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Use of ecological brick soil cement in civil construction

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1 INTRODUCTION

Environmental degradation has been one of the most discussed topics. The field of civil construction is not different and for all reason, because both in the manufacture of materials used in construction, as in the work itself there is enough dirt and pollution.

In construction there are some ways to make the closure of a structure, division of internal environments, ensuring resistance to moisture and thermal movements. However, the most popular method that has these functions is sealing masonry. Among the various types of sealing masonry, the most used is the ceramic block, popularly known as Bahian brick, which is a material made of clay and then burned at very high temperatures, thus forming a type of brick very fragile and brittle, which makes it end up leaving a lot of dirt on the construction site and also as a result of its burning, it also causes a lot of pollution in the earth's atmosphere. Because of this, it ends up being a type of material very degrading to the environment, which makes it necessary to have less aggressive alternatives.

One of these alternatives is the cement soil brick, which is a type of fence masonry currently little used. Much of this happens due to the lack of knowledge of it and also the low offer of the product. However compared to its best-known competitor it demonstrates better sustainable characteristics, due to its manufacturing process where it does not require burning, access to its raw material is easier and provides more cleaning and consequently less pollution on the construction site. Due to these reasons, it is popularly known as ecological brick.

In addition to all these characteristics regarding sustainability, it also presents better qualities concerning the construction, that is, it has better quality and more resistance. To get an idea the Bahian brick has a compressive strength of around 1MPa, while the cement ground brick can double or even triple this value.

Figure 1: Ecological soil-cement brick manufactured by the authors.

Source: authors

In addition, they provide several other advantages when compared, such as better thermal insulation and also greater acoustic insulation, which are characteristics that added together, or even separately prove the superiority of the soil-cement brick when compared to the best-known and used Bahian brick.

The technical standards that speak about the brick cement soil, are as follows: ABNT NBR 10833:2012, where it explains the whole process of how the preparation and choice of materials used for the manufacture, manufacture, curing, storage and transport of the brick should be made; ABNT NBR 8491:2012, where it shows the requirements of the brick, i.e. demonstrates the different types of brick cement soil, the age at which they can be marketed and used, their dimensions according to their types, the analysis of the values regarding the compression of the specimens, the analysis of water absorption and the inspection of the material by the customer, and that it is also up to the same to accept or reject the brick if the specifications of the standard regarding dimension, compressive strength and water absorption are not met; The ABNT NBR 8492:2012 brings the same parameters and values of ABNT NBR 8491:2012, but this is more focused on the method of tests where specific machines and tanks are used to test the specimens, then the results are annotated and calculated in various ways, so that in the end a report is made and tables are prepared where the results can be visualized.

2 METHODOLOGY

Through bibliographic surveys related to this research, articles, and studies on sustainability in civil construction, pollution, ways of softening this, especially in the part of sealing masonry, and also demonstrating the characteristics of soil-cement bricks and their superiority over conventional ceramic bricks.

Another way to show this analysis was in the laboratory part of tests, which were carried out in the laboratory of the Redentor/Afya University Center, located in Itaperuna-RJ. In which the soil-cement bricks were manufactured, by weighing the collected soil, cement, the mixture of both, and the press made in the

mechanical press present in the same place, and the cure was made according to nbr, throwing some water every day and covering them with a canvas.

These tests were performed using the hydraulic compression press, and in basins that were placed the bricks and covered with water, all in the same place, the results were recorded and compared later, and these results, values, and comparations are present throughout the text.

3 CONCLUSION

The results obtained by the laboratory tests were satisfactory exceeding expectations, because the compressive strength values were much higher than the soil-cement brick compared to the conventional one, reaching four times higher than the value resisted by the conventional brick, in one of the soil-cement brick tests. The values of the water absorption test were also very effective, because in all cases the water absorption of conventional bricks had on average six times more moisture absorption than the ecological ones, even absorbing 14 times more water than the other.

Both tests have been listed, annotated, and placed in comparative tables as follows:

Table 1: Results of the compression strength tests of ecological and conventional bricks.

TYPE OF BRICK	VALUE (ton)	VALUE (kgf/cm²)
Ecological (9)	3,5	79,205
Ecological (2)	6,0	135,78
Ecological (6)	4,0	90,52
Conventional (1)	1,5	33,945
Conventional (2)	1,5	33,945
Conventional (3)	1,5	33,945

Source: authors

Table 2: Results of water absorption tests of ecological and conventional bricks.

TYPE OF BRICK	DRY BRICK WEIGHT IN GRAMS	BRICK WEIGHT AFTER 24h SUBMERGED IN WATER IN GRAMS	AMOUNT OF WATER ABSORBED IN GRAMS	PERCENTAGE OF WATER ABSORBED BY THE BRICK ABOUT ITS WEIGHT
Ecological (1)	2878,1	2921,3	43,2	1,5%
Ecological (2)	2945,0	3067,0	122,0	4,14%
Ecological (3)	2750,4	2833,5	83,1	3,02%
Ecological (4)	2927,7	2992,7	65,0	2,22%
Conventional(1)	2021,7	2416,7	395,0	19,54%
Conventional(2)	1975,5	2370,2	394,7	19,98%
Conventional(3)	2074,8	2466,7	371,9	17,92%
Conventional(4)	1949,6	2364,2	414,6	21,27%

Source: authors

As seen in Table 1, the ecological bricks far surpassed the conventional bricks in the compression test, the lowest value of the soil-cement bricks was 3.5 tons, while the values of the conventional bricks were the same in compression - the values were all equal by the lack of precision of the machine in which the tests were made about the exact values, then we used the closest values, in the thesis the conventional bricks did not reach even 1.5 tons of compressive strength – that is, the worst result of ecological bricks was more than twice the best results of conventional bricks, while the highest value was four times higher. The average values of ecological bricks were 4.5 tons, i.e., tripled the values of ceramic bricks, as expected.

Table 2 also noticed the difference between ecological bricks with conventional bricks in the water absorption test, the test values were well above the expected average, conventional bricks absorbed on average 19.5% of water concerning their dry weight, while ecological bricks absorbed on average of 2.7%, that is, ceramic brick absorbs on average 7 times more water. When compared to the lowest results in grams the difference is 328.7g, when compared to the highest results the difference is 292.6g. This comparison becomes even more unfair for the conventional brick when compared to the highest value with the lowest value, the difference is 371.4g, which is equivalent in percentage to 19.77%. This demonstrates once again the superiority of ecological soil-cement bricks over conventional ceramic bricks.

With this it was possible to observe the superiority of the soil-cement bricks because the results previously seen in research and literature reviews were not so out of reality in relation to the results obtained, quite the contrary in practice the results were very satisfactory and even beyond what was expected with these studies. With this knowledge, we can note that if investments are made in the manufacture of these bricks, they can quietly replace conventional bricks shortly, and without leaving to be desired being much superior to them.

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