

LIFE CYCLE COST ANALYSIS OF A COMMERCIAL BUILDING

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Abstract - Life cycle cost analysis is a beneficial technique for assessing the total cost of assets. The estimator of the construction company usually only calculates the project cost of commercial building but the entire cost to be spent till the project lasts should be calculated. Thus, operational and maintenance costs of the commercial building throughout its life are calculated. Previously operational and maintenance costs were not given much importance but day by day increase in operational and maintenance costs given importance to it. By investing at the initial stage of building operations and maintenance costs are calculated. In this paper life cycle cost of a commercial building of G+4 is carried out using the NPV method. The LCC analysis of economic buildings administered during this work are often wont to perform the LCC analysis of the other building project in other cities or of other technology with some modifications in the input Data. The LCC of a commercial building by NPV method is calculated as Rs.15,51,2500/-

Key Words: LCS - Life Cycle Costing, LCCA - Life Cycle Cost Analysis, NPVM - Net Present Value method, Discount Rate, Operational and maintenance costs, Non-Annual Recurring Costs, Energy Costs, Salvage value.

1.INTRODUCTION

Life Cycle Cost (LCC) is the most straightforward and least demanding to decipher financial valuation measure. The objective of an LCCA is to assess the overall expenses of options in contrast to the project and pick the arranging that guarantees that the force gives absolute bottom by and large expense of proprietorship as per its quality and execution. LCA ought to be performed ahead of schedule inside the planning cycle while there's still space to calibrate the wanting to ensure lifecycle cost decrease. Life Cycle Cost is a significant financial investigation utilized in choosing choices that influence current and future expenses. Analyse introductory speculation choices and distinguish less expensive options for a particular time frame of a year. Life Cycle Costing is a strategy for assessing the all-out cost of responsibility for the office. It thinks about every one of the costs of gaining, claiming, and eliminating a structure or development framework. LCCA examination is particularly helpful when it's important to coordinate with plan choices that meet comparable exhibition necessities yet vary in beginning expenses and working expenses, to choose the one that boosts net reserve funds. The proprietor just considers the underlying development costs yet the support costs are exceptionally important. Thusly, the working and upkeep costs determined during the arranging and simultaneously

the pre-monetary arranging are a lot higher. The customer just glances at the tasteful plan of the task, yet the customer should have an essential comprehension of underlying and support costs to be monetarily ready for future costs. Life Cycle Cost (LCC) is the least complex and most straightforward to decipher financial valuation measure. The objective of an LCCA is to gauge the overall expenses of options in contrast to the project and pick the arranging that guarantees that the force gives absolute bottom generally speaking expense of proprietorship as indicated by its quality and execution. LCA ought to be performed ahead of schedule inside the plan interaction while there's still space to adjust the intending to ensure lifecycle cost decrease. Life Cycle Cost is a significant monetary investigation utilized in choosing options that influence current and future expenses. Analyse beginning speculation choices and recognize less expensive choices for a particular time frame of a year. Life Cycle Costing is a strategy for assessing the absolute expense of responsibility for the office. It thinks about every one of the costs of getting, claiming, and eliminating a structure or development framework. LCCA investigation is particularly valuable when it's important to coordinate with plan choices that meet comparable presentation prerequisites yet contrast in introductory expenses and working expenses, to choose the one that augments net reserve funds. The proprietor just considers the underlying development costs however the support costs are extremely fundamental. In this way, the working and upkeep costs determined during the arranging and simultaneously the pre-monetary arranging are a lot higher. The customer just ganders at the tasteful plan of the venture, yet the customer should have a fundamental comprehension of underlying and support costs to be monetarily ready for future costs.

1.1 Necessity of LCCA of Commercial Building

Life cycle costing is frequently utilized for alternative valuing when buying new resources and for settling on choices to limit costs over the existence of a resource. It is additionally applied to genuine expense correlations for comparable resource types and as input in future plans and secure choices. The LCA adjusts the underlying financial venture with the drawn-out costs of proprietorship and the executives of the structure. The fundamental benefit is that the costs that emerge after the development or securing of a resource, like upkeep, activity, removal, become a significant factor in the dynamic interaction. It likewise permits an investigation of the interrelationships between organization capacities. Low advancement expenses can prompt high

support or client care costs later on. LCCA will likely fulfill client needs, as clients bear just the underlying development cost as opposed to considering future O&M costs. Thusly, the proprietor of the resource should consider the required working and support costs. For the assortment of upkeep costs, pre-monetary arranging should be completed

1.2 LCCA applications

1. Development area.
2. Apparatus and hardware.
3. Assembling of the item.
4. LCC for building, atomic, and energy plants.
5. LCC of incorporated designs, framework unwavering quality, viability.
6. LCC for transport and aviation.
7. Screen a continuous undertaking.
8. Choice from contending bidders for an undertaking.
9. Pre-monetary arranging.

1.3 Objectives of the investigation

1. Study Life Cycle Cost Analysis.
2. Study the different costs engaged with life cycle costing.
3. Study the net present worth strategy.
4. Play out the LCA of a G + 4 business-building utilizing the net present worth strategy.
5. Study the benefits and disservices of the NPV strategy.

2. PROBLEM STATEMENT

The main problem arising in the construction industry is that the initial cost is considered but the maintenance cost is considered less or neglected. This problem can be overcome by calculating life cycle cost previously considering the time value of money and pre-planning financially for maintenance of the commercial building. The owner takes into consideration only the initial construction cost, aesthetic design and fulfills the goal of client expectations instead of structural cost alone. The client should also take into mind operational and maintenance costs for proper pre-financial budgeting and planning.

3. METHODOLOGY

3.1 General

Life Cycle Costing might be a strategy for assessing the whole expense of responsibility for the office. Life Cycle examination is utilized for different purposes like buying medical care hardware, instructive and government assistance administrations, building valuation, military purposes. A few expenses are included inside the complete lifetime of a resource, similar to land securing, development costs, power expenses, devices and hardware, substitution costs, working and upkeep expenses, and removal costs. . the worth of the entire structure, from the securing of materials to the costs of development, activity, and support, is determined on the possibility of the worth of the existence cycle. Monetary getting ready for future development and support costs are moreover determined from life cycle costs. In life cycle costing, future expenses, such as working and support costs identified with a thing, ought to be limited to their present qualities prior to adding them to the thing's acquisition or acquirement cost. Throughout the long term, numerous equations are created to change cash from one second over to ensuing. Here are the means required inside the existence cycle costing philosophy:

Stage 1: Determine the goals of the existence cycle costing investigation.

Stage 2: Literature Reviews and Problem Statement.

Stage 3: Life Cycle examination Method Using the web Present Value Method.

Stage 4: Collect all the information important for the examination of an announcement building.

Stage 5: Apply the gathered information to the picked techniques.

Stage 6: Calculate the whole life cycle cost.

Stage 7: Formulate the aftereffects of the existence cycle investigation. The existence cycle cost recipe is:

$$\text{Life cycle cost (LCC)} = C + R + A + MS$$

Where C = Initial expense.

R = Present worth of the expense.

A = Present worth of yearly repeating costs, activity, upkeep, and fix.

M = Current worth of non-repeating the executives, upkeep, and fix costs.

E = Current worth of energy costs.

S = Present resale worth or lingering worth or rescue esteem.

3.2 Net Present Value Method

Net present value (NPV) can be a method used to determine the present value of all future cash flows generated by a project, including the initial capital investment. It is used extensively in the capital budget to determine which projects can generate the most profit. The net present value method takes into account the time value of money and provides realistic results. The net present value is used to calculate the present value of a future payment flow. If the NPV of a project or investment is positive, it means that the present value of all future cash flows related to that project or investment will be positive, and therefore attractive. To calculate the NPV, you need to estimate the future cash flows for each period and determine the correct discount rate. The formula for the NPV varies according to the number and size of future cash flows. The formula for the net present value is:

$$NPV = \sum_{t=0}^T \frac{C_t}{(1+r)^t}$$

Where, NPV = Net present value

C_t = cost in the year, t

r = discount rate in decimals

t = time period.

The discount rate is the interest rate used to convert future expenditures to their present value at the base date taking into consideration the time value of money and the rate of inflation.

The discount rate is calculated as:

$$(1+i) = \frac{(1+\text{interest rate})}{(1+\text{inflation rate})}$$

4. DATA COLLECTION

The data to be collected for the analysis of the life cycle cost of commercial buildings is located in Malegaon, Nashik, and is called City Junction. The construction of the building was completed in 2020. It is a commercial building consisting of a total number of 10 shops, 2 offices, 1 hotel, 1 medical clinic. This is building G + 4. The data collected includes the total cost of the works and the operating and maintenance costs of the building each year. To do this, the LCC used the net present value method. The life span of the building is estimated at 80 years. The total construction cost of the building is taken and the O&M costs are calculated by converting all monthly expenses such as electricity costs, water costs, cleaning staff, guards, etc. into annual expenses. Non-annual recurring costs such as coloring are done every 10 years. The costs of replacing components such as walls,

elevators, electrification, and plumbing are calculated based on the initial construction cost. Borewell and CCTV replacement costs are calculated every 10 years, lift replacement every 25 years, replacement of electrical and plumbing fittings respectively every 30 years according to the CPWD of the Indian government.

5. DATA ANALYSIS

The life cycle cost of an economic building was administered using the Internet present value method. The salvage value is collected at 10% of the total cost of the initial construction. The discount rate is calculated using the interest rate and the inflation rate. The interest rate is taken from the Custodian Financial Institution of India website and then the inflation rate is taken from the Government of India's Ministry of Statistics and Central Statistics Bureau for Program Implementation. Long-term operating and maintenance costs, recurring and non-annual replacement costs are assumed to increase by 10% per year. The Internet present value of O&M costs is calculated by adding all the present values. Similarly, the NPV of non-annual recurring and replacement costs is calculated. Non-annual recurring costs such as coloring are calculated at 10-year intervals. Borewell and CCTV replacement costs are calculated every 10 years, elevator replacement every 25 years, electrical and plumbing replacement every 30 years is calculated at certain intervals respectively. All calculations are performed using MS Office Excel.

6. RESULTS AND DISCUSSION

The Life cycle cost analysis result by NPV method for the commercial building located in Malegaon, Dist.- Nashik is shown in table no.1. The results show the values obtained for initial cost, replacement cost, operation and maintenance cost, non-annually recurring costs, and the salvage value is taken for 80 years of the life span of the building at a 3.24% discount rate. Total LCC is obtained by adding all these costs together except for the salvage value which is being subtracted. The LCC for commercial building by NPV method is obtained as Rs. 15,51,2500/-

Table -1: Life cycle cost of commercial building for 80 years at 3.24% discount rate.

Sr. no	Description	NPV Method (Cost in Rupees)
1	Initial cost (C)	15,512,500/-
2	Replacement cost (R)	4,713,057/-
3	Operation, maintenance cost (A, M and E).	1,548,060/-
4	Non-Annual Recurring Cost	2,082,134/-
5	Salvage value (S)	- 1,551,250/-
6	Total Life Cycle Cost (LCC)	22,304,501/-

LCC analysis performed in this work can be used to perform the LCC analysis of any other similar commercial building and other technologies with changes in the input data. LCC analyses are often employed by builders and residents to spot project budget needs beforehand and lift funds for them.

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6.1 Advantages of the NPV method:

1. Good value for money and gives realistic results.
2. For correct decision making and provides better predictions.
3. Good measure of profitability
4. Easy to understand and takes into account the risk of future cash flows.
5. Accept the conventional cash flow model.

6.2 Disadvantages of the NPV method:

1. Difficulty determining the required rate of return and ignoring sunk costs.
2. Cannot be used to compare projects of different sizes.
3. It can lead to bad decisions about investments that are mutually exclusive.

7. CONCLUSIONS

In this thesis, the life cycle cost analysis of the commercial building in Malegaon, Nashik is calculated using the NPV method. The costs involved in the LCA are initial construction costs, operating and maintenance costs, replacement costs, non-annual recurring costs. The LCC for commercial buildings using the NPV method is estimated at Rs. 22.304.501 / - The full cost in the initial phase of the project will be easy and will take less time than in the years to come. This method can be expensive early on, but it helps optimize costs for years to come and helps with financial planning. The