Australian Government

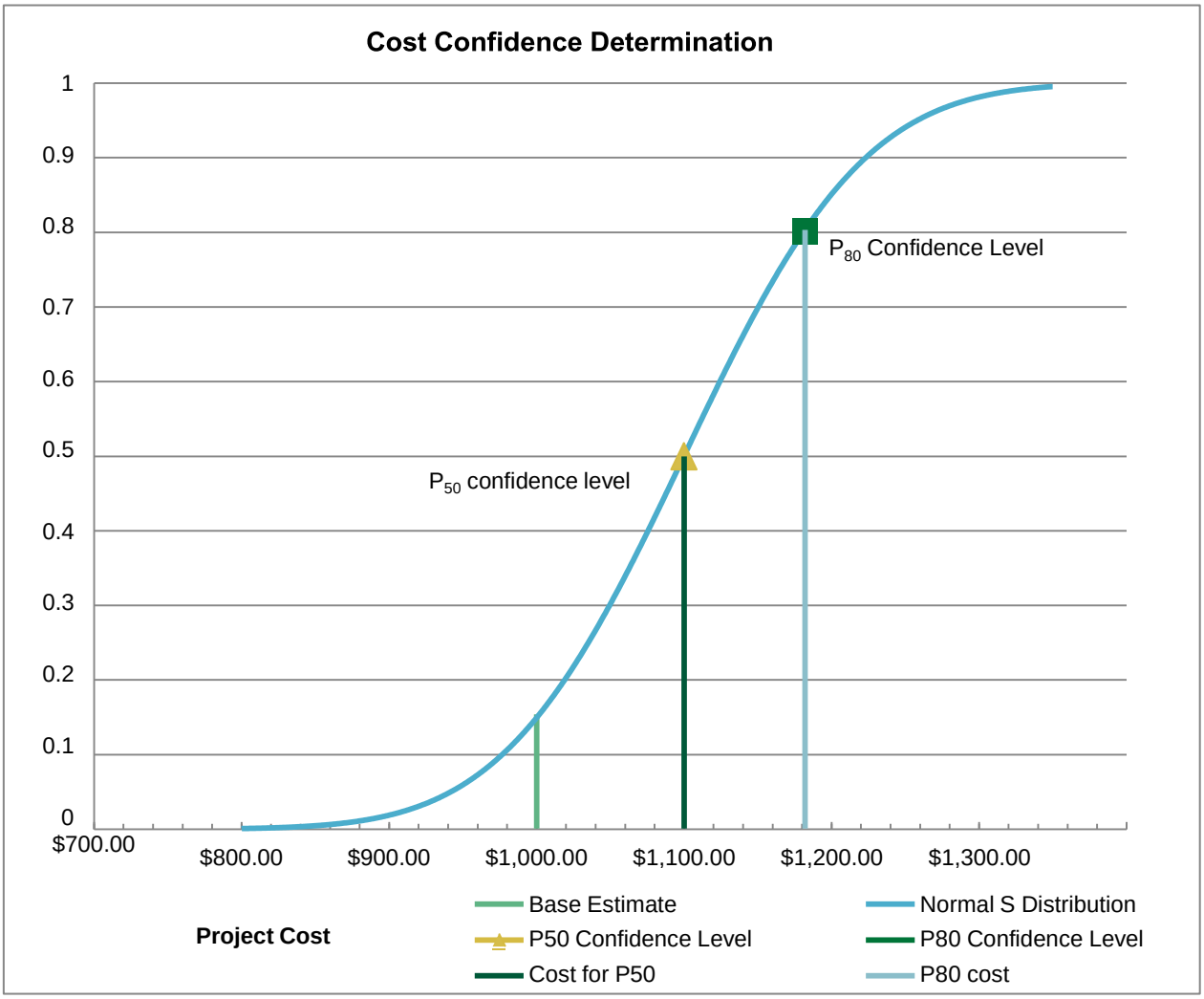
Department of Finance

Defining P50 and P80 Manual

Defining P50 / P80

P50 and P80 refer to a confidence level regarding the probability of the cost not being exceeded, and does not indicate a quantum of cost or proximity to the actual cost realised. That is, P80 is not a cost plus/minus 20% but instead it is a cost that will not be exceeded 80% of the time.

Risk profiles take the shape of the asymptotic 'S' curve shown below. The curve shown is for a fictional representative project with an arbitrary parametric cost estimate of $1,000 and a simplified risk profile. This demonstrates the position of the P50 and P80 confidence level estimates and risk allowances (contingencies). Note that to reach P100, all risks would be identified and allowed for at their estimated cost, leading to an impractically large contingency allowance (observe the asymptotic nature of the probability curve) or require an excessive time to deliver the project. Conversely, if the parametric estimate (in this example $1000 with P15 confidence) was all that was allowed for, that is with no contingency allowance, then the cost will be exceeded in almost every circumstance. Clearly, prudent project management and informed investment decision requires a consistent confidence level applied to all projects. It is for this reason that the entities must use a P50 confidence level in the cost estimate at First Stage of the Two Stage Capital Works Approval Process and requires a P80 confidence at Second Stage Approval.



Note that base estimate is a parametric cost with 'most likely' values for inherent risks (range risks). This value is not P0 as a consequence of range risks which have the potential to result in a lower cost (though unlikely). Where this line intersects the S curve indicates the cost confidence associated with that estimate on the represented risk profile (in this case the parametric estimate is approximately P15 – the other way to consider this confidence level is that the parametric estimate will be exceeded by some amount 85% of the time).

The S Curve is a cumulative probability curve arising from the normal distribution analysis of the risks identified.

Note that the graph above demonstrates the difference in risk allowance between a P50 and a P80 cost estimate. However, this is only at a moment in time – the refinement, realisation and retirement of risks through the due diligence investigations between First and Second Stage approvals will change both the base case and the standard deviation on the normalised distribution of risk, changing the placement of P50/P80 points on the cumulative probability curve.

In practice the progression from P50 at First Stage Approval P80 at Second Stage Approval involves the refinement, retirement and realisation of many identified risks. This usually results in the base case estimate increasing and the contingency allowance decreasing commensurately. However, if the estimate was in fact P50, this should be the case in only half of all projects, while the other half have budget estimates that decrease through maturity. The reality shows this not to be the case indicating probable optimism bias in the estimates or inadequate recognition/assessment of risks.

It is also critical to 'lock-in' the scope of the project at Second Stage Approval, as any further changes to the project scope and performance will also have flow on effects to the project cost and risk. Should the scope or performance change, the assumptions and estimates would affect the overall cost and risk profile for the project and would certainly alter the project from what was agreed by Government at Second Stage Approval.

Ascertaining your P50 or P80 confidence level cost

Deriving the appropriate cost confidence requires a cumulative assessment of the applicable risks. There are two different risk categories that form the risk profile: inherent (range) risk and contingent risk.

Range risk involves assessing the highest likely, lowest likely and most likely cost impact of an event that will occur (probability =100%). This may be a range of both quantity and rate separately, or combined.

Example - the bulk earthworks are assessed as 200,000m^3 at \$25 per m^3 with the quantity and rate combined range being -20%, 100%, +40%. The range of costs for this is:

- Lowest likely = (200,000 x \$25) -20% which equals \$5.0m x 0.8 = \$4.0m.
- Highest likely = (200,000 x \$25) +40% which equals \$5.0m x 1.4 = \$7.0m.
- Most Likely = (200,000 x \$25) -0% = \$5.0m.

The mean value is then considered the base estimate plus risk and so the risk allowance to include is the mean minus the most likely.

Contingent risk is an assessment of, and allowance for, unmeasured items. These may include items such as weather, geotechnical problems, political issues, design/owner requirements and other similar unknowns. These risks have a probability of less than 100% chance of occurring. As such, the risk needs to be allowed for in the contingency in a probabilistic manner. That is: cost (\$) x likelihood of occurrence (probability %).

To ascertain the appropriate risk allowance, the risks and costs are viewed as a normalised cumulative cost probability as shown in the graph above.

Ascertaining the normalised cumulative cost probability curve is done by use of the Monte Carlo simulation method where all identified risks are simulated over a number of projects probabilistically to ascertain the normal distribution of risk costs. This can be completed using a random number generator in a spreadsheet application to determine the mean and standard deviations of costs derived from the simulation. This represents the application of the accumulated risks (both inherent and contingent).

For additional information on application of the P50 and/or P80 confidence level/s to costing estimates, please contact your Chief Financial Officer or relevant financial area.