Examining life cycle costing construction essay

Life Cycle Costing (LCC) is a technique to establish the total cost of ownership. The total costs of ownership are machinery and equipment, including its cost of acquisition, operation, maintenance, conversion, and/or decommission (SAE 1999). Besides, it is a structured approach that addresses all the elements of this cost and can be used to produce a spend profile of the product or services over its anticipated life-span. Common terms used to describe the consideration of all the costs as associated with a built asset throughout its life span are called Life Cycle Costs (LCC), Whole Life Costs (WLC), Cost-in-use and etc.

As Flanagan and Norman (1983) have defined the Life Cycle Costing of an asset is the total cost of that asset over its operating life, including the initial acquisition costs and subsequent running costs. Another Life Cycle Costing defined by Hoar and Norman is Life Cycle Cost of an asset as the present value of the total cost of the asset over its operating life including initial capital cost, occupation costs, operating costs and the cost or benefit of the eventual disposal of the asset at end of its life.

The cost planning is importance for a construction project, if the cost planning cannot be effective unless the total costs are considered. For example, both of the initial cost and future cost and using the present value and some formulation to calculated. In a constraint, the “ Real Cost” should encompass the initial acquisition costs and the running costs of maintaining costs of maintaining and operating a building throughout its effective life include refurbishment.

Life Cycle Costs is refer to as ultimate life cost or total cost, a technique of cost prediction by which the initial constructional and associated costs and the annual running and maintenance costs of a building, or part of the building, can be reduced to a common measure. As a summary Life Cycle costing is an initial cost plus maintenance cost and planting cost.

2. 1. 2 Nature of Life Cycle Costing

Life Cycle costing is employed as a design tool for the comparison of the cost of different design, materials, components and constructional techniques. Besides, it also is a valuable guide to the designer in obtaining value for money for construction project client. In the construction project the Life Cycle costing normally is used by property managers or developers to compare costs against the value accruing from future rents for any element or part in construction works.

The perform of the Life Cycle Costs can be enables building functions to be expressed in terms of the costs of repairing and renewing the finishing and fittings, lighting and servicing and of the labour needed in operating the building. Besides, it also can be enable the vast range of factors on which judgment is necessary to be reduced to a comparison of a single cost with the personal assessment of the value of the building.

Life Cycle Cost also known as Whole Life Costs is include consideration some factors when designing and specifying. The first factor is initial or procurement costs, including design, construction or installation, purchase or leasing, fees and charges. Second factor as future cost of operation, maintenance and repairs, including management costs such as cleaning, energy costs and etc. Third factor is future replacement costs, which including loss of revenue due to the non-availability. Fourth factor is future alteration and adaption costs, loss of revenue due to the non-availability. The fifth or last factor is future demolition or recycling costs.

Whole Life Costs can be carried out at any stage of the project and not just during the procurement process. The potential of its greatest effectiveness is during procurement because of; refer to the (Figure 2. 1) as below:

Sale

Recycle

Rent

Business

Sublet

Fiscal

Rent/ rates

Energy

Utilities

Maintenance Repair/Replace

Refurbish

Demolition

Non-available

Management

Price

Adaptation

Commission

Fit out

Fees

In-house

Finance

Site

Design

Construction

Commission Fit out

Fees

In-house

Finance

Figure 2. 1 Whole Life Costs

All the costs in the Life Cycle can be converted to present value (PV) by discounting techniques which makes it possible to combine all the costs of the building. In perform of Life Cycle, it will provide rationale for choice in circumstances where there are alternative means for achieving a giving object. In any economic appraisal one should not ignore the inevitable future upkeep costs necessary for a building to perform its complete function. The cost of maintenance must affect the true economic worth of a building in use.

The relative importance of first and running costs is influenced by financial interest of the client. A developer will not usually consider the running costs, for an industrialist will certainly influenced by the greater tax savings obtainable for running costs. Besides, an occupier will be more concerned with the total effect of the design upon the costs of owning and operating the building.

2. 1. 3 Why Life Cycle Costing is Important?

The visible costs of any purchase represent only a small proportion of the total cost of ownership. In many departments, the responsibility for acquisition cost and subsequent support funding are held by different areas and, consequently, there is little or no incentive to apply the principles of LCC to purchasing policy. Therefore, the application of LCC does have a management implication because purchasing units are unlikely to apply the rigours of LCC analysis unless they see the benefit resulting from their efforts.

There are some major advantages of using Life Cycle Cost analysis.

Life Cycle Cost Analysis is gives an emphasis on a whole or total cost approach undertaken during the acquisition of a capital cost project or asset, rather than merely concentrating on the initial capital cost alone. In another words we can said Life Cycle Cost can be improved awareness of total costs, the application provides management with an improved awareness of the factors that drive costs and the resources required by the purchase. It is important that the cost effective areas of the purchase. Additionally, awareness of the cost drives will also highlight areas in existing items which would benefit from management involvement.

Life Cycle Cost technique wills more accurate forecasting of cost profile, the application of Life Cycle Cost techniques allows the full cost associated with a procurement to be estimated more accurately. It leads to improved decision making at all levels, for example major investment decisions, or the establishment of cost effective support policies. Additionally, Life Cycle Cost analysis allows more accurate forecasting of future expenditure to be applied to long-term costing assessment. For example, it takes into account the initial capital costs, repairs, running and replacement costs and expresses these in comparable terms.

Benefit of evaluation of competing options in purchasing, Life Cycle cost is a technique allow for evaluation of competing proposal on the basis of through life costs and the Life Cycle Cost analysis is a relevant to most of the service contracts and equipment purchasing decision. It is also an asset management tool that allows the operating costs of premises to be evaluated at frequent intervals.

Last advantages of Life Cycle Cost analysis is the performance will be trade-off against cost. In the purchasing decision cost is not the only factor to be considered when assessing the options. There are other factors such as the overall fit against the requirement and the quality of the goods and the levels of services to be provide. Life Cycle Cost analysis allows for a cost trade-off to be made against the varying attributes of the purchasing options.

Whilst there has been an emphasis upon the use of Life Cycle Costing during the pre-contract period, its use can be extending throughout every phase of a building’s life, as follows:

At inception. Life Cycle Costing can be used as a component part of an investment appraisal. The technique is used to balance the associated costs of construction and maintenance with income or rental values.

During the design stage. It is to evaluate the different design options in order to assess their economic impact throughout the project’s life. It is frequently used alongside value management and other similar techniques. The technique focuses on those areas where economic benefits can be achieved.

During the construction stage. During this phase there are many different areas that can be considered for its application. It can be applied to the contractor's construction methods, which can have an influence upon the timing of cash flows and hence the time value of such payments. The contractor is able to apply the principles to the purchase, lease or hire of the construction plant and equipment. Construction managers and contractors' surveyors are able to offer an input to the scrutiny of the design, if involved sufficiently early in the project's life to be able to identify whole life cost implications of the design, manufacture and construction process.

During the project's use and occupation. It is a physical asset management tool. Costs-in-use do not remain uniform or static throughout a project's life, and therefore need to be reviewed at frequent intervals to assess their implications. Taxation rates and allowances will change and have an influence upon the facilities management policies being used.

At procurement. The concept of the lowest tender bid price should be modified in the context of whole life costing. Under the present contractual and procurement arrangements, manufacturers and suppliers are encouraged to supply goods, materials and components which ensure their lowest initial cost, often irrespective of their future cost-in-use. It is now accepted by many clients a greater emphasis should be placed upon the overall economic performance of the different components.

In energy conservation. Whole life costing is an appropriate technique to be used in the energy audit of premises. The energy audit requires a detailed study and investigation of the premises, recording of outputs and other data, tariff documentation and appropriate monitoring systems.

2. 1. 4 Difficulties in Assessing Life Cycle Costs

There are some difficulties when assessing the Life Cycle Costs technique. The first difficulty of accurately is when assessing including the maintenance costs and running costs of different materials, processes and systems in the buildings. Sometime for the person who has less experience, they will refer the historical cost data to measure. The great scarcity of reliable historical cost data and predicting the lives of materials and components is often fraught with dangers.

In construction team, the quantity surveyor will rely on his own knowledge of the material or component or possibly on manufacturer’s data in the case of relatively new products. For example, for the paint show variations and are influenced by type of paint, number of coats, condition of base and extent of preparation, degree of exposure and atmospheric conditions, it is hardly to estimate the Life Cycle Cost for the element.

The difficulties will appear also depend on the human being. Owners’ and occupiers’ maintenance produces may also vary considerably. They may can delay or didn’t not follow the specific schedule to do maintenance activity which planned by the manufacturer’s specifications. In the other hands, the types of payments will be calculated by initial, annual and periodic requires knowledge of discounted cash techniques. For example, calculated for the maintenance cost for elevator, need to using the future cost converts into prevent value.

Besides, the government tax has bearing on maintenance costs and needs consideration. Selection of suitable interest rates for calculations involving periods of up to sixty years is extremely difficult.

Where projects are to be sold as an investment on completion, the client may show little interest in securing savings in maintenance and running costs. Where the initial funds available to the client are severely restricted, or his interest in the project is of quite short-term duration, little consequence that he can save large sums in the future by spending more on the initial construction.

Future costs can be affected by changes of taste and fashion, changing statutory requirements for the buildings and the replacement of worn out components by superior updated items. Lives of different types of buildings are difficult to forecast with accuracy.

Practical Problems Which Affect Life Cycle Costing

Life Cycle costing study is to prepare a cash flow schedule for the building including all the different user costs as they occur throughout the building’s life. besides, it is time consumed for the requirement of the life and maintenance profiles for the components and materials that need to be prepared.

Lives of building components can be predicted on the basis of observed rated of failure for existing buildings. However, it often shows substantial differences in the maintenance profiles of seemingly similar buildings.

Life Cycle Cost the main weakness is the large proportion of the construction techniques and components in a typical modern building and the collected data becomes out of date or is no longer applicable as new components and materials are introduced and possibly more innovative designs produced.

Realistic life cycle costing profiles are very difficult to prepare. Many predictions and assumptions are of questionable validity. Changes in the basic prices of materials, components, labour and capital are difficult to forecast with accuracy and will affect all user costs.

Sophisticated cost models incorporating many assumptions can be rendered invalid by changes in basic prices, unlikely to be uniform across the different components. Changes in government policy have far reaching effects on future needs and costs.

Social, economic and technological changes are bound to have significant effect on the costs incurred throughout a building's life and are all unpredictable at the time of preparing the life cycle costing plan.

Emergency repairs and maintenance, arising from unforeseeable design faults or bad workmanship, constitute a significant proportion of maintenance costs, display a random pattern in both timing and extent, associated disruption costs can only be assessed in a very approximate form. Foreseeable maintenance work such as cleaning and redecoration, the actual decision as to the timing of the work depends to a considerable extent on management policy.

Redecoration cycles vary significantly to meet changing tastes and fashions, to implement a new colour scheme or on an unexpected change of occupancy. Besides, the longer cycles can result from financial constraints leading to deferment of the repainting and increasing substantially the cost the eventual work.

2. 2 Hydraulic Elevator

2. 2. 1 Introduction

In the modern sense, an elevator is defined as a conveyance designed to lift people and / or material vertically. The conveyance should include a device to prevent it from falling in the event the lifting means or linkage fails. Elevators with such safety devices did not exist until 1853 when Elisha Graves Otis invented the elevator safety device.

Elevator is the technique of applying the available elevator technology to satisfy the traffic demands in multiple and single purpose multi-floor buildings. Elevator in the modern sense, is the process of applying elevators and the building interfaces necessary for the vertical transportation of personnel and material within buildings. Services should be provided in the minimum practical time and equipment should occupy a minimum of the building’s space.

2. 2. 2 Benefit

Hydraulic elevator is common chosen by the customer who using low rise building. It is cheaper to build, install and service, and because it has a decidedly better safety record than the other type of elevator, such as electric elevator. For the areas being have the earthquake, hydraulic elevator has proven itself to be clearly the safer option, due to the threat presented by swinging counterweights and also because the car is suspended from the top of the hoist way. The figure below was show that the comparison for how the construction safety perform in electric elevator and hydraulic elevator happened fire or earthquake.

Figure 2. 2 Electric Elevator and Hydraulic Elevator

Hydraulic elevator's jack assembly, by necessity, is located below the lowest floor. The jack is located in a casing, and while it will resist damage from small amounts of water seepage, total inundation by floodwaters will usually result in contamination of the hydraulic oil and possible damage to the cylinders and seals of the jack. Salt water will make it corrosive and can particularly damaging the hydraulic elevator. The hydraulic pump and reservoirs of the hydraulic elevator are also susceptible to water damage, but they can easily be located up to two floors above the jack as shown in Figure 2. 3 Float and Control Mechanism to Control Cab Descent.

Figure 2. 3 Float and Control Mechanism to Control Cab Descent

Some equipment common to all elevators will be damaged by flood waters unless protected. The most obvious examples are the elevator cab. Depending upon the size of the cab and the types of interior materials used, a cab may cost between S5, 000 and S50, 000. Flood damage, which can range from superficial to nearly a complete loss, can easily be avoided by keeping the cab above floodwaters.

A hydraulic systems is they can easily multiply the relatively weak force of the pump to generate the stronger force needed to lift the elevator car.

2. 2. 3 Disadvantages for Hydraulic Elevator

The main problem is the size of the equipment. In order for the elevator car to be able to reach higher floors, you have to make the piston longer. The cylinder has to be a little bit longer than the piston, of course, since the piston needs to be able to collapse all the way when the car is at the bottom floor. In short, more stories mean a longer cylinder. The problem is that the entire cylinder structure must be buried below the bottom elevator stop. This means you have to dig deeper as you build higher. This is an expensive project with buildings over a few stories tall. To install a hydraulic elevator in a 10-story building, for example, you would need to dig at least nine stories deep.

A hydraulic elevator is that they're fairly inefficient. It takes a lot of energy to raise an elevator car several stories, and in a standard hydraulic elevator, there is no way to store this energy. The energy of position (potential energy) only works to push the fluid back into the reservoir. To raise the elevator car again, the hydraulic system has to generate the energy all over again. The rope elevator design gets around both of these problems.

2. 2. 4 Hydraulic Elevator Impact

Actually for any type of elevator system has the maintenance requirements in its life cycle. The maintenance cost is expensive for the owner, so that need to understanding the nature and sources that will always make elevator breakdowns or make the elevator need to do repair works. To be finds the most cost-effective ways for the owner is to keep the elevator performing well and decrease the downtime and repair cost.

One of the most common, expensive and irritating problems that always make the elevator breakdown is vandalism. The vandalism can destroy the appearance and interfere with the operation of the elevator, even compromise safety of the elevator. While to prevent the vandalism in elevators can install vandal-resistant interior and control panels in elevator cabs and making certain elevators are operating efficiently. Besides, long wait times and long travel times will produce frustration that leads to vandalism also.

Elevators operating defectively in a condition of long wait time and long travel and there are the warnings that the elevator control system is developing problems. Average wait times and elevator speed should be check and record on a regular basis, for an example inspection make by every six months. The inspection by compare the time spent for waiting an elevator during peak and off-peak periods to a baseline or to the manufacturer's specification for such type of application of elevator. The age and overall condition of the elevator may cause by a mulfaction, for example defective relay or problems appears will affect to be long wait time and slow performance for an elevator.

Another one of the common causes of elevator malfunctions is overheating for the elevator's drive and control system. The elevator equipment found in places of the environmental conditions are not ideal then the problem will continuously accrue. Hydraulic elevator control system is located in an enclosed basement area with little or even no ventilation or regulation of humidity, in other words not in a good environmental conditions. The heat will come from hydraulic pumps and solid-state controls during high-use period can easily make the room temperatures to be increase to the point where components overheat. The ways to prevent overheating can be install a dedicated cooling system. It is using the 100 percent recirculated air and this system can regulate both temperature and humidity levels while keeping dirt and dust out. Besides, if there have any existing ventilation louvers, doors and other openings need to properly sealed when installing the system.

Now a day the sophistication of elevator is increasing, the power factor to be concern with the problem of old elevators have the low power factor. Power factor is importance, because of the way utilities bill customers to be impose a penalty in the form of higher rates in the concern of low power factor. The higher of the magnetizing current, then the less circuit’s capacity to provide current that does produce a useful work. Low power factor can be result in the overloading circuits and having to upgrade the system power lines.

Quality of power is sensitive to buildings which are filled with computerized equipment. Interfere with the equipment or cause damage by any modification to the system voltage or the shape of the wave form of the alternating current. Common to the older elevator systems which using the motor generator sets, it causes of the harmonic distortion to voltage and the current waveforms. These distortions are generated by the way when the elevator drive uses power from the system supplying it and harmonic distortions can disrupt the operation of sensitive electronic equipment.

Besides, it can suffer from overheating, leading to early failure when other motors are connected to the circuit.

Comprehensive planned maintenance program is importance to minimize the elevator breakdowns. The planned maintenance can eliminate many common problems for example like improper door operation, inaccurate stopping and inoperative safety devices. In the maintenance contract, need range of coverage to be wide, from the basic breakdown repair to full-service contracts that include insurance against accident claims. The contract should need to include all the maintenance activities recommended by the manufacturer and all safety testing required by the local jurisdiction and by the manufacturer. The lowest cost of contract generally mean by fewer labour hours spent maintaining or fewer parts being replaced, and fewer part to be maintenance, so it will result in the ore higher overall costs due to the more rapid deterioration of elevator components.

2. 3 Life Cycle Cost of Hydraulic Elevator

2. 3. 1 Introduction

Cost effectiveness is a key component of designs and system with improved long-term performance. Life cycle cost analysis not only considers the “ first costs” of an elevator, but also the long-term costs, including utilities, operations, and maintenance. The guideline for Life Cycle Cost analysis help the project teams calculate the maintenance costs and operation costs and used them to inform planning, design, and construction decisions.

Life Cycle Cost Analysis is a cost-based process, its goal is to identify the most cost-efficient building design and construction strategies over the life of the asset. Life Cycle Cost Analysis addresses values that can be stated in dollars, not subject issues such as occupant comfort or environmental impact. The most cost-effective solution is not always the most environmentally ideal choice. For example, a building system might consume very little energy but cost more than it saves in energy costs. However, careful design choices that result in efficient use of energy and water often do yield long-term cost savings.

Life Cycle Cost analysis is a method of evaluating the cost-effectiveness of project design decision. Life Cycle Cost analysis is comprehensive because it properly accounts for many project cost variables. These include a wide variety of project costs, which include the construction costs, operating costs, maintenance costs, replacement costs, utilities and others. They also encompass the time value of money, including a project-specific discount rate, inflation, and cost escalations for a variety of goods services.

The Life Cycle Cost analysis process or study involves to establishing objectives for the analysis, to determining the criteria for evaluating alternatives, to identifying and developing design alternatives, gathering cost information, and developing a life cycle cost for each alternative.

According to the principles of Life Cycle Costing, the cost of ownership of an elevator is incurred throughout is whole life and does not occur at the point of acquisition. The figure below give an example of a spend profile showing how the costs vary with the time.

In some instances the disposal cost will be negative because the item will have a resale value whilst for other procurements the disposal, termination or replacement cost is extremely high and must be taken into account at the planning stage.

2. 3. 2 Initial Cost

Initial cost, sometime referred to as project cost or first costs, include both " hard" or construction costs and " soft" costs. The " hard" costs which include the labour costs, materials cost, equipment costs, furnishing costs and others. For the " soft" cost including the design fees, permit fees and others. Costs estimates and information from contractor, vendors and design teams can be used to develop project costs for Life Cycle Cost analysis alternatives.

In the Life Cycle Cost analysis studies, the cost differences between alternatives are usually what is important, not the absolute costs. The initial costs only need to be developed for the components that vary between alternatives, all costs vary must be captured in order to make a valid comparison. Design and other soft costs should be identified and built into the Life Cycle Cost analysis calculations.

In providing services for a building there must be two cost considerations. One is the cost of the initial construction and the second is the return from investment over the economic life of the building.

In elevatoring any building the cost-return considerations start with the initial plans. Many factors external to the building itself establish the criteria. It is very seldom that land is unlimited and that any type of building, low-rise or high-rise, can be chosen for a given site. Zoning regulations must be complied with and the restrictions of land use on a particular plot must be related to the building height. In areas where land use may be unrestricted, needs for parking and access to parking must be considered. The cost of walking long horizontal distances, in terms of time consumed, should be compared with vertical travel by elevator.

In formulating the initial plans the foregoing alternatives are usually considered. As with any plan, the approaches taken may represent compromises because there is often more than one way to solve any problem. In elevatoring a building the final result will generally be one of compromise between requirements of initial cost, space consumption, service quality, and passenger-time-conservation.

2. 2. 3 Operating Cost

The operating cost for hydraulic elevator can be considered as utility costs or the energy costs. For each types of utility service there is a cost per unit of energy delivered that will be charged to the building by monthly or other specific period. The rates and units for these utilities are listed below under the Life Cycle Cost Parameters.

Energy estimating methods, typically the mechanical and/ or electrical engineers on a design team will estimate the amount and rate of building use. The most comprehensive and widely used method of performing these estimates involved detailed hourly computer simulation of building operations.

2. 2. 4 Maintenance Cost

Once an elevator is installed and operating, periodic maintenance is required, and, as its use continues, replacement of wearing parts. Maintenance, which consists of ensuring the elevator is properly lubricated and operating, should take places as often as weekly in a heavily used installation, and as little as once a month in a lightly used facility.

Replacement of minor wearing parts such as contracts on controllers is part of regular maintenance, and major replacements such as replacing wire ropes will need to be done at periods from 8 to 10 years, depending upon the use, condition, and design of elevator. Failures such as the burnout of a motor, a bearing failure, or other repair items have to be corrected as needed.

Practically all elevator manufacturers offer a maintenance contract to provide maintenance care and needed replacement of their equipment. This manufacturer's maintenance is available in several forms, the most desirable and highest priced being called full maintenance.

Elevator maintenance is billed at a monthly rate. The elevator companies count on sufficient maintenance business each year to write off the cost and to make a return on their investment in tools, manpower, inventory, training, and all the incidentals of doing business. There is no reserve built up to cover next year's expenses. If one building does not require major replacement this year, it partially pays for some other building that does. This approach suggests that if there is a tax advantages to building up a reserve for future replacements for an organization, it may pay to arrange with the elevator maintenance company to just pay for labour expended and maintain an inventory of needed parts and pay for major repairs as required.

Maintenance contracts should include the costs of making safety and operational teats as may be required by governmental and insurance agencies. They do not include the cost of making any changes to the equipment either due to obsolescence or as may be required by new laws, such as the addition of a life-safety system. The rapid progress in elevator design and the changing taste in architectural treatment can lead to the need to completely modernize elevators at the age of 20 to 25 years. In fact, many building