

# Single Point Estimates

By Bert Hamilton

In the olden days, the tools of the work place were simple. Breakdowns were probably frequent but repairs could be made without calling in a specialist – or the accountant, and there would certainly be no need for a financial adviser. Failure in one area seldom had direct impact on another. Today, the projects and the work involved in planning, executing and controlling them is complex, breakdowns can be catastrophic and the impact can have far reaching consequences. We must be constantly aware of malfunction, deviations and errors. Mastery of risk is what defines the boundary between the past and modern times.

The word risk is believed to come from the early Italian 'risicare', which means to dare. In that regard risk was seen as a choice rather than a fate. Depending on how free we are to make choices human beings and their actions are fundamental to the management of risk.

The serious study of risk began in the Renaissance period about 350 years ago. Prior to that time there was no real understanding of risk or the nature of decision-making. Two Frenchmen, one a mathematician, the other a lawyer, discovered the theory of probability and therein lay the basis for the modern concept of risk. Our understanding of risk enables us to make decisions in a rational way.

Most stakeholders engaged in today's projects want an asset delivered that works in accordance with predetermined requirements, is delivered on time and within the agreed budget. In most cases, those involved try everything possible to produce such an outcome but in the real world the project's customer is often provided with something different and in extreme cases that can mean ending up with a 'white elephant'.

Risk in projects is all about determining how much 'difference' can be tolerated.

When we observe this country's largest public sector construction project, the Dublin Port Tunnel, we can be excused for asking a series of non-rhetorical questions in relation to that project's performance to date. Why was the project estimated in mid 1999 to cost IR£175m (€224m), which doubled by the letting of contracts in October 2000, and at completion will be close to three and a half times that initial figure? Why was the project contracted to take three and a half years from the start date of June 2001 but instead took almost five years to construct? Why was the tunnel designed to take less than 100% of all heavy goods vehicles from and to the port area? Is it likely to achieve its overall purpose of directing heavy goods vehicles away from the city's streets? Will it effectively improve traffic flows in the city? But, perhaps, most significantly, was the project subject to rigorous risk assessment in the early conception phase and has there been a continuous process of mitigating risks of all types?

The Dublin Port Tunnel has been mentioned specifically in the case of project risk but any of the State's private projects or other public projects could be contenders for examining attitudes towards the use of risk management.



## Risk Management

Increased concerns about project risk have given rise to various attempts to develop risk management methodologies. Such methodologies cannot be prescriptive because of the variability in the scope and the uniqueness of project characteristics but they invariably use the project life cycle to schedule and sequence the application of appropriate tools and techniques used in the risk process.

Ideally, the risk process should address the individual needs of each stakeholder within a particular project. Unfortunately, investigations show that contractors and owners of projects give minimal consideration to risks outside the realm of their own concerns.

The sequential procedures that are construction risk management are universally considered to be:

- Identification
- Assessment
- Plan responses
- Implement responses.

The author has found through his many years of managing major projects that the best way of identifying risks is to utilise the project's work breakdown structure (WBS). The WBS, which should incorporate information on all permanent and temporary work, offers a useful model that the project's stakeholders can use in risk identification. In other words, a project's risk breakdown structure is an overlay to the WBS and is directly linked to it.

Each identified risk event needs to be evaluated using a qualitative and/or a quantitative approach as appropriate to the project's cir-

cumstances. The assessment of each risk event should describe all relevant characteristics, including the nature of the uncertainty faced and the nature of its (positive or negative) potential for impact on the project requirements. The combined effect of risks on a project will provide crucial information on the level of overall project risk.

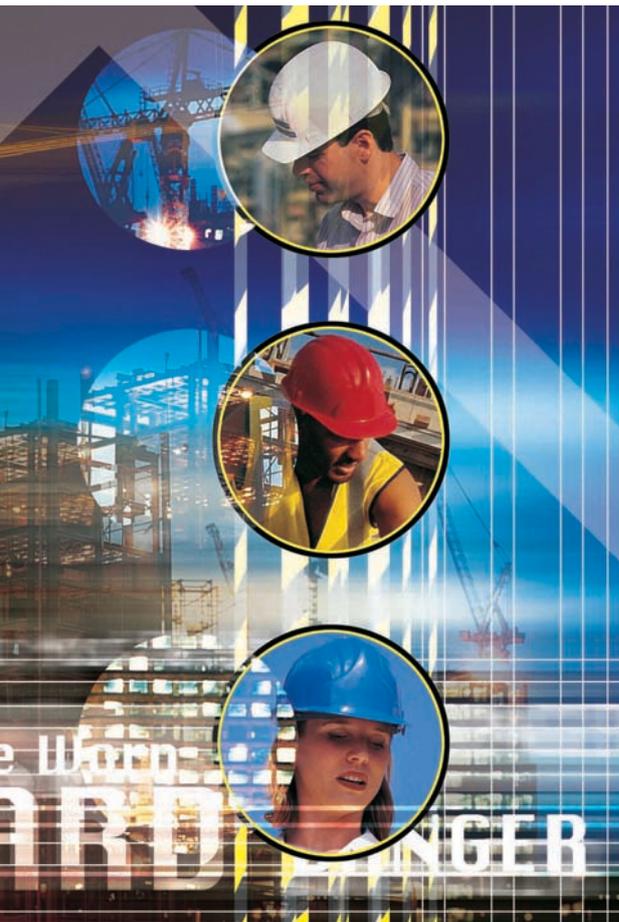
The aim of 'plan responses' is to avoid or minimise threats and to exploit or maximise opportunities in order to optimise the likelihood of achieving a project's requirements. Lessening the impact of any risk event is commonly referred to as risk mitigation. There are four strategies that can be used when mitigating a threat, namely:

- Avoidance - when a risk is not accepted and other lower risk choices are available from several alternatives
- retention/acceptance - when a decision is made to accept the consequences should the risk event occur
- control/reduction - when a process of continually monitoring and correcting the effect of the risk event on the project is used
- transfer/deflect - when the risk is shared through contractual shifting, performance incentives, insurance, etc.

Whichever strategies are used, it is essential to have a detailed plan on how each identified risk needs to be dealt with and for such plans to be integrated into the overall plan for designing, constructing and commissioning the project.

The 'implement responses' procedures ensure that effective actions are implemented based on the decisions taken during the 'plan responses' stage.

# Increase Project Risk



perceived to be time-related but as the project neared completion it became clear that most of the risks related to costs. However, that was a fallacy and now we know better.

Scope, time-schedule and cost are parameters that are project risk areas throughout the life cycle. Uncertainty in any project can be considerable and most project management activities are concerned with managing uncertainty from project start to completion. A lack of clarity caused by stakeholder behaviour, inadequate data, a poor organisational framework for resolving issues and project issue assumptions all have the potential to create uncertainty. It is a fact that this uncertainty and ambiguity is greatest in the earliest project phases. It is also true that the potential for uncertainty is dominated by estimating the project parameters (quality, time and cost).

A project's owner, the customer, contemplating an instruction to start a project, is traditionally provided with advice that states the project under consideration will cost Euro X, will take Y months (or years) and will be provided to Z quality. The customer is at a severe disadvantage because this advice is totally inadequate for decision-making. What's missing? Yes, the missing link is probability – the chance that the project can be delivered within the X budget, the Y period, and to the required Z level of quality. For instance, if there is only a 15% chance that the project under consideration will cost Euro X, then X is a meaningless amount of money.

Because a project consists of work tasks captured in a WBS it is not a complicated exercise to estimate each task with a lower limit and an upper limit as well as its target value. An estimator in his/her attempt to measure uncertainty produces the practical range of a tasks cost (or time period) and the probability of achieving the target value. By aggregating the ranges and probabilities of

each task the range and the associated probability can be established for the overall project.

An example of the outcome of such estimating of ranges for an overall project cost is shown in the diagram. The diagram is a graph with the vertical axis as the probability of completing a project within a specified cost and the horizontal axis as budget estimate in Euro millions. It can be seen that when all uncertainties (risks) are accounted for the project cost range could be between a low of about €8m to a high of about €30m. Typically, when using such an approach what is known as the 70% confidence interval is used to establish a more meaningful range outcome. In regard to this confidence interval, a low of €13.1m and a high of €22.1m equates to a 15% probability and an 85% probability respectively.

The traditional approach of using a single value for estimating each task's cost was aggregated for the overall project as €16.1m and is shown as the unadjusted cost. By plotting on the diagram, the traditional estimating approach of single values for task costs, it can be discerned that this equates to a 41% chance of completing the project within €16.1m. In this particular case, the customer decided that the risk was too high and opted for a 54% probability of successful cost outcome. This meant that the expected cost would be €17.4m and a contingency fund of €1.3m should be available to cover those risks that couldn't be avoided or transferred.

This demonstration raises important questions regarding the way prospective project owners specify their project needs, what they request when procuring contractors and suppliers and how the construction industry deals with uncertainty.

## Discrete Estimates v Range Estimates

At one time it was thought that, as a project progressed through its lifecycle from start to finish, risk could be classified at the initial or conception phase as scope of work (amount and type of work) threats. During the subsequent design and initial start-up of construction, the threats were

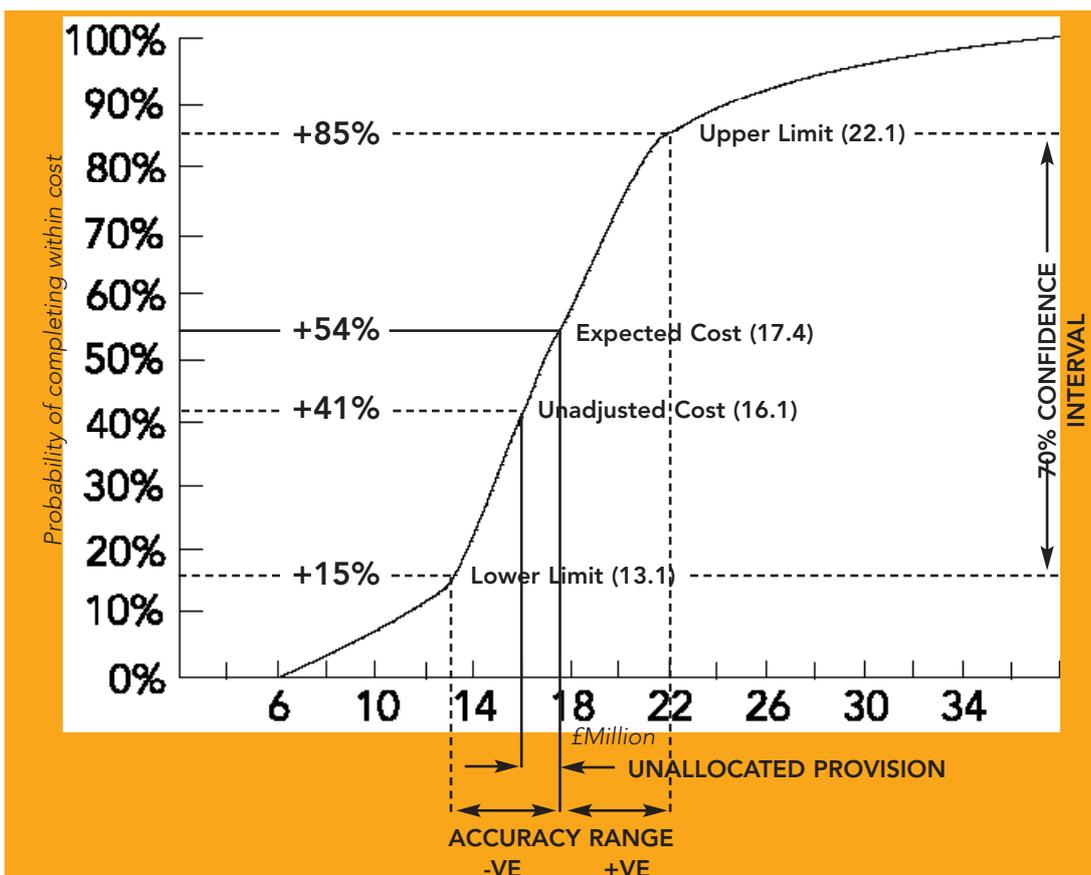
## Conclusions

Risk management can make an important contribution to effective project management.

The construction industry needs to explore and understand what is meant by uncertainty and how well established techniques can be used to help in identifying, assessing and managing the events that lead to 'missing targets'.

It is hardly any wonder that project owners, prospective end-users and those who watch the performance of the construction industry are continually at a loss to know why it is that there has been no improvement in the performance of project outcomes. Depending on the approach taken there is a school of thought that is convinced that performance is getting worse not better.

One thing is for sure. Those regulating the construction industry should demand that single-point estimating be banned from all projects and their management. Single point estimating is totally inadequate and it does not represent reality because it takes no account of uncertainty – which is, after all, an every-day certainty!



## THE AUTHOR

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