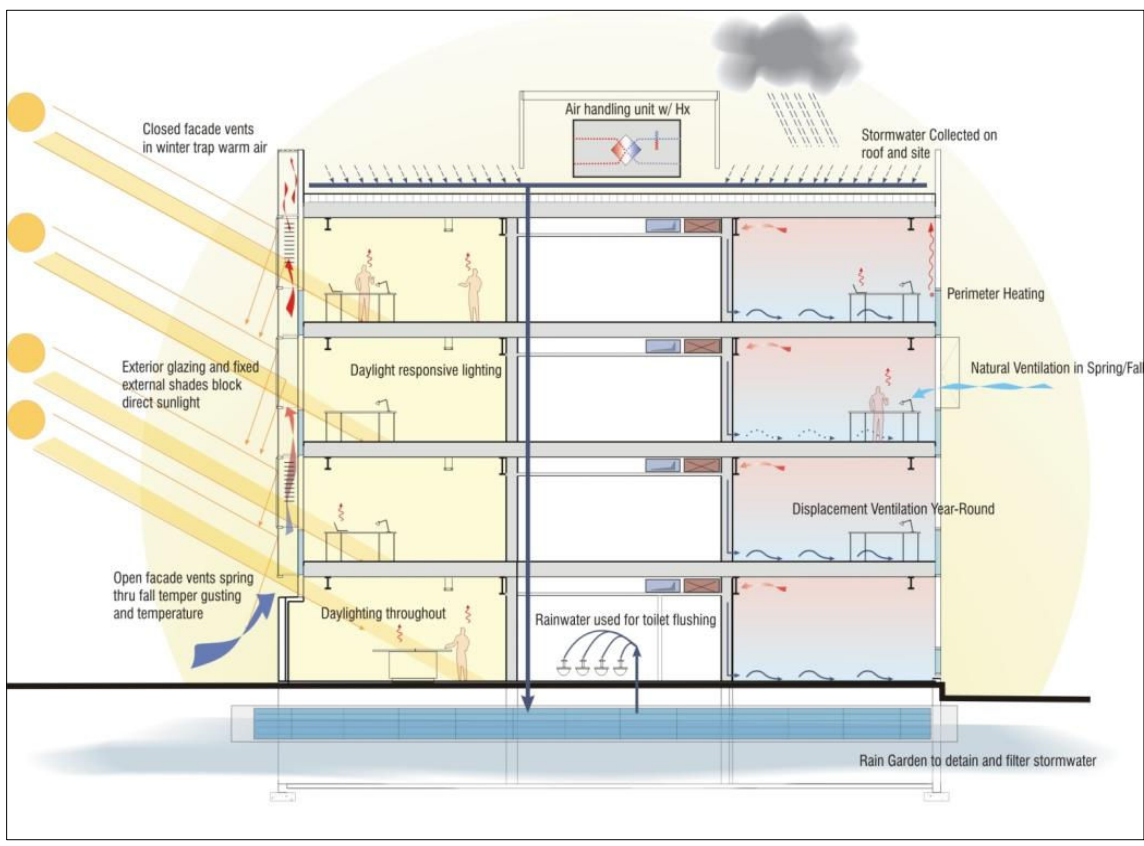
The design studio courses will constantly be called upon to reinforce the importance of integration and more effective cross-disciplinary teamwork. It is in the design studio that students are expected to bring together knowledge from the different disciplines to improve the quality of their architectural designs.

### **Integration Instead of Incorporation**

Since working off the LEED Checklist was not successful we were forced to develop another approach, one aimed more at integration. This approach used what we called “Environmental Sections”. Students have been required to develop, design and present their sustainable strategies and features graphically. The students have been much more successful with this approach. Examples of what we call “environmental sections” are shown below.

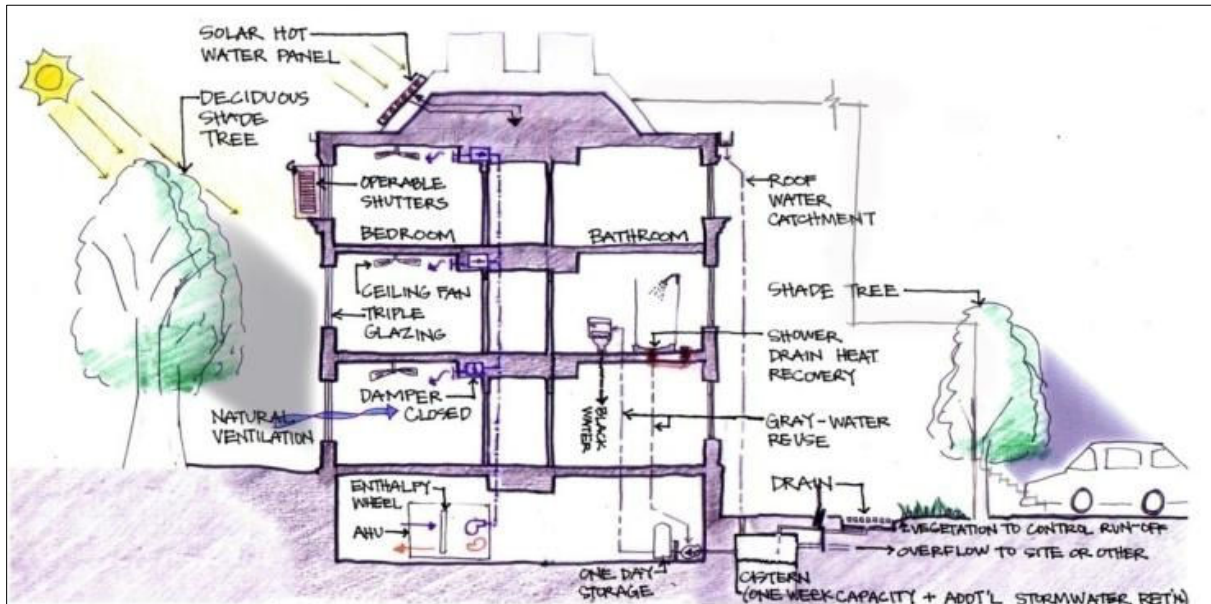


Environmental Section 1

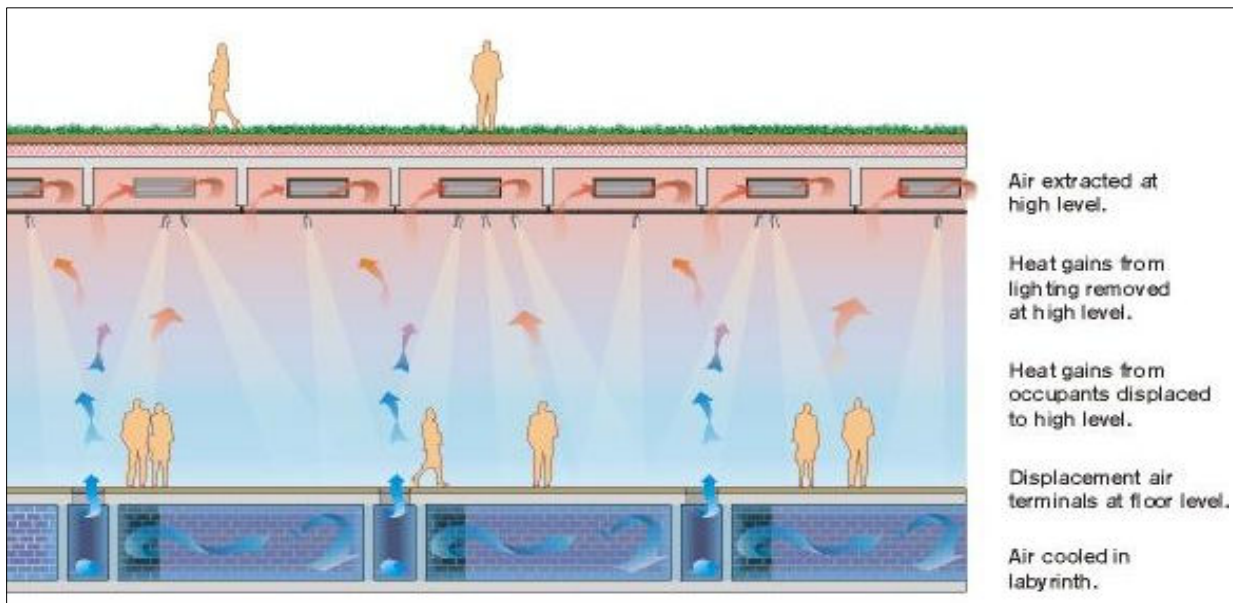


Environmental Section 2

These “environmental sections” can be very helpful and typically are quite attractive, and have led to an integration of sustainability instead of simply applying sustainability to a building after the design is completed. They are equally effective to showcase high visibility strategies like energy monitors, wind power, PV panels and green roofs; partial visibility strategies like shading & operable windows, energy efficient lighting, fuel cells and water saving features; and low/no visibility features like ground source heat pumps, glazing, ice storage and labyrinth.



Environmental Section 3



Environmental Section 4



## Good Design

We strongly believe that sustainable design is synonymous with ‘good design’, and results in facilities that delight, improve well-being, conserve energy, and are environmentally friendly. Therefore we use sustainable design principles to guide our upper-level students as they design their projects. The students are required to incorporate an environmentally sustainable design philosophy with each of their projects.

We talked to the students about how quality design has for centuries respected the environment and buildings were built with performance and sustainability in mind. Examples are shown which included examples from history (Parthenon, Pantheon and Gothic Cathedrals), industry (light from the north, natural ventilation and gathering energy from wind/water) and agriculture (tobacco barns, cisterns, and orientation to the sun). We also mentioned how some other cultures (Scandinavian and Oriental) have been much more conscious of sustainability issues for many years.



Basically ‘good designers’ were adhering to the key principles of sustainable design all along, while other designers seem to have become oblivious to these issues and forgotten what history has taught us. We stress that the building and landscape should do more while the building systems do less. We expect pragmatic solutions and integrated designs, “doing right by doing well”.

We call for an integrated design where architectural design, building systems, and site design are developed together, and not an approach where the architecture is designed and the engineering systems are imposed and the building is then dropped on the site. The integrated design process brings together the various disciplines involved in designing a building and reviews their recommendations as a whole. To be successful we need to incorporate ‘green’ from the beginning of the building design process:

- Develop the site wisely
- Incorporate day lighting
- Protect indoor air quality
- Optimize acoustics



- Select technologies to support strategies
- Use high performance HVAC strategies
- Chose materials wisely
- Conserve water
- Encourage use sustainable construction practices

### **The Next Step, an Integrated Sustainable Site**

Our next step is to integrate sustainable strategies into the design of the site and not just the building. The approach to the site design should create a dialogue between building systems and natural systems. The placement of the building and its supporting services, the location of vehicular circulation, parking, arrival spaces, and landscape amenities such as outdoor dining and walking trails are integrated into our strategy of creating a healing, sustainable site.

Site organization is the key factor in finding sustainable storm water solutions for new development. In sum, the site is an active, living system that can process, clean, and reuse storm water that accumulates with the addition of impermeable surfaces. We can orient the building towards the more naturalized features of the site like a native meadow, pond, or native forest. In addition scenic benefits, meadows and ponds can take an active role in filtering, cleaning, and detaining the storm water runoff from all new impermeable surfaces that are introduced to the site. Parking lot storm water can flow into bioswale rain gardens where it can be filtered on its way through native meadow bioswales to the storm water pond.

Storm water from the roof can be captured for irrigation use in the courtyard or gardens, and a rainwater garden or reflecting pool can be a focal point of the building. Water that is not captured for irrigation will move through the native meadow to the storm water pond. Porous material can be used in lieu of asphalt whenever possible in order to reduce impermeable surfaces on site. Alternative energy technology (wind) can be used to power exterior site amenities.

Landscape “types” can be tied to historic, vernacular uses: orchards, meadows, native grasses similarly used in an airfield. These attract wildlife, both migratory and local, and reflect seasonal change. Amenities can also be incorporated, like walking trails, outdoor dining terraces, signature alternative technology feature (wind turbine), biking, or a bus stop to support use of public transportation.

### **Conclusion**

We have recognized that sustainable/green design is fundamental to the mission of our upper-level design studio curriculum. Formal training on sustainability is required to ensure that future architects and engineers are knowledgeable of sustainable design and can integrate sustainable concepts in real-world design projects. We believe we have found an effective way for the faculty to teach and the students to design and present sustainable design strategies. We agree with a Kenyan Proverb that says, “We have not inherited the earth from our ancestors; we have only borrowed it from our children.”

LEED publications state, “a green building is generally not distinguishable in appearance and style from other, less sustainable buildings”. In our design studio classes, we promote the celebration of a building’s greenness and believe that green buildings are sexy. We believe that green buildings should be distinguished from other less sustainable buildings, that they should be better, more attractive, and interesting, and that a building's greenness should not be invisible but rather celebrated.

The Architectural Program will continue to emphasize an integration with the constant exploration of innovative design. In a collaborative, integrated and multidisciplinary setting, our Architectural Program provides a professional education joined with other programs. The practitioner-based program balances theoretical, technical, professional, and current knowledge. Students are ultimately prepared for careers in architecture and a wide assortment of other design, construction, or business related professions. Architecture curriculum is by nature connected.

Many believe that learning in a compartmental fashion has never been fully successful; our architecture curriculum is by its nature integrated and connected. We have found that the most important element in good teaching is enabling students to think and learn on their own. However, more importantly, our graduates are finding a flattering reflection of their active-learning educational experience in the integration-rich workplace. Architecture is a multidisciplinary field of study that draws on many areas of study. Architecture education must successfully involve the integration of art, engineering, business, sustainability, and other disciplines.

## References

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