CLOUDS OF WOOD: A COLOMBIAN DESIGN-BUILD EXPERIENCE

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ABSTRACT

The idea of complexity in the teaching and practice of architectural design is linked to formal processes or their programmatic features, leaving aside relevant aspects of the complete cycle of an emergent building: the relationships with the communities involved, management of financial and material resources, technical designs, environmental qualities, construction, and performance. In this way, too much relevance is given to the production of architectural representations and the student's individual work, in detriment to the real impact that the student's activities may have on our society. In the Clouds of Wood Design-Build Studio (Medellín, Colombia, 2013–17), complexity was understood as the passage of a team of two professors and thirty students through the stages of design and construction of small-format buildings, made in association with rural communities near Medellín and a local company specializing in building with immunized wood. Constructions with a light program, low cost, and high impact on the communities' daily lives were agreed on between all parties. Excessive production of drawings, models, and simulations was avoided, and collaboration between students, teachers, community leaders, representatives of municipal governments, and construction instructors was encouraged.

In each semester of this course (ten studios in five years), the students worked in an articulated way in five groups with defined roles and responsibilities (fund-raising, drawing, wooden models, budget, construction). They only drew plans after knowing in depth the materials and construction technologies to be implemented; they only designed after visiting the communities involved; and they only built after understanding the budgets and the various constraints in play. If in a traditional design studio the students spend at least 80 percent of their time in activities of representation, often disconnected from everyday reality, in this course, they spent half of their time in meetings with experts and leaders, generating not only a balance in favor of the project but also a limited number of precise drawings. The course ran in four one-month modules: the first one to define in a group the overall aspects of the design (program, size, location, qualities) and evaluate five variants; the second, to develop the chosen design proposal; the third, to plan the construction phase; and the last, to build and inaugurate the building with the community. The result was the creation of a family of permeable buildings that are resistant and adapted to the tropical climate; have minimal geometric, structural, and tectonic variations; and made use of the constructive advantages of immunized wood. In addition, the consolidation of a group of students committed to the particular problems of communities, who can propose necessary, relevant, and unexpected buildings, raised the question about what is significant or even radical, today, in the education of architectural design: (a) the exploration of worlds (not yet seen)

through images and models, or (b) the incorporation of design into the (already existing) complex and restrictive dynamics through a built architecture project?

Keywords: Communities, Complexity, Permeability, Tropics, Wood

1. INTRODUCTION

The work presented below was carried out in the Clouds of Wood Design-Build Studio of the Universidad Pontificia Bolivariana (UPB) School of Architecture in Medellín, Colombia. During five consecutive years (2013–17), two professors and a group of thirty students in each semester worked together in partnership with the administrations of San Vicente Ferrer and Támesis, municipalities of the department of Antioquia in Colombia, and with the local company Serye, which is dedicated to construction with wood. Based on the social mission of UPB, and emphasizing collaborative work, we built two small-scale projects each year, leaving a tangible benefit for these rural and underserved communities.

San Vicente Ferrer is an agricultural municipality located in the eastern part of the department of Antioquia, 48 km from the city of Medellín. It has 22,000 inhabitants, and the vast majority are farmers (fruit, bean, potato, and corn crops) who visit the urban area on weekends to sell their products. This region has a cold climate without seasons, constant throughout the year. Támesis is a tourist and agricultural municipality located in the southwest of Antioquia, 65 km from the city of Medellín. It has 16,000 inhabitants, the majority of whom are farmers (coffee, banana, cocoa, and fruit crops). However, recently, tourist activity has begun to be significant due to the spring climate and the exuberant nature of the region. A traditional local architecture of houses with a central courtyard, large perimeter corridors, and simple materials (bricks, wooden columns, gabled roofs, and clay tiles) exists in both municipalities. In recent years, and due to its low cost and maintenance, light architecture, built with immunized Caribbean pine wood, has become an essential option for constructing small-format buildings in these municipalities: kiosks, pavilions, bridges, viewpoints, decks, classrooms, and so on. By building a relationship of trust with the Secretary of Education (Gloria Giraldo) of both municipalities (2013 to 2015 in San Vicente Ferrer and 2016 to 2017 in Támesis), it was possible to determine the needs of several educational communities and to propose new small-format buildings in immunized wood for their use:

- Semester 1/2013: Auditorium (Roof and steps for the courtyard of the cultural center)
- Semester 2/2013: Sunshade (Cover, cladding, and structural reinforcement for a soccer field grandstand)
- Semester 1/2014: Community house (House for peasant farmers)
- Semester 2/2014: Bleacher (Stand to connect a school and a community center)
- Semester 1/2015: Outdoor meeting area (Covered space for classes and games in a small rural school)
- Semester 2/2015: Lobby (Covered space for multiple activities in a rural school)
- Semester 1/2016: Covered walkway (covered space to connect existing classrooms)
- Semester 2/2016: Decks (Outdoor platforms for music classes and watching sports activities)
- Semester 1/2017: Theater (New roof for an existing outdoor theater)
- Semester 2/2017: Social pavilion (New covered space for community meetings).

2. DISCUSSION

During the development of these projects, we understood the idea of complexity in architecture not as a problem of size, combination of programs, or formal challenges, but as the complete path that each student takes along the material and social cycle required by any architecture that is built. In each studio cohort, we defined the program and chose the place to intervene with representatives of the municipalities. We made design versions, explained them to the community, planned the technical networks with engineers, and managed economic resources through raffles and fund-raising. We participated in the construction, delivered the project to the community, participated in the opening and future maintenance of the buildings, and managed future publications to disseminate the work and access supplemental funding.

We proposed a secondary role for architectural representations; thus, only digital plans and a few models were made. In return, students were encouraged to invest the money spared from printings and simulations on construction. Somehow, reducing representations to a minimum allowed students to give greater relevance to the constraints that each project faced (Stonorov 2018, 1), due to the simple fact that the students spent more time visiting the place, talking with the community, understanding the technical aspects of the wood, and making the best possible use of a limited budget. Although each student attended the various stages of the process, they also found a suitable place to participate, with independent responsibilities and concrete tasks. This made a way for students not so qualified in architectural design to contribute from other vital angles of the project, some of which are often less considered in conventional design studios. Tasks such as the choice of the program were, in all cases, a matter of great interest to the students. Therefore, we tried to focus on the fundamental problems of the communities, proposing activities that they would not have expected to have. For example, if the community required a roof repair, we proposed a new auditorium covering a patio; if they needed stairs to connect two public buildings, we proposed an educational bleacher; if they asked for a platform to see sports activities, we raised recreational decks; and if they needed a new meeting room for a rural school, we offered them a classroom for the garden.

The total area of the ten buildings built over the years came to no more than two thousand square feet, at a cost of US$200,000. Still, we estimated that within the municipalities a total of two thousand people were positively affected by the projects, including students, teachers, managers, parents, farmers, and visitors. In five years, a total of three hundred architecture students participated in this educational process.

By briefly reviewing two relevant case studies of design-build studios in Latin America, we can observe the particularities of our course with more precision. In the last year of the design-build studio of the University of Talca in Chile (Uribe 2013, 99), each student, before graduating, designs and constructs a small building for a specific community in a rural area. Each student has one year to draw, define the program, manage resources, and build. In the case of Matéricos Periféricos, at the University of Rosario in Argentina (Valderrama et al. 2019, 5), students from different years work together on long-term projects (two, three, or more years), designing and constructing buildings or public spaces for consolidated neighborhood communities. Projects usually have several phases, and they use donated building materials that accumulate over the years.

Clouds of Wood is only for third-year students. We work with a limited time of four months per project for the same communities and municipalities, using the same materials and construction techniques. Thus, the knowledge is cumulative, although the projects

change. During each academic period, the thirty students form five teams that work in an articulated manner throughout the course: Fund-raising Team, Budget Team, Drawing Team, Model Team, Construction Team. Each team has a leader who can make agreed-upon decisions. The course is divided into four modules of one month each. We defined the general aspects of design, program, location, and size during the first month. Then, each group proposes a version of the project. In the second month, we choose the final design version developed by the drawing and model teams, while the remaining teams hold meetings with engineers, advance budgets, raise funds, and perform other tasks. In the third month, we present the final project to the community and plan the construction. And finally, during the fourth month, we build and inaugurate the new building. The work between teachers, students, engineers, instructors, and the community is intense and collaborative.

From the beginning of the course, students know that they will carry out different activities and that it will be more critical to work collaboratively than individually. Each of them decides which team they want to participate in according to their preferences: some want to learn about construction, others about budgets, others about design, and so on. For most of the students, the building they build during this course is their first project built and the only one during their architecture education, which in Colombia lasts five years. For them, it is not only stimulating to approach the complexity of professional work but also to work for underserved communities in remote regions of Antioquia. The work done in this course benefits them because it gives them tools they can implement in courses that require further development and technical knowledge. Still, it also allows them to understand the limits of architectural design and the various constraints it faces.

The municipality representatives and the academic communities where the buildings will be built are always positive because they participate in the process: they manage and contribute financial resources and help define the program and the project's characteristics. Therefore, on the one hand, the result is not a surprise because they have followed the process and feel part of the work team. But, on the other, the new spaces surprise them, because we always provide something more than what they were expecting. We have learned that communities do not want imposed gifts but necessary projects in which they can participate.

3. CONSTRUCTION

These Clouds of Wood are light and porous constructions. They are small monochrome buildings and structures to provide shade; in them, the wood assumed minimal geometric and structural variations. Although they were built to withstand twenty years, they can also function as temporary buildings. We constructed them in tropical mountainous, humid environments at different elevations. Six were built in eastern Antioquia, in the municipality of San Vicente Ferrer, located 2,200 meters above sea level; The other four were built in southwestern Antioquia, in the municipality of Támesis, at 1,600 meters above sea level. These constructions were closely linked to the unseasonal tropics, with constant temperature correlated to elevation above sea level and bimodal rainfall. Furthermore, their permeable configurations control the afternoon sun and allow continuous cross-ventilation, protecting against the accumulation of moisture and rain.

We carried out the work with the support of the local company Serye, which provided the knowledge regarding the advantages and limitations of *pino patula* (patula pine) wood, a

species native to Mexico and introduced in South America more than fifty years ago. The crops and extraction processes are certified by local environmental entities. Their technical characteristics favor the construction of structural and secondary members at a low cost. The vacuum immunization process gives them resistance to fungi and insects for more than twenty years with minimal maintenance. The recycling of the chemical product of the immunization (Chromated copper arsenate, CCA) in a closed cycle is framed in a code of good environmental practices for immunization. However, currently, this product is being replaced by others, free of arsenic and safer for human health. This product has been banned in the United States by the Environmental Protection Agency (EPA) since 2003 for residential use. In Colombia, the use of this medium-density and fast-growing wood prevents deforestation of tropical forests and the extraction of native timber of high density and slow growth, almost all belonging to endangered species.

Figure 1: Construction processes (Students)

We discarded the use of metal connections (collars, plates, knife plates) due to cost. Therefore, we employed simple connections, such as galvanized bolts and screws through the wood, allowing for a frontal or tangential joint between primary and secondary members (columns, beams, struts, decks, and enclosures). We built the foundations using reinforced concrete pillars (diameter: 3.2 feet; depth: 6.5 feet) in which the wooden columns were embedded directly. Taking advantage of a qualified and economical local workforce, instructors and students collaborated with them to construct buildings with simple details, avoiding complexity (Figures 1, 2, 3).

Figure 2: Construction processes (Students)

Figure 3: Covered walkway connecting two school buildings in Támesis (Alejandro Arango)

4. CATALOG OF BUILT PROJECTS

The following catalog presents the ten projects we built during a five-year period (2013–17). All have educational or recreational functions and support programs for rural communities or educational institutions in the municipalities of San Vicente Ferrer and Támesis. In all

cases, we used the same geometry and construction techniques, trying to take advantage of the qualities of the immunized wood of Caribbean pine, widely cultivated in various regions of Antioquia. The learning objectives that supported these constructions were repeatedly the same: bringing students closer to the phenomena of design and construction, positively understanding the various constraints that arise in each architecture project, and putting architecture at the service of underserved communities, verifying its capacity for transformation. We tried to consolidate a cumulative knowledge that would allow us to act quickly and pertinently on each project.

4.1 San Vicente

4.1.1 Auditorium

Task: To improve the common spaces of a community center and repair the roof.

Background: The stepped courtyard was abandoned and in poor condition; it was being used as a warehouse. Its façade, which could have enjoyed the view of the distant landscape, was covered by a wall. The use of the patio was minimal due to the climatic characteristics of the municipality, where rain is constant.

Project: We proposed reworking the patio as a small auditorium, covering it with a polycarbonate roof and a permeable wooden ceiling to control the sun, locating lamps that allowed its use at night. We demolished the wall that was obstructing the view and installed a new stone floor. Currently, the auditorium is used as a rehearsal room for music and theater (Figure 4).

Figure 4: Auditorium in the community center, San Vicente (Alejandro Arango)

4.1.2 Sunscreen

Task: To improve the standing roof over the grandstand of the municipality's soccer field.

Background: The afternoon sun prevented good visibility of the field. The existing roof could be extended and remodeled, but we realized that it was in bad shape when we studied the metal support structure. Dismantling it involved spending money we didn't have, and it was dangerous, so we opted to repair and improve it.

Project: We reinforced the columns, covering their bases with new concrete pedestals. We added braces and extended the trusses of the metal structure toward the nearby slope, connecting them with new concrete foundations. By avoiding adding excess weight to the existing structure, we could lift a new cladding of wooden elements that works as a ceiling and a sunscreen (Figure 5).

Figure 5: Sunscreen for the grandstand of a soccer field in San Vicente (Alejandro Arango)

4.1.3 Community House

Task: To build a gathering space for farmers who visit the plaza of the municipality to sell their agricultural products twice a week.

Background: Many the farmers who live in rural areas and visit the town center to sell their products lack a place where they can recover from the trip, store their belongings, pause, have a coffee, or refresh. The only lot available to build a gathering space for the farmers was a small corner lot located ten feet below the market's level.

Project: We built a stilt house articulated to the market area, accessed from a wooden bridge. In its interior, two skylights allow access to natural light, and its rear façade has a balcony with a view of the distant agricultural landscape (Figure 6).

Figure 6: Community house for visiting farmers in San Vicente (Alejandro Arango)

4.1.4 Bleacher

Task: To connect a cultural center to a public school.

Background: Although the buildings were adjacent and provided complementary services, they were not articulated. The school students and the users of the cultural center had to look for the entrance of the other nearby building. The difference in levels between the two buildings was 30 feet.

Project: Initially, we designed a ramp that involved many columns and foundations, which was expensive. Therefore, we decided to connect the two buildings by employing a bleacher that adapts to the existing slope and expands its size at the bottom, lending itself to various activities, such as picnics, recreation, and outdoor discussions and classes (Figure 7).

Figure 7: Bleacher connecting a school and cultural center in San Vicente (Alejandro Arango)

4.1.5 Outdoor Meeting Area

Task: To provide an outdoor meeting area for a rural school.

Background: The school facilities lacked covered outdoor spaces for student activities. Parents insistently requested a space for meetings and celebrations.

Project: Instead of a conventional meeting space, we designed and built a space for the garden and placed it on the stepped floor of an old orchard, taking advantage of the slope to suggest the activities that could happen: classes, readings, games, and religious ceremonies (Figure 8).

Figure 8: Outdoor meeting area in a rural school in San Vicente (Alejandro Arango)

4.1.6 Lobby

Task: To cover the access platform of a rural school.

Background: The school was organized with a semicircular geometry of buildings scattered around a concrete and staggered platform. This space, which functioned as an arrival area and a place for recreation, was exposed to the constant rains.

Project: We decided to cover a fragment of the platform to turn its upper level into a covered hall connected to the entrance and exit of the school. The challenge was to cover as much area as possible using the fewest number of columns to avoid blocking the view (Figure 9).

Figure 9: Lobby for a school in San Vicente (Alejandro Arango)

4.2 Támesis

4.2.1 Covered Walkway

Task: To connect two classroom pavilions.

Background: This is a school with an agricultural emphasis, so many activities happen outdoors, but the institution lacked covered areas for recess hours.

Project: The new structure was built on a long-existing stepped platform, but its columns were located in the garden to gain interior space. The slope favored the intervention, since the space does not function simply as a place of passage but also as an elongated gathering area (Figure 10).

Figure 10: Covered walkway connecting two school buildings in Támesis (Alejandro Arango)

4.2.2 Decks

Task: To build a bleacher in the garden from which to observe sports activities.

Background: Although the sports area was the most used school space, it lacked support infrastructure to watch these activities, and the nearby café needed seating areas.

Project: Instead of a conventional bleacher, we decided to build five modular, staggered decks that serve as places to observe sports activities, conduct an outdoor class, or have a picnic (Figure 11).

Figure 11: Decks for outdoor teaching and watching soccer games in Támesis (Alejandro Arango)

4.2.3 Theater

Task: To build a roof for an outdoor theater.

Background: The stands and stage of an existing outdoor theater were underutilized and almost abandoned in a municipality lacking cultural infrastructure. The teachers at the nearby school requested a roof that would help reactivate the underused space.

Project: The area initially intended to be covered was very large, and our budget was insufficient. Thus, we opted to cover the stands and part of the stage areas by employing a polygonal and ring-shaped roof, which set up a small patio (Figure 12).

Figure 12: Theater in a rural area in Támesis (Alejandro Arango)

4.2.4 Social Pavilion

Task: To build a new space for community meetings on a lot owned by the municipality.

Background: The community and its representatives, who had to meet once a week, used places such as the church or the library due to the lack of a proper meeting space.

Project: Although the community required a flexible and flat interior space, the only area available for the construction was a steep slope with a beautiful view of the distant rural landscape. Therefore, we proposed and built a horizontal stilt building on the hillside, open on one end to direct attention to the distant mountains (Figure 13).

Figure 13: Social pavilion for the community leaders in Támesis (Alejandro Arango)

5. CONCLUSIONS

In these exercises, we built a close relationship with the rural communities and public officials of the mentioned municipalities; trust and credibility were achieved with constant effort and were an essential part of the process. The most relevant aspects from an educational point of view were having to face the environmental and social restrictions of the context, turning these into qualitative aspects of the built projects, and maintaining an open attitude to dialogue and collaboration.

Exploring new innovative worlds through suggested and personal images that usually inhabit architectural design studios had no space or usefulness on this occasion. Still, its absence opened the question about what is relevant and even radical in architectural design education today (Mesa and Mesa 2107, 8).

The ten projects carried out become more relevant when they are understood as a strategy to build permeable projects in tropical and rural regions, and as a tactic on the part of the academy to produce necessary architecture without giving up architectural design as an exploratory activity linked to its context (Figure 14).

By understanding complexity in architecture as the process necessary to build a project and not simply as a formal matter, students understood the many phenomena that can affect architecture and determine its qualities. They understood that a suitable building requires economic resources, adequate materials, pertinent construction systems, and a community that needs it and can make use of it. They were aware of the transformative capacity of built architecture and the limits of representation and drawing.

Figure 14: Projects drawn, designed, and built during Clouds of Wood Design-Build Studio (Students, Mesa Estándar, Alejandro Arango)

ACKNOWLEDGMENTS

San Vicente Municipality: José Antonio Bedoya (former mayor), Gloria Giraldo (former Secretary of Education).
Támesis Municipality: Iván Alexander Zuluaga (former mayor), Gloria Giraldo (former Secretary of Education).
Universidad Pontificia Bolivariana, Facultad de Arquitectura: Samuel Ricardo Vélez. (head of Architecture Department).
Inmunizadora Serye: Sandra Hernández (manager), Aura Grisales (engineer).

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