LIFE CYCLE COST ANALYSIS TO MAINTAIN MATERIAL CONSTRUCTION ON HOTEL DEVELOPMENT PROJECT BATU

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ABSTRACT

Life cycle cost analysis is a crucial design process in controlling the initial costs and future costs of owning a company investment project. Therefore, it is necessary to conduct a life cycle analysis study cost to find out what cost categories are contained in the Project hotel development in the Batu City area also, see how much the total cost incurred by a project. The construction of the hotel starts from the design stage to the technical age of the hotel that has been completed set. The purpose of this study is to identify service life components hotel building materials, and make a long-term plan for the life cycle cost of the hotel building in the Batu City area. The results of this study indicate that in the Life Cycle Cost Analysis using the essential cost of building investment for 15 years, where there are items of Initial Cost, Annual Recurring Cost, Non-Recurring Cost, the LCC cost of Architectural Work on the Initial Design is IDR 21,542,108,279.

***Keywords**: Annual Recurring Cost, Initial Cost, Life Cycle Cost, Non-Recurring Cost.*

1. INTRODUCTION

In developing an area, it takes effort in infrastructure development in it. Infrastructure is the main component that supports the life cycle in various fields, such as the construction of roads, railroads, irrigation facilities, reservoirs, ports, airports, power plans, offices, housing, and more [1].

According to the purpose the building was built, the presence of buildings has an essential role in human life. After it is completed, it is hoped that it will carry out its functions according to the plan's age. However, with increasing the age of a building, there is a decrease in the performance of the building, which is caused by various factors, for example, the environment around the building and the use of materials that are not appropriate [2].

This Hotel Development Project is one of the efforts in developing an area in the Batu City area. This development project is planned to cost IDR 89,019,629,375. With this project, it is hoped to support the existing facilities or infrastructure in the area.

One of the methods used to analyse the economic value of buildings in the early stages by considering the cycle costs throughout the life of the building is the Life Cycle Cost (LCC) [3]. Life Cycle Cost can be defined namely examining the number of costs incurred to obtain and operate the required facilities [4]. This method is used because the LCC method's cost calculation is more straightforward while paying attention to other cost components. The LCC method is suitable for selecting a project with various alternatives [5].

Life Cycle Cost (LCC) is a deep economic method to evaluate the overall project costs incurred starting from the management, operation, maintenance, and disposal a component of a project, where is this made such an important consideration to make a decision. Life Cycle Cost (LCC) is a cost calculation modelling concept from the initial stage to dismantling an asset from the project as a tool to make the decision on an analytical study, and the calculation of the total costs exists throughout its life cycle.

Therefore, the purpose of this study is to determine the value of the Life Cycle Cost of a Hotel Development Project.

2. RESEARCH METHOD

Life cycle cost analysis is used to determine the cost cycle of the material building; in life cycle cost analysis, the cost variables are calculated as follows [6]. First, Initial costs include, Building costs (item costs) are costs incurred to build a construction building and Development costs are costs used for the process of design, testing, and modelling. Second, Annual Recurring Costs include, Operational costs are related to annual costs such as fuel, insurance, taxes, utilities, and other service and labour costs and Maintenance costs are costs incurred annually for scheduled preventive maintenance and maintenance on a building to keep it in good condition. Third, Non-recurring costs include, The cost of repair and replacement is a cost that estimates damage and replacement that has been predicted in advance and Salvage is the remaining use-value of a building or product that is at the end of its service life in the life cycle cost.

The life cycle cost phase used in this research is in the construction phase of the building up to the building investment period (gate-to-gate) of 15 years. The life cycle cost calculation technique used is the present worth analysis approach. The present worth analysis method is the equivalent value at the present time, where all cash outflows are calculated against the current point in time at a desired minimum rate of return. Present worth is based on the concept that all cash inflows and outflows are discounted to the present end of time at the usual interest rate [7]. The following is the formula for present worth analysis (P/A) in this study.

P/A = Maintenance Cost per Year x P/A Value (1)

Where the P⁄A value is obtained from the table of compound interest factors by taking into account the interest rate (i) and the length of time of investment (n).

3. RESULT AND DISCUSSION

Data on the Budget Plan were recapitulated, and the architectural work with the highest cost item was IDR. 31,731,112,475. For this reason, architectural work will be the main focus of this life cycle cost analysis **Table 1**.

Table 1. Jobs Cost Recapitulation

No	Works	Percentage (%)	Cost (IDR)
1.	Structure	28.91	25,732,791,700
2.	Architecture	35.65	31,731,112,475
3.	Plumbing, Mechanical and Electrical	17.82	15,867,575,200
4.	Interior	13.15	11,708,450,000
5.	Legal Aspect	4.47	3,979,700,000
	Total	100	89,019,629,375

After knowing that architectural work had the highest cost of all the work, the next thing was to describe the work in architectural work based on construction costs from the work that had the most increased cost to the job with the lowest cost. **Table 2**.

Table 2. Architectural Works Jobs Cost Recapitulation

No.	Works	Cost (IDR)
1.	Wall, Floor, Wall Ceramic Work	17,976,070,225
2.	Finishing	3,788,372,250
3.	Door and Window	3,060,792,500
4.	Ceiling	2,783,906,250
5.	Roof	1,479,687,500
6.	Sanitary	1,437,234,250
7.	Hanger and Locker	1,160,049,250
8.	Preparation	45,000,000
	Total	31,731,112,475

From the analysis results obtained, wall, floor, and wall ceramic work is the work with the highest cost of IDR 17,976,070,225 with 56.65%. The last one are followed by making a Pareto diagram to determine what work items will be used for value engineering analysis to reduce the costs generated by these work items **Figure 1**.

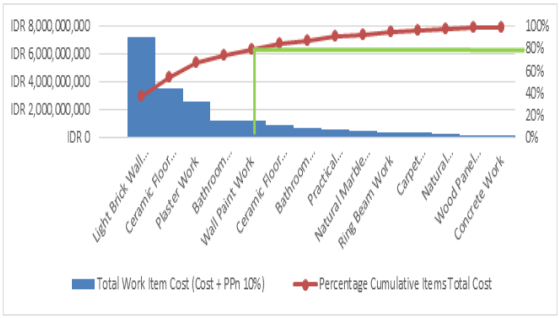

Figure 1. Pareto Chart of Wall, Floor, Wall Ceramic Floor

The item of work carried out by Pareto diagram analysis is light brick wall work, ceramic floor work, bathroom wall ceramic work

Table 3. Wall, Floor, Wall Ceramic Floor Cost Recapitulation

No.	Works	Cost (IDR)
1.	Light Brick Wall Work (1pcs:5ps)	6,530,934,375
2.	Ceramic Floor Work 60/900 (ex. Gani Marble)	3,188,347,500
3.	Bathroom Ceramic Wall Work 30/60 (ex.Vino)	1,103,187,500
	Total	10,822,469,375

After seeing the result of the Breakdown Cost Analysis, the work item that will be studied is the one that gives the highest cost to the total cost of the Wall, Floor, Wall Ceramic Work with the highest work budget. Based on the **Table 1**, the most important or highest work item is namely Light Brick Wall Work (1pcs:5ps), Ceramic Floor Work 60/900 (ex.Gani Marble), Bathroom Ceramic Wall Work 30/60 (ex.Vino).

3.1 Life Cycle Cost Analysis

The life cycle cost calculation technique used is the present worth analysis approach. Present worth is the equivalent value at the present time (time 0), where all cash outflows are calculated against the current point in time at a desired minimum rate of return. The investment period of this building through interviews with related parties is approximately 15 years, and the deposit interest rate used is shown in **Table 4**.

Table 4. Deposit Interest Rate

No	Bank	Interest Rate (%)
1	BCA	2,00%
2	CIMB Niaga	2,75%
3	Mandiri	2,60%
4	BNI	2,75%
5	BRI	2,85%
6	BTN	2,80%
	Total	15,75%
	Average	2,625%

Where the interest rate is obtained, it is calculated by the formula:
i = Safe rate + Risk
Where :
Safe rate: average deposit interest rate
Risk : comparison to safe rate (used safe rate)
So, i = 2.625 + (1/2 x 2.625)
= 3.94 = ~ 4%

3.1.1 Light Brick Wall Work (1pcs:5ps)

a. Initial Cost

Construction Cost or Item Cost = IDR 6,530,934,375

Development Cost

There are no design, testing and modelling costs because only in planning fase.

b. Annual Recurring Cost

Operational Cost

Operational costs are not needed because they do not need the help of something to carry out their functions

Maintenance Cost

According to [8], concerning Guidelines for the Maintenance and Maintenance of Buildings, maintenance performed for light brick walls is not required. However, the value of maintenance costs will be planned for 0.80% per year of the total construction value [9] and the result of present worth of annual cost is IDR 397,394,294.85.

c. Nonrecurring Cost

Repair and Replacement Cost

According to interviews with architectural practitioners, the durability of this lightweight brick is approximately 15 years. Therefore, there

is no need for repair and replacement costs during the investment period.

Salvage Cost

Because during the investment period there is no material repair and replacement activity, the residual value of the material does not exist.

Table 5. Life Cycle Cost Analysis Result of Light Brick Wall Work

Present Value		Budget Cost (IDR)
Light Brick Wall Work		**6.928.328.669,85**
Initial Cost	Construction Cost	6.530.934.375
	Development Cost	0
Annual Recurring Cost	Operational Cost	0
	Maintenance Cost	397.394.294,85
Non Recurring Cost	Repair and Replacement Cost	(15 Year)
	Salvage Cost	0

3.1.2 Ceramic Floor Work 60/900 (ex. Gani Marble)

a. Initial Cost

Construction Cost or Item Cost = IDR 3,188,347,500

Development Cost

There are no design, testing and modelling costs because only in planning fase.

b. Annual Recurring Cost

Operational Cost

Operational costs for this work are cleaning services so that the floor looks cleaner and more beautiful. To calculate the number of cleaning staff using the workload benchmark described in the [10] and also the Full-Time Equivalent Method with the following formula.

Table 6. Total Time Workload per Day

No.	Work Element	Duration (Minute)	Frequency	Workload Time (Minute)
1	Sweeping	120	3	360
2	Rake	60	3	180
3	Wipe	60	3	180
4	Floor Mop	45	2	90
5	Wet Mop	120	2	240
6	Dry Mop	120	2	240
7	Tool Cleaning	45	3	135
Total Time Workload (1 Day)				1425
Total Time Workload (1 Year)				520.125

Table 7. Budget Plan Floor Cleaning Work

Definition	Koef	Sat	Price (IDR)	Total Price (IDR)
Cleaning Service	1	Ls		
Cleaning Service	5	Org	1.500.000	7.500.000
Total/Month				7.500.000
Total/Year				90.000.000

The result operational Cost is IDR 684,540,000.00 and maintenance Cost is IDR 194,004,568.68.

c. Nonrecurring Cost

Repair and Replacement Cost

According to interviews with architectural practitioners, the durability of this lightweight brick is approximately 15 years. Therefore, there is no need for repair and replacement costs during the investment period.

Salvage Cost

Because during the investment period there is no material repair and replacement activity, the residual value of the material does not exist.

Table 8. Life Cycle Cost Analysis Result of Ceramic Floor Work

Present Value		Budget Cost (IDR)
Ceramic Floor Work		**4,066,892,068.68**
Initial Cost	Construction Cost	3,188,347,500
	Development Cost	0
Annual Recurring Cost	Operational Cost	684,540,000
	Maintenance Cost	194,004,568.68
Non Recurring Cost	Repair and Replacement Cost	(15 Year)
	Salvage Cost	0

3.1.3 Bathroom Ceramic Wall Work 30/60 (ex.Vino)

a. Initial Cost

Construction Cost or Item Cost

= IDR 1,103,187,500

Development Cost

There are no design, testing and modelling costs because only in planning fase.

b. Annual Recurring Cost

In operational costs is IDR 684,540,000.00 and in maintenance cost is IDR 67,126,753.

c. Nonrecurring Cost

Repair and Replacement Cost

According to interviews with architectural practitioners, the durability of this lightweight brick is approximately 15 years. Therefore, there is no need for repair and replacement costs during the investment period.

Salvage Cost

Because during the investment period there is no material repair and replacement activity, the residual value of the material does not exist.

Table 9. Life Cycle Cost Analysis Result of Ceramic Wall Work

Present Value		Budget Cost (IDR)
Ceramic Wall Work		**1,854,854,253**
Initial Cost	Construction Cost	1,103,187,500
	Development Cost	0
Annual Recurring Cost	Operational Cost	684,540,000
	Maintenance Cost	67,126,753
Non Recurring Cost	Repair and Replacement Cost	(15 Year)
	Salvage Cost	0

3.1.4 Presentation

At this stage, the overall results of the value engineering analysis will be presented merely with various supporting data from the previous stages. The results of this analysis are expected to be input to the project owner. The results of the changes from the existing alternatives in light Brick Wall Work, Floor Ceramic Work, Bathroom Ceramic Wall Work can be seen in **Table 10.**

Table 10. Comparison Initial Cost and Life Cycle Cost

No	Design	Initial Cost (IDR)	Life Cycle Cost (IDR)
1	Light Brick Wall Work	6,530,934,375	6,928,328,669.85
2	Ceramic Floor Work	3,188,347,500	4,066,892,068.68
3	Ceramic Wall Work	1,103,187,500	1,854,854,253
	Total	**10,822,469,375**	**12,850,074,990**

4. CONCLUTION

Based on the analysis in this journal that has been carried out, the following conclusions can be drawn; after the Breakdown Cost Model analysis was carried out, it was Architecture (Wall, Floor, Ceramic Wall Work) was a work item with reasonably high work cost item, so it was necessary to implement Life Cycle Cost.

Life cycle cost analysis uses the present worth analysis technique by considering building, development, operational, maintenance, repair and replacement, and salvage cost.

The Light Brick Wall work's initial design value is IDR 6,530,934,375, and the Life Cycle Cost is IDR 6,928,328,669.85. In Ceramic Floor Work, the initial design value is IDR 3,188,347,500, and the Life Cycle Cost is IDR 4,066,892,068.68. Finally, in the Ceramic Wall work, the initial design value was IDR 1,103,187,500, and after the Life Cycle Cost analysis was carried out, it became IDR 1,854,854,253.

From the analysis that has been carried out, it is found that the results of the calculation of the life cycle cost on the selected alternative have a more efficient cost compared to the initial design, so that this life cycle cost analysis can be said to be saving.

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