Whole Life Costing

Who should read this fact sheet?

This fact sheet introduces the principles of whole life costing for organisations that are new to the subject or in the early stages of working with whole life costing.

Who might be interested in Whole Life Costing?

Procurers (clients) and suppliers (for example contractors, consultants or manufacturers) need to be involved in agreeing the approach if whole life costing is to be successfully adopted and its benefits realised.

Whole life costing is typically adopted by clients who have a long term interest in the property concerned. Often such clients come from the public sector and own a large portfolio of property – it is a Treasury requirement that major capital projects should be let taking account of whole life costs – through Design & Build, PFI or Prime Contracting, or one of the newer procurement initiatives such as NHS Estates Procure 21.

Local Authorities often adopt whole life costing as part of their response to their duty to deliver Best Value.

Private clients who intend to own a property over a long-term period also want to understand the full cost of that ownership.

Consortia formed to undertake PFI projects are evidently long term owners and it is important for them to consider whole life costs as they develop their designs and bids and to monitor and control costs thereafter.

Demand from such clients typically causes designers, contractors and manufacturers to develop their understanding of whole life costs as applied to specific projects or their generic services.

Funders and insurers may be interested in whole life costs as part of their due diligence enquiries into how robustly bids have been constructed and how successfully the risks of designing and constructing buildings have been tackled.

What is Whole Life Costing?

Whole Life Costing is defined in the draft International Standard, ISO15686 Part V - (see references) [i] as: *"economic assessment considering all agreed projected significant and relevant cost flows over a period of analysis expressed in monetary value. The projected costs are those needed to achieve defined levels of performance, including reliability, safety and availability".*

Although this definition captures a number of the essential issues in whole life costing it is not particularly easy as an introduction, and it may be easier to consider the nCRISP definition which is:

"the systematic consideration of all relevant costs and revenues associated with the ownership of an asset".

Neither of these definitions reveal that whole life costing is a tool, to assist in making decisions between different options with different cash flows over a period of time. In this respect it is a form of investment analysis.

Whole life costing is relevant when considering whole estates, whole facilities, individual buildings or structures and when comparing alternative investment scenarios such as:

- Retain and refurbish or sell,
- alternative designs (such as between framed and load-bearing structures) and
- alternative specifications (such as between timber and metal windows).

It is particularly used to justify whether an alternative with a higher capital cost is justified.

Why does Whole Life Costing matter?

Whole life costs are substantially greater than capital or initial costs - it is estimated that the operational expenditure will be 5 - 10 times as much as the capital cost. The Royal Academy of Engineering (see reference below) found that for a typical office building, over a 30-year period, the ratio would be 1:5. A similar study on building design and management (see reference below) indicated the ratio was 1:10.

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However, even these ratios are small when compared with the ratio of capital expenditure to the operating costs of businesses occupying the building. These two studies estimated company's staff costs to be respectively 100 and 200 times as much as their buildings' initial costs. These ratios indicate that *a 1% improvement in productivity /output of staff would effectively pay for the entire capital costs of the building*.

What are the benefits of Whole Life Costing for companies ?

The benefits for clients, as identified in the Clients Guide to Whole Life Costing (see references below), include:

- encouraging analysis of business needs and communication of these to the project team
- optimising the total cost of ownership / occupation by balancing initial capital and running costs
- ensuring risk and cost analysis of loss of functional performance due to failure or inadequate maintenance occurs.
- promoting realistic budgeting for operation, maintenance and repair
- encouraging discussion and recording of decisions about the durability of materials and components at the outset of the project
- providing data on actual performance and operation compared with predicted performance for use in future planning and benchmarking

How do we get started ?

Clients need to ask for whole life costing in the brief – it is not normally included as a standard part of a commission.

Clients, designers and contractors need to spend time agreeing the performance requirements that should be taken into account before the costing exercise is commenced. Only acceptable solutions should be costed.

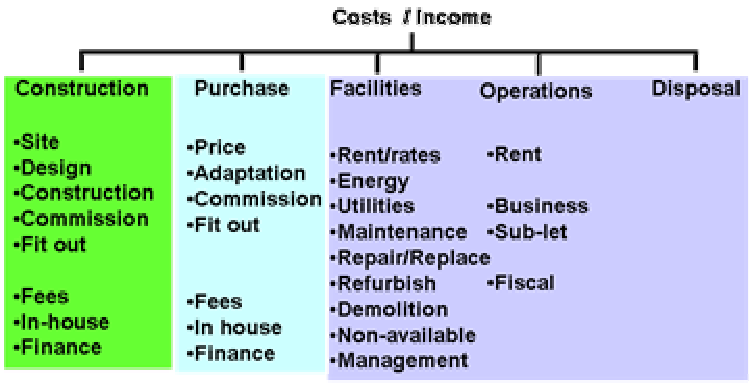
Most benefit will be obtained if whole life costing is taken into account at the earliest stages of design, and in setting initial budgets. Budgets based purely on previous experience will reflect earlier procurement experience based on lowest capital costs.

The goal is to achieve an initial whole life cost plan, which can be modified as the design and construction is undertaken and as more details of specifications become available.

What are the basic steps in Whole Life Costing ?

1. Identify capital and operational costs and incomes
2. Identify when they are likely to occur
3. Use "discounted cash flow" analysis to bring the costs back to a common basis – items should normally be entered into the analysis at the current cost and a "real" (excluding inflation) discount rate applied. Normally this will be done on a commercial spreadsheet package, which includes equations for discounted cash flow.
4. Undertake sensitivity analysis of the variables such as the discount rate, the study period, the predicted design lives of components, assumptions about running costs, etc.

What costs are taken into account ?



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Values for the costs should be as accurate as possible. Greater effort may be required for the most significant cost variables. Values can be derived from:

- a direct estimation from known costs and components;
- historical data from typical applications;
- models based on expected performance, averages etc;
- best guesses of future trends in technology, market and application.

For each cost, there should be an associated time profile of when the cost occurs (or recurs) for Whole Life Costing to be carried out. Time profiles of the costs may only consist of one occurrence but any cost spread over time or one which is repeated will generate a series of cost and time pairs. Costs may be fixed or variable over time. These values are most readily converted into calculations using a computer spreadsheet or purpose-built software.

The costs should be expressed in current terms as many financial or tax transactions are based on actual values at the time rather than the value in future (e.g. the current cost of a boiler should be used, not a projected future cost).

What other variables are important?

Aside from setting the performance criteria, it is essential to determine the following inputs to the calculation:

- the discount rate (if set too high it will make future costs appear insignificant)
- the period of study (often this is the contract period for PFI contracts or the period of foreseeable ownership)
- the format(s) in which whole life costs will be recorded and compared

(HM Treasury requirement for public sector organisations is 3.5% real discount rate, but different rates will be appropriate for different organisations.)

Reporting formats and recording results

The format for reporting Whole Life Costing is often the Net Present Value or NPV – which is a single figure representing all the future costs and incomes at their equivalent present value. Annual equivalent costs may be more appropriate in particular circumstances. The Annual Cost or Annual Equivalent Value is a uniform annual amount equivalent to the project net costs, taking into account the time value of money throughout the period of analysis. This technique is used to compare the merits of competing investments where the natural replacement cycle is not an exact multiple of the period of analysis. The annual equivalent value is the regular annual cost that, when discounted, equals the NPV of the investment. By choosing the option with the lowest annual equivalent cost, the option with the lowest total cost is chosen.

Other ratios can also be useful, such as payback periods. Payback is a calculation of the time period it takes to cover investment costs.

ISO 15686-3 describes the audit trail and process of performance review for service life planning. For WLC analysis, records should be retained in accordance with the guidance in ISO 15686-3. These records should include:

- cost calculations;
- evidence of service life;
- sources of cost data;
- discussions on the scope of analysis;
- retained copies of software packages/ Whole Life Costing models.

There are potential liabilities associated with providing assessments of Whole Life Costs and/or service life planning. Record keeping (whether paper or electronic) should include issues such as professional indemnity insurance, retention or handover of records to other parties at later date.

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How important are maintenance and operational costs for different buildings?

There is great variability in the relevance of maintenance and operational costs to different building types and other facilities, in the typical levels of cost, and the relationship of these to capital costs. These reflect real differences in the use and design, in the relative efficiency of particular buildings as facilities. Table 1gives an indication of the areas to look for cost improvements in buildings.

How Whole Life Costing analysis is used

Figure 1 and 2 below show how an analysis of WLC can be used to select a particular component, or a particular design from a selection of acceptable alternatives. Note however that the figures shown are indicative for the particular projects being analysed. The relationships between the different costs and when they occur will need to be analysed in every case.

References

Whole Life Costing – A Client's Guide

A short guide intended for clients and their supply chains, produced by the Construction Clients Forum

BS/ISO 15686 on Service Life Planning

(available from BSI (Tel: 020 8996 9000) or http://www.bsi-global.com

This multi-part standard provides guidance on how to estimate the service life of buildings and components. Part 1 is the most appropriate part for a general audience – it contains general principles and guidance. Part 2 will be particularly relevant to manufacturers who need to predict service life using accelerated test data, and Part 3 is relevant to checking whether service life issues have been taken into account throughout the process.

The Royal Academy of Engineering conducted a study of the long-term costs of owning and using buildings. They found that for a typical office building, over a thirty-year life span, for every unit of capital expenditure, there will be associated 5 units of operational expenditure, and 200 units of business operating cost. David Kernohan, John Gray and John Daish claim a 1:10:100 ratio in which 1 unit of operating cost (energy, maintenance and rates), is associated with 10 units building cost (capital and rental), and 100 units of employees salary costs over the lifetime of an office building. From both of these ratios of lifetime costs, it can be argued that an improvement in productivity, or business output value of 0.1 per cent over the lifetime of the building more than pay for its initial cots.

References

D Kernohan, J Gray and J Daish. *User participation in Building Design and Management.* Butterworth Architecture. ISBN 075062888X. 2nd edition 1996.

R Evans, R Haryott, N Haste and A Jones. *The Long Term Costs of Owing and Using Buildings.* The Royal Academy of Engineering, Great Peter Street, London, SW1P 3LW. November 1998.

20 steps to encourage the use of Whole Life Costing

This report, intended for housing organisations in particular, is to help clients and others to take the first steps in adopting a structured management approach to efficient long-term investment in housing.

http://www.constructingexcellence.org.uk/sectors/housingforum

Information on energy use and cost effective improvements – all building sectors

Action Energy works with organisations large and small to reduce costs and improve environmental performance, and alongside Government to tackle climate change. www.actionenergy.org.uk (Tel: 0800 58 57 94).

Information on energy use and cost effective improvements – housing only

Energy Efficiency Best Practice in Housing – training, tools and support for the housing profession. http://www.est.org.uk/bestpractice/

Cost Data on capital and maintenance / operational costs

Building Cost Information Service (BCIS) and Building Maintenance Information (BMI) are trading arms of the Royal institution of Chartered Surveyors – they provide a subscription service and publications on a wide range of costs, including special reports on individual cost headings and building types. www.bcis.co.uk Tel: 020 7695 1500

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Table 1 – importance of maintenance and operational costs (based on 2002 - 3 typical cost figures by BMI).

Building Type	Cost Heading	£/100m^2 (per annum)	% of total revenue costs
Factory	Cleaning	750	21%
	Utilities	750	21%
	Administrative Costs	1,000	28%
	Services Maintenance	500	14%
	Fabric Maintenance	400	11%
	Decorations	150	4%
Offices (air conditioned)	Cleaning	1,200	13%
	Utilities	2,050	22%
	Administrative Costs	3,050	33%
	Services Maintenance	1750	19%
	Fabric Maintenance	900	10%
	Decorations	250	3%
Hospitals – General and acute	Cleaning	2,900	36%
	Utilities	1,050	13%
	Administrative Costs	1,500	18%
	Services Maintenance	1350	17%
	Fabric Maintenance	1000	12%
	Decorations	250	3%

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Figure 1 – Analysis of payback period for energy efficient option

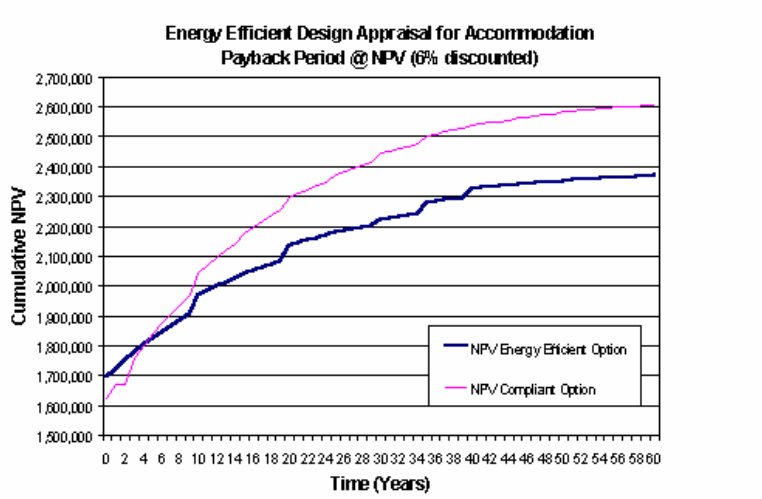

Figure 2 – Analysis of alternative floor finishes