

## COMPARISON STUDY OF COMPRESSIVE STRENGTH OF RED BRICKS AND LIGHT BRICKS

Mohammad Djaelani<sup>1</sup>, Didit Darmawan<sup>2</sup>, Ella Anastasya Sinambela<sup>3</sup>, Rahayu Mardikaningsih<sup>4</sup>

<sup>1,2,3,4</sup> Program Studi Teknik Sipil Universitas Sunan Giri Surabaya

Email : bpk.mohammaddjaelani@gmail.com<sup>1</sup>, dr.diditdarmawan@gmail.com<sup>2</sup>,  
easinambela@gmail.com<sup>3</sup>, rahayumardikaningsih@gmail.com<sup>4</sup>

**Abstract** – The progress of development in Indonesia is very rapid, building materials are demanded to have very good quality. The purpose of this study is to determine the comparison of the compressive strength of red brick and lightweight brick as it should be in the field of development that affects economic development, in this study it is very useful for the community when buying materials. This type of research is qualitative. The data was obtained by conducting research on data analysis techniques. used is to use a formula to determine the value of compressive strength. The results showed that red bricks and light bricks had different compressive strength values. Lightweight bricks which are heated in the sun for 7 days have a compressive strength value of 58.916 kg/cm<sup>2</sup>, while those that are soaked in water for 4 days have a compressive strength value of 36.256 kg/cm<sup>2</sup> and those which are blown in the wind for 28 days have a compressive strength value of 45.32 kg/cm<sup>2</sup>. for red bricks that are dried for 5 days and then burned for 1 day. after the red bricks are ripe and then heated in the sun for 7 days has a compressive strength value of 33,709 kg/cm<sup>2</sup> while those that are soaked for 4 days have a compressive strength value of 29,495 kg/cm<sup>2</sup> and those that are ventilated for 28 days have a compressive strength value of 25,281 kg/cm<sup>2</sup>.

**Keywords** : Differences In Compressive Strength; Red Brick; Light Brick.

**Abstrak** – Kemajuan pembangunan di Indonesia sangat pesat, bahan bangunan dituntut memiliki kualitas yang sangat baik. Tujuan dari penelitian ini adalah untuk mengetahui perbandingan kuat tekan bata merah dan bata ringan sebagaimana mestinya dalam bidang pembangunan yang mempengaruhi perkembangan ekonomi, dalam penelitian ini sangat bermanfaat bagi masyarakat dalam membeli bahan. Jenis penelitian ini adalah kualitatif. Data diperoleh dengan melakukan penelitian tentang teknik analisis data. digunakan adalah dengan menggunakan rumus untuk menentukan nilai kuat tekan. Hasil penelitian menunjukkan bahwa bata merah dan bata ringan memiliki nilai kuat tekan yang berbeda. Bata ringan yang dipanaskan di bawah sinar matahari selama 7 hari memiliki nilai kuat tekan sebesar 58,916 kg/cm<sup>2</sup>, sedangkan yang direndam dalam air selama 4 hari memiliki nilai kuat tekan sebesar 36,256 kg/cm<sup>2</sup> dan yang ditiup angin. selama 28 hari memiliki nilai kuat tekan sebesar 45,32 kg/cm<sup>2</sup>. untuk bata merah yang dijemur selama 5 hari kemudian dibakar selama 1 hari. bata merah setelah matang kemudian dipanaskan di bawah sinar matahari selama 7 hari memiliki nilai kuat tekan sebesar 33.709 kg/cm<sup>2</sup> sedangkan yang direndam selama 4 hari memiliki nilai kuat tekan sebesar 29.495 kg/cm<sup>2</sup> dan yang diberi ventilasi selama 28 hari memiliki nilai kuat tekan sebesar 25.281 kg/cm<sup>2</sup>.

**Kata kunci** : Perbedaan Kuat Tekan; Bata Merah; Bata Ringan.

### INTRODUCTION

Red brick is one type of basic material for building houses that is very commonly used in Indonesia, from ancient times to modern times as now red brick has indeed become one of the mandatory materials in building a house. Understandably enough, red brick is still more widely used than light brick or press brick, because apart from having been tested for its strength, getting this type of material is not difficult.

Red brick is a building element used in building construction and is made from clay plus water or without a mixture of other materials through several stages of work, such as digging, processing, printing, drying, burning at high temperatures until it matures and changes color. and will harden like stone when cooled so that it cannot be destroyed again when immersed in water.

The red brick in question is a brick made from molded soil and then burned at a high

temperature so that it becomes completely dry, hardens and has a reddish color. The soil used is not just any soil, but rather clay soil so that it can blend together during the printing process. For this reason, a house whose walls are made of red brick will feel more comfortable and cooler. In addition to being stronger and sturdy and durable, so that cracks in walls built of red brick material are rare. In addition, this material is very resistant to heat so it can be a separate protection for your building from fire hazards.

Brick is one of the building materials that is often used by the people of Indonesia, even the production system has also been controlled by many people, so that almost every region has its own manufacturing center. The use of bricks itself is very common to be used as the walls of residential houses in Indonesia, while for other functions, bricks are usually used in making gates, statues, bridge barriers, and many others.

In Indonesia, the use of bricks or red bricks has been known since the days of ancient kingdoms. For kingdoms in the archipelago that have used bricks since the era of the Majapahit kingdom, the center of which was in Mojokerto, East Java. As we know that historical relics originating from the pre-Majapahit kingdom, many use stone chisels/broken stones derived from large stones. Only after the era of the Majapahit kingdom, many relics that use bricks as the main material.

Humans first learned that building materials could be made from clay that was shaped and dried in Mesopotamia around 8000 BC. According to history, the Tower of Babel was built using sun-dried bricks. Bricks have been used in almost all regions of North Africa, parts of the Middle East, and Central and North America. Thick mud and clay from the Tigris and Euphrates rivers became the building materials for building the Abelonian civilization (+/- 4000BC). Kingdoms and temples were built using sun-dried bricks. For walls in royal buildings and temples used glass or bricks that have been coated with glass. Recent research from Egypt, shows that in Ancient Egypt, the process of making bricks was done by drying using sunlight and burning. These bricks were used to build kingdoms and temples at that time. Not only the Egyptians, the Romans also used

dried bricks for building materials around 54 BC. At that time the construction of Colchester Castle which was built from 1080 used bricks.

The bricks owned by the Romans were thin in thickness compared to their length. To construct buildings at that time, bricks were laid in a thick layer of mortar (a mixture of materials that binds bricks together). The art of brick making in Europe disappeared in 410 AD when the Romans lost the war. In the 14th century, brick was again popular in continental Europe since the Flemish came to England. The art of making bricks again became popular among people in the plains of Europe. In North America the first building built using bricks was on Manhattan Island in 1633. The bricks used for construction in this area were imported from England and the Netherlands. Maximum use of bricks is only carried out until the discovery of bricks made by burning using a furnace. Brick furnaces were first used around 1650 in the United States. Bricks made in the past are difficult to identify due to different specifications. For example, bricks in Assyria, Mesopotamia with the characteristics of having a weight of 18 Kilograms or Roman bricks are thinner like floor tiles than other bricks.

Light brick is a building material that looks like concrete that has strong properties and is resistant to water and fire, which is made using machines in factories (Joglekar et al., 2018). The shape of this type of brick is quite light with a smoother surface of the pliers, and a higher level of flatness compared to red bricks. The purpose of making this lightweight stone is so that the structural load of the construction building is lighter, saves the remaining material during the construction project of the building wall, and speeds up processing time (Kua & Kamath, 2014).

Light brick is a building material produced from modern technology to produce a higher quality building or house (Algin & Turgut, 2008). In the construction world, there are 2 types of lightweight bricks, namely Autoclaved Aerated Concrete or AAC lightweight bricks and Cellular Lightweight Concrete or CLC lightweight bricks. species significantly. While the difference lies in the drying process where the AAC type is processed by drying in a device called a high-

pressure autoclave oven. This is different from the CLC lightweight brick, which drying process is done naturally, so CLC is often also called Non-AAC lightweight brick.

Since 1980, AAC Block is increasingly being used in the construction industry in various parts of the world because of the characteristics of AAC which is light but strong, so it can reduce the cost of building structures. The use of natural materials in the production technology of building materials such as quartz sand and lime has been known since the late 19th century, at the beginning of the 20th century the production process was improved by the introduction of the addition of a water vapor pressure system in its treatment (steam curing).

In 1923 for the first time in Sweden developed lightweight concrete AAC. This development is carried out as an alternative building material so that deforestation can be minimized. Then in 1923, Joseph Hebel from West Germany redeveloped ACC lightweight concrete for greater benefits.

AAC lightweight concrete was first developed in Sweden in 1923 as an alternative building material to reduce deforestation. AAC lightweight concrete was then developed again by Joseph Hebel in West Germany in 1943. He decided to develop a better building system at a more economical cost. His brilliant innovations such as the process of cutting using wire, opened up new possibilities for the development of this product. As a result, lightweight aerated concrete is considered perfect, including an environmentally friendly building material, because it is made from abundant natural resources. It is strong, durable, malleable, efficient, and highly efficient. Hebel's success in Germany was soon seen by other countries. In 1967 in collaboration with Asahi Chemicals built the first Hebel plant in Japan. Until now Hebel has been in 29 countries and is the largest producer of aerated concrete in the world. In 1995, Indonesia was introduced to lightweight concrete building materials. Lightweight concrete began to be known since PT Hebel Indonesia was established in the East Karawang area, West Java.

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known since 1995, when PT Hebel Indonesia was established in East Karawang, West Java.

In a project work, the use of building materials greatly affects the quality of the building (Russ, 2005). One of the project work that requires material is the work of making walls, in general the main components of making walls using conventional materials such as bricks and bricks, the development of building materials is currently increasingly advanced along with the demands of the need to achieve the most effective and efficient cost, time, quality and with the development of previous material technology used such as the main component is now replaced by using lightweight brick and lightweight concrete as wall raw materials (Aouba et al., 2016). Therefore, researchers conducted research on the compressive strength of red bricks and light bricks that could be tested in the laboratory.

## METHOD

This type of research is qualitative research, the samples are red bricks and light bricks after that the compressive strength test is carried out and each test object is carried out 1 time, namely some are heated, soaked in water, and blown in the wind. This research was conducted to compare the strength of red brick (11 cm long, 11 cm wide, and 6 cm thick) and lightweight brick (15 cm long, 15 cm wide, and 10 cm thick) with a red brick compressive strength of 2.5 - 25 N/mm<sup>2</sup> (SII-0021,1978) and lightweight brick compressive strength > 4.0 N/mm<sup>2</sup>. The samples that will be tested are red bricks and light bricks, each of which there are 3 pieces and each presentation and proportion of manufacture is done manually and after that a compressive strength test will be carried out in the laboratory. To calculate the compressive strength of the sample, it is necessary to measure the parameters, namely the compressive load (compressive force, F) and the area of the brick sample (A). After testing the compressive strength of the sample, then the standard value is compared based on the reference or national standard that is set. The average compressive strength of bricks can be adjusted to the compressive strength and coefficient of variation of the permitted red bricks (SII-0021-1978).

**RESULT AND DISCUSS**

Table 1 shows the weight and type of bricks to be tested. The size of the bricks is in accordance

with the standard size used, namely SNI-21-(1978). In addition, the sample size of red bricks and light bricks is adjusted to the size of the pressure test equipment found in the laboratory

**Table 1.** Results of Test Object Weight and Area

HEATED MATERIAL	Heavy (kg)	LENGTH (cm)	WIDTH (cm)	THICKNESS (cm)
RED BRICK	0,95	11	11	6
LIGHT BRICK	3,9	15	15	10
IMMERSED MATERIAL				
RED BRICK	1,12	11	11	6
LIGHT BRICK	4,05	15	15	10
MATERIALS IN THE WIND				
RED BRICK	0,8	11	11	6
LIGHT BRICK	3,58	15	15	10

Source: Researcher

Based on table 2, red bricks and light bricks heated for 7 days have different compressive strength values. Red brick 33,709 kg/cm<sup>2</sup> light brick 58,916 kg/cm<sup>2</sup>, which is soaked in water for 4 days red brick 29,495 kg/cm<sup>2</sup> light brick 36,256 kg/cm<sup>2</sup>, and which is in the wind for 28 days red brick 25,281 kg/cm<sup>2</sup> light brick 45, 32 kg/cm<sup>2</sup>.

The results of the research that have been obtained are testing the compressive strength of red bricks and light bricks. The materials used in the manufacture of red bricks are clay, sand, water while light bricks are sand, cement, fly ash, lime,

egg white or aluminum paste. After making the red bricks, they are printed and then dried for 5 days and then burned for 1 day in the kiln or it can also be called a brick hut. After the red bricks are ripe, I separate them into 3 methods, namely heated in the sun, soaked in water, in the wind, while the light bricks are printed. Then this research uses 3 methods, namely heated in the sun, soaked in water, and blown out. Those that use natural heat or are dried in the sun for 7 days, while those that are soaked in water for 4 days and those that are aerated for 28 days.

**Table 2.** Compressive Strength Test Results of Red Bricks and Lightweight Bricks

HEATED MATERIAL	Compressive Strength (KN)	Yield (kg/cm <sup>2</sup> )
RED BRICK	40	33,709
LIGHT BRICK	130	58,916
IMMERSED MATERIAL		
RED BRICK	35	29,495
LIGHT BRICK	80	36,256
MATERIALS IN THE WIND		
RED BRICK	30	25,281
LIGHT BRICK	100	45,32

Source: Researcher.

The results of the compressive strength test in the laboratory show that red bricks and light bricks have different compressive strengths, lightweight bricks that are heated in the sun for 7 days have a compressive value of 58.916 kg/cm<sup>2</sup> while those

that are soaked in water for 4 days have a compressive value of 36.256 kg/cm. cm<sup>2</sup> and which is aerated for 28 days has a compressive value of 45.32 kg/cm<sup>2</sup>. For red bricks that are dried for 5 days and then burned for 1 day after the red

bricks are ripe and then heated in the sun for 7 days have a compressive strength value of 33,709 kg/cm<sup>2</sup> while those soaked for 4 days have a compressive strength value of 29,495 kg/cm<sup>2</sup> and the in the wind for 28 days has a compressive strength value of 25.281 kg/cm<sup>2</sup>.

## CONCLUSION

Based on the results of the tests and discussions that have been carried out on the results of the red brick and light brick test objects, several conclusions are obtained. Red bricks and lightweight bricks have different compressive strengths and the materials themselves are also different so that it affects the compressive strength value of each test object, from the data that has been obtained those lightweight bricks have a high compressive strength value compared to red bricks because the manufacturing method is different from brick making. light. The heated material for 7 days has an effect on the compressive strength of red brick by 33,709 kg/cm<sup>2</sup> and light brick 58,916 kg/cm<sup>2</sup>. Material soaked in water for 4 days has an effect on the compressive strength of red brick by 29.495 kg/cm<sup>2</sup> and lightweight brick by 36.256 kg/cm<sup>2</sup>. The material that is aired for 28 days has an effect on the compressive strength of red bricks at 25.281 kg/cm<sup>2</sup> and lightweight bricks at 45.32 kg/cm<sup>2</sup>.

The advice that can be taken from this research is if you have difficulty finding a developer or it can be called aluminum paste, you can use egg whites and the method of use is almost the same as aluminum paste. If the construction of low-rise buildings such as residential houses is recommended to use only red brick because it can reduce costs for wall installation. If the construction of a high-rise building is recommended to use lightweight brick material as a wall pair because its lightweight nature can reduce the burden that burdens the construction of the building so as to reduce the costs incurred for the building structure. For further research that wants to examine red bricks and light bricks, it is hoped that in the manufacturing process using an industrial scale so that the results obtained are more leverage.

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