

7 Managing risk

7.1 Risk in construction

Construction is undeniably a risky business for many reasons, including:

- Poor record of cost and time certainty for clients
- Adversarial attitudes and high levels of disputes and litigation
- The intense competition for work
- Low margins and profit risk
- The industry's poor safety and occupational health record
- Pressure from management and shareholders to produce a high return on funds invested
- Pressure on construction teams, especially site management and operatives, to save time and money
- Pressure on health and safety provision

Raftery (1994) argues that construction is nothing special compared with other industries because we simply carry out projects to a specified timescale using teams of specialists for design and construction by marshalling appropriate resources to overcome physical and technical problems involved. He also argues that construction projects exhibit much lower levels of technical complexity than aerospace, defence or computer software projects.

Smith (1999) distinguishes between risk and uncertainty in decision-making such that a risk is a decision having a range of possible outcomes to which a probability can be attached, whereas uncertainty exists if the probability of possible outcomes is not known. He suggests that risk falls into three categories:

1. Known risks – risks that are an everyday feature of construction
2. Known unknowns – risks which can be predicted or foreseen
3. Unknown unknowns – risks due to events whose cause and effect cannot be predicted

This point is also raised by Thompson and Perry (1992) and by Edwards (1995) who say that it is the unforeseen events which can have the most significant impact. Raftery goes on to judge that risk has to be recognised, assessed and managed and that overemphasis on risk avoidance leads to overcaution and negative attitudes.

7.2 The Turnbull Report

There are many risks in construction (in common with other industries) and this has been recognised by the Institute of Chartered Accountants who commissioned a report into the management of risk as an aspect of corporate governance. This is the Turnbull Report (ICAE 1999) and the recommendations from this took effect from the beginning of the year 2001.

Effectively, company directors have to show that they have proper and ongoing procedures to manage the risks to which their organisations are exposed and they have to demonstrate that in their annual report and accounts. This is not a mandatory requirement but is equivalent to other accounting standards and practices which accountants recognise. These standards are important to the extent that auditors, when they are not satisfied that the appropriate standards have been applied, will qualify the accounts accordingly. This is effectively a vote of no confidence in the accounts and can have a dramatic effect on the standing of the company and its ability to attract investors and customers. Compliance with the recommendations of the Turnbull Report has been a condition of London Stock Exchange listing since January 2001.

Turnbull suggests that risk management is an ongoing process for identifying, evaluating and managing significant risks and that this must be evident in the way the affairs of the business are conducted. The report identifies risk assessment as central to this process to the extent that 'the significant internal and external operational, financial, compliance and other risks' should be identified and assessed on an ongoing basis. These significant risks include:

- Market
- Credit
- Liquidity
- Technological
- Legal
- Health, safety and environmental
- Reputation
- Business probity

7.3 Project risk

Edwards (1995) suggests that identifying hazards is an essential part of a structured approach to risk management but that it is often unidentified hazards, for which no provision has been made, that have the most significant impact. Thompson and Perry (1992) observe that all too often risk is either ignored or dealt with in an arbitrary way on construction projects, the fact that the practice of adding a 10% contingency is typical industry practice. Alternatively, the contractor may 'take a view' to cover for any shortfall in the estimate or inaccuracy in the client's documentation.

Figure 7.1 illustrates that risk assessment will not remove all risks on a project and that both the client and contractor must recognise that residual risks will always remain no matter what provisions are made. The aim of risk management is to ensure that such risks are managed effectively by the party best able to do so.

Table 7.1 Risk assessment

Step	Example
1 Identify the hazard	Deep drainage excavation in bad ground
2 Identify who or what might be harmed	Pipe layers in trench
3 Evaluate the risks arising from the hazard	High risk of collapse
4 Determine the control measures required	Use steel trench drag box
5 Evaluate remaining risks	Risk of crushing/injury from excavator bucket
6 Record the findings of the risk assessment	Risk of falling materials
7 Make contingency plans for the residual risks	Fill in risk assessment sheet Prepare safety method statement based on risk assessment
8 Review and revision	Supervisor to give task talk Permit to work required Banksman working with excavator Monitor site operations and modify risk assessment where necessary Hold further task talk if method statement is changed

that has the potential to cause human injury, damage to property, damage to the environment or economic loss.

In order to control risk, a risk assessment is carried out. This is a statutory requirement under the Management of Health and Safety at Work Regulations 1999 with regard to risks to health and safety. The risk assessment might follow the steps listed in Table 7.1.

Risk is measured by evaluating the chance of something happening (the hazard) and the severity or consequences if it does. This can be based on a hunch or by making an intuitive assessment of whether the risk is high, medium or low or by using a matrix to do a simple calculation (Table 7.2).

Therefore, on a scale of 1–3, if the likelihood (chance) is 2 and the severity is 3, the risk is 6 out of 9. This would be in the high-risk category. However, it must be remembered that the prediction of likelihood and severity is difficult to do with any degree of certainty.

The matrix could be used to assess commercial risk at tender stage or the risk due to a variety of possible ground conditions or the chance of a fatal or non-fatal accident to people. The effect of exposure to this risk might be the loss of money, loss or damage to property, or business losses including loss of reputation or loss of individual skill and experience due to an accident to a key worker.

Table 7.2 Risk matrix

Severity	Likelihood		
	1	2	3
1	Low	Low	Medium
2	Low	Medium	High
3	Medium	High	High

7.6 Client risk

Thompson and Perry (1992) suggest that uncertainty is greatest at the earliest stages of a project and that time and cost overruns can invalidate the client's business case for a project by turning a potentially profitable venture into a loss-maker. They also emphasise that the risks with the most serious effects for clients are:

- Failure to keep within the cost estimate
- Failure to achieve the required completion date
- Failure to achieve the desired quality and functional requirements

Thompson and Perry's work emphasises that appropriate strategies are necessary for the control and allocation of risk and that, while risk cannot be eliminated through procurement contractual arrangements can greatly influence how risks are managed. This is illustrated in Figure 7.3 which provides a simplified view of the balance of risk according to the procurement strategy chosen. This diagram is based on the work of Walker and Greenwood (2002) and Edwards (1995).

Some of the risk management considerations made by a client at project level are considered here.

PROCUREMENT RISK

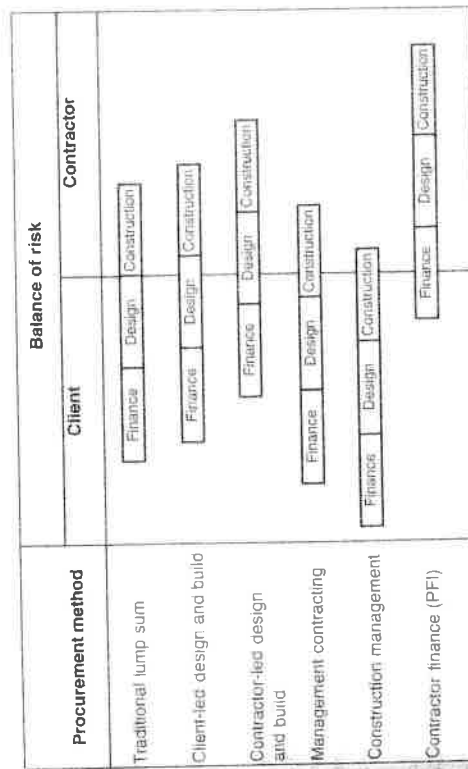


Figure 7.3

Feasibility risk

At the early stages of projects, clients must confirm the business case, identify options and develop the preferred solution. Once a scheme is sanctioned by the client, major commitments are made in terms of design, procurement and construction.

Design risk

Business decisions are all about risk and reward and the client must decide how much control is required over the design of the project. Retaining control over the quality of the design may be important for the client but the downside is that the design risk remains with the client as well. Partial or complete contractor design may remove the risk but then the client risks getting the wrong end result.

Funding risk

The contractor's income is the client's negative cash flow and arrangements must be made for available funds to draw down in order for the client to make regular monthly or stage payments for work in progress. The client's quantity surveyor must be careful not to expose the client to the risk of the contractor's insolvency by overvaluing interim payments.

Tender documentation risk

The traditional bills of quantities contract came about in order to give tendering contractors a level playing field. If traditional procurement is used and provided the design is well developed before going out to tender, quantities will be firm and all other documentation complete. Clients risk contract variations and budget overspend if they push for a fast start on site, and they may be well advised to consider more appropriate procurement arrangements in such cases.

Time risk

The obligation to complete the project on time is the contractor's responsibility and the client has redress in standard contracts through the liquidated and ascertained damages (LADs) provisions. Despite being a genuine estimate of the client's loss, LADs may not be adequate compensation if the contractor is late finishing, especially if a sell-on deal is lost or a prestigious opening deadline is missed.

Commercial risk

For most clients, buildings represent assets which are used to generate income and profits. The commercial success of a project may well be undermined if the job is delivered late or over

budget or if the quality of design and construction is below the necessary standard. Clients should engage competent professional representatives to make sure this does not happen irrespective of the procurement method used for the project.

7.7 Contractor risk

Some of the biggest risks taken by contractors are at tender stage when they commit to a price and programme. Many companies now consider risk management to be an essential part of the tendering process. A contractor's risk assessment at the estimating stage may include consideration of the following risk areas.

Tender risk

At tender stage, the contractor needs to consider many factors before submitting a bid. Among these are:

- Previous experience (good/bad) working with the client team
- The financial stability of the client
- Market conditions and the level of competition for the contract
- Inflation – is a firm or fluctuating price required?
- Ground conditions and the balance of risk in the contract and method of measurement

Risks are involved with checking each section of the estimate build-up to ensure that the estimator's allowances are realistic. Final adjustments, the tactical movement of monies in the bills of quantities and the distribution of overheads and profit among the trade sections can expose the contractor to risk once the contract is awarded.

Quantity risk

The contractor must assess the accuracy of the quantities in the bills at tender stage because margins can be lost if the quantity work is subsequently reduced on re-measure. Provisional quantities in the bills pose a risk in rating up and allocation of margin.

Where quantities have been taken off by the contractor, failure to include associated labour items may add risk to the overall bid. On design and build projects, the contractor is responsible for taking off his own quantities but many serious quantity errors are often not apparent until the contract has been awarded. The contractor must then simply accept the error and grin and bear the loss (or find another way of making up the money).

Subcontractor risk

On many contracts, the contractor may simply be responsible for managing subcontractors, with very little work directly under his control. The ultimate success of the project may lie

in the performance and organisation of subcontract operations. The contractor takes all the tendering risk and is especially vulnerable to subcontractors who are unwilling to stand by their quotes at tender stage.

The following check procedures may be implemented and when undertaken in conjunction with a well-managed workload should reduce the risk to the company:

- Subcontract tenders should be abstracted from priced bills and checked against individual trade sheets.
- The correct selection of subcontractors and suppliers to ensure suitability for the work must be considered.
- Ensure liaison with construction, surveying and the buying department to ensure that the best subcontract packages have been selected.
- Subcontract price comparisons should highlight potential high/low rates so that assessment may be made in tender settlement meetings.
- The design input of work packages should be compared to ensure that the quotations meet design requirements. Likely cost savings proposed by subcontractors in relation to time and quality should be highlighted. Variations from the norm should be investigated.

Design risk

The contractor may be responsible for temporary works design only or may be involved in partial or complete design of the permanent works. On design and build contracts, perhaps under a JCT 05 Design and Build Contract, it is likely that most of the design work will be let to subcontractors on a 'design and build' basis. Consequently, the risk in each design package must be carefully assessed because the contractor remains wholly responsible for the quality of the work of his subcontractors and their design. The contractor's risk will be less where he is responsible for only part of the design – say under a JCT 05 Standard Building Contract with Contractor's Designed Portion because part of the design risk is carried by the client and his architect. As further risk issue is that lead-in times for design packages must be carefully considered at tender stage so that the contractor is not committed to an unrealistic programme.

Programme-time risk

Where the time for completion is stated in the tender documents, the contractor may be at risk if the client/project manager has got it wrong. On the other hand, where the tender documents require the contractor to insert his own assessment of the contract period, the contractor will be gambling on his own judgement.

It is essential for the success of the project that a realistic assessment of the construction period is backed up by a comprehensive pre-tender programme. The build-up of the contract preliminaries is based on the programme, together with major items of plant. Including contingencies for liquidated damages for non-completion (where a tight programme period has been stated) only makes the tender less competitive.

Method risk

The contractor's choice of construction method at the tender stage is crucial to winning the contract, but also fraught with risk. The ground conditions on site may be different to those expected and the type of earthwork support required may be more expensive than that allowed for in the tender. Relief may be obtained through the method of measurement but this is not always the case, especially on civil engineering projects.

It may be that the estimator's choice of plant or technique is not feasible once the contract has been awarded, but the contractor is stuck with the allowances in the tender. This is where the contracts manager earns his money because cost-effective ideas will be needed to prevent contract losses.

Health and safety risk

Health and safety risk arises from the impact of hazards. Where there is no hazard there is no risk, but in construction there are hazards everywhere on a site. The best that can be done is to eliminate hazards in the design of the building and reduce the possible effects of residual risks through good management. The effective planning, organisation and control of construction work is central to that process.

People at risk from construction work include:

- Persons at work
- Visitors to site (including client representatives)
- General public
- Children

Documentation risk

Clarity of tender documentation is important. Bills of quantities containing extensive provisional quantities need careful pricing. Prices based on drawings and specifications, or schedules of work containing extensive spot items, may prove difficult to price accurately.

Where there are defined provisional sums in the bills of quantities, the contractor has to allow for this work in his programme, even though there may be little information as to the precise nature of the work required.

The contractor needs to scrutinise the tender documentation very carefully in order to assess the implications of:

- Onerous contract terms
- Clauses deleted from standard contracts
- High levels of liquidated damages
- Unrealistic contract period
- Possible novation of the design (design and build contracts)
- Contract bonds and guarantees required

After consideration of all the risks to be assessed at the tender stage, it may be better for the contractor to withdraw from the competitive tender altogether, and spend his time negotiating work (or even consider partnering).

7.8 Tendering risk

When competition for work is fierce, contractors have to find ways of winning work and making a profit at the end of the job. The starting point is the estimate produced by the estimator. Many contractors will carry out a risk assessment at tender stage and this may identify areas for making savings in the tender figure. The contractor may spot undermeasure or overmeasure in the contract bills or there may be scope for variations in the documents. Alternatively, the contractor may take into account buying 'muscle' on suppliers' and subcontractors' prices as a means of reducing the tender figure. This is frequently referred to as commercial opportunity or scope.

In the example in Table 7.3, it can be seen that the contractor's adjustments bring the tender figure (£1 780 500) below the estimator's net cost (£1 800 000). Effectively, the contractor is tendering at below net cost or, in other words, tendering at a negative margin. This is achieved simply by transferring the risk to others, principally the domestic subcontractors.

The contractor is taking a gamble in that he might not be able to squeeze down subcontractors' prices once the contract has been awarded, or the anticipated returns from variations and

Table 7.3 Tender summary

	£	£	£
Preliminaries			130 000
Measured work			
Labour	100 000		
Plant	60 000		
Materials	240 000		
Subcontract	820 000		
PC sums		1 220 000	
Provisional sums		300 000	
Net total		150 000	
Overheads and profit 7%			1 800 000
Total			1 926 000
Commercial opportunity			
Materials	7.5%	240 000	18 000
Subcontract	10%	820 000	82 000
PC sums	2.5%	300 000	7 500
Provisional sums ^a	8%	150 000	12 000
Preliminaries ^b	4 weeks	6500	26 000
Tender total			(145 500)
			1 780 500

^a Assuming rates for this work will include 7% markup and allowing for commercial opportunity of say 5% on materials and subcontractors

^b Assuming a 4-week reduction on the 20-week contract period and that all preliminaries costs are time-related

claims may not be forthcoming. This does not mean that the contractor will necessarily lose money on the contract; all will be well, provided that allowances in the tender can be achieved in reality.

The tender documentation offers the contractor many opportunities to take commercial advantage, which can be used as a means of winning contracts and making money during the contract period. For instance, documents are frequently littered with mistakes or inaccuracies and contractors can take advantage of these. In such circumstances, the contractor might spot that the concrete work is undermeasured and that the architect will have to issue variation instructions for additional work.

At tender stage, the contractor can set the scene to make money out of this situation during the contract. By increasing his bill rates for these items of work, which will subsequently be re-measured and valued during the contract, the contractor can 'load' the rates and thus make more profit. To do this without increasing the tender sum, the contractor will take money away from some bill items and reallocate it to the undermeasured items. This technique is sometimes called rate loading.

Tender loading is a similar technique and is another way for the contractor to move risk on to the employer and make money at the same time.

Front-end loading reduces the early negative cash flow effect by increasing the margin. This is done by pricing the bill of quantities so that the margin is allocated to those items which will be carried out during the early stages of the project.

Back-end unloading is a similar technique but involves increasing both margin and net cost on early items of work. This is a dangerous practice and involves moving part of the net cost allowance for later items of work in the bill of quantities to those which are to be carried out earlier in the contract.

Harris and McCaffer (2006) explain these techniques further.

7.9 Health and safety risk

Despite having a much superior safety 'record' than our European counterparts, fatalities in the UK construction industry continue to give rise for concern and we have yet to make the 'step change' in construction health and safety expected in the 1990s. On average someone dies every week as a result of construction work and the large, well-organised contractor is no less prone to suffer a fatality than a smaller company.

Construction health and safety risk is managed through legislation and in particular:

- The Health and Safety at Work Act 1974
- The Management of Health and Safety at Work Regulations 1999
- The Construction (Design and Management) Regulations 2007

A raft of other legislation, such as the Work at Height Regulations 2005, which is not construction industry specific, also applies to construction projects.

The Health and Safety at Work Act 1974 is enabling legislation which sets out the penalties for failure to comply, and confers powers on inspectors who may require site practices to be changed if they are considered unsafe or in breach of legislation. A contractor can be served

with an improvement notice or may even be prevented from continuing an unsafe operation through a prohibition notice.

The Management of Health and Safety at Work Regulations 1999 deal with assessment of risk and arrangements for and competence in the measures needed to protect individuals and prevent accidents at work. The impact of this legislation is to ensure that issues identified by risk assessments are dealt with by effective planning, organisation and control and that procedures to monitor and review such arrangements are put in place.

The Construction (Design and Management) Regulations 2007 require a construction phase health and safety plan for all but the smallest of projects and this acts as an important means of communication which is intended as a continuous theme throughout the construction phase of the project.

In practice, the construction phase plan relies on pre-construction information prepared by the design team in conjunction with the construction design and management coordinator. This is developed by the principal contractor into a safety management system for organising, implementing and monitoring health and safety arrangements on site.

The Approved Code of Practice (HSE 2007) gives comprehensive guidance concerning the contents of the construction phase plan and explains the responsibilities of those who have duties under the Construction (Design and Management) Regulations:

- Client
- Designers
- CDM coordinator (statutory appointment)
- Principal contractor (statutory appointment)
- Contractors and the self-employed

The principal contractor role is normally undertaken by the main contractor under the contract, although the statutory appointment and the appointment of the contractor under the civil contract are quite separate and distinct appointments. The duties of the principal contractor include responsibility for the health and safety management system for the project. This normally involves conducting site inductions, establishing site rules, the provision of training and information and the prevention of unauthorised access to the site.

7.10 Fire risk

Fire is an ever-present risk on construction sites, especially with respect to:

- Hot work such as welding, blowlamps, cutting and grinding
- Heating appliances, especially gas bottles in welfare facilities
- Litter, especially in rest rooms and drying areas
- Arson
- Smoking
- Burning of waste on site
- Stored materials, including adhesives and solvents

Construction (Design and Management) Regulation 2007 provides for such eventualities and requires contractors to:

- Take measures to prevent risk of injury from fire
- Provide and maintain fire-fighting equipment, fire detectors and alarm systems
- Give instructions to people in the use of fire-fighting equipment
- Give instructions to people where their work activities involve a fire risk
- Indicate fire-fighting equipment with suitable signs

Standard forms of contract provide for insurance of the works during construction and this includes the risk of fire. However, the high cost of site fires has prompted the publication of a Joint Code of Practice: Fire Prevention on Construction Sites (Construction Confederation, 2006). This provides that potential fire risks are considered at design stage and also that a site fire safety plan is developed by the principal contractor. This plan must include provision for a comprehensive fire prevention regime including:

- Organisation and responsibilities for fire safety
- Hot work provisions
- Fire escape and communications
- Fire drills and training
- Emergency procedures

The fire safety plan may be included in the construction phase health and safety plan. It should be noted that adherence to the Joint Fire Code is a contract condition in some standard forms (e.g. JCT 05).

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