

The Characteristics Of Bricks In West Sumatera

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Abstract: The majority of earthquake victims were caused by building debris. The latest research after earthquake in Padang city found that there were many victims fell due to the collapse of the brick wall. Other research states that bricks in Sumatera Barat was not in Indonesian standard or Indonesian National Standards or SNI 15-2094-2000. This is the reason to study the characteristics of bricks in Sumatera Barat. This associative research collected bricks in Sumatera Barat randomly. In each place, brick samples were taken when people or worker building a houses. It was found that the average Sumatera Barat bricks had a higher density than the standard, which was 1.39 gr/cm² or above SNI 1.2 gr/cm², and the highest was found from Pesisir Selatan 1, 44 gr/cm². All dimensions are below the minimum standard, the average length of 18.17 cm, width 8.88 cm, height 4.64 cm, while according to the standard the length is 23 cm, width 11 cm, and height 5.5 cm. For the brick water absorption test found an average of 26.21%, which exceeds the maximum standard of only 20%. Furthermore, the average compressive strength was found to be 43.04 kg/cm², meaning that it was below the SNI standard of 50 kg/cm². No dimensional, density and water absorption effects were found on the compressive strength of bricks, with an average influence value <0.4. This finding is important as a basis for the need to improve the characteristics of bricks in Sumatera Barat, so that they are more better and friendly to earthquakes to be used in Sumatera Barat.

Index Terms: Brick, Density, Water Absorption, Brick Compression strength

1. INTRODUCTION

Based on earthquake data in the last 10 years in Indonesia, most of the earthquake's impact was the collapse of buildings [1] caused by weak construction. Brick walls were the building part that causes the most casualty [2][3]. The distribution of house damage due to the Sumatera Barat earthquake in September 30th 2009 was quite alarming. Damage to houses in the category of moderately and severely damaged occurred in areas with high disaster hazard index such as Pesisir Selatan were 2,187, Padang were 37,587, Padang Pariaman were 57,771 and Pasaman Barat were 3,240 [4]. A JICA-PU research report in 2010, stated that the majority of damage occurred in modest houses with red brick wall coverings. Other data shows similarities, namely damage occurs in many non-structural parts such as cracked or broken brick walls [5]. The results of the study found that the quality of bricks used by the community in Padang Pariaman Regency did not meet the strength requirements or ≤ 25 kg/cm² [6]. In addition, the quality of bricks used by the community in Padang Pariaman regency does not meet the requirements of physical form, brick size and compressive strength under 15.25 kg/cm². Based on these findings, it is known that the quality of bricks in Sumatera Barat is low/inferior [4][6]. As building material, bricks must be standardized [7].

So, it is necessary to innovate a new brick model with better quality [8][9], and be safe from earthquakes. In planning, this research will add a mixture of lime which contain Calcium Carbonate for brick material. Because the addition of lime mixture can increase the strength of bricks [10].

2 RESEARCH METHOD

This Research used an associative research method that is looking for relationships between one variable with another variable. Generally, comparisons were made between bricks from one area to another including differences in characteristics such as dimensions, weight, density, absorption, and strength press. Besides that, it also compares the findings in the field with Indonesian brick standards SNI 15-2094-2000. In addition to comparing with brick standards, it was also seen the relationship between the characteristics of these bricks so that it can be known the parts that need special attention in the future. As for making comparisons, it is known that the characteristics of the bricks which parts contribute to each other and influence the strength of the bricks. Samples were taken from five different regions in West Sumatra, the names of the regions were West Pasaman Regency, Agam Regency, Padang Pariaman Regency, Padang City, and Pesisir Selatan Regency. Each area was taken as many as 30 bricks.

3 RESULT AND DISCUSSION

After all samples were collected from each region and brought to the laboratory, the measurement of bricks starting from seeing the color, flatness, texture, dimensions, weight, density, water absorption, then the compressive strength test. The tools used in measuring the characteristics of bricks were rulers, scales, ovens, molen, shovels, spoons, and pressure test equipment. As for the brick press test, a space was made with cement and sand mixture of 1: 3.

3.1 Result

This research found four parts of result. First is about dimension brick, second about density, third is about absorption, and fourth is about strength press. These results can be seen in Table 1 and Table 2.

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3.1.1. Dimension

Table 1. Sumatera Barat Brick Dimensions

Value	Research finding (mm)	SNI 15-2094-2000 M-6a,6b,6c,6d (mm)
Length	181,7	230 ± 5
Width	88,8	110 ± 3
Thick	46,1	55 ± 5

In table 1 it can be seen that the length, width, and height of Sumatera Barat bricks are below the standard bricks determined by SNI 15-2094-2000. This result needs to be of concern to Sumatera Barat brick producers because these results are in line with previous findings, but no changes have been made by Sumatera Barat brick producers to improve their products to meet standards.

3.1.2. Density, Absorbtion, & Strength Press

Table 2. Density, Absorbtion, & Strength Press

Value	Density (gr/cm ²)	Absor-ption (%)	Strength Press (MPa)
The Mean Value	1,39	26,82	3,5
SNI 15-2094-2000	≥1,2	≤ 20	5

Table 2 shows that the density is above the minimum density limit ≥ 1.2 or according to the standard. Whereas the average absorption of Sumatera Barat bricks is 26.82% or absorbs a lot of water. In the third part, it can be seen that overall it can be found that the average compressive strength of Sumatera Barat bricks is below grade 5 brick standards.

3.1.3. Correlation of thickness, density and absorption to compressive strength

Table 3. Correlation of thickness, density and absorption to compressive strength

Regions	Thickness	Density	Absorption
Pasaman	0.050	0.697	-0.688
Agam	-0.063	0.315	-0.417
Padang Pariaman	-0.238	-0.002	-0.459
Padang	-0.002	0.285	-0.034
Pesisir Selatan	0.097	0.364	-0.649
mean	-0.031	0.332	-0.449

Note. Below 0.4 has a low influence relationship

In tabel 3, it shows that the brick's thickness in Pasaman, Agam, Padang Pariaman, Padang, and Pesisir Selatan do not correlate with compressive strength. Then, only pasaman brick has a correlation between density and compressive strength of brick with a value of 0.697. Then, it appears that there is no correlation between absorption and compressive strength of bricks.

3.2. Discussion

Bricks as the main material that often collapsed walls when the earthquake in Sumatera Barat has been studied. There were 5 areas that became the most points of wall collapse during the

2009 Padang earthquake, samples were taken at random while construction was being carried out. It was found that the dimensions of Sumatera Barat bricks varied, with the largest dimension being owned by Padang city area bricks with length was 18.46cm, Width was 8.98cm, height or thickness was 4.7cm, and the lowest dimensions were owned by Pasaman region bricks with length was 17.99cm, Width was 8.76cm, height or thickness was 4.55cm. In general, the dimensions of the Sumatera Barat brick were not in accordance with the standards determined by SNI 15-2094-2000. So the Sumatera Barat brick producers must add the dimensions of their products to meet the specified standards. In addition, the dry weight of Padang city bricks became the heaviest with an average of 1062.17 grams and an average saturated weight of 1342.71 grams. While the lightest dry weight is owned by the Pasaman region which is 1011.16 grams with the lightest saturated weight of 1289.42 grams. This shows that there is no significant effect between the dry weight and saturated weight of Sumatera Barat bricks. Then, Sumatera Barat's brick water absorption was not up to standard with an average of 26.21% or more than 20%. A lot of water absorption will affect the cement water factor in the masonry space. Sumatera Barat brick producers must improve their products so that the absorption of water does not exceed 20%. Sumatera Barat brick density is not standard with an average of 1.39 gr/cm² or above 1.2 gr/cm². this should be homework for Sumatera Barat brick producers so that the brick density is up to standard. Besides that the compressive strength of Sumatera Barat bricks is below the standard with a strength figure of 43.04 kg/cm² or below <50 kg/cm². The results of this study are in line with Andayono's research [4] and Putri's research [6] which state that Sumatera Barat bricks were not in accordance with SNI 15-2094-2000 standards. This is a very big problem and needs to be fixed by the brick manufacturer. Bricks must have the right strengths so that people can use them to build buildings and save the lives of many people. After being analyzed, there was no relationship between dimensions specially about thickness of brick and compressive strength of bricks. Likewise with the absorption which has no relationship with the influence of the compressive strength of bricks. Whereas density has a very weak relationship with brick compressive strength. Based on these results, it was found that there are other factors that determine the compressive strength of bricks apart from dimensions, density, and absorption. Other factors that must be investigated are related to salt content, brick raw material, or other innovations in addition to achieving the standard values of power determined by policy makers. These results are very meaningful for the development of building materials in Sumatera Barat, Indonesia, especially regarding bricks, because the government must look at this and determine a new policy so that bricks are made according to standards by the producers. And this is worthy of being used as preliminary data to create new findings about high quality bricks as a building material innovation.

4 CONCLUSION

The results of this research are the dimensions of the Sumatera Barat bricks were not in accordance with SNI 15-2094-2000 bricks and did not reach length is 19 cm, width 9.2 cm and thickness 6.5 cm. Then, the density of Sumatera Barat brick also did not meet the standard of 1.39 gr/cm² or above 1.2 gr/cm². Then, brick absorption was not standard, it

was above 20% or 26.82%. The average compressive strength of West Sumatra brick is 43.04 kg/cm², below 50 kg/cm² for class 50. No influence relationship was found between dimensions, density, and absorption of compressive strength of Sumatera Barat bricks.

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