Whole Life Costing

A new approach

Peter Caplehorn

Whole life costing

Whole life costing has been waiting to come of age for many years. A subject that was previously of mainly academic interest is now becoming a key business tool in the procurement and construction of significant projects.

With the advent of public–private partnerships (PPP), and in particular of the private finance initiative (PFI), details of a project's life need to be assessed and tied in to funding and operational plans. Many projects run to millions of pounds and are of high political or social importance, so the implications of the life of materials are crucial. A fundamental requirement of these procurement routes has been that the whole enterprise should be included within the bid, so that a company takes on not only the construction, but also the running and maintenance, of any building.

Additionally, as sustainability has emerged and grown in importance, so has the need for a whole life time-costing approach, driven partly by government insistence. At the heart of sustainability is an understanding of what the specification means for the future of the building and how it will affect the environment. *Whole Life Costing* considers part of this and provides an understanding of how materials may perform and what allowances are needed at the end of their life.

This book sets out the practical issues involved in the selection of materials, their performance, and the issues that need to be taken into account. The emphasis, unlike in other publications, is not to formularise or to package the issues but to leave the reader with a clear understanding and a sensible, practical way of arriving at conclusions in the future.

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Chapter 1

Introduction

I have been a qualified chartered architect for over 30 years, and in that time I have designed and overseen the construction of countless projects. In the main, these have been commercially based schemes, ranging from individual or complex apartment blocks, town-centre schemes, offices and schools through to industrial complexes and airports.

Through that experience, I have been involved in detailed work to develop the best solutions for the client and to ensure that the answers provided are regulation-compliant and best value for money.

I have always been interested in the balance between good design and functional excellence. The skills the designer needs to conceive the best solution are considerable – however, in this increasingly complex world, we also need to be able to convince the client and the construction team that the design is valid, practical, good value, and therefore viable.

However, the result of this process often involves a compromise as a result of the many debates and pressures that affect the construction industry today. These may sometimes play out positively, but often negatively, and we all are the poorer for it.

I have always considered the technical and practical aspects of the profession to be the most challenging. 'Form follows function' has been the mantra of many an architect, and is as valid today as ever.

Throughout the whole of my career, I have been concerned over the use or misuse of materials and the squandering of energy. In the early part of the twenty-first century, we seem to have returned to the same issues that I started out with in the 1970s, when Schumacher, Brenda and Robert Vale, Alex Pike and others were making the case for more rational use of resources. We are now revisiting many of these principles under the heading of sustainability and – possibly humanity's single greatest challenge – taming the use and proliferation of carbon (and related gases) and its effects on our planet's climate.

I hope, through this discussion of some of the aspects of whole life values, to develop this debate into a more considered and applied approach that will deliver some tangible and meaningful results.

The need for whole life costing

There has long been a need for greater understanding of materials and resources, and how we use them. As with many issues in the construction industry, this question has been hijacked by third parties, in this case the 'whole life costing lobby'.

In theory, this has produced a raft of information that is supposed to identify the life of the cost of a building, and the cost of the life of that building.

In the real word, however, this is rarely relevant – the normal outcome is to pare costs to the bone, or to justify poor material choices. By the time the results of these decisions have surfaced, those who made them are long gone, possibly retired. We therefore have the construction equivalent of the 'emperor's new clothes'.

This book attempts to clarify this central challenge and to offer some solutions to this dilemma. This is a book rooted firmly in the real world, confronting the real challenges that affect construction professionals on a daily basis. It is intended as a management and project guide that will offer real benefits to projects in the future. It offers:

- an explanation of the workings of the construction industry today
- an account of how circumstances have developed in combination with the practicalities of construction
- some key principles to ensure that sensible analysis can be undertaken to arrive at a real whole-value view of a project.

These factors all have a foundation in financial issues, but are all practical and quantifiable.

So why is life-cycle costing so rooted in money? I suggest that this is largely because the issues involved have been taken over by the financial part of the industry. The client's ear is always open to money matters, and whole life values in themselves are difficult to get on the agenda. We are therefore left with an analysis that is largely removed from the real, practical, everyday world, and will mainly be public relations (see Chapter x). Central to the practicalities of this subject is the characteristic of ageing.

Why is whole life costing important?

Today, so much of what we construct is based on a short-term perspective, and the cost plan is completely dominant. Most project models, especially in the commercial world,

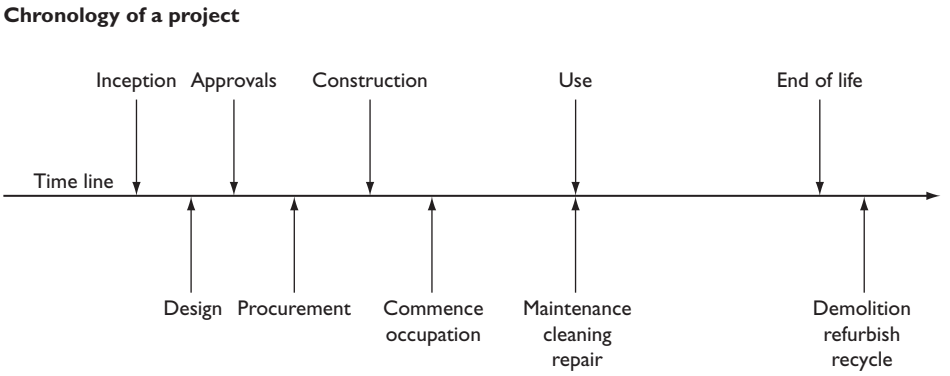

Figure 1.1 The project life cycle

are formulated around the principle of units and the cost of those units. These are later developed into elemental costs, and then into a cost plan.

For many designers, this is unhelpful and disjointed, the relationship of the cost plan and the design being entirely out of step. It is easy to point the finger at the cost consultants here – but the truth is that all members of the design team are usually to blame. Seeing the whole picture, or caring about the requirements of other disciplines, is disappointingly rare. The inevitable consequence is a design that is underdeveloped and a cost plan that is based on too many assumptions – a model that is firmly rooted in short-term profit.

It is for these reasons that the financial detail will not coordinate with the design, any fit between them being very much a matter of chance. This is, of course, both short-sighted and regrettable. The focus is entirely on money. Using finance as the driver to reach more rational conclusions, but not to derive a solution, as most seem to do, is hardly rational. Confused and irrational, these methods just serve to compound the problem.

This book aims to set out a more rational process, away from the financial issues, and to focus on the practical, physical issues that actually establish the whole life cost of buildings and their components. Logically, delivering a real whole life analysis must surely benefit the project and the client, as well as the reputation of the team. In the long term, this must be the only way forward.

Cost is important, of course, but it must be seen in context of the project as a whole, not as a result of – nor the driver for – whole life costing. All forms of analysis to date use a multitude of assumptions to establish a financial statement. This is then used to establish the whole life potential of a particular course of action. How can this possibly be of any real benefit, or in the least way accurate?

It is better to focus on real-world issues to establish the potential, and then to identify whether this is a cost worth paying, and whether it is affordable or even achievable. All too often, the paper principles may not even be achievable, and this cannot be a sensible way to proceed. We need to take action now – if not, we will be forced into reactive measures in future decades.

First, the logic of what is useful and what is not needs to be determined. There is no point in devoting large amounts of resource to analysing a project for it to be so entirely theoretical as to be meaningless. We should be asking at the start: what is the point, where will this benefit the building, or the client, or the end users? Quality of work and maintenance is crucial to all of this, and without a clear understanding of what is required and what can be delivered, there is no point to the exercise. Ensuring that these factors are controlled and undertaken in accordance with the project plan is fundamental. But currently there are few drivers.

Predicting trends in future materials, fashions and commercial pressures is also a complex area. Without some understanding of these, it is difficult to see how any assessment will be of use.

By looking in detail at all the factors involved, a useful model can be produced that allows a range of outcomes to be identified. This can then be used to determine the specification and building operation procedures to deliver the anticipated outcome.

What are whole life cost and whole life value? What benefits do they have? It is important to at least try to estimate the answers, even if flawed.

Any project requires resources. At the beginning, these include the design team and construction processes. For any client requirement, there are a multitude of solutions

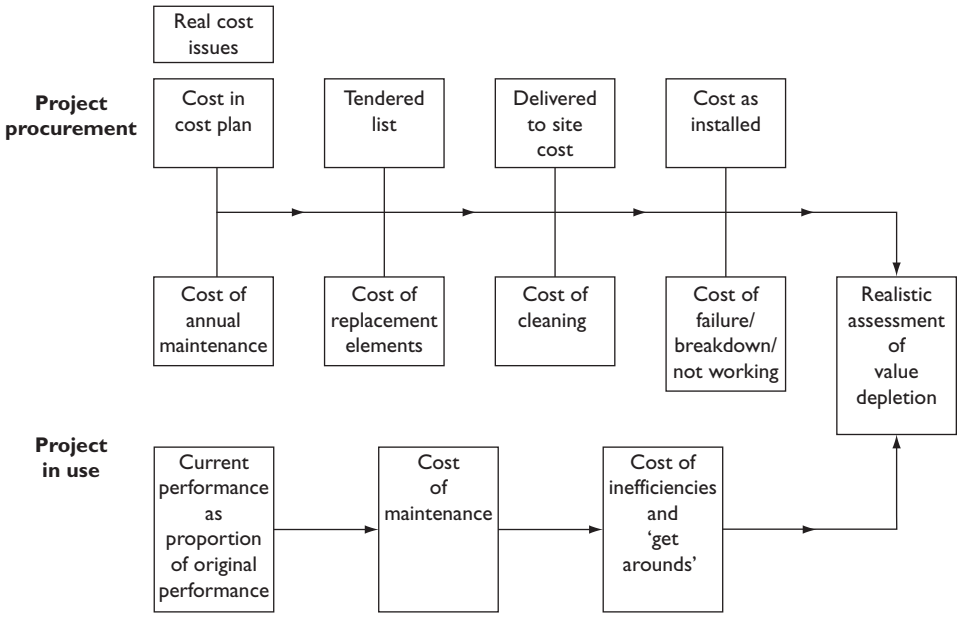

Figure 1.2 Project costs

that will arrive at more or less the same result. However, the details as applied can result in wide variations as to how the building will perform in use, and how long it will last. Additionally, the level of maintenance a building needs to continue to perform will vary, as will the level of maintenance that an owner or occupier carries out. This, too, will have a substantial effect on the life of the building.

There is no single answer to the whole life question. Many variables give rise to a completed project, which will then be subject to many others, all of them affecting the life of the building.

The conundrum does not stop there. How exactly do we establish 'life' and quantify the values of the issues affecting it? This is where fiscal methods alone are inadequate – there is a need to take into account all the various factors to arrive at anything like an accurate answer. For example, it is questionable when a building's life 'ends' – buildings can often be refurbished and reused, which changes the original estimates of whole life value and can change the entire model.

These are difficult issues, certainly, but careful analysis can give some useful results. Linking this with the need to be more careful over the use of materials and energy work done in this area is crucial to the future of appropriate construction. Sustainability and carbon are also part of this story.

It is possible to make some clear statements about what is, and what is not, whole life cost and value, which help to separate the useful from the irrelevant.

Whole life cost is:

- a true assessment of the worth of a building, within limits
- a theoretical judgement using the best information available

- a process to balance the design procurement and use factors
- a process to place cost in perspective as one important element
- a process to be used with care, as results will be a guide only
- useful as part of the analysis to arrive at whole life value.

Whole life cost is not:

- accurate – it should not be relied on to set a business case
- the only measure to assess a project's viability or future
- the only indicator that should be used
- a sensible way to approach future-proofing.

Whole life value is:

- a true reflection of a building's potential heritage
- a realistic appraisal, taking account of all the variables
- a contextual understanding of the future
- a means of understanding the cause and effect of a building's potential future
- a sensible way of identifying a building's future – but must always be viewed in context.

It is also important to identify the meaning of the key concepts involved in this issue.

Life

The time to the first point when the building becomes unviable. This can be due to a number of factors. An asset is unviable when it cannot be used for its prime function and cannot be readily used in any alternative way – when some significant change is needed.

Value

The real worth of a project, taking all the inputs into account. This will vary during the life of a building, but a range of values can be derived, giving an informed view. These can be used to manage the variables during a building's life to achieve the best outcomes.

Benefit

Initially may be in monetary terms, then in terms of resources, quality of performance, or as a net asset, for the purposes of establishing the sustainable options for the building.

Futures

There are a number of possible options, given a building's starting point in use. A variety of paths affecting a building's life will be possible as time progresses, and these may diverge from the mapped direction. The degree of this divergence will be the major influence on achieving the prescribed life value.

Chapter 2

Context of whole life costing

What does 'whole life' mean?

A concept has grown up that, by identifying the whole life cost, rational feedback can inform the choices made at the early design stages. But is this really the case? How does this help, and what does it help to achieve? Any reference to whole life issues may be swamped by much more demanding pressures from a host of other issues. It is therefore not surprising that not much concerted attention is paid to considering either the process or the results of any whole life analysis, and that it has little or no impact on real-world issues in the real world.

Other concerns stemming from this concept are many and varied, not least the need to keep to time, comply with regulations, and ensure that the project is on budget. It is, however, important that the benefits for the client's business are clearly identified, as far as possible, from the very start. The client and the design team should be in the position of understanding the implications of their actions and being aware of the ultimate cost of the project – the whole life cost over the project's total life. But in considering cost, is it not value that should be defined, but true benefit.

When trying to ascertain what happens in the real world, there is little informed information available. It is very difficult to find any evidence that, in real situations, all the analysis and systems produce any tangible benefit. From personal experience of many teams over several decades, I am aware that a considerable amount of effort is employed in discussing this. The usual course of events is that the team confirms the correct path is being chosen and ensures that the given solutions to be built produce a self-congratulatory audit trail that is in fact just a smokescreen – admittedly, a very good smokescreen that fools most of the people, most of the time. Some may disagree with this suggestion, but I have yet to see anything to the contrary in practice. While clients continue to be taken in by this approach, teams will continue to spend time perfecting a story with limited appeal and certainly no tangible outcome.

As the world wakes up to the need to limit resources and to use them wisely, there will undoubtedly be more focus on achieving a good balance between today and tomorrow. Unfortunately, while we continue to base solutions on false premises, the results will not provide the benefits that are undoubtedly needed.

The plain fact is that most of these systems do nothing more than add administration to a project, through an enormous and complex risk assessment to confirm that we are on the right path and that the client need not worry. It is disturbing that so much can be produced for the justification of very little, in many cases nothing at all.

While some will disagree with this assessment, it is made on the basis of 30 years' practice. And it is a point made not with satisfaction, but with great regret. In the future we need to focus on resources, and target construction to be worthy of the resources it consumes. Too much is delivered for too many of the wrong reasons, squandering resources and, in a sense, future options.

Many situations like this have occurred in the construction industry over the years. In particular, this is reminiscent of the early days of the Construction (Design and Management) Regulations 1994, 2007, when risk assessment blossomed like buds in spring, although delivering nothing at all in terms of health and safety benefits.

The fundamental problem in this case, as with many issues in the construction industry, is that theory and practice mix slightly less well than oil and water. It is disappointing that, while considerable effort is poured into joined-up thinking, many key areas such as this remain completely disconnected. If better and more rational thought were applied and used in a constructive manner, we would all benefit considerably.

What goes wrong?

So what are the real issues here, and why does this go wrong? In an ever-more complex world, we need to balance the pressures on a project to ensure the outcome is a true reflection of the project's needs. Not all projects will require long-life characteristics – it is the *fit* of the life issues that is important. In fact, some projects will require a deliberately short life, in which case the design should encourage the reuse of materials, or at least should maximise initial effort to encourage a future life as an entirely different project.

All projects can benefit from whole life analysis, whatever their size, but larger and therefore more complex projects potentially can benefit the most. However, large projects are normally extremely complex and involve timescales of many years that can easily hamper or blur the well meant analysis undertaken if, as is usually the case, there are no checks and balances in this area. In these projects, large teams of people quite often result in considerable churn of personnel, so that those involved at the beginning are long gone by completion, or even in some cases before the start on site. This mechanism devolves responsibility and makes strategic decisions less clear or robust. The net result takes away any real benefits established by the whole-project analysis.

Key industry structures

In considering the established pattern of work, it is helpful to describe the key structures to which the industry works and to generate the main interactions present in any project. There are three core drivers: the conventional project organisation and contract; the team structure; and the contract form. For the majority of projects, these combine to form the backbone of project creation and implementation.

- The Royal Institute of British Architects (**RIBA) Plan of Work** is the established formula for construction projects. It enables the project to be organised around set benchmarks.
- The **project team composition** follows a common pattern of core personnel.
- The **contract form** sets the formula for the roles and responsibilities of the team.

Project organisation

The RIBA Plan of Work consists of several key stages. These are in chronological order, and are used throughout the industry as the basic default standards for breaking down a project into actions and phases.

Stage A Appraisal
Stage B Design brief
Stage C Concept
Stage D Design development
Stage E Technical design
Stage F Production information
Stage G Tender documentation
Stage H Tender action
Stage J Mobilisation
Stage K Construction to practical completion
Stage L Post-practical completion
Stage M Operation and maintenance
Stage Z End of life.

Project team composition

The majority of projects have a team composed of key decision-making and originating people. This is the heart of any project, and the majority of effective actions will be taken by this team.

Client

The client is the originator and the entity in authority, ultimately driving the project and taking the rewards. Clients need to have a clear vision and understanding of the processes and mechanisms involved. Often they are very clear in respect of only some of the issues, and this is where consultants' skill can help and lend value to the project. This is especially true of the one-off client.

Often clients may need assistance and guidance to identify the real benefits from sustainability and whole life value.

Design team

These are the core professionals employed by the client, and sometimes the contractor, to ensure documentation is appropriate. They develop the documentation needed and, in many cases, ensure regulatory compliance and assist the construction team through to completion, occupation and beyond. It is essential that, where required, consultants can employ the best understanding and enable whole life values and principles to be employed, with real long-term benefits.

Contractor

The contractor is employed to procure the components and undertake the project, either directly or indirectly. A large project may use a contractor to manage many