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AMAZONIAN MASS TIMBER IN THE NEW CIPEM'S HEADQUARTERS – MATO GROSSO, BRAZIL

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ABSTRACT: The Mato Grosso Timber Production and Export Industries Center (CIPEM) is the union of eight forest-based employers' unions, whose purpose is to organize and strengthen the sector. It encourages the productivity and conscious consumption of wood and its forest-based products regarding the current legislation and in a sustainable basis. Cipem is at vanguard of sustainable forest management in Brazil and there is a huge potential of exploiting medium and low density amazonian species that are ignored by the market. Its new headquarters was designed by using mass timber made of Amazonian wood. The partnership between Cipem and mass timber brazilian manufactors will allow all the required certification for those species' behavior aiming to produce CLT and glulam components. The design of the building had as premisses the fast assembling of the timber structures based on its constructive rationalization, the maximum exposure of the variability of the amazonian species managed by Cipem and the search for an architectural language and contemporary design. Huge poles with 10m heigh and coming from the Amazonian forest will be highlighted in the building, aiming to show the amazing transformation from this raw material into a contemporary constructive material.

KEYWORDS: Wood, Amazonian Wood, Mass Timber, Timber Structures, Contemporary Design

1 INTRODUCTION

CIPEM is the entity that represents the forestry sector in the state of Mato Grosso and its objective is to organize and strengthen this sector. The entity promotes the productivity and conscious consumption of wood and forest based products in a sustainable way, in accordance with current legislation and in harmony with the environment. Within this philosophy and with the aim of promoting the use of Amazonian wood in the construction sector, the design of its new headqurters was developed with mass timber solutions that highlight the material. This article presents the design of this building.

2 METHODOLOGY

The project of the Cipem's new headquarters was developed from the following premises:

• use of lesser-known species added to efficient timber structures to promote the quality of native essences;
• definition of constructive solutions based on mass timber components made of Amazonian woods;
• use of several Amazonian wood species managed by CIPEM in different uses in the building;
• highlight colour, texture, and workability of this raw material.

3 DESCRIPTION OF THE PROJECT

The design of the building was conceived with two main areas of interest, a 3 stories central area were administrative and technical staff will be installed, and an auditorium linked to a central hall that connects all areas of the building. Figure 1 shows its ground floor plan, and a section of the building can be viewed in Figure 2.

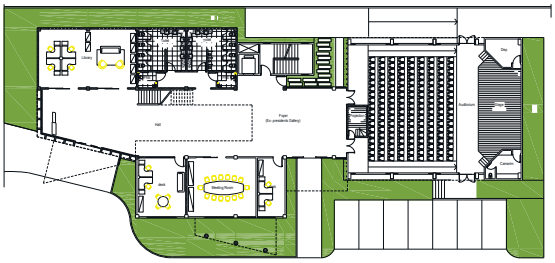

Figure 1: Ground floor plan

Figure 2: Section

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The fist and second pavement of the building are illustrated in Figures 3 and 4 highlighting several levels of the timber structures. Figure 5 shows a cross section of the building.

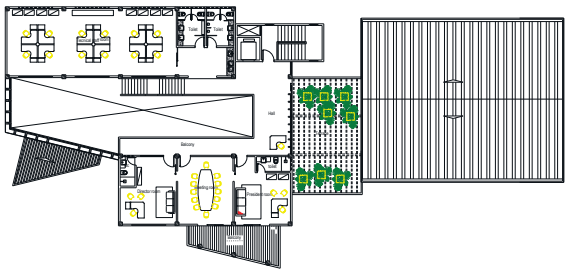

Figure 3: *First pavement*

Figure 4: *Second pavement*

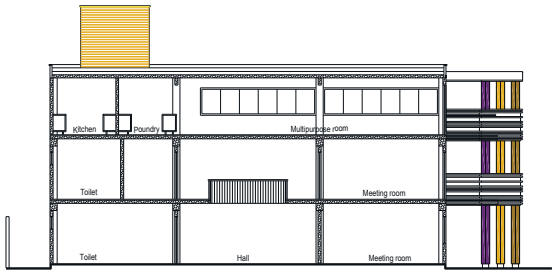

Figure 5: *Cross section of the building*

Wood species were selected according to CIPEM's priorities related to market strategies and aiming to promote lesser-known essences. Also, their physical and mechanical properties were considered taking in account their specific use in the proposed timber structures.

Low density species like Cedrinho (*Erisma uncinatum*), Amescla (*Trattinnickia burseraefolia*) and Marupá (*Simarouba amara*) were selected for glulam and CLT. Secondary structures, flooring and finishings will be made with Tauari (*Couratari sp.*), Roxinho (*Peltogyne sp.*), Cumaru (*Dipterix sp.*), Muiracatiara (*Astronium lecointei*) and Orelha de Macaco (*Enterolobium contortisiliquum*). Figure 5 illustrates those selected Amazonian woods.

Wood came from different exploitation regions and this diversity represents the eight forest-based employers' unions that are organized by CIPEM.

Figure 5: *Selected Amazonian woods*

4 BUILDING PROCESS

The use of amazonian wood in the buildings starts with applied research related to the physical and mechanical behavior of these species. For example, glulam can be manufactured using both softwood and hardwood and can use a variety of different types of timber.

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CLT has many applications in the building as it is used for walls, floors, and roofs. CLT and glulam products are significantly lighter the traditional building materials, so foundations were designed to support smaller load and therefore use less material.

The building structural system was based on a glulam post and beam structure with CLT slabs, walls, and ceiling. Post and beam construction utilizes large, widely spaced wood to provide structural support to the building, allowing the desirable freedom in developing both interior and exterior space of the building, as showed in Figures 6 and 7.

Figure 6: *Post and beam MLC consumption is about 80 m3*

Figure 7: *CLT slabs and walls' consumption is 330 m3*

CLT and glulam will be fully fabricated before transportation to site. It will enable quicker construction times compared to other materials, and cost savings.

The construction will start with the execution of foundations and concrete core. Concrete core aids the building's structural stability and provides access and escape via lifts and stairs, regarding fire code requirements. Figure 8 shows an image of the building highlighting mass timber and concrete core.

Figure 8: *Aerial 3D image of the CIPEM's new headquarters*

Amazonian wood will be used to create delicate and warm spaces inside the building. Research has demonstrated that like the way indoor plants can help ease stress, using indoor natural wood surfaces can also improve physiological health.

Figures 9 and 10 illustrates the central area of the building where mass timber solutions made of Amazonian wood are exposed.

Figure 9: *Internal view of the central hall of the building*

Figure 10: *Internal view*

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Aesthetics reasons and the warmth given using wood are key elements of the auditorium, and room acoustics are improved. As showed in Figures 11 and 12, the presence of wood gives a contemporary design and instantly adds a natural light to the interior.

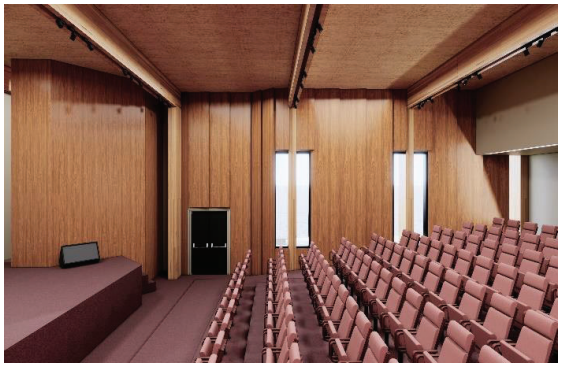

Figure 11: *Internal view of the auditorium*

Figure 12: *Internal view*

Wooden cladding made of Amazonian species will give durability, colour options and easy-maintenance to the facades of CIPEM"s new headquarters. They are not structural elements and form a protective layer on the building.

They are more than just decorative elements and help in aiding sound insulation. Wooden cladding can be easily recycled, renewed, or painted over to provide a whole new look. Figures 13, 14 and 15 illustrates the use of Amazonian wood cladding in the facades of the building.

Figure 13: *Wood cladding in the main entrance of the building*

Figure 14: *Main entrance*

Figure 15: *External wood cladding in the auditorium*

Huge poles with 10m heigh and coming from the Amazonian Forest will be highlighted in the building, aiming to show the amazing transformation from this raw material into a contemporary building material.

High density species like Roxinho (*Peltogyne sp.*), Cumaru (*Dipterix sp.*) and Orelha de Macaco (*Enterolobium contortisiliquum*) will be placed in the facade. Figure 16 shows the presence of Amazonian timber poles in the building.

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Figure 16: *Amazonian timber poles in the façade*

Thermoacoustic roof will be installed in the building and external pergolas will act as green roofs with many benefits in terms of sustainability because the vegetation will convert CO2 into oxygen and filters particulate matter from the air.

The pergolas will provide shade, remove heat from the air and reduce temperatures of the roof surface and surrounding air. They can also contribute to moderate the heat island effect specially in a city with hot climate. The building is in Cuiabá, the capital of Mato Grosso State. Figure 17 shows an aerial view of the building highlighting the presence of the pergolas.

Figure 17: *Aerial view showing the pergolas*

5 CONCLUSIONS

The experience of designing CIPEM's new headquarters with mass timber made of Amazonian wood confirms the several possibilities of building with this raw material, aiming to create an unique Mato Grosso's native wood showcase.

The use of mass timber in our country is increasing in a remarkable rate, and due to its huge market Amazonian timber has strategic role in this field. The reduction in the assembling time that is typical of the prefabricated structures is added to the aesthetics given by the presence of wood, making it very competitive against other building materials.

Some advantages of using glulam and CLT structures like prefabrication of large components at the factory and short assembly times at the construction site will be highlighted to improve timber construction techniques in Brazil's central region.

The use of Amazonian timber structures is evidence of the flexibility of this sustainable and locally sourced material. It should be pointed out the importance of demystifying the use of timber structures as "non-ecological" in our country, because wood is the only choice for a renewable and sustainable building material and wood materials are desirable for their strength, durability, beauty, and cost-effective construction.

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