



Evaluation of the Cost and Time of Red Brick and Light Brick Work on the Madrasah Muallimat Tambak Beras Jombang Construction Project

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ABSTRACT: To support the student teaching and learning process optimally, the existence of learning support facilities is very necessary. To obtain the quality of madrasah buildings according to applicable standards and guidelines, the construction of school buildings must take into account space requirements, size of space, quantitative requirements and quality of space as well as accessibility and circulation between spaces. However, school construction, such as the construction of the Madrasah Muallimin Muallimat Tambak Beras Jombang Building, is limited by time and costs. The aim of the research is to analyze the cost calculations obtained from the cost and time analysis of placing red bricks and light bricks on the Madrasah Muallimin Muallimat Tambak Beras Jombang Building Project. To find out the installation time of red bricks and light bricks from the Cost and Time Analysis on the Madrasah Muallimin Muallimat Tambak Building Construction Project. Jombang Rice. The research method used is Value Engineering analysis to produce cost savings. The results of this research include: a) Cost and time analysis for wall equipment, namely by facilitating alternative materials as replacements for the initial materials, resulting in cost savings of Rp. 28,298,995.61, and b) When compared with productivity, the builders were able to complete the red brick wall work in 133 days, while with light brick wall materials, the builders were able to complete the work in 66 days. So in terms of work speed, lightweight bricks are faster than red brick walls.

KEYWORDS: Funds and Time, Project Savings, Value engineering

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I. INTRODUCTION

The word school comes from Latin, namely skhhole, scola, scolae or skhola which means free time or free time[1]. School is a free time activity for children in the midst of their main activities, namely playing and spending time enjoying childhood and adolescence. His free time activities include learning how to count, reading letters and getting to know morals (character) and aesthetics (art). To accompany children in school activities, they are accompanied by people who are experts and understand child psychology, thus giving children as many opportunities as possible to create their own world through various lessons.

A school is an institution designed to teach students or pupils under the supervision of educators or teachers. Most countries have a formal education system which is generally mandatory in an effort to create students who experience progress after experiencing the learning process. By country, the names for the schools vary, but generally include primary schools for young children and secondary schools for teenagers who have completed primary education.

To support the student teaching and learning process optimally, the existence of learning support facilities is very necessary[2]. To obtain the quality of madrasah buildings according to applicable standards and guidelines, the construction of school buildings must take into account space requirements, size of space, quantitative requirements and quality of space as well as accessibility and circulation between spaces. It is hoped that the development carried out will be able to accommodate learning process activities supported by comfortable space, accessibility and adequate space circulation.

The construction of the Madrasah Muallimin Muallimat Tambak Beras Jombang is a project that aims to provide learning support facilities at the 6 Year Madrasah

MualliminMuallimatBahrulUlumTambakberasJombang. The main aim of this school is to create a cadre of teachers (mu'allim) for the community. In the process of building the Madrasah MualliminMuallimatTambakBerasJombang building, there were problems with funds and limited time. So it is necessary to analyze the work according to the initial design after changes have been made to alternative designs in order to get maximum time and cost allocation.

When constructing a building, the Planned Cost Budget (RAB) is calculated after building construction calculations[3]. This is related to the selection of designs and materials used in planning the construction of the building. Budget Plan Building project costs are prepared as optimally and efficiently as possible with quality and quality that remains guaranteed. Multi-storey building construction consists of an upper structure and a lower structure[4]. The wall element is part of the room divider. Some building elements have large costs, but these elements can still be optimized by making them more efficient.

The selected work item that will be analyzed in the construction work of the Madrasah MualliminMuallimatTambakberasJombang Building is a pair of walls made of light brick/hebel material. From a technical point of view, the availability of materials for wall installation work in current developments includes more than 1 material, including concrete panels (which are only used for large volumes, for example the construction of multi-storey apartments and other high-rise buildings), red brick, light brick and partitions (used for work). interior). With this, the approach regarding the material needed for this building work is light brick compared to other work items. In wall masonry work using light brick/hebel, it is necessary to analyze whether the work time can be faster and whether the price comparison obtained is cheaper [5].

So this research aims to calculate the costs obtained from the cost and time analysis of replacing red bricks with light bricks on the Madrasah MualliminMuallimatTambakBerasJombang Building Project. Find out the installation time for red bricks and light bricks from the Cost and Time Analysis on the Madrasah MualliminMuallimat Building Construction Project. Jombang Rice Farm

II. LITERATURE REVIEW

Understanding Value Engineering

In general, the meaning of value engineering is a technique that uses an approach by analyzing the value of its function. The process taken is to emphasize reducing costs as far as possible while maintaining the desired quality and reliability

Key Elements of Value Engineering

Value Engineering has several capabilities that can be used as a tool for Value Analysis [6]. These capabilities are known as the main elements of Value Engineering, the main elements are as follows:

- a. Selection of projects for Value Engineering Study
- b. Pricing for Value
- c. Life Cycle Costing (The Life Cycle Costing)
- d. Functional Approach (The Functional Approach)
- e. Functional Analysis System Technique (FAST)
- f. Value Engineering Work Plan
- g. Creativity
- h. Establish and maintain Value Engineering
- i. Human Dynamics (habits, barriers, and attitudes)
- j. Relationship between Assignee, Planning Consultant, and Value Engineering Consultant.

Wall

A wall is a solid structure that limits and sometimes protects an area. Generally, walls limit a building and support other structures, limit the space within a building into rooms, or protect or limit a space in the open air. The three main types of structural walls are building walls, boundary walls and retaining walls. The wall structure is one of the building elements that functions to separate and form rooms[7].

III. RESEARCH METHODS

Research Object

The object taken in this research is the Madrasah MualliminMuallimatTambakBerasJombang Building Construction Project [8]. The application of value engineering is specifically for wall installation work at the Madrasah MualliminMuallimatTambakBerasJombang Building

Research data

The data used in the research is grouped into 2, namely:

a) Primary data

Primary data is the main data used in conducting Value Engineering analysis. Primary data can be technical data from the project, such as drawings, Cost Budget Plan (RAB).

b) Secondary Data

Secondary data is supporting data that can be used as input and reference in carrying out Value Engineering analysis. According to the Big Indonesian Dictionary (KBBI), secondary data is data obtained by a researcher not directly from the object, but through other sources, both oral and written. Secondary data is a collection of information that previously existed and is used to complement research data needs. Secondary data, including data regarding unit price lists and labor analysis, data on materials or building materials used, labor data, building regulations from the Department of Public Works and other data that can be used as a reference in analyzing Value Engineering[9].

Method of collecting data

Data collection can be done by:

a) Primary Data Collection Method is a method by conducting a direct survey on consultants and implementers handling the project. Apart from that, researchers also made direct observations.

b) Secondary Data Collection Method is a method by conducting direct surveys on agencies or companies that are considered interested. These companies can include building materials companies, consultants, contractors, labor contractors, agencies that handle building services and construction issues and other companies that can be used as reference material.

Data analysis

From the data that has been collected, a Value Engineering analysis is carried out to produce cost savings[10].

IV. RESULTS AND DISCUSSION

Cost and Time Analysis of Walls

Working walls are a building body that has a very important role in a residence. Not only does it function as a space divider, but the wall also provides privacy to residents and provides comfort and beauty. The general function of walls is: a) As a barrier to wind, light and water, b) As a separator between rooms that have different functions, c) As a barrier to noise. The following Pareto diagram of the wall work analysis is shown in Figure 1.

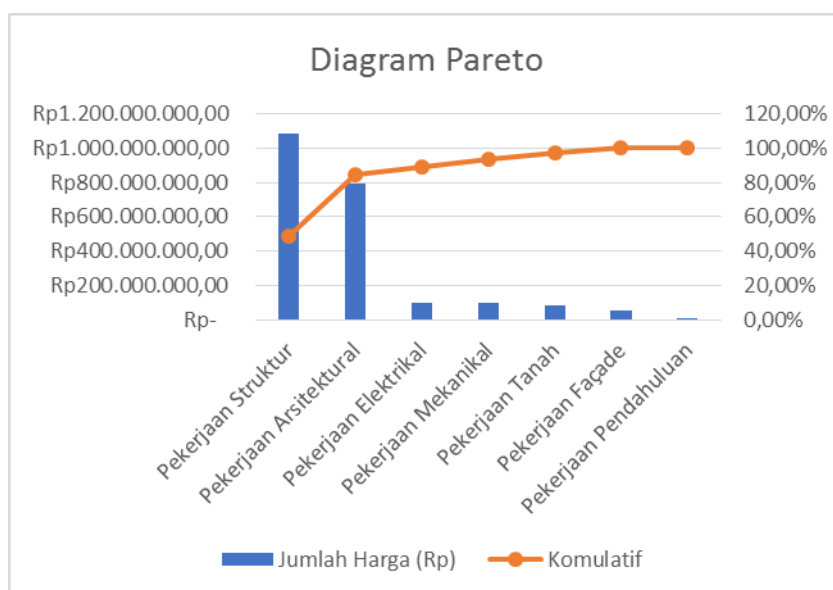


Figure 1. Pareto diagram

Source: Author's analysis

Wall work is the main work with a cost of 80% of the total work items.

Information Stage

Table 1. General Information and Design Criteria for Existing Walls

No	Description	Project Technical Data
1	Design Criteria	½ 1Pc red brick: 4PP
2	Total volume of brick masonry	663.21 m2
3	Cost estimation Work	Brick Wall Pair = 663.21 m2 x Rp. 147,169.74 = Rp. 97,604,440.61

Source: Researcher Processed Data (2023)

Innovation Stage

Table 2. Advantages and disadvantages of lightweight brick/hebel

Excess	Lack
1) Installation time is relatively faster	1) Because it is a new type, not all builders have ever installed lightweight bricks
2) The stiffening concrete frame is wider, between 9-12 m ²	2) It is still rarely found in small building materials shops and is only sold in quantities of 1m ³
3) It has waterproof properties so there is very little chance of water seepage	
4) It is light, fireproof, and has good soundproofing	

Source: Researcher analysis data (2023)

At this stage, we propose alternative designs to replace bricks using hebel/light bricks. Light brick/hebel has a lighter weight and a smoother surface. The size of the lightweight brick is 60 cm x 20 cm with a thickness of 8-10 cm.

Calculation of light brick walls for 1m2 as follows:

Instant cement = 0.105 sacks

Light bricks = 8 pieces

Water = 0.15-0.16 liters

Analysis Stage

Next, the analysis stage is carried out after the innovation stage. At this stage, an analysis of the calculations for light brick/hebel masonry work will be carried out, to determine recommendations for the next stage. The cost analysis method used is cost analysis using the SNI method. The basic regulations used are SNI 2008 which has been modified and adapted to conditions in the field for material coefficients. Meanwhile, the work coefficient is the same. The basis for calculating the SNI method is to first find the unit price of each job by multiplying the coefficient by the unit price of the materials/workers' wages used. After obtaining the unit price for each job, we can find/calculate the required budget plan or what is often called the Bill of Quantity (BQ) by multiplying the unit price for each job by the total volume for each job on the project. The following is an analysis of the cost calculation for walls using light brick/hebel masonry:

a. Calculation of light bricks per m²:

The size of the light bricks used is 60 cm x 20 cm x 7.5 cm. In 1 m² with 3 mm specs there are:

$$\frac{10,000 \text{ cm}^2}{(60\text{cm} + 0.3\text{cm}) \times (20\text{cm} + 0.3\text{cm})} = 8.16 \text{ light bricks}$$

From the calculation above, we get 8.16 light bricks to make a wall pair which is equivalent to the size of a ½ brick wall.

b. Calculation of cost requirements for every 1 m²:

Wall Area

The total wall area minus doors and windows

Main Building 1st Floor Wall Area = 315.41 m²
 Main Building 2nd Floor Wall Area = 347.80 m²
 Total Wall Area = 663.21 m²

c. Wall price estimate

Total price of walls with light brick:
 = (663.21 m² x IDR 104,500)
 = Rp. 69,305,445.00

Implementation Stage

The cost of the existing wall is Rp. 97,604,440.61 while the cost of wall work with an alternative replacement for hebel is Rp. 69,305,445.00 so the total savings on wall work is Rp. 28,298,995.61.

Table 3. Wall Work Savings

No	Work	Volume	Unit	Duration (Days)
1	Red Brick Wall Pair	663.21	m2	132,642
2	Light Brick Wall Pair	663.21	m2	66,321

Source: Researcher analysis data (2023)

Based on this table, it can be concluded that a craftsman is able to complete a red brick wall in 133 days. Meanwhile, the duration of light brick wall installation work for 1 craftsman is 66 days. So, the duration of light brick masonry is faster than red brick masonry.

a) Cost Savings

By using starting materials, the total cost of wall work is Rp. 97,604,440.61 and if you use alternative materials using lightweight brick/hebel then the total cost of wall work is Rp. 69,305,445.00. There is a difference in cost savings when using alternative materials, namely IDR. 28,298,995.61.

b) Time Savings

By using alternative materials, the implementation time will be faster than using the initial material because the material is light and practical, making the work easier. When compared with productivity, a builder can complete a red brick wall in 133 days. Meanwhile, the duration of light brick masonry work for 1 mason is 66 days. So, in terms of work speed, lightweight bricks are faster than red brick walls. If a construction project experiences a time crunch, then using lightweight bricks can potentially save overall project costs. So, judging from the time effectiveness of alternative materials, alternative materials are more effective.

There are several other points of view that can be outlined in the table as follows:

Table 4. Comparison of Red Brick Work with Light Brick Work

No	Description	Initial Wall Work	Alternative Wall Works
1	Time Implementation	Long, takes 133 days/person (craftsman)	Faster, takes 66 days/person (craftsman)
2	Financing	It is quite expensive because it requires quite a lot of bricks per m2, namely 70 pieces/m2	It's cheaper because it only requires 8 pieces of furniture per 1m2 and the process is relatively fast and practical
3	Availability of materials	Requires free space to move around	Doesn't require a lot of free movement space
4	Supervision and control criteria	It is relatively difficult because there are many	It's relatively easy because installing the hebel is faster and
5	Labor	Lots	Less because of the ease and lightness of the material used

Source: Researcher Processed Data (2023)

V. CONCLUSION

From the results of the cost and time comparison analysis for the construction of the madrasah building above, several conclusions can be drawn: a) Based on the results of the cost and time analysis for wall items, namely by proposing alternative materials as replacements for the initial materials, resulting in cost savings of Rp. 28,298,995.61., and b) When compared with productivity, a builder can complete a red brick wall in 133 days, whereas with light brick wall material a builder can complete the work in 66 days. So, in terms of work speed, lightweight bricks are faster than red brick walls. Based on the author's analysis, what should be done in relation to value engineering efforts to construct a building with an optimization theme is that there needs to be integrated coordination between Value Engineering specialists, Project Owners and Planners who examine in depth and comprehensively all the requirements so that the Value Engineering effort can be done well and perfectly

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