14 Cost

This chapter explores the issues concerning the analysis of the cost of a proposed construction solution. The ideas of cost–price chains and the need to identify the costs in a clear time frame within an economic and fiscal context demonstrate the necessity to be clear about whose cost it is and what the cost should include. There is no single definition of the cost of a solution. The most usual interpretation of the cost is the actual construction cost to the client. However, this may be misleading, and design, running and even disposal cost may be a better basis for choice. This depends on to whom the cost applies and the value he/she puts on current and future expenditure.

Cost and value

It is clear that the cost of a solution is important if for no other reason than that ultimately a solution which is outside the economic reach of the client will not be built. It is also true that clients are unlikely to want to spend more than they need to obtain what they want. Two solutions of similar performance are likely to be chosen on price. What clients want and what they can afford may be two very different things, which may conflict. This will have to be resolved in the evaluation of a proposed solution. All of these need a clear basis for the analysis of costs.

What clients want, and the proportion of their money they are prepared to spend on it, is related to the worth or value they place on the service they get from the building. This sense of value or worth that clients are likely to place on different features of the building has to be established at the briefing stage, along with the more straightforward idea of the budget that will be available. Judgements on value will be made in different ways and these will influence the way in which cost should be analysed.

Perhaps the simplest notion of value comes from the provision of what may be termed the basic performances, such as weatherproofing and fire performance. Here the value is in a level of performance that the client would probably suggest should be achieved at least cost. However, clients may be prepared to pay a great deal for the appearance of the building, for its value may be in the symbol or image it represents of the individual or the corporation. This is evident in the premium that clients are prepared to pay for tall buildings located in city centres. Other clients may value the quiet that can be achieved with acoustic measures (assuming location has been fixed) or the quality of light from additional money spent on lighting. These judgements on value are predominantly issues of design that need to be translated into solutions, and here costs will be included which will have to be borne by the client. These design issues are often difficult to justify in cost terms as they can, in basic performance terms, be seen as useless. However, useless should not be confused with worthless, as it is in its value to the purchaser that the cost is justified.

There is another notion of value: one associated with paying more now for lower cost in the future. This is the argument for the value of thermal insulation, with its associated payback periods of lower heating bills. However, some clients may not be prepared to pay for insulation over and above the statutory requirements,

for they may wish to invest their current resources in other assets and be willing to fund future costs from future income.

Cost and price

The cost incurred in adopting a particular solution for the construction of a building is computed from the price paid for the various resources employed for the goods and services in order to complete the work. Costs are created from a chain of prices charged which create the costs of each stage in the process. Hence the cost to the client for the construction of a wall is not the cost to the constructor. It is the price the client agrees to pay the constructor. The cost to the constructor is the price the constructor agrees to pay suppliers of goods and services needed to complete the works.

If, therefore, it is required to analyse the cost of a solution, the question that has to be asked first is 'To whom?' The usual answer to this would be the client, for it is the client that has the resources to invest, and the expectation of a return on the investment.

The scope of much analysis of cost that is carried out for the client is limited to the cost for the construction itself, the price paid to the constructor for the final assembly. This is often represented by the tender price. In the professional and industrial context there is considerable thought put into this concept of cost, for its commercial significance is high and hence data are available for its analysis. It is, therefore, tempting to use this as the basis on which a suggested solution for the construction should be evaluated for cost. This is, however, the client's cost, representing the price paid for the services from the constructor, and any evaluation will be based on historical tender data. This may not be the most appropriate basis on which to analyse the cost of a solution.

The two major limitations in applying this basis of analysis are, first, that the cost data are historical, making interpretation of the figures for new or novel solutions difficult, and, second, it does not take into account the design or running costs, let alone the disposal and redevelopment implications.

Cost and time frames

The construction cost forms only part of the outlay the client will have to make. Even staying within the same time frame of cost incurred after land acquisition and prior to occupation of the building, there are costs associated with designing the works. Generally, where construction solutions are well established, the design costs will be lower than for novel designs. If experience and the gathering of existing knowledge still prove inadequate to determine the performance with an appropriate level of confidence, research and development costs may be incurred, although these are rare in construction generally.

The time frame of land acquisition to occupation also represents for the client a period of expenditure prior to gaining an income from the building. Designers and constructors will require payment in stages as the design and construction work proceed. The longer it takes to bring a building into occupation, the higher this cost. If the time between initial investment in the land and occupation can be influenced by the selection of a construction, it could be argued that this is a cost associated with that choice. Hence it could be seen as part of the analysis of its cost.

Different solutions have different costs after occupation of the building. Deterioration of materials suggested for alternative solutions will take place at different rates, requiring different renewal cycles to maintenance requirements. The reliability of components will vary, leading to different replacement costs. The detailing will determine the ease with which renewal and replacement can be achieved. This not only affects the direct cost of maintenance but also may carry a cost of disruption to the occupants while the work is carried out.

The overall building will have associated running costs directly affected by the construction choice. The example of the inclusion of

insulation has already been mentioned and represents a part of the energy-use cost of a building. Another example is associated with the choice of surfaces, where the cleaning of a commercial building over its life may be many times that of the original construction costs. If cleaning could be achieved with less staff, albeit that the initial cost of the surface was more expensive, the overall cost might be less.

Finally, different solutions will have different disposal costs. This is not just the cost of demolition but also, increasingly, the cost of safe transport and deposit of waste from the demolition of the building. However, some materials that are waste to one project may have value to another. Recycling of architectural salvage has long had a commercial value, but increasingly building waste can also provide an income when the building is to be demolished.

There are cost implications associated with the land that has to be purchased by the client. The availability of certain types of construction solutions will bring land into economic use. This is particularly true in the case of foundation and geotechnical ground improvement processes that can make poor land economic or allow usable space below ground. This can also be the case if lightweight superstructure solutions can lower the cost of foundation solutions.

Increasingly the development of brownfield sites where previous development has left land contaminated is becoming more viable as technical solutions to cleaning or capping sites are developed. This is also true if projected to the end of the life of the building in order to consider the redevelopment costs. While it is unlikely that new development will be allowed to contaminate land in the way past users have, certain foundation solutions such as piles may be difficult to remove. This will make the value of the land less for redevelopment at the end of the life of the building.

The analysis of the cost of a solution has to be qualified by the question of not only whose costs are to be analysed but also over what time frame does this individual want the costs evaluated. It is unlikely that the full spectrum will be taken into account, as the client has to balance the use of current capital against future income. However, increasingly a fuller cost evaluation, often defined as lifecycle costing, is being undertaken and is affecting the choice of the construction.

Cost and cost data

It has already been identified that while data concerning construction costs are readily available, they are predominantly based on historical prices for which constructors were willing to undertake the work once it was fully specified. The costs are based on measurements of parts of designed buildings and therefore rely on new work being similar to previous construction. There are reliable processes for estimating the cost of this measured work, but this is linked to construction costs of items measured in a standard way.

Extending the requirements of a cost analysis beyond that of construction costs into extended time frames has the difficulty of establishing reliable cost data. While design costs can be estimated, it may be difficult to extract costs for designing a specific part of the building. Feedback on the cost of running a building may be limited, particularly for costs expected to arise some decades into the future. The lives of buildings are long and ownership often not continuous, so gathering these data is difficult. Even if these data were available there would still be the need to project this into the future, where resource availability and economic conditions would be difficult to predict.

A more fundamental basis of analysis

Costs arise from the deployment of resources. The price that has to be paid for resources depends on economic (and fiscal) conditions.

For example, resources to be deployed for manufacture and assembly can be identified from an analysis of the operations required and

the methods that could be used to complete those operations. This is the analysis undertaken to identify the buildability of a solution identified in Chapter 13. It involves taking materials and components and operating on them with appropriate labour and equipment in a safe manner. This will give not only the quantity of resources required but also the time over which the labour and equipment will be employed. To these direct operational costs one must add any management and technical support and a proportion of the organisation costs, for these are also deploying resources.

In a market economy, price is primarily influenced by supply and demand; with the tendency to surplus, price falls, whereas with scarcity, price rises. In a competitive market the bid price will be based on a judgement of what others may be asking for the equivalent goods or services. The fiscal conditions influencing costs are either direct taxation or inducements such as employment schemes or regional development grants.

The further into the future these predictions have to be made, the greater the chance of errors in the cost analysis. Running costs in the first few years can be identified with some certainty, but the long-term renewal and replacement costs are often some years or decades ahead. Alternative resources may become available (or existing resources become unavailable), which may make an analysis of the expected operations and methods inappropriate. Changes in demand and supply or in the presence of new alternatives increasing competition will distort price differentials. New taxation will change prices, as happened in the UK with the introduction of VAT on maintenance work as well as new-build. At the end of the building's life, demolition may be made very expensive with the discovery of new hazards, as happened with asbestos, or made cheaper by the introduction of recycling methods, as with concrete.

All this means that estimating costs in extended time frames can only be carried out with less confidence. The figures will be subject to possible errors and risks that need to be analysed before choices are made based on these extended time frames.

Building up the price

While this chapter is about evaluating cost, it has been established that costs are built up from a cost–price chain where economic (and fiscal) factors influence price. It is therefore necessary to understand the generation of prices.

Price can be fixed in one of two basic ways: what the market will stand or the application of rational margins. In practice there are likely to be aspects of both in the setting of a price, particularly in bidding in a competitive situation. In both cases, knowledge of the expected costs is important, plus some estimate of how certain those costs will be. This allows some judgement on margins. The margin is the excess of price over cost that an organisation needs to survive and grow. The need for margins and the role of profit is beyond the scope of this text. Even if rational margins are applied to the costs, there is still the question of what the market will stand. If this is below costs, it may not be sensible to bid.

While, as has been indicated, a full analysis of pricing is beyond the scope of this text, there is one more aspect that could be usefully highlighted at this stage. The relationship between cost and price should also reflect the risk. This may represent the technical risk of non-performance of the completed works and the subsequent costs this will incur. It may represent a financial risk associated with delay and non-performance of the contract. For these and other risks it may be possible to identify insurance that is at least a known cost that can be included. If, however, the risk is to be carried, some judgement on what price makes the risk worthwhile has to be made. Generally it should be possible to get a lower price if you are willing to take the risk. Who in the cost–price chain takes what risk is dependent on the contract entered into. Designs based on manufacturers'

components and calculations transfer risk to the manufacturer. Developments such as serial tendering and partnering have the effect of limiting or even sharing the risk through shared understandings and information between the contracting parties. This is likely to affect the construction solutions seeking lower costs for all parties involved.

Summary

1. It is necessary to be clear what the client sees as value for money in establishing design and performance criteria, following which it is reasonable to seek economic solutions.
2. Cost is not a single figure but depends on the answer to whose cost it is and what time frame the cost is to include. Cost could include construction, design, running and disposal costs, which can be further refined by looking at investment cost and fiscal advantages.
3. In accounting for costs that will be incurred in the near future, price information may be available. Allowing for expenditure in the future requires knowledge of future technical developments and the economic and fiscal context and is therefore less easy to predict.
4. Price may be based on market forces and/or rational margins but will also reflect the risk, technical and financial, that is to be taken in designing, constructing and operating the chosen construction solution.