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SPECIAL SIZED TIMBER POLES AS MAIN STRUCTURAL MATERIAL IN TWO SPORTS GYMS AND A WINERY – BRAZIL

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ABSTRACT: Brazil has a long tradition of building with concrete. Although our country possesses the largest tropical forest of the planet, timber structures aren't the first choice for designers and builders. The urgency of develop low-carbon solutions to built environment is the key element of promoting the only construction system sequestering carbon and engineered to be "energy positive", and this raw material is wood. In central Brazil, due to its geographic location, there are suppliers for both hardwood from the Amazon region and softwood from the southern. Starting from the experience of several timber structures executed in this region, it was proposed the use of pressure treated eucalyptus poles as the main structural material in two sports gyms and a winery, also using sawed hardwood as secondary structure. The structural system of the gyms is composed of porticos and the size of the rounded pieces reaches 24m long. A spatial structure was proposed to the winery according to contemporary design. The remarkable aesthetics given by the natural appeal of timber along with its sustainable aspects became powerful marketing tools to the enterprises.

KEYWORDS: Timber Structures, Low-carbon Solutions, Eucalyptus Poles, Structural System.

1 INTRODUCTION

Although timber structures are yet undervalued as building solutions in Brazil, new demands coming from the urgency of develop low-carbon solutions are indicating that wood products are strategic to the planet.
Starting from the experience of several timber structures executed in central Brazil, it was proposed the use of pressure treated eucalyptus poles as the main structural material in two sports gyms and a winery. This article shows the design and construction of these buildings.

2 METHODOLOGY

The projects of the buildings were developed from the following premises:
• structural modulation that optimizes the dimensions of the porticos and the size of the eucalyptus poles;
• intensive use of continuous members to the whole structures looking for simplify construction;
• standardization of bolted joints and carvings aiming to rationalize its assembling system;
• timber structures designed with base fixity and a consequent reduction in bracing elements;
• use of Amazonian sawed wood as secondary structure.

3 DESCRIPTION OF THE PROJECTS

As the main structural material of the related buildings, wooden poles are ecological materials that comes from reforestation and need much less energy for their production, and that production does not involve non-renewable components.
The wooden posts are much lighter than the concrete posts, reducing the cost of transportation. In addition, the handling of these poles is very simple, as it does not require the use of special equipment. It is also important at the time of installation, which is much easier to do.

3.1 UNIQUE GYM EXPANSION

Unique Gym is a remarkable building made of eucalyptus timber poles and since 2005 stands out as one of the most original gyms in our city as showed in Figures 1 and 2.

Figure 1: *External image of the Unique Gym*

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Figure 2: *Internal view of the wooden building*

The covering of the building's expansion is a mix between ceramic tiles and thermoacoustic covering according to the plan is showed in Figure 3.

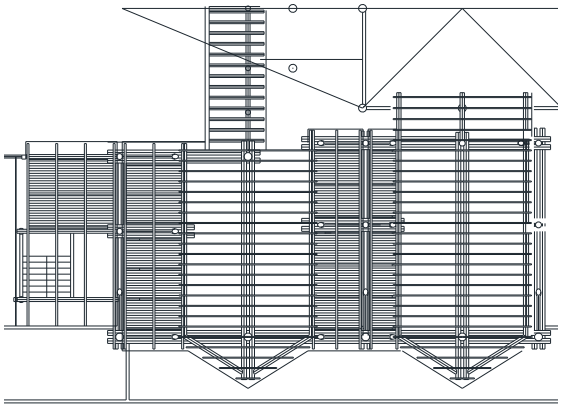

Figure 3: *Plan of the covering showing timber pieces*

The design of the expansion of the original Unique Gym was conceived considering its location over an existing concrete slab area. Due to this special location its structural system was designed by using 12m long beams, aiming to reach special sized pillars installed outside the slab area as illustrated in Figures 4, 5, 6, 7 and 8.

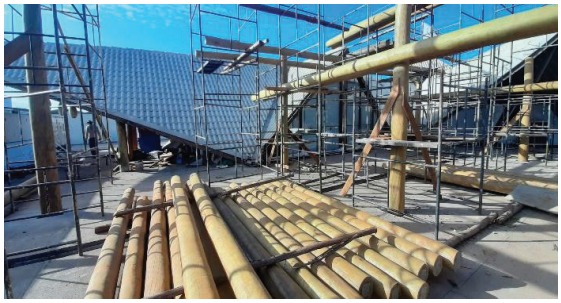

Figure 4: *Assembling of the timber structure over the existing concrete slab*

Figure 5: *Assembling of the timber structure*

Figure 6: *Assembling of the covering timber structure highlighting the 12m long beams*

Figure 7*: Execution of the covering*

Figure 8: *Internal view showing the original building and the expansion of the gym*

Besides providing both vertical and horizontal structural support to the gym's expansion, the presence of timber pole's structural system reveals its outstanding aesthetics that links the to the original building and highlight wood as the main building element of the sports complex. Figures 9, 10 and 11 shows images of the buildings.

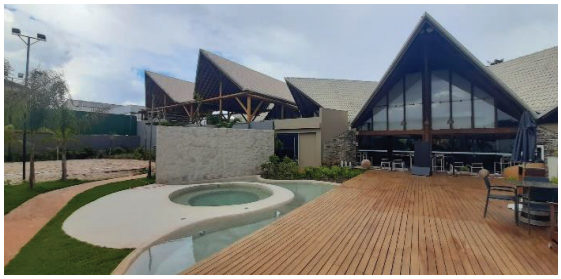

Figure 9: *External view of the buildings*

Figure 10: *External view of the buildings*

Figure 11: *External view of the finished wooden pole structure*

3.2 NEW UNIQUE GYM

The design of the new Unique Gym was defined according to timber structural solutions experienced in the original building. Eucalyptus timber poles of special sizes allows larger spans and heights resulting in a 3 times bigger building then the original. Figures 12, 13, 14, 15 and 16 shows the plan and a scale model of this building.

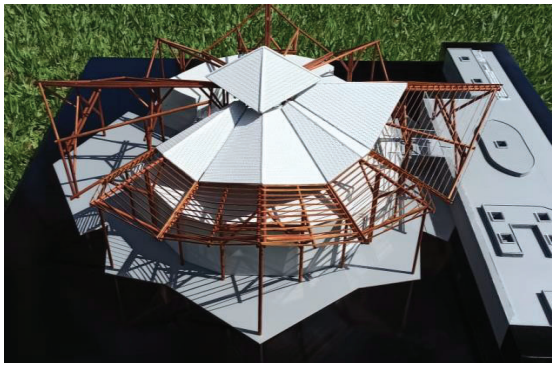

Figure 12: *Scale model of Unique new building*

Figure 13: *External view of the model*

Figure 14: *Internal view of the model*

Figure 15: *Internal view of the model*

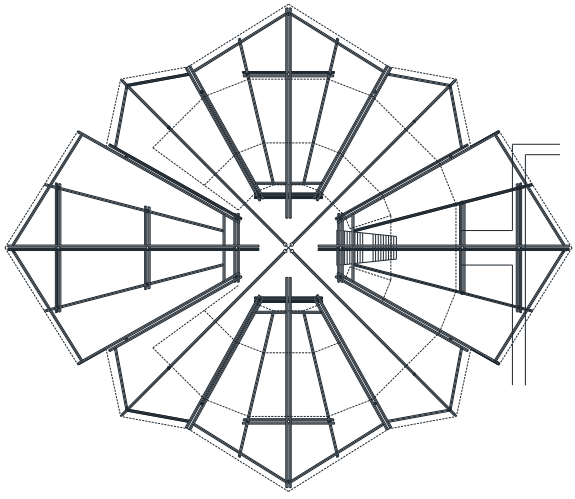

Figure 16: *Plan of the new Unique Gym*

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3.3 WINERY

The building consists in a massive reinforced concrete block where's the winery central core, sheltered by a wood cantilever umbrella cover that defines a terrace with panoramic view of the vineyards. Figures 17 and 18 shows a covering plan and a section of the building.

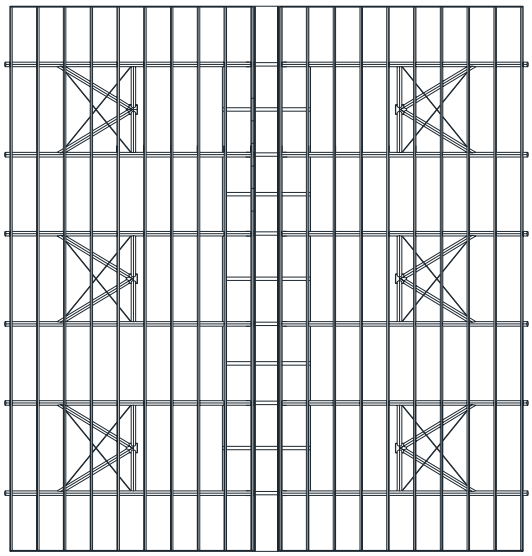

Figure 17: *Plan of the covering of the winery*

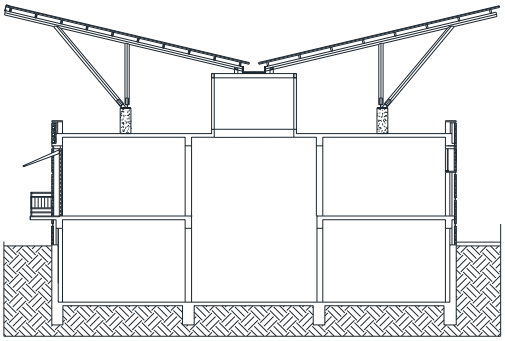

Figure 18: *Cross section of the building*

In this building timber poles are typically utilised to provide support for gravity loads and resistance against lateral forces. But the natural appeal of timber ensures that its role is not purely structural however, and it enables the design conception to take full advantages of beautiful outlooks as it can be viewed in this winery.
Due to its larger sizes such as 12m long beams, poles where spaced further apart than is usual, creating a more spacious building interior, that allowed greater interior design flexibility to the terrace.

Figures 19, 20, 21 and 22 illustrates the designed pole frame and its base plated connections and steel bracing sets. Columns were designed from the outset as columns with pinned bases. A grid of sawed hardwood was used to install the thermos acoustic metallic covering.

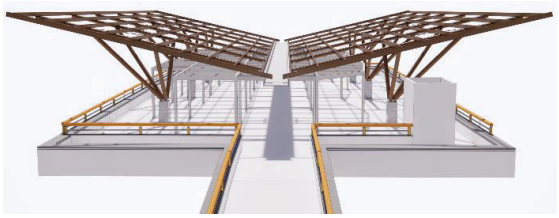

Figure 19: *3D image of the timber structure of the winery*

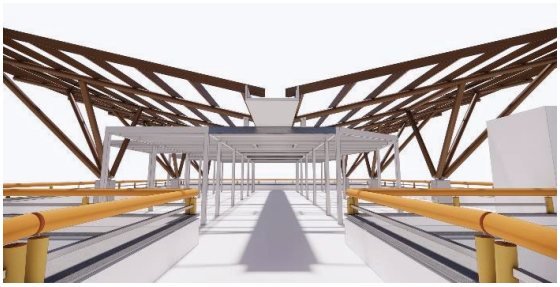

Figure 20: *External 3D image of the terrace*

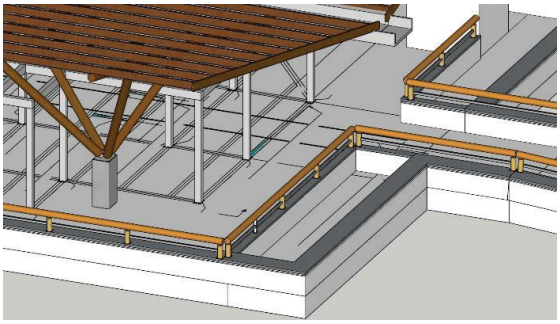

Figure 21: *3D image of the terrace*

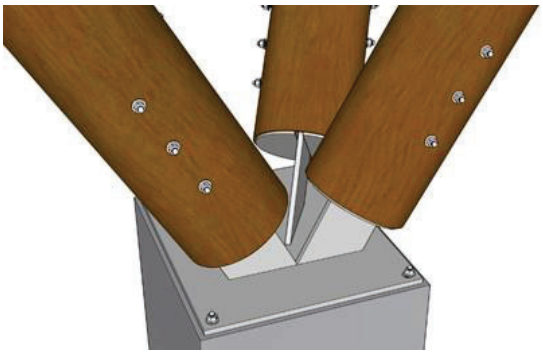

Figure 22: *Base plated connections detail*

Pole frame construction was extremely adaptable to architectural expression as showed in Figures 23,24, 25, 26, 27, 28 and 29.

Figure 23: *External view of the spatial structure of the winery*

Figure 24: *External view of the pole frame*

Figure 25: *Internal view of the pole frame*

Figure 26: *External view*

Figure 27: *Panoramic view of the terrace*

Figure 28: *External view of the winery*

Figure 29: *External view*

4 CONCLUSIONS

The experience of designing timber structures with special sized eucalyptus poles confirms the several possibilities of building with this raw material.

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The excellent balance between its weight and resistance results in lighter components that can be more easily transported and assembled.

Finally, it should be pointed out the aesthetics benefits that come from the presence of the timber structures in the buildings, once complementing architectural designs and promoting low-carbon solutions.

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