GREEN ARCHITECTURE WITHIN AN URBAN CONTEXT:
EDUCATING THE PUBLIC ABOUT A MORE SUSTAINABLE BUILT ENVIRONMENT
Green Architecture within an Urban Context:
Educating the Public about a More Sustainable Built Environment

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Ball State University
College of Architecture and Planning
This past year has been a lot of fun and a great learning experience. I feel all of the work leading up to this point has culminated to build a strong foundation as I begin my professional design career. For all of this success, I would like to thank the following...

**My family, friends, and fiancée Jessica** – For all the support they have given me throughout the years. There is no way any of this would be possible without all of you. Thank you all very much.

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PROJECT ABSTRACT

How can green architecture be implemented into an urban context in a way that educates the surrounding community about the importance of creating a more sustainable built environment? Unfortunately, the majority of successful and efficient "green" buildings do not exist within the context of a highly populated urban setting. These types of buildings are more commonly found in rural areas where natural energy forces are more favorable and where fewer people have the opportunity to interact with them. The success of these buildings is admirable because of their contribution toward creating a more sustainable built environment; however, in order for people to understand the benefits of ecological design and ultimately integrate these values into their own lives, they must be given the opportunity to experience green buildings more frequently.

This project explores how green architecture can be implemented into an urban context in a way that teaches the public about a more sustainable built environment. It is important that ecological design solutions become evident in urban settings so people can understand their benefits through daily interaction. The project is a United States Postal Service station, located in downtown Indianapolis, Indiana, which will respond to environmental issues influenced by the context of the site. The post office building provides the best opportunities to carry out the thesis ideas because of the connections a post office has with the community it serves. The project is based on the conventional program of a postal service station and responds specifically to physical, social, and environmental influences of and around the site. The overall building design will display green design strategies in a way that promotes a sustainable environment within an urban context, focusing on the implementation of double-skin facade technologies.
OVERVIEW

THESIS TOPIC:

How can green architecture be implemented into an urban context in a way that educates the surrounding community about the importance of creating a more sustainable built environment? Unfortunately, the majority of successful and efficient "green" buildings do not exist within the context of a highly populated urban setting. These types of buildings are more commonly found in rural areas where natural energy forces are more favorable and where fewer people have the opportunity to interact with them. The success of these buildings is admirable because of their contribution toward creating a more sustainable built environment; however, in order for people to understand the benefits of ecological design and ultimately integrate these values into their own lives, they must be given the opportunity to experience green buildings more frequently.

The context of an urban site provides more challenges and opportunities when dealing with green design because of the impact other buildings can have on the site's natural energy flows. How does a building, in an urban context, respond to the uniqueness of a site in a way that educates its users about green design?

"With the construction of 500-700 facilities annually, the United States Postal Service has one of the largest construction programs in the nation. The organization recognizes a unique opportunity to implement widespread green building techniques." - U.S. Environmental Protection Agency

This project, located within an urban context, will respond to the uniqueness of a site in a way that educates its users about green design through daily interaction with the building. Since the project is a post office, it has a lot of public interaction locally and throughout the community it serves. Even though the United States Postal Service is not owned and operated by the U.S. government, the general public typically considers post office buildings a civic type of building. Since civic/public buildings are usually judged on their performance, function, and architectural style, the post office building type provides the best opportunities to test the issues of this thesis.

"Environmental issues are not distinct from social ones. Policies aimed at improving the environment can also improve the social life of citizens. Ecological and social solutions reinforce each other and build healthier, livelier, more open-minded cities. Above all, sustainability means a good life for future generations." - Richard Rogers

On a larger scale, it would be interesting to explore a portion of the city around this building and see how green design could be integrated into other types of public services. These other projects would include the public transportation system, bus stops, street lights, traffic lights, etc. The goal would be to see how all of these things could be designed to work together using green design strategies/materials while creating an image/theme that allows green design to work its way into a part of people's everyday lives. Since people have been using fossil fuels to heat/cool their homes and power their vehicles, we have become unaware of the benefits of the earth's natural forces. Now it is time to re-establish the connection between humankind and the natural environment so we can benefit from each other.
ARCH 400 RESEARCH PROJECT

During the spring semester of 2002, Dr. Stephen Kendall began the semester long project with a group research project. The purpose of the project was to create a research document that included information pertaining to office building design that could be shared by the studio and used for the design of an Incubator Research Facility for Muncie, Indiana. My group researched ecological architecture and I, specifically, researched green building applications including atria design, living machines, green roofs, photovoltaic applications, daylighting, and green building materials. Up until this point, I had not researched much information regarding green building applications, but I became very interested in this subject because of the endless benefits green design strategies offer to the building users, owners, and most importantly, the environment.

DOUBLE-SKIN FACADE RESEARCH

During the past fall semester, I had the opportunity to take a class focusing on renewable energy sources instructed by Dr. James C. Eflin. During the class and throughout the past year, I have been researching double-skin facade technology with another undergraduate student, Steven R. Cook. During the fall semester, Steve and I began learning about double-skin design strategies, which ultimately lead to the design and construction of a double-skin demonstration model. Continuing with what Steve and I learned, we continued our research during the spring semester with the independent study under the supervision of Robert J. Koester, Director of the Center for Energy Research/Education/Service. The independent study has involved in-depth inquiry and testing of the solar chimney on the Ball State University College of Architecture and Planning building.
USPS STATION

The design project is a USPS station that implements ecological design strategies as a way to educate the surrounding community about the importance of creating a more sustainable built environment. The new post office site is located in downtown Indianapolis, Indiana at the intersection of New York Street, Delaware Street, and Massachusetts Avenue, which provides a great deal of exposure to the site to pedestrians and motorists. The project focuses on the topic of energy efficiency through the use of natural energy flows, revealing different ways in which green design can be used to show the public how beneficial it would be for all types of architecture. This would allow people to understand how the earth’s natural forces can be respected in order to provide healthier, safer, and more attractive environments. Additional to the daily functions of the post office building, this project will be devoted to educating the public about green design. It is hoped that the daily interaction with the post office building will allow the users and employees to become more aware of the benefits of green design when applied to architecture within an urban context.

The design of the new USPS station is the result of responses to environmental, programmatic user, and urban contextual issues. All of these contextual issues have been considered and explored while maintaining a concern for green design issues. Ultimately, the implementation of double-skin facade exploration has been the main focus for this project.
<table>
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<th>Program Summary</th>
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USPS STATION
ROCHESTER, INDIANA

MSKTD & Associates completed 2001 15,600 s.f.

The program for the thesis project was based off a similar, but conventional, USPS station in Rochester, Indiana. Thanks to the assistance of George Short – USPS Administrative Services, Indianapolis, Indiana – who provided most of the technical information regarding square footage requirements, space relationships and overall building and site organization. Typically, USPS stations, serving the public, are designed and built with public security and privacy being the primary concern. In order for the new USPS station to be open to the public in a way that communicates green design, careful thought about security and privacy issues is necessary to keep the project practical. Site visits to the Rochester post office provided a clear understanding of how the building's users and employees interact with the building and the site.
USPS POST OFFICE
MUNCIE, INDIANA

Robert J. Patton  Fall 2002 (not built)  3,200 s.f.

Features of the building:
Photovoltaic integrated, Double skin wall system, Geo-thermal
Heating system, Natural ventilation

The design of the plan and section are based off the March/September sun path.
The double-skin wall system incorporates the use of movable photovoltaic panels
that stay perpendicular to the sun throughout the year.
The "solar" wall on the south facade acts as the main collector of energy and as
a buffer to the harsh climatic conditions.

This project was intended to be a precedent to the thesis project by addressing
the issues of educating the public through green design and to get an
understanding of the post office program. The project specifically dealt with
how the building responds to the context and how it affects environmental issues.
BRITISH PAVILION
SEVILLE, SPAIN

Nicholas Grimshaw & Partners  completed 1992  7,000s.M.

Features of the building:

- Sail-like louvers shade roof from sun
- Photovoltaic panels integrated into the louvers generate energy to power the water wall
- Water wall provides instant physical and psychological cooling effect
- Polyethylene fabric shades the south facade of the building
- Evaporative cooling

This building combines the use of high tech architecture and ecological design concerns. The use of high-tech building materials has allowed this building to be dis-assembled so it may re-assembled at another location. The ability to dis-assemble buildings is a sustainable design strategy itself. More importantly, the British Pavilion was designed for the 1992 World Exhibition, which allowed the building to be a showcase for green design. The building's green design strategies are attractive and interesting to those who visit the exhibition space it creates. The building both serves a function as an exhibition space and passively educates the building's users about the possibilities of high-tech green design.
BEYELER FOUNDATION MUSEUM
RIEHEN, BASLE, SWITZERLAND

Renzo Piano  Completed 1997  8,220s.M.

Features of the building:
Photovoltaic collection, daylighting, double-skin roof system, thermal
storage mass, natural ventilation

The combination of precisely engineered, high tech green design strategies with
elegant architectural design is quite remarkable. The all glass, double-skinned
roof, which was carefully engineered, is exceptionally energy efficient and
innovative. The photovoltaic integrated panels are the upper-most layer of a
series of elements that control the admission of light into the gallery spaces below.
The cavity between the double-skin roof system creates a thermal buffer, reducing
heat gains and losses. Further energy efficiencies is the displacement air-
conditioning system that keeps conditions stable in the lower parts of the tall
galleries occupied by people while allowing temperatures to fluctuate under the
ceiling, where air is exhausted to pass through heat exchangers. Massive stone
walls on the longitudinal sides of the museum act as thermal storage masses,
collecting heat during the day and radiating at night.
Rodin Museum, Kohn Pedersen Fox - view of entry

Rodin Museum, Kohn Pedersen Fox - view of gallery

Rodin Museum, Kohn Pedersen Fox - aerial night view

Rodin Museum, Kohn Pedersen Fox - street side facade

Rodin Museum, Kohn Pedersen Fox - double-skin cavity

**RODIN MUSEUM**

**SEOUL, SOUTH KOREA**

Kohn Pedersen Fox  
completed 2000  
12,500 s.f.

Sometimes referred to as the “see through museum,” the Rodin Museum uses double-skin strategies on all facades and roof of the building. Several different types of glazing make up the majority of the building’s mass allowing for a very open, daylight and attractive design. The exterior walls (skins) are made up of two layers of glazing which create a buffer zone between the outdoor and indoor temperatures. The building’s mechanical system was designed to operate in two modes of operation – one for summer and one for winter, as well as occupied and unoccupied modes of operation. In the winter, the double-skin wall system is heated by grilles at the base of the cavity, which combats against heat loss. In the summer time, the double-skin cavity operates in the same way while supplying cold air instead. The layering of glazing in the roof of the building allows for plenty of daylight into the gallery while minimizing the effects of solar and ultraviolet effects through the use of high-tech, specialty coated glazing. The building’s transparency draws much attention to itself from both the user and the pedestrians passing by the site.
SITE INFORMATION

CONTEXT:
The proposed site for the new post office building is located in downtown Indianapolis, Indiana at the intersection of New York, Delaware, and Massachusetts Streets. The uniqueness of the three heavily traveled, intersecting roads provides an interesting location within the city, which will help draw attention to the building. The Lockerbee area, located along Massachusetts Avenue, which has several small shops, as well as the core of downtown will attract many pedestrians to the area. With the location of the site being at such a focal area in downtown, pedestrians and motorists will find the site to be easily accessible from all directions.

ENVIRONMENTAL ISSUES:
Located all around the site, several other taller buildings make up the context, which will influence the environmental conditions of the site. This site was specifically chosen to create a challenge for designing within a densely populated urban context. Rather than designing the project on a completely open site, this site requires a great deal of environmental site analysis to create a successful project. In order for the public to have the opportunity to experience green design, the project must relate to and interact with the community it serves. Therefore, this downtown Indianapolis site provides an ideal location to publicly display green design.
SITE CONTEXT

The area around the downtown urban site, located in Indianapolis, Indiana, is very active throughout all times of the day and year. The activity comes from all of the attractions surrounding the site including the Indianapolis Star building, the Lockerbee Area businesses, the office tower, and the homeless shelter. Currently, the site exists as a ground level parking lot, which creates a void in the center of activity. On a larger scale, the emptiness of the site, currently, creates an interruption in the urban fabric of this downtown location. This interruption changes the experience for the people passing by the site compared to other places in the city. Therefore, the site provides a great opportunity to draw people from all of these other sources of activity around the site. The site location, with the addition of a USPS station, will create a center node to serve all of the people around the area.
View of the Lockerbee Area (northeast of the site)

View of the site (photo taken from the south)

View of the Indianapolis Star Building (located immediately west of the site)

View looking east from site down New York Street
FORMS OF CONTEXT

PHYSICAL – The site is located between a widely diverse physical context. Brick, concrete, limestone, steel, glass, and granite can all be seen from the site. Building types range from commercial to parking garages and from historical to modern. The intersection of the three major roads makes the site unique because of the focal point this intersection creates. It is important for the new USPS station to relate to the existing physical context but also stand out in a way that captures the attention of people passing by the site.

SOCIAL – The variety of different uses around the site brings together a wide variety of people doing different activities. The Lockerbee Area is usually occupied by middle-class people shopping in the many businesses in the area. Business people occupy the tall office tower south of the site, while homeless people gather around the mission located on the adjacent block. In the same way that the post office attracts a wide variety of people, the site is also capable of drawing a diverse range of people doing different activities to the site, which provides a great opportunity for the new USPS station to passively educate the general public.

ENVIRONMENTAL – Open spaces in the urban landscape and a 400' tall office tower combine to create a unique environmental impact on the site. A large building cluster to the north and west of the site provide protection from harsh winter winds while the tall office tower projects shade across most of the site during mid-day intense sun exposure. Solar design strategies are crucial for the success of this project.
View of "Abraham Lincoln" Plaza (one block west of the site)

View of Christian Homeless Mission (southeast of site)

View looking south down Pennsylvania Street (tall office tower)
SUNLIGHT STUDY

Since solar design strategies are an important part of the design of the post office, a sunlight study analyzes how much the surrounding buildings impact the site throughout all times of the year. A 1" = 150' scale model, including all of the buildings around the site, studies the impact of this context on the amount of sunlight the site receives. The heliodon was used to simulate sunlight patterns during the months of June, December, and March/September. With this information, solar strategies and site positioning decisions can be justified.
INITIAL SITE RESPONSES

Study models display three different initial site responses while maintaining a concern for green design strategies, scale, proportion and programmatic requirements. The (1) Environmental Response is a "green" reaction to environmental influences on the site. The site receives more sunlight during the morning hours, so the building curves to accept the sun's energy during the early half of the day. This scheme represents active and passive solar strategies, a double-skin facade and day lighting strategies. The (2) Programmatic/User Response is a representation of how the building is used by the public and the workers. The model displays concerns for how people approach and use the site and building including vehicular and pedestrian circulation, worker/user needs, and how the public views the site/building. The (3) Urban Context Response is a formal reaction to the site and other buildings near and around the site. The square shape represents a "box within a box" idea that is pushed up to the edge of the site in order to maintain the urban edge within the city.
CONCEPTUAL DESIGN PROCESS

The conceptual design is based on a combination of the three initial site studies (environmental, programmatic/user, and urban context). The overall form of the building takes the shape of a box as represented in the urban context model. At this point, the use of double-skin facade technology becomes the primary focus for the overall design scheme of the project. The project's overall concept is a series of layers that step inward into the center of the building much like many other things in nature. The conceptual design phase takes this layering concept and begins to formalize it into a functional plan and section. The building consists of an outer skin, intermediate space (support space), and a core in the center, which can be compared to an apple. These layers define the use of the spaces they represent. The outermost layer is the double-skin cavity, which is the main public entry into the building. The intermediate space consists of spaces such as offices and other building support spaces that create a ring around the center core, which is the heart of the building where all mail circulation takes place.
CONCEPTUAL DESIGN PROCESS

The design of the building becomes more formal with a series of zones that create a system of rings into the building. The (1) outermost layer is the outdoor space, which consists of anything outside of the outer skin of glazing (outdoor condition). The (2) interstitial layer is the double-skin cavity, which is the main public entry into the building. The double-skin cavity serves as a buffer against harsh climatic conditions protecting the inner skins of the building. The double-skin layer is conditioned passively throughout the year. The (3) inner layer is the ring of support spaces adjacent to the double-skin layer. The support spaces can be mechanically or passively conditioned during appropriate times of the year. The (4) innermost layer is the workroom floor, which is the center of all mall circulation. This layer is the "core" of the building, which is where the building is mechanically conditioned during most times of the year. The space and the manner in which it is treated (mechanical or passive) are based on the user/worker activities that take place within that space.
Section A sketch (mid review)

Section B sketch (mid review)
DESIGN INTENT

The final design project is the result of a year's worth of intense research, observation, understanding and design involved with green architecture in an urban context and the USPS station. The main concern of this post office design is to passively educate the public about the importance of creating a more sustainable built environment. The function of the building as it serves the surrounding community as well as how the building relates to the context it belongs to is another major design issue. The intent of the new USPS station is to allow green design to capture the attention of the public – the workers, the users, the pedestrians, the motorists passing by the site.

The final design of the USPS station maintains the hard edge along New York and Delaware streets in order to maintain the urban edge within the city. Parking on the site is minimal because of its location and the abundance of on street parking all around the site. Service circulation is provided on the north side of the building to maintain efficiency and security for incoming and outgoing mail.
SOLAR DESIGN STRATEGIES

Double-skin design techniques on the south, east, and west facades as well as the roof allow for a great amount of daylight, passive heating and cooling, thermal storage, and active solar collection throughout the year. Typically, the post office building type is very massive, opaque and secure. The use of glass and stone in this project provide an interesting contrast relating to public and private areas of the building. The cavity of the double-skin in both the walls and roof, allow air to heat up and create a buffer between the indoor space and the outdoor temperature during extreme temperature conditions. The heating of air within the cavity also promote air circulation, which is necessary to ventilate the building. Since overheating, due to solar radiation, can occur due to the large amount of glazing, translucent solar panels on the south facade and roof protect the building during extreme solar exposure while collecting solar energy. The solar panels on the south facade are movable in order to stay perpendicular to the sun throughout the year, which creates a “living” facade.
View of East Facade (Delaware Street)
View of South Solar Wall (winter time operation)
View of South Solar Wall (Summer time operation)
REFLECTION

The final design project is the result of a year's worth of intense research, observation, understanding and design involved with green architecture in an urban context and the USPS station. The main concern of this post office design is to passively educate the public about the importance of creating a more sustainable built environment. Green architecture within an urban context may be interpreted in several different ways. As for myself, I believe that green architecture within a dense urban setting must be innovative, visual, high-tech, and well designed. In order for people to have the opportunity to understand and experience green strategies and technologies the architecture must communicate these ideas through design. The quality of a space should never be sacrificed in order to maintain green design strategies, but rather enhance the space to make it better.

The function of the building as it serves the surrounding community as well as how the building relates to the context it belongs to is another major design issue. The intent of the new USPS station is to allow green design to capture the attention of the public - the workers, the users, the pedestrians, the motorists passing by the site. The building’s position on the site not only establishes the urban edge within the city, its purpose is to engage all people passing by the site. The south facade, with its movable solar panels, changes throughout the year, which acts as a billboard advertising the idea of green design. It is important for these technologies to be recognizable so the user begins to question and therefore learn about the benefits of green design and how it affects our environment.

The final design of the USPS station maintains the translucent image that developed from the conceptual design. The building evolved into a much more formal layout with a strong sense of layers that reveal their significance in plan and section. The layers into the building are mechanically or passively conditioned, which correspond to the use of the space within each layer. The transparency of the roof remains to be a concern because of its potential to create overheating. This issue could be easily resolved by making some areas of the roof more opaque in areas where less daylight is less desirable. Overall, the project has provided an interesting challenge, which inspired me to learn and understand many of the issues pertaining green design, especially double-skin technology.


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