

## USE OF EUCALYPTUS POLES IN TIMBER STRUCTURES - BRAZIL

Roberto Lecomte<sup>1</sup>, Sheila Beatriz<sup>2</sup>

**ABSTRACT:** The use of eucalyptus wood in the building site is intensifying in Brazil, consolidating it as an alternative to the native tropical wood. Nowadays, planted forests occupy only 0.6% of Brazilian territory and supply about 85% of all forest-based products found in the market. Pinus and eucalyptus are the main fast-growth species that occur in our country. The structural performance and linearity of the rounded pieces result in a crescent use of eucalyptus treated wood, especially in rural constructions and fences, as well as in country houses and high standard beach houses and hotels. The pressure-treated wood market is becoming more and more attractive, due to its profitability and crescent demand by the building sector. Eucalyptus rounded shape results in a cost-effective application of the material, besides providing an economical form of construction. 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 different building types as an urban house, a restaurants and an observatory in a natural area. The buildings were designed according to bioclimatic guidelines, to be fully adapted to local climate. Some requirements as natural ventilation and illumination, thermal inertia, green covering, and protection against sunlight in the facades were added to the architectural designs, aiming to build “sustainable constructions”.

**KEYWORDS:** Eucalyptus wood, timber structures, sustainable constructions.

### 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 our country. Eucalyptus wood comes from planted forests and it's becoming an alternative to the tropical hardwood due to its availability in almost all the country.

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 different building types as restaurants, wineries, homes, and facilities in natural areas. The projects of the buildings were developed from the following premises:

- Structural modulation that optimizes the dimensions 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;
- Designs based in bioclimatic guidelines, in order to be fully adopted to local climate;
- Proposed mixed building solutions between traditional concrete structures and timber structures, aiming to promote “greenest materials”.

### 2 – BACKGROUND

Eucalyptus is an affordable and beautiful wood and it has a wide range of characteristics that make it incredibly and aesthetically pleasing. Eucalyptus poles are classified as a hardwood and are very popular in the building industry in our country.

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<sup>1</sup> Roberto Lecomte, Casacerta Architecture Design & Building, Brasília, Brasil, roberto.lecomte@gmail.com

<sup>2</sup> Sheila Beatriz, Casacerta Architecture Design & Building, Brasília, Brasil, sheilabtriz@gmail.com

In the world of timber utilization, the preservation of eucalyptus poles stands as a significant concern for professionals seeking to maximize the material's lifespan and performance. Treated eucalyptus timber undergoes a meticulous treatment process to enhance its durability and resistance to decay, insects, and weathering.

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. Eucalyptus 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 – PROJECT DESCRIPTION

Timber structures made of eucalyptus poles were designed to different building types as an urban house, a restaurant and an observatory in a natural area. Eucalyptus frames were mixed to concrete structures and masonries, creating inspiring skeletons for the buildings. The size of the poles allowed larger spans and heights and the balance between its weight and resistance resulted in lighter components that could be more easily transported and assembled.

The construction of the buildings started with the execution of traditional reinforced concrete foundations and the assembling of the timber structures. Next stage was the execution of the coverings with ceramic tiles and thermoacoustic panels. In general wood buildings are covered in short time because coverings are supported by timber structures that are fast assembled instead of concrete buildings.

#### 3.1. THE URBAN HOUSE

The first timber structure showed in this paper is an urban house designed and built in Brasília and its was demanded by a special client who believes in the benefits of biofilic principles aiming to live in a wooden home.

It was built as an expansion of an old farm house and an imposing eucalyptus skeleton was assembled in the new area with two pavements and a pool under a suspended balcony as showed in Figures 1, 2, 3, 4 and 5.



Figure 1: External view of the urban house



Figure 2: External view highlighting timber structure





Figure 3: Internal view of the house



Figure 4: Internal view showing mix between wood and masonry



Figure 5: A rustic table jointed to the timber structure

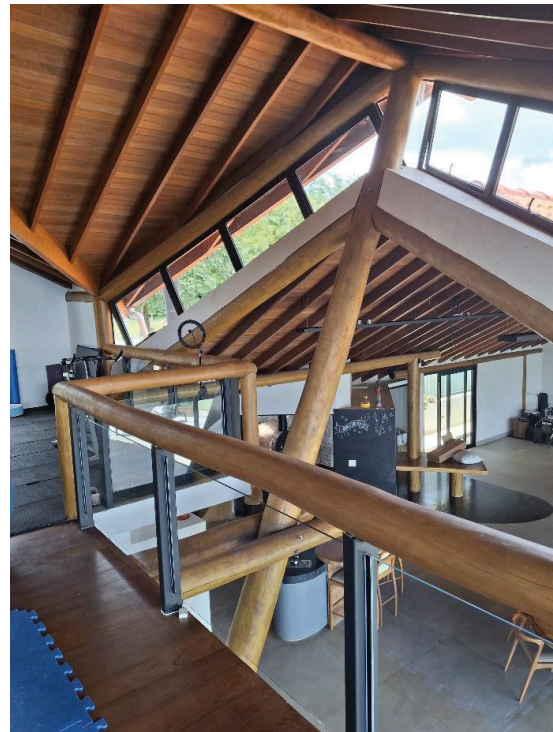


Figure 5: Integration between the two pavements

### 3.2. THE RESTAURANT

The second timber structure is one of several timber buildings to be assembled in a new tourist enterprise near the city of Brasília. The building site is located in a valley with remarkable landscapes of *cerrado* biome and it's under construction. Figures 6 and 7 shows 3D images of the restaurant.





Figure 6: 3D image of the restaurant



Figure 7: Internal view

The post beam constructive system has several levels that allows an original covering with many facets and favors natural ventilation and illumination to the restaurant hall. Sawn hardwood of *massaranduba* and *cedrinho* ceiling were use in the covering structures. Figures 8, 9 and 10 illustrates the timber structure and covering details executed in the building.



Figure 8: Execution of timber structures



Figure 9: Timber frame and covering details



Figure 10: Conclusion of timer frame assembling

Some cottages were designed with similar premisses aiming to create an visual identity to the buildings as showed in Figures 11 and 12.





Figure 11: Cottage with one pavement



Figure 12: Cottage with two pavements

### 3.3. THE OBSERVATORY

The observatory was designed and built to increase the touristic facilities of an special natural area inside on of the most populated cities around Brasília. It's the final part of a suspended walkway circuit inside the park.

It's timber structure is a composition of inclined pillars and double beams made of eucalyptus poles creating two platforms made of sawed hardwood. The higher platform is 5m heigh and allows the contemplation of tree canopys of a well preserved area.

The observatory structure has the same visual identity of the other facilities of the park aiming to promote timber structures as a remarkable constructive solutions that links humans to nature like no other building material. Figures 13, 14, 15 and 16 illustrates the observatory.



Figure 13: External view of the observatory



Figure 14: Timber structures supports two wooden platforms





Figure 14: Central area of the observatory



Figure 14: Timber structures links humans to nature

#### 4. CONCLUSIONS

Brazil has a long tradition of building with concrete and timber buildings aren't the first choice for designers and builders. The urgency of develop low-carbon solutions to build environment is the key element of promoting the only construction system sequestering carbon and engineered to be “energy positive”.

The use of eucalyptus poles, a sustainable and locally sourced material, is cost-effective building solution and illustrates the several possibilities of building in wood in our region, based in the fact that wood materials are desirable for their strength, durability, beauty, and cost-effective construction.

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