IIT Design/Build: Library & Community Center, Vietnam

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Frank Flury is a tenured professor and director of the BArch program at IIT in Chicago. Flury has 15 years of experience teaching a Design/Build curriculum to fourth year, fifth year, and graduate students in the College of Architecture. Flury focuses on the important connection between thinking and doing and in his design studios, students have designed and then built projects for numerous not-for-profit and charitable organizations.

Colleen Humer holds a BA in Art History and a post-grad degree in architecture from the University of British Columbia. She received an MA in art history, from the University of Toronto, while working for Webb Zerafa Menkes Housden and Arthur Erikson. Since 2006, she has taught architectural history and currently manages international programs and directs the first-year studio.

Jonah LaDuca is a fifth-year student of architecture. While studying in Chicago, he learned about and gained a love for designing and arranging interior spaces. Nearing graduation, he is excited to take part in work that would allow him to design spaces on projects with a variety of scales, hoping to bring order to a chaotic world.

Jason Pion is a recent graduate of the IIT Bachelor of Architecture program and a former student of the Vietnam Design/Build Studio. Before starting school, he developed a passion for affordable urban housing and community-led projects that require the democratization of design.

Jayhawk Reese-Julien is a fifth-year architecture student involved in faculty and student-led Design/Build projects. As Director of the IIT Chapter of Freedom by Design, he brings community-driven projects together with the Design/Build process to better support communities throughout Chicago. He brings his professional architectural experience at Thomas Roszak Architecture, and currently at Dirk Denison Architects to these groups.

Alejandro Noe Reyes is a fifth-year architecture student. He is interested in contributing to the larger academic discourse in architecture surrounding work that explores both the technical and theoretical sides of the field. He holds experience in the professional architectural field and on multiple faculty-led projects for the College of Architecture at IIT.

Abstract

In the summer of 2023, the IIT Design/Build Studio traveled to Vietnam to build an addition to a library in Gia Bac for the not-for-profit partner Eco Vietnam Group (EVG). The IIT Design/Build Studio, led by Prof. Frank Flury, developed the design over the course of a semester through meetings with EVG to ensure the new building would support the existing social infrastructure. This report discusses the vernacular precedents and contemporary analysis that underlay the development of the practical design solutions in the studio, and the practical results of on-site construction.

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Introduction

The pavilion project, adjacent to an existing library, was constructed in the remote town of Gia Bac in the south-central highlands of Vietnam. The studio began by researching the local vernacular as precedent for the library addition. It is an hour's drive on a twisting mountain road to the closest store with construction materials. The limited material access meant that a localized vernacular had developed for the region. One of the main takeaways from a scouting visit to Vietnam in February 2023 was the prevalence of bricks and screen blocks. The form of the screen ventilation blocks was 3D printed and studied before being selected as the primary wall element. The accurate model of the screen blocks allowed the studio team to study how these local materials would react to elements such as wind, light, and rainfall.

The existing community library in Gia Bac is used as a classroom for supplementing the local education system. The community had outgrown the space. Initially, the aim was to design a second classroom space for the campus. Through our discussions with the clients, the building's program became more flexible as we brainstormed new ways to support the community. The result was an adaptable space that could serve a multitude of purposes.

The studio's original plan was to be on-site for most of the summer, around 90 days, but due to visa difficulties, this was limited to 30 days. With the shifting program mentioned above, and the shortened timeline, the prototype was iterated multiple times as the project progressed, both during the design phase and the construction phase. The scope, structure, and form of the project were reduced to yield adequate time for completion.

Precedent/Existing Conditions

Gia Bac, Vietnam is a small rural community located in the mountains of the south-central Lam Dong region of the country. It has a population of about 2,500, with a total of 450 households. Around 99 percent of the residents are members of the K'ho minority ethnic group. Because of the geographical location, the village is unable to farm rice, unlike many other parts of the country, and therefore the main source of revenue is typically generated by family farming of coffee and corn. As children typically work

these family farms, education levels in the village are low, despite the presence of a local school.

The architectural vernacular of Gia Bac speaks to the concerns, desires, and abilities of the residents. Buildings must resist the powerful rains, high winds, and high temperatures of the central highlands. Additionally, the primary means of transportation in the village is the motorbike, which limits the acquisition of construction materials of either large size or quantity. Observing, recording, and drawing inferences about buildings and construction practices that are typical to the village provided insight into what type of structure would be most effective.

The buildings in Gia Bac are generally one story tall (see Figure 1). Smaller wooden buildings are often one-room and serve as support program for the farms. Concrete homes, on the other hand, usually feature several different rooms for distinct purposes. The rooms themselves often shift their use depending on the time of day.

Bricks and masonry units are common as wall materials and structural support (see Figure 2) and are often decorated with tile. It is also a common practice to cover these porous bricks with concrete as a sealer. Residential buildings that are not fully concrete usually have walls with a 1-meter-high concrete base as a foundation. The roofs of the residential buildings in Gia Bac are consistently constructed of corrugated metal sheets. Larger public buildings, such as schools, instead use roofs made of ceramic tiles. On construction sites, bamboo is visibly used as a lightweight scaffolding, often outlining the general shape of the building to come. Awnings and porches act as social spaces for the community. Many of the homes are set back from the street and rainwater drainage systems are open channels next to the roads. Often temperatures are cooler outside under ventilated shade than inside, bringing people to their front yards and porches. Due to the mountainous terrain, the sites on which buildings rested were flattened out through excavation, although on occasion, lighter wooden buildings sat upon infill sites. The remoteness, limited material accessibility, climate, and terrain enforces a somewhat uniform local building style. It is in the decoration, therefore, where individuality, and distinction from one's neighbors, can take place.

The most striking means of decoration is through color. Occurring on concrete buildings, light, almost pastel colors are frequently painted to a house's exterior. The secondary method of decoration is tile. Being simple to apply to a concrete building, ceramic tilework is often seen covering the floors, corners, columns, and bases of many of the more solid structures. Some wooden structures even featured approximations of these tiles, utilizing a patterned plastic veneer resembling ceramic tilework. And in an inadvertent application of color, both the aluminum and wooden sidings of buildings are tinged orange by the clay dust, creating a striking contrast between the manufactured structures and the rich green vegetation surrounding them.

Clothing hangs on wires or along roadside fences, adding another layer of color to already vibrant homes, while sandals sit out on porches to mark the presence of residents inside. Personal vehicles, usually bikes, trucks, or motorbikes, are seen parked uncovered in the front or side yards. In addition, the family's source of nourishment and income is on display in the form of the expansive farms. This activation of outdoor living spaces speaks very directly of the residents. This directness, where practice serves a

Figure 1. Typical home in Gia Bac, Lam Dong Province, Vietnam. These are assembled with various building methods and materials, most of which are lightweight, as heavy construction equipment and long travel distances complicate supply provision.

Figure 2. Concrete and masonry building under construction in Gia Bac.

purpose, points to the underlying basis of the vernacular. In an environment which exists by trimming the unnecessary, everything which appears consistently has a strong reason behind its presence.

The use of concrete and corrugated metal is a primary example of this. The consistency of their use demonstrates the value of their material properties. There are limits to the range of materials that residents here can buy and utilize; concrete and corrugated metal are both accessible to, and affordable for, the village. They are easy to install, and they resist the monsoons, which produce powerful seasonal storms in the region.

Consistency in spatial organization of the homes also offers insight into effective architecture in the village. Most buildings are single rooms with open fronts. Flexibility of use is a common trend, with the one main room being used variously throughout the day. This practice saves space, while also allowing for larger families to reside comfortably in their homes, by reducing the number of separate rooms needed in a house.

The open front addresses several environmental concerns. Firstly, in the intense heat, the large open fronts promote a passive airflow through the building, not trapping any heat inside of the primarily concrete and metal structure. In addition, it also turns the attention of those inside, outwards. This general tendency to move outdoors in high temperatures at first may seem counterintuitive. Using passive ventilation as primary means of climate control means that the insides of a home almost spill outside. This is as much a factor in the communal lifestyle of Gia Bac as it is a response to the climate the village faces. Relaxation and recreation occur entirely outdoors, with children utilizing the streets or parks, and residents often choosing to lounge in their shaded porches and front yards.

Altogether, Gia Bac's observable fabric seen during the study speaks to five key principles reflected in local vernacular construction:

Sturdiness

Despite wood traditionally being an easier material to build with, it was common to see a building composed partially, if not entirely, of concrete. Its prevalence comes from its ability to resist the storms common to the area. Corrugated metal roofs resist rain, while also repelling excess heat gain from the sun due to their rippling shape. A structure that resists structural and erosive damage caused by exposure to water is valuable in this climate.

Flexibility

Nearly every building in Gia Bac has one large communal area that could be utilized programmatically for multiple purposes. Any structure that allows for universal flexibility can better serve the needs of a community accustomed to the repurposing of enclosed space.

Control

Materials in Gia Bac are chosen first because of their effectiveness. With the wide variety of climate conditions the central highlands face, it is crucial that an occupied space can passively regulate its temperature, humidity, and airflow. Doors and windows remain wide open during the day to allow for maximum airflow and are closed at night to protect the interior from insects and animals. A structure that controls its thermal comfort in a variety of different conditions and using a variety of different methodologies can be utilized more throughout the seasons.

Availability

Marking every building in Gia Bac is the similarity of their materials and the priority of functionality. The remoteness of the village contributes to this. If a building is damaged or needs an extension, the required materials are easily accessible. Observing their widespread use, wood, concrete, masonry, and corrugated metal are the primary materials which make economic sense to use. For a structure to have a long life in the village, it must utilize accessible materials and familiar construction practices.

Identity

Individuality becomes critical to displaying a building's investment and character. Concrete buildings are often painted in bright colors and coated in distinct tiles to display their importance. Roof colors are strong and distinct, drawing more attention to the buildings they protect. The design and character of a building gives information about the people or business inside. Taking these extra steps towards creating a unique appearance in an environment where rigorous efficiency is so highly valued demonstrates that such distinctions are important.

These five principles represent the deep-rooted knowledge that the local builders of Gia Bac builders bring to their work. Learning from the wisdom of the local building style and practices is a crucial step towards understanding how we can make appropriate architecture and better implement building resources.

Eco Vietnam Group (EVG) Library as Precedent

Eco Vietnam Group (EVG) was the main partner and client for the library extension. EVG is a not-for-profit organization that provides afterschool programs for youth in rural villages of Vietnam. It has multiple library location, each focused primarily on communities of indigenous populations. The project was focused on extending the educational spaces of the library in the village of Gia Bac. The existing library on the site was part of the research.

Of all the buildings in the village, the EVG library (see Figure 3) is the best example and adaptation of the traditional vernacular practices of the village to a more contemporary building, providing an example of how these traditional practices can be recontextualized for current practice.

The building is oriented with the short axis facing south to reduce solar heat gain. It also sits on a raised concrete base, elevating the structure slightly off the

Figure 3. EVG Community Library: elevation looking into classroom.

Figure 4. EVG Community Library. The building porch is the site of much of the activity, keeping patrons cool and dry under the roof.

Figure 5. EVG Community Library interior classroom view, looking towards swinging bamboo doors.

ground and protecting the building from rainwater and flooding. Also, the concrete base shields the wooden structure and protects the books from water damage. This increases the longevity and structural integrity of the library.

The library incorporates an exterior covered colonnade, which acts as a buffer space, shielding the bamboo doors and interior space from direct rain, and regulating temperature (see Figure 4). The rotating bamboo doors create cross ventilation, increasing indoor air quality and thermal comfort (see Figure 5). In addition to their mechanical properties, the rotating bamboo doors bring daylight into the building and provide a visual connection between the library and its surroundings. On the west side, occupants face the campus courtyard, while on the east side, they are greeted by the lush greenery of the nearby farm.

The northwest structural wall defines the exterior kitchen space. Along the outer wall, a concrete counter houses a sink and an electric stove, along with multiple kitchen appliances, which sit on the counter itself and in a cabinet nearby. The floor also features an in-built basin that drains out to the nearby garden. The kitchen space stretches another 5 meters outwards, where several wooden tables offer a place for people to gather. Tables are portable, allowing the narrow area to serve a wide range of purposes during our study, from preparing dinner to coordinating construction plans.

An iconic feature of the EVG library is its asymmetrical roof design. This unconventional approach prevents water from draining into the circulation space. It also increases comfort by capturing and expelling heat through its interior double-height space.

The unique construction of the EVG library also stands out against the typical vernacular buildings of Gia Bac through its use of sustainable materials. Incorporating renewable resources such as bamboo and

wood and careful use of locally sourced non-renewable materials like aluminum sheeting and brick, the building sets the precedent for sustainable construction practices. The library minimizes the use of brick, with only the short walls of the building incorporating structural masonry. By employing alternative sustainable materials wherever possible, the building achieves a balance between functionality and environmental responsibility.

Wood, a key sustainable material used in the construction of the EVG library, offers numerous environmental benefits. As a renewable resource, wood contributes to carbon sequestration by absorbing and storing atmospheric carbon dioxide. This helps reduce greenhouse gas emissions and mitigate climate change. Additionally, wood is biodegradable, ensuring minimal environmental impact at the end of the building's lifecycle. As much as wood is a sustainable material, its longevity is compromised by the humidity and seasonal storms in Vietnam. To address this problem, the wood columns are propped off the ground with metal connector plates. This mitigates the erosion of wood caused by exposure, increasing the material's life cycle.

In conclusion, the EVG library exemplifies sustainable design principles and innovative features while also combining local vernacular practices. By using climate-responsive design strategies and sustainable materials, the EVG library served as precedent for our prototype's construction and methods.

Contemporary Prototype and Environmental Analysis

The next step in the project was to take what we had learned from our precedent research, using contemporary techniques to potentially improve on the existing design. We wanted the design for the classroom in Vietnam to take full advantage of all the climate data and analysis tools available.

Wind and Temperature Analysis

Using GIS data and local weather stations, we found yearly climate data for the region.

The prevailing winds across the campus come from the west and northeast directions. The winds shift biannually between the two directions during the rainy and dry seasons. In the rainy season, the winds come from the west, averaging 13.9 m/s, and during the dry season shift back to the northeast at 6.7 m/s. This helped determine the project's orientation; openings across the northeast and western façade would allow for prevailing winds to pass through and cool the interior.

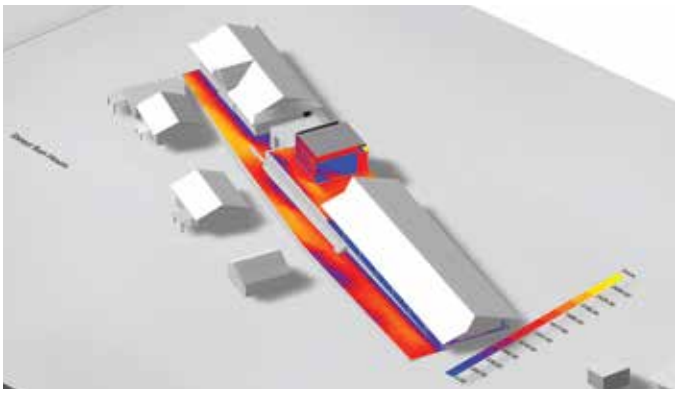

Figure 6. 3D Analysis of direct sun hours on site after construction of project, looking northwest.

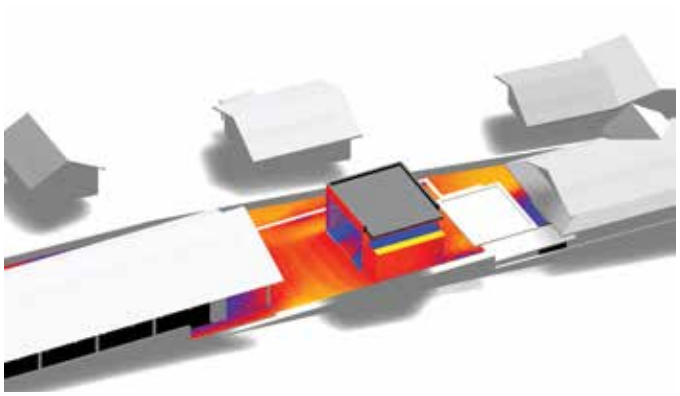

Figure 7. 3D analysis of direct sun hours on site after construction of project, looking south.

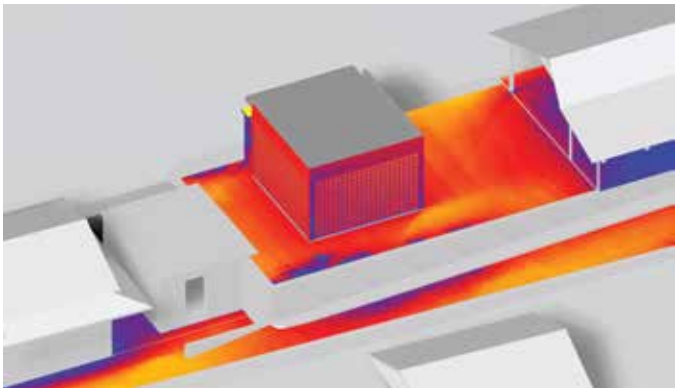

Figure 8. 3D Analysis of direct sun hours on site after construction of project, view looking north.

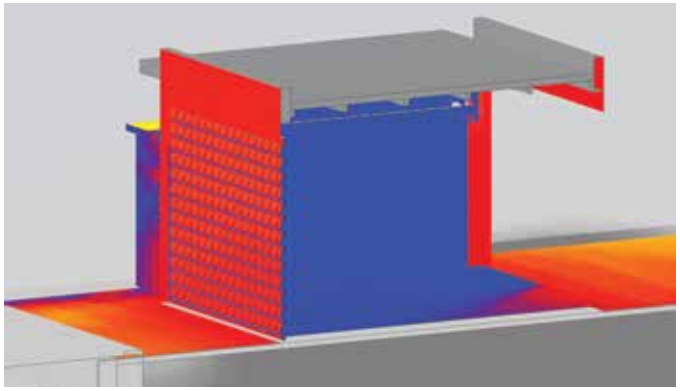

Figure 9. Sectional analysis of the screen block wall, designed to admit airflow while blocking solar exposure and precipitation.

Solar Analysis

As we refined the solar analysis model, our studio found that the main circulation pathway on the site and many of the smaller circulation areas are shaded by vegetation. Direct solar exposure varies greatly depending on whether it is the dry or rainy season, but the temperature does not change drastically with it (see figures 6, 7, and 8). The site maintains dry bulb temperatures of around 25°C in the rainy season and a wider diurnal change in temperature of 15 to 30°C in the dry season.

This demonstrates the humidity level changes due to precipitation, but the temperature remains consistently high, reinforcing the value of systems such as solar shading and passive ventilation, especially considering limited access to electricity and environmental best practices for this climate zone. Using the building's placement at the site's northern end, we could keep the space daylit, but not overexposed, to reduce solar heat gain.

The screen blocks used in the project were selected to maintain the greatest amount of airflow through the building while also blocking solar exposure and precipitation (see Figure 9). By analyzing the cross section of the wall, we could select blocks that created the largest difference of solar exposure between the façade and the interior space. This difference helped determine how much solar heat gain would occur in the space. Therefore, we were able to select screen blocks that prevent the interior from overheating.

The building design was informed by careful use of environmental analysis. First, the overall orientation and position used wind and temperature analysis to maximize airflow. Second, the screen blocks were positioned to balance shading and solar exposure with ventilation. Finally, the solar analysis helped maintain the existing shaded pathways throughout the site. Using these studies helped focus passive strategies and adapt our design to the local environment (see Figure 10).

> “In the rainy season, the winds come from the west, averaging 13.9 m/s, and during the dry season shift back to the northeast at 6.7 m/s. This helped determine the project's orientation.”

Figure 10. Conceptual rendering of the library pavilion, using a concrete frame, a ventilated wall of screen blocks, and swinging doors, incorporating similar principles to the original library building and local vernacular construction practices.

Construction and Activation

The preliminary research phase was finished during the spring semester (January–May 2023). Over the summer semester (May–August 2023), the project was constructed on an expedited timeline (see figures 11–16).

The final part of the story is the activation of space. In any construction, there is a point at which a building is passed from architect to user. In Vietnam, our studio discussed with our partners how the new building could be activated once it was constructed. In this study we will look at two possible activations: a classroom and a coffee roastery. Eco Vietnam Group has voiced interest in both options. These studies imagine the final form of the building and its surrounding spaces.

Figure 11. Concrete column and beam structure under construction.

Figure 12. Exterior wall construction.

Figure 13. Detail view of ventilated wall system under construction.

Figure 14. Steel roof purlins and brick parapet under construction atop the frame.

Figure 15. Concrete roof under construction.

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Figure 16. Crew assembled in front of completed structure, July 2023.

> “The screen blocks used in the project were selected to maintain the greatest amount of airflow through the building while also blocking solar exposure and precipitation.”

The Classroom

The first option is to have the building serve as a supplementary classroom (see Figure 17). This would enable EVG to educate more students at its Gia Bac campus. The school could offer separate content to different age groups and host classes simultaneously in both classrooms at once.

The classroom would be equipped with low desks and cushions to sit on. Shelving

on the north wall could store the desks and cushions when not in use. The screen block would create passive ventilation to keep the students at a comfortable temperature while daylighting the space. Large roller doors on the east side could close off the classroom from the rest of the campus or open it up to the courtyard. The courtyard can serve as a much-needed outdoor play area for the students. Retractable shading devices can cover the courtyard when needed. Classroom activities connect with the existing campus by spilling out into the courtyard.

The Roastery

The second activation possibility is a coffee roastery (see Figure 18). The building would offer a place for local farmers to dry, shell, and roast their coffee. The local coffee could then be consumed in a café. The roastery would be a place of education and entrepreneurial development for the local economy.

The roastery equipment would be housed inside the main building. The roof of the building could be used for drying coffee beans in sanitary and dry conditions. The roof also provides unobstructed sunlight exposure for the drying beds. To the south of the site, a pergola could be placed to shade tables for a café pop-up. Coffee can be planted on the site to educate visitors and students about the local coffee industry.

The new building has multiple possibilities for activation. As a classroom, children can have more space to grow and learn. As operators of a coffee roastery, the local farmers can educate the public and promote their business.

Figure 17. One potential activation of the completed structure, as a classroom, with original library building shown at right.

Figure 18. A second potential activation of the completed structure, as a coffee roastery.

Conclusion

Our prototype for the rural community of Gia Bac, Vietnam was successful in utilizing the techniques from the typical Vietnamese rural typology in the construction of a library addition for our not-for-profit partner EVG, which had envisioned it serving the overall development of their campus.

Our early mission was to build a facility that could adapt to the existing infrastructure challenges of Gia Bac. We learned through our research that flexibility was key to addressing the long-term needs of the community. Unlike typical research projects, we were able to get a more direct hands-on experience of the building process by traveling to Vietnam. The building can serve as a prototype and provide a template for future development on this remote site in Gia Bac, and throughout the world in similar conditions. ■

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