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Comparison Of Wall Material Efficiency Between Lightweight Bricks And Red Bricks In Residential Construction

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ABSTRACT

Wall work is a crucial part of building construction, impacting the cost and time of a project. The selection of wall materials, such as lightweight bricks and red bricks, is crucial for optimal efficiency. This study aims to compare the efficiency of lightweight brick and red brick wall materials in residential construction, in terms of cost and time.
The research method used was a comparative descriptive approach with a case study approach on a 100 m² residential construction project. The data analyzed included material costs, labor costs, and the duration of the wall work for each material. The analysis was conducted by comparing the total cost per square meter and the productivity of the work time in the field.
The results of the study showed that the total cost of wall work using red brick was Rp145,000/m², while lightweight brick was Rp175,000/m². However, the implementation time using lightweight brick was shorter, which was around 8–9 days compared to red brick which reached 12–13 days. Thus, red brick was more efficient in terms of cost by 17.14%, while lightweight brick was more efficient in terms of time by 30.77%. In conclusion, the choice of wall material should be tailored to project priorities. If the project emphasizes timeliness, lightweight brick is more recommended. However, if the focus is on cost savings, red brick is a more efficient choice.

Keywords: *Efficiency, Lightweight Bricks, Red Bricks, Construction Costs, Implementation Time*

I. INTRODUCTION

In building construction, walls are a crucial element, serving as room dividers, weather protection, and distributing some of the building's load. The choice of wall material is crucial because it directly impacts construction costs, construction time, and the quality of the final product (Mulyono, 2004).

Traditionally, red bricks have been widely used in Indonesia due to their easy availability, good strength, and relatively affordable price. However, with the advancement of material technology, lightweight bricks (autoclaved aerated concrete/AAC) are now widely used as a modern alternative offering various advantages, such as lighter weight, precise dimensions, faster installation, and better thermal insulation (Hidayat, F. 2020).

However, the use of lightweight bricks is often considered less cost-efficient due to their higher unit price compared to red bricks (Hidayat, F. 2020). Therefore, a comparative analysis of the efficiency of the two materials is necessary to determine which is more advantageous in terms of cost, implementation time, and material efficiency.

II. RESEARCH METHODOLOGY

1. Types and Approaches of Research

This research is a comparative descriptive research that aims to compare the efficiency of using two types of wall materials, namely lightweight bricks and red bricks, based on the aspects of cost and time of work implementation.

The research approach used a case study method, collecting and analyzing data from residential construction projects using both types of materials. The data obtained was then compared to determine the efficiency of each material.

2 Location and Time of Research

The research was conducted on a residential construction project located in the Bintara Jaya Housing Complex, West Bekasi.

The research implementation time was carried out during the construction period, namely from the wall work stage to the finishing stage, or based on data on the volume and cost of work that had been realized in the field.

3 Data and Data Sources

1) Data Types

The data used in this study include:

1. Wall work cost data, namely material prices, labor costs, and adhesive/plastering costs.
2. Implementation time data, namely the duration of wall installation work for each type of material.
3. Work volume data, namely the total wall area (m^2) worked on.

2) Data source

Data sources are obtained from:

1. Primary data, results of direct observation in residential construction projects.
2. Secondary data, in the form of Budget Plan (RAB) documents, daily project reports, and references to construction work unit prices from official sources (for example, SNI or Governor's Regulations).

4. Data Collection Techniques

Data is combined in several ways, namely:

1. Field observation, to obtain actual data related to implementation time and work methods.
2. Documentation, through collecting cost data, volume, and photos or notes of the work implementation process.

3. Interviews with project implementers or foremen to determine workforce productivity and obstacles in the field.

5.Research Variables and Indicators

Variables	Measurement Indicators	Unit	Information
Cost efficiency	Total cost of wall work (material + labor)	Rp/m²	Based on the actual price of the project
Time efficiency	Duration of wall work execution	Days/m²	Based on the productivity of the craftsmen in the field

6. Data Analysis Techniques

The analysis is carried out in the following stages:

1) Calculating the total cost of wall work

Costs are calculated based on the unit price of materials and labor wages for each type of brick:

Total cost (Rp/m²) = (Material price per m²) + (Labor cost per m²)

(This calculation refers to the unit price analysis method for construction work as explained in SNI 2835:2008 – Procedures for calculating unit prices for concrete work in the construction of buildings and residential houses, along with the Minister of PUPR Regulation Number 28/PRT/M/2016 which regulates the Guidelines for Unit Price Analysis of Work

2) Calculating the efficiency of implementation time

The implementation time is calculated from the labor productivity of each type of material:

$$\text{Time (days)} = \frac{\text{Volume pekerjaan } (m^2)}{\text{Produktivitas tukang } (m^2/\text{hari})}$$

(This labor productivity value refers to the Work Unit Price Analysis (AHSP) which is regulated in the Regulation of the Minister of Public Works and Public Housing Number 28/PRT/M/2016, as well as the Indonesian National Standard 7394:2008 entitled Procedures for Calculating Work Unit Prices for the Building and Housing Sector.).

3) Comparing the results between the two materials

Cost and time data are then compared to determine which material is most efficient.

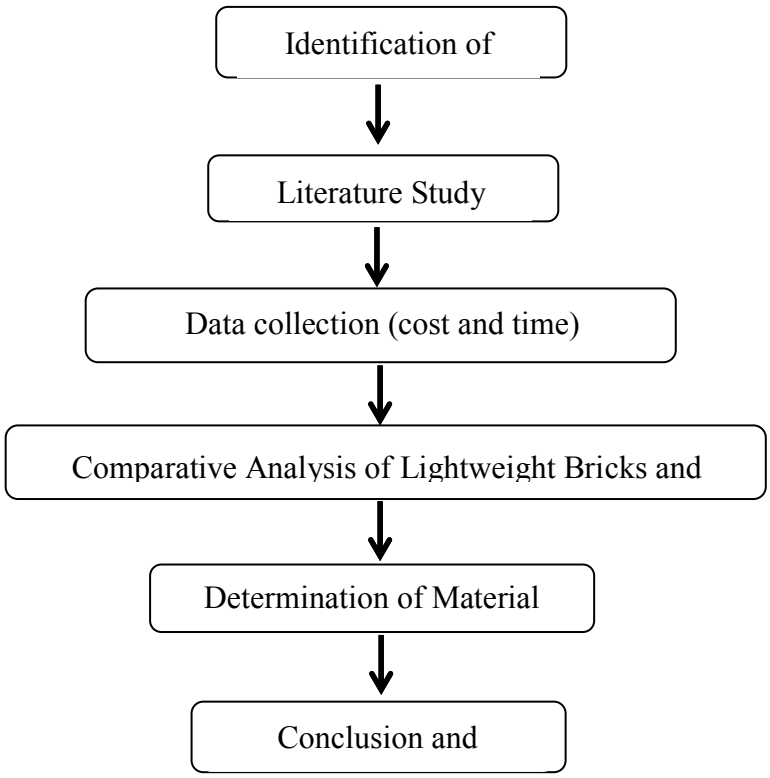
Efficiency assessment criteria:

- Lower costs → more economically efficient.
- Less time → more efficient in execution.

4) Draw a conclusion

The comparison results are analyzed descriptively to determine the most efficient materials to use in residential wall work.

7. Research Flowchart



With this method, the research results are expected to be able to objectively show the most efficient wall materials in terms of cost and implementation time in residential construction projects.

III. RESULT AND DISCUSSION

1. Research Project Overview

This research was conducted on a type 70 residential construction project located in the Bintara Jaya Housing Complex in West Bekasi. The wall construction used two types of materials: lightweight brick and red brick, which were compared based on cost efficiency and construction time.

The total area of wall work used as a research sample was 100 m², with cost and time data obtained from field observations and project budget plan documents.

2. Research Result Data

Wall Work Cost Data

The following data shows the average cost of wall work based on field observations:

Material Type	Material Price (Rp/m²)	Labor Cost (Rp/m²)	Total Cost (Rp/m²)
Lightweight bricks	130,000	45,000	**175,000**
Red brick	90,000	55,000	**145,000**

The table above shows that the total cost of wall construction using lightweight bricks is approximately Rp 30,000/m² higher than using red bricks. This is due to the higher unit price of lightweight bricks, although labor costs are lower due to faster installation.

Wall Work Implementation Time Data

Material Type	Craftsman Productivity (m²/day)	Work Area (m²)	Processing Time (days)
Lightweight bricks	12	100	**8–9 days**
Red brick	8	100	**12–13 days**

Based on the data above, using lightweight bricks can speed up wall construction by up to 30% compared to red bricks. The larger, more precise size of lightweight bricks results in fewer joints, speeding up the work.

3. Comparative Efficiency Analysis

a. Cost Efficiency

In general, the total cost of red brick wall construction is lower than that of lightweight brick. However, cost efficiency isn't just about material costs, but also labor costs and project duration.

If the project has a tight time target, the use of lightweight bricks can reduce indirect costs such as equipment rental, daily wages for workers, and project supervision.

To compare the level of cost efficiency, the formula is used:

$$Eb = \times 100\% \frac{C1-C2}{C1}$$

Information:

- Eb= Cost efficiency (%)
- C1= Higher costs (lightweight bricks)
- C2= Lower cost (red brick)

This formula is used to determine the percentage of cost savings resulting from more efficient material alternatives. This cost efficiency concept refers to the principles of engineering economic analysis (Soeharto, 1999 and Ervianto, 2005) in construction project cost management.

$$Eb = \times 100\% = 17.14\ \% \frac{175.000-145.000}{175.000}$$

This means that red bricks are 17.14% more cost efficient than lightweight bricks.

b. Time Efficiency

The comparison of execution time is calculated using the formula:

$$Ew = \times 100\% \frac{T2-T1}{T2}$$

Information:

- Ew= Time efficiency (%)
- T1= Lightweight brick time
- T2= Red brick time

This formula is used to determine the amount of time saved by using materials that can be installed more quickly. This concept refers to the principles of productivity analysis and time efficiency in construction project management (Soeharto, 1999 and Ervianto, 2005).

$$Ew = \times 100\% = 30.77\%\frac{13-9}{13}$$

From the calculation results, lightweight bricks are 30.77% more time efficient than red bricks.

The research results show that there is a significant difference between the use of lightweight bricks and red bricks in residential wall work.

1. In terms of cost, red brick remains more economical for projects with limited budgets due to its lower material cost. However, this cost-effectiveness can change if the project requires a shorter timeline or a reduced workforce.
2. In terms of construction time, lightweight bricks have proven to be faster to construct due to their larger dimensions, easier installation, and less need for plastering. This can reduce the overall duration of field work.
3. In terms of overall efficiency, if the project requires a fast construction time and a neat wall surface, lightweight bricks are superior. However, if the project emphasizes material cost savings, red bricks remain an efficient choice.

Thus, the selection of wall material types needs to be adjusted to the project's objectives and priorities – whether prioritizing time efficiency or cost efficiency.

IV. CONCLUSION

Based on the results of the analysis and discussion regarding the Comparison of Wall Material Efficiency between Lightweight Bricks and Red Bricks in Residential Construction, the following conclusions can be drawn:

1. In terms of cost, using red brick is more economical than lightweight brick. The total cost of wall construction using red brick is Rp145,000/m², while using lightweight brick is Rp175,000/m². Therefore, red brick is approximately 17.14% more cost-effective than lightweight brick.
2. In terms of execution time, lightweight bricks are faster to complete. For a 100 m² area, lightweight bricks take approximately 8–9 days, compared to 12–13 days for red bricks. This indicates that lightweight bricks are approximately 30.77% more time-efficient than red bricks.
3. Overall, the efficiency of wall material usage depends on the project priorities:
4. If the project prioritizes implementation time, then lightweight bricks are more efficient because they speed up the work and reduce indirect costs.
5. If the project prioritizes saving material costs, then red brick is more efficient to use.

Thus, the selection of wall material types should take into account the project characteristics, budget, and target implementation time so that the construction results are optimal from a technical and economic perspective.

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