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Cost Control during the Pre-Contract Stage of a Building Project – An Introduction

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If you have to ask what it costs, you can't afford it – JP Morgan.

Introduction

Cost control seeks to deliver a high degree of cost certainty during the various stages of the building project in order that the project can be completed within budget.

One of the most important tasks carried out by quantity surveyors (QS) involves providing advice to clients and design team colleagues to enable the design to be finalised within the approved budget. This financial management process is referred to as cost control. Successful projects are often viewed as those which are delivered to the required quality standards, on time, and within budget. Effective cost management therefore is vital to the successful outcome of building projects. Clients frequently expect the final cost of their project to be no more than the original estimate and, indeed for many, this may be their main priority. Quantity surveyors can make important contributions to the effective management of design costs by providing realistic early cost advice, planning how budgets should be allocated to the various elements of the project, actively monitoring the evolving design, advising the client and members of the design team of the likely cost implications of their design decisions, and proposing solutions where costs appear to be exceeding the approved budgets. This study provides an introduction to the process of controlling costs during the design stage of a 'traditionally' procured building project up to the stage where the contract documents are prepared. The study is confined to capital costs of projects only and does **not** examine the closely related area of whole life costing**.**

In Ireland, guidance on cost control is provided in the Capital Works Management Framework Guidance Note *Planning and Control of Capital Costs GN 2.2* (Department of Public Enterprise and Reform, 2011) (referred to as GN 2.2 and DPER respectively) which is for use on public sector projects. Guidance for private sector projects is provided by the

National Building Elements Committee (NBEC) in the *National Standard Building Elements and Design Cost Control Procedures* (Environmental Research Unit, 1993) (ERU).

The Importance of Cost Control

> Suppose one of you wants to build a tower. Will he not first sit down and estimate the cost to see if he has enough money to complete it? For if he lays the foundations and is not able to finish it, everyone who sees it will ridicule him saying. 'This fellow began to build and was not able to finish' (St. Luke 14, 28-30).

The underlying challenge in controlling costs stems from the fact the practically all clients have limited funds. During the briefing/inception phase of a project the architect seeks to establish what the client's requirements are and what he/she is prepared to spend. There is little doubt that some items on the client's 'wish list' will have been sacrificed or curtailed during the course of these discussions. This process sets a **cost limit** at the outset. Many clients may insist that expenditure cannot exceed this limit.

The result of the briefing process will mean that the budget will almost certainly be set at the limit of what is considered to be affordable. Where an inadequate budget is set there is a strong possibility that further economies will have to be made during the design stages. This process wastes time and the 'cuts' often results in loss of amenity in the design and this is likely to disappoint clients. Cost overruns during the construction phase are even more problematic and may seriously over-extend the client financially to the point where the project may have to be abandoned. In addition, clients who end up having to pay more than they were originally advised may suspect that they have paid too much for the work.

On the other hand, where a budget is set too high, a risk-adverse client may abandon the project because they feel it is unaffordable or not worthwhile.

The Department of Finance (2009) argue that *'a budget that fails to predict the outturn cost with a degree of accuracy and certainty is of little use.'* The Department notes that budgetary under-provision may result in projects being given the go-ahead which otherwise would not have been approved or would have been reprioritised. This causes difficulties when, inevitably, the extra funds have to be found at a later stage. The shortfall results in scarce financial resources being diverted from other, perhaps more deserving public projects. Over-

provision on the other hand is wasteful, and results in paying too much. Consequently, other projects may have to be shelved.

It must be noted however, that not all clients will regard rigid cost certainty as their main priority, particularly where early project completion or high quality are their primary objectives. In this regard Ashworth and Hogg argue that '*The focus of cost control must be balanced with the importance of value in terms of what is being provided for a client*' (2007, p.121).

The related concepts of affordability and cost certainty are central features of design cost control. The challenge is to ensure that the contract sum is agreed within the original budget adjusted for *authorised* changes. The task involves establishing a reliable and adequate budget and then planning that budget so that the funds are allocated effectively over the project. The objective is to provide the client with best value for money.

Cost Forecasting During the Pre-Contract Phase

The design process on substantial projects usually develops over a period of (many) months and proceeds through a number of stages during which the client's requirements are established, developed and refined. This process culminates with the issue of the tender documents, which are priced by contractors who submit bids to carry out the works. The primary objective of cost planning and pre-contract cost control is to ensure that the successful contactor's tender does not exceed the client's budget.

The client will be given cost forecasts at various stages during the design phase. Figure 1 below indicates that the forecast accuracy becomes progressively more reliable as the level of detail and information available increases. The degree of accuracy depends heavily on the degree to which the employer's brief has been defined. Early cost advice is often benchmarked against price ranges published by the larger quantity surveying practices. These suggest ranges of in the order of 25%-30% for various categories of building- i.e. about ±15% around the mid-range. It is not difficult to envisage situations where complex or innovative projects or the requirement for superior levels of quality or energy performance could exceed these ranges. Potts (2008 p.49) reports research claiming that the accuracy of initial estimates on engineering projects may only be in the order of -25% to +50%.

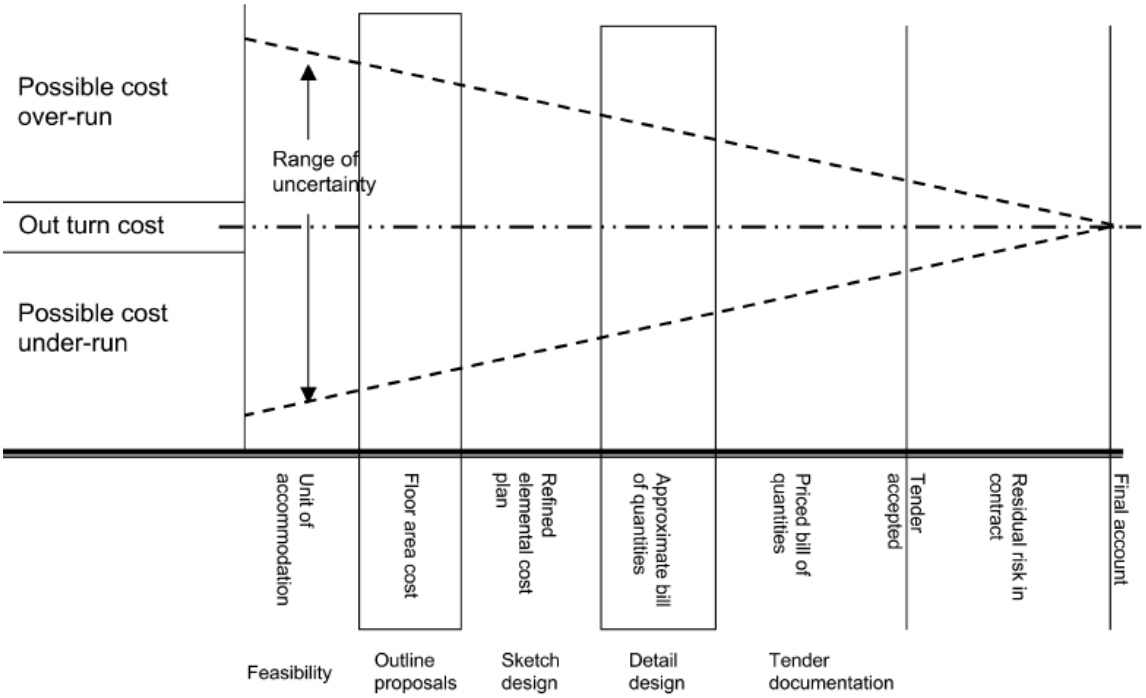

Figure 1 Reliability of Estimates during the Project (Source Brook 2009)

Figure 2 below shows the cost forecasting activities during the design stages of a notional 'traditionally' procured project in the private sector.

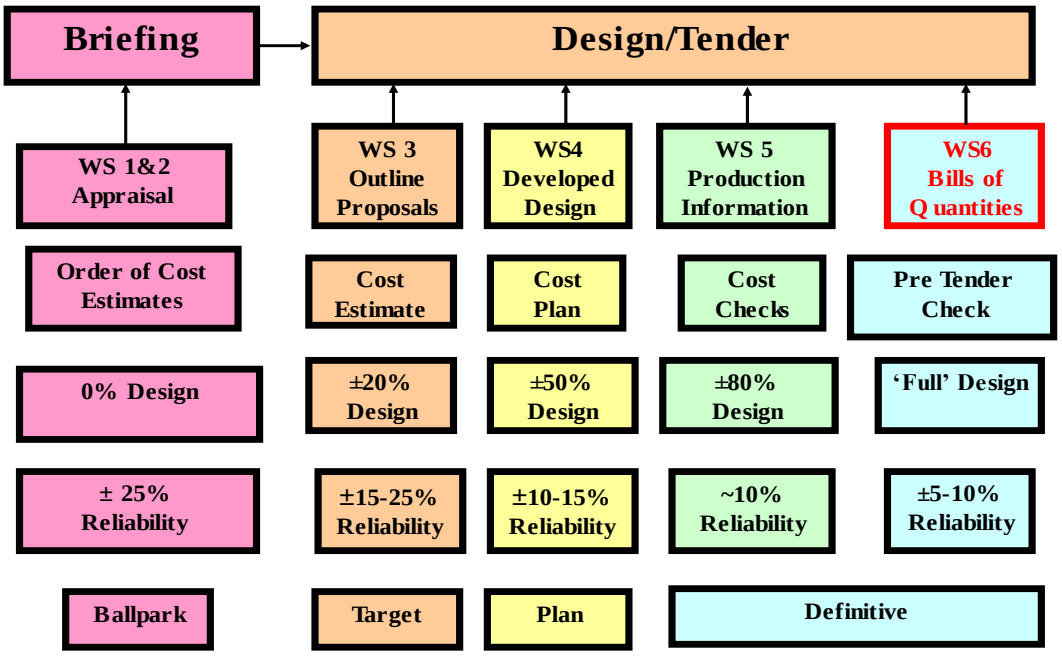

Figure 2 NBEC Work Phases Showing Pre-contract QS Involvement

At the inception stage of a project the building client will need an indication of how much the project is likely to cost (referred to as an **order of magnitude cost**) to assess the overall feasibility of the project. This advice is necessary in order to make fundamental decisions such as making a bid for a site and/or whether the project will go ahead of not. If the project is considered to be viable the design process may be set in motion and outline design proposals prepared. These will enable the QS to produce an overall **cost estimate**. This cost estimate, when approved, becomes the **authorised project budget** and is often described as a **cost limit.** It sets the cost parameters within which the design team must operate. Further development of the scheme design enables a **cost plan** to be prepared setting detailed target costs for each part of the building and ensuring that the budget is balanced over the different parts of the project. This plan will act as a guideline for **cost checking** the final design to ensure that targets are not exceeded before the project is sent out to tender. During the tendering period the QS often prices the **bill of quantities** as a final cost check. Where the tenders exceed the cost plan it may be necessary to make post-tender savings by way of a bill of reductions.

Cost Control Systems

Figure 2 above indicates the quantity surveyor's ongoing involvement in providing cost advice during the inception and design phases of the building project. In many instances the design development process is carried out in accordance with a systematic 'plan of work' which establishes an underlying structure or framework of operation. In Ireland **private sector** developments are often organised in accordance with the *National Standard Building Elements and Design Cost Control Procedures* (ERU, 1993). Likewise the CWMF *Planning and Control of Capital Costs GN 2.2* (DPER, 2011) sets out the various stages involved in **public sector** projects.

GN 2.2 defines cost control as:

> The management of the costs associated with the design process (in each cost holding category) to achieve a predefined approved capital budget. Continuous assessment of the cost holding categories during the Planning Developed stage (including preparation of tender documentation) will test the robustness of the costs in these categories that make up the approved budget.

The *National Building Elements Committee* (ERU, 1993) notes that a cost control system:

- ‘enables a reliable target cost for the building to be set at an early stage in the process;
- enables the target cost to be distributed in a balanced way over the different parts of the building;
- enables corrective action to be taken by the Design Team during the evolution of the design when it appears that the target costs might be exceeded, and
- makes available to the Design Team quick and reliable cost guidance on alternative solutions for each part of the building as the design is being developed’.

Kirkham (2014) adds that effective cost planning systems should:

- ‘Ensure that the tender figure is as close as possible to the first estimate, or that any likely difference between the two is anticipated and within an acceptable range;
- . . . always involve the measurement and pricing of approximate quantities at some stage of the process, and
- aim to achieve good value at the desired level of expenditure.’

The process of cost planning and cost control aims to deliver the best possible design solution that the budget will allow. The process provides the client with the cost advice to underpin decisions about how best to spend the budget. It allows adjustments, alternatives and redesign to be accommodated within an overall cost framework. This helps to eliminate abortive design work and helps to achieve an overall balanced design. The Aqua Group describe this dynamic process as ‘*the controlling measures necessary to ensure that the authorised maximum cost of the project is not exceeded*’ (Hackett, Robinson and Statham, 2007). They note that the process continues into the post-contract phase of the project.

There are two basic approaches to cost control at design stage. These are ‘costing a design’ and ‘designing to a cost’. Costing a design involves estimating the cost of the evolving design and reporting the results to the client and design team. This approach tends to be somewhat flexible in relation to budgeting as clients may sanction additional funds as the design develops. Designing to a cost, on the other hand, requires cost overruns to be corrected in line with the cost limit. This approach forms the basis of ‘elemental cost planning’.

Elemental Cost Planning

‘*Without planning it is difficult to envisage the successful conclusion of any project*’. (Cooke and Williams, 2009). Control implies a plan, which in turn, identifies how the project’s aims

and objectives are to be achieved. Elemental cost planning approaches allow design teams to plan how the budget is to be spent. It also enables the QS carry out comparative cost estimates to identify alternative, more effective or economic solutions, both at detail and overall design level and hence improve value for money. For example an adjustment can be made if change from brick faced cavity walls to curtain walling is being considered. Cost planning is, therefore, a vital component in the financial control of projects.

In Ireland elemental cost planning is the most widely used methodology for controlling evolving design costs. The NBEC argues that the individual work items included in 'trade' bills of quantities must be rearranged into design **elements** in order for the bill to become useful for cost control purposes. They write:

> – in designing, the Architect is not thinking in terms of cu m of concrete or of sq m of brickwork but in terms of how to shape and enclose the building, the number of floors, the partition layout and the type of lighting, type of finishes etc., that are necessary. Consequently, the design element has been adopted as the cost centre for cost control.
>
> An element may be defined as that part of the building which always fulfils the same function irrespective of design or specification.
>
> … Standard elements are common to Architect, Engineer and Quantity Surveyor and therefore facilitate co-ordinated working between all Design Team members. The concept of standard elements is the cornerstone of the whole design cost control system. (ERU, 1993 pps.1 and 2)

Figure 3 presents the NBEC matrix of building and siteworks elements which underpin 'standard' Irish cost control practice.

BUILDING (Direct Costs)							SITE (Direct Costs)
Substructure	Structure	Structure Completions	Finishes	Services (Mainly Piped and Ducted)	Services (Mainly Electrical)	Fittings and Furniture	
(1 -) Substructure Generally	(2 -) Structure Generally	(3 -) Structure Completions Generally	(4 -) Finishes Generally	(5 -) Services (mainly Piped and Ducted) Generally	(6 -) Services (Mainly Electrical) Generally	(7 -) Fittings and Furniture Generally	(- 0) Site Generally
(11) Ground, Earth Shapes	(21) External Walls	(31) External Walls : Completions within Openings	(41) Wall Finishes Externally	(51) Heating Centre	(61) Electrical Supply and Main Distribution	(71) Display, Circulation Fittings	(10) Prepared Site
(12) Reserved	(22) Internal Walls, Partitions	(32) Internal Walls, Partitions : Completions within Openings	(42) Wall Finishes Internally	(52) Drainage and Refuse Disposal	(62) Power	(72) Work, Rest, Play Fittings	(20) Site Structures
(13) Floors in Substructure	(23) Floors, Galleries	(33) Floors, Galleries : Completions	(43) Floor Finishes	(53) Water Distribution	(63) Lighting	(73) Culinary Fittings	(30) Site Enclosures
(14) Reserved	(24) Stairs, Ramps	(34) Stairs, Ramps : Completions	(44) Stairs, Ramps : Finishes	(54) Gases Distribution	(64) Communications	(74) Sanitary, Hygiene Fittings	(40) Roads, Paths, Pavings
(15) Reserved	(25) Reserved	(35) Suspended Ceilings	(45) Ceiling Finishes	(55) Space Cooling	(65) Security and Protection	(75) Cleaning, Maintenance Fittings	(50) Site Services (Mainly Piped and Ducted)
(16) Foundations and Rising Walls	(26) Reserved	(36) Reserved	(46) Reserved	(56) Space Heating	(66) Transport	(76) Storage, Screen-ing Fittings	(60) Site Services (Mainly Electrical)
(17) Piled Foundations	(27) Roofs	(37) Roof : Completions	(47) Roof Finishes	(57) Ventilation and Air Conditioning	(67) Reserved	(77) Reserved	(70) Site Fittings
(18) Reserved	(28) Frames	(38) Reserved	(48) Reserved	(58) Other Services (Mainly Piped and Ducted)	(68) Other Services (Mainly Electrical)	(78) Reserved	(80) Landscape, Play Areas
(19) Summary : Building Substructure	(29) Summary : Building Structure	(39) Summary : Building Structure Completions	(49) Summary : Building Finishes	(59) Summary : Building Services (Mainly Piped and Ducted)	(69) Summary : Building Services (Mainly Electrical)	(79) Summary : Building Fittings and Furniture	(90) Summary : Site

Figure 3 Matrix of Building and Siteworks Elements (Source ERU 1993)

A similar approach is adopted in *Guidance Note GN 2.2* which explains that cost planning should be based on a series of cost holding categories. On new build projects these would typically be elements described immediately above. Other work breakdown structures may be appropriate for refurbishment of non-routine project designs.

The Guidance recommends that each cost holding category should be allocated a target value which is both reasonable in itself, and proportionate to the overall budget. The total of the various cost holding categories should not exceed the overall approved project budget. The Guidance continues '*Once an Outline Cost Plan is established, the cost holding categories should be continually assessed to ensure that the integrity of the project budget continues to hold true*' (DPER 2011).

Plans of Work and Periodic Reviews

A key aspect in the successful functioning of any process is the need to regularly check that it is working effectively. In Ireland cost planning and control procedures are organised according to systematic **plans of work** set out in the CWMF or the NSBE guidance notes referred to above. These organise the development process into a number of work stages which often require formal reports to be produced at various milestones.

The two approaches are similar with the main distinctions being in terminology rather than process. They have been developed in order to establish a formal review process with the objective of achieving the client's stated objectives. The review process imposes a discipline on the QS to identify and report potential cost overruns and to propose corrective action where required. As the design develops, it is prudent to reconsider earlier decisions to ensure that it continues to satisfy the employer's overall objectives. Table 1 sets out the design stage reviews under traditional private and public traditional procurement approaches.

Private Sector Work Stage	Public Sector Review Number
1 Briefing	1 Confirm approval for design expenditure (Decision-in-principle to proceed)
2 Feasibility (Order of Magnitude Cost)	2 Confirm requirements; review procurement strategy (Pre-design Review)
3 Outline Proposals (Cost Estimate or Cost Limit)	3 Assess project design (Outline Cost Plan)
4 Developed Scheme Design (Cost Plan)	4 Assess project prior to statutory approval (Cost Plan)
5 Production Information (Cost Checks)	5 Assess outcome from statutory approval (Cost Checks)
6 Bill of Quantities (Cost Checks)	6 Approve detailed design solution; review pre-tender cost check; review risk. (Pre-Tender Cost Check)
7 Tender Action (Cost Analysis)	7 Review tender returns in advance of awarding the contract. (Cost Analysis)

Table 1 Review Procedures under the CWMF and NSBE Procedures

Project reviews allow clients to question whether their projects are on target. The cost control activities take place between the reviews, and these determine whether the project proceeds further, or not. On traditionally procured **public sector projects**, there are seven mandatory reviews. The fields identified in red in Table 1 above require the client referred to as the 'Sponsoring Agencies' (for example a post-primary school board of management) to report to their superior 'Sanctioning Authority' (in this example the Department of Education and Science) to obtain authority to proceed. The project may be suspended or referred for reassessment if budgets are exceeded without authorisation. Approval must be obtained from the Sanctioning Authority for change to the project scope involving budgetary changes.

The Different Types of Cost Estimates.

Figure 2 and Table 1 above identified that cost estimates are provided at different stages of the design, such as feasibility, budget or pre-tender estimates. The following section sets out the purpose of the estimates, identifies the bases on which they are prepared and comments on their source data.

Initial Cost Advice – Order of Magnitude Costs

> A Budget tells us what we can't afford but it doesn't stop us from buying it.
> (William Feather 1889-1981)

The needs are identified, the broad parameters of a solution are agreed, and a decision-in-principle is made to proceed on the basis of order of magnitude costs.

The cost of the building project is a primary concern for the vast majority of construction clients. Indeed one of the first questions any client will ask is '*what is it going to cost*?' usually quickly followed by '*can we do it any cheaper*?' The first figure provided to the client is often referred to as an indicative budget but it more formally termed an '**order of magnitude cost**'. These are usually expressed as a range or a 'ballpark' figure 'plus or minus x percent'. Nevertheless this figure is one that will determine whether the project will go ahead or not, despite the fact that it is the least reliable of all the estimates produced during the design stage. It is also the figure that the client always remembers and uses to benchmark subsequent cost outcomes. It is essential therefore, that the cost advice given at this point is as realistic and honest as possible. The *New Rules of Measurement* (NRM) has this to say:

> "The purpose of an order of cost estimate is to establish if the proposed building project is affordable and, if affordable, to establish a realistic cost limit for the building project. The cost limit is the maximum expenditure that the client is prepared to make in relation to the completed building project, which will be managed by the project team (i.e. authorised budget)" (RICS 2009 p.17).

The *Aqua Group* (Hackett *et al*. 2007) describe three 'primary' ways of establishing the budget. Firstly, *prescribed cost limits,* these represent the maximum amount that the client can afford; 'once in a lifetime' clients, often adopt this approach. This may be said to be a '*This is all that I can afford'* type budget. Secondly, *unit cost limits* are based for example on €x per person to be accommodated or €x/m^2 of gross floor area to be provided. This approach is used by public bodies[1] and clients who frequently procure buildings and the budget represents what it usually costs to construct similar developments. This type of budget may be described as a '*This is all you're getting*' type. Finally *determined cost limits* are variable and ultimately depend on the expected return from the project. The standard of building will determine the income which, in turn, establishes the maximum that can be afforded to build. Professional developers normally adopt this approach. This may be said to be *'Is this a worthwhile investment?'* type budget.

Clients are often aware, or indeed have very fixed requirements, of what their project should cost. As noted above, indicative cost ranges for various types of development are regularly published on-line by the larger quantity surveying practices. It is only natural therefore, for a client to check these sources and question why their development cannot be built at the lower end of the particular cost range.

Forecasting the eventual cost of a project is challenging, particularly at the early stages. Most building projects are one-off, unique, purpose made buildings. The initial indicative budget is nearly always sought before any drawings are prepared and is typically calculated using single price estimating techniques such as **cost per unit** or **cost per square metre** related to the outturn costs of previous similar work (historic costs). Although the advice can usually be traced back to particular past projects, these order of magnitude costs need careful

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[1] The Department of Education and Science have *prescribed cost limits* within which their facilities must be built. For example the current cost limit (June 2015) for the Basic Building Costs for post primary schools is €1.150 per square metre of floor area including VAT and excluding external works. Achieving this limit presents a real challenge for designers particularly where the projects are located in the major urban centres.

consideration. They must be assessed in the context of wide range of interrelated factors such as: the client's quality expectations, the architect's 'signature', the building's geometry (size, shape, height, storey height, planning efficiency, grouping of buildings etc.), specification levels, provision of services, market conditions, inflation, location etc[2]. Clients may need to be advised that buildings at the cheaper end of the published cost ranges can only be procured under very specific conditions.

The initial cost advice translates the client's brief into money. The figure mentioned often comes as a shock and there may be a strong temptation on the designer's part to understate the likely costs in order to 'nurse' the project along. Where project budgets are set too low and the client proceeds to design stage, it is likely that the project will become strongly finance-led. Inappropriate decisions may be taken on cost grounds and it is probable that short term budget imperatives may overrule better quality long term alternatives. This approach should be resisted, as it frequently results in a disappointed client.

Kirkham (2014) provides the following advice in this regard:

> … If the total of the estimate is much too high it is best to face facts, and either reduce the size of the building or get the brief substantially modified. It is the easiest thing in the world to cut an estimate by 10% … under the influence of the client's pleadings and the designer's optimism.
>
> It must be emphasised that an overall 10% cut in costs means much more than a 10% cut in standards as much of the structural work, for example, cannot be reduced in cost. … (p.207).

It should also be noted that while building costs represent the bulk of a project's costs that other factors such furnishing and equipment, VAT, professional fees, inflation, planning contributions, and so on must also be budgeted for. It is essential, therefore, that all estimates must make clear what is included and excluded in the forecast.

Outline Proposals Stage – Outline Cost Plan

The Outline Cost Plan confirms that the initial cost advice is sound and establishes cost targets for the selected design solution. It benchmarks the selected solution against similar building types.

[2] Readers may wish to refer to a separate study '*Factors Affecting the Costs of Building*' (available on-line http://arrow.dit.ie/beschreoth/27/) by the Author for a more detailed discussion of these factors.

The process of cost control, proper, commences with the appointment of the QS and the initiation of the design process. The forecasts made at the inception/briefing stage above are usually based on either the units of accommodation or the gross floor areas to be provided priced at an appropriate €/unit, or €/m^2 rates. These cost forecasts are highly variable, particularly where a complex or an innovative project is envisaged.

If a decision in principle has been taken to proceed it is likely that a number of design solutions, (**outline proposals)** may be tabled. The various proposals are examined to see which option best meets the clients brief and budget. Key features of the various proposals such as plan shapes, numbers of floors, overall height, types of structure etc. are measured and these allow key metrics such as gross floor area, wall to floor ratios and/or net to gross floor ratios to be established. The designs will also identify in broad terms the quality of materials and workmanship to be specified and indicate the likely level of the engineering services. In addition specific costs relating to the nature of site and other abnormal costs must be considered in carrying out these studies. These metrics and comparators enable the various designs to be benchmarked and cross checked against norms for similar building types. They also reveal whether the design accords with the order of magnitude costs advised earlier.

The Outline Proposals stage concludes with the client approving a particular concept design and **cost estimate** for the project. This solution is based on outline scale drawings which show the size and shape of the building(s). As relatively little detailed design is carried out at this stage; the budgets, therefore, cannot be precise. The National Building Elements Committee has this to say:

> Because, even by the end of Stage 3, there will be relatively little detailed design information available, it is emphasised that the Cost Estimate referred to above cannot be a precise estimate of every component of the final design. It will instead be merely a total or limit to which the Design Team must work in evolving a design that will fulfil the Client's requirements as set out in the Brief.
>
> This Estimate satisfies the first requirement of a cost control system in providing a reliable target cost at an early stage in the design process; it also permits confirmation of the Budget.

In Ireland, these estimates are still typically reported on a cost per square metre basis. The NBEC and GN2.2 recommend that the overall outline cost estimate should be broken down

into broad cost categories (GN 2.2 refers to these as high level cost holding centres). The NBSE for example recommends that '*The Cost Estimate is built up, using the historical elemental cost data bank previously referred to, by determining probable costs for the various broad sections of the project, viz. substructures, structures, completions, finishes, mechanical and electrical installations, fittings and furniture, site works, connective works, special costs and indirect costs*.' The summary elements along the bottom row of the Matrix of Elements in Figure 3 above represent these categories.

Outline cost plans typically represent about 25% design completion and are considered to have an accuracy of around ±15% depending on the certainty of the employer's brief. Cost control at this stage remains focussed on benchmarking the evolving design against the 'control' project. Where the designs are considered to be beyond the budget the probable approach to making corrections will involve amending the design to better resemble the control project in terms of geometry or specification.

Where accepted this cost estimate becomes the **authorised cost estimate or cost limit**, Which forms the basis for further design development work at the 'developed scheme design and the cost plan.

The Cost Plan

> The cost plan is a statement of how the project team proposes to distribute the available budget among the elements of the building. It provides a frame of reference from which to develop the design and maintain cost control. (NRM 2009, p.36)

As the design of the project develops, further decisions are made about the type of structure, components, finishes, services and fittings to be included in the project. The developing design is documented on general arrangements drawings comprising the various floor plans elevations and main sections supported by outline specifications are prepared. The cost plan is usually produced when the design has been progressed to the stage where planning permission is being sought.

The cost plan is a strategic financial plan whose primary objectives are to confirm and/or update the cost estimate developed at outline proposal stage, to ensure that the target costs are distributed in a balanced way over the different parts of the building, and to predict the

contractors' tenders. Cost plans set out to ensure that the amount provided for each element is appropriate in itself, and is also appropriate to the overall design of the project.

Cost plans are typically prepared in elemental format and are based on measured **approximate quantities** of work priced at current **composite** rates. This process enables specific target costs to be applied to each element of the building. In addition the QS will also include 'budget prices' for area to be covered by prime cost sums in the BQ. These provisions are typically obtained from specialist subcontractors and/or other design team members such as the structural, mechanical and electrical engineering consultants.

This technique involves measuring the major items having a significant bearing on the overall cost of the project. Studies have shown that up to 80% of the overall cost of new construction projects are covered within 20% of the bill descriptions. Approximate quantities estimating techniques seek to identify, measure and price these significant items and add an appropriate percentage addition to cover for minor unmeasured items. The quantities are priced using rates obtained from recent successful tenders on similar projects. The cost plan confirms and refines the previous cost estimate and sets detailed target costs, which act as guidelines for cost control during the production of tender documentation.

The cost plan is a key planning document in ensuring that budget constraints are adhered to. The NRM (2009) states: '*The detailed cost plan provides a sound basis for the client to confidently proceed with the scheme. It also provides a basis for cost checking during the subsequent design development stages. The cost plan is therefore an extremely important document.*'

Cost plans typically represent about 50%+ design stage completion and are considered to forecast tender prices to approximately ± 90% accuracy depending on the degree of design completion and the level specialist design content (See Potts 2008). On public sector projects tenders which exceed the cost plan by more than 10% are subject to a consultant fee correction mechanism.

Cost Checking

The process of finalising the design and production information commences following the approval of the cost plan. This phase may include the incorporation of solutions required by

regulatory bodies such as planning or building control authorities (fire officers etc.) During this stage the QS carries out regular cost checks and works closely with the design team to ensure they are aware of changes which may impact on the cost plan targets. Details are checked as they are issued and this enables corrective action to be taken where it appears that the target cost might be exceeded. The production of the bill of quantities which fully describes and accurately represents the quality and quantity of the work marks the substantial completion of the design process.

Quantity surveyors may carry out a final pre tender cost check by pricing the bill of quantities. This check involves pricing each of the individual bill items at current rates. This check allows the final design to be compared and reconciled with the cost plan and benchmarked against other projects. The result will alert the QS to the risk of the tenders being over budget. Where this check reveals that tenders are likely to exceed the cost plan, the QS will be prepared for the probability of cost saving measures being required. If changes have occurred without the client's approval then this is the final opportunity to capture these before it is too late. It also identifies whether changes to the design are additions or require the implementation of value engineering (RICS n.d.).

Where tenders, do in fact, exceed the budget the tender analysis and cost plan reconciliation will reveal where overruns have occurred and these will usually be the focus of a negotiated **bill of reductions** which may be necessary to return the project to budget. Bills of quantities may represent 90%+ design stage completion where specialist design has been developed in tandem with the general project design. In these cases the forecast costs may approach 95% accuracy.

Cost Control Strategies and Techniques

Quantity surveyors employ a number of strategies and techniques to keep the design within budget. The primary requirement is to develop a definitive project brief and realistic budget as commented on above. The budget must be maintained during the design process. The task involves selecting appropriate procurement strategies, advising the other members of the design team, and maintaining an appropriate contingency. At a more formal level value engineering and risk and change management procedures may be considered. These are discussed below.

Selecting appropriate procurement options

The selection of an appropriate procurement option is a key decision in ensuring that cost targets are achieved. The risk of cost overruns arising from the design varies with the choice of procurement path and form of contract. Design-build arrangements which provide for competition in both the design and pricing aspects of the project, often deliver the cheapest capital cost solution. Design-Build is also identified with strong cost certainty as the contractor is required to develop the design within the quoted price (i.e. design to cost). However, the approach requires fully developed employer's requirements in order to successfully brief the contractor. If the client subsequently wishes to change the contractor's proposals these variations are likely to cost (significantly) more than would be the case under traditionally procured projects. At the other extreme Management Contracting and Construction Management arrangements emphasise quality and speed, but these objectives are often achieved at an additional cost. These approaches require intensive cost control input in order to ensure that overall project budget targets are adhered to. Management approaches are by their nature are more challenging to control from a cost perspective.

The QS may also be involved in selecting a panel of contractors to tender for the project. In compiling this panel the QS will be concerned with selecting competent contractors, that are 'hungry for work', thus helping to secure a keen price. In certain instances, however, it may be appropriate to negotiate a price with a particular contractor.

Cost certainty is optimised when the client's work requirements are fully developed prior to seeking tenders. 'Traditional' and Design-Build lump sum contractual arrangements based on fully developed designs and/or employer's requirements are means of delivering this objective. Cost certainty, however, is compromised where bills of quantities include a significant proportion of provisional sums, provisionally measured work and prime cost sums. Management arrangements which are primarily based on prime cost sums consequently provide poor cost certainty.

Budgetary Control

Figure 4 sets out the basic method of controlling budgets. The Figure is based on the premise that the overall budget sets the parameters (limits) within which the design must be developed. Options which exceed these cost limits may be rejected under the principle of

‘don’t touch what you can’t afford’. If the client requires the option then, either additional money must be made available, or the cost of the option must be reduced, or savings must be found elsewhere. Ideally savings can be made within the particular element involved, but failing that, they may be found elsewhere in the project; - a ‘robbing Peter to pay Paul’ approach. In cases of major overruns this may result in a back-to-the-drawing-board situation, - or worse, abandoning the project.

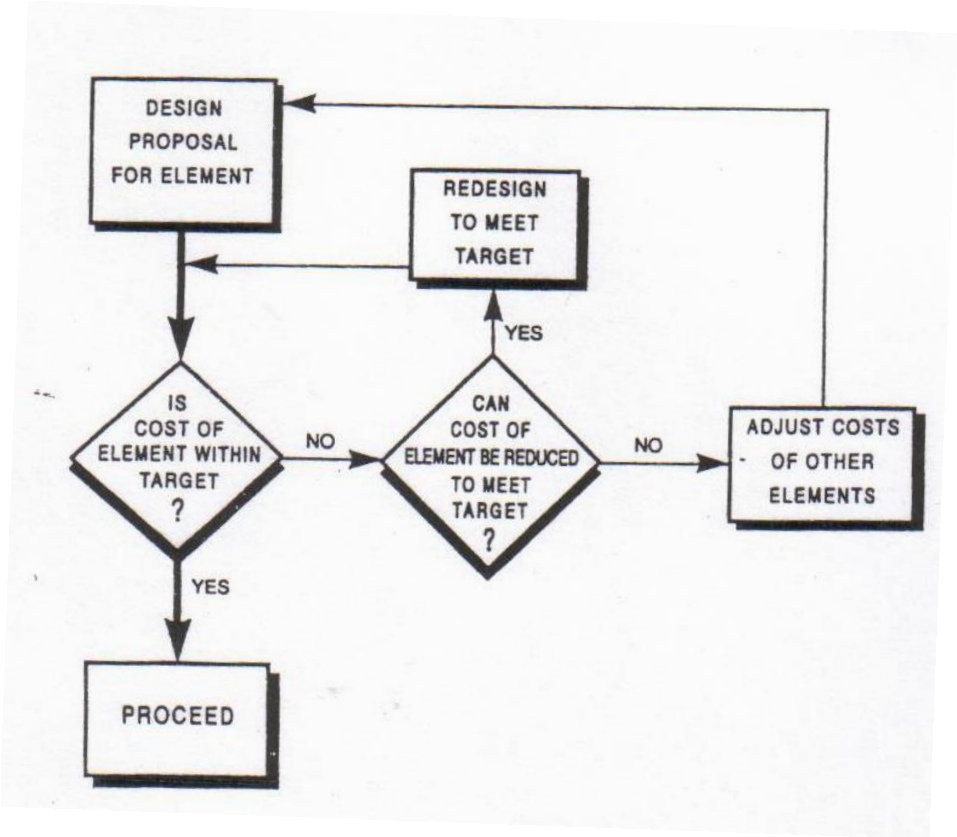

Figure 4 Budgetary Control on Building Projects (Source ERU, 1993)

Controlling the Consultants

The Chartered Institute of Building *Code of Project Management* (CIOB 2002) suggests that 80% of a project’s cost is determined by its design. It tells us that effective cost control involves ensuring that design decisions are made within overall budgetary constraints. The Code states that ‘*it is important that the project team is aware that no member of the team has the authority to increase costs on its section or element of the work. Increased costs on*

one item must always be balanced by savings on another.' It is vital therefore that the designers develop solutions in accordance within their own particular budget allocation.

A particular challenge faced by the QS is ensuring that the design team does not inadvertently develop a design which exceeds the approved budget. Designers instinctively, and by their training, seek to develop the best possible solutions. The design process is on-going and iterative and there is a continuing impetus to improve the product. The risk of cost escalation during this stage is clear. It must, however, be emphasised that **design is not the remit of the quantity surveyor** and the QS (unless acting in the role of the project manager) has no veto over design decisions. The QS must, nevertheless, react promptly to developments and provide the necessary information in good time in order to enable designers to develop solutions within budget.

The Importance of Communication

The QS must adopt a proactive approach towards cost control rather than adopting a monitoring role. This involves assuming financial leadership of the design team and ensuring that financial discipline is maintained. The challenge is to ensure that the other consultants, for whom costs may not be a main priority, are aware of the cost targets for their work and continue to work within these limits. In order to achieve this aim, regular reviews of the evolving design should be carried out by the QS who should ensure that the client and design team are circulated promptly with up-to-date accurate cost reports. The communication process is, nonetheless, a two way process and the QS must keep up-to-date with the correspondence and minutes to identify any potential cost implications of further design developments.

The QS must make effective recommendations and provide timely advice which must be communicated to the team. Early advice on incomplete information is much better than late advice based on better information. The QS is a team player (think of him or her as the financial goalkeeper) and must lead and direct the design team effectively to prevent overruns. Attention must also be paid to specialist areas of cost control, in particular the services design. By working closely with specialist members of the design team the QS will become aware of potential budget overruns at an earlier stage which makes taking appropriate corrective action much easier.

Meetings

The formal stage review process has been discussed above. These reviews however are only part of the liaison process between clients and the design team. Regular design team meetings are held during the design development process. These meetings provide an ideal forum for 'round table' discussions on the emerging design. They enable the QS to update the cost situation and provide the design team with the necessary information to make effective decisions. The agenda typically involves the QS in presenting a review of the financial status of the project, this is entered in the minutes. This process promotes the maintenance of financial discipline within the team. The meetings also present an opportunity for the QS to get further information from the design team.

The QS should, however, be careful of situations where clients or the design team look for 'on the spot estimates' for alternative design options or where a major issue arises. 'Off the cuff' advice in these situations may prove to be seriously inadequate when the full design implications are investigated.

Contingency / Risk Management

The discussion of the cost planning process above indicated that as the more information becomes available and as the design becomes more detailed, that the corresponding budget forecasts becomes more reliable and the associated margins of error reduce. This margin of error at this stage is referred to as the design development contingency.

The design process is fluid and the design team leader should retain an adequate and realistic contingency to cover design development. The level of the contingency should reflect the nature of the project; for example a new build project on a 'green field site' is considered much less risky in terms of cost overruns than an infill refurbishment project. The contingency is continuously reduced in line with the design development: order of magnitude costs can be within 25%, cost estimates within 15%, cost plans and bills of quantities to within 5-10% depending on the extent of the design (Potts 2008). The Department of Public Enterprise and Reform (2014) remains committed to reducing post-contract contingencies to 2%.

There are various approaches to calculating the project contingency. These vary in terms of sophistication, and range from basing the contingency on professional judgement and previous experience to using sophisticated risk management techniques. Examples of major risks which may arise during the design period may relate to matters such as the requirement to make major scope changes as a result of planning conditions, discovery of problematic ground conditions necessitating redesign of the foundations, new legislation requiring more expensive construction processes or technology, and so on.

Guidance Note GN 2.2 sets out the risk management procedures to be employed on public sector projects. The appropriate risk management responses depend on value and complexity of the project. Figure 5 sets out various cost management activities. High value projects are defined as those over €5,000,000. Complex projects are less easily defined and are judged on the facts of the individual case.

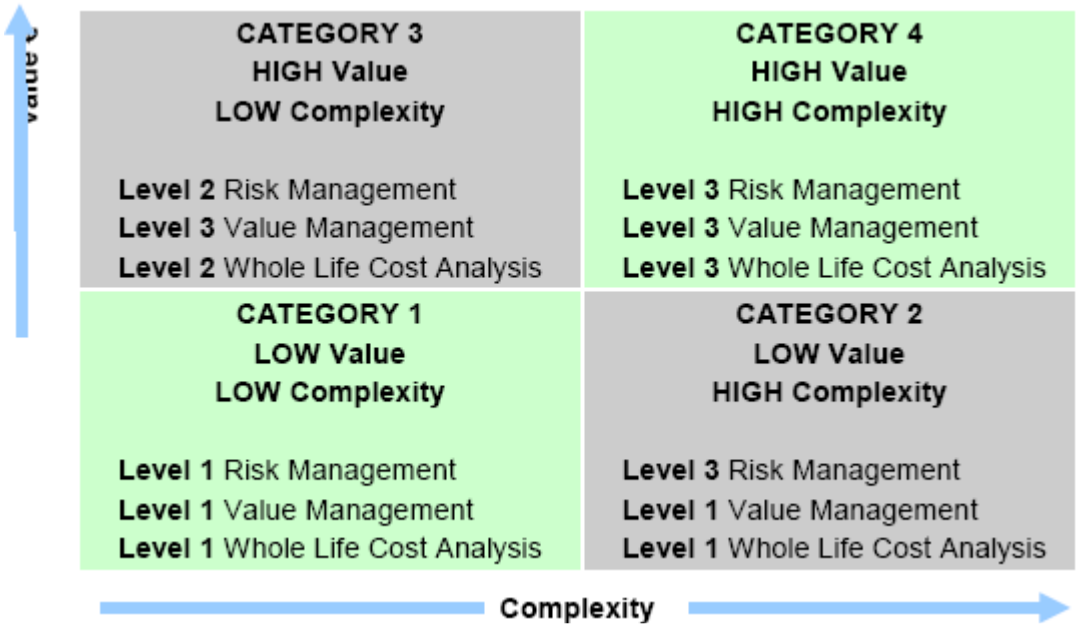

Figure 5 Value Complexity Matrix (Source DPER 2011)

Figure 6 below sets out the various risk management activities associated with these levels.

Level 1	Level 2	Level 3
Risk Management should be a constant agenda item at Design Team meetings. With the cooperation of the Design Team, the risks should be identified and discussed, and strategies should be developed to minimise, mitigate or manage the risk	Level 1 procedures *– plus –* Establish a formal Risk Register with the nature of each risk defined, quantified and valued, and a strategy for dealing with each of them should be developed.	Level 1 and 2 procedures *– plus –* Run Risk Workshops using an experienced risk management expert not directly involved in the project.

Figure 6 Risk Management Activities (Source DPER 2011)

Low value low complexity projects requires that risk management should be a constant agenda at design team meetings and should be fully discussed at these venues (Level 1). High value low complexity projects additionally require that a formal risk register is produced in which the nature of each risk is defined quantified and valued, and a strategy for dealing with each of them is devised. (Level 2). **All** complex projects require Level 1 and 2 procedures plus running risk workshops using an experienced risk management expert not directly involved in the project.

Value Management/Engineering

Guidance Note GN 2.2 (DPER 2011) regards value for money as the optimum balance between a project's benefits and the required investment involved. It adds that value management is a set of structured activities that are carried out throughout the project cycle aimed at maximising value for money.

According to Ashworth and Hogg (2007) Value Management (VM) enables the QS to improve value to the client. VM may be described as a search for improvements through a structured examination of every aspect to of the project in order to reduce capital; running or maintenance costs. The objective is to design better layouts, function, aesthetics, and deliver a better return – '*Anything which gives client better value for money*.' (Janssens 1993) It is often regarded as an area of expertise but many QS firms now provide value management services to their clients.

VM does not cut costs that are necessary, rather it eliminates unnecessary costs before and during construction. As with contingency management above, various approaches and techniques can be used. On public sector projects *Guidance Note GN 2.2* identifies that VM is required as part of the design phase cost control procedures. The extent of the service depends on whether the project is above or below the €5,000,000 threshold set out in Figure 5 above. Projects below the threshold require a Level 1 response, projects above the threshold require a Level 3 response. The activities associated with these Levels are set out in Figure 6

Level 1	Level 2	Level 3
In addition to the cost/ m^2, cost/km, unit cost etc., benchmarks as a basis for estimation the benchmark should also be used as a tool for reviewing value for money compared to other updated similar projects.	Level 1 procedures *– plus –* Other benchmarking tools should be used including Functional Analysis to understand the Sponsoring Agency's interpretation of Value. Value engineering option appraisal should also be carried out.	Level 1 and 2 procedures *– plus –* Run Value Management Workshops that focus on value for money as part of an ongoing process. This involves a review of the design to identify areas of improvements.

Figure 6 Value Management Response Measures (Source DPER 2011)

Figure 6 shows that Level 1 consists of a basic benchmarking process against comparable projects. High value projects, exceeding €5,000,000 require a Level 3 response which requires formal design review risk management workshops in addition to benchmarking, and value engineering exercises.

VM workshops involve the client, the design team and independent consultants in considering potential solutions which deliver the client's objectives in the most economic manner without adversely affecting the function of the building. VM exercises can be undertaken throughout the inception and design development stages. It is generally felt, however, that VM initiatives are most effective during the inception and early design stages. However there is a balance to be struck, if they are done too early, there may not be enough

information to do a productive examination. On the other hand if they are too late opportunities to make significant changes will involve considerable abortive work and may be costly to implement. In Figure 7 Kirkham (2014) shows the diminishing potential for savings and rising resistance to making scope changes and cost of such changes as the design progresses.

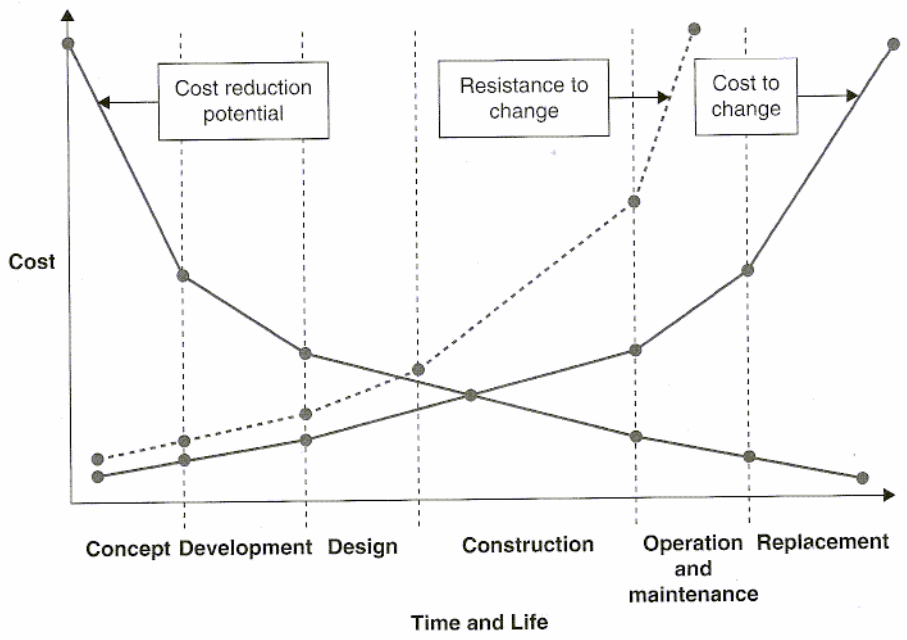

Figure 7 Relationship between cost and opportunity of change through the project life cycle (Source Kirkham, 2014)

Quantity Surveyor's Expertise

To carry out proper cost planning and cost control on a project it is essential that expert cost advisers are appointed to carry out this work. These advisers should be appointed at the earliest possible stage and their responsibilities should be clearly assigned. Cost advisers must be skilled in all areas of cost management and should have experience of projects of a similar size, nature and complexity to that proposed (DPER, 2011).

The QS must ensure that the project is adequately resourced in terms of time allocation and expertise. The surveyor must be 'up to the job' this requires professionalism and personal attributes such as authority, integrity and ethics. The surveyor must be aware other people's money and livelihoods depend on his or her work/advice, as does the reputation of the surveyor. Cost advice is give on many occasions throughout the building process and all

occasions require the application of technical competence and due care. His or her advice is, in effect, committing the employer to spend money. It is assumed that he or she is conscious of the responsibility and is worthy of it.

Richard Kirkham (2014) has this to say:

> At an early stage the cost planner is quite likely to be told 'This will be an economy job' and only a knowledge of the people and practices concerned will indicate how far this statement can be relied on in framing the estimate. The cost planner should never allow the amount of the estimate to be influenced by opinions expressed by interested parties, or worse still by the figure that the client would like the job to cost. When an estimate based on early designs has worked out at £3,500,000, it is all too easy to remember that the budget is £2,250,000. The danger then is that the cost planner may assume that the estimate is too high and reduce it a little to make the difference less breathtaking. Cost planners may also find themselves in front of a committee or board, one of whose members 'knows a job just like this one which was built for much less than the cost planner's figure.
>
> Remember that it is the person who has prepared and possibly signed the estimate who will be held responsible for it, not the designer, client, or the assertive committee member. This is as it should be. Cost planners are paid for their skilled evaluation of real probabilities, not for telling people what they want to hear.' (p. 196).

Conclusion

Cost overruns are commonplace at all stages of the construction development process. Cost estimates may be unreliable as a consequence of rushed time frames, indefinite and uncompleted project scope, over-optimism, inadequate contingency due to poor risk assessment, delays in dealing with changes, and general lack of awareness of the importance of cost issues within the design team. Achieving satisfactory cost control requires an effective plan which takes account of the nature and complexity of the project, the client's priorities, and the procurement approach and exploits the ability of the quantity surveyor to estimate, plan and negotiate the process.

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