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Comparative Analysis between Burnt Cement Floor and Porcelain Floor in a Commercial Area of Manaus-AM

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Abstract**—** *The field of civil engineering has been evolving over the years, with increasing technological advances and innovations in several areas. Agility combined with quality are fundamental and must be thought of in all works, in addition to economic viability. The construction methods and materials for flooring and flooring available in the market should be analyzed to choose which one is the most suitable for the project model. Thus, it is questioned what the ideal floor type to be used in a commercial project is aiming at the best cost-benefit. The objective of this article is to present to the reader simply and directly the advantages and disadvantages of using burnt cement compared to porcelain in the execution of a work in a commercial area in the city of Manaus - AM. Given this quantitative research, a comparative analysis was performed between the execution of two types of floors used in civil construction, which are the burnt cement floor and the porcelain-type ceramic floor. The result of this work indicates that the burnt cement coating has the best cost-benefit because the execution time is relatively shorter, and the cost is also low when compared to porcelain.*

Keywords**—Burnt cement; Materials; Porcelain tile; Coating.**

I. INTRODUCTION

Commercial areas are mainly leveraged by the product they offer their customers. However, other aspects must also be observed to make the place inviting and attractive to users, such as lighting, acoustic and thermal comfort, among others.

Among the mentioned items, it is very important to pay attention to the typology of the floor used, because it is the one that ensures the mobility of customers with comfort and safety.

Once a building is built, whether residential or industrial, there is a need to promote comfort to its users, and nothing is more uncomfortable than living in places where the floor has irregularities, compromising visual well-being and sometimes even safety, as well as making hygiene difficult. [10]

This article is limited to address the advantages and disadvantages of using burnt cement floor compared to porcelain ceramic floor in the execution of a work in a commercial area located in the city of Manaus, examining the processes of execution of pavements, comparing the execution time between both and analyzing the economic viability between these two types of floors.

II. THEORETICAL REFERENCE

2.1 Floor

The floor is defined as a flat horizontal surface designed to withstand certain stresses and is one of the constructive steps in finishing a work. [10]

The whole environment needs regularization of the floor for your safety. The subfloor is defined by a layer applied on a base, which can be of structural slab of concrete ballast. Indoors of a building, whether residential or commercial, are used from 200 to 250 kg / m³ of mortar, and the trace of the commonly used cement and wet sand mortar is 1: 5 to 1: 7, thus obtaining the average dash of 1: 6 in its usability. [8]

The subfloor usually has a thickness of 5 cm giving a support for floor regularization. Using the "masters" ensures leveling and trim, they can be used with grounded wood, reaching the desired level, aligned and spaced every 1.80 m. For better adhesion of the subfloor to the smoothing layer, consideration is given to cleaning the surface by sweeping with hard fiber brooms. [5]

Some requirements are fundamental given the finish and already regularized surfaces. For the flatness of the floors, the values of 3 mm in relation to the ruler with 2 m in length, in any direction and position of the floor. [5]

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New flooring materials and innovative technologies have been worrying about the applicability with regard to durability in return over time for the performance of new found solutions. Thus, it is necessary to adopt measures that aim at the long duration of the buildings ensuring the quality in the construction processes and materials used in them. [5]

Regarding the types of floors, the most common is the type of ceramic tile. However, the manufacture of concrete floors, which support large loads on its surface, has grown. [10]

2.2 Cement

Portland cement is the name given to cement obtained by the intimate mixture of limestone, clay or other silica materials, alumina and materials containing iron oxide. [6]

Concrete is an attempt to make an artificial stone with the enormous advantage of having the shape, strength and dimensions you want. [3]

Burnt cement is a technique made from a mixture of cement, sand and water and can be used in almost any environment, as it is a coating that has high abrasion resistance. [4]

It is already a constructive stage that many consider the finishing stage of the work, but it is important that its support base is correctly executed and, in some cases, an efficient waterproofing treatment is necessary. A very common defect is not respecting the required slopes towards runoff points, especially in areas considered "wet" where water use is constant, such as in residential buildings such as bathrooms, utility areas, kitchen, laundries, balconies and kennels. [2]

2.3 Porcelain

Porcelain is defined as a ceramic slab formed of clay, feldspar, and other inorganic raw materials, formed by extrusion, pressing or other processes, whether or not enameled, polished or natural, rectified or unrectified. [1]

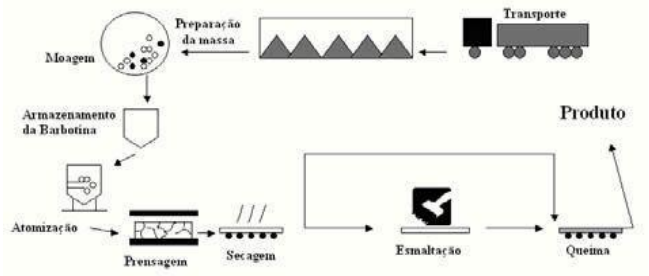

Fig. 1: Porcelain Manufacturing Process, Source: The Tile, 2014.

Ceramic floors are classified into three types, enameled ceramic, gres ceramic and ceramic tile. These are obtained by baking clay, are used for residential, commercial and industrial use. Presenting several textures with finishes that please the most diverse tastes and different sizes, we have the most commercialized, according to Table 1.

Table. 1: Porcelain Plate Measurements

30x30	45x45	50x50	60x60	30x60
40x60	80x80	90x90	100x100	120x120

Source: Own authorship, 2019

Ceramic coatings are graded according to the enamel wear resistance test of abrasion. This classification is known as the PEI Index, where the most suitable environments for its application are indicated. [12]

III. METHODOLOGY

The research used in this work is quantitative. Interpretation is the main factor to perform a comparative data and can demonstrate the results through collection, analysis and supporting numerical information such as proportion, ratio and software. [9]

The context used was in a commercial environment at Amazonas Shopping located at Avenida Djalma Batista, 482 - Parque 10 de Novembro, Manaus-AM (Figure 2). The quantitative method was used, analyzing the advantages and disadvantages between both types of floors.

Fig. 2: Satellite Image of Shopping Location, Source: Google Earth, 2019.

The architectural design was reproduced in AUTOCAD 2018 software, as shown in Figure 3, to calculate the area and follow up the activities proposals. In the next step, A survey of materials and time was performed for each stage of the activities.

From this, the fastest and most cost-effective activity for the work was observed.

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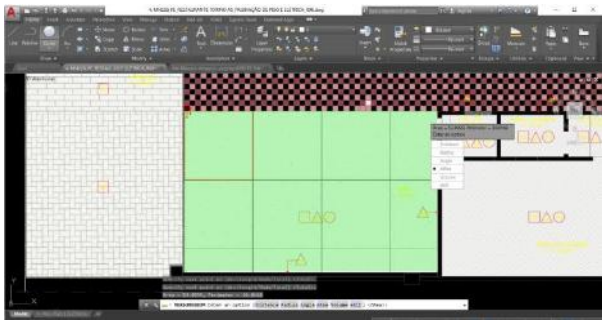

Fig. 3: Architectural project, Source: Santos Damasceno Architect, 2019.

3.1 Execution of burnt cement floor

The initial step for the execution of the burnt concrete is to perform the cleaning of the existing surface, so as not to damage the adhesion of the mortar to the soil. Then fix the expansion joints to the surface every two meters as shown in Figure 4.

Fig. 4: Fixation of expansion joints, Source: Own authorship, 2019.

It is necessary to apply mortar made with cement, sand and water. It needs to be executed with a height between 30 and 50 millimeters according to Figure 5. Once applied For mortar, the surface must be leveled using the ruler. After leveling the surface, the floor should be sprayed with sieved cement powder with the mortar still damp.

Fig. 5: Leveling with the ruler, Source: Own authorship, 2019.

If the project specifies a different color, some kind of coloring powder can be mixed with the dry cement. Immediately after spraying the powder, stick it to the paste for about ten minutes.

In the next step, the tread smoothing is started, which can be done manually or automatically as shown in Figure 6. This feature provides the adhesion of materials, forming a different finish depending on the mode performed.

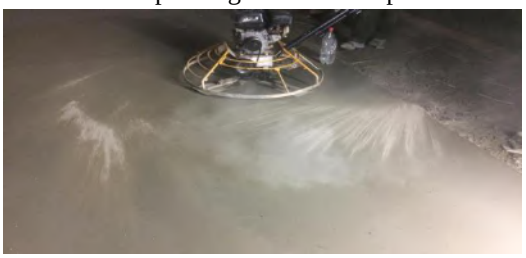

Fig. 6: Floor straightening, Source: Own authorship, 2019.

The curing process of the floor is slow and to ensure that it occurs as smoothly as possible, it is necessary to humidify the floor at intervals of 8 to 12 hours in the first 07 days, taking care to avoid sunlight on the floor within 03 days. initials. This is important so that drying occurs slowly, wetly, not soaked. Once the mortar is fully cured, allow the surface to dry completely to complete the process.

Depending on the final use of the pavement, it is necessary to finish with waterproofing made with wax or own resins and is the step that will ensure its poleness, and the burnt cement floor is characterized by its natural porosity.

3.2 Execution of porcelain floor

The first step resembles that of burnt cement, which is cleaning the subfloor. Then, the mortar is prepared, following the manufacturer's recommendations, in a proper trough. Then apply the mortar to the subfloor with the aid of a trowel. Lay the plate together with the appropriate spacer, placing the leveler base between the mortar and floor, as shown in Figure 7, and with the help of a rubber hammer, adjust the plate.

Fig. 7 - Placement of porcelain floor, Source: Own authorship, 2019.

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After the mortar has hardened, prepare the paste for grout application. Carry out grouting with the aid of a plastic spatula so as not to damage the porcelain tile according to Figure 8.

Fig. 8 - Placement of porcelain floor, Source: Own authorship, 2019.

III. RESULTS ANALYSIS AND DISCUSSION

Analyzing both types of internal floors, it was noticed that both have the same initial execution procedure cleaning the area and regularizing the floor.

In the next steps it was noted that the porcelain tile laying service presented the high execution time, high labor value and consequently a higher total cost of the service according to the following tables 2 and 3:

Table 2: Value per m² of porcelain

PORCELAIN TILE ELIANE 60X60				
SERVICE	UNITS	AMOUNT	UNIT PRICE	SUB TOTAL
MORTAR SUBFLOOR TRACE 1: 4 (CEMENT AND SAND), MECHANICAL PREPARATION	M²	53,40	R$ 15,00	R$ 801,00
PORCELAIN TILE DIMENSIONS 60X60 CM BRAND ELIANE	M²	53,40	R$ 20,00	R$ 1.068,00
			TOTAL =	R$ 1.869,00

Source: Own authorship, 2019.

Table 3: Value per m² of burnt cement

BURNT CEMENT				
SERVICE	UNITS	AMOUNT	UNIT PRICE	SUB TOTAL
MORTAR SUBFLOOR TRACE 1: 4 (CEMENT AND SAND), MECHANICAL PREPARATION WITH CONCRETE 400 L, THICKNESS 5CM	M²	53,40	R$ 15,00	R$ 801,00
FLOOR BURNISHED CEMENT TRACK 1: 4 (CEMENT AND SAND) Smooth Finish THICKNESS 2.0 CM, MORTAR MANUAL PREPARATION	M²	53,40	R$ 15,00	R$ 801,00
			TOTAL	R$ 1.602,00

Source: Own authorship, 2019.

Since the subfloor is easier and faster to perform, it takes advantage of it even in the curing process to do all the detail of cement burning, saving time in execution, speed in the process and guaranteeing the delivery of finish and coating to the cement (Figure 9).

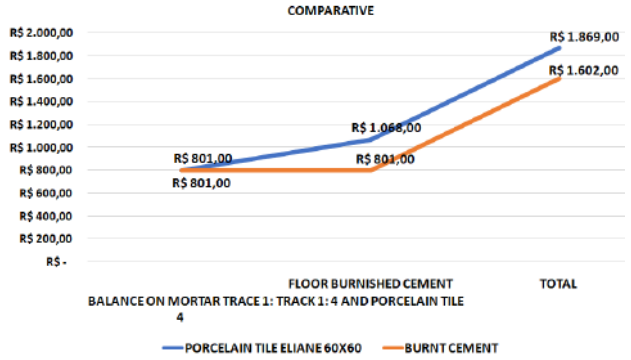

Fig. 9 – Comparative chart of values, Source: Own authorship, 2019.

Porcelain tiles have disadvantages compared to burnt cement, because the execution time is clearly higher, labor value becomes more expensive, consequently the total cost of service is higher.

IV. CONCLUSION

This article was developed to address two types of materials and two types of construction techniques in the finishing part of floor covering, which are concrete and porcelain.

The burnt cement floor, being concrete, has a long service life. Easy to deploy, durable, durable and inexpensive, and cost-effective. This execution process has the advantage of being very elegant due to the fire effect it has, and in addition, pigments can be added during concrete preparation, so that the floor acquires a desired coloration [11]. For not having amendments in its surface because the expansion joints are flush, the floor presentas a flat and even surface, making it difficult to accumulate dirt and facilitating cleaning.

The use of porcelain tiles is popular in residential and commercial areas because it is a common technique, but it brings different types of pagination, pleasing the customer for its delicate and elegant form. The material has different textures and colors, but is prone to reach cracks and cracks, being necessary to reserve a spare parts stock, which does not occur with burnt cement.

When comparing the burned cement and porcelain tiles coatings, it can be concluded that both types of floors are viable for commercial areas, being the burnt cement the most favorable to places with higher load intensity, however, the culture of the country still not fully receptive to the constructive method as it refers to low-income places.

This comparative analysis does not propose replacing the porcelain tile floor with burnt cement, but rather exposes another option in a constructive manner, taking

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into account the execution time and the service life of the two materials.

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