# Three-point Estimates

**Purpose**

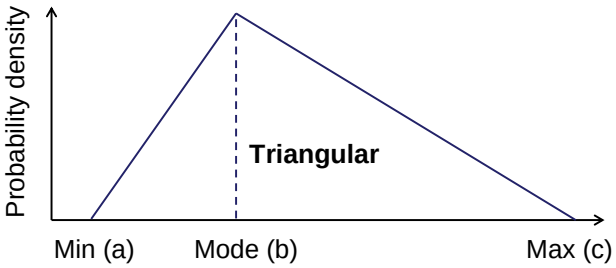
Provide a simple means of representing the magnitude and range of risk impact or effect

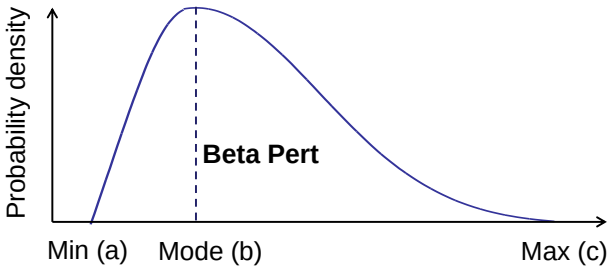
**Context**

Three-point estimates are often made for the cost or schedule effects of project risk. However they may also be used in connection with other important variables. For example, on an aircraft development project, design-related risks might be assessed in terms of their effect on weight. Three-point estimates are often used as inputs to quantitative risk analysis.

**Probability Density Functions**

Three-point estimates are associated with probability density functions (PDFs). The two most commonly used PDFs are the Triangular and Beta Pert.




**Triangular**

Mean ($\mu$) = $(a + b + c) / 3$

St dev ($\sigma$) = $\sqrt{((a^2 + b^2 + c^2 - ab - ac - bc) / 18)}$

**Beta Pert**

Mean ($\mu$) = $(a + (4 \times b) + c) / 6$

St dev ($\sigma$) = $(c - a) / 6$ (approximately)

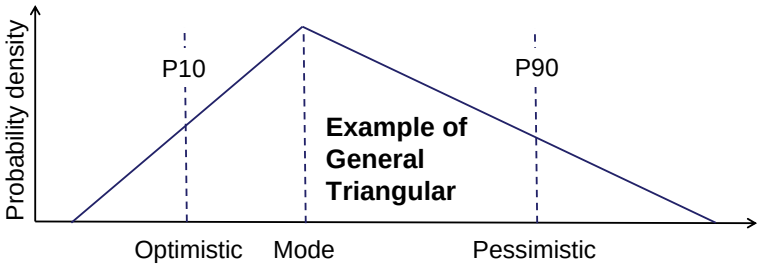
**Standard Deviations**

A triangular distribution has a higher standard deviation than a Beta Pert distribution with the same range. Moreover, whereas the standard deviation of a triangular distribution increases as its shape is skewed (i.e. as the mode comes closer to the Min or Max), the reverse is the case for a Beta Pert distribution.

The triangular distribution's relatively high standard deviation is sometimes argued as a reason for using it in preference to Beta Pert as a means of compensating for the tendency of three point estimates being unrealistically narrow. However, this thinking can lead to lazy estimating. It is more important to ensure that three point estimates are realistically wide (see hints and tips below).

**Confidence-based three point estimates**

An alternative three-point estimates approach to is to use the upper and lower points to represent confidence levels e.g. 10th percentile (P10) and 90th percentile (P90) values. Some estimators are more comfortable with this than estimating extremes.




The General Triangular distribution is a confidence-based three point estimates used to define a PDF. An optimistic P10 estimate represents a value for which there is only a 10% probability of the actual value being lower. Similarly there would only be a 10% probability of the actual value being higher than the P90 estimate. Note: the formulae above for $\mu$ and $\sigma$ do not apply to the General Triangular distribution.

**Estimating hints & Tips**

Most people's intuitive three point estimates tend to be too narrow, often by a factor of at least two. Making realistic three point estimates therefore requires a well-structured estimating approach.

A key to making realistic three point estimates is to identify the sources of uncertainty involved and understand how they could combine to produce variance in risk outcome. It is also necessary to recognise that best case and worst case scenarios could be very different to the mode.

A well structured estimating approach will normally involve making estimates for the upper and lower points before moving on to estimate the mode. On projects, most PDFs might be negatively skewed (as illustrated in all the figures above). A typical ratio for (Mode – Min) : (Max – Mode) is 1:2.

A common form of bad practice is default use of planned values as Mode estimates. This transfers any bias in the plan to the risk estimates. Estimating lower and upper points as generic deviations from the Mode e.g. +/-10%, without regard to the sources of uncertainty involved, is also bad practice.