

### Estimating Expense Budget - Answering Two Questions

When submitting an expense budget proposal for a project, two key questions of likely interest are:

- a) What's the probability the project will actually be delivered within this budget?
- b) How much contingency (i.e. extra funds) should be included in order for this budget to be achieved with 90% confidence?

This model shows how one might answer these questions through simulation. The base case for cost elements of the project are shown in the "Base case \$k" column below. It's further assumed each item's actual cost will be within a min-max range. The distributions are assumed to be skewed (or slanted in a specific direction) in this case and parameters have been chosen to reflect the assumption that costs are more likely to exceed rather than fall below the base case (as shown in the box below). Pert (which stands for Program Evaluation and Review Technique) distributions are applicable to describe possible costs of each item in practice as shown in the "Sampled" column below. The sum total of sampled project costs for each iteration and the contingency required above the base case of \$20M are both entered as @RISK outputs. The Total Project Cost (or Budget) is estimated by running 1,000 iterations of the model using @RISK.

The user may change any of the light blue colored cells, which are the model's inputs. Answers to the key questions can be found by appropriate interrogation of the output in an @RISK Results Summary window or in user defined graphs and tables as shown on the following page. Alternatively, as shown below, desired statistical results can be built into the model automatically using the @RISK Statistics functions.

Also as shown below and on the following page, it is anticipated the project will be delivered within the targeted \$20M budget less than 20% of the time. A contingency of roughly \$0.5M is needed to increase confidence in meeting the budget on an expected basis. In order for the budget to be achieved with 90% confidence, a contingency of about \$1.2M will need to be added resulting in a total budget of \$21.2M compared to the originally targeted budget of \$20M.

Possible refinements to this model include: (a) Incorporating dependency or correlation relationships between some of the variables; and (b) Using other distributions in place of the Pert, such as (i) the LogNormal distribution to model an unbounded range for the maximum, or (ii) the Binomial distribution to add risk to the model that certain specific adverse events may or may not occur.

Cost elements	Base case \$k	Min	Most Likely	Max	Min	Most Likely	Max	Sampled
Land	2,500	90%	100%	125%	2,250	2,500	3,125	2,563
Buildings	5,000	90%	100%	125%	4,500	5,000	6,250	5,125
Raw Mats	5,000	90%	100%	125%	4,500	5,000	6,250	5,125
Salaries etc	2,000	90%	100%	125%	1,800	2,000	2,500	2,050
IT	1,500	90%	100%	125%	1,350	1,500	1,875	1,538
Vehicles	500	90%	100%	125%	450	500	625	513
Marketing	1,000	90%	100%	125%	900	1,000	1,250	1,025
Other general overhead	2,500	90%	100%	125%	2,250	2,500	3,125	2,563
<b>Total Project Cost</b>	<b>20,000</b>							<b>20,500</b>
<b>Contingency</b>								<b>500</b>

Desired Statistical Results

Probability of meeting value of 20,000	18.9%	
Total budget required for 90.0% confidence	21,238	90%
Contingency required for 90.0% confidence	1,238	

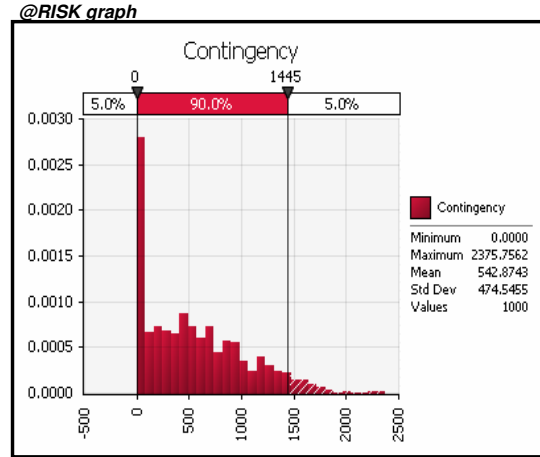
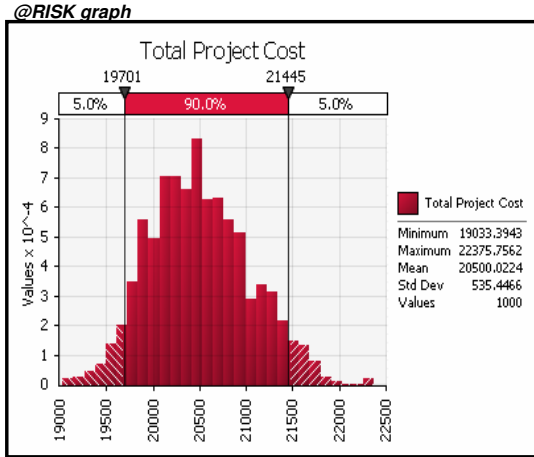
Cell Formula Notes:

C49=RiskTarget(J45,C45)  
 C50=RiskPercentile(J45,D50)  
 C51=C50-C45

J36=RiskPert(G36,H36,I36), J37=RiskPert(G37,H37,I37), etc.  
 J45=RiskOutput("Total Project Cost")+SUM(J36:J43)  
 J46=RiskOutput("Contingency")+MAX(J45-C45,0)

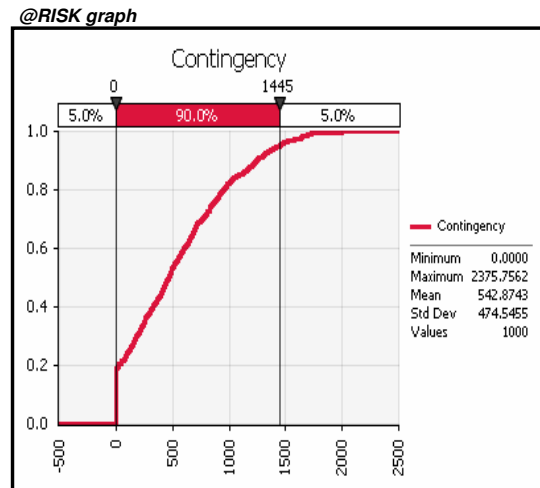
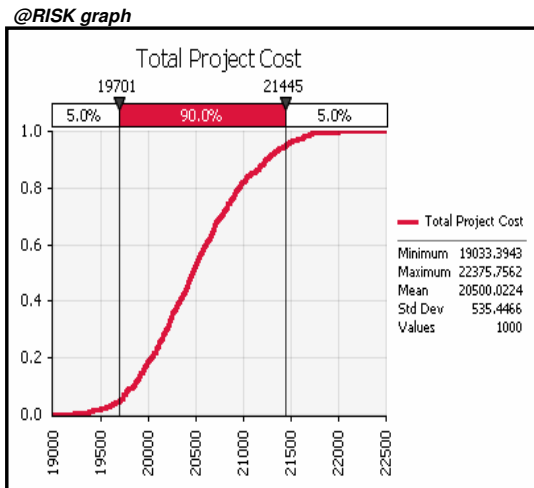
Prepared by  David Koegel Associates, Inc.

**Loss Results**



Statistic	Value
Min	\$19,033
Max	\$22,376
Mean	\$20,500
StdDev	\$535
90th P	\$21,238
95th P	\$21,445
99th P	\$21,724
P(Proj Cost <= \$20,000)	19%

Statistic	Value
Min	\$0
Max	\$2,376
Mean	\$543
StdDev	\$475
90th P	\$1,238
95th P	\$1,445
99th P	\$1,724



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