Project 2 LEED Platinum Building Design & Construction of a new College for Elizabethtown University

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Introduction

The project proposes designing and developing a new College of Architecture, Art, and Sustainability on the eastern side of the Elizabethtown College campus. Based on already developed LEED Building Design and Construction (BD+C) standards, this document is dedicated to the specific building design based on the development of the previously created LEED Neighborhood Development (ND) master plan.

The aim is to design energy efficient and high-performance buildings, which are responsive to the environmental conditions as well as user requirements. Special attention is given to both thermal comfort and day lightinging as well as energy performance through application of psychometric analysis and solar design strategies specific to Elizabethtown, Pennsylvania. The project will pursue the goals of LEED Platinum certification and improved academic functionality and student experience through the integration of passive and active systems.

Site Plan

Figure 1: Site Map

Point 1 is the main entrance to the site. Right now, there is a barrier, but if it were removed it would be easier to access the area as well as be more inviting. Point 2: this is a space where we are going to build an accessible ramp, where people can easily move between different elevations. Point 3 is where the parking lot will be put in; respecting the area of preservation indicated, we will divide the parking lot so the area is preserved. This area is flat and near the entrance making it a sensible site.

Point 4 is the point on the location of the theater. It is a large open and closed space that can accommodate events and performances. Point 5 is an area that focuses on circulation which is where both ramps and stairs will be added to ensure movement can only be easily and accessible for everyone. Point 6 is where the student center and mini market will be located. This space will be important for students to meet, study as well as get food.

Point 7 showing a pathway between the new buildings and the athletic fields. Improvement to this path will help link the new development with the existing campus. Point 8 is for the locker rooms, to be placed in a central position for better

serving the athletic fields in the area. Point 9 would be where the architecture building main would be located. It will be of U-shape with a courtyard in the middle, designed as a nice and open environment. Finally Point 10 which is a quieter area that will be used for art studios and acoustic rooms. This space is more separated, and as a result, is better for creative and focused work.

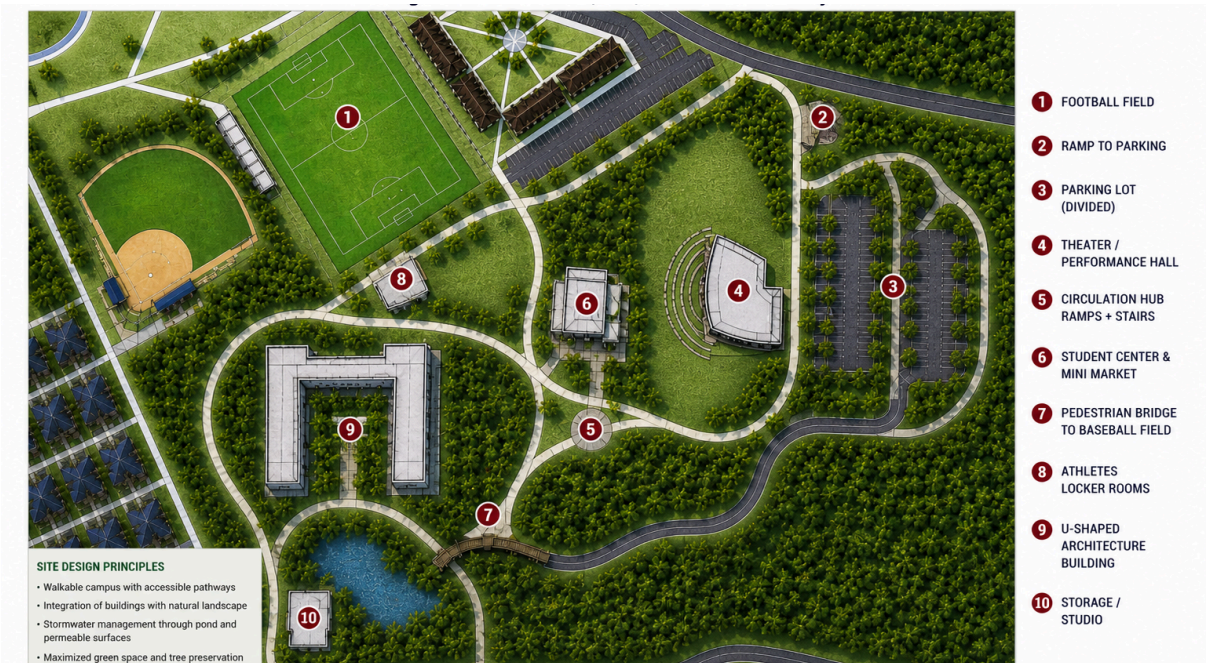


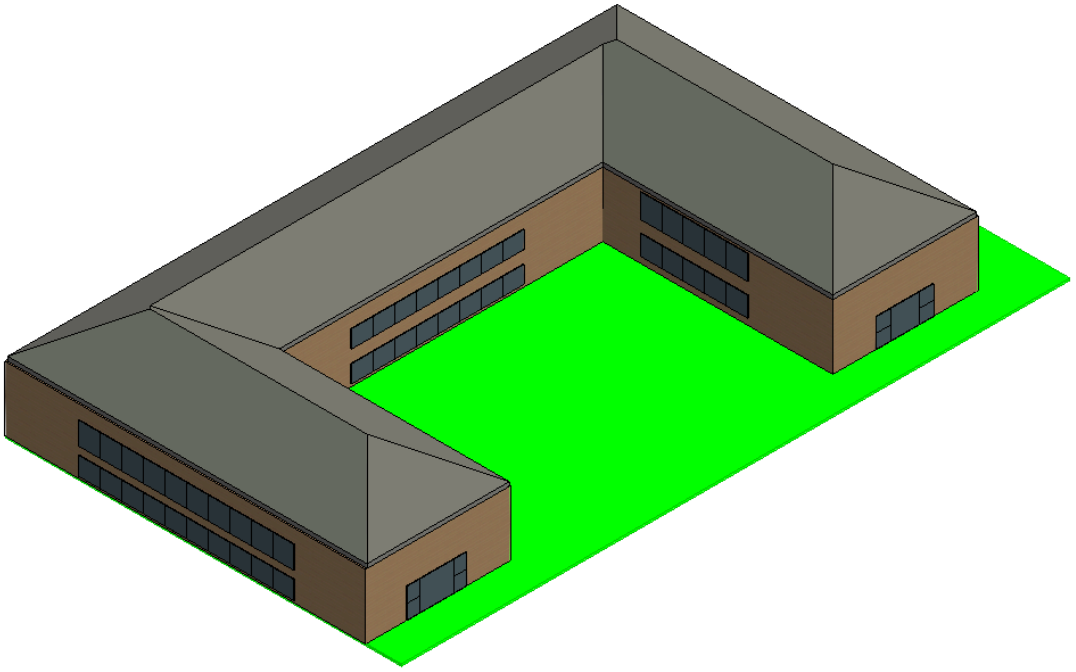
Figure 2: Detailed Site Plan

The site plan is designed around a central pedestrian walkway or greenway that links all of the major buildings and outdoor areas. This type of design is based on the idea of walkability and has a reduced amount of automobile movement within the premises.

Parking will be available at the southern entrance to the campus to minimize traffic in the campus core. Pedestrian walkways facilitate movement across the site, to provide a safe and open environment. The student center is centralized, making it a social and functional space to connect academic, recreational and community spaces.

Building 1: Architecture Building (U Shaped)

Foto revit



The main architecture building was designed in the U-shaped structure with the central courtyard. This shape improves natural daylighting and communication among students by providing some confined outdoor environment. The courtyard enables the sunlight to enter deeper into the interior space as well as enabling outdoor learning and collaboration between students.

The focus of the building is made on passive design measures. Passive solar heating is optimized in winter by using Southern exposure and in summer by reducing heat gain by shading the building with devices and by orienting the building. Natural Ventilation is achieved by opening windows and cross-ventilation to allow natural airflow and improve indoor air quality and reduce the use of mechanical systems.

The architecture building provides a broader thermal comfort zone due to its design flexibility, facilitated by natural ventilation and interaction with users. This causes it to be one of the most energy efficient buildings in the project and a leading example of sustainable design principles.

Building 2: Student Center and mini market (“Jay’s Nest”)

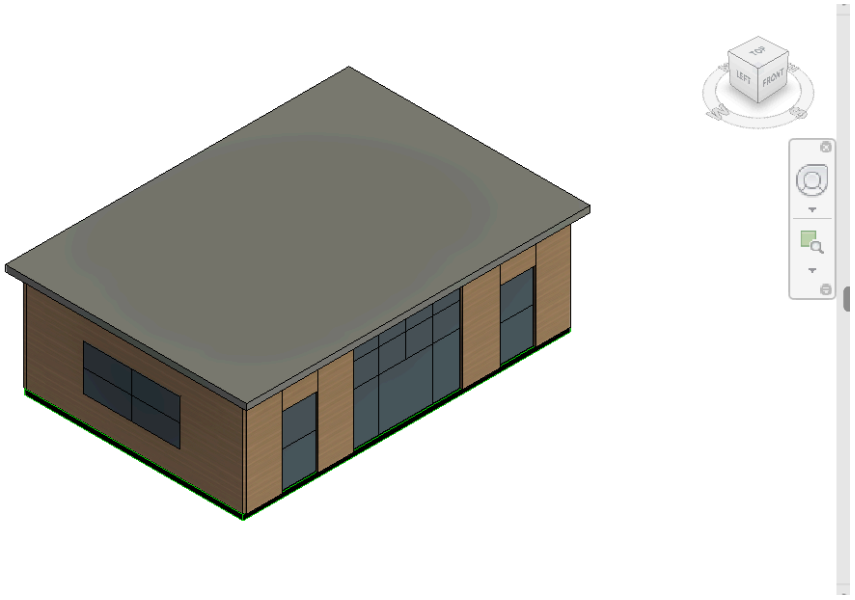


Figure 4: Revit Picture of Building Idea

The social and functional center of the campus is the student center and mini market. This building which is located in the middle of the site plan (shown on Figure 2) will connect academic, recreational and outdoor areas.

Its design is focused towards high occupancy and versatile use, requiring a “trade off” between comfort and energy efficiency. The building also includes natural ventilation of the building in moderate temperature conditions and the use of mechanical HVAC systems in extreme hot and cold conditions.

Large openings and strategic day lighting will reduce artificial lighting and shading elements used to control solar heat gain. This building is important because it links the campus and assists in everyday life of the student.

Psychrometric Charts

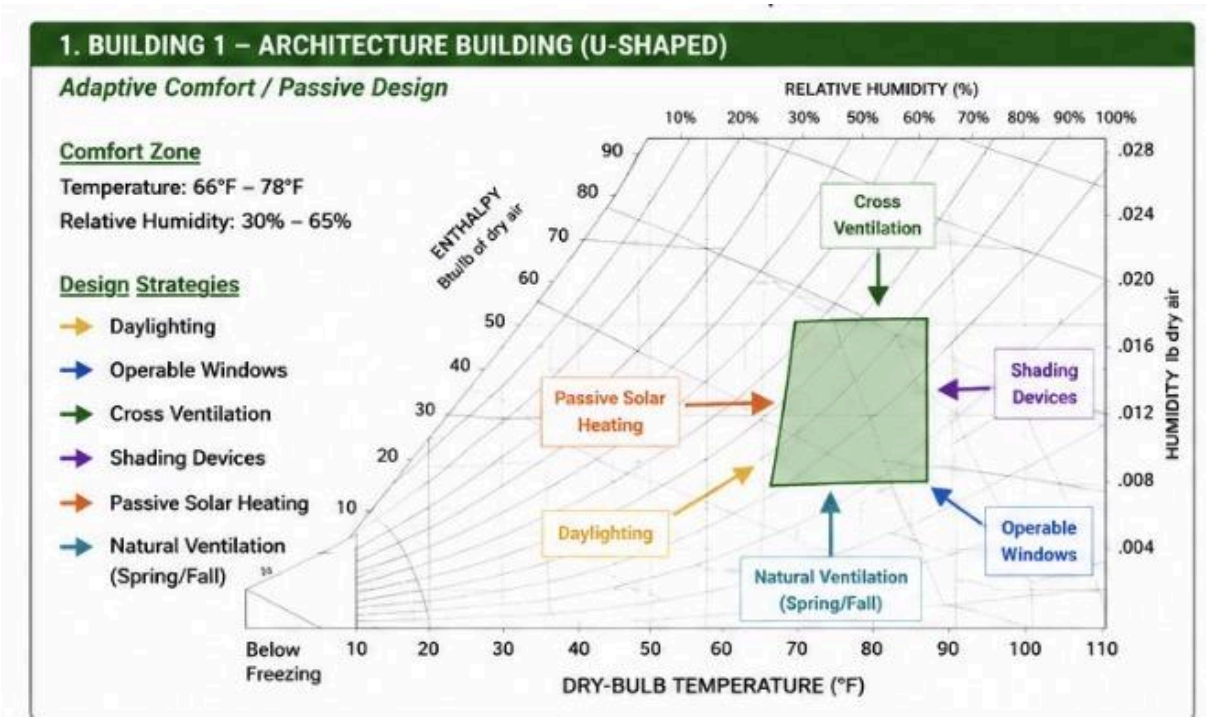


Figure 5: Chart for Architecture Building (AI generated)

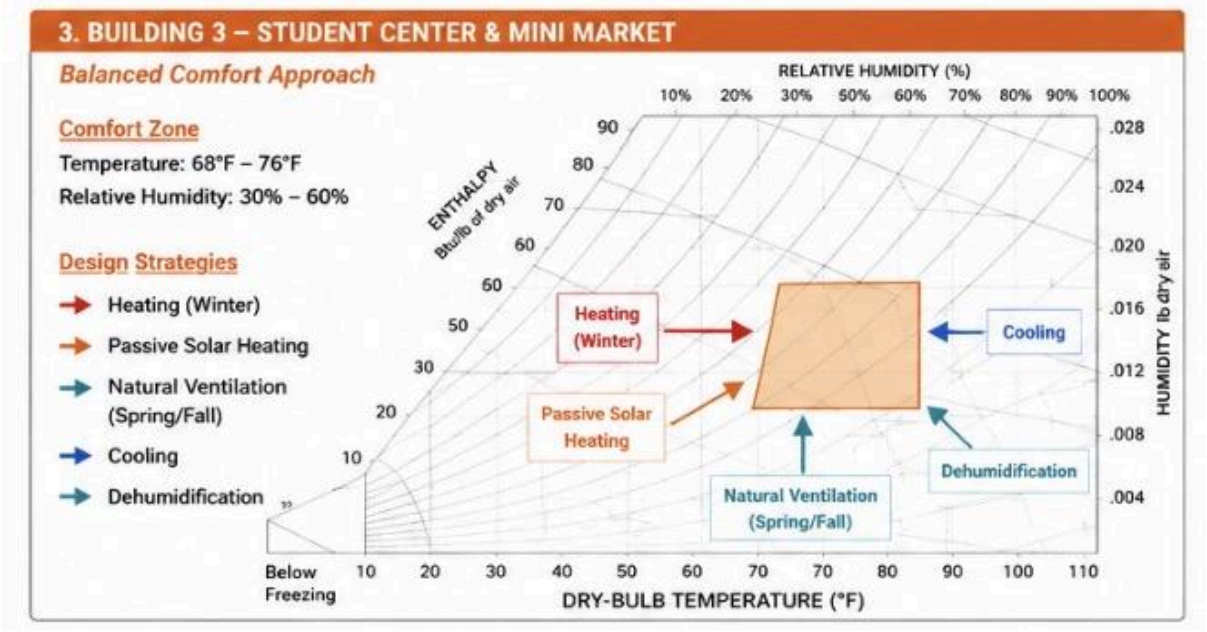


Figure 6: Chart for Student Center (AI generated)

Each building had psychometric charts that were used to analyze the conditions of thermal comfort depending on the climate of Elizabethtown, Pennsylvania, which experiences cold winters, and warm and humid summers.

Every building has a different comfort zone according to their purpose. The student center has a more moderate range of comfort, whereas the architecture building has a broader adaptive range of comfort. Other critical environmental strategies that are identified in the charts include heating, cooling, dehumidification, and natural ventilation.

These charts demonstrate how outdoor conditions can be modified through design strategies to achieve indoor comfort, supporting energy-efficient building performance.

Sunlight, Daylight and Thermodynamics:

The sunlight is very important in the design of the buildings. The orientation of every structure is thought to maximize the southern exposure to exploit the passive solar heating in winter and minimize the heat gain in summer through shading strategies.

Daylighting is also included by using large windows, open courts, and the orientation of buildings so that they do not need to light them up with artificial light. Insulation, ventilation and solar control measures enhance the thermodynamic performance of the buildings.

The seasonal solar variations have a great impact on the performance of the buildings across the year. The lower sun angle in winter enables the sunlight to enter deeper into the interior spaces and enhance passive solar heating as well as reducing heating demand. During summer, the increased sun angle increases the chances of overheating, and shading devices, trees, and the orientation of buildings are used to reduce direct solar gain. The U-shaped architecture building has the advantage of controlled daylighting by its courtyard. These seasonal plans enhance comfort of the occupants besides minimizing total energy use.

Architectural Details (more thoughts than visuals):

- **ERV System**- Student Center:

Energy Recovery Ventilation improves indoor air quality while reducing energy loss.

- **Cross Ventilation**- Architecture building:

Operable windows and the courtyard improve natural airflow and cooling.

- **Stormwater Pond**- Site:

The pond and landscaping reduce runoff and improve water management.

- **Solar Geometry**- Architecture Building:

The building responds to seasonal sun angles for heating and shading.

- **Passive Solar Heating**- Architecture Building:

South-facing glazing increases winter solar heat gain.

- **Solar Panels**- Student Center:

Roof-mounted solar panels generate renewable energy.

- **Shading Devices**- Student Center:

Exterior overhangs reduce summer heat gain and glare.

- **Daylighting**- Architecture Building:

Large windows and the courtyard improve natural lighting.

- **Automated Ventilation**- Architecture Building:

Automated windows improve airflow and thermal comfort.

- **Building Envelope**- Theater:

Insulated wall systems improve thermal performance.

- **HVAC System**- Theater:

Mechanical ventilation maintains indoor comfort and air quality.

- **Acoustic Wall Assembly**- Theater:

Acoustic insulation improves sound quality and reduces noise transfer.

LEED BD+C Scorecard

The sustainability decisions that were to be made during the project were guided by the LEED BD + C v4.1 scorecard. The design concentrates on such categories as Sustainable Sites, Energy and Atmosphere, Indoor Environmental Quality, and Water Efficiency.

The project has strategies such as stormwater management, native landscaping, passive solar design, daylighting, efficient HVAC, and walkable pathways, which help towards achieving the goal of the project of becoming a LEED Platinum project.

In sum, the mixture of passive and active environmental practices enhances sustainability, energy performance and occupant comfort during the development of the campus.

Category	Key Strategies	Estimated Points
Location & Transportation	Walkability, bike access, centralized parking	12
Sustainable Sites	Stormwater pond, preserved green space, native landscaping	13
Water Efficiency	Low-flow fixtures, efficient landscaping	8
Energy & Atmosphere	Passive solar design, daylighting, efficient HVAC	22
Materials & Resources	Sustainable materials, waste reduction	7
Indoor Environmental Quality	Daylighting, ventilation, thermal comfort	12
Innovation & Regional Policy	LEED-focused campus planning	7

Based on this estimated score, the site is LEED Platinum.

Conclusion:

This project shows how environmentally responsible and sustainable architectural and environmental design approaches can be used to develop a functional and environmentally responsible campus development expansion. The project improves the comfort of the occupants, minimizing the use of energy and environmental impact by having passive and active systems combined.

Integrating psychometric analysis, daylighting, solar orientation, and LEED BD+C concepts will produce a unified design, which will support sustainability and

student experience. By incorporating environmental design, site planning, and integration of buildings, the project is able to propose a modern campus expansion that is able to meet the LEED Platinum certification.