Air Force Acquisition Excellence & Change Office (AQXC) Schedule Risk Assessment (SRA) Process

Version: 2.0, 18 JAN 2012

U.S. AIR FORCE

Document Configuration Management Log

Version (Date)	Content Summary / Change Description
V. 1.0 (27 July 2011)	**Content:** Includes overview and detailed steps for conducting a Schedule Risk Assessment (SRA).
V. 1.1 (23 September 2011)	**Content:** Includes additional information pertaining to a Schedule Risk Assessment (SRA).
V. 2.0 (18 January 2012)	**Content:** Includes information and instruction for using Open Plan Professional to conduct a Schedule Risk Assessment (SRA).

Draft Version Status (Updated 18 January 2012)

This document is released in draft form prior to coordination and approval. Modifications to the process and advanced SRA techniques may be implemented once current process is tested on an actual SRA.

This document is to be updated based on feedback from the user community.

Table Of Contents

Air Force Acquisition Excellence & Change Office (AECO) Schedule Risk Assessment (SRA) Process *1*

Overview *5*

Purpose and Benefits **5**

SRA Policy and Requirements **5**
DI-MGMT-81650; Integrated Master Schedules 5
ANSI-748 6
DOD-I 5000.2 6
DI-MGMT-81466A, Contract Performance Report (CPR) 6

SRA Roles **7**
Government Role 7
Supplier (Contractor) Role 7
CAM/IPT Role 7

Independent and Joint SRAs **7**

SRAs and Integrated Risk Assessments (IRAs) **8**

Entrance Criteria **9**

Exit Criteria **9**

Statistical Concepts *9*

Probabilities **9**

Cumulative Probability **10**

Mean **10**

Median **10**

Mode **11**

Range **11**

Standard Deviation **11**

Confidence Interval **11**

Distribution Curves **11**
Normal Distribution Curve 12
Triangular Distribution Curve 13
Beta Distribution Curve 13
Uniform Distribution Curve 14

Monte Carlo Simulation **15**

Statistical Significance **16**

SRA Process *18*

Preparation Phase 19
Establish Expectations 19
Determine Reporting Tasks / Key Activities 20
Assess and Prepare IMS 20

Data Collection Phase 29
Determine Critical Paths 29
Determine Three Point Estimates 31
Determine Distribution Curves 35

Execution Phase 42
Risk+ 42
Open Plan Professional 90

Results Phase 167
Produce SRA Outbrief 167
PMO Follow Up 167

Managing the Schedule Based on SRA Output 168

Improving the Schedule Completion Date 168
Adding Resources 168
Fast Tracking 169
De-Scoping 169

Managing Schedule Margin 169

Advanced Risk Modeling Using Risk+ 170

Probabilistic Branching 170

Conditional Branching 170

Correlated Risks 170

Acronyms 171

Air Force Schedule Risk Assessment Process and Instruction

Overview

Purpose and Benefits

A Schedule Risk Assessment (SRA) is a process that uses statistical techniques to quantify the schedule impact of technical, programmatic, and other risks in a project. This analysis focuses on critical path, near-critical path and high risk activities, as well as less critical activities, since any activity may potentially affect the program's completion date.

All programs contain some amount of risk and uncertainty. Program schedules only reflect what happens if everything goes according to plan. An SRA provides a means to quantify the risks in a program and determine the effect of things that may not go according to plan. Since ignoring risks does not make them go away, an SRA should be conducted for most projects.

The following are benefits of an SRA:

- Identifies high risk areas, providing program management insight when engaging risk mitigation activities to prevent or minimize potential schedule slips.
- Provides a method to quantify schedule risks by calculating the probability of achieving the dates for selected milestones or events if identified risks are not mitigated.
- Enables the participants to understand and manage their project better by performing the analysis and reviewing the results.
- Determines the impact of schedule risk resulting from merge bias. Merge bias is the effect on a schedule when parallel paths merge together into fewer paths, creating a pessimistic bias.

SRA Policy and Requirements

Excerpts from the following documents illustrate why SRAs are both essential and required for program success:

DI-MGMT-81650; Integrated Master Schedules

Section 2.4.1.23 – Schedule Risk Assessment
Three point estimates shall be developed for remaining durations of remaining tasks / activities that meet any of the following criteria: (1) critical path tasks / activities, (2) near-critical path tasks / activities (as specified in the Contract Deliverables Requirement List), and (3) high risk tasks / activities in the program's risk management plan. These estimates include the most likely, best case, and worst case durations. They are used by the Supplier to perform a probability analysis of key contract completion dates.

Section 2.4.1.23.1 – Most Likely Estimate
Most Likely Estimate. Remaining schedule durations based on the most likely estimates.

Section 2.4.1.23.2 – Best / Worst Case Estimates
Best / Worst Case Estimates. Best and worst case assumptions shall be disclosed.

The contractor schedule risk assessment shall explain changes to the critical path, margin erosion, and mitigation plans. It shall be incorporated into the Supplier's program risk management process. The schedule risk assessment shall be submitted as specified in the CDRL and prior to the Integrated Baseline Review. The risk analysis may be performed within the IMS or within a separate risk tool as appropriate based on the capability of the automated scheduling tool.

ANSI-748

Section 3.4 – Program Schedule
Schedule planning and control, budget planning and control, work scope definition, and program risk handling are necessary prerequisites for basic and effective program management control. The integrated schedule and budget plans should take into account risk handling plans.

DOD-I 5000.2

Enclosure 9, Section 4, paragraph d: Acquisition of Services Planning.
Consistent with the size and complexity of the program, Senior Officials or their designees shall consider the following (section 2330 of Reference (k)): Risk Management: An assessment of current and potential technical, cost, schedule, and performance risks and the plan for mitigating or retiring those risks.

DI-MGMT-81466A, Contract Performance Report (CPR)

Section 2.2.2 – Estimated Cost at Completion
These blocks shall present the contractor's range of estimated costs at completion. The range of estimates is intended to allow Supplier management flexibility to express possible cost outcomes. Contractors shall provide the most accurate Estimate at Completions (EAC) possible through program-level assessments of factors that may affect the cost, schedule, or technical outcome of the contract. Such program-level assessments shall include consideration of known or anticipated risk areas, and planned risk reductions or cost containment measures.

Section 2.2.2.3 – Management Estimate at Completion - Most Likely
Enter in Block 6.c.1 the contractor's most likely EAC. This EAC is the value that the contractor's management believes is the most likely outcome based on a knowledgeable estimate of all authorized work, known risks, and probable future conditions.

SRA Roles

Various roles must be fulfilled for an SRA to be successful.

Government Role

The Government has overall responsibility to understand the program risks and manage the program and works with the Supplier to identify, analyze and mitigate risks. The Government may receive and analyze an SRA performed by the Supplier or perform an Independent SRA on a program IMS.

Supplier (Contractor) Role

The Supplier has overall responsibility to follow the contract and conduct an SRA IAW the CDRL, DID, and other contractual requirements. The Supplier should:

- Document CAM / IPT specific inputs with rationale.
- Explain any changes to the critical path, margin erosion, and mitigation plans to the Government.
- Routinely incorporate SRA results into the risk management process.
- Report trends for completion dates.
- Incorporate SRA results into EACs.

CAM/IPT Role

CAMs / IPTs are responsible to:

- Identify any risk tasks within their control accounts.
- Develop three point estimates with rationale for their tasks.
- Be available to answer any questions throughout the SRA process.
- Develop mitigation plans for tasks deemed to be high risk.

Independent and Joint SRAs

An SRA may be run as an Independent SRA, with the Government using the IMS provided by the Supplier to perform the SRA, without Supplier participation. Alternatively, an SRA may be run as a Joint SRA with the Government and Supplier working together to perform the SRA. The following are key differences between these two types of SRAs.

Three Point Estimates

- Data for three point estimates are supplied by the Supplier for a Joint SRA.
- Government adjusts Supplier three point estimates or provides independent three point estimates for an Independent SRA.

IMS Preparation

- Adjustments to the IMS in preparation for the SRA are performed by the Supplier for a Joint SRA.
- Adjustments to the IMS in preparation for the SRA are performed by the Government for an Independent SRA.

This process document is based on the Government and Supplier conducting a Joint SRA. If the Government conducts an Independent SRA, Government personnel would take on the roles of the Supplier as well.

U.S. AIR FORCE

SRAs and Integrated Risk Assessments (IRAs)

An IRA is an AFMC/ASC mandated risk assessment process performed for certain major milestone reviews and periodically on major acquisition programs. An SRA is similar to an Integrated Risk Assessment (IRA) but there are notional differences that are outlined in the table below.

Component	SRA	IRA
Bottom Line Up Front	• Addresses known work & duration range • Given my current schedule of known work and duration range for tasks, when are the reporting tasks / key activities (such as Program Complete or other major program milestones) projected to finish?	• Addresses additional work & additional duration • Given my current schedule and quantified risks assumed to occur, requiring additional time and budget to accomplish work not previously acknowledged or planned, when are the reporting tasks / key activities projected to finish. This identifies the risks that have the potential to most impact the reporting tasks / key activities and focus risk mitigation efforts on these conditions.
Risk Objectives	• Quantify the impact to focus milestones' forecast finish dates, if risks are not mitigated.	• Quantify the impact of known risks to focus milestones' forecast finish dates, assuming risks occur.
Scope of Analysis	• Show schedule impact when a range of possible task durations are introduced by means of three point estimates on all discrete tasks. • Simulations determine a range of probabilities for focus milestone finish dates, if risks are not mitigated.	• Assess schedule impact of discrete tasks associated with risks as identified by the program. • Focus of analysis is only on probabilities and consequences for risk tasks. • Simulations determine a range of probabilities for focus milestone finish dates, assuming risks occur.

Data Points	• Supplier assigns minimum, most likely and maximum duration estimates for all discrete tasks in the IMS via one of the following methods:
	  • Tasks on the critical path, near critical paths, and tasks determined to contain risk are assigned individually determined three point estimates.
	  • All other tasks are assigned three point estimates via global edits.
		• Risk "if, then" statements are developed for each identified risk.
		• Assuming risk occurs, Supplier assigns minimum, most likely and maximum duration estimates in addition to the remaining durations only for tasks associated with risks.
		• Supplier assigns probabilities of occurrence for minimum, most likely and maximum duration estimates.
		• Supplier assigns probability for each risk occurring.

Schedule Health Assessment	• Schedule health metrics for entire IMS. • Focus is on the critical path, near critical paths, and tasks determined to contain risk.	• Schedule health metrics for entire IMS. • Focus is on the risk tasks and the tasks within their logic networks.

Data Preparation	• Supplier develops minimum, most likely and maximum duration estimates via individually determined three point estimates or global edits.	• Supplier has three weeks to complete the following, as assigned during first on-site meeting.
		  • Select a task in IMS associated with each identified risk.
		  • Assign a probability for each risk occurring.
		  • Develop minimum, most likely and maximum duration estimates in addition to the existing remaining durations for each task.
		  • Assign a probability of occurrence for each of the three point estimates.

On-Site Meetings	• No on-site meeting required. However, CAM / IPTs may be asked about their tasks in the IMS and the risk parameters (three point estimates) they have assigned if an on-site meeting is determined to be necessary.	• Two one-week long meetings:
		  • First week: Identify risks, create risk statements, and rate probability and consequence.
		  • Second week (occurring after three weeks for data preparation): Review and discuss / defend estimates and potentially address newly discovered risk items.

Risk Simulations	• Typically, for official results, one analysis including all tasks in the IMS is run.	• Multiple analyses may be run, generating related output. For example, each risk may be run individually and then all risks may be run together. • Other possibilities for different scenarios for comparison purposes also exist.

Entrance Criteria

The quality of the SRA is directly proportional to the quality of the Integrated Master Schedule (IMS). To conduct a comprehensive and credible SRA, the program must have a healthy schedule that includes an accurate network that clearly identifies the critical path and that is based on a minimum number of date constraints / target dates. More information related to schedule health is found under the Assess and Prepare IMS section.

Exit Criteria

A joint SRA is considered complete when the SRA outbrief has been delivered to the Government Program Manager. A contractor monthly SRA is considered complete when delivered to the Government.

Statistical Concepts

Below are statistical concepts that aid in understanding the SRA process and results.

Probabilities

- The probability of an event is a measure of how frequently that particular event occurs relative to all other possible events.
- Probabilities are usually expressed as a percentage (e.g. 50%), as a fraction (e.g. 1/2) or as a decimal value less than or equal to 1 (e.g. 0.5).
- The probability of a single event is determined by dividing the number of times that event occurs by the total number of possible events.
- The combined probability of all possible events is always exactly 1 (100%). This reflects one of the possible events definitely occurring.
- An example is a coin toss that has only two possible outcomes: "heads" and "tails". To put it another way, the coin is going to come up either "heads" or "tails" 100% of the time. Since either outcome is equally likely, we divide the 100% equally to a get a 50% likelihood, or probability, for either result.

Cumulative Probability

- Cumulative probability is the sum of probabilities up to and including some event. The cumulative probability is always between 0 and 1.
- For an SRA, this indicates the likelihood of completing on or before a specific date or equal to or less than a specific cost.
- In the example below, there is a 50% chance of Event A finishing on or before 7/17/12. There is a 90% chance of Event A finishing on or before 7/30/12.

Completion Probability Table for Event A

Prob	Date	Prob	Date
0.05	7/2/12	0.55	7/17/12
0.10	7/3/12	0.60	7/18/12
0.15	7/9/12	0.65	7/19/12
0.20	7/10/12	0.70	7/23/12
0.25	7/11/12	0.75	7/24/12
0.30	7/12/12	0.80	7/25/12
0.35	7/12/12	0.85	7/26/12
0.40	7/13/12	0.90	7/30/12
0.45	7/16/12	0.95	8/1/12
0.50	7/17/12	1.00	8/14/12

Completion Probability Table

Mean

- The mean is the average or norm.
- To calculate the mean, add up all the values to find a total. Then divide the total by the number of values added together.
- Example: 2 + 5 + 9 + 4 + 2 + 3 = 25. There are six values and the total is 25. Thus, the mean is 4.17 (25 divided by 6).

Median

- The median is the middle value in a group.
- To determine the median, put all values in order from lowest to highest. The median is the middle value.
- If there are two values in the middle, the median equals the mean of these two values.
- Example: The values 4, 7, 5, 9, 2, 6, 0 would be reordered to 0, 2, 4, 5, 6, 7, 9. The median is 5 because this is the value that falls in the middle of the group.

Mode

- The mode is the value that occurs most frequently in a group.
- To determine the mode, count how many of each value appears. The mode is the value that appears the most.
- There can be more than one mode.
- Example: For values 2, 5, 6, 6, 7, 9, 9, the mode is 6 and 9 because these values occur the most frequently.

Range

- The range is the difference between the lowest and highest value.
- To calculate the range, find the highest and lowest values in a group. Then subtract the lowest value from the highest value.
- Example: For values 2, 2, 3, 6, 6, 8, 10, 10, 13, 14, 15, 15, the lowest value is 2 and the highest value is 15. The range is 13 (15-2).

Standard Deviation

- Standard deviation indicates the degree of clustering around the mean (average) value.
- The greater the standard deviation, the less clustering. Therefore, possible completion dates or costs are spread further apart.
- The greater the standard deviation, the mode, median and mean values are less pronounced and other dates have a greater likelihood of occurring.

Confidence Interval

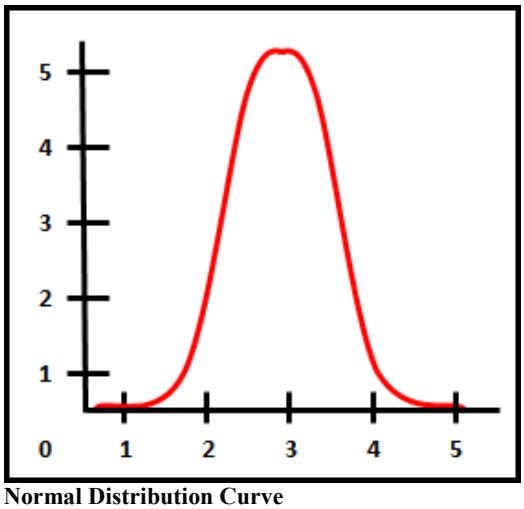
- The confidence interval indicates the quality of the estimate (sampling error).
- The confidence interval is always centered around the sample mean.
- Says in effect: "I don't know where the real mean is, but I know it's around here somewhere."
- The wider the confidence interval, the more likely it is to contain the real mean. We can be 100% certain that the real mean lies between +/- infinity, but that is not useful information.
- Sampling error is unavoidable but can be reduced by repeat sampling.
- Example: If the 95% confidence interval is 0.7 days and the expected finish date is March 3, 2012, then we are 95% confident that the mean (expected finish date) is accurate within +/- 0.7 days, indicating the possible amount of variation for the expected finish date. The actual expected completion date lies between March 2, 2012 and March 4, 2012.

Distribution Curves

Distribution curves represent how data is arranged according to the frequency of occurrence, resulting in a graph of a frequency distribution. The following are four types of distribution curves that are relevant to SRAs. Information about how to select a distribution during an SRA is provided under the Determine Distribution Curves section.

Normal Distribution Curve

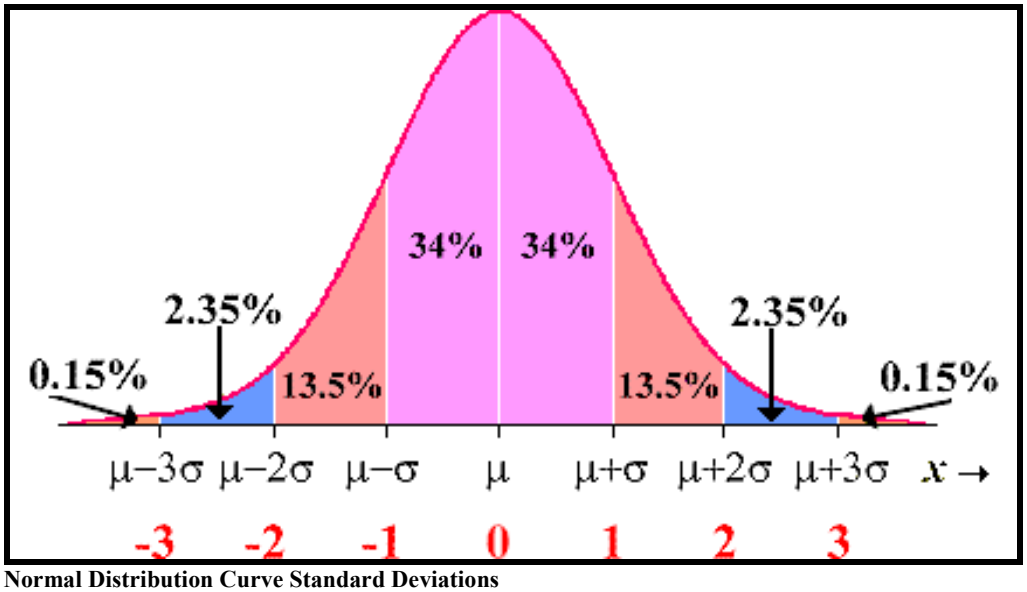
- The mode and mean are always the same.
- Most events occur near the peak.
- Events in the tails are unlikely to occur.



Normal Distribution Curve

Standard Deviations and the Normal Distribution Curve

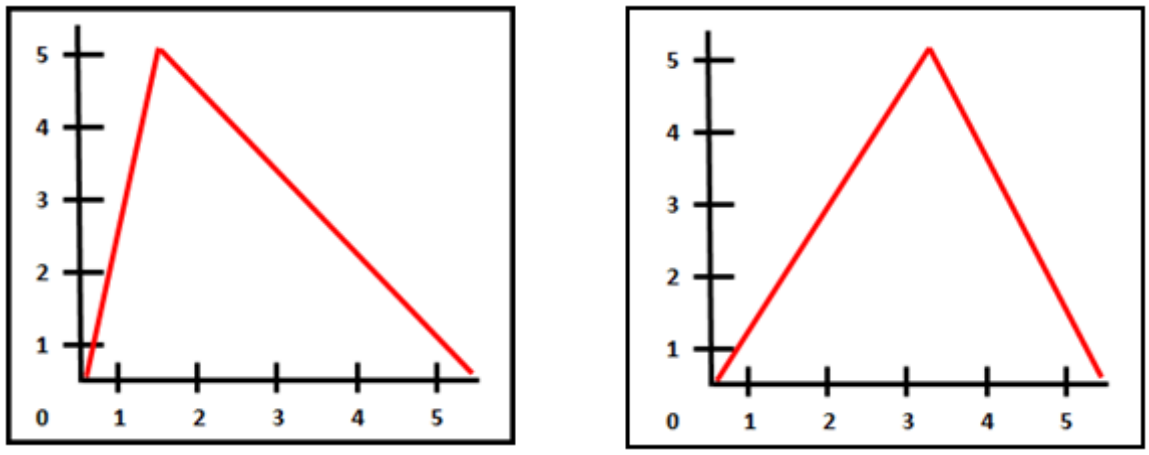
- 68% of the distribution lies within one standard deviation from the mean (1 sigma).
- 95% of the distribution lies within two standard deviations from the mean (2 sigma).
- 99.7% of the distribution lies within three standard deviations from the mean (3 sigma).



Normal Distribution Curve Standard Deviations

Triangular Distribution Curve

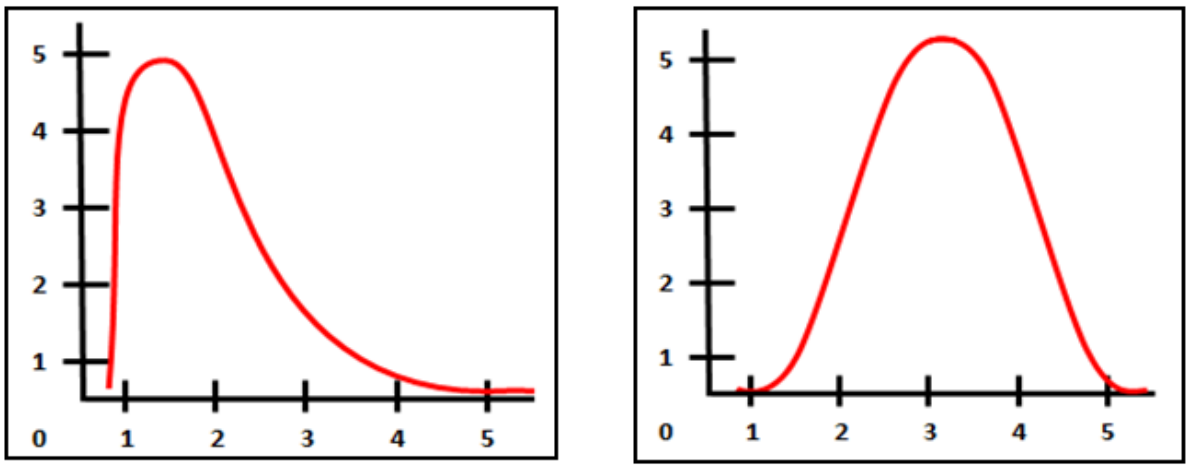
- The peak (mode) can be placed anywhere on the distribution.
- Probabilities decrease uniformly from mode to tails.
- Events in the tails retain significant probability of occurrence.
- Expect the "worst" or "best" but want to retain the possibility of things going "a little worse" or "a little better".



Triangular Distribution Curves

Beta Distribution Curve

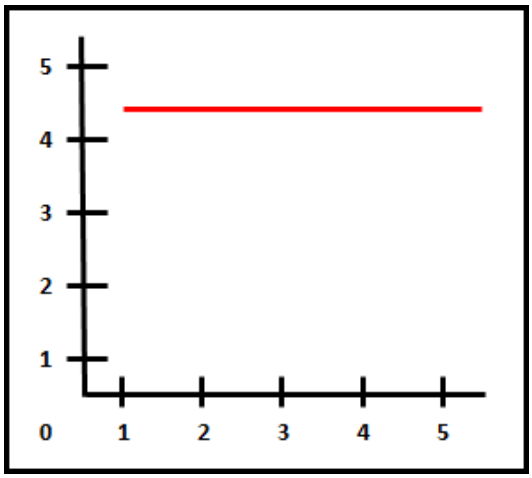
- The peak (mode) can be placed anywhere on the distribution.
- Probabilities decrease smoothly but quickly from mode to tails.
- Events at the tails are extremely unlikely.



Beta Distribution Curves

Uniform Distribution Curve

- All events are equally likely to occur.
- The most likely value is between the minimum and maximum values.
- May be chosen if there is not enough information to justify a more sophisticated guess.



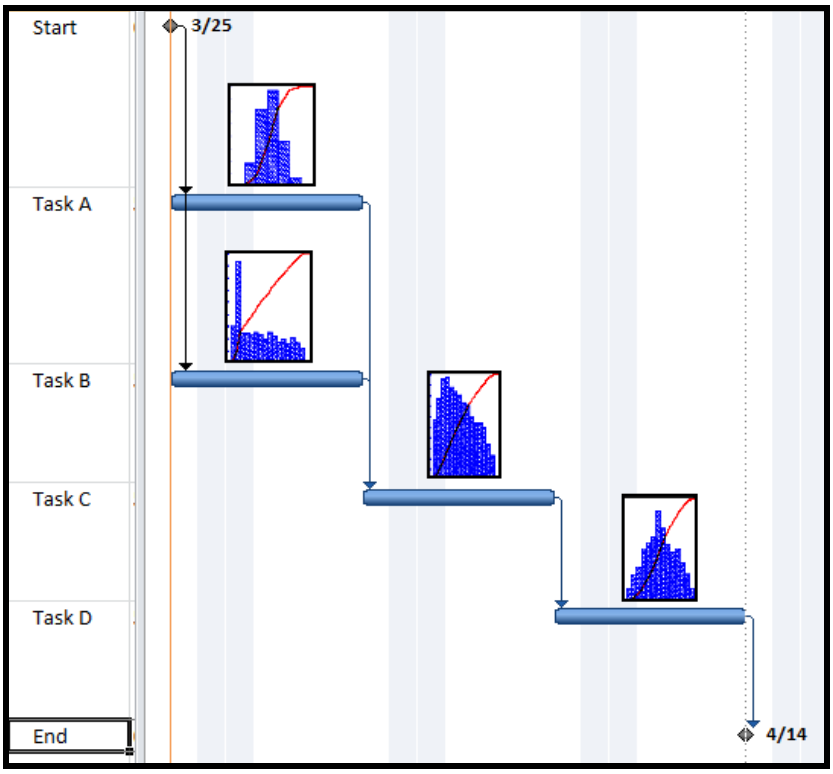
Uniform Distribution Curve

Monte Carlo Simulation

- Monte Carlo Simulation is a method of using statistical sampling to determine the probable outcome of an identified event.
- The simulation iterates up to thousands of possible outcomes, producing a probability distribution curve for each selected event.
- Software is used to conduct a Monte Carlo Simulation and produce the output for analysis.

Monte Carlo Simulation and the SRA

- For an SRA, this process is used to simulate risk in the program schedule by using inputs for the three point duration estimates applied to the schedule.
- The SRA simulates the schedule a large number of times (iterations), randomly selecting one remaining duration for each activity that is somewhere between the minimum and maximum values, according to the distribution chosen. A probability of completion using all the iterations is then calculated.
  - An SRA using a Monte Carlo simulation provides a more reliable project completion date prediction than the current forecast completion date for a number of reasons.
    - First, since there is no certainty that a task is going to take the exact amount of time entered into the schedule, each task has its own duration probability distribution. The simulation mimics each individual task's duration distribution, demonstrated in the chart below.



Simulation Representation

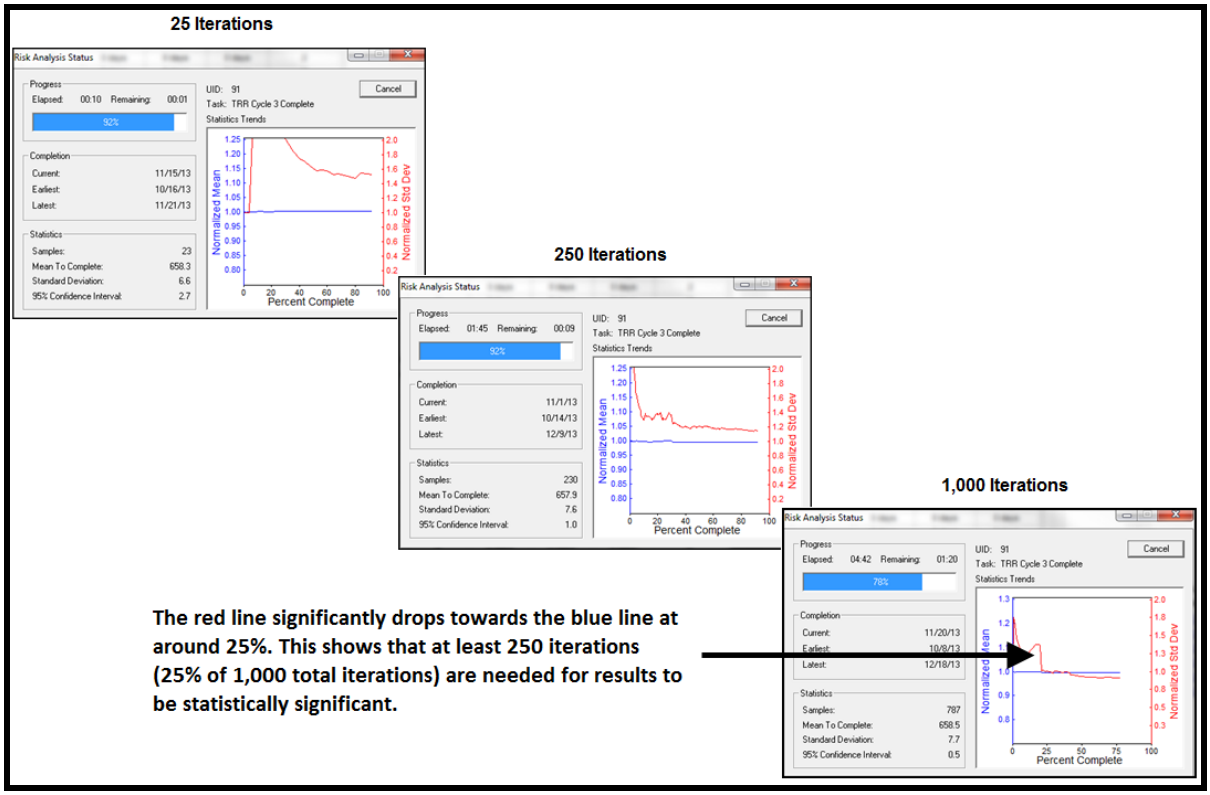
- Secondly, the schedule is composed of multiple tasks and many relationships between those tasks. There are a number of separate paths to the project completion. The lengths of these paths ebb and flow with the variations in task durations calculated during each iteration. The longest path to project completion is not static and may change with each iteration. For example, in the chart above a different duration for either Task A or B changes the longest path to project completion.

Statistical Significance

- In statistics, a result is called statistically significant if it is unlikely to have occurred by chance.
- Used as a measure of goodness of a statistical study.

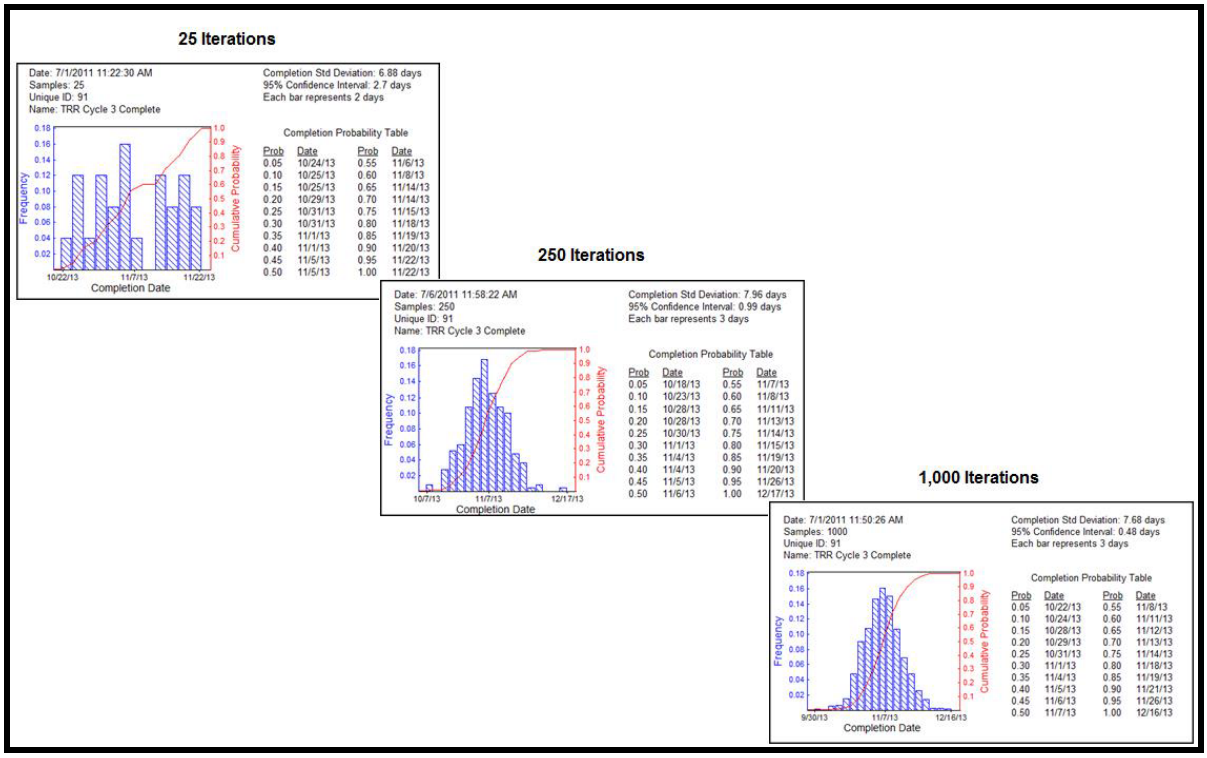
Statistical Significance SRA Results

- It is important to ensure the SRA results are statistically significant by running enough iterations during the Monte Carlo simulation.
- The illustration below depicts how this may be determined when running an analysis using Risk+ by studying when the line representing the normalized standard deviation drops towards the line representing the normalized mean.
- Typically, more iterations than necessary are run to get more confidence in the results, usually at least 1,000 iterations.



Statistically Significant Determination

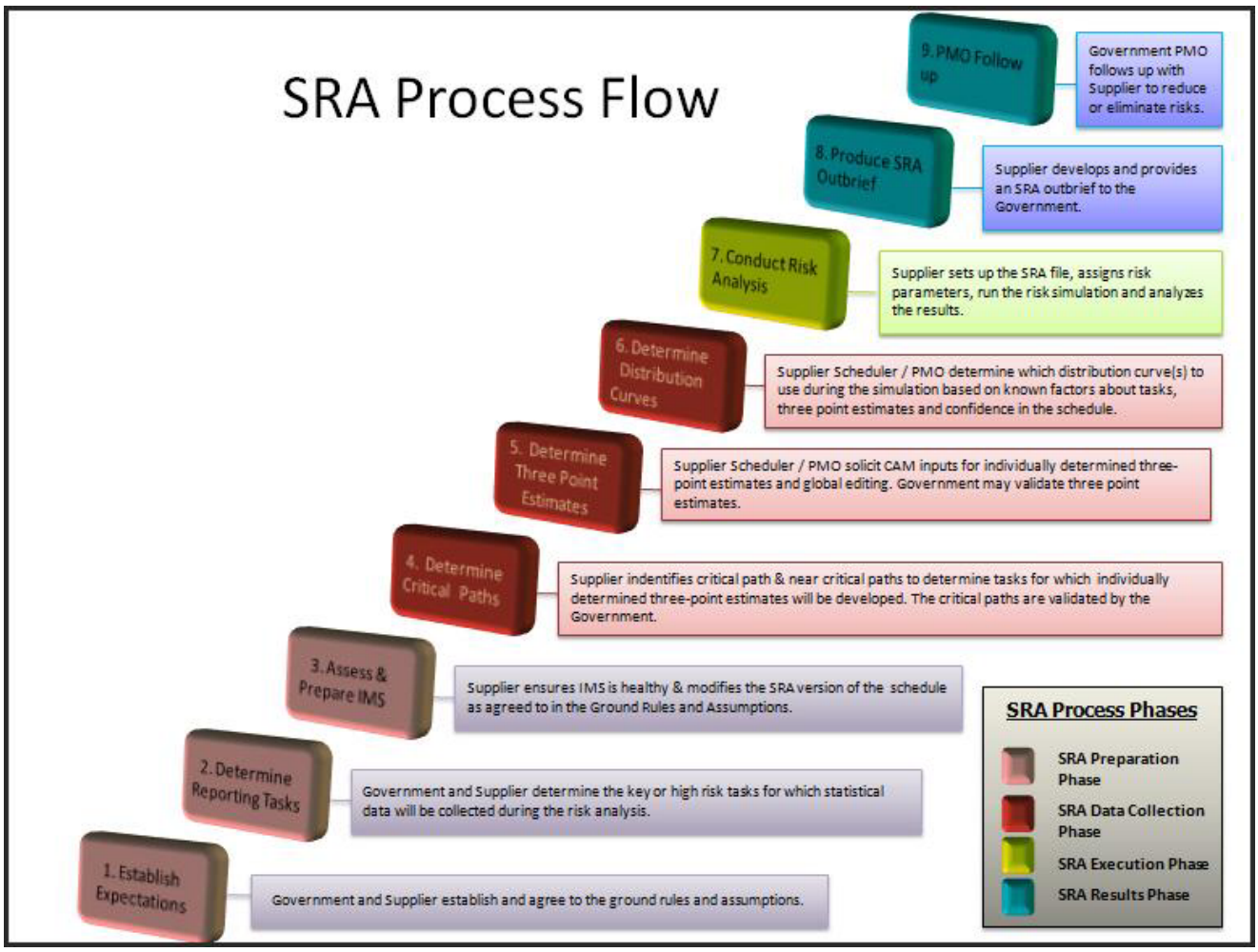
- The results below show how the distribution curve becomes more normalized as the number of iterations increase.



Difference in Result Based on Number of Iterations

SRA Process

The following process is based on the Government and Supplier conducting a Joint SRA.



SRA Process

Note: Much of this process documentation is based on using Risk+ with Microsoft Project or using Open Plan Professional but preparation and analysis techniques apply to most tools.

Preparation Phase

Establish Expectations

Ground Rules and Assumptions are established to ensure a consistent and thorough approach for the SRA. The Government and Supplier develop ground rules together to ensure a mutual understanding. This should occur early in the SRA process, prior to conducting the risk analysis. While not all information is known at this time, the Ground Rules and Assumptions should be as complete as possible and updated as more information becomes available.

The following points should be addressed and agreed to in the Ground Rules and Assumptions:

- Status date of the IMS to be used for the SRA.
- Milestone(s) used to calculate the critical path.
- Software to be used for the Monte Carlo simulation.
- Specific SRA outputs to be incorporated in the final SRA report
- Roles and responsibilities of participants.
- Standard views and reporting format.
- Acceptable schedule health metrics for schedule to be deemed ready for SRA. Corrections should be made until schedule passes.
- Reporting tasks / key activities that analysis is based.
- Schedule preparations for SRA:
  - Hard constraints / target dates removed.
  - Schedule margin tasks removed or set to zero duration.
  - Logic for level of effort (LOE) tasks removed.
  - Risk fields checked and cleared if necessary (for Risk+).
- Tasks to receive individually determined three point estimates:
  - Critical path tasks.
    - Those with a total float less than or equal to zero days.
    - Could be subjectively defined using a custom field.
    - Could be determined with a longest path analysis tool.
  - Near-critical path tasks.
    - Definition should be in IMS Basis and Assumptions (IMS B&A), Program Unique Instruction, or other document.
  - High risk tasks.
    - Definition should be in the Risk Management Plan / Risk and Opportunity Management Plan (RMP / ROMP).
- Tasks to receive global editing.
  - All remaining discrete tasks.
- Method for determining global editing.
  - Duration variance analysis of prior or analogous work.
  - Use of Low / Med / High risk categories for remaining tasks.

Note: During the simulation, questions may arise regarding adjustments to logic or durations that CAMs / IPTs or other program personnel need to address. They should be available for immediate consultation while the simulation is conducted.

Determine Reporting Tasks / Key Activities

Risk+ uses the term *Reporting Tasks* and Open Plan uses the term *Key Activities*. The Government and Supplier identify and agree to the reporting tasks / key activities to be used for the SRA. These are key or high risk tasks that statistical data is collected for during the risk analysis. These should be high risk tasks or major program milestones or events that signify completed deliverables or the end of a program. The number of reporting tasks / key activities should be limited but at least two milestones should be identified, one near term (8-9 months out is optimal) and one at the end of the program. The key task or milestone used for the critical path trace is a recommended reporting task.

Assess and Prepare IMS

Assess the IMS

The foundation for the SRA is the IMS. Thus, the meaningfulness and validity of the SRA results are directly related to the quality of the IMS used during the SRA. A mechanically unsound schedule may have the following effects on an SRA.

- Soft constraints / target dates may prevent earlier risk estimates from forecasting realistically.
- Hard constraints / target dates prohibit tasks from starting and finishing as soon as possible or as determined by a simulation trial, making the network path irrelevant and prohibiting dates from freely calculating during simulations.
- Leads and lags hinder network logic and task durations from determining forecast dates, distorting simulations.
- High task durations may hide risk and inhibit the development of valid three point estimates.
- High float values absorb the impact of three point estimates.
- Lack of finish-start relationships inhibit tasks from properly propagating the impact through the network during simulations.
- Improper or missing logic ties prevent fluidity and distort simulations.
- Improperly statused tasks do not provide valid remaining durations as a basis for three point estimates and simulations.

The Supplier should check the following in the IMS:

- Is the status date correct?
- Are durations adequate for the work represented?
- Is the schedule statused completely and accurately up to the project status date?
- Are all forecast start dates after the project status date?
- Are all forecast finish dates after the project status date?
- Does work in the IMS match work in the IMP, SOW, and contract?
- Does the work in the IMS cover the entire program and all functions?
- Do at least 90% of tasks have a predecessor and a successor?
- Are at least 90% of remaining relationships finish-start?
- Are there limited / appropriate use of constraints / target dates?
- Is there only positive total slack / float?
- Is there limited use of leads or lags?
- Does status align with logic so there is not any out-of-sequence activities?
- Is there an unbroken critical path from time now to program finish?
- Is there sufficient detail in IMS to maintain insight / manage program?
- Do the logical task relationships between activities make sense?
- Does the schedule make overall sense?

Prepare the IMS

Once the schedule is deemed healthy, the Supplier makes a copy of the schedule and completes the following preparations for the SRA.

Check Constraints / Target Dates

- Risk+ uses the term *Constraint* and Open Plan Professional uses the term *Target Date*.
- There should be a limited use of constraints / target dates when performing a risk analysis so tasks are able to start and finish as soon as possible based on the network logic, allowing an accurate expected project finish date to be determined.
- All constraints/ target dates should be checked to determine why they are used and if they are going to make a difference in the risk simulation.
- Once checked, determine whether or not a constraint / target date should be removed.
- It is recommended that, at a minimum, all hard constraints be removed.
- For Risk+, convert Must Start On, Must Finish On, Start No Later Than, Finish No Later Than, and As Late As Possible constraints to As Soon As Possible or use judgment to substitute these with Start No Earlier Than or Finish No Earlier Than constraints, but only where necessary and appropriate.
- For Open Plan, convert On Target and Fixed Target types to None or use judgment to substitute these with Start No Earlier Than or Finish No Earlier Than target types. On Target and Fixed Target types constrain simulation trials. Start No Later Than and Finish No Later Than target dates are disregarded during the risk analysis so these may be left on activities without affecting the results.
- The only start constraints /target types that should be in a schedule are those used for near-tern resource planning purposes, for receiving items from other Suppliers when these schedules are not integrated into the prime schedule, or for receiving customer-directed authorizations / approvals. These tasks typically have “Start No Earlier Than” constraints / target types. The use of these constraints / target types should be limited and have explanations for their use well documented.
- All start and finish constraint / target types should be validated prior to removal. Once determined to be unnecessary, ensure that the schedule does not unintentionally change as a result of removing the constraint / target type. Arbitrarily removing these may have unintended consequences.

Remove LOE Logic

Remove logic for LOE and ensure the schedule is not changed as a result. The discrete network logic should be maintained. Proper logic should be captured in the detailed level tasks and LOE should not be on the discrete network logic path. LOE tasks may be found in the schedule by searching for *LOE* in the task names or in an EVM field, if available.

Clear Risk Analysis Fields (Risk+)

If using Risk+, check and clear risk analysis fields of any existing data and custom fields. Risk+ uses a number of optional data fields in Microsoft Project to perform various functions. It is important to ensure that these data fields are not already in use since information in these fields could be overwritten or skew results. The default data fields that are used by Risk+ are shown below.

Minimum Remaining Duration	Duration 1
Most Likely Remaining Duration	Duration 3
Maximum Remaining Duration	Duration 2
Duration Distribution Curve	Number 1
Task Reporting ID	Number 3
Branch Definition	Text 8
Branch ID	Text 9
Risk Critical Index	Number 4
Risk Critical Flag	Flag 1
Duration Mean	Text 27
Duration Standard Deviation	Text 28
Cost Mean	Text 29
Cost Standard Deviation	Text 30
Sensitivity Early Finish	Finish 8
Sensitivity Expected Finish	Finish 9
Sensitivity Late Finish	Finish 10
Sensitivity Range	Duration 10
Probabilistic Fixed Cost	Cost 10

Risk+ Default Data Field Usage

Check for Data

To check to see if these fields are in use, create a table showing each field column and determine if any there is any existing data.

Unique ID	Name	Probabilistic Fixed Cost	Minimum Remaining Duration	Maximum Remaining Duration	Most Likely Remaining Duration	Sensitivity Range	Sensitivity Early Finish	Sensitivity Expected Finish	Sensitivity Late Finish	Risk Critical Flag	Duration Distribution Curve	Task Reporting ID	Risk Critical Index	Branch Definition	Branch ID	Duration Mean	Duration Standard Deviation	Cost Mean	Cost Standard Deviation
1	**XYZ IMS**	**$0**	**1425 days**	**0 days**	**0 days**	**0 days**	**5/1/11**	**NA**	**NA**	**No**	**0**	**0**	**0**	**s Possible**					
2	**ones**	**$0**	**1425 days**	**0 days**	**0 days**	**0 days**	**5/1/11**	**NA**	**NA**	**No**	**0**	**0**	**0**	**s Possible**					
46	ct	$0	0 days	0 days	0 days	0 days	NA	NA	5/1/11	No	3	0	0				As Possible		
143	te	$0	0 days	0 days	0 days	0 days	NA	NA	6/8/11	No	4	0	0				As Possible		
92	te	$0	0 days	0 days	0 days	0 days	8/16/11	NA	NA	No	0	0	0	As Possible					
91	te	$0	0 days	0 days	0 days	0 days	10/4/13	NA	NA	No	0	0	0	As Possible					
90	te	$0	0 days	0 days	0 days	0 days	12/20/13	NA	NA	No	0	0	0	As Possible					
120	te	$0	0 days	0 days	0 days	0 days	2/7/14	NA	NA	No	0	0	0	As Possible					
121	/e	$0	0 days	0 days	0 days	0 days	10/14/16	NA	NA	No	0	0	0	As Possible					

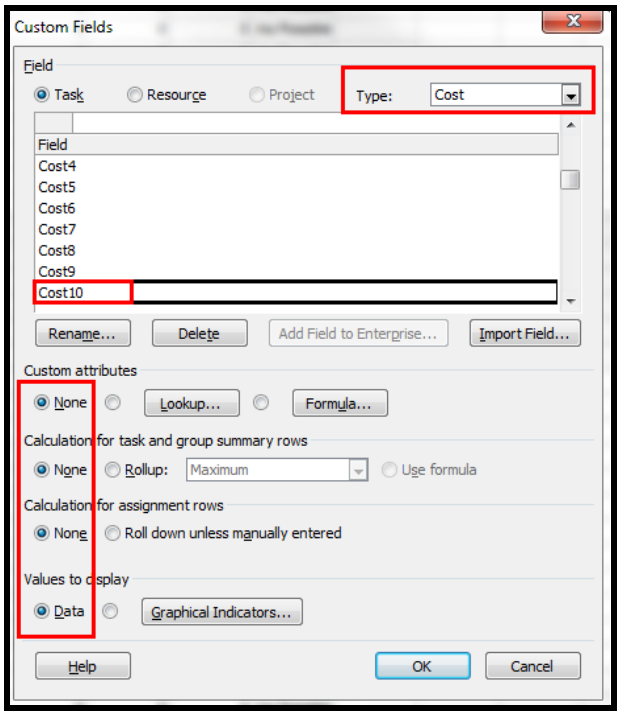
Risk+ Field Table

Check Custom Fields

To check to see if Risk+ fields are used as custom fields:

1. Select *Tools* > *Customize* > *Fields.*

2. Select each field that Risk+ uses and ensure the buttons for *None* and *Data* are selected.



Custom Fields

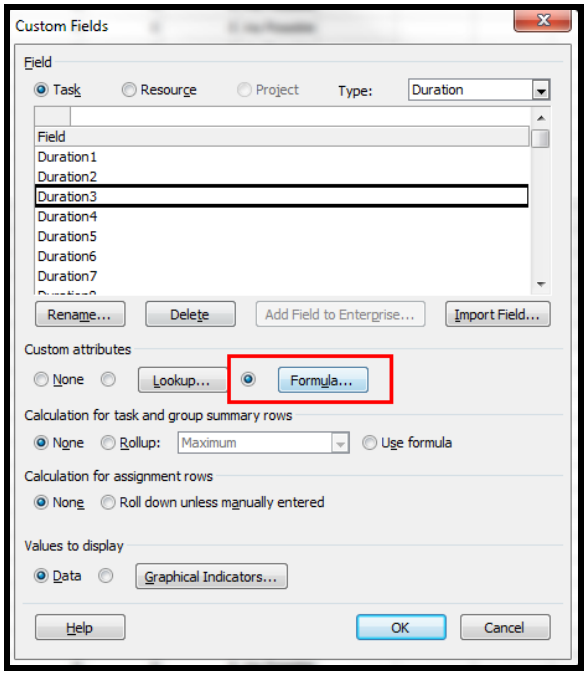
Options for Risk+ Fields

If a Risk+ field is in use, there are two options:

Delete or Move Data

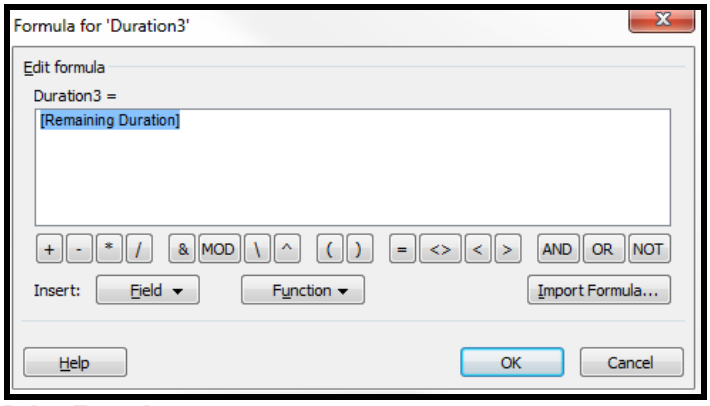
First, the data can be deleted from the Risk+ field and copied over to another field if it needs to be retained. If a Risk+ field is in use as a custom field, this can be removed by following these steps:

1. Select *Lookup*, *Formula* or *Graphical Indicators*, depending on the one used.



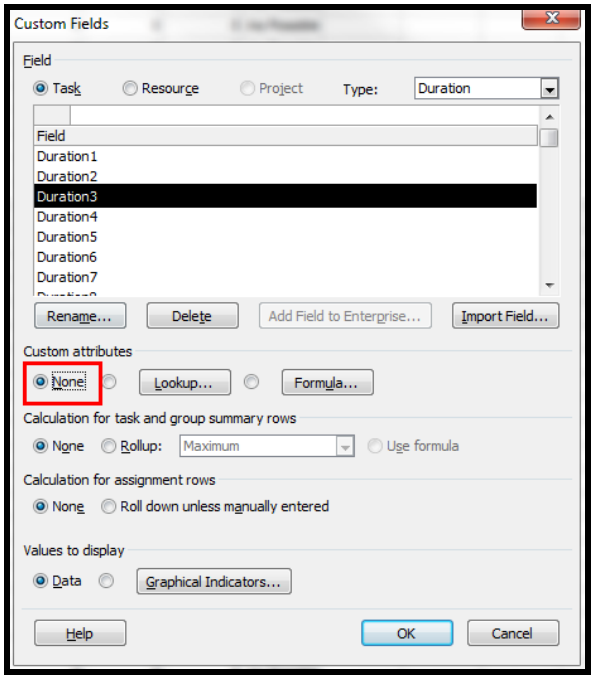
Custom Fields

2. Delete any lookup values, formulas, or graphical indicators associated with the fields.



Delete Formula

3. Select the *None* or *Data* button for the field.



Custom Fields

4. Clear the data in the field. In this example, Duration 3 is the Most Likely Remaining Duration column.

Unique ID	Name	Probabilistic Fixed Cost	Minimum Remaining Duration	Maximum Remaining Duration	Most Likely Remaining Duration	Sensitivity Range	Sensitivity Early Finish	Sensitivity Expected Finish	Sensitivity Late Finish
1	**XYZ IMS**	**$0**	**1425 days**	**0 days**	**0 days**	**0 days**	**5/1/11**	**NA**	**NA**
2	**ones**	**$0**	**1425 days**	**0 days**	**0 days**	**0 days**	**5/1/11**	**NA**	**NA**
46	ct	$0	0 days	0 days	0 days	0 days	NA	NA	5/1/11
143	te	$0	0 days	0 days	0 days	0 days	NA	NA	6/8/11
92	te	$0	0 days	0 days	0 days	0 days	8/16/11	NA	NA
91	te	$0	0 days	0 days	0 days	0 days	10/4/13	NA	NA
90	te	$0	0 days	0 days	0 days	0 days	12/20/13	NA	NA
120	te	$0	0 days	0 days	0 days	0 days	2/7/14	NA	NA
121	ve	$0	0 days	0 days	0 days	0 days	10/14/16	NA	NA
122	**nent**	**$0**	**1425 days**	**0 days**	**0 days**	**0 days**	**5/1/11**	**NA**	**NA**
444	**)E**	**$0**	**1425 days**	**0 days**	**0 days**	**0 days**	**5/1/11**	**NA**	**NA**
445		$0	110 days	0 days	79 days	0 days	5/1/11	NA	NA
446		$0	260 days	0 days	260 days	0 days	10/3/11	NA	NA
447		$0	260 days	0 days	260 days	0 days	10/1/12	NA	NA
448		$0	260 days	0 days	260 days	0 days	9/30/13	NA	NA
449		$0	260 days	0 days	260 days	0 days	9/29/14	NA	NA
450		$0	265 days	0 days	265 days	0 days	9/28/15	NA	NA
451		$0	10 days	0 days	10 days	0 days	10/3/16	NA	NA
147	**w**	**$0**	**0 days**	**0 days**	**0 days**	**0 days**	**NA**	**NA**	**6/8/11**
146		$0	0 days	0 days	0 days	0 days	NA	NA	5/26/11

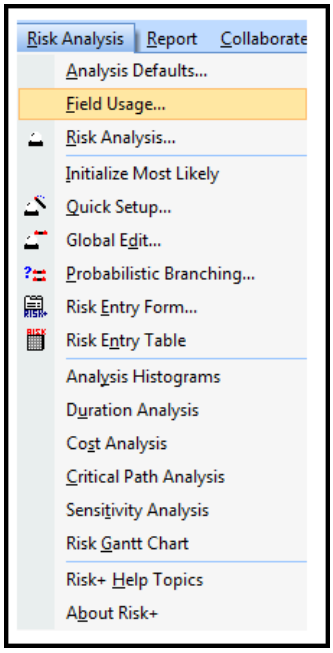
Clear Data

Note: It is important to understand why a field is in use before deleting any data.

Change Risk+ Field

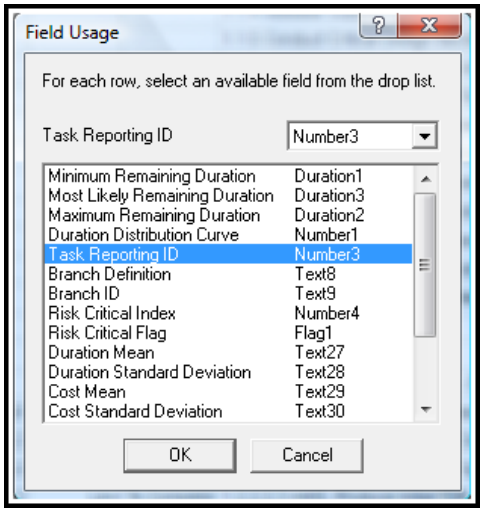
Alternatively, the Risk+ data fields can be changed by following these steps:

1. Select Field Usage from the Risk Analysis menu.



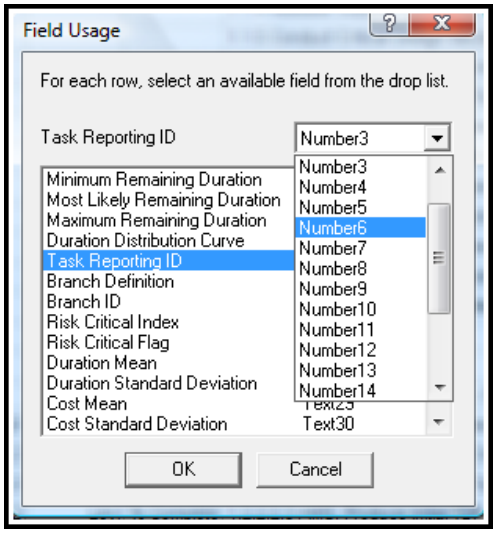
Field Usage Menu Option

2. Select the Risk+ field to modify.



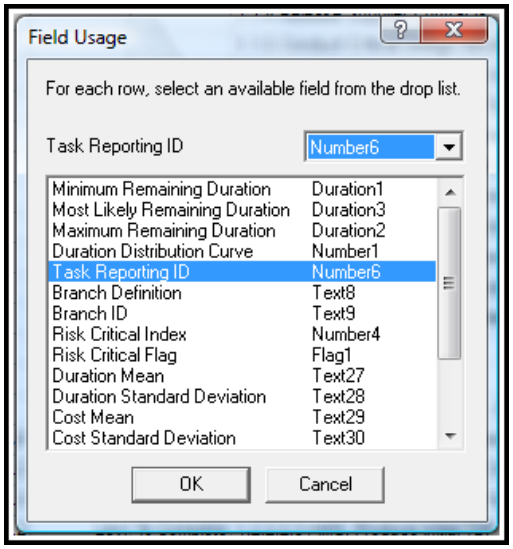
Select Data Field

3. Select a new project data field from the dropdown list.



Select Replacement Data Field

4. The new data field selection is reflected in the Field Usage box.



Verify Data Field Replacement

5. Repeat steps 2-4 for any additional fields that require modification.

Data Collection Phase

Determine Critical Paths

Critical Path

The critical path is the longest path through the network in terms of the amount of time the entire project takes. The tasks included on the critical path are assigned individually developed three point estimates for the risk analysis. The Supplier identifies the critical path that is then validated and agreed to by the Government. Follow the steps below to calculate the critical path:

Microsoft Project:

1. Make a copy of the schedule.
2. Ensure all logic for LOE tasks has been removed.
3. Identify the latest finishing key task or milestone that the critical path is traced from.
4. Ensure all hard constraints have been removed and also remove soft constraints, except for 'no earlier than' constraint types.
5. Assign an appropriate, temporary deadline on the last task or milestone and recalculate the schedule.
6. Manually trace the critical path from the last task or milestone. Tasks with the lowest total float are those pushing the end finish date.

Open Plan Professional:

1. Make a copy of the schedule.
2. Ensure all logic for LOE activities has been removed.
3. Identify the latest finishing key activity or milestone that the critical path is traced from.
4. Ensure all On Target and Fixed Target types have been removed and also remove soft target types, except for 'No Earlier Than' target types.
5. Assign an appropriate, temporary On Target date on the last activity or milestone and recalculate the schedule.
6. Use Open Plan Professional's Trace Critical Path Facility to trace the critical path from the last activity or milestone.

Near-Critical Paths

Depending how many tasks are on the critical path, additional near-critical paths may also be included in the risk analysis to provide more fidelity by increasing the number of tasks receiving individually determined three point estimates.

Determine Three Point Estimates

The most significant input for risk analysis includes assigning minimum, most likely, and maximum remaining duration values for each tasks.

- **Most Likely Duration**:
  - Risk+: The most likely remaining working days required to complete a task. The most likely duration estimate is usually equal to the remaining duration found in the schedule. However, in some cases, it may be necessary to modify these values if the schedule is too optimistic or pessimistic.
  - Open Plan Professional: The most likely total working days required to complete a task. The most likely duration estimate is usually equal to the original duration found in the schedule. However, in some cases, it may be necessary to modify these values if the schedule is too optimistic or pessimistic.

- **Best Case / Optimistic / Minimum Duration**: The minimum remaining working days required to complete a task that has at least a 5 percent chance of occurring. The estimator should be able to list the success factors necessary for the duration estimate to occur.

- **Worst Case / Pessimistic / Maximum Duration**: The maximum remaining working days required to complete a task that has at least a 5 percent chance of occurring. The estimator should be able to list the delaying factors necessary for the duration estimate to occur.

The terms for explaining durations vary from organization to organization. The following table groups the more common terms together.

Minimum	**Most Likely**	**Maximum**
Optimistic	**Normal**	**Pessimistic**
Best Case	**Duration**	**Worst Case**

Duration Terms

Three point estimates may be derived from applying individual three point estimates or global edits, both introducing risk and opportunities to the networked schedule.

Individually Determined Three Point Estimates

The following types of tasks are evaluated and assigned individually determined three point estimates with supporting rationale:

- **Critical Path Tasks**: Identified as the program critical path in the IMS
- **Near-Critical Path Tasks**: Specified in the CDRL in Block 16 and identified in the IMS
- **High Risk Tasks**: Identified in the program risk management plan or by a CAM / IPT

Some points to keep in mind when determining three point estimates include:

- Durations, not dates, should be considered when determining three point estimates.
- When using Risk+, the time left to complete work (remaining duration), not original duration, should be considered when determining three point estimates.
- When using Open Plan Professional, the original duration, not remaining duration, should be considered when determining three point estimates for in-progress activities. Original duration and remaining duration are equal for all other activities.
  Note: For in-progress activities, these duration estimates are later converted to be based on the remaining durations (which are based on user selections in the Activity Progress dialog box) during the risk analysis process. This process is completed in the background by Open Plan Professional.
- Only factors pertaining solely to a particular task's duration should be taken into account.
- Minimum and maximum durations should be based on reasonable optimism and pessimism.
- Extreme situations, such as a tornado destroying the plant, should not be factored into the estimates. As such, an estimate must have at least a 5 percent chance of occurring.
- Three point estimates are documented in data worksheets with rationale provided for the minimum and maximum duration estimates for each task.
- A review of actual past program performance, if available, may aid in determining three point estimates.
- Government may validate three point estimates.

Note: Some programs constrain the best case and worst case remaining durations to those values that have a 90 percent confidence. This reduces the distribution tail skewing. Document the definitions used for the three point estimates in the SRA Ground Rules and Assumptions and in the SRA report.

The following is an example of data collected for individually determined three point estimates:

Three Point Estimates										
						MIN	ML	MAX	MIN DELTA	MAX DELTA
Activity Unique ID	WBS / IPT	CAM	Crtcl Path	Activity Description	Org Dur (in days)	Opt Dur (in days)	Rem Dur (in days)	Pess Dur (in days)	Rationale	Rationale
214375	1.2.1.3.1.12.4.1	A Smith	CP1	Validate Data Load Dry Run 2	7	6	6	8	Duration is based on past execution time and previous client set-up tasks There are no anticipated changes.	The IST client build strategy has changed. Possible unanticipated or changed requirements may occur.
214480	1.2.1.3.1.12.4.1	A Smith	CP1	Execute Backup of Dry Run 2 Client	1	1	1	2	Duration is based on past execution time and previous client set-up tasks There are no anticipated changes.	Duration is based on past execution time and previous client set-up tasks There are no anticipated changes.
214490	1.2.1.3.1.12.4.1	A Smith	CP1	Record Mercury Scripts for Critical Processes	5	3	5	12	N/A	IST client build strategy has changed, resulting in a possible delay in completing this task.
208480	1.2.1.3.1.12.6.1.2	A Smith	CP1	Load Open Purchase Orders - Mock 2	25	4	7	8	Day-by-day plan supports completion within the MIN duration.	Approximately 81% of the delivered records have been successfully loaded. 2 data types have not yet been started. Softw are changes that occurred in IST testing have had unforseen impacts on the conversion programs.
214440	.1.2.1.3.1.12.3.1	A Smith	CP1	Import All Transports into RQ Dry Run 2	1	1	1	3	Duration is based on past execution time. There is no anticipated changes.	Time to execute will vary based on the number of outstanding transports. If the transport queue is larger than expected, the duration will increase. OT will be utilized if needed.
214500	1.2.1.3.1.12.3.1	A Smith	CP1	Restore Dry Run 2 Client	1	1	1	2	Duration is based on past execution time. There are no anticipated changes.	Duration is based on past execution time. There are no anticipated changes.

Individually Developed Three Point Estimate Data Collection

Global Editing / Risk Banding

Global editing, also known as risk banding, refers to the process of applying a Low, Medium, or High risk rating to a group or groups of activities. This serves as a convenient way to apply three point estimate inputs to large portions of the schedule. Tasks may be grouped based on a similar risk characteristic, CAM / IPT, Work Breakdown Structure (WBS) or technical issue associated with risk. Global editing may be used for tasks that are not included on the critical path, near-critical paths, or deemed to be high risk. These are tasks that are not required to have individually developed three point estimates assigned. Rationale must be provided when identifying risk levels. The risk ratings are defined below.

- **Low Risk**: There is a good chance the team meets or exceeds the Most Likely Duration identified in the schedule.
- **Medium Risk**: There is a good chance the team meets the Most Likely Duration identified in the schedule.
- **High Risk**: There is a good chance the team does not meet the Most Likely Duration identified in the schedule.

Percentages for minimum and maximum durations need to be determined for global editing. The following are examples of values for low, medium, and high risk based on sample durations.

Most Likely Duration	Low Risk		Medium Risk		High Risk	
	85%	110%	90%	115%	95%	125%
	Min	Max	Min	Max	Min	Max
1	0.85	1.1	0.9	1.15	0.95	1.25
4	3.4	4.4	3.6	4.6	3.8	5
8	6.8	8.8	7.2	9.2	7.6	10
16	13.6	17.6	14.4	18.4	15.2	20
32	27.2	35.2	28.8	36.8	30.4	40

Percentages of most likely durations to use for tasks identified as low, medium or high risk

Resulting minimum and maximum remaining durations

Example of Global Editing Percentages

For example, using the percentages above for a task that has a most likely duration equalling16 days and is deemed to be medium risk:

- Minimum Duration = 14.4 days (90% of 16 days)
- Maximum Duration = 18.4 days (115% of 16 days)

The following is an example of data collected for global edits:

Global Risk Assignment Spreadsheet							
WBS Code	Total Activities	CAM	WBS Name	Start	Finish	Risk (Low, Medium, High)	Rationale
PM-1.1.1.2.1.2	2	P Smith	ILS Management	5-Mar-07	11-Jun-07	Low	No outstanding ILS issues. Anticipate favorable results for MS C ILA.
PM-1.1.1.2.1.4	95	P Smith	Interface Control Agreement (ICA) Development Process	28-Aug-06 A	14-Apr-08	Low	All the ICAs and DCAs requried for 1.0 are identified and in the process of being developed
PM-1.1.1.2.1.4.1	72	P Smith	Interface Control Agreement (ICA) Development Process [1.0]	28-Aug-06 A	16-Aug-07	Low	All the ICAs and DCAs requried for 1.0 are identified and in the process of being developed
PM-1.1.1.2.1.4.1.1	3	P Smith	DFAS - ADS ICA [1.0]	29-Aug-06 A	6-Aug-07	Medium	This is a new DFAS system and also includes ADS FRB with Treasury so there is greater risk of delays.
PM-1.1.1.2.1.4.1.1.1	3	P Smith	Tech Execution	29-Aug-06 A	6-Aug-07	Medium	This is a new DFAS system and also includes ADS FRB with Treasury so there is greater risk of delays.
PM-1.1.1.2.1.4.1.1.1.1	3	P Smith	Establish system to system connectivity	29-Aug-06 A	6-Aug-07	Medium	This is a new DFAS system and also includes ADS FRB with Treasury so there is greater risk of delays.
PM-1.1.1.2.1.4.1.2	3	P Smith	DFAS - APVM/PPVM ICA [1.0]	28-Aug-06 A	6-Aug-07	Medium	This requires hosting with DISA which requires funding which increases risk.
PM-1.1.1.2.1.4.1.2.1	3	P Smith	Tech Execution	28-Aug-06 A	6-Aug-07	Medium	This requires hosting with DISA which requires funding which increases risk.
PM-1.1.1.2.1.4.1.2.1.1	3	P Smith	Establish system to system connectivity	28-Aug-06 A	6-Aug-07	Medium	This requires hosting with DISA which requires funding which increases risk.
PM-1.1.1.2.1.4.1.3	2	P Smith	DFAS - CMET ICA [1.0]	5-Mar-07	5-Apr-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.3.1	2	P Smith	Tech Execution	5-Mar-07	5-Apr-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.3.1.1	2	P Smith	Establish system to system connectivity	5-Mar-07	5-Apr-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.4	3	P Smith	DFAS - DCAS (FRS) ICA [1.0]	31-Aug-06 A	6-Aug-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.4.1	3	P Smith	Tech Execution	31-Aug-06 A	6-Aug-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.4.1.1	3	P Smith	Establish system to system connectivity	31-Aug-06 A	6-Aug-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.5	2	P Smith	DFAS - DDRS - B (GF/WCF) ICA [1.0]	2-Jul-07	16-Aug-07	Medium	Requirements are not clear about DDRS ability to replace FDR.
PM-1.1.1.2.1.4.1.5.1	2	P Smith	Tech Execution	2-Jul-07	16-Aug-07	Medium	Requirements are not clear about DDRS ability to replace FDR.
PM-1.1.1.2.1.4.1.5.1.1	2	P Smith	Establish system to system connectivity	2-Jul-07	16-Aug-07	Medium	Requirements are not clear about DDRS ability to replace FDR.
PM-1.1.1.2.1.4.1.7	3	P Smith	DFAS - DCPS ICA [1.0]	30-Oct-06 A	6-Aug-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.7.1	3	P Smith	Tech Execution	30-Oct-06 A	6-Aug-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.7.1.1	3	P Smith	Establish system to system connectivity	30-Oct-06 A	6-Aug-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.8	2	P Smith	DLMS CCR ICA [1.0]	5-Mar-07	26-Apr-07	Low	Connectivity established. Low risk.
PM-1.1.1.2.1.4.1.8.1	2	P Smith	Tech Execution	5-Mar-07	26-Apr-07	Low	Connectivity established. Low risk.

Global Editing Data Collection

Determine Distribution Curves

A distribution curve must be assigned to each task that has a three point estimate and is chosen based on known factors about the task, three point estimates and confidence in the schedule. These are used to model how durations should be selected during each iteration.

Different terms may be used to explain the same concepts related to distribution curves. The following table groups these terms together.

Most Likely (unless uniform distribution)	Less Likely (unless uniform distribution)
Peak	Edges
Mode	Tails

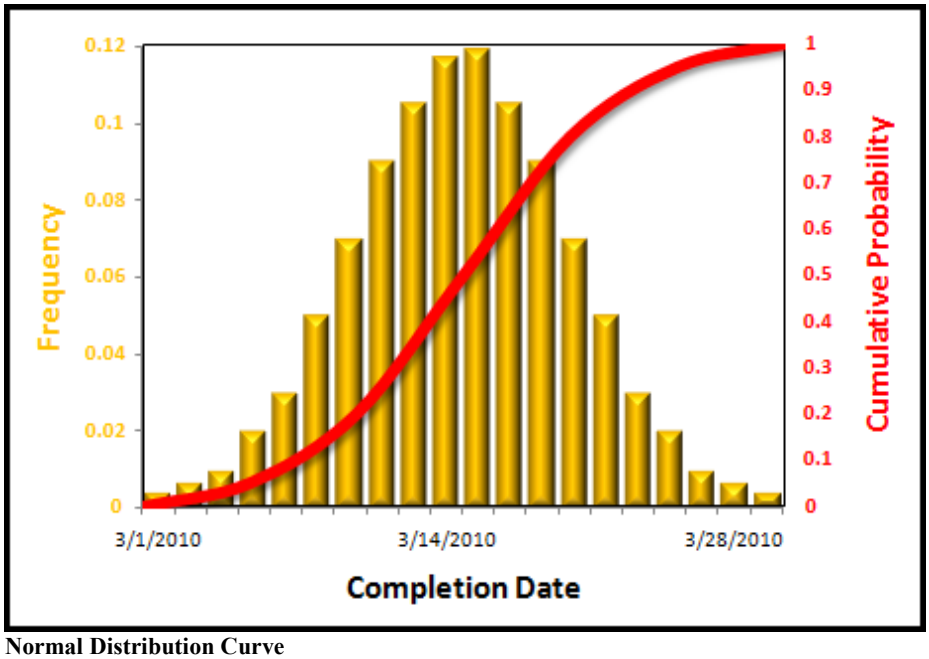
Distribution Curve Terms

Normal Distribution Curve

For a normal distribution curve, the most likely value is at the center of the distribution range. Most values occur near the peak, with those on the edges unlikely to occur. For this distribution, the mode and mean are identical.

A normal distribution curve is preferable when:

- Confidence in three point estimates is high and just as likely to be wrong either way.
  - Compared to the triangular distribution, the normal distribution has a lower standard deviation. As a result, values towards the edges are relatively less likely to occur while values near the center are relatively more likely. Thus, a normal distribution should be chosen over a triangular distribution with the same range when there is higher confidence in the estimates.
- Number of factors influencing the duration is relatively large.
  - The duration would be expected to change smoothly as more of the factors come into play. If the negative or positive factors are unlikely to all occur at once then it is unlikely that the extreme duration values occur. In this case, the smoother tapering off of probabilities in the normal distribution is preferred to the more abrupt triangular distribution where the probabilities remain significant to the edge of the distribution, then abruptly go to zero.
- Confidence in the schedule is high.



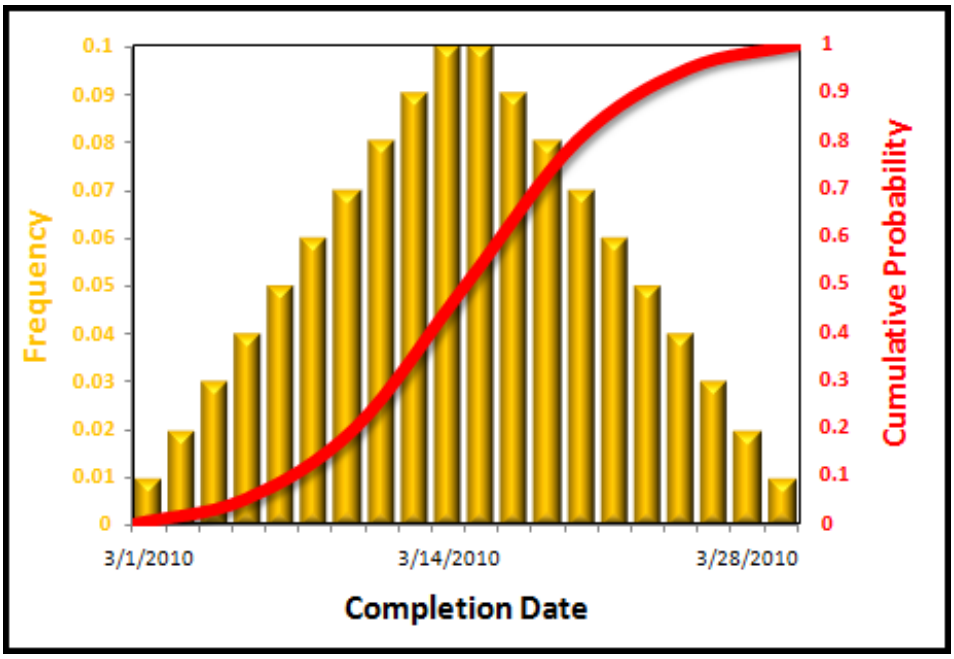
Normal Distribution Curve

Triangular Distribution Curve

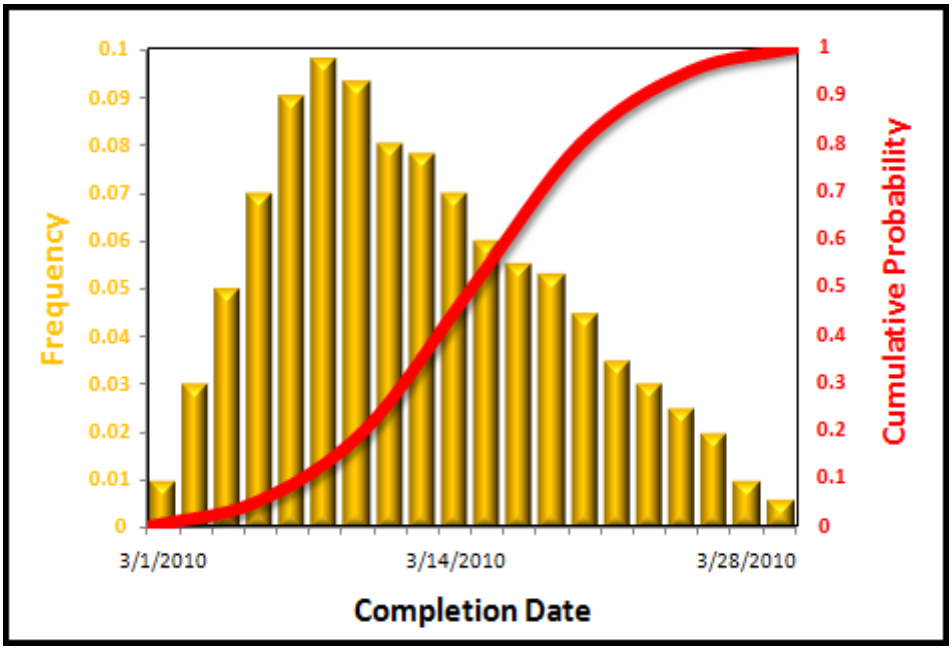
For a triangular distribution curve, the most likely value can be placed anywhere in the range of the distribution, not necessarily at the center, with the probabilities decreasing uniformly from the peak to the edges. Events at the edges retain significant probability of occurrence.

A triangular distribution curve is preferable when:

- The worst case or best case is expected but the possibility of things going "a little worse" or "a little better" still needs to be allowed.
  - Permitting the schedule to be skewed to the left or right provides a more realistic simulation result.
  - An example when triangular distribution would be preferable is for a task that should take four days to complete, but could possibly take five, and could even take six, but should definitely not take seven days.
- Number of factors influencing the duration is relatively small.
  - The duration would be expected to change significantly if those factors come into play.
- Confidence in the schedule is low.



Triangular Distribution Curve (1)



Triangular Distribution Curve (2)

Beta Distribution Curve

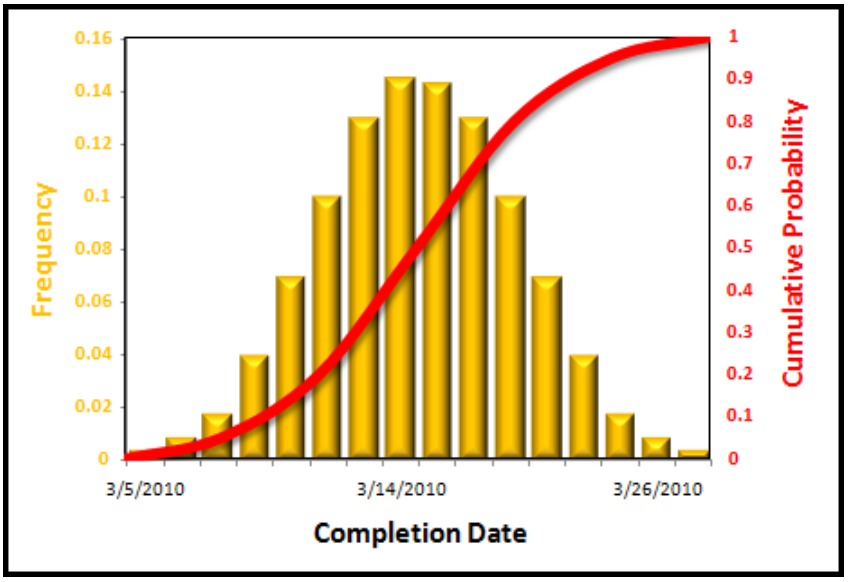
For a beta distribution curve, the most likely value can be placed anywhere in the range of the distribution, not necessarily at the center, with the probabilities decreasing smoothly but quickly from the peak to the edges. Events at the edges are extremely unlikely.

A beta distribution curve is preferable when there is a higher level of confidence in the estimates, resulting in fewer extreme values.

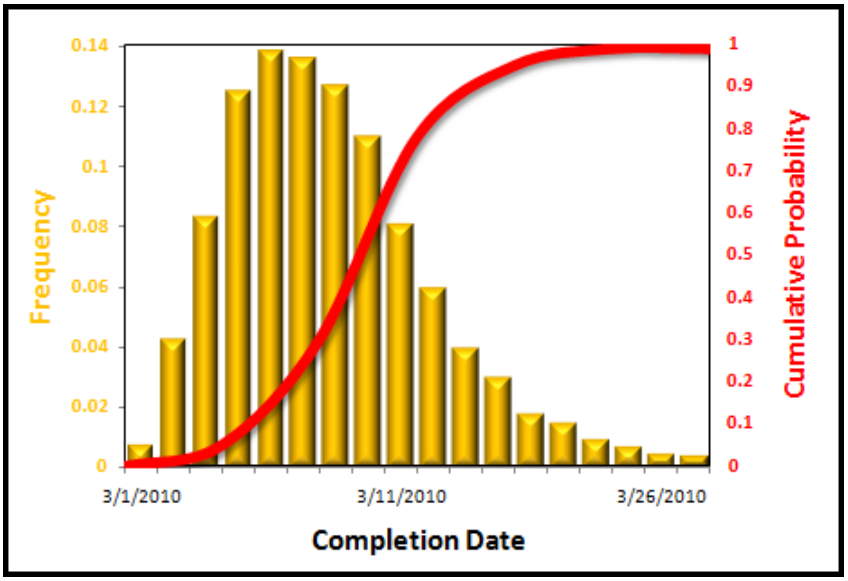
The beta distribution combines key qualities of the normal and triangular distributions. Specifically, it has the "smoothness" of the normal distribution. At the same time, the most likely value can be placed anywhere in the range, similar to the triangular distribution.

The attributes that distinguish the beta and triangular distributions are the same as those that distinguish the normal and triangular distributions. Therefore, a beta distribution would be preferable over a triangular distribution when the possible outcomes are expected to vary smoothly, and when extreme values are unlikely to occur. This distribution operates much like the triangular, but doesn't choose endpoints as often.

A beta distribution with the most likely value in the center of the range looks similar to a normal distribution. However, a beta distribution has a smaller standard deviation than a normal distribution with the same range that implies a higher level of confidence in the estimate.



Beta Distribution Curve (1)



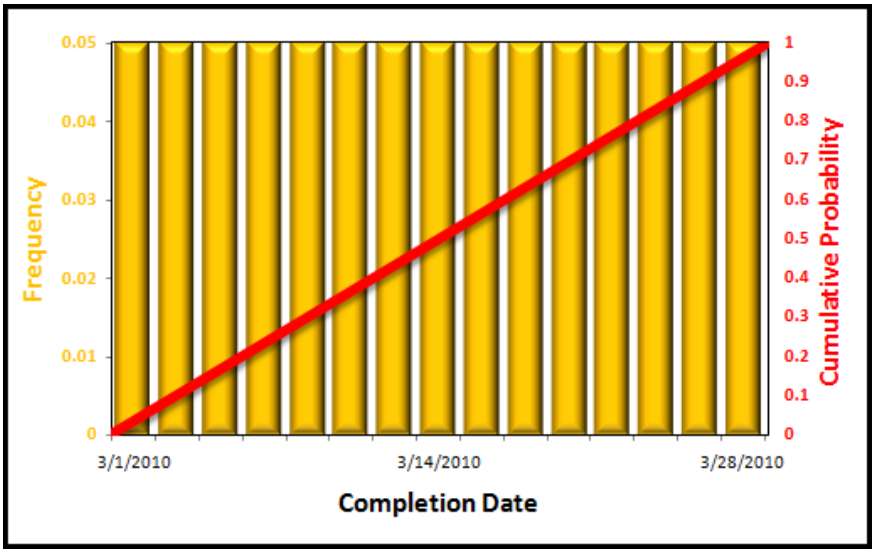
Beta Distribution Curve (2)

Uniform Distribution Curve

For a uniform distribution curve, the most likely value is between the minimum and maximum values so each task duration is equally likely to occur.

A uniform distribution curve is preferable when:

- No task duration is any more or less likely than others.
- There is not enough information to justify a more sophisticated guess.



Uniform Distribution Curve

Execution Phase

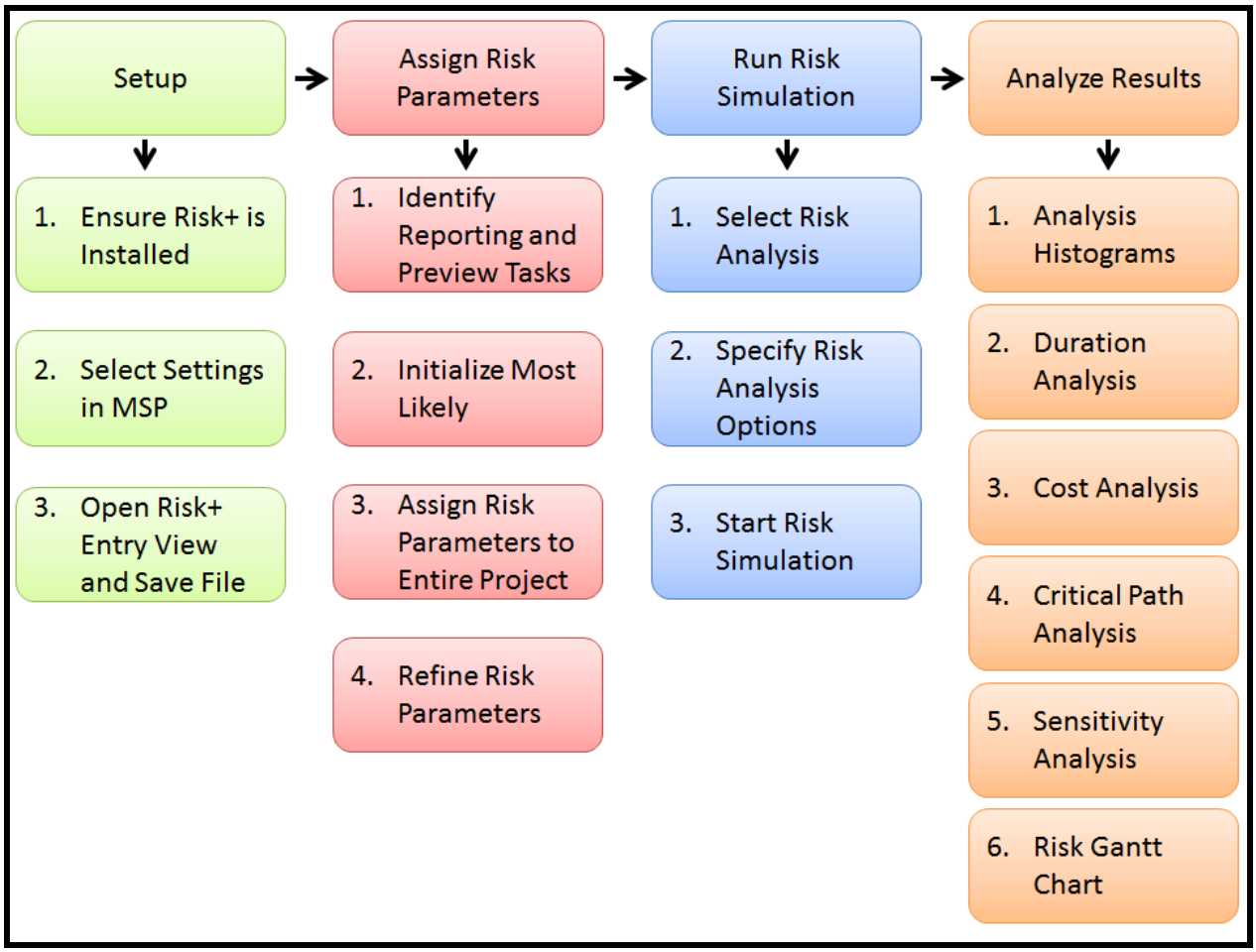
Conducting the risk analysis consists of the following steps:

- Set Up
- Assign Risk Parameters
- Run the Risk Simulation
- Analyze the Results

Various tools may be used to perform a risk analysis, including Risk+ and Open Plan Professional. Instructions for using both these tools are included below.

Risk+

The process for conducting an SRA using Risk+ includes four individual operations, as shown in the chart below. The significant activities associated with each are numbered below their respective operations.



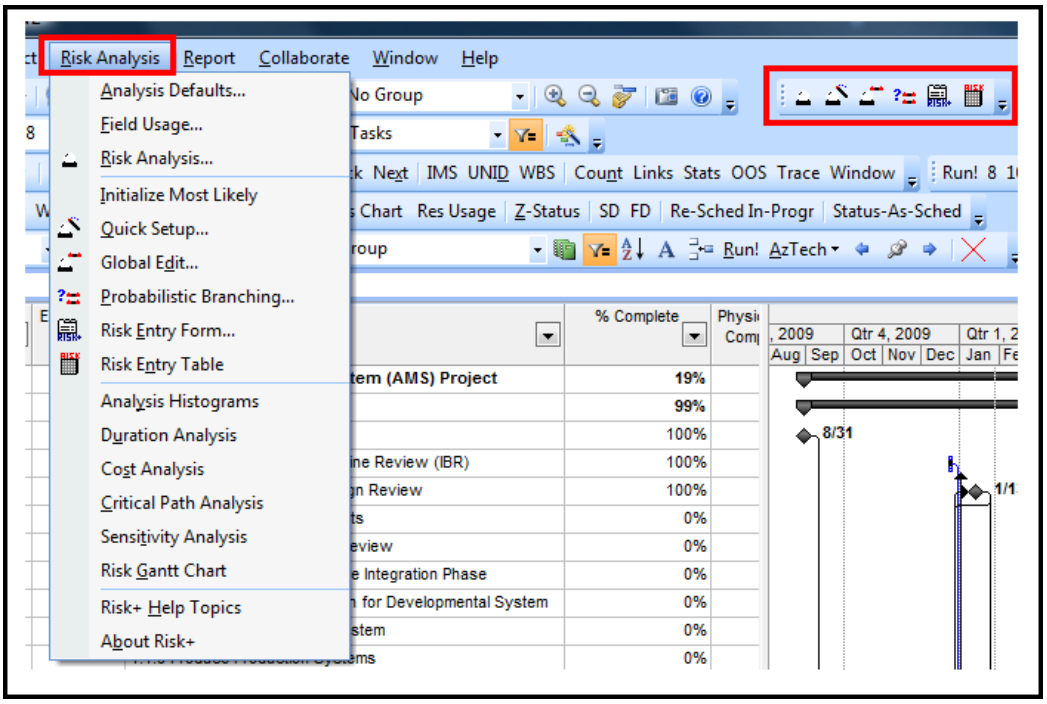
SRA Operations and Activities Using Risk+

Setup

Ensure Risk+ is Installed

Risk+ is a risk analysis add-in that integrates with Microsoft Project to quantify the cost and schedule risks associated with a project. Once installed, Risk+ becomes an internal tool within Microsoft Project with menu items, input screens, a risk analysis toolbar, and a Monte Carlo simulation tool. This allows for all risk analysis functions to be performed within Microsoft Project.

The screenshot below shows the Risk+ toolbar and menu that should appear once Microsoft Project is opened. These items are automatically added to Microsoft Project when Risk+ is installed. All necessary functions to complete a risk simulation and view results are listed under the Risk Analysis menu. Ensure that both the Risk+ toolbar and menu appear when the Project file is opened.

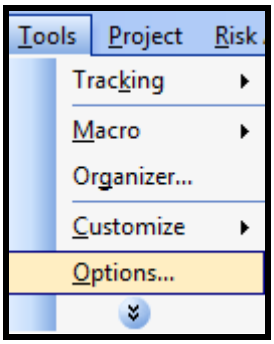


Risk+ Toolbar and Menu

Select Settings in Microsoft Project

Microsoft Project has several settings that need to be checked and possibly modified prior to running the risk analysis.

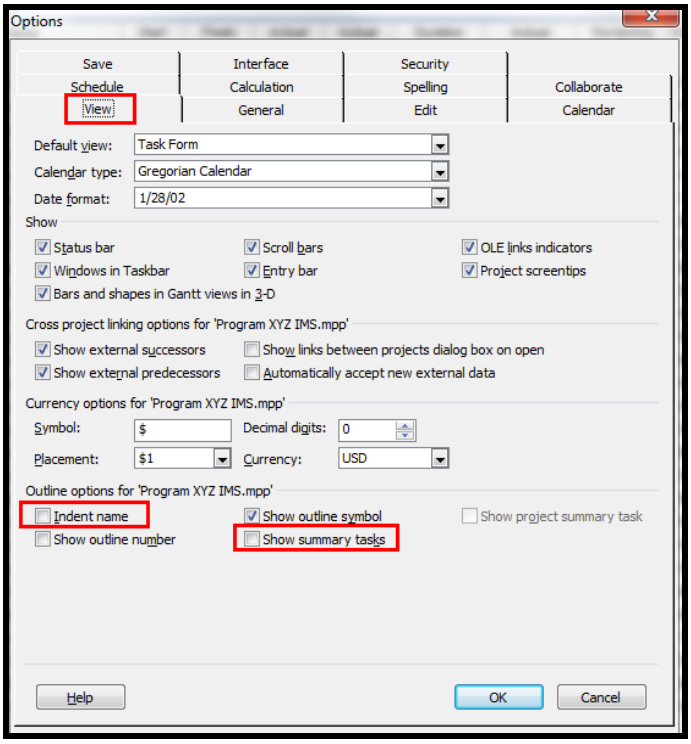
Select *Tools* > *Options* to check the settings.



Tools Menu

View Settings

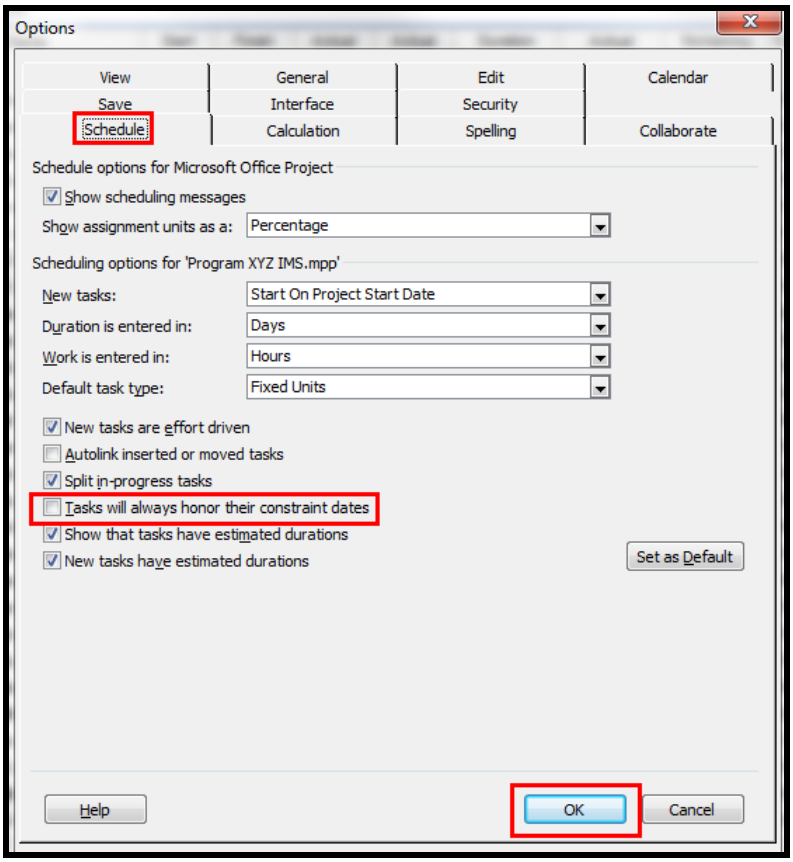
1. Select the *View* tab.
2. *Indent name* should not be selected.
3. *Show summary tasks* should not be selected.
    - It is important to ensure there are no logic ties, constraints, or deadlines associated with summary tasks and that proper logic is captured in the detailed level tasks.



View Settings

Schedule Settings

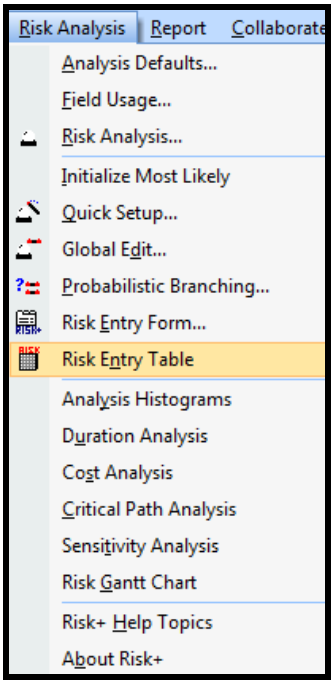
1. Select the *Schedule* tab.
2. *Tasks will always honor their constraint date* should not be selected.
3. Select *OK*.



Schedule Settings

Open Risk+ Entry View and Save File

Open the table used to assign the risk parameters by selecting *Risk Entry Table* from the Risk Analysis menu.



Risk Entry Menu Option

The *Risk Entry Table* displays five columns of fields always available in Microsoft Project. These columns are not populated until utilized by Risk+ and are required to run the Monte Carlo simulations.

Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
92	CDR Complete	0 days	0	0 days	0 days	0 days	0
91	TRR Cycle 3 Complete	0 days	0	0 days	0 days	0 days	0
90	UAT Complete	0 days	0	0 days	0 days	0 days	0
120	Milestone C Complete	0 days	0	0 days	0 days	0 days	0
121	Go Live	0 days	0	0 days	0 days	0 days	0
445	Program Management FY11	79 days	0	0 days	0 days	0 days	0
446	Program Management FY12	260 days	0	0 days	0 days	0 days	0
447	Program Management FY13	260 days	0	0 days	0 days	0 days	0
448	Program Management FY14	260 days	0	0 days	0 days	0 days	0
449	Program Management FY15	260 days	0	0 days	0 days	0 days	0
450	Program Management FY16	265 days	0	0 days	0 days	0 days	0
451	Program Management FY17	10 days	0	0 days	0 days	0 days	0
141	Prepare for CDR	26 days	0	0 days	0 days	0 days	0
140	Finalize CDR Presentation	15 days	0	0 days	0 days	0 days	0
139	Conduct CDR	5 days	0	0 days	0 days	0 days	0

Risk Entry Table

Save the Microsoft Project file as the Set Up file. The file is saved as a separate file so the previously performed steps do not have to be repeated for each new risk simulation.

Assign Risk Parameters

Four steps are included in assigning the risk parameters to tasks:

- Identify Reporting and Preview Tasks
- Initialize Most Likely
- Assign Risk Parameters to the Entire Project
- Refine Risk Parameters to Select Tasks

Identify Reporting and Preview Tasks

Reporting Tasks

Identify the reporting tasks by typing a *1* next to the task in the *Rept ID* column. The reporting and preview tasks may also be selected with the Risk Entry Form.

Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
92	CDR Complete	0 days	0	0 days	0 days	0 days	2
91	TRR Cycle 3 Complete	0 days	0	0 days	0 days	0 days	2
90	UAT Complete	0 days	0	0 days	0 days	0 days	2
120	Milestone C Complete	0 days	0	0 days	0 days	0 days	2
121	Go Live	0 days	1	0 days	0 days	0 days	2

Reporting Task

Preview Task

A task or milestone identified as a preview task has its statistics displayed during a simulation. Only one task can be the preview task during a simulation and the preview task is automatically a reporting task. Identify the preview task by typing a *2* next to the task in the *Rept ID* column.

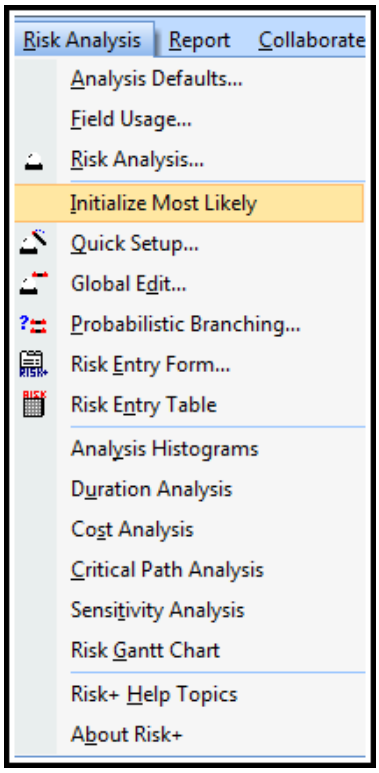
Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
92	CDR Complete	0 days	0	0 days	0 days	0 days	2
91	TRR Cycle 3 Complete	0 days	2	0 days	0 days	0 days	2
90	UAT Complete	0 days	0	0 days	0 days	0 days	2
120	Milestone C Complete	0 days	0	0 days	0 days	0 days	2
121	Go Live	0 days	1	0 days	0 days	0 days	2

Preview Task

Tip: To view statistical data for the entire program during simulation, choose the Project Summary bar as the preview task. This can be accomplished by either inserting a summary bar for the project or checking the "Show Project Summary Task" option by selecting Tools>Option>View in Microsoft Project.

Initialize Most Likely

Use the Initialize Most Likely function to copy the remaining durations to the Risk+ *Most Likely Remaining Duration* field for all tasks. Select *Initialize Most Likely* from the Risk Analysis menu.



Initialize Most Likely Menu Option

Note: Only Initialize Most Likely one time. Doing so more than once can lead to errors. Also, if a project does not have a status date, Risk+ assigns the current date as the status date during this step.

The *ML Rdur* column is now populated. The most likely values equal the remaining durations.

Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
140	Finalize CDR Presentation	15 days	0	0 days	15 days	0 days	0
139	Conduct CDR	5 days	0	0 days	5 days	0 days	0
123	Draft ICA	30 days	0	0 days	30 days	0 days	0
413	Conduct Negotiations for ICA	35 days	0	0 days	35 days	0 days	0
127	Finalize ICA	15 days	0	0 days	15 days	0 days	0
126	Aquire Signature for ICA	5 days	0	0 days	5 days	0 days	0
417	Draft DCA	30 days	0	0 days	30 days	0 days	0
416	Conduct Negotiations for DCA	35 days	0	0 days	35 days	0 days	0
415	Finalize DCA	15 days	0	0 days	15 days	0 days	0
414	Aquire Signature for DCA	5 days	0	0 days	5 days	0 days	0
391	Prepare DRR Checklist	2 days	0	0 days	2 days	0 days	0
390	Review DRR Checklist Items for Interna	2 days	0	0 days	2 days	0 days	0
392	Prepare DRR Briefing	5 days	0	0 days	5 days	0 days	0
395	Conduct DRR Briefing Dry Run	2 days	0	0 days	2 days	0 days	0
394	Conduct DRR	3 days	0	0 days	3 days	0 days	0
393	Prepare DRR Report	6 days	0	0 days	6 days	0 days	0
397	Assign DRR Findings	1 day	0	0 days	1 day	0 days	0

Initialize Most Likely Results

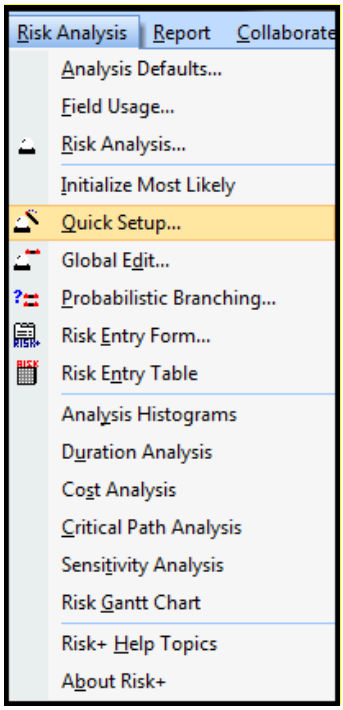
Assign Risk Parameters to Entire Project

Assign risk parameters for all tasks in a project by using the *Quick Setup* or *Global Editing* functions in Risk+. These risk parameters should be those that are assigned to the majority of tasks. Groups of tasks and individual tasks are further refined through additional global edits and individually assigned three point estimates later.

Quick Setup

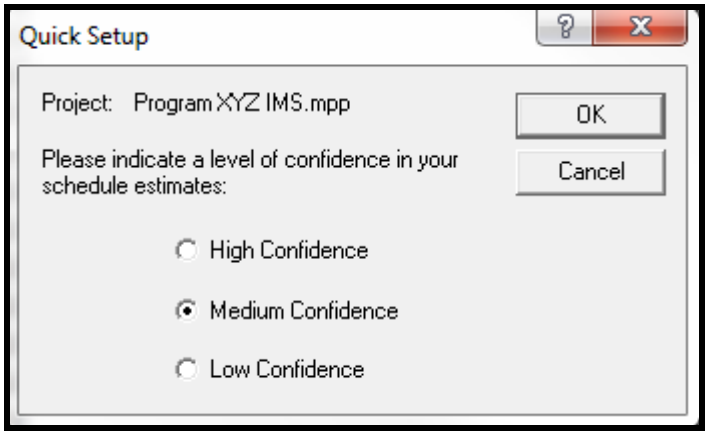
The *Quick Setup* command initializes the risk parameters for each task based on the selected level of confidence, according to the defaults specified in the *Analysis Defaults* dialog box.

1. Select *Quick Setup* from the Risk Analysis menu.



Quick Setup Menu Option

2. Select *High*, *Medium* or *Low Confidence* for the schedule estimates.



Quick Setup

High Confidence: Confident in the accuracy of the Most Likely Durations
Risk+ Defaults:
Minimum Duration= minus 10% of Most Likely Durations
Maximum Duration= plus 10% of Most Likely Durations

Medium Confidence: Somewhat confident in the accuracy of the Most Likely Durations
Risk+ Defaults:
Minimum Duration= minus 25% of Most Likely Durations
Maximum Duration= plus 25% of Most Likely Durations

Low Confidence: Not confident in the accuracy of the Most Likely Durations
Risk+ Defaults:
Minimum Duration= minus 50% of Most Likely Durations
Maximum Duration= plus 50% of Most Likely Durations

Note: The confidence level percentages and the normal distribution curve are the Risk+ default values that are assigned for the various risk analysis functions the program uses. Select Analysis Defaults from the Risk Analysis menu to view or modify these settings.

3. The assigned minimum durations, maximum durations and distribution curves now appear for all tasks. The 3 in the Dur Curve column represents the normal distribution curve.

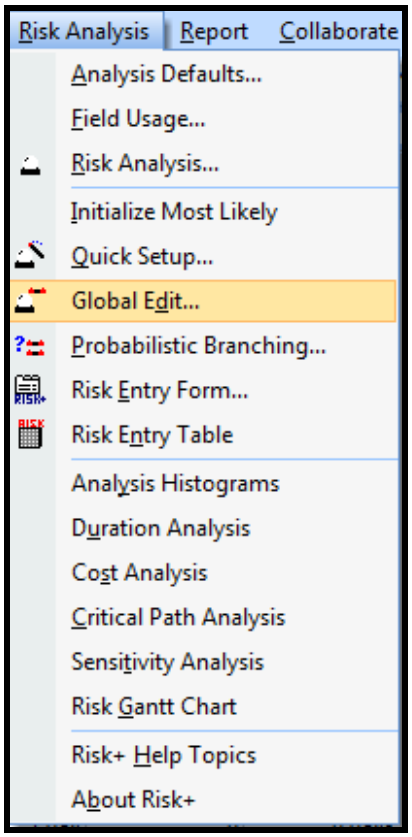
Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
203	Write FDS for FDS RMM2100	10 days	0	7.5 days	10 days	12.5 days	3
204	Obtain Estimates for FDS RMM2100	2 days	0	1.5 days	2 days	2.5 days	3
205	Obtain FDS Approval for FDS RMM210	2 days	0	1.5 days	2 days	2.5 days	3
206	Write FTP for FDS RMM2100	20 days	0	15 days	20 days	25 days	3
207	Approve FTP for FDS RMM2100	10 days	0	7.5 days	10 days	12.5 days	3
208	FDS Complete for FDS RMM2100	0 days	0	0 days	0 days	0 days	3
222	Write FDS for FDS RMM3100	10 days	0	7.5 days	10 days	12.5 days	3
223	Obtain Estimates for FDS RMM3100	2 days	0	1.5 days	2 days	2.5 days	3
224	Obtain FDS Approval for FDS RMM310	2 days	0	1.5 days	2 days	2.5 days	3
225	Write FTP for FDS RMM3100	20 days	0	15 days	20 days	25 days	3
226	Approve FTP for FDS RMM3100	5 days	0	3.75 days	5 days	6.25 days	3

Quick Setup Results

Global Editing

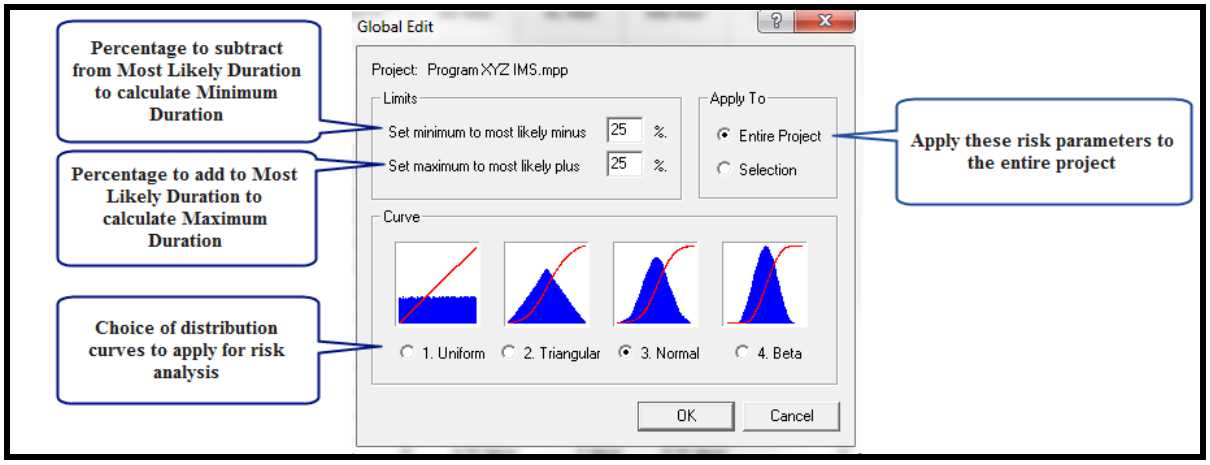
Another option for applying risk parameters to the entire project is using the *Global Editing* function. This function calculates the minimum and maximum remaining durations as percentages of the most likely duration.

1. Select *Global Edit* from the Risk Analysis menu.



Global Edit Menu Option

2. Specify the global editing parameters.



Global Editing

Note: The global edit selections that first appear are the Risk+ default values that are assigned for the various risk analysis functions the program uses. Select Analysis Defaults from the Risk Analysis menu to view or modify these settings.

3. The assigned minimum durations, maximum durations and distribution curve now appear for all tasks. The 3 in the *Dur Curve* column represents the normal distribution curve.

Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
203	Write FDS for FDS RMM2100	10 days	0	7.5 days	10 days	12.5 days	3
204	Obtain Estimates for FDS RMM2100	2 days	0	1.5 days	2 days	2.5 days	3
205	Obtain FDS Approval for FDS RMM210	2 days	0	1.5 days	2 days	2.5 days	3
206	Write FTP for FDS RMM2100	20 days	0	15 days	20 days	25 days	3
207	Approve FTP for FDS RMM2100	10 days	0	7.5 days	10 days	12.5 days	3
208	FDS Complete for FDS RMM2100	0 days	0	0 days	0 days	0 days	3
222	Write FDS for FDS RMM3100	10 days	0	7.5 days	10 days	12.5 days	3
223	Obtain Estimates for FDS RMM3100	2 days	0	1.5 days	2 days	2.5 days	3
224	Obtain FDS Approval for FDS RMM310	2 days	0	1.5 days	2 days	2.5 days	3
225	Write FTP for FDS RMM3100	20 days	0	15 days	20 days	25 days	3
226	Approve FTP for FDS RMM3100	5 days	0	3.75 days	5 days	6.25 days	3
227	FDS Complete for FDS RMM3100	0 days	0	0 days	0 days	0 days	3

Global Editing Results

Refine Risk Parameters

Global Editing

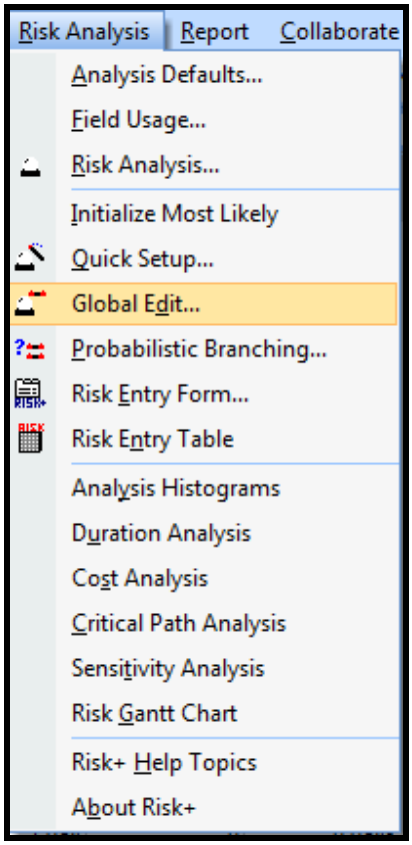
Risk parameters may be further refined by applying global edits to a select group of tasks.

1. Highlight the relevant tasks.

Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
203	Write FDS for FDS RMM2100	10 days	0	8.5 days	10 days	12.5 days	2
204	Obtain Estimates for FDS RMM2100	2 days	0	1.7 days	2 days	2.5 days	2
205	Obtain FDS Approval for FDS RMM210	2 days	0	1.7 days	2 days	2.5 days	2
206	Write FTP for FDS RMM2100	20 days	0	17 days	20 days	25 days	2
207	Approve FTP for FDS RMM2100	10 days	0	8.5 days	10 days	12.5 days	2
208	FDS Complete for FDS RMM2100	0 days	0	0 days	0 days	0 days	2
222	Write FDS for FDS RMM3100	10 days	0	8.5 days	10 days	12.5 days	2
223	Obtain Estimates for FDS RMM3100	2 days	0	1.7 days	2 days	2.5 days	2
224	Obtain FDS Approval for FDS RMM310	2 days	0	1.7 days	2 days	2.5 days	2
225	Write FTP for FDS RMM3100	20 days	0	17 days	20 days	25 days	2
226	Approve FTP for FDS RMM3100	5 days	0	4.25 days	5 days	6.25 days	2
227	FDS Complete for FDS RMM3100	0 days	0	0 days	0 days	0 days	2
240	Write FDS for FDS RMM4100	10 days	0	8.5 days	10 days	12.5 days	2

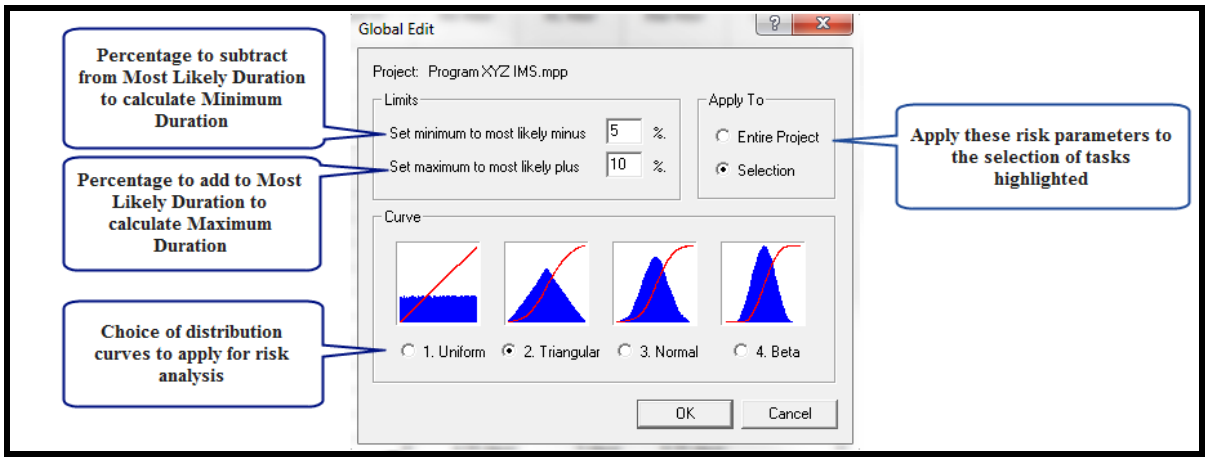
Select Tasks for Global Edit

2. Select *Global Edit* from the Risk Analysis menu.



Global Edit Menu Option

3. Specify the global editing parameters.



Selecting Global Edit Distribution

4. The assigned minimum durations, maximum durations and distribution curve now appear for the selected tasks. The 2 in the *Dur Curve* column represents the triangular distribution curve.

Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
207	Approve FTP for FDS RMM2100	10 days	0	7.5 days	10 days	12.5 days	3
208	FDS Complete for FDS RMM2100	0 days	0	0 days	0 days	0 days	3
222	Write FDS for FDS RMM3100	10 days	0	9.5 days	10 days	11 days	2
223	Obtain Estimates for FDS RMM3100	2 days	0	1.9 days	2 days	2.2 days	2
224	Obtain FDS Approval for FDS RMM310	2 days	0	1.9 days	2 days	2.2 days	2
225	Write FTP for FDS RMM3100	20 days	0	19 days	20 days	22 days	2
226	Approve FTP for FDS RMM3100	5 days	0	4.75 days	5 days	5.5 days	2
227	FDS Complete for FDS RMM3100	0 days	0	0 days	0 days	0 days	2
240	Write FDS for FDS RMM4100	10 days	0	9.5 days	10 days	11 days	2
241	Obtain Estimates for FDS RMM4100	2 days	0	1.5 days	2 days	2.5 days	3
242	Obtain FDS Approval for FDS RMM410	2 days	0	1.5 days	2 days	2.5 days	3

Global Editing Results

Individually Assigned Three Point Estimates

1. Reference the CAM / IPT data spreadsheet to assign the individually determined minimum and maximum duration estimates.

Unique ID	Activity Description	Org Dur	Minimum Dur	Rem Dur	Maximum Dur
203	Write FDS for FDS RMM2100	10 days	9	10 days	12
204	Obtain Estimates for FDS RMM2100	2 days	1	2 days	4
205	Obtain FDS Approval for FDS RMM2100	2 days	1	2 days	5
206	Write FTP for FDS RMM2100	20 days	18	20 days	22
207	Approve FTP for FDS RMM2100	10 days	5	10 days	12

Individually Developed Three Point Estimate Data Collection

2. Find each task in the schedule to receive individually determined three point estimates.

3. Enter the minimum and maximum duration estimates into the *Risk+ Entry Table* by typing in the corresponding cell.

Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
203	Write FDS for FDS RMM2100	10 days	0	9 days	10 days	12 days	2
204	Obtain Estimates for FDS RMM2100	2 days	0	1 day	2 days	4 days	2
205	Obtain FDS Approval for FDS RMM210	2 days	0	1 day	2 days	5 days	2
206	Write FTP for FDS RMM2100	20 days	0	18 days	20 days	22 days	2
207	Approve FTP for FDS RMM2100	10 days	0	5 days	10 days	12 days	2
208	FDS Complete for FDS RMM2100	0 days	0	0 days	0 days	0 days	2
222	Write FDS for FDS RMM3100	10 days	0	9.5 days	10 days	11 days	3
223	Obtain Estimates for FDS RMM3100	2 days	0	1.9 days	2 days	2.2 days	3
224	Obtain FDS Approval for FDS RMM310	2 days	0	1.9 days	2 days	2.2 days	3
225	Write FTP for FDS RMM3100	20 days	0	19 days	20 days	22 days	3
226	Approve FTP for FDS RMM3100	5 days	0	4.75 days	5 days	5.5 days	3
227	FDS Complete for FDS RMM3100	0 days	0	0 days	0 days	0 days	3

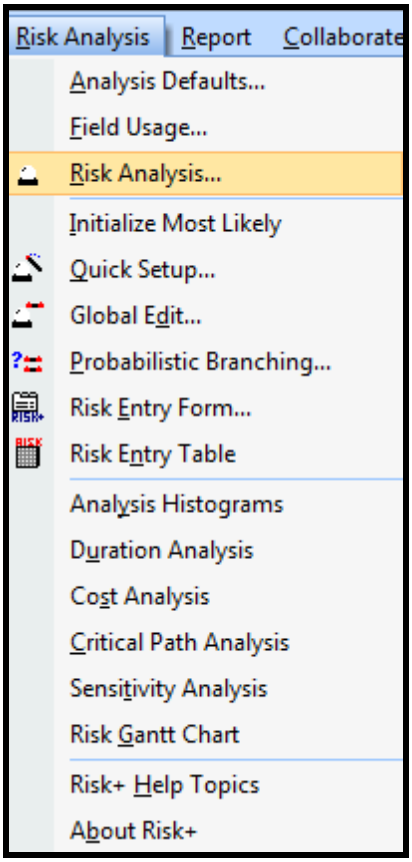
Individually Developed Three Point Estimate Assignments in IMS

Run Risk Simulation

The following steps are required to run a Monte Carlo simulation using Risk+.

Select Risk Analysis

Select *Risk Analysis* from the Risk Analysis menu.



Risk Analysis Menu Option

Specify Risk Analysis Options

Specify the following options in the *Risk Analysis* dialogue box:

- **Iterations**: The number of iterations to perform during the simulation. It is important that enough iterations are run for results to be statistically significant.

- The following are the different types of analysis that may be selected:

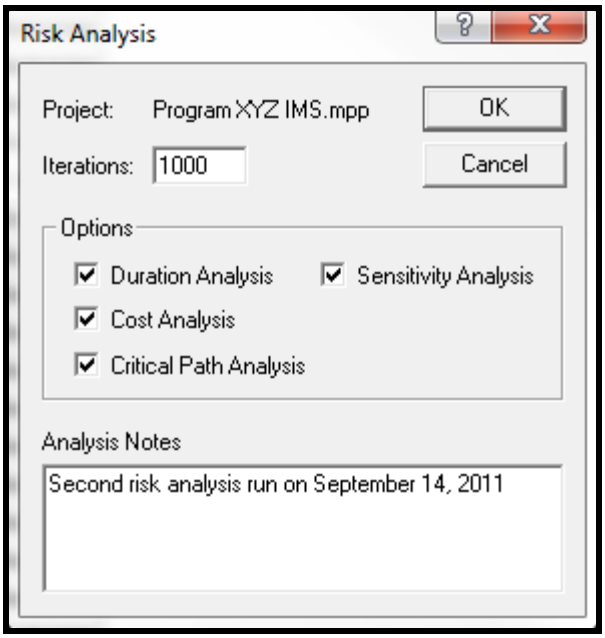
  Duration Analysis: Calculates the duration mean and standard deviation for all tasks. It is not necessary to perform a duration analysis to generate completion date histograms for reporting tasks.

  Cost Analysis: Calculates the cost mean and standard deviation for all tasks, along with a cost histogram. Costs must be applied to tasks in the IMS to run this type of analysis.

  Critical Path Analysis: Identifies tasks that are not normally on the critical path but become critical once risk is introduced to the schedule, calling attention to areas that may need special attention. It is important to note that a constraint (Must Finish No Later Than) or a deadline must be applied to the Microsoft Project file for the Critical Path Analysis to run. The constraint or deadline should be applied to one of the reporting tasks.

  Sensitivity Analysis: Determines how the finish date of a project is affected by changes in its individual task durations. By identifying the tasks that have the greatest impact on the project finish date, this analysis helps direct risk mitigation efforts to areas where they are most effective.

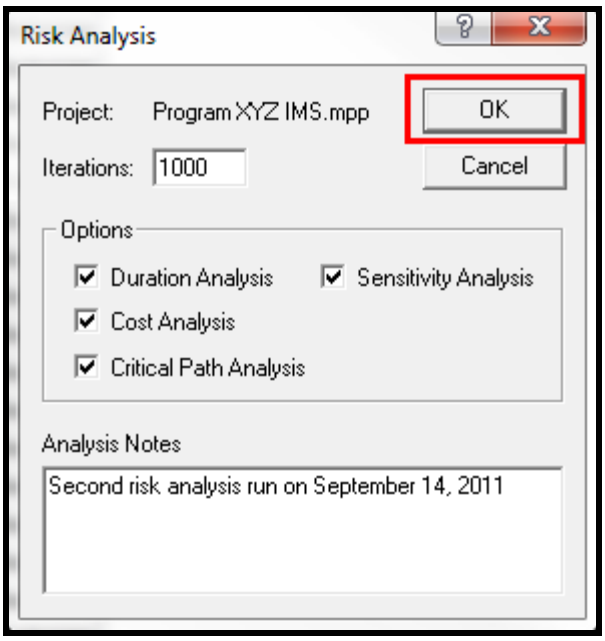
- **Analysis Notes**: Additional analysis detail may be added if desired.



Risk Analysis Options

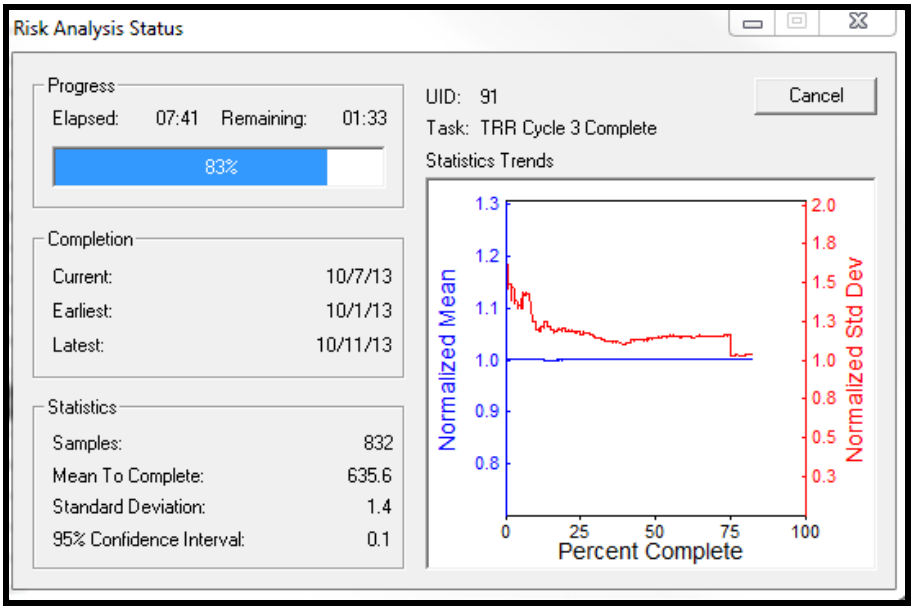
Start Risk Simulation

Select *OK* to start the risk simulation.



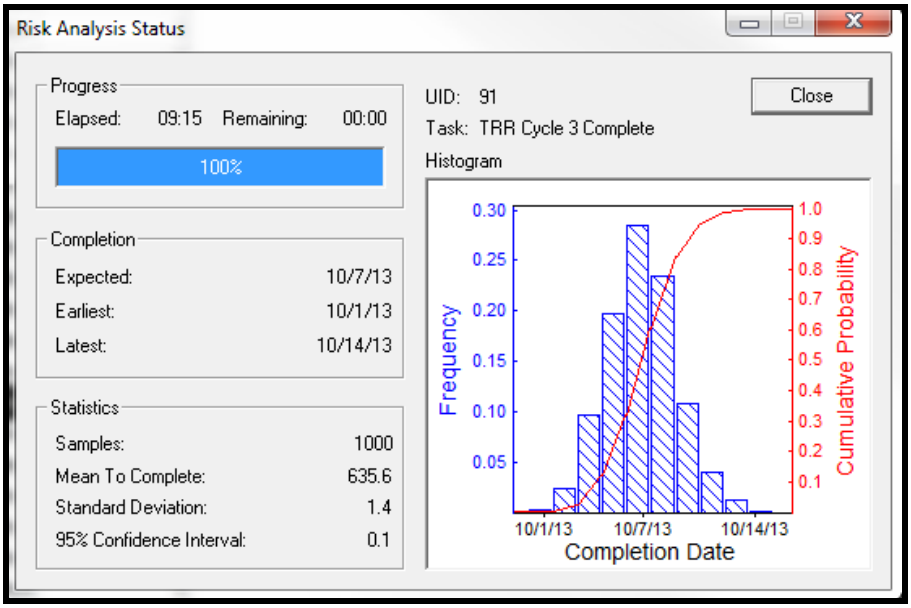
Risk Analysis Start

The *Risk Analysis Status* dialog box displays the preview task's progress as the analysis runs.



Risk Analysis Status Dialog Box

When the simulation is finished, a completion date histogram and other statistical data for the preview task are displayed.



Risk Analysis Status Dialog Box

Note: This dialogue box may be closed manually or closes automatically after one minute.

Analyze Results

Running the simulation is only the first part of the SRA process. Collecting and interpreting the results so they effectively aid the program in understanding and mitigating risks is the next significant step. After the simulation has been run, the following data may be available for analysis (depending upon the options selected during the simulation):

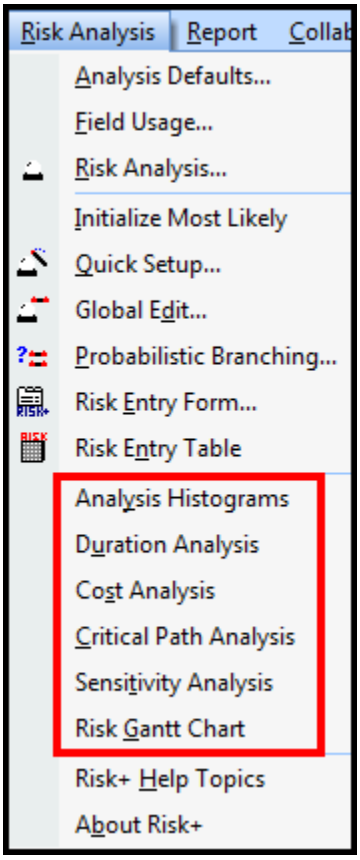
- Analysis Histograms- Duration and Cost
- Duration Analysis
- Cost Analysis
- Critical Path Analysis
- Sensitivity Analysis
- Risk Gantt Chart

In addition, there may also be an SRA Trend Analysis available if a chart has been created and maintained to document the results of previous SRAs. This is not an output that Risk+ provides.

With this data, the analyst should seek to develop answers for the following questions:

- What is the probability of completing the project or a specific milestone by a particular date?
- What tasks have the greatest likelihood of delaying the project?
- What tasks not currently on the critical path have the greatest chance of appearing on the critical path sometime in the future?
- Does the project have adequate schedule margin?
- What is the trend of the simulation results? Is the completion projection slipping each time an SRA is run?
- Are there any trends in the three point estimates for individual tasks on the critical path?
- How do the three point estimates compare with actually observed duration variances? Duration variance analysis helps to validate the three point estimates.

The analysis results may be selected by using the *Risk Analysis* menu.



Risk+ Output Menu Options

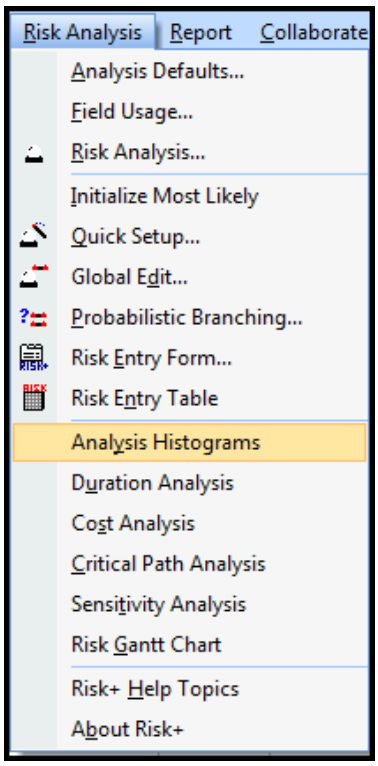
Note: Duration, Cost, Critical Path, and Sensitivity Analyses are optional. Data is displayed from the last analysis the options are selected for.

Analysis Histograms

Estimated Completion Date Histogram

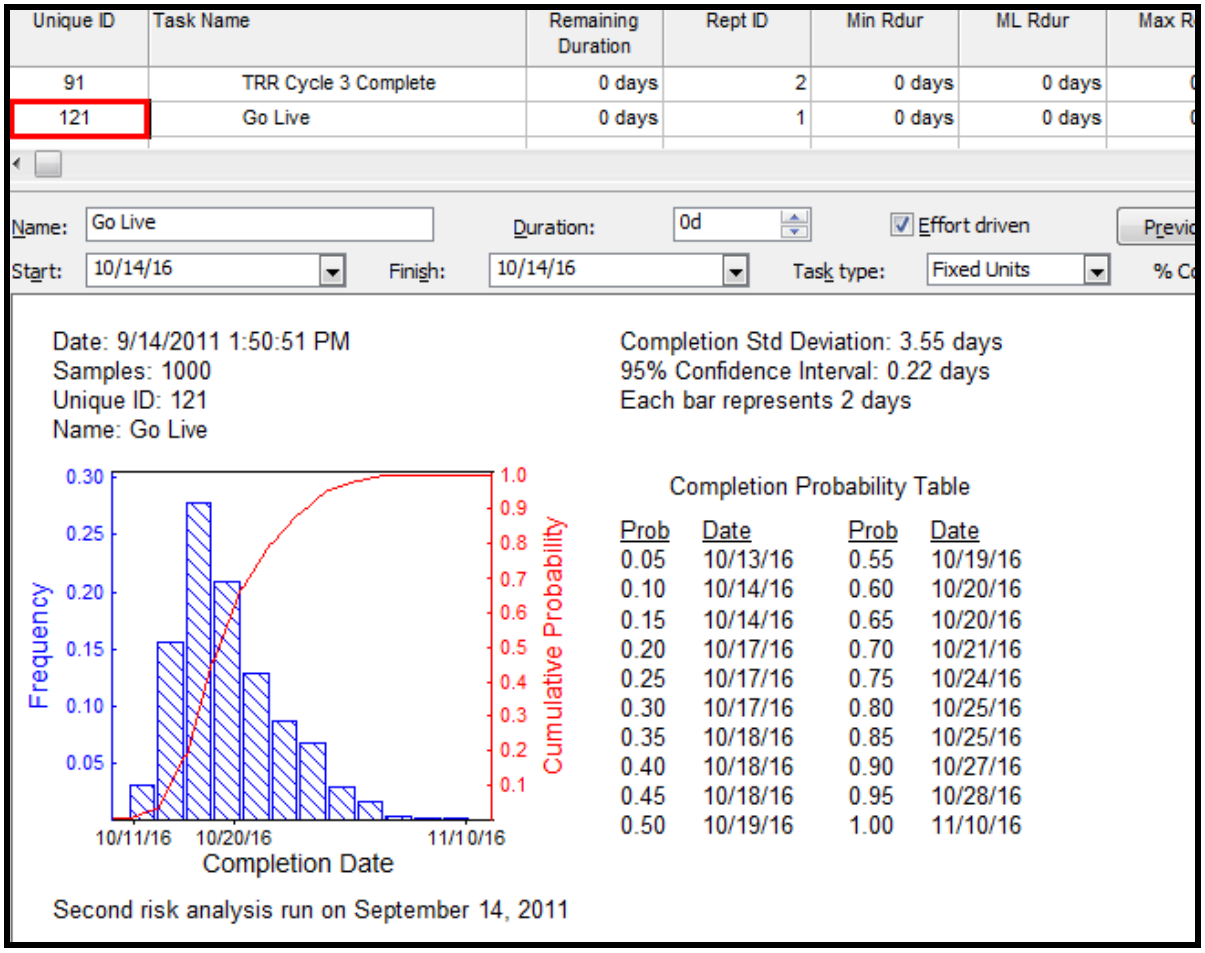
Follow the steps below to view the Estimated Completion Date Histogram results:

1. Select *Analysis Histograms* from the Risk Analysis menu.



Analysis Histograms Menu Option

2. Select a reporting task to see the simulation results. The Estimated Completion Date Histogram and Table appear in the detail window.



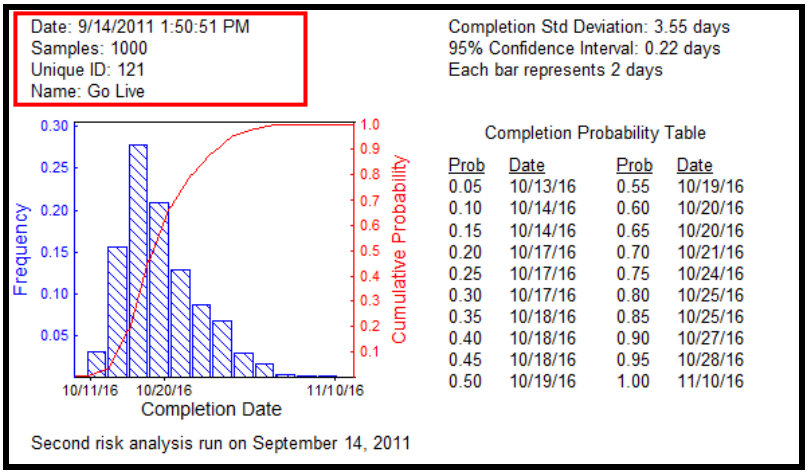
Estimated Completion Date Histogram and Table

The Estimated Completion Date Histogram and Table identifies the cumulative probability of the estimated finish date after risk is introduced. Results vary from run to run.

The following information is included for the Estimated Completion Date Histogram and Table:

Identifying Information
Includes the following information:

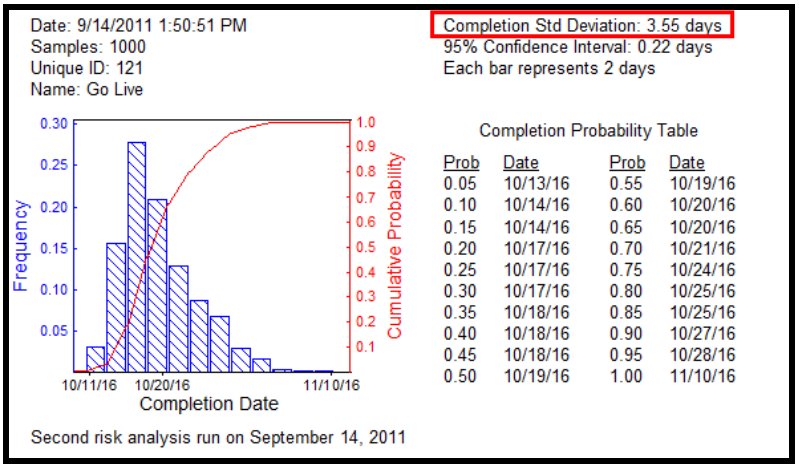
- Date and time of the analysis
- Number of samples (iterations)
- Unique ID of the reporting task used for the analysis
- Name of the schedule used for the analysis



Estimated Completion Date Histogram and Table

Completion Standard Deviation

- Indicates the degree of clustering around the mean (average) value.
- The greater the standard deviation, the less clustering. Therefore, possible completion dates are spread further apart in time.
- The greater the standard deviation, the mode, median and mean values are less pronounced and other dates have a greater likelihood of occurring.
- In this case, a standard deviation equaling 3.55 days indicates that the time between the mean +/- 3.55days accounts for 68.3% of all probable outcomes. There is a 68.3% chance of finishing in this timeframe.



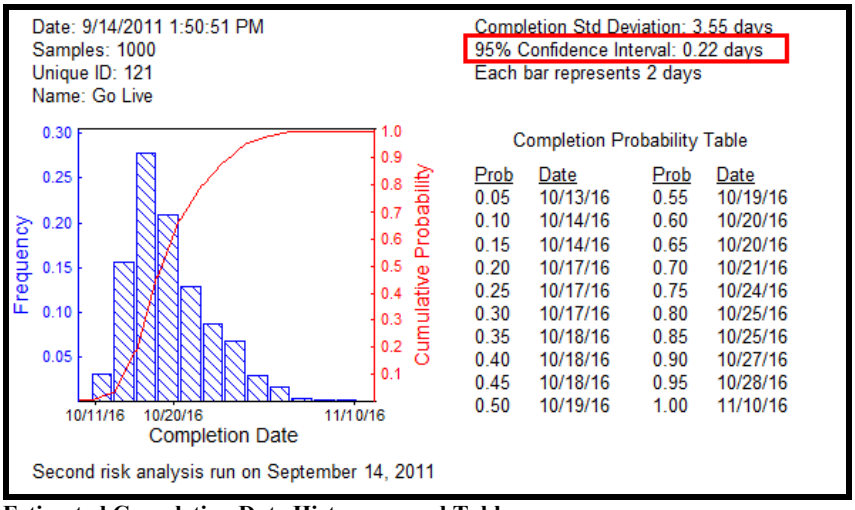
Completion Probability Table

Prob	Date	Prob	Date
0.05	10/13/16	0.55	10/19/16
0.10	10/14/16	0.60	10/20/16
0.15	10/14/16	0.65	10/20/16
0.20	10/17/16	0.70	10/21/16
0.25	10/17/16	0.75	10/24/16
0.30	10/17/16	0.80	10/25/16
0.35	10/18/16	0.85	10/25/16
0.40	10/18/16	0.90	10/27/16
0.45	10/18/16	0.95	10/28/16
0.50	10/19/16	1.00	11/10/16

Estimated Completion Date Histogram and Table

95% Confidence Interval

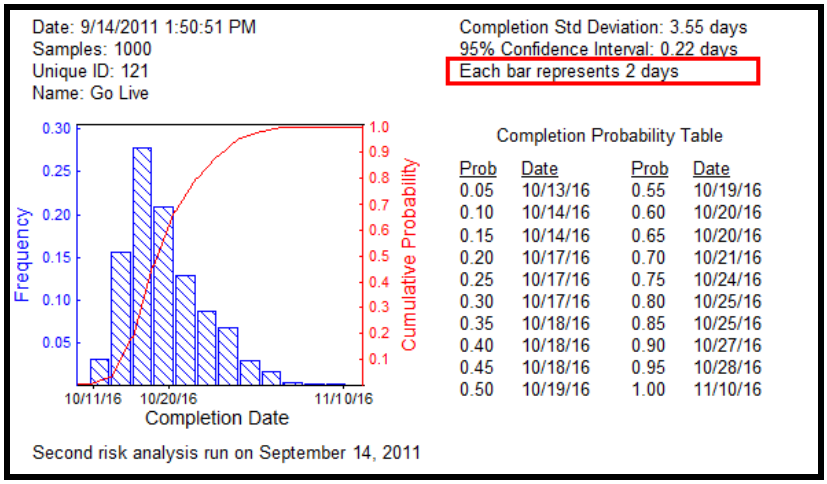
- Monte Carlo analysis uses a representative data sampling based on the distribution type assigned to the tasks. The result is a calculated estimate of the mean and distribution. The 95% confidence interval helps determine how "statistically exact" the simulation is.
- Indicates the quality of the estimate (sampling error).
- Always centered around the sample mean.
- Says in effect: "I don't know where the real mean is, but I know it's around here somewhere."
- The larger the confidence interval, the more likely it is to contain the real mean. Risk+ uses a 95% confidence interval as the default.
- Sampling error is unavoidable but can be reduced by repeat sampling.
- Should not be confused with "confidence" that a task completes before a certain date.
- In this case, a confidence interval of 0.22 days indicates that Risk+ is 95% confident that the mean is accurate within +/- 0.22 days, signifying the confidence and possible amount of variation for the estimated finish date.



Estimated Completion Date Histogram and Table

Bar Intervals

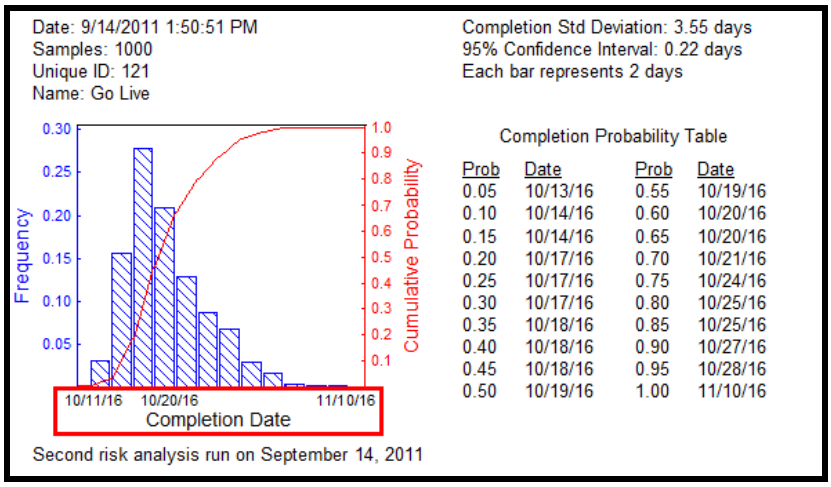
- Indicates how many days are represented by each vertical blue bar shown in the histogram.
- In this case, each vertical blue bar represents an interval of two working days.



Estimated Completion Date Histogram and Table

Completion Dates

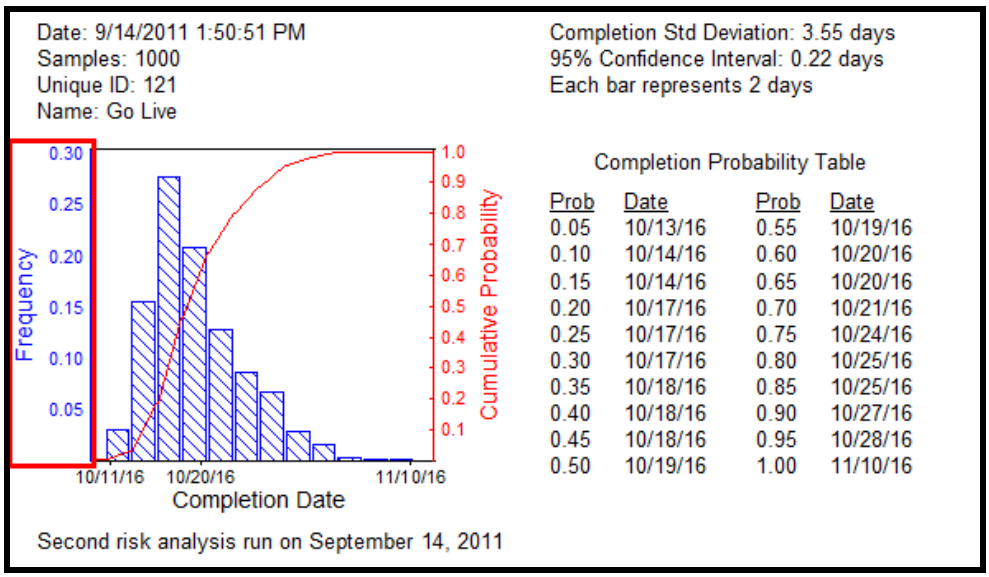
- The completion dates shown along the bottom of the histogram indicate the earliest, expected and latest completion dates.
- The earliest and latest completion dates are variable from run to run. The expected finish date (middle value) is the true mathematical mean of the distribution (50th percentile).
- The following completion dates are shown in the results below:
  Earliest Completion Date: 10/11/16
  Expected Completion Date: 10/20/16
  Latest Completion Date: 11/10/16



Estimated Completion Date Histogram and Table

Frequency

- The height of each bar indicates the percentage of time a particular date interval is calculated as the most likely finish during the simulation. In this run, each bar represents an interval of two working days.
- The highest bar (mode) indicates the range occurring most often during the simulation. In this run, the project completed about 27% of the time in the two-day interval between 10/16/16 - 10/18/16, more than any other interval.
- The most likely range (occurring the most often during the simulation) is variable from run to run, so it is not a good indicator of the predicted finish date. The expected completion date is a better predictor. In this case, the expected completion date is 10/20/16.



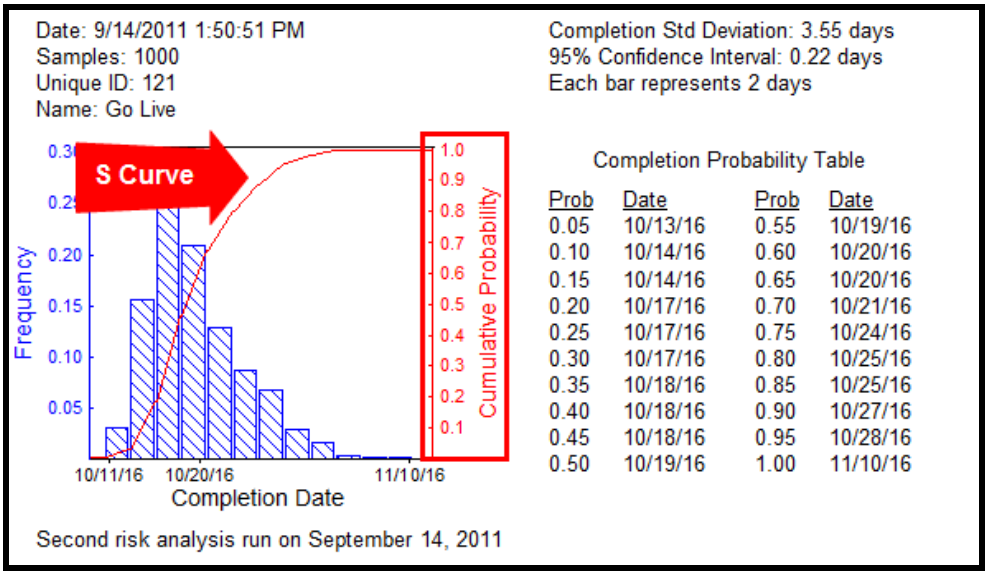
Completion Probability Table

Prob	Date	Prob	Date
0.05	10/13/16	0.55	10/19/16
0.10	10/14/16	0.60	10/20/16
0.15	10/14/16	0.65	10/20/16
0.20	10/17/16	0.70	10/21/16
0.25	10/17/16	0.75	10/24/16
0.30	10/17/16	0.80	10/25/16
0.35	10/18/16	0.85	10/25/16
0.40	10/18/16	0.90	10/27/16
0.45	10/18/16	0.95	10/28/16
0.50	10/19/16	1.00	11/10/16

Estimated Completion Date Histogram and Table

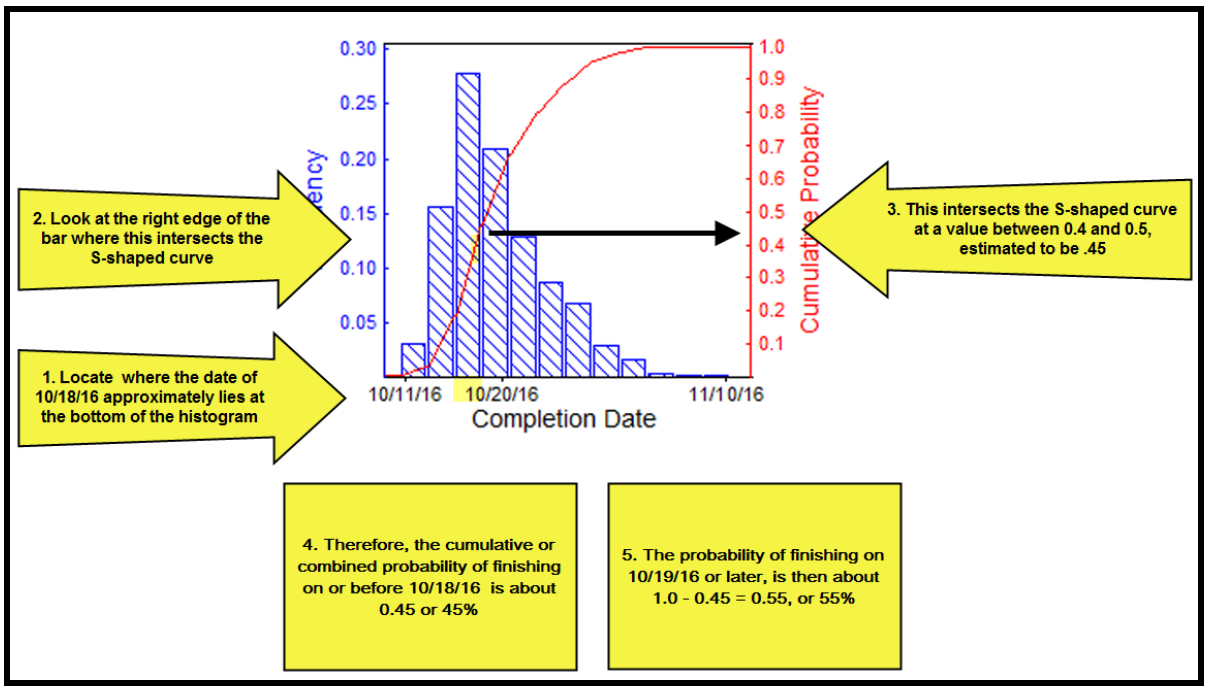
Cumulative Probability and S-Curve

- Indicates the likelihood of completing on or before a specific date.



Estimated Completion Date Histogram and Table

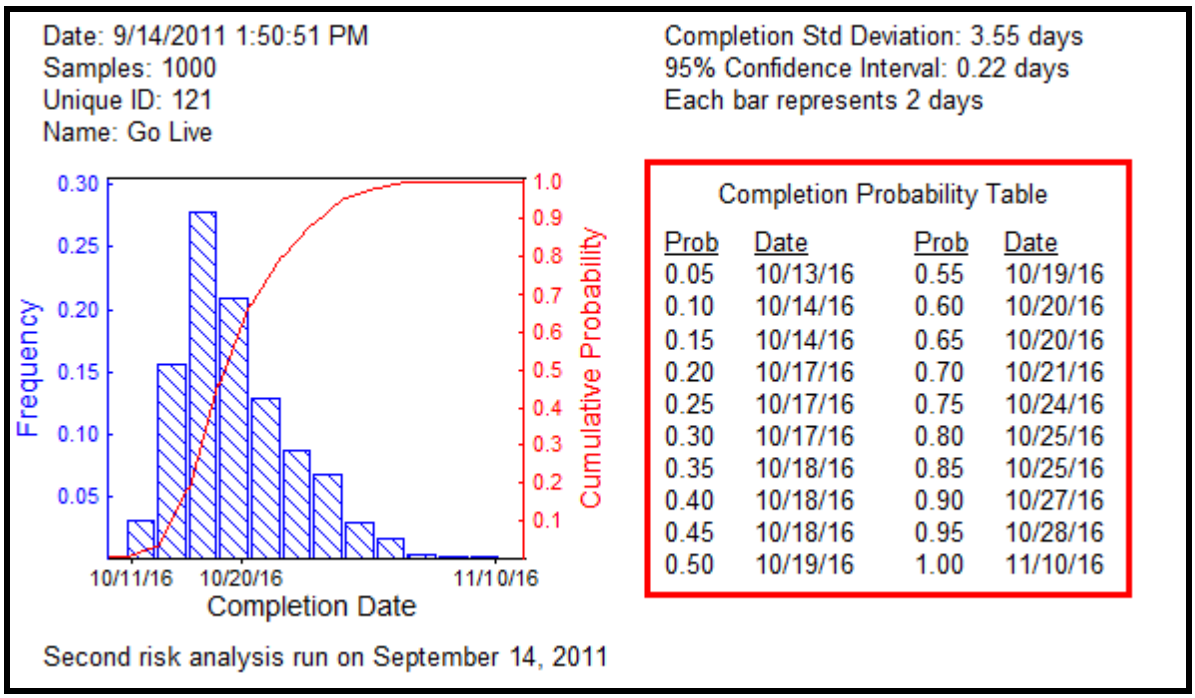
- For example, the probability of completing on or before 10/18/16 can be determined by using the S-shaped curve by following the steps shown below.



Estimated Completion Date Histogram and S-Shaped Curve

Completion Probability Table

- Tabular view of the S-shaped curve, showing the cumulative probability of completing on or before a specific date.
- These dates should be compared to the target finish date established by the program to determine the extent that mitigation efforts may be needed.

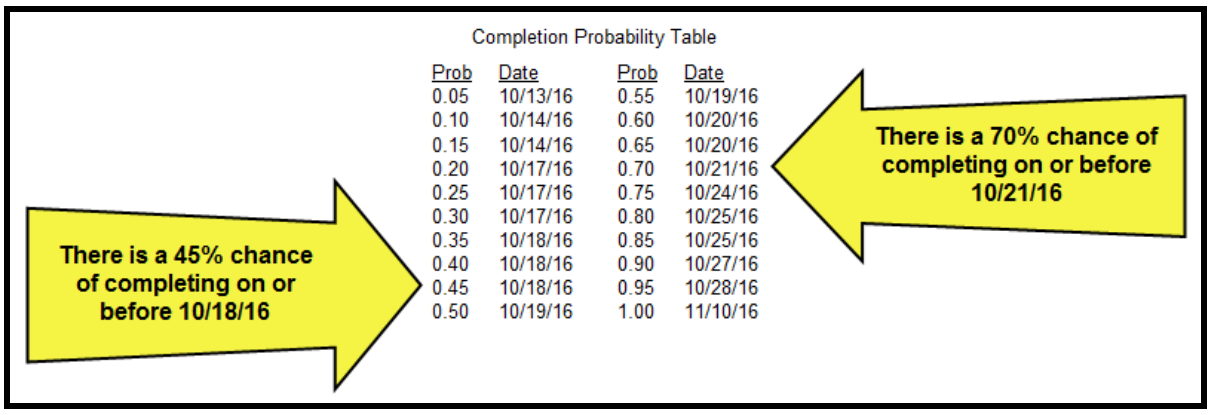


Completion Probability Table

Prob	Date	Prob	Date
0.05	10/13/16	0.55	10/19/16
0.10	10/14/16	0.60	10/20/16
0.15	10/14/16	0.65	10/20/16
0.20	10/17/16	0.70	10/21/16
0.25	10/17/16	0.75	10/24/16
0.30	10/17/16	0.80	10/25/16
0.35	10/18/16	0.85	10/25/16
0.40	10/18/16	0.90	10/27/16
0.45	10/18/16	0.95	10/28/16
0.50	10/19/16	1.00	11/10/16

Estimated Completion Date Histogram and Table

- In this case, the probabilities of finishing on or before specific dates can be derived from the table shown below.

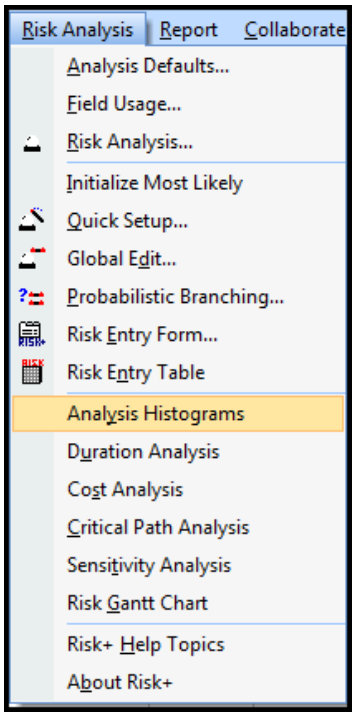


Estimated Completion Date Table

Estimated Cost Histogram

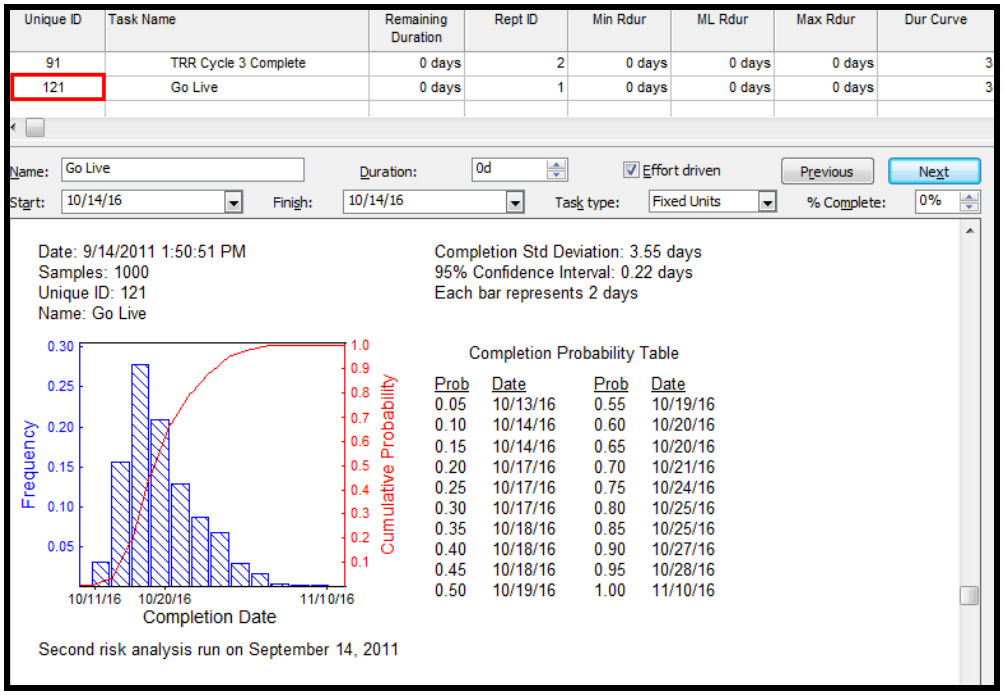
Follow the steps below to view the Estimated Cost Histogram results:

1. Select *Analysis Histograms* from the Risk Analysis menu.



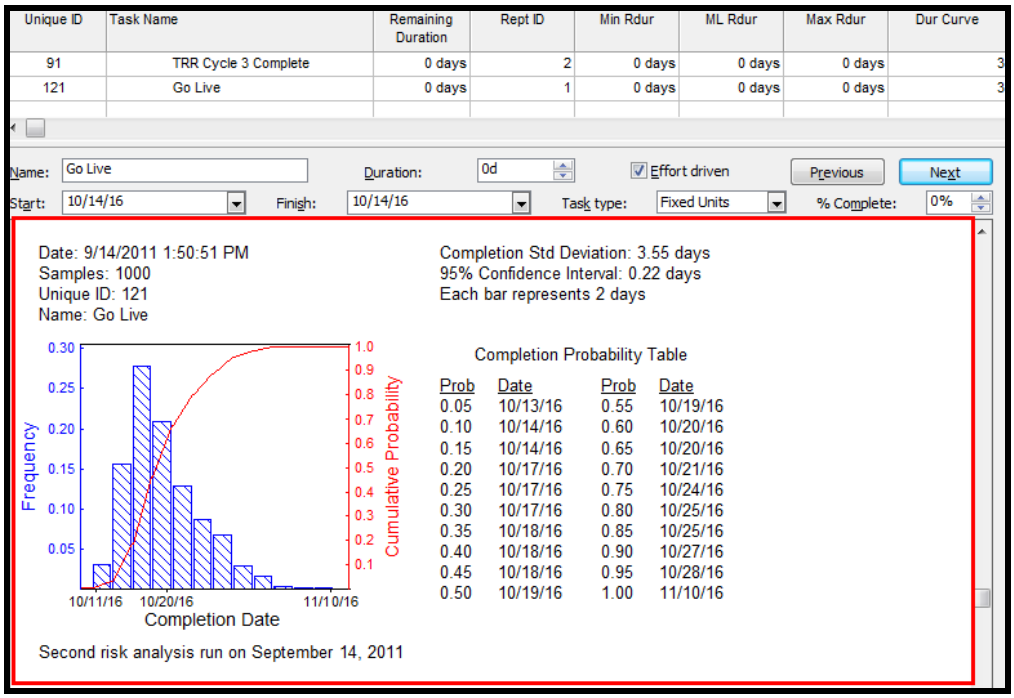
Analysis Histograms Menu Option

2. Select a reporting task to see the simulation results.



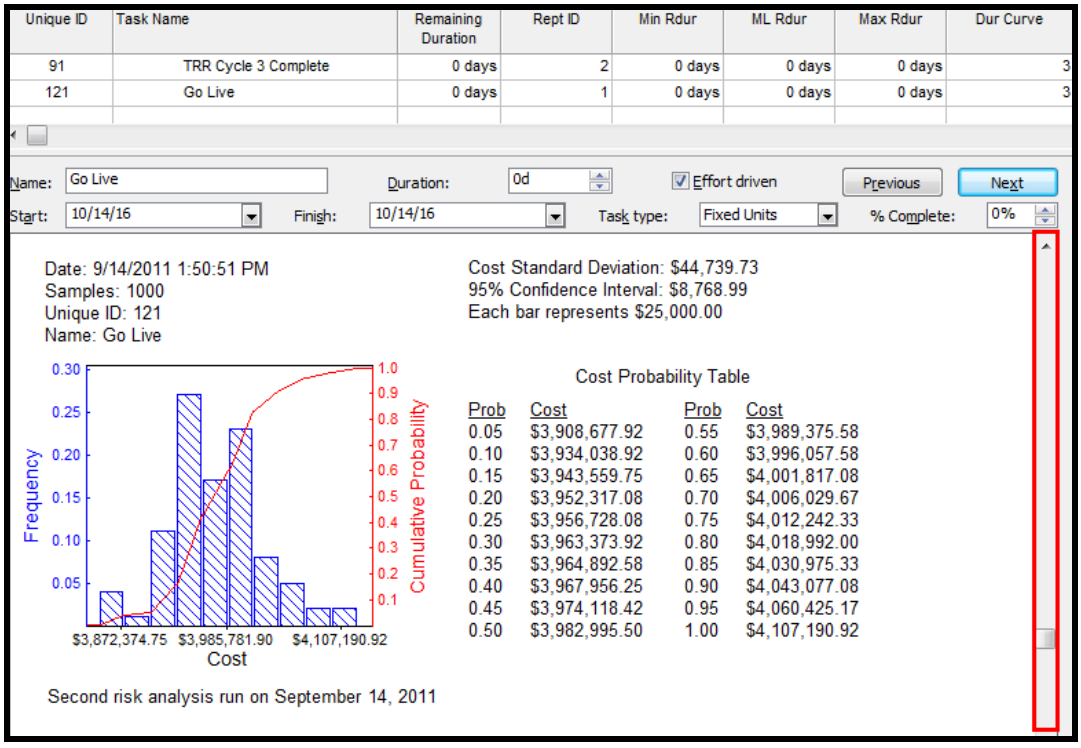
Estimated Cost Histogram and Table

3. Place the cursor anywhere in the Detail window.



Estimated Cost Histogram and Table

4. Press the down arrow on the keyboard or use the scroll bar on the right to scroll down to the cost histogram.



Unique ID	Task Name	Remaining Duration	Rept ID	Min Rdur	ML Rdur	Max Rdur	Dur Curve
91	TRR Cycle 3 Complete	0 days	2	0 days	0 days	0 days	3
121	Go Live	0 days	1	0 days	0 days	0 days	3

Name: Go Live Duration: 0d Effort driven Previous Next
Start: 10/14/16 Finish: 10/14/16 Task type: Fixed Units % Complete: 0%

Date: 9/14/2011 1:50:51 PM
Samples: 1000
Unique ID: 121
Name: Go Live

Cost Standard Deviation: $44,739.73
95% Confidence Interval: $8,768.99
Each bar represents $25,000.00

Cost Probability Table

Prob	Cost	Prob	Cost
0.05	$3,908,677.92	0.55	$3,989,375.58
0.10	$3,934,038.92	0.60	$3,996,057.58
0.15	$3,943,559.75	0.65	$4,001,817.08
0.20	$3,952,317.08	0.70	$4,006,029.67
0.25	$3,956,728.08	0.75	$4,012,242.33
0.30	$3,963,373.92	0.80	$4,018,992.00
0.35	$3,964,892.58	0.85	$4,030,975.33
0.40	$3,967,956.25	0.90	$4,043,077.08
0.45	$3,974,118.42	0.95	$4,060,425.17
0.50	$3,982,995.50	1.00	$4,107,190.92

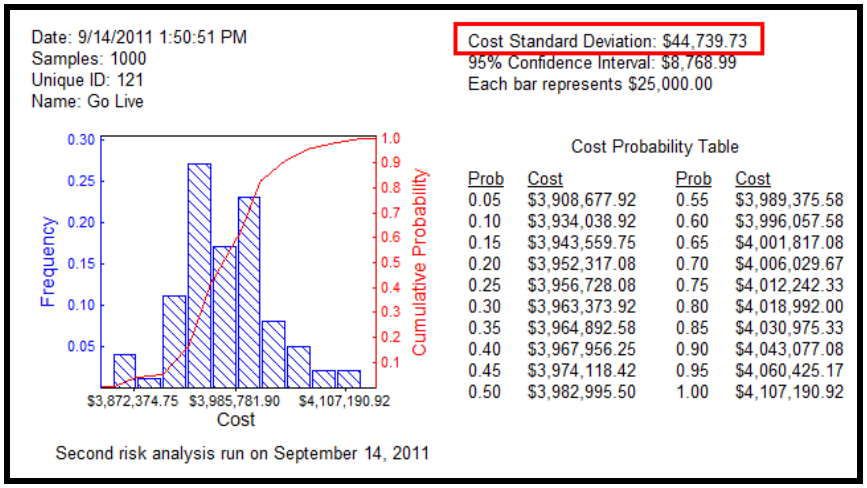
Second risk analysis run on September 14, 2011

Estimated Cost Histogram and Table

The Estimated Cost Histogram and Table identifies the cumulative probability of the estimated cost after risk is introduced. The results vary from run to run. The same information that is provided in the Estimated Completion Date Histogram and Table is provided for cost.

Cost Standard Deviation

- The greater the standard deviation, the mode, median and mean values are less pronounced and other costs have a greater likelihood of occurring.
- In this case, a standard deviation equaling $44,739.73 indicates that the amount between the mean +/- $44,739.73 accounts for 68.3% of all probable outcomes. There is a 68.3% chance of the costs falling within this amount.



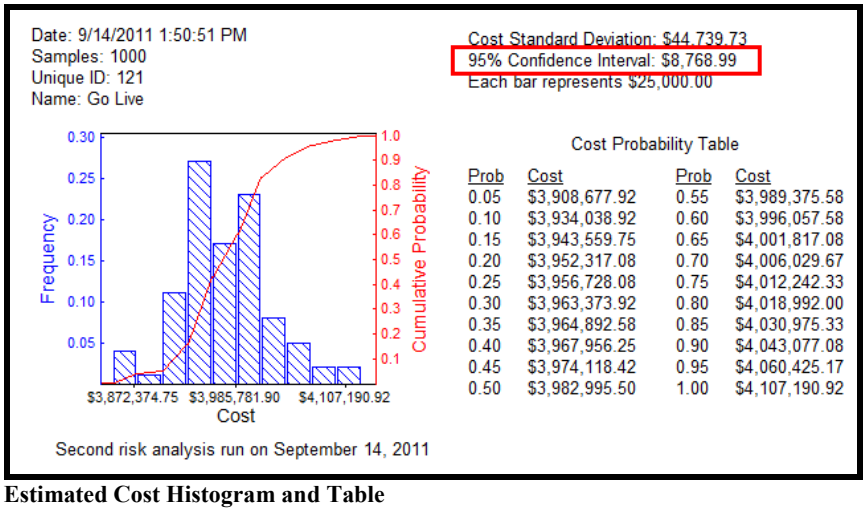
Cost Probability Table

Prob	Cost	Prob	Cost
0.05	$3,908,677.92	0.55	$3,989,375.58
0.10	$3,934,038.92	0.60	$3,996,057.58
0.15	$3,943,559.75	0.65	$4,001,817.08
0.20	$3,952,317.08	0.70	$4,006,029.67
0.25	$3,956,728.08	0.75	$4,012,242.33
0.30	$3,963,373.92	0.80	$4,018,992.00
0.35	$3,964,892.58	0.85	$4,030,975.33
0.40	$3,967,956.25	0.90	$4,043,077.08
0.45	$3,974,118.42	0.95	$4,060,425.17
0.50	$3,982,995.50	1.00	$4,107,190.92

Estimated Cost Histogram and Table

95% Confidence Interval

- In this case, a confidence interval of $8,768.99 indicates that Risk+ is 95% confident that the mean is accurate within +/- $8,768.99, signifying the confidence and possible amount of variation for the estimated cost.



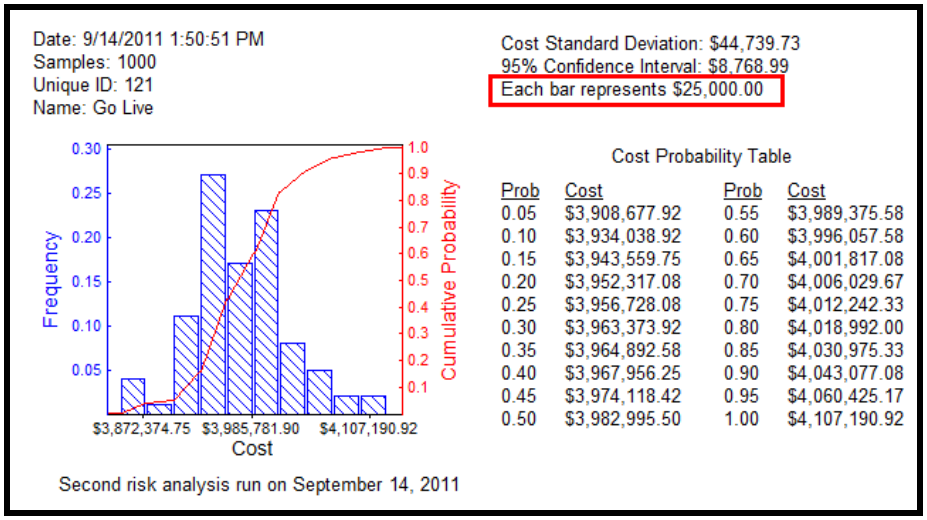
Cost Probability Table

Prob	Cost	Prob	Cost
0.05	$3,908,677.92	0.55	$3,989,375.58
0.10	$3,934,038.92	0.60	$3,996,057.58
0.15	$3,943,559.75	0.65	$4,001,817.08
0.20	$3,952,317.08	0.70	$4,006,029.67
0.25	$3,956,728.08	0.75	$4,012,242.33
0.30	$3,963,373.92	0.80	$4,018,992.00
0.35	$3,964,892.58	0.85	$4,030,975.33
0.40	$3,967,956.25	0.90	$4,043,077.08
0.45	$3,974,118.42	0.95	$4,060,425.17
0.50	$3,982,995.50	1.00	$4,107,190.92

Estimated Cost Histogram and Table

Bar Intervals

- Indicates how much money is represented by each vertical blue bar shown in the histogram.
- In this case, each vertical blue bar represents an interval of $25,000.00.



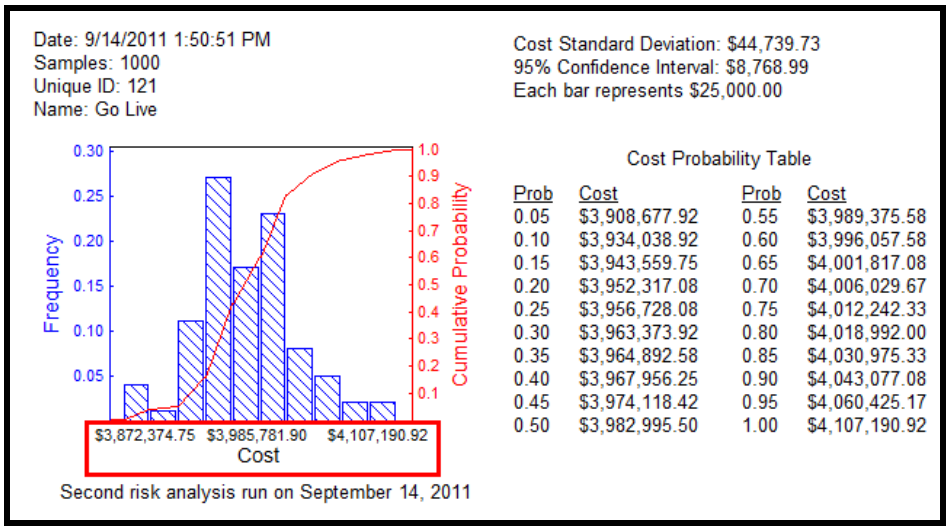
Cost Probability Table

Prob	Cost	Prob	Cost
0.05	$3,908,677.92	0.55	$3,989,375.58
0.10	$3,934,038.92	0.60	$3,996,057.58
0.15	$3,943,559.75	0.65	$4,001,817.08
0.20	$3,952,317.08	0.70	$4,006,029.67
0.25	$3,956,728.08	0.75	$4,012,242.33
0.30	$3,963,373.92	0.80	$4,018,992.00
0.35	$3,964,892.58	0.85	$4,030,975.33
0.40	$3,967,956.25	0.90	$4,043,077.08
0.45	$3,974,118.42	0.95	$4,060,425.17
0.50	$3,982,995.50	1.00	$4,107,190.92

Estimated Cost Histogram and Table

Completion Costs

- The costs shown along the bottom of the histogram indicate the minimum, expected and maximum costs.
- The minimum and maximum costs are variable from run to run. The expected cost (middle value) is the true mathematical mean of the distribution (50th percentile).
- The following costs are shown in the results below:
  Minimum Cost: $3,872,374.75
  Expected Cost: $3,985,781.90
  Maximum Cost: $4,107,190.92



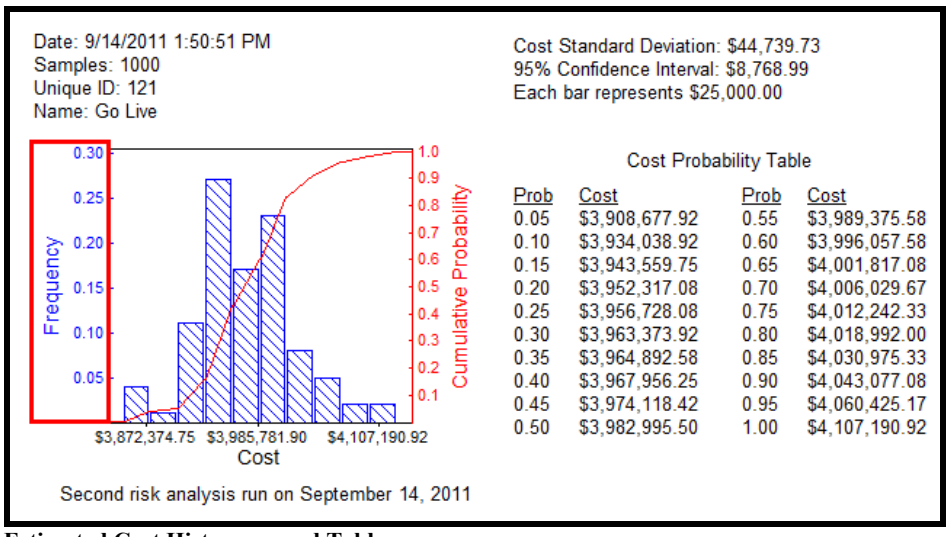
Cost Probability Table

Prob	Cost	Prob	Cost
0.05	$3,908,677.92	0.55	$3,989,375.58
0.10	$3,934,038.92	0.60	$3,996,057.58
0.15	$3,943,559.75	0.65	$4,001,817.08
0.20	$3,952,317.08	0.70	$4,006,029.67
0.25	$3,956,728.08	0.75	$4,012,242.33
0.30	$3,963,373.92	0.80	$4,018,992.00
0.35	$3,964,892.58	0.85	$4,030,975.33
0.40	$3,967,956.25	0.90	$4,043,077.08
0.45	$3,974,118.42	0.95	$4,060,425.17
0.50	$3,982,995.50	1.00	$4,107,190.92

Estimated Cost Histogram and Table

Frequency

- The height of each bar indicates the percentage of time a particular cost interval is calculated as the most likely cost during the simulation. In this run, each bar represents an interval of $25,000.
- The highest bar (mode) indicates the range occurring most often during the simulation. In this run, the cost calculated about 27% of the time in the $25,000 interval between approximately $3,947,374.75 and $3,972,374.75, more than any other interval.
- The most likely range (occurring the most often during the simulation) is variable from run to run, so it is not a good indicator of the predicted cost. The expected cost is a better predictor. In this case, the expected cost is $3,985,781.90.



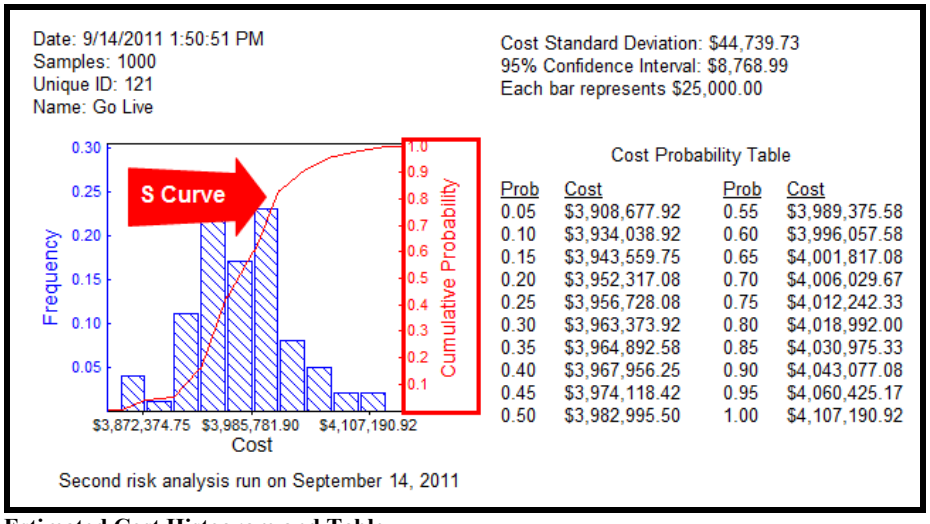
Cost Probability Table

Prob	Cost	Prob	Cost
0.05	$3,908,677.92	0.55	$3,989,375.58
0.10	$3,934,038.92	0.60	$3,996,057.58
0.15	$3,943,559.75	0.65	$4,001,817.08
0.20	$3,952,317.08	0.70	$4,006,029.67
0.25	$3,956,728.08	0.75	$4,012,242.33
0.30	$3,963,373.92	0.80	$4,018,992.00
0.35	$3,964,892.58	0.85	$4,030,975.33
0.40	$3,967,956.25	0.90	$4,043,077.08
0.45	$3,974,118.42	0.95	$4,060,425.17
0.50	$3,982,995.50	1.00	$4,107,190.92

Estimated Cost Histogram and Table

Cumulative Probability and S-Curve

- Indicates the likelihood of completing with a cost less than or equal to a given value.

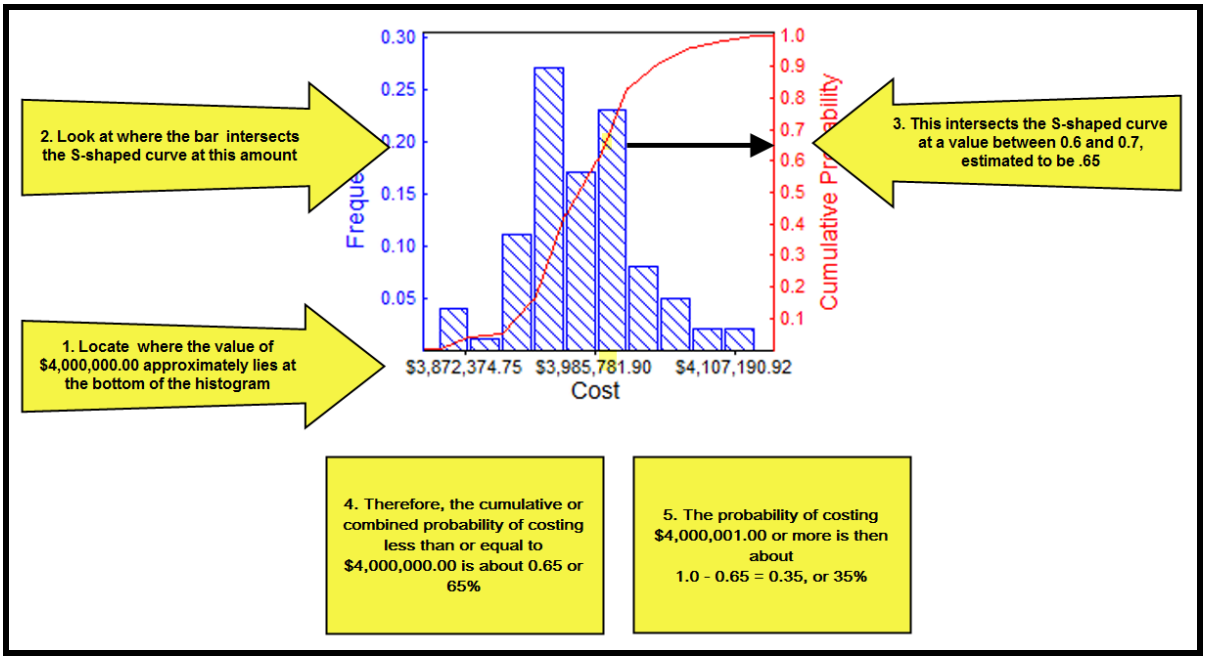


Cost Probability Table

Prob	Cost	Prob	Cost
0.05	$3,908,677.92	0.55	$3,989,375.58
0.10	$3,934,038.92	0.60	$3,996,057.58
0.15	$3,943,559.75	0.65	$4,001,817.08
0.20	$3,952,317.08	0.70	$4,006,029.67
0.25	$3,956,728.08	0.75	$4,012,242.33
0.30	$3,963,373.92	0.80	$4,018,992.00
0.35	$3,964,892.58	0.85	$4,030,975.33
0.40	$3,967,956.25	0.90	$4,043,077.08
0.45	$3,974,118.42	0.95	$4,060,425.17
0.50	$3,982,995.50	1.00	$4,107,190.92

Estimated Cost Histogram and Table

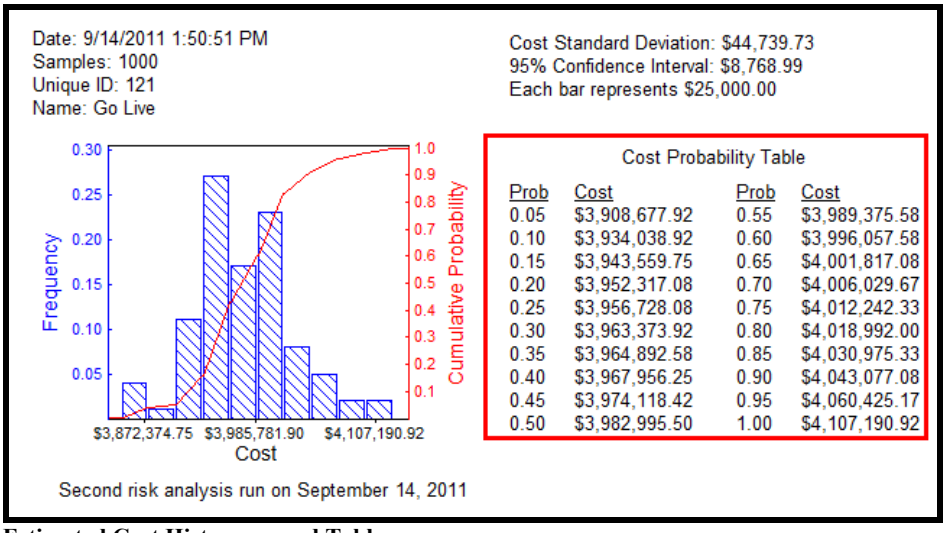
- For example, the probability of costing less than or equal to $4,000,000.00 can be determined by using the S-shaped curve by following the steps shown below.



Estimated Cost Histogram and S-Shaped Curve

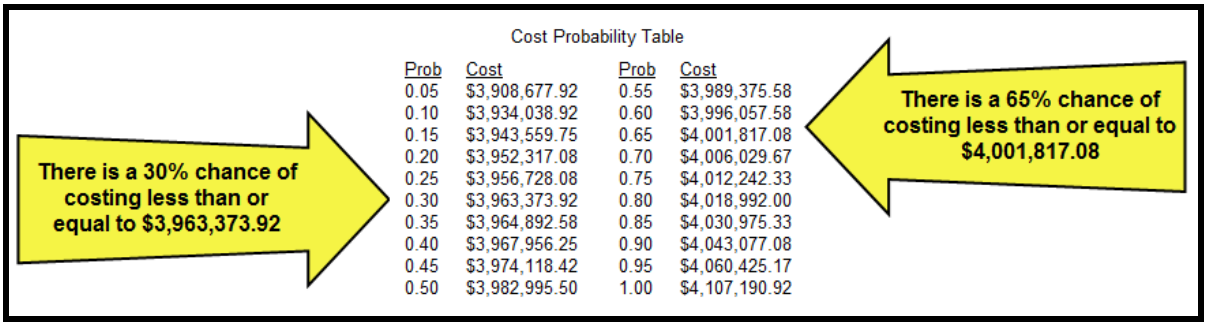
Cost at Completion Probability Table

- Tabular view of the S-shaped curve, showing the cumulative probability of costing less than or equal to a specific value.
- These costs should be compared to the target costs established by the program to determine the extent that mitigation efforts may be needed.



Estimated Cost Histogram and Table

- The examples below demonstrate how to read the Cost Probability Table.



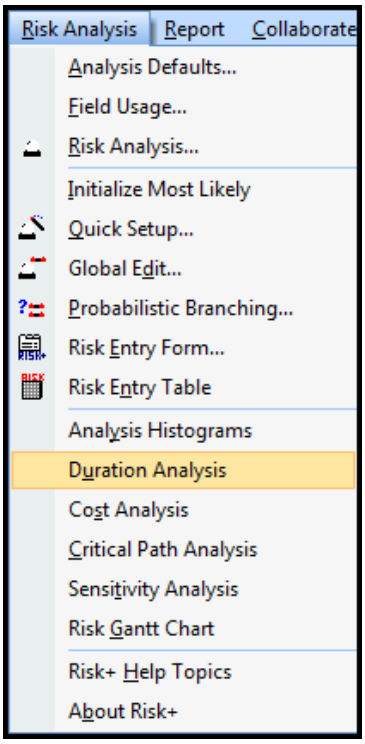
Cost Probability Table

Prob	Cost	Prob	Cost
0.05	$3,908,677.92	0.55	$3,989,375.58
0.10	$3,934,038.92	0.60	$3,996,057.58
0.15	$3,943,559.75	0.65	$4,001,817.08
0.20	$3,952,317.08	0.70	$4,006,029.67
0.25	$3,956,728.08	0.75	$4,012,242.33
0.30	$3,963,373.92	0.80	$4,018,992.00
0.35	$3,964,892.58	0.85	$4,030,975.33
0.40	$3,967,956.25	0.90	$4,043,077.08
0.45	$3,974,118.42	0.95	$4,060,425.17
0.50	$3,982,995.50	1.00	$4,107,190.92

Estimated Cost Table

Duration Analysis

To view the Duration Analysis results, select *Duration Analysis* from the Risk Analysis menu.



Duration Analysis Menu Option

This analysis shows the duration mean and standard deviation in the presence of risk for each task.

Task Name	Rem Duration	Mean	Std Dev
FDS RMM2100	**85 days**	**88.37 days**	**2.94 days**
Write FDS for FDS RMM2100	10 days	10.3 days	0.61 days
Obtain Estimates for FDS RMM2100	2 days	2.33 days	0.64 days
Obtain FDS Approval for FDS RMM2100	2 days	2.67 days	0.82 days
Write FTP for FDS RMM2100	20 days	20.08 days	0.89 days
Approve FTP for FDS RMM2100	10 days	8.99 days	1.32 days
FDS Complete for FDS RMM2100	0 days	0 days	0 days
FDS RMM3100	**85 days**	**87.74 days**	**2.12 days**
Write FDS for FDS RMM3100	10 days	10.29 days	0.25 days
Obtain Estimates for FDS RMM3100	2 days	2.04 days	0.05 days
Obtain FDS Approval for FDS RMM3100	2 days	2.05 days	0.05 days
Write FTP for FDS RMM3100	20 days	20.53 days	0.5 days
Approve FTP for FDS RMM3100	5 days	5.12 days	0.12 days
FDS Complete for FDS RMM3100	0 days	0 days	0 days
FDS RMM4100	**85 days**	**87.29 days**	**2.25 days**
Write FDS for FDS RMM4100	10 days	10.28 days	0.23 days
Obtain Estimates for FDS RMM4100	2 days	2.08 days	0.15 days
Obtain FDS Approval for FDS RMM4100	2 days	2.06 days	0.15 days
Write FTP for FDS RMM4100	25 days	25.79 days	2.02 days
Approve FTP for FDS RMM4100	5 days	5.08 days	0.38 days
FDS Complete for FDS RMM4100	0 days	0 days	0 days

Duration Analysis

The duration analysis provides the following information:

Remaining Duration

- The number of working days each task takes to complete as specified in the schedule.

Mean

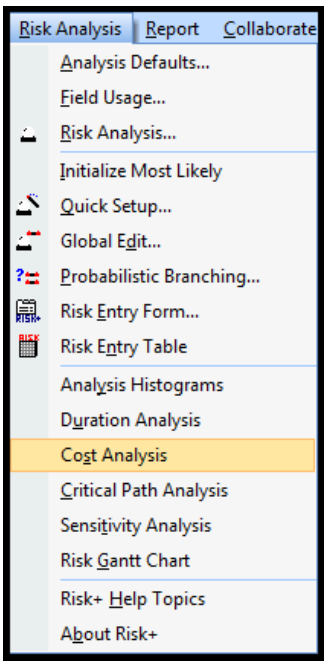
- The average remaining duration for each task in the presence of risk. This is also the expected remaining duration.

Standard Deviation

- How much variation there is from the average (mean) remaining duration.
- The higher the standard deviation, the greater the range of possible remaining durations.

Cost Analysis

To view the Cost Analysis results, select *Cost Analysis* from the Risk Analysis menu.



Cost Analysis Menu Option

This analysis shows the cost mean and standard deviation in the presence of risk for each task.

Task Name	Physical % Complete	Start	Finish	Cost	Mean	Std Dev
Prod Sys 1 & 2, Proc, Supplier	**0%**	**Mon 3/12/12**	**Tue 12/25/12**	**$156,520.00**	**$156,461.15**	**$6,290.94**
Prod Sys 1 & 2, Proc, Supplier, Cabinets -WP	0%	Mon 3/12/12	Mon 10/15/12	$68,640.00	$68,613.00	$5,635.74
Prod Sys 1 & 2, Proc, Supplier, PC HW -WP	0%	Mon 3/12/12	Wed 4/25/12	$17,160.00	$17,120.39	$1,422.16
Prod Sys 1 & 2, Proc, Supplier, Cables/Elec -WP	0%	Mon 3/12/12	Tue 3/27/12	$6,240.00	$6,259.05	$527.50
Prod Sys 3 & 4, Proc, Supplier, Cabinets -WP	0%	Thu 11/1/12	Tue 12/25/12	$20,280.00	$20,312.82	$1,698.37
Prod Sys 3 & 4, Proc, Supplier, PC HW -WP	0%	Fri 5/11/12	Tue 6/26/12	$17,160.00	$17,184.36	$1,424.99
Prod Sys 3 & 4, Proc, Supplier, Cables/Elec -WP	0%	Fri 4/13/12	Mon 4/30/12	$6,240.00	$6,235.44	$515.18
Prod Sys, Proc, Supplier, SW OS -WP	0%	Mon 3/12/12	Fri 4/6/12	$10,400.00	$10,368.70	$837.61

Cost Analysis

The cost analysis provides the following information:

Cost

- The cost for each task as specified in the schedule.

Mean

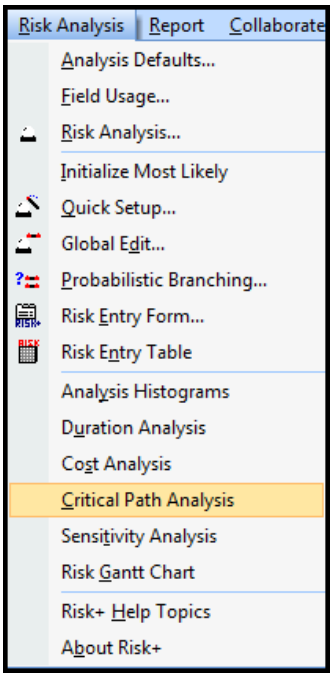
- The average cost for each task in the presence of risk. This is also the expected cost.

Standard Deviation

- How much variation there is from the average (mean) cost.
- The higher the standard deviation, the greater the range of possible costs.

Critical Path Analysis (Criticality Indicator)

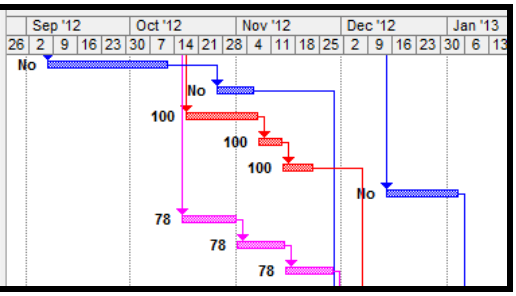
To view the Critical Path Analysis results, select *Critical Path Analysis* from the Risk Analysis menu.



Critical Path Analysis Menu Option

This analysis shows tasks that are not normally on the critical path but become critical once risk is introduced to the schedule. This information helps in determining where to focus mitigation efforts before the critical path is impacted.

Task Name	Total Slack	Critical	% Critical	Risk Critical
Write FTP for FDS RMM6100	5	No	12	No
Approve FTP for FDS RMM6100	5	No	12	No
Write HLD for FDS RMM1100	0	Yes	100	No
Review FTP for FDS RMM1100	0	Yes	100	No
Develop TDS for FDS RMM1100	0	Yes	100	No
Write HLD for FDS RMM2100	1	No	71	No
Review FTP for FDS RMM2100	1	No	78	Yes
Develop TDS for FDS RMM2100	1	No	78	Yes
Input TDS for FDS RMM2100	1	No	78	Yes



Critical Path Analysis

The critical path analysis provides the following information:

Critical

- Represents tasks that are critical in the IMS given the most likely duration and logic in the existing schedule, prior to introducing risk.
- These tasks are identified in red in the Gantt chart.

% Critical

- Represents the percentage of time a task appeared on the critical path during the simulation.
- Does not explain if a task is critical after risk is introduced or if a task is critical based on logic and total float in the existing schedule.
- This percentage is also identified to the left of the Gantt chart bars.

Risk Critical

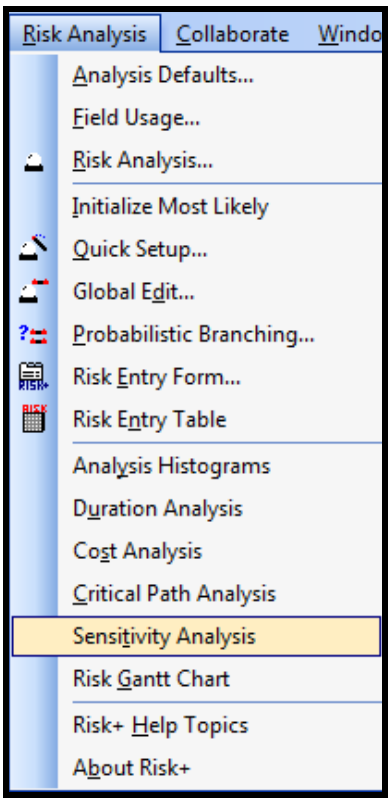
- Represents tasks that are not usually on the critical path but become critical once risk is introduced greater than a specified percentage of time. The Risk+ default is 75%.
- These tasks are identified in magenta in the Gantt chart.

Tasks that are not critical, neither before nor after risk is introduced, are identified in blue in the Gantt chart.

Note: This analysis does not change the schedule critical path or alter any network connections.

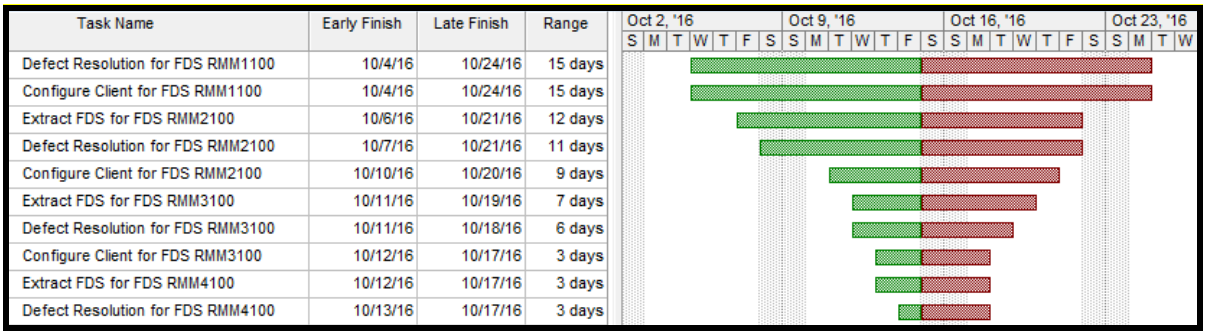
Sensitivity Analysis

To view the Sensitivity Analysis results, select *Sensitivity Analysis* from the Risk Analysis menu.



Sensitivity Analysis Menu Option

This analysis shows how the finish date of a project is affected by changes in its individual task durations by determining each task's impact on the end date if the minimum (optimistic) or the maximum (pessimistic) durations come true. By identifying the tasks that have the greatest impact on the finish date of the project, a sensitivity analysis helps direct risk mitigation efforts to areas where they are most effective.



Task Name	Early Finish	Late Finish	Range
Defect Resolution for FDS RMM1100	10/4/16	10/24/16	15 days
Configure Client for FDS RMM1100	10/4/16	10/24/16	15 days
Extract FDS for FDS RMM2100	10/6/16	10/21/16	12 days
Defect Resolution for FDS RMM2100	10/7/16	10/21/16	11 days
Configure Client for FDS RMM2100	10/10/16	10/20/16	9 days
Extract FDS for FDS RMM3100	10/11/16	10/19/16	7 days
Defect Resolution for FDS RMM3100	10/11/16	10/18/16	6 days
Configure Client for FDS RMM3100	10/12/16	10/17/16	3 days
Extract FDS for FDS RMM4100	10/12/16	10/17/16	3 days
Defect Resolution for FDS RMM4100	10/13/16	10/17/16	3 days

Sensitivity Analysis

The sensitivity analysis provides the following information:

Early Finish

- The date calculated when a task finishes in its minimum remaining duration.
- The green bar in the Gantt chart represents the amount of time available to mitigate between the earliest completion date and the expected completion date.

Late Finish

- The date calculated when a task finishes in its maximum remaining duration.
- The red bar in the Gantt chart represents the amount of time available to mitigate between the expected completion date and the latest completion date.

Range

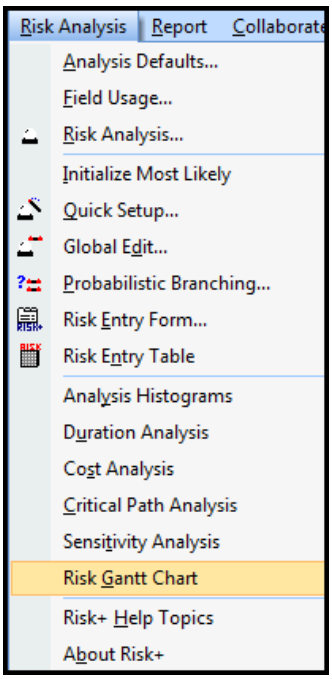
- The number of working days between the early and late finish dates.

The dashed line down the middle of the Gantt chart represents the expected completion date, usually centered around the mean.

Tasks are displayed from largest impact ability to smallest impact ability, using the minimum, most likely, and maximum remaining durations.

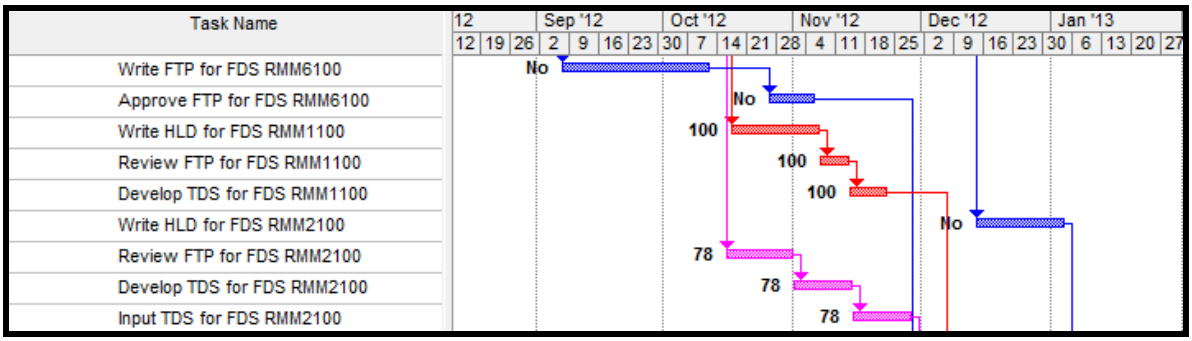
Risk Gantt Chart

To view the Risk Gantt Chart, select *Risk Gantt Chart* from the Risk Analysis menu.



Risk Gantt Chart Menu Option

The Gantt chart shows areas of the schedule that may need special attention by identifying the non-critical, critical, and risk critical tasks in the schedule, similar to the Gantt chart shown in the Critical Path Analysis.



Risk Gantt Chart

The following information is shown in the Risk Gantt Chart:

Critical

- Tasks identified in red are tasks that are critical in the IMS given the most likely duration and logic in the existing schedule, prior to introducing risk.

Risk Critical

- Tasks identified in magenta are tasks that are not usually on the critical path but become critical greater than a specified percentage of time once risk is introduced. The Risk+ default is 75%.

Non-Critical Tasks

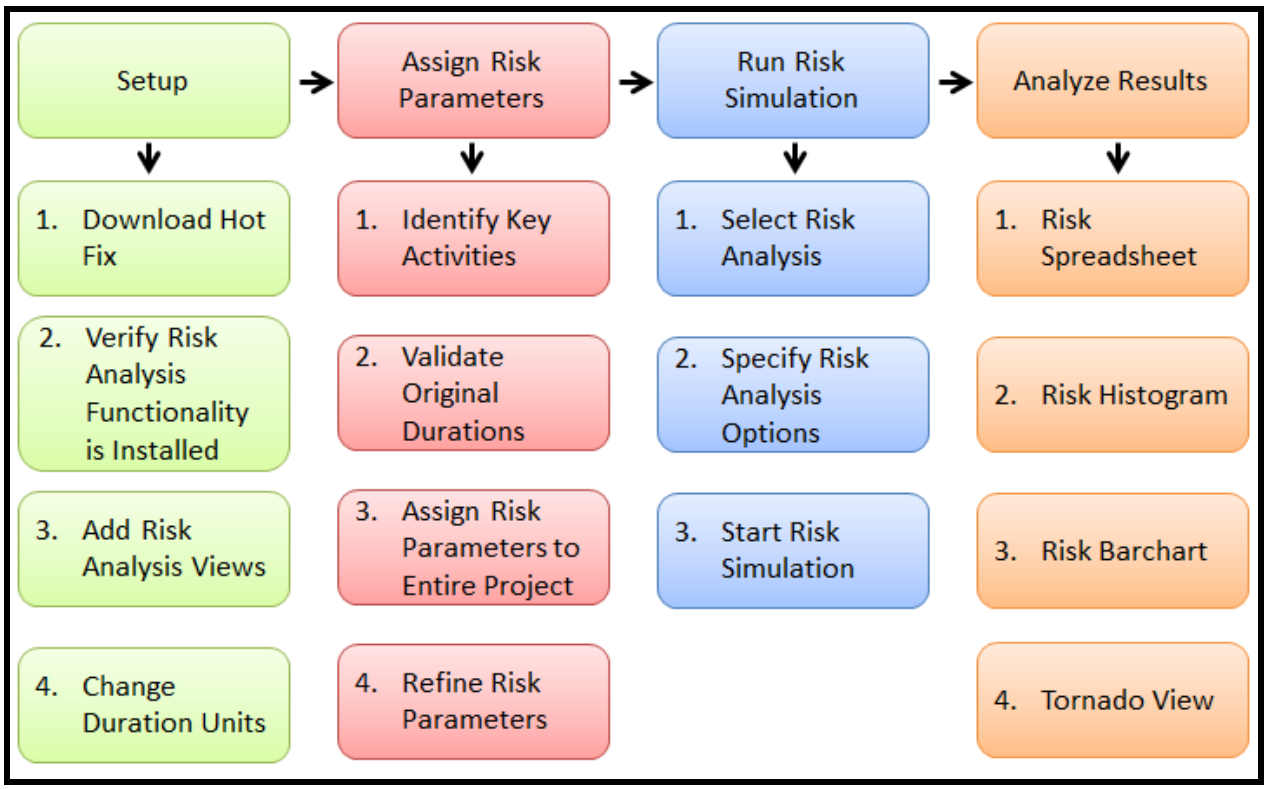
- Tasks identified in blue are not on the critical path, neither before nor after risk is introduced.

% Critical

- Represents the percentage of time a task appeared on the critical path during the simulation.

Open Plan Professional

The process for conducting an SRA using Open Plan Professional includes four individual operations, as shown in the chart below. The significant activities associated with each are numbered below their respective operations.



SRA Operations and Activities Using Open Plan Professional

Setup

Download Hot Fix

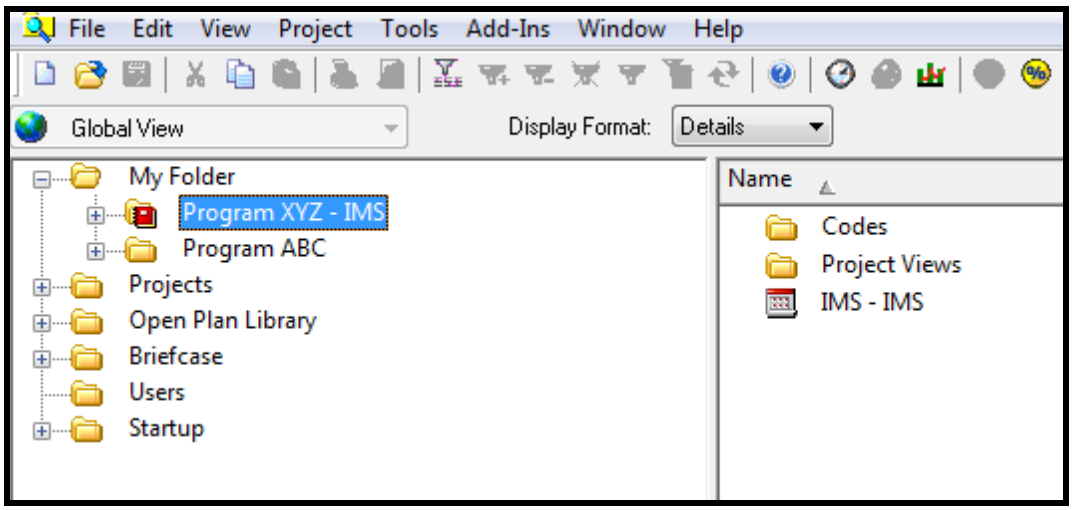
Download Hot Fix 07 if using Open Plan Professional, version 3.3 or earlier. This hot fix can be found on the Deltek website at http://www.deltek.com.

The Hot Fix enables Open Plan Professional to take in progress activities into account when running a risk analysis. Otherwise, in progress tasks have their distributions equal to their remaining durations during a risk analysis. Open Plan Professional determines percentages of the assigned optimistic and pessimistic durations based on the original durations. It then uses these percentages to derive new values for the optimistic and pessimistic durations based on the remaining durations. Thus, the three point estimates are based on remaining durations, not original durations, during the risk analysis. These steps are all done in the background and do not need to be included as part of the risk analysis process.

Verify Risk Analysis Functionality is Installed

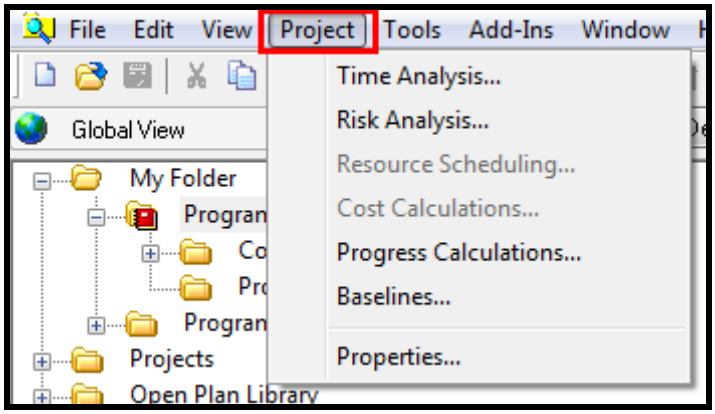
Verify Open Plan Professional is loaded on the computer and the risk analysis functionality is available to use.

1. Ensure a project folder is selected.



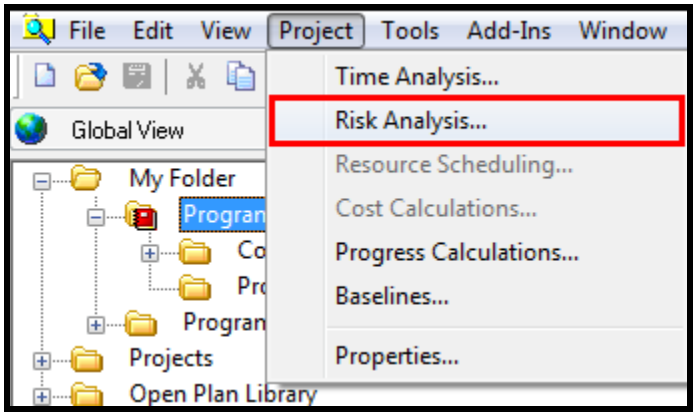
Project Folder in Open Plan Explorer

2. Select *Project.*



Project Menu on Toolbar

3. Ensure Risk Analysis appears in bold (not grayed out), indicating it is available for use.

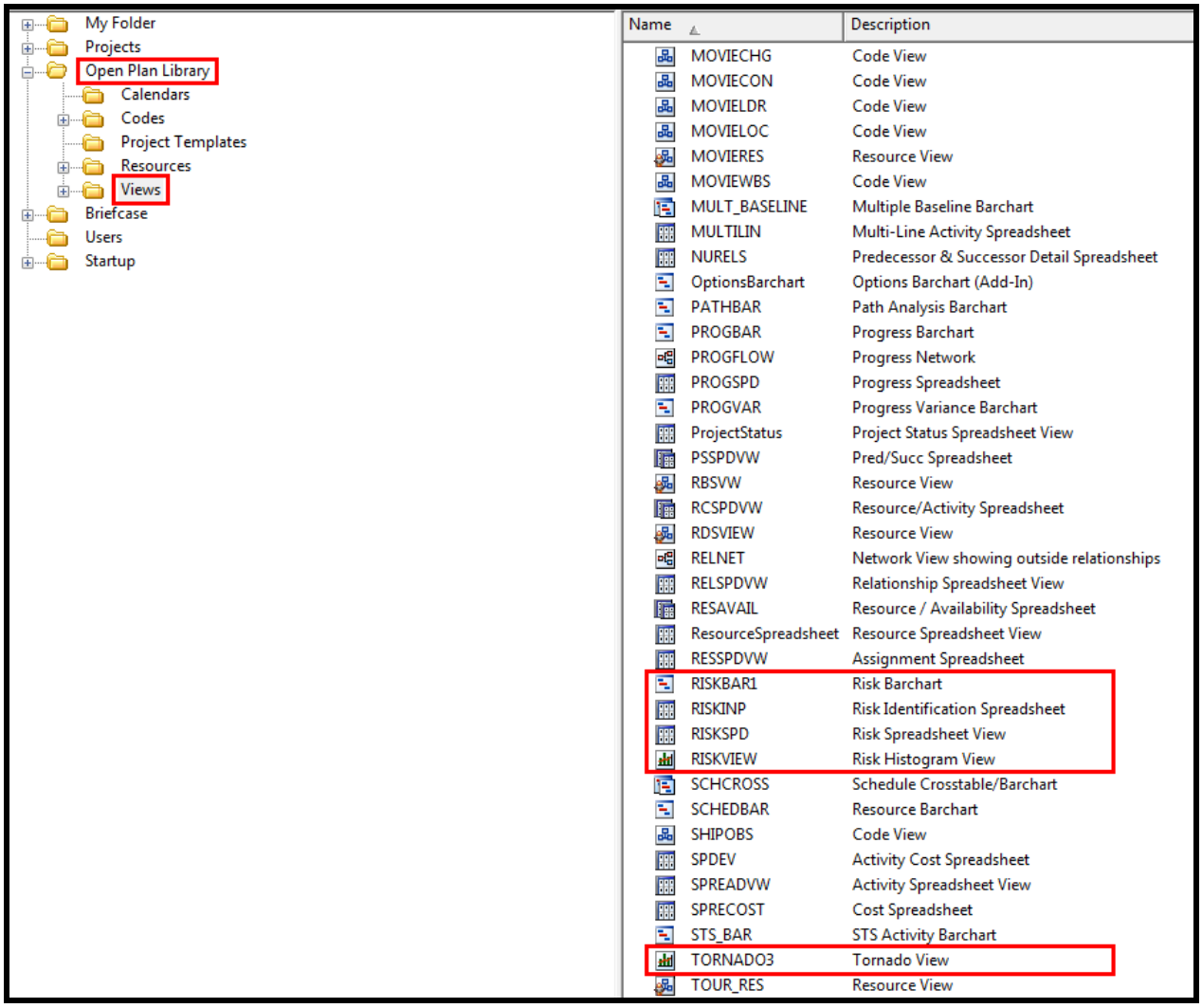


Risk Analysis Menu Option

Add Risk Analysis Views

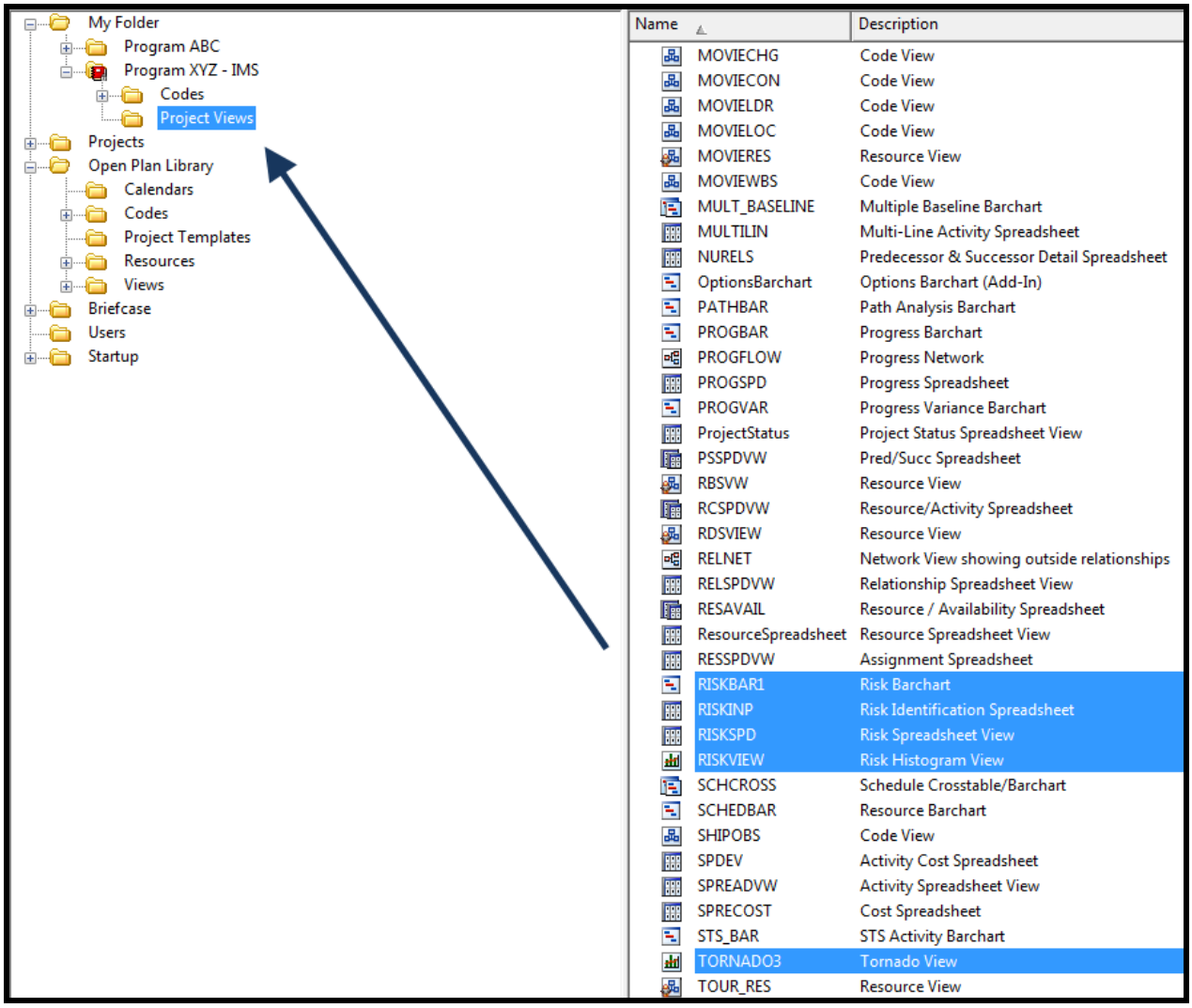
Open Plan Professional requires the appropriate risk analysis views to be associated with the SRA project. Add the risk analysis views stored in the Open Plan Library for the SRA project.

1. In Open Plan Explorer, select the *Open Plan Library* folder.
2. Select the *Views* folder.
3. Select the five risk analysis views shown below.



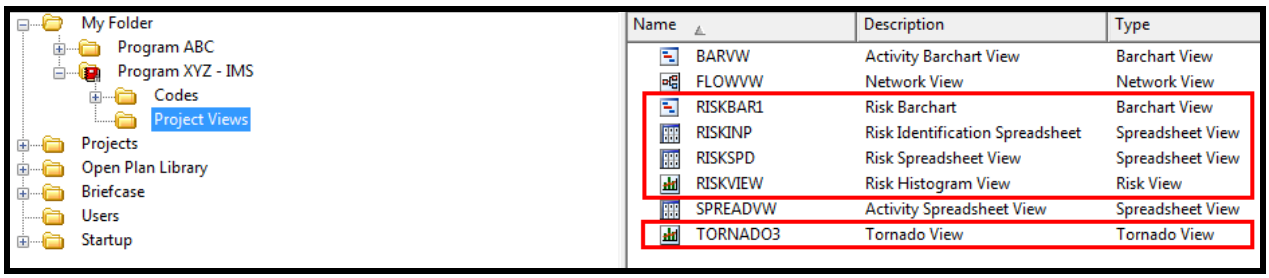
Risk Analysis Views

4. Drag these views under the *Project Views* folder for the SRA project.



Copying Risk Analysis Views

5. The risk analysis views now appear for the project.



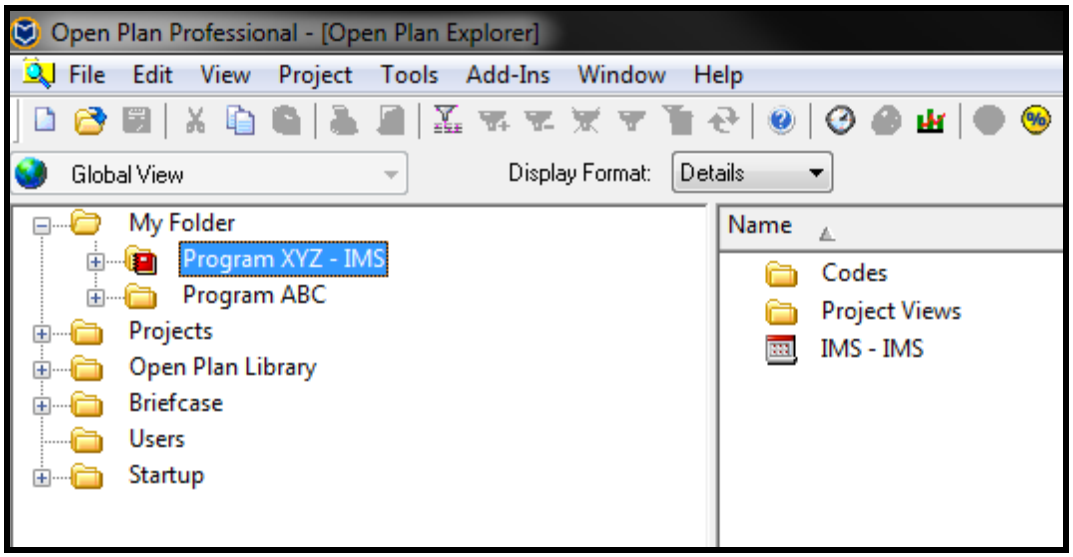
Risk Analysis Views in Project Views Folder

Change Duration Units

Setting the duration units to days for the risk analysis will simplify inputs and comparisons. Assign Days as the duration units for both the project file and the risk duration fields.

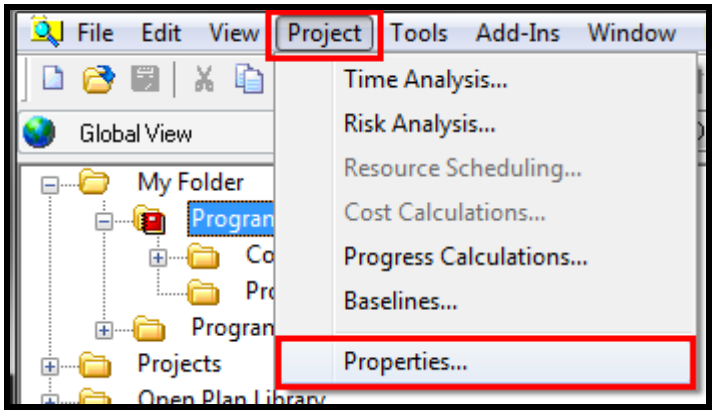
Project File

1. Ensure the project folder is selected.



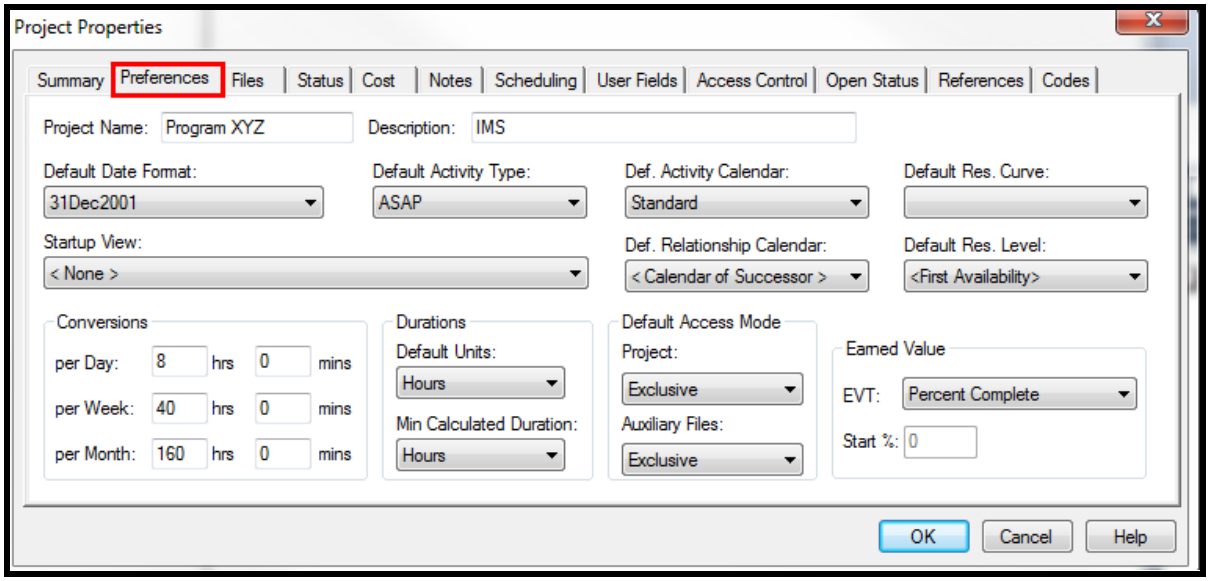
Project Folder in Open Plan Explorer

2. Select *Project* > *Properties.*



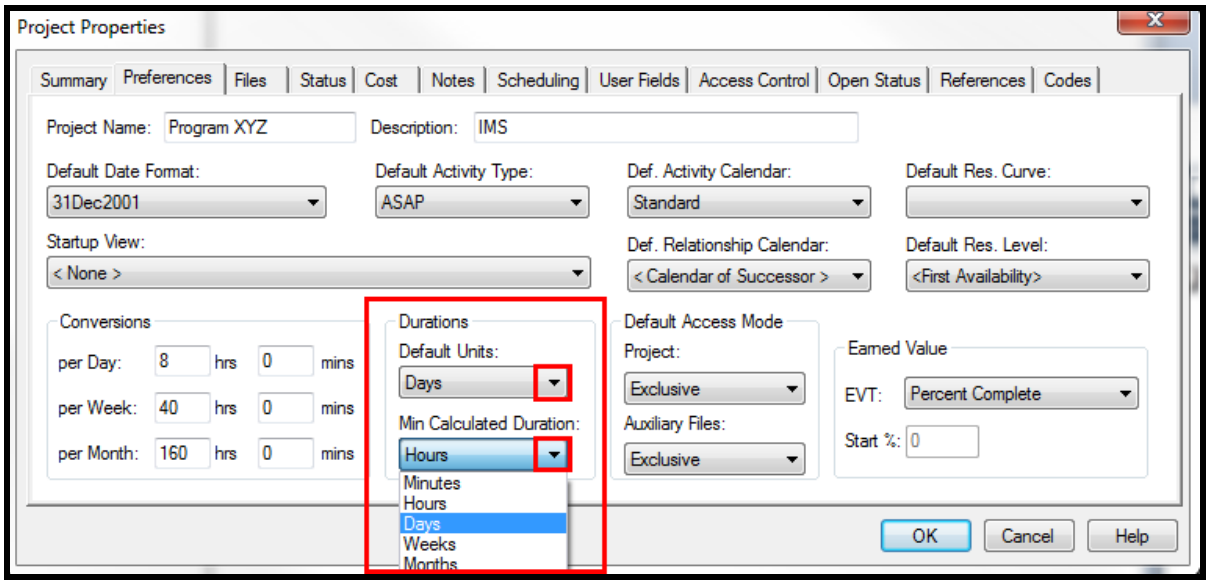
Properties Menu Option

3. Select the *Preferences* tab.



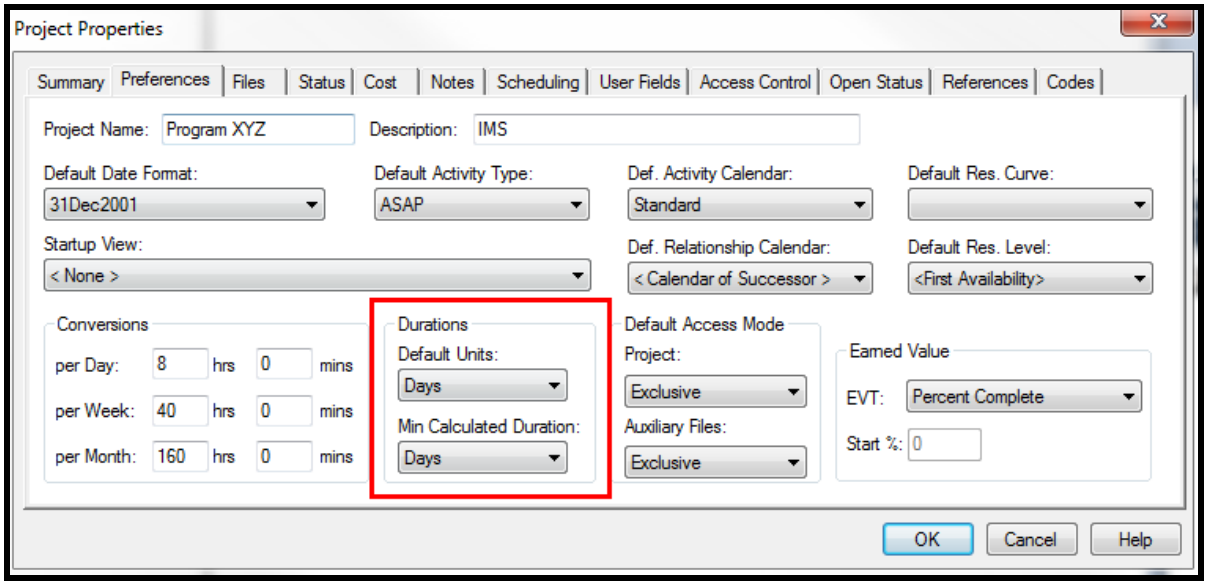
Preferences Tab

4. Use the dropdowns to select *Days* for both *Default Units* and *Min Calculated Duration*.



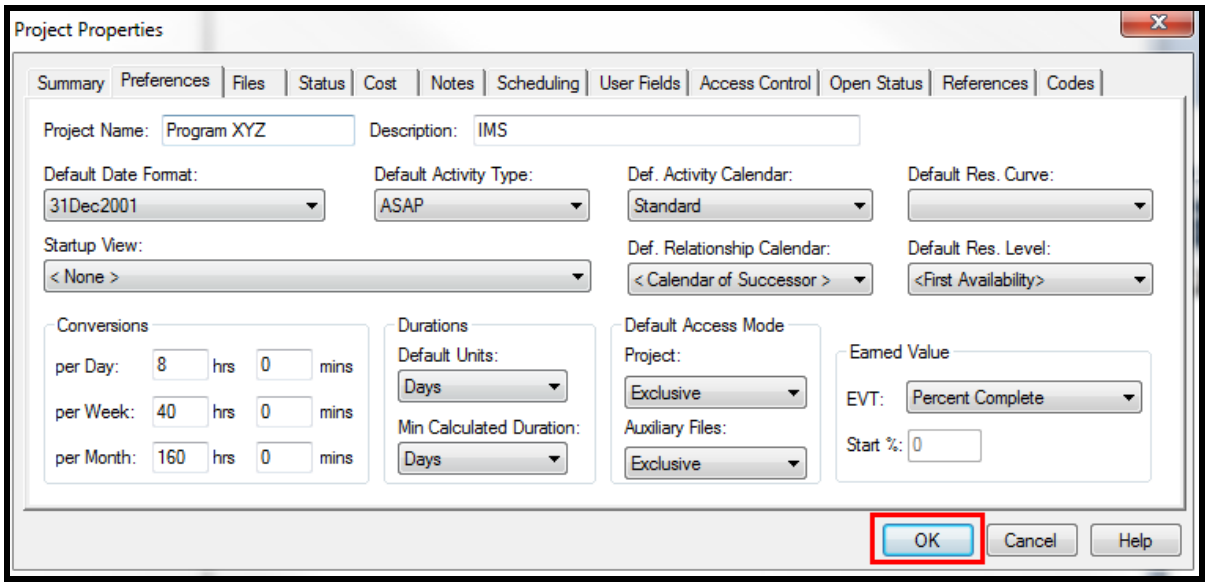
Duration Unit Selections

5. Durations now appear in Days.



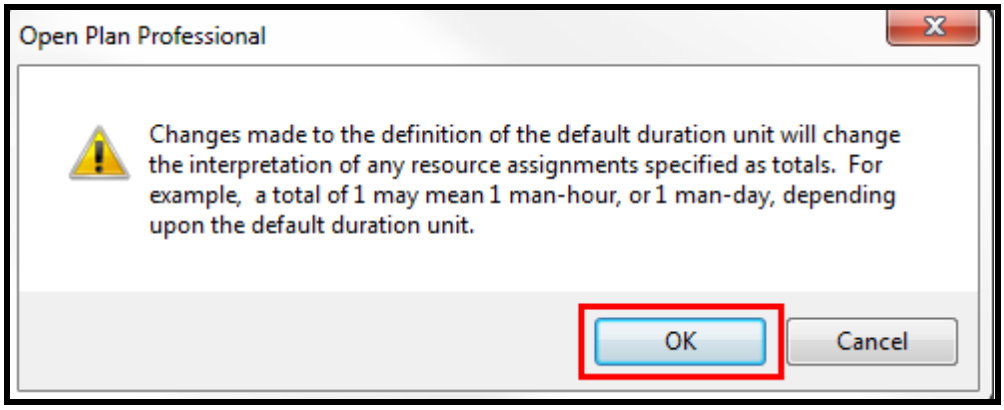
Duration Units in Days

6. Select *OK*.



Confirming Edits to Preferences Tab

7. Select *OK* when a notification appears about changes to resource assignments.

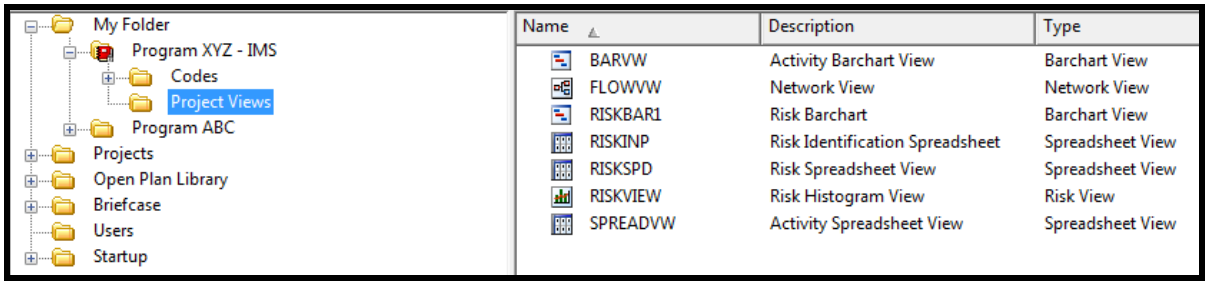


Open Plan Notification

Optimistic and Pessimistic Durations

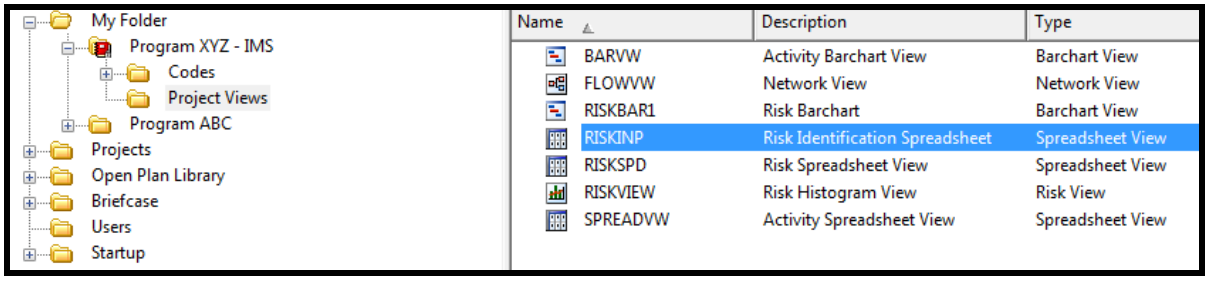
The steps below prepare the Risk Identification Spreadsheet for entering risk parameters.

1. Select *Project Views* under the SRA project folder.



Project Views Folder in Open Plan Explorer

2. Double click on *Risk Identification Spreadsheet* to open view.



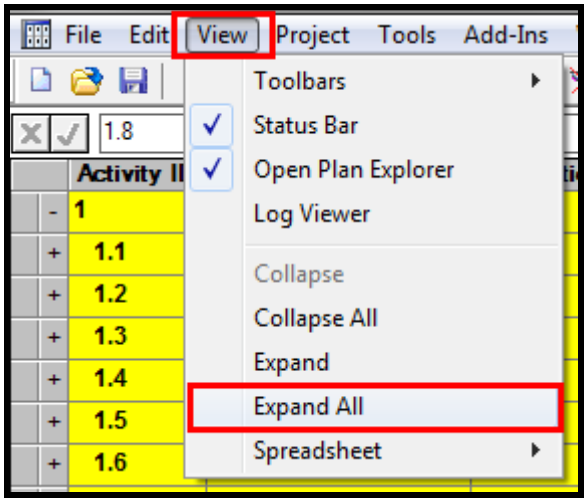
Risk Identification Spreadsheet Selection

3. The Risk Identification Spreadsheet now appears.

	Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
-	1	Program XYZ IMS	0	1425d	0	None	False
+	1.1	Program Milestones	0	1425d	0	None	False
+	1.2	Program Management	0	1425d	0	None	False
+	1.3	Configuration	0	505d	0	None	False
+	1.4	Development	0	491d	0	None	False
+	1.5	Testing	0	185d	0	None	False
+	1.6	User Management	0	470d	0	None	False
+	1.7	Data Management	0	150d	0	None	False
+	1.8	Training	0	194d	0	None	False
+	1.9	Cutover	0	80d	0	None	False

Risk Identification Spreadsheet

4. Select *View* > *Expand All* to see all the activities.



Expand All Option

5. All the activities now appear.

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
1	Program XYZ IMS	0	1425d	0	None	False
1.1	Program Milestones	0	1425d	0	None	False
1.1.1	Start Contract	0	0	0	None	False
1.1.2	SFR/SRR Complete	0	0	0	None	False
1.1.3	CDR Complete	0	0	0	None	False
1.1.4	TRR Cycle 3 Complete	0	0	0	None	False
1.1.5	UAT Complete	0	0	0	None	False
1.1.6	Milestone C Complete	0	0	0	None	False
1.1.7	Go Live	0	0	0	None	False
1.2	Program Management	0	1425d	0	None	False
1.2.1	Program Management	0	1425d	0	None	False
1.2.1.	Program Management	0	110d	0	None	False
1.2.1.	Program Management	0	260d	0	None	False
1.2.1.	Program Management	0	260d	0	None	False
1.2.1.	Program Management	0	260d	0	None	False
1.2.1.	Program Management	0	260d	0	None	False
1.2.1.	Program Management	0	265d	0	None	False
1.2.1.	Program Management	0	10d	0	None	False

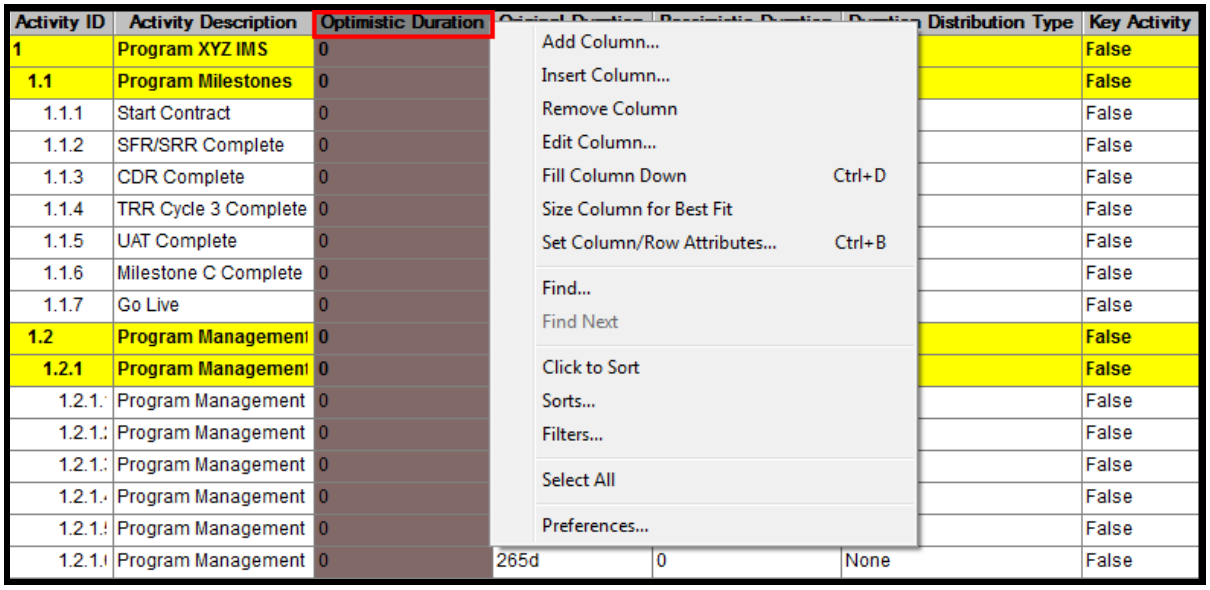
Expanded Risk Identification Spreadsheet

6. Highlight *Optimistic Duration* column.

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
1	Program XYZ IMS	0	1425d	0	None	False
1.1	Program Milestones	0	1425d	0	None	False
1.1.1	Start Contract	0	0	0	None	False
1.1.2	SFR/SRR Complete	0	0	0	None	False
1.1.3	CDR Complete	0	0	0	None	False
1.1.4	TRR Cycle 3 Complete	0	0	0	None	False
1.1.5	UAT Complete	0	0	0	None	False
1.1.6	Milestone C Complete	0	0	0	None	False
1.1.7	Go Live	0	0	0	None	False
1.2	Program Management	0	1425d	0	None	False
1.2.1	Program Management	0	1425d	0	None	False
1.2.1.	Program Management	0	110d	0	None	False
1.2.1.	Program Management	0	260d	0	None	False

Optimistic Duration Column Selection

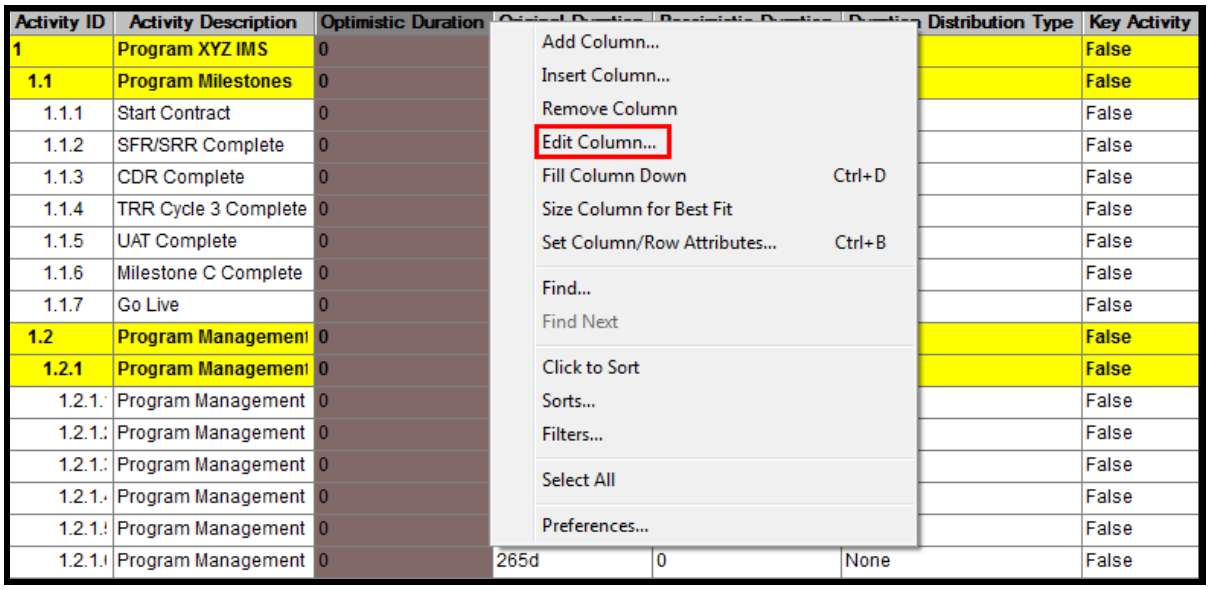
7. With mouse hovering over header, Right Click.



Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
1	Program XYZ IMS	0				False
1.1	Program Milestones	0				False
1.1.1	Start Contract	0				False
1.1.2	SFR/SRR Complete	0				False
1.1.3	CDR Complete	0				False
1.1.4	TRR Cycle 3 Complete	0				False
1.1.5	UAT Complete	0				False
1.1.6	Milestone C Complete	0				False
1.1.7	Go Live	0				False
1.2	Program Management	0				False
1.2.1	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0	265d	0	None	False

Menu Options for Optimistic Duration Column

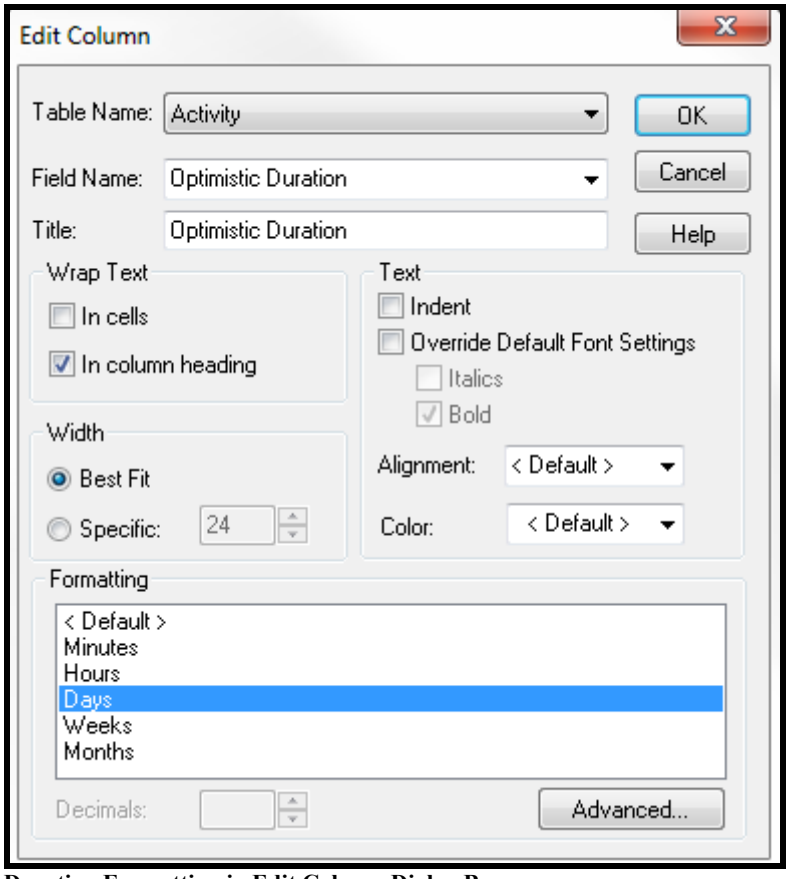
8. Select *Edit Column.*



Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
1	Program XYZ IMS	0				False
1.1	Program Milestones	0				False
1.1.1	Start Contract	0				False
1.1.2	SFR/SRR Complete	0				False
1.1.3	CDR Complete	0				False
1.1.4	TRR Cycle 3 Complete	0				False
1.1.5	UAT Complete	0				False
1.1.6	Milestone C Complete	0				False
1.1.7	Go Live	0				False
1.2	Program Management	0				False
1.2.1	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0				False
1.2.1.	Program Management	0	265d	0	None	False

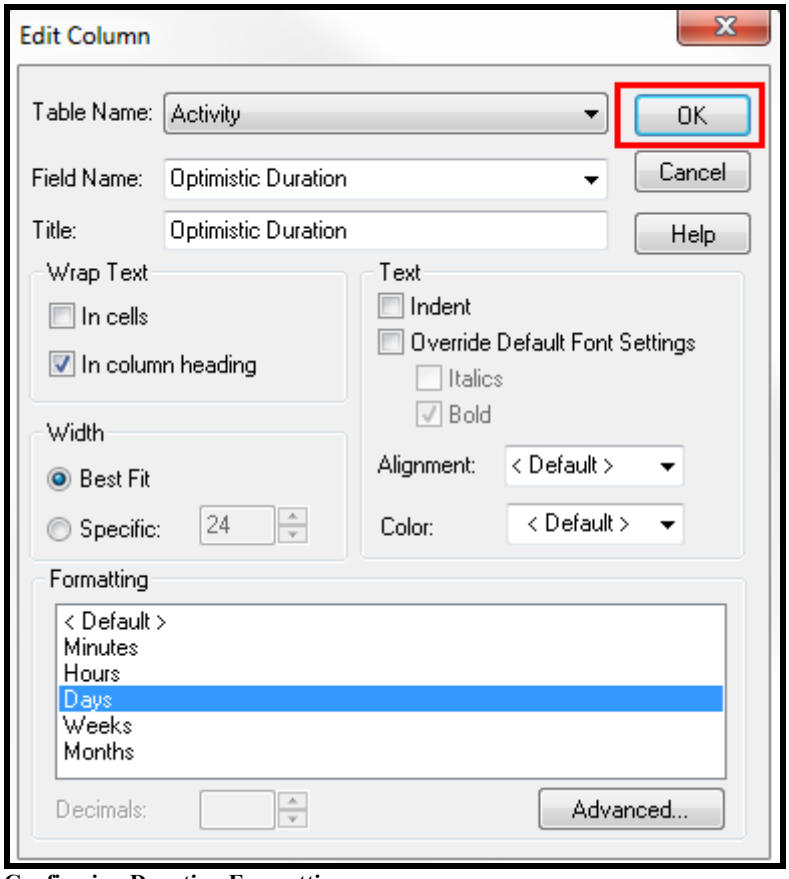
Edit Column Selection

9. Under *Formatting*, select *Days*.



Duration Formatting in Edit Column Dialog Box

10. Select *OK*.



Confirming Duration Formatting

11. Repeat Steps 6-10 for the *Pessimistic Duration* column.

Assign Risk Parameters

Identify Key Activities

Detailed risk analysis information is provided for key activities that are identified in the schedule. It is prudent to limit the number of key activities, as selecting too many results in increased calculation time, complex histogram selection and an overwhelming number of results.

Identify the key activities by typing *True* next to the task in the *Key Activity* column. The key activities may also be selected using the Risk tab of the Activity Details dialogue box.

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
1	Program XYZ IMS	0	1425d	0	None	False
1.1	Program Milestones	0	1425d	0	None	False
1.1.1	Start Contract	0	0	0	None	False
1.1.2	SFR/SRR Complete	0	0	0	None	False
1.1.3	CDR Complete	0	0	0	None	False
1.1.4	TRR Cycle 3 Complete	0	0	0	None	True
1.1.5	UAT Complete	0	0	0	None	False
1.1.6	Milestone C Complete	0	0	0	None	False
1.1.7	Go Live	0	0	0	None	True

Key Activity Selection

Validate Original Durations

The values in the *Original Duration* field are considered the mode (most likely) values for the risk analysis. Original durations should be reviewed and validated prior to running the SRA. An activity with a blank duration field is interpreted as having zero duration during the risk analysis.

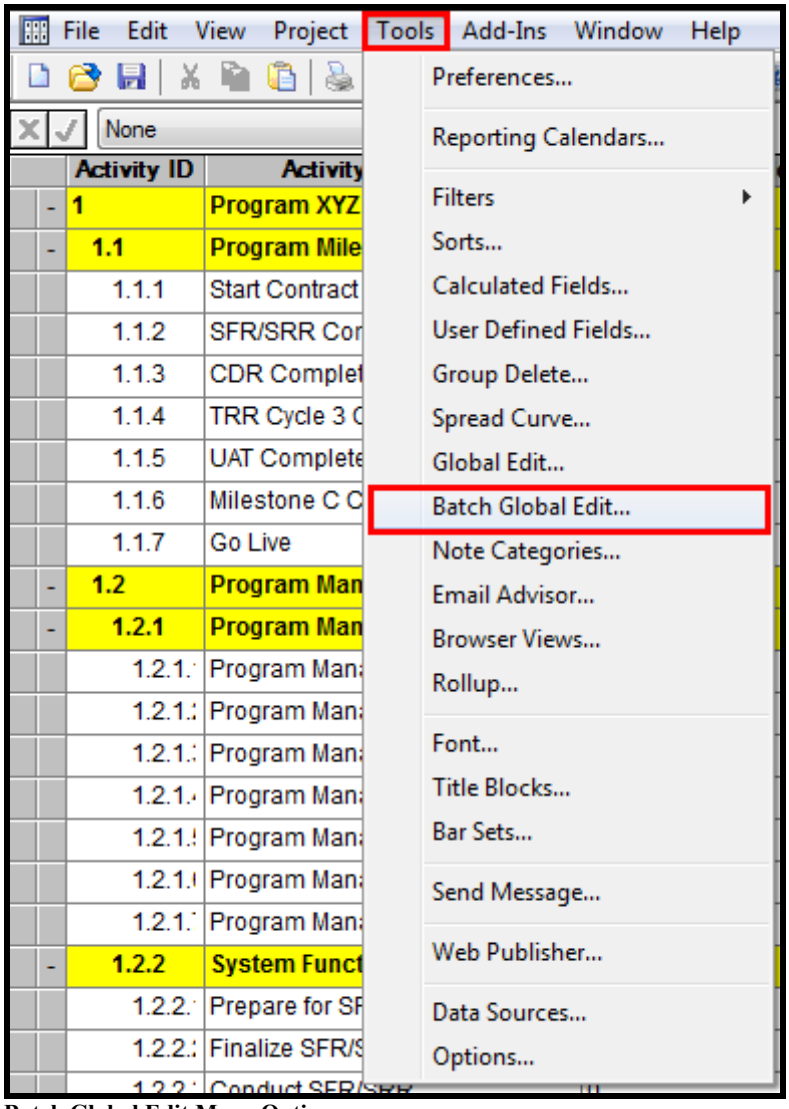
Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
1.2.3	Critical Design Review	0	50d	0	None	False
1.2.3.1	Prepare for CDR	0	30d	0	None	False
1.2.3.2	Finalize CDR Presentation	0	15d	0	None	False
1.2.3.3	Conduct CDR	0	5d	0	None	False
1.2.4	Interface Control Agreement	0	85d	0	None	False
1.2.4.1	Draft ICA	0	30d	0	None	False
1.2.4.2	Conduct Negotiations for ICA	0	35d	0	None	False
1.2.4.3	Finalize ICA	0	15d	0	None	False
1.2.4.4	Aquire Signature for ICA	0	5d	0	None	False
1.2.5	Design Control Agreement	0	85d	0	None	False
1.2.5.1	Draft DCA	0	30d	0	None	False
1.2.5.2	Conduct Negotiations for DCA	0	35d	0	None	False
1.2.5.3	Finalize DCA	0	15d	0	None	False
1.2.5.4	Aquire Signature for DCA	0	5d	0	None	False

Original Durations

Assign Risk Parameters to Entire Project

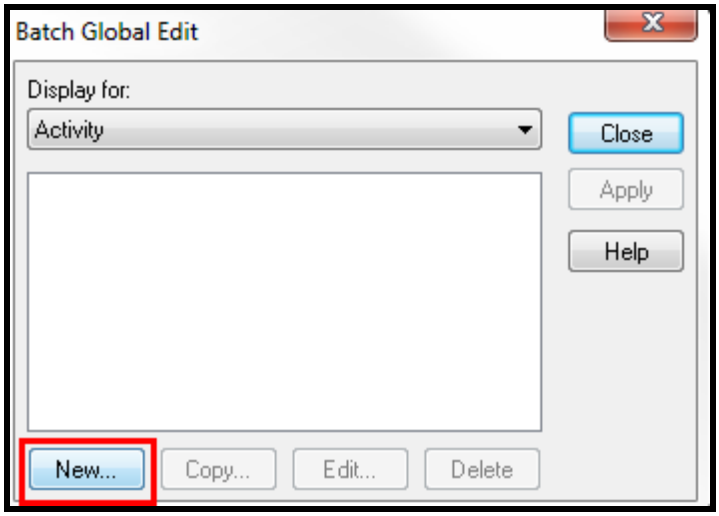
Assign risk parameters for all activities in a project by using the *Batch Global Editing* function in Open Plan Professional. These risk parameters should be those assigned to the majority of tasks. This function calculates the minimum and maximum remaining durations as percentages of the original duration and is used to assign distribution curves to activities. Groups of tasks and individual tasks are further refined through additional global edits and individually assigned three point estimates.

1. Select *Tools* > *Batch Global Edit.*



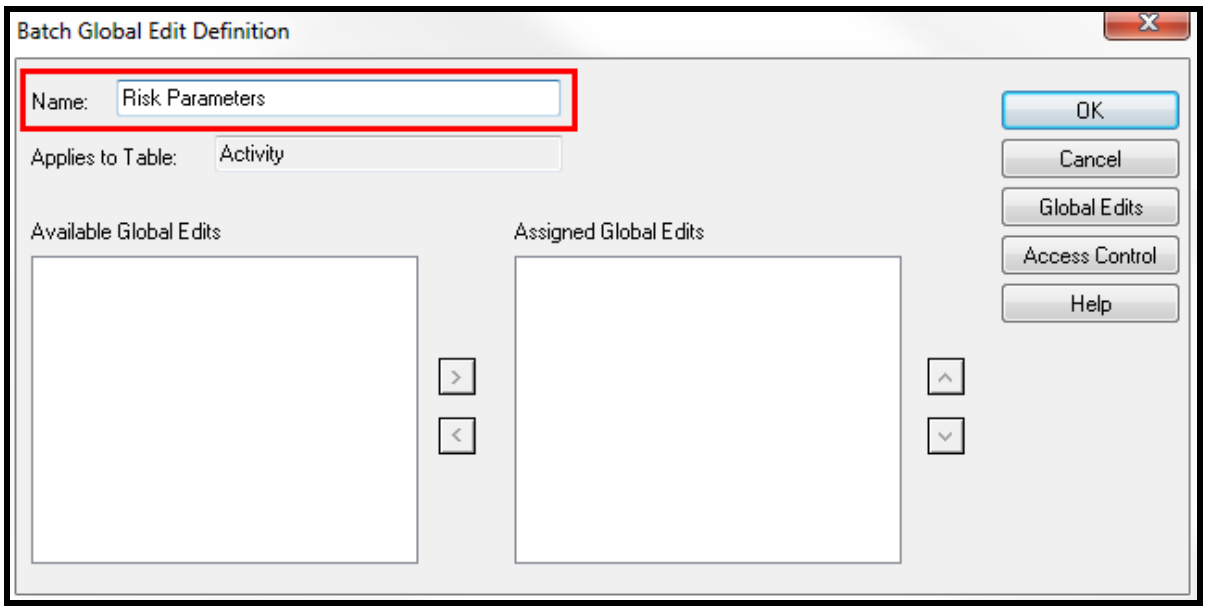
Batch Global Edit Menu Option

2. Select *New.*



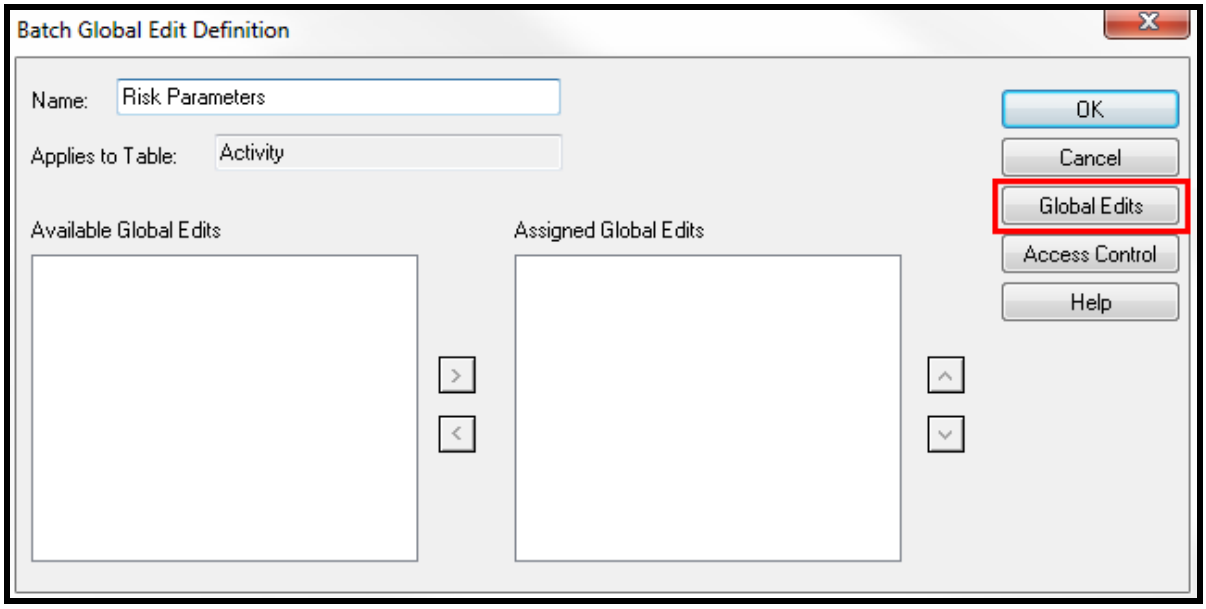
New Batch Global Edit Selection

3. Name Batch Global Edit *Risk Parameters.*



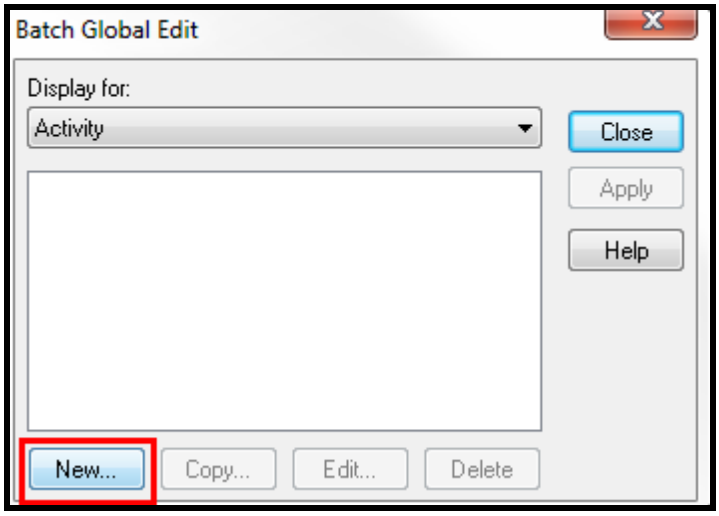
Naming Batch Global Edit

4. Select *Global Edits.*



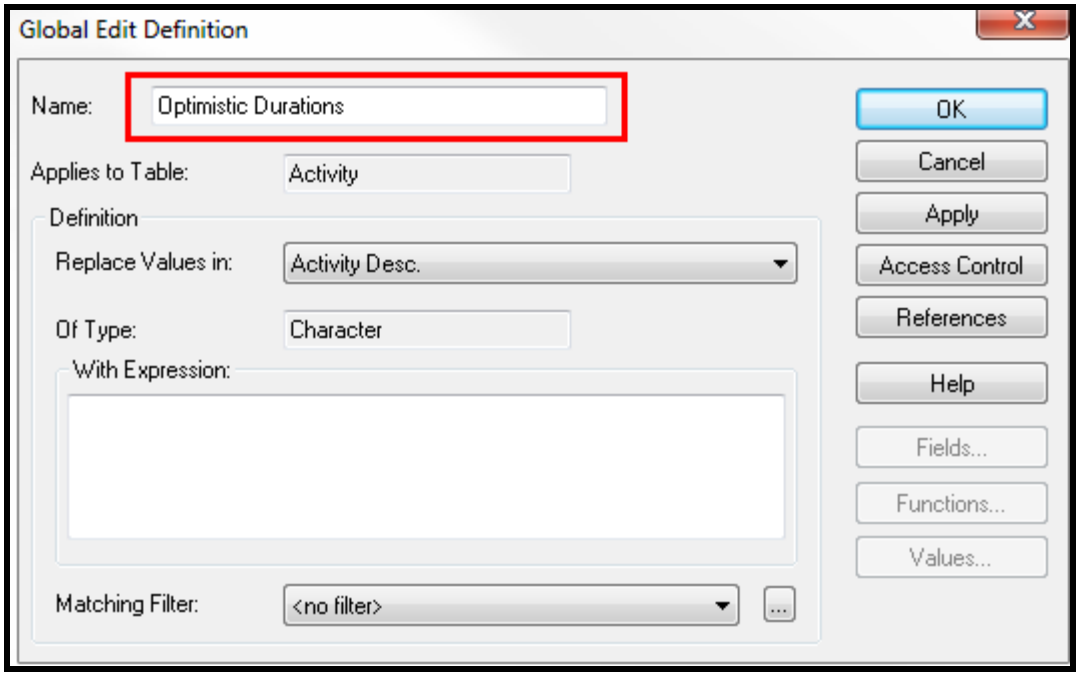
Global Edits Selection

5. Select *New.*



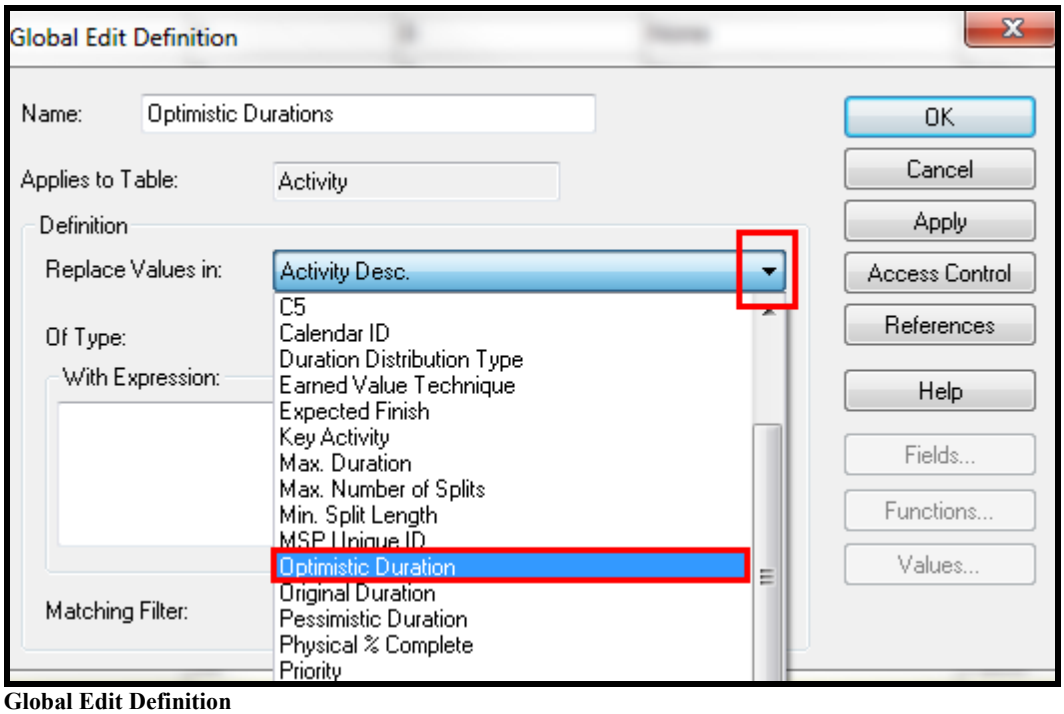
New Global Edit Selection

6. Name the Global Edit Definition *Optimistic Durations.*



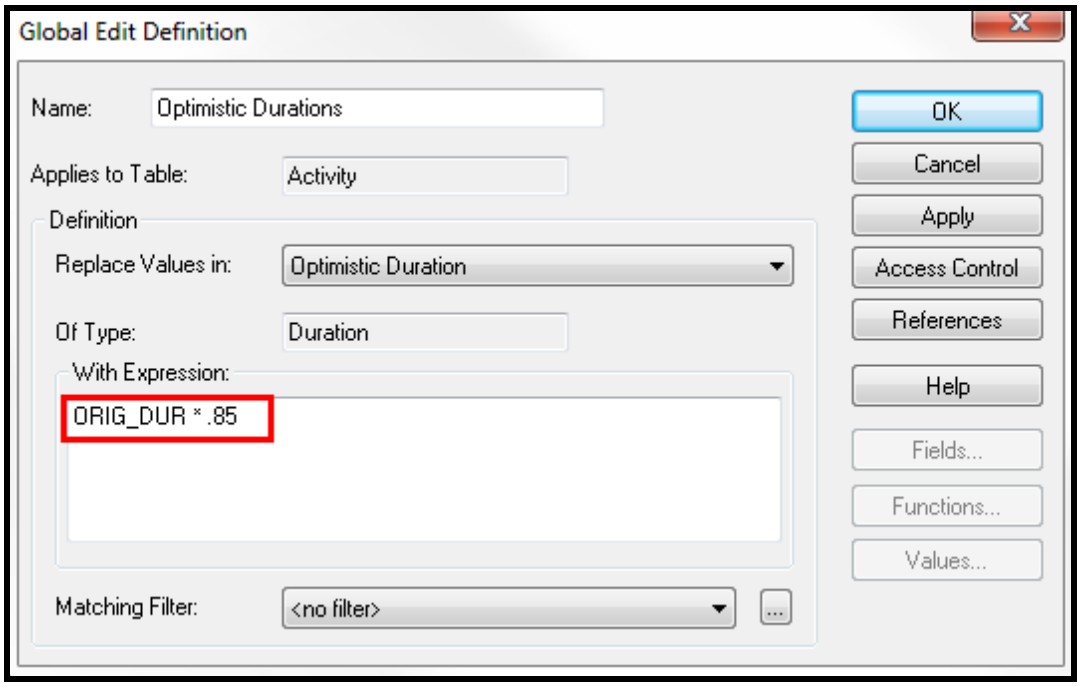
Naming New Global Edit

7. Select the dropdown beside *Replace Values in* and select *Optimistic Duration.*



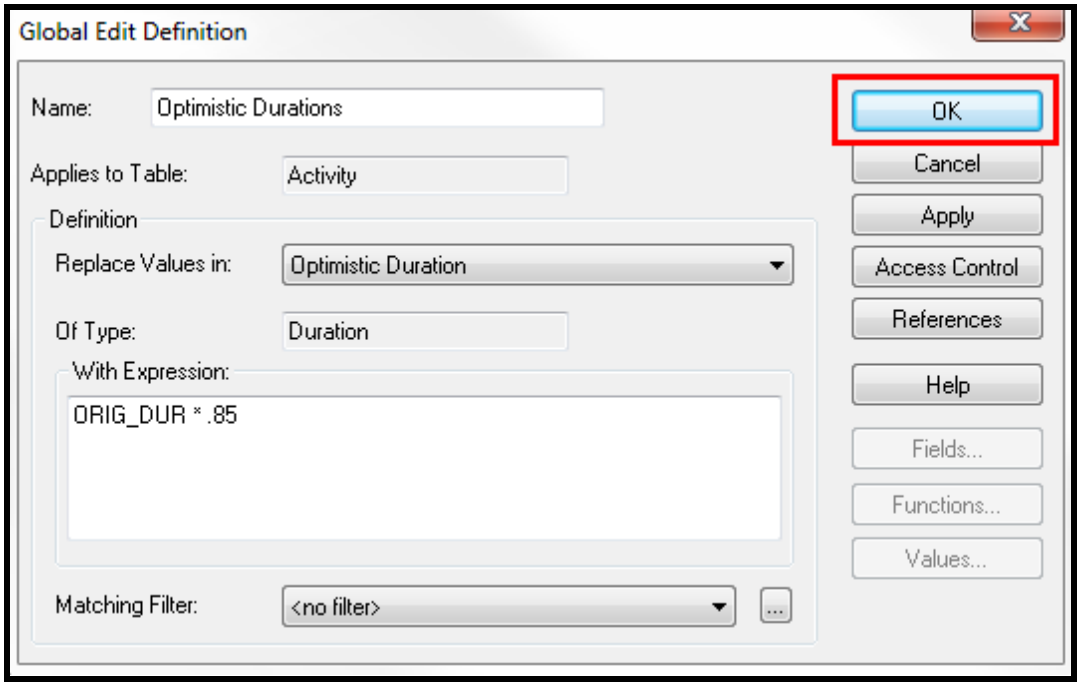
Global Edit Definition

8. Under *With Expression*, type *ORIG_DUR * .85* to subtract 15% from the original duration and use this for the optimistic duration, as an example. Note: There are spaces before and after *.



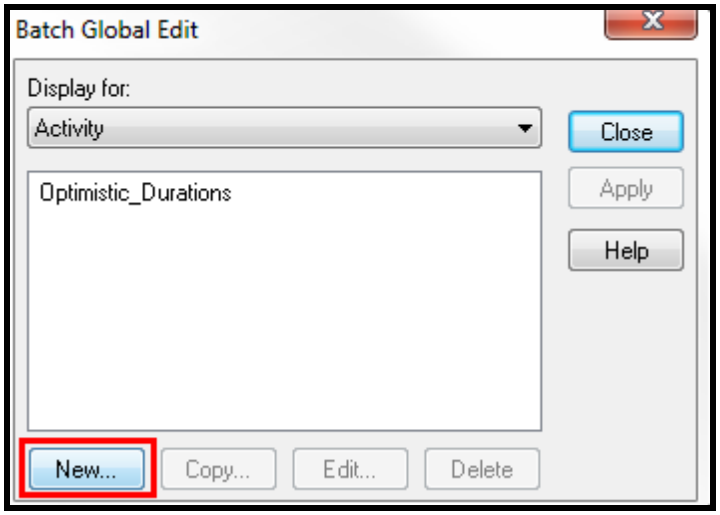
With Expression Command

9. Select *OK*.



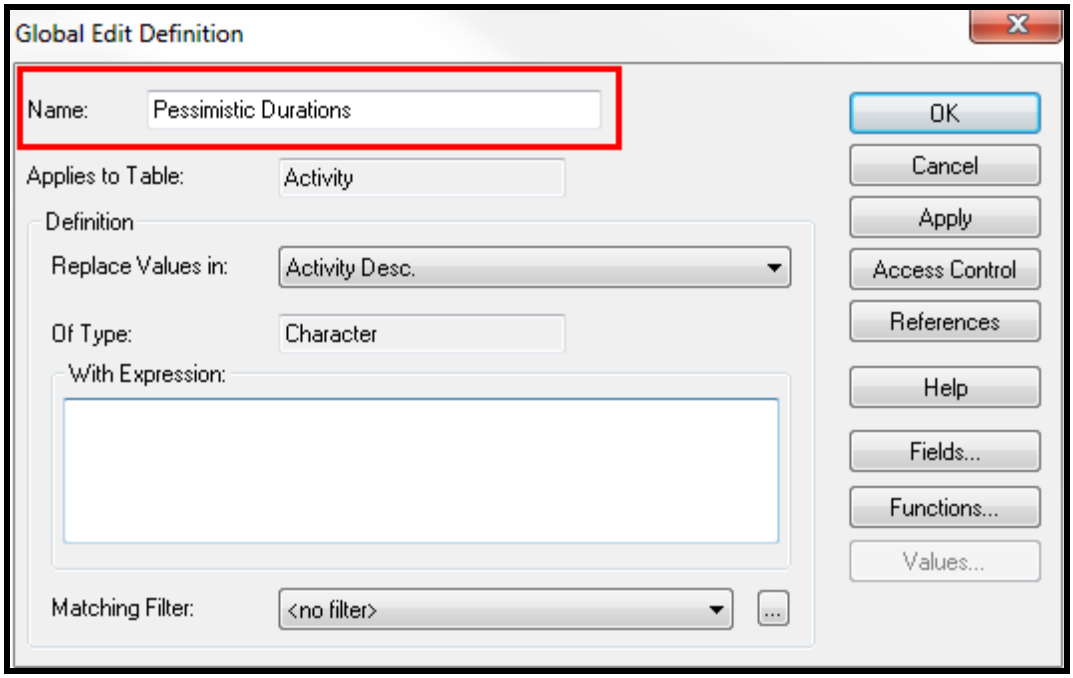
Global Edit Definition Confirmation

10. Select *New*.



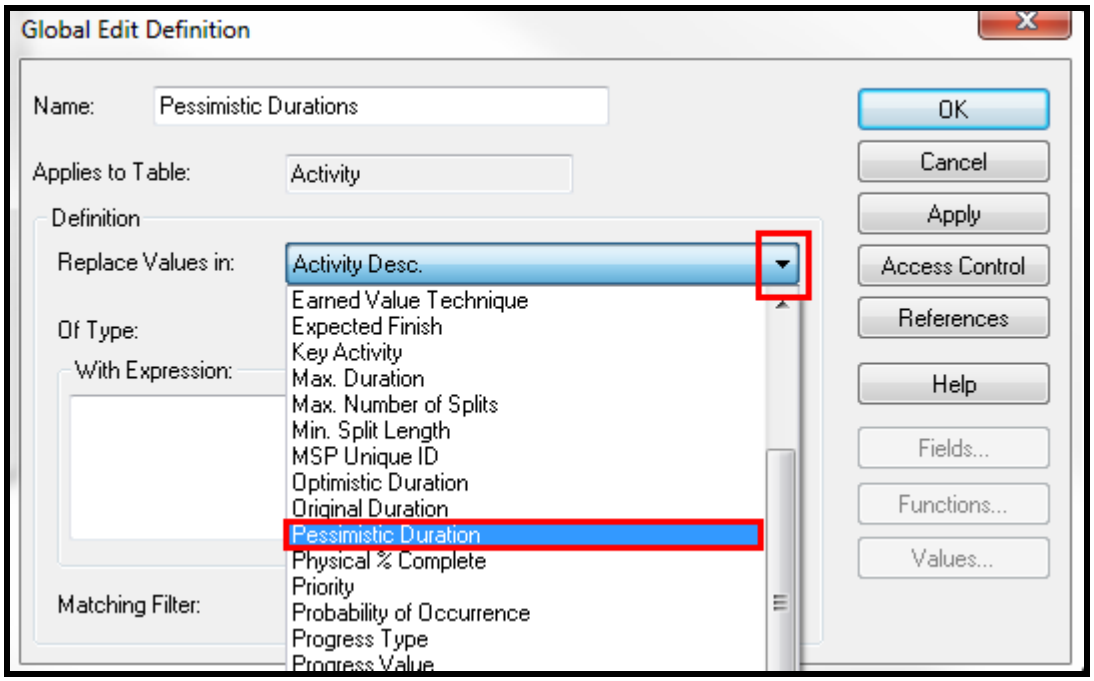
New Global Edit Selection

11. Name the Global Edit Definition *Pessimistic Durations.*



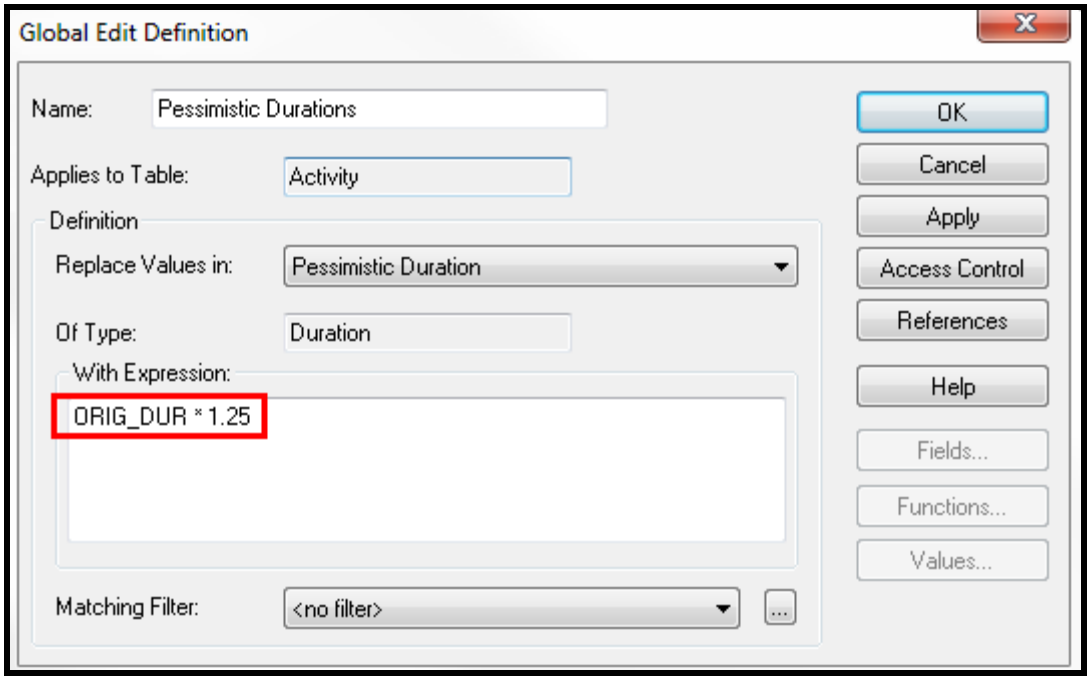
Naming New Global Edit

12. Select the dropdown beside *Replace Values in* and select *Pessimistic Duration.*



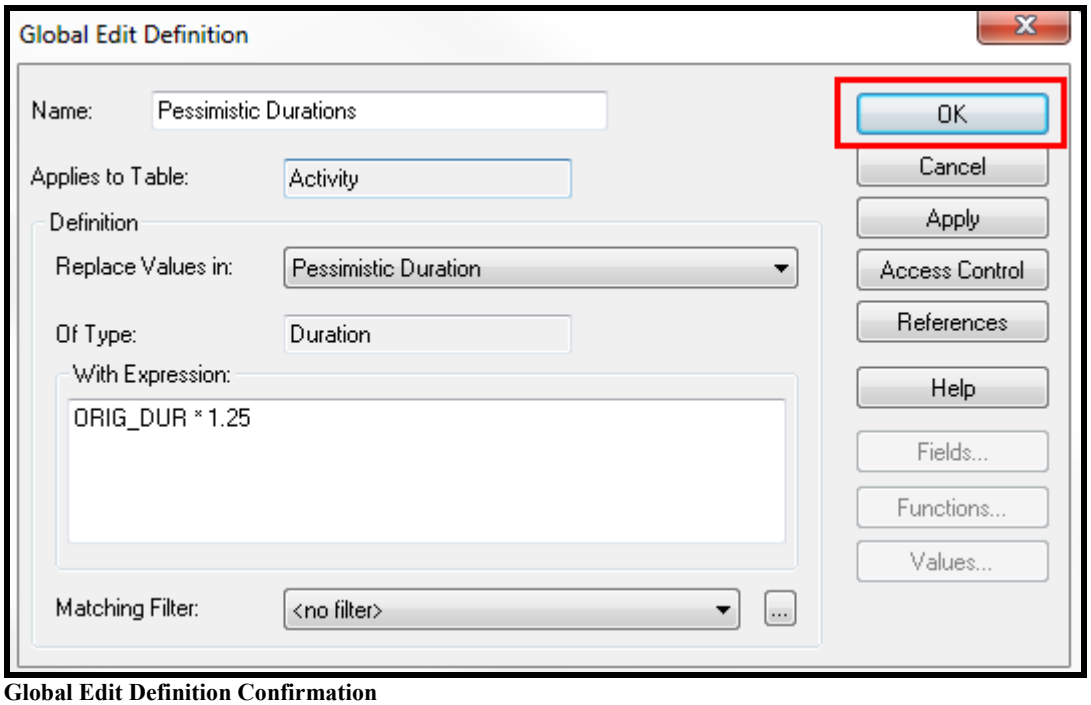
Global Edit Definition

13. Under *With Expression*, type *ORIG_DUR * 1.25* to add 25% to the original duration and use this for the pessimistic duration, as an example. Note: There are spaces before and after *.



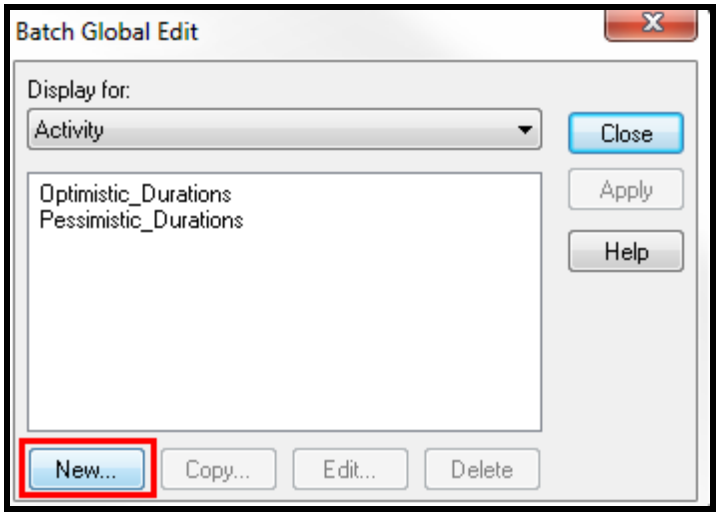
With Expression Command

14. Select *OK*.



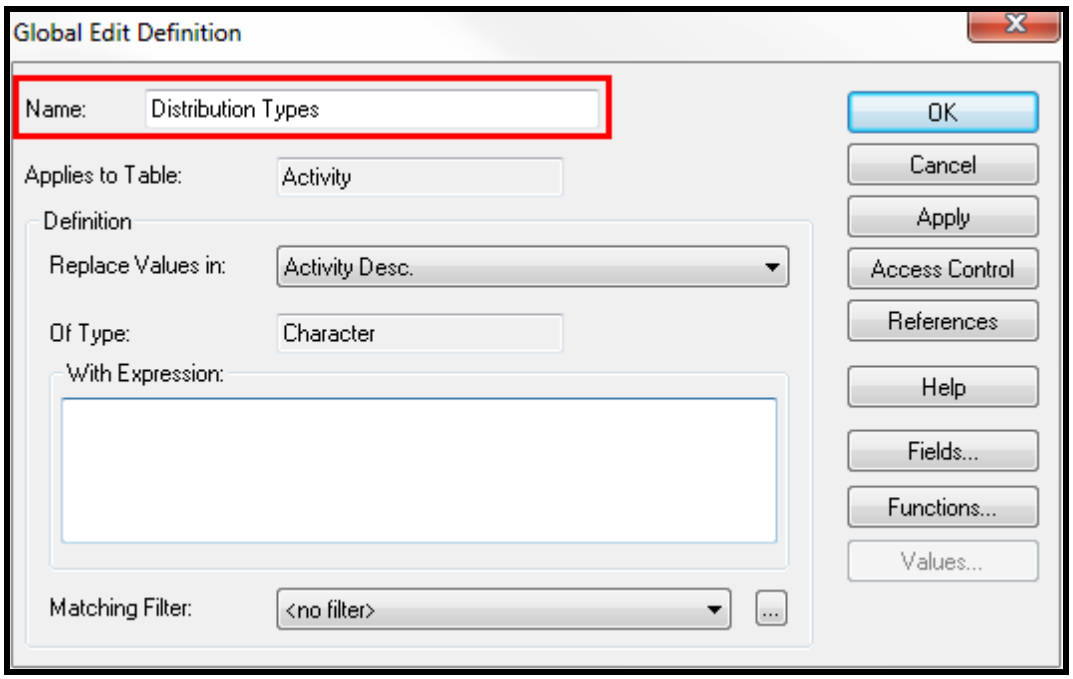
Global Edit Definition Confirmation

15. Select *New*.



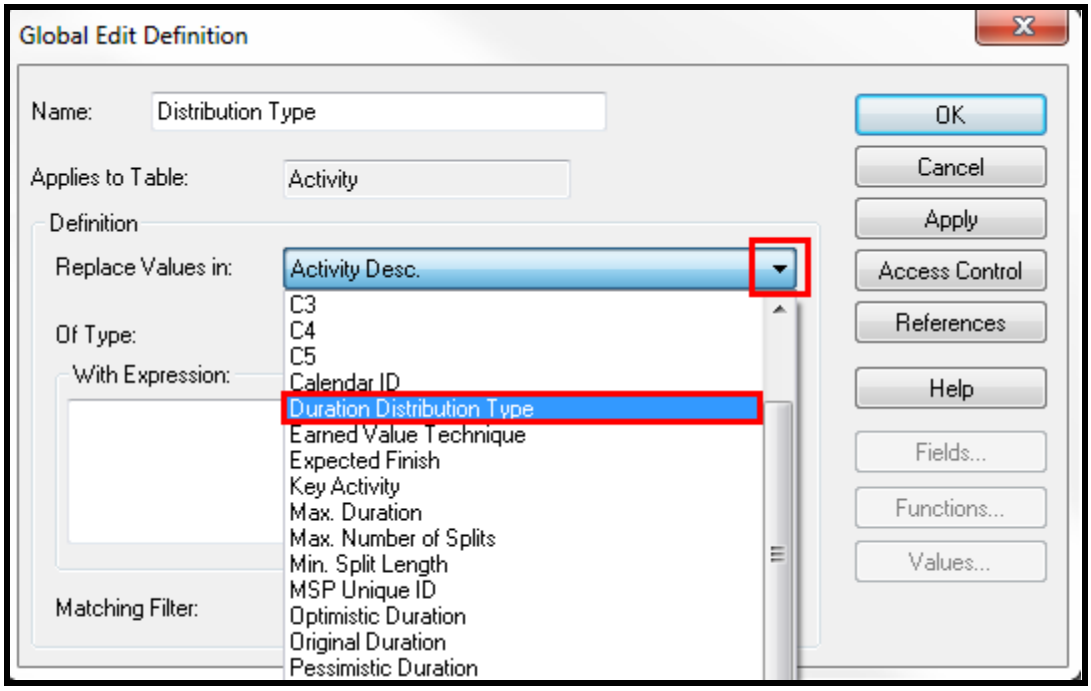
New Global Edit Selection

16. Name the Global Edit Definition *Distribution Types*.



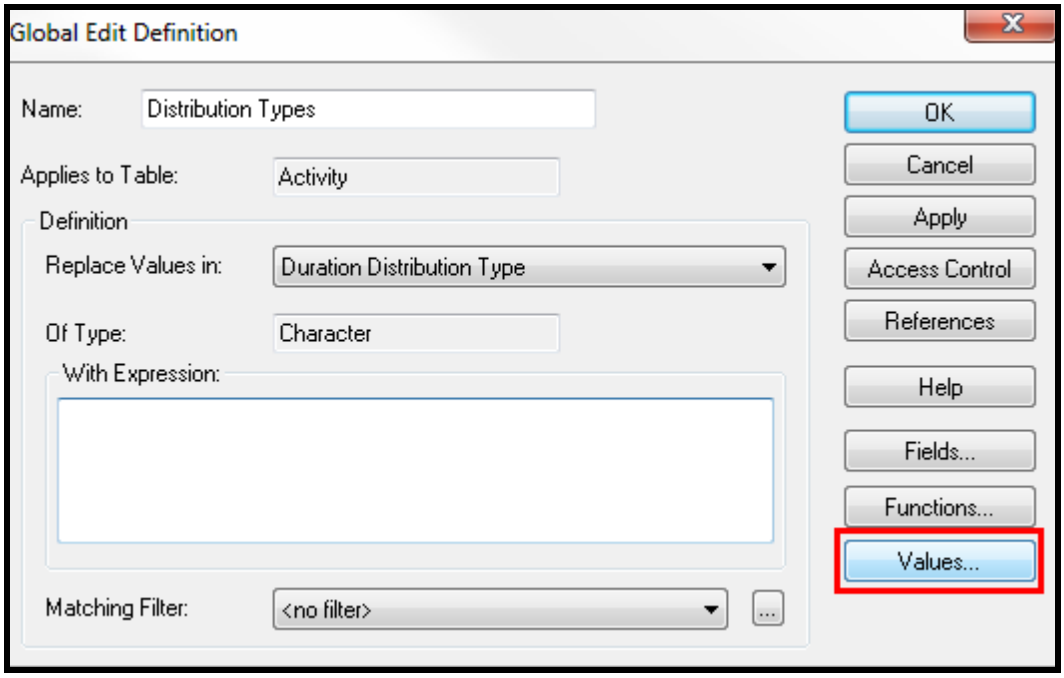
Naming New Global Edit

17. Select the dropdown beside *Replace Values in* and select *Duration Distribution Type.*



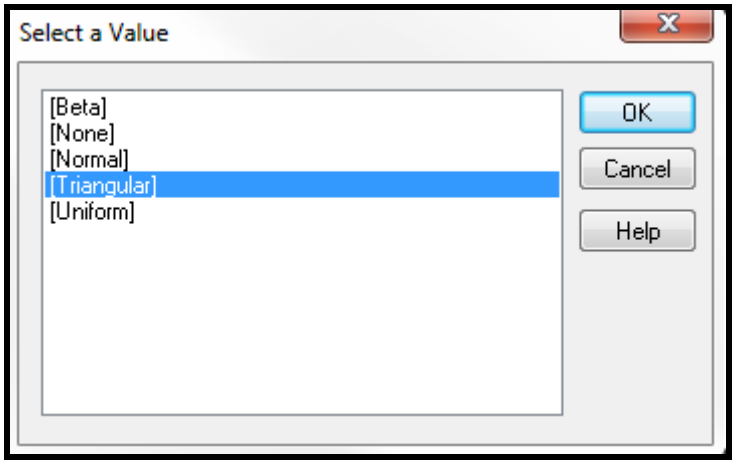
Global Edit Definition

18. Select *Values.*



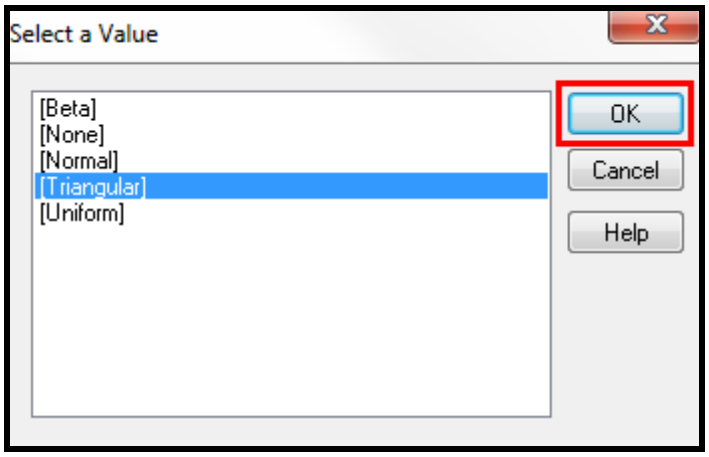
Values Selection

19. Select a distribution type from the list.



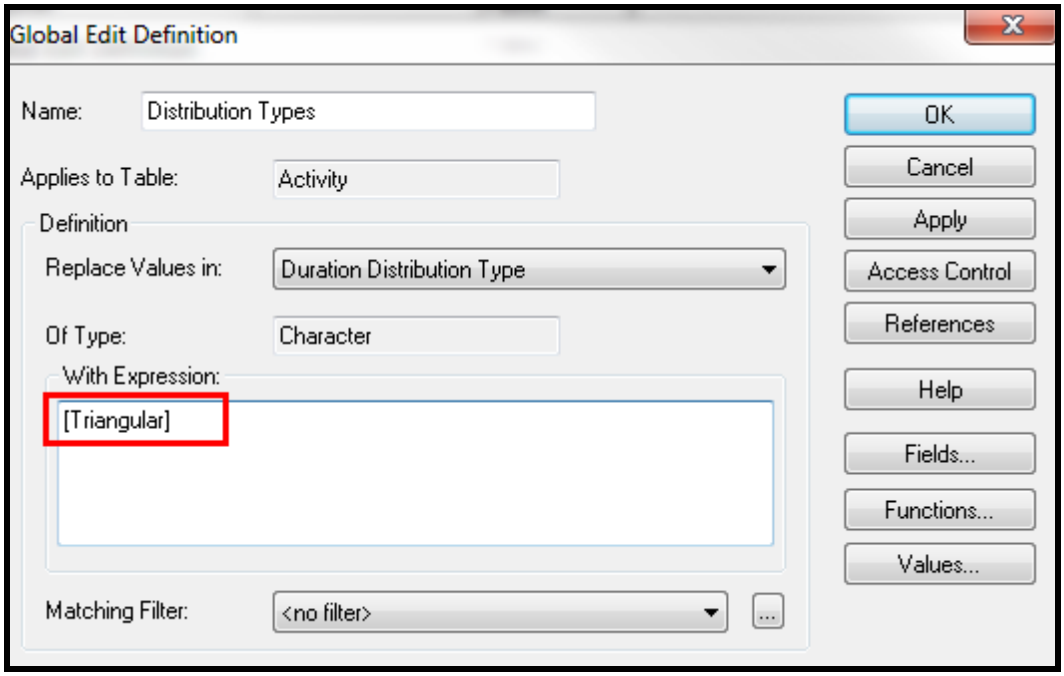
List of Distribution Types

20. Select *OK*.



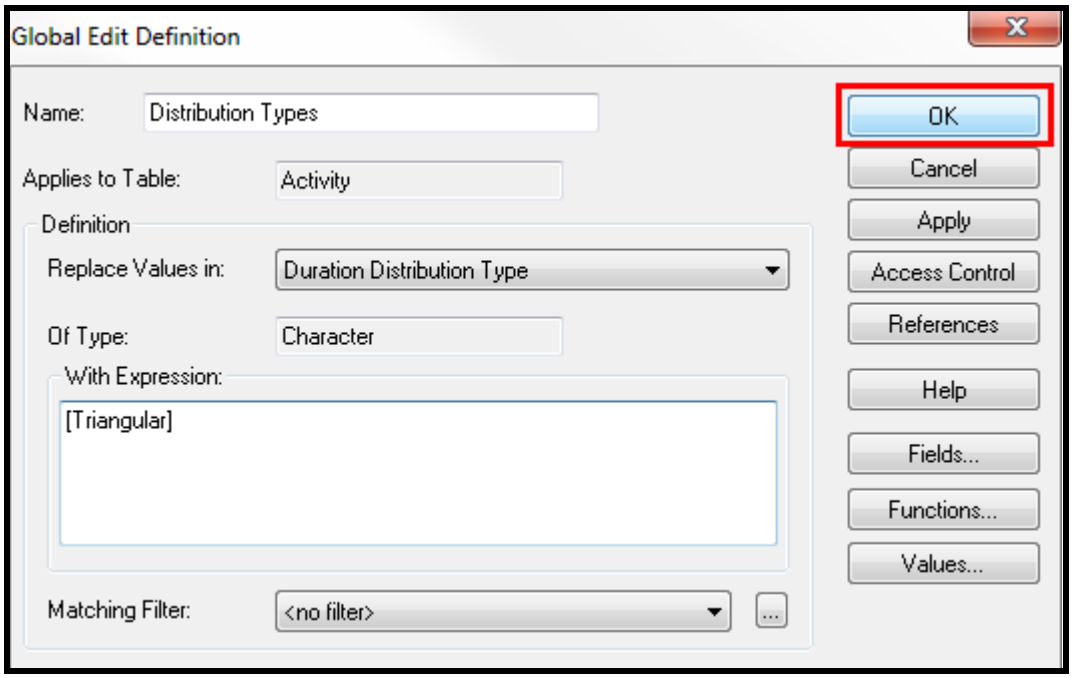
Distribution Type Confirmation

21. The assigned distribution type appears in the *With Expression* text box.



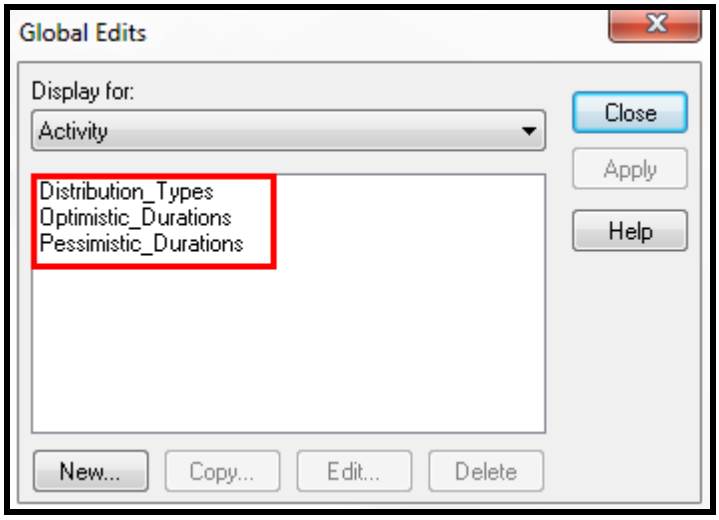
With Expression Command

22. Select *OK*.



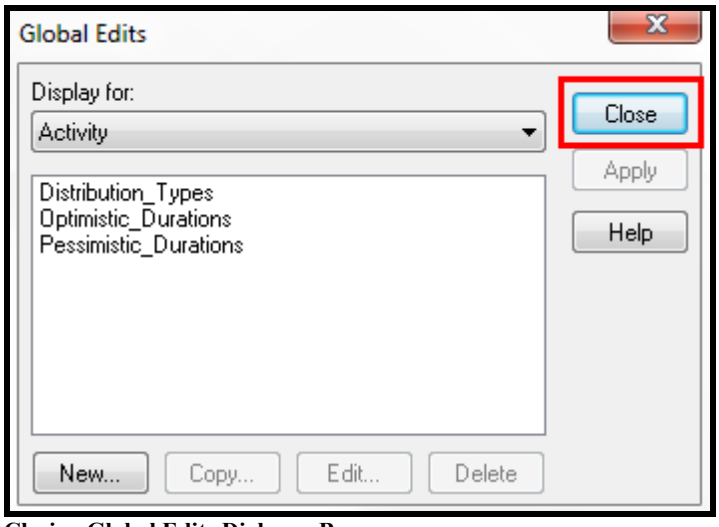
Global Edit Definition Confirmation

23. The global edits are listed.



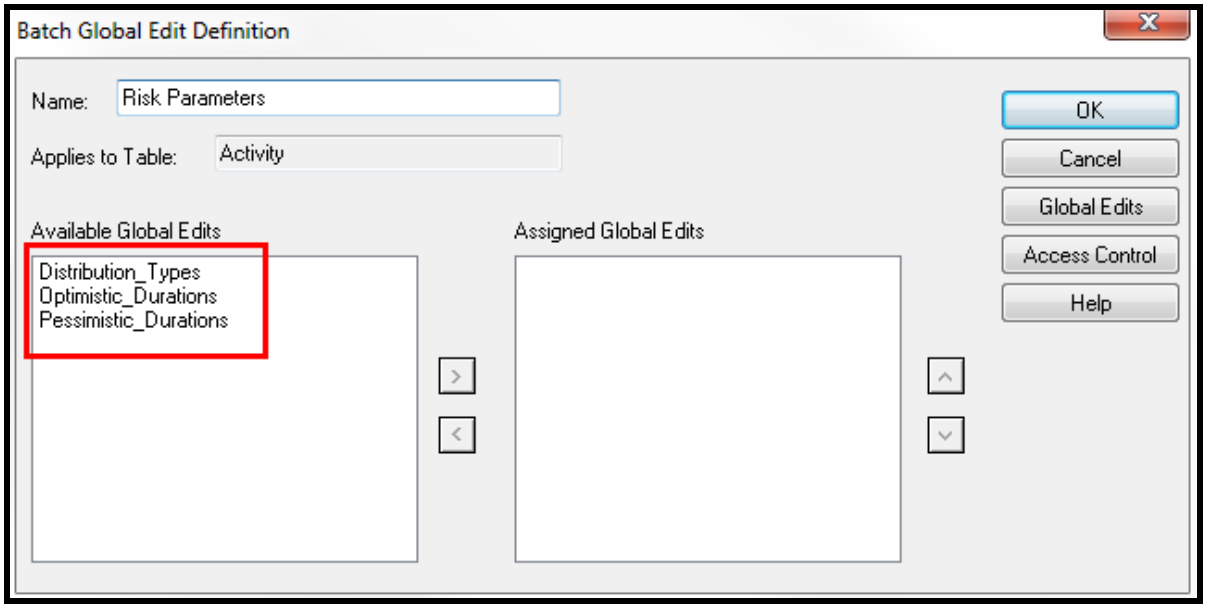
Newly Created Global Edits

24. Select *Close.*



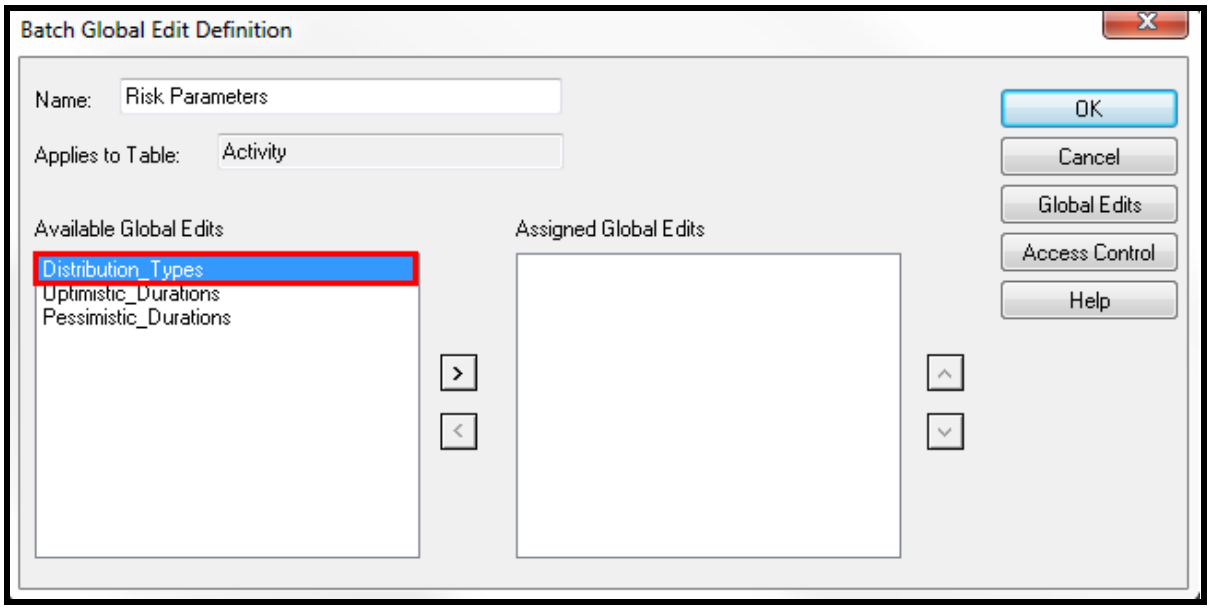
Closing Global Edits Dialogue Box

25. The global edit definitions that are available to be assigned to the Risk Parameters batch global edit are listed.



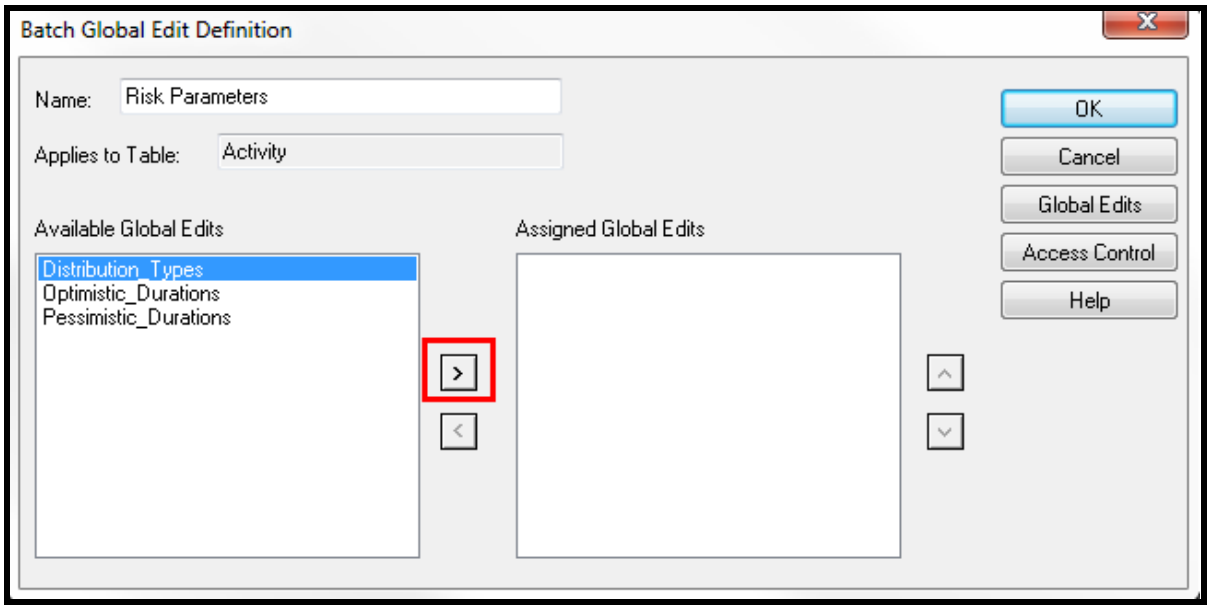
Batch Global Edit Definition

26. Highlight the *Distribution Types* global edit.



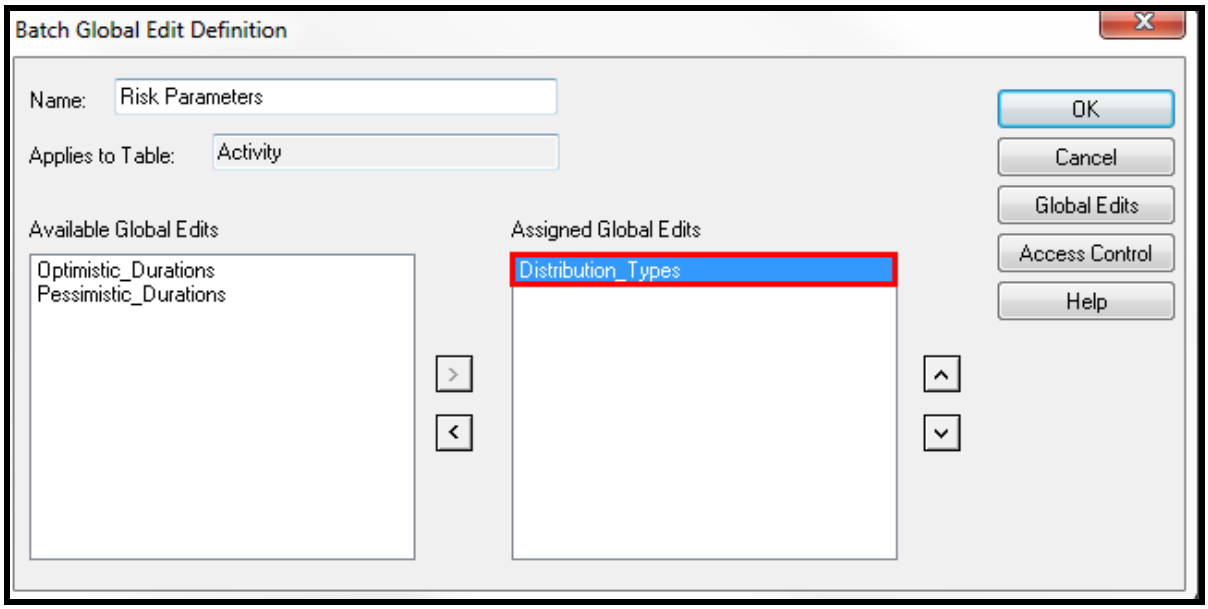
Distribution Types Global Edit

27. Select the left arrow to copy this global edit definition over to the *Risk Parameters* batch global edit.



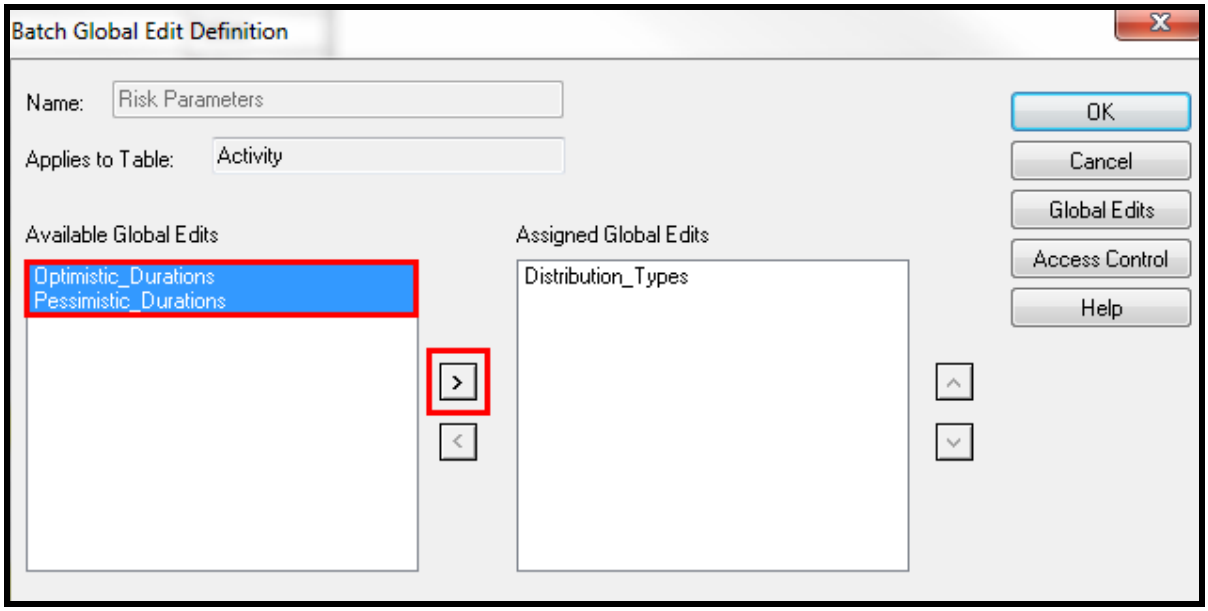
Copying Global Edit

28. The Distribution Types global edit now appears within the *Assigned Global Edits* text box.



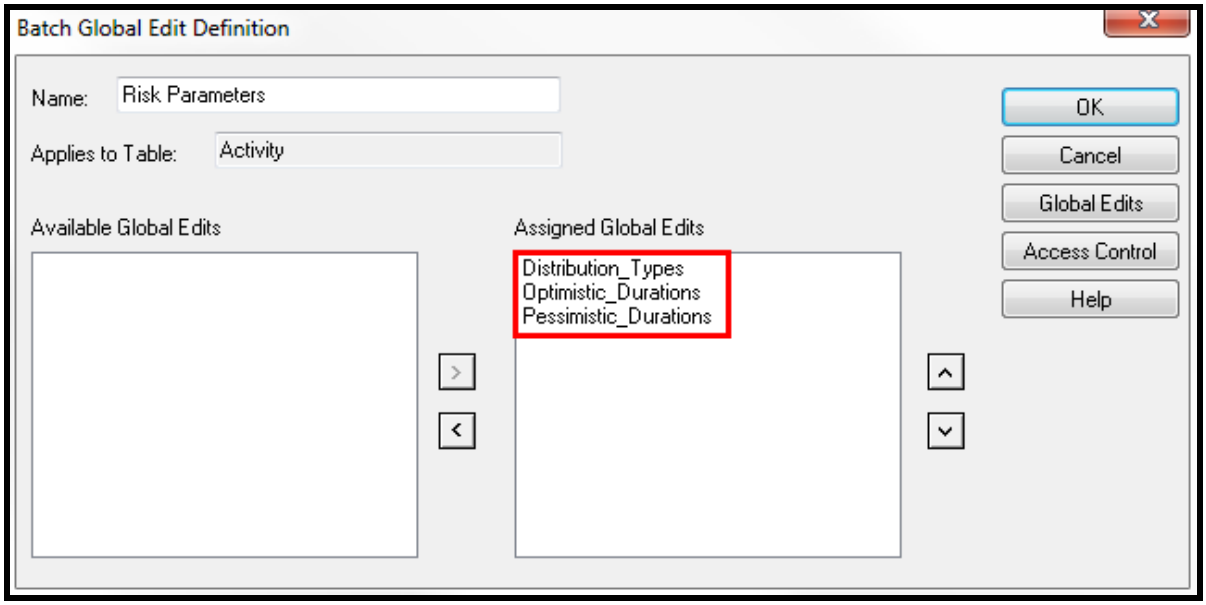
Assigned Global Edit

29. Repeat steps 26-27 to copy over the global edit definitions for the *Optimistic* and *Pessimistic Durations*. Note: These may be selected and copied over as a group if desired.



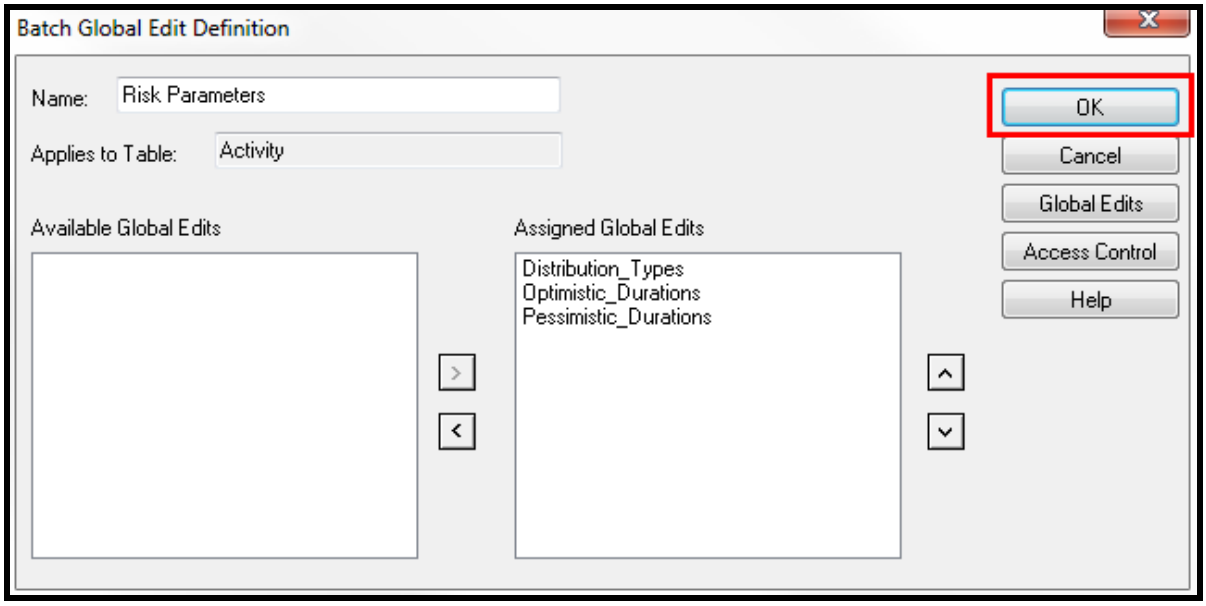
Assigning Additional Global Edits

30. All three global edits now appear within the *Assigned Global Edits* text box.



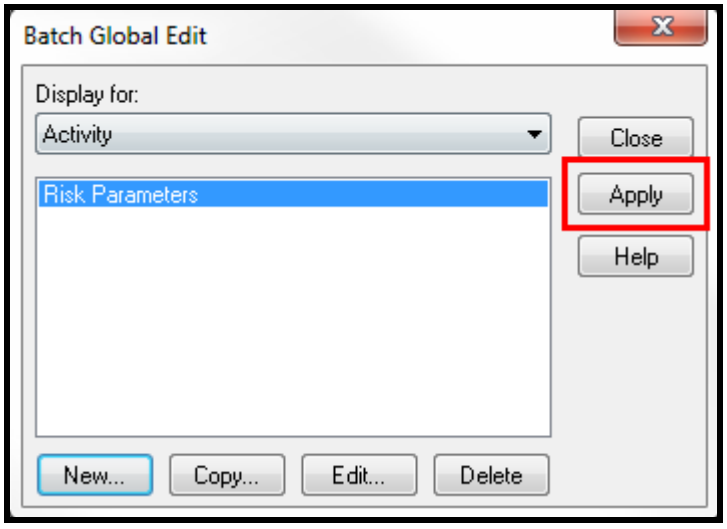
Assigned Global Edits

31. Select *OK*.



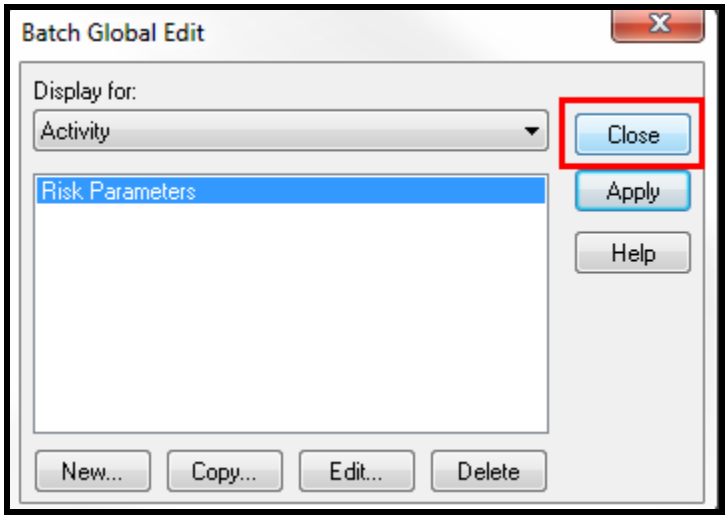
Confirming Batch Global Edit Definition

32. Select *Apply*.



Applying Batch Global Edit

33. Select *Close.*



Closing Batch Global Edit Dialogue Box

34. The *Optimistic Duration, Pessimistic Duration and Distribution Type* columns are now populated.

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
1.2.2	System Functional Review/Sy	0	28d	0	None	False
1.2.2.1	Prepare for SFR/SRR	0	19d	0	None	False
1.2.2.2	Finalize SFR/SRR Presentatio	0	6d	0	None	False
1.2.2.3	Conduct SFR/SRR	0	3d	0	None	False
1.2.3	Critical Design Review	0	50d	0	None	False
1.2.3.1	Prepare for CDR	0	30d	0	None	False
1.2.3.2	Finalize CDR Presentation	0	15d	0	None	False
1.2.3.3	Conduct CDR	0	5d	0	None	False
1.2.4	Interface Control Agreement	0	85d	0	None	False
1.2.4.1	Draft ICA	0	30d	0	None	False
1.2.4.2	Conduct Negotiations for ICA	0	35d	0	None	False
1.2.4.3	Finalize ICA	0	15d	0	None	False
1.2.4.4	Aquire Signature for ICA	0	5d	0	None	False
1.2.5	Design Control Agreement	0	85d	0	None	False
1.2.5.1	Draft DCA	0	30d	0	None	False
1.2.5.2	Conduct Negotiations for DCA	0	35d	0	None	False
1.2.5.3	Finalize DCA	0	15d			
1.2.5.4	Aquire Signature for DCA	0	5d			

Before

After

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Key Activity
1.2.2	System Functional Review/Sy	23.80d	28d	35d	Triangular	False
1.2.2.1	Prepare for SFR/SRR	16.15d	19d	23.75d	Triangular	False
1.2.2.2	Finalize SFR/SRR Presentatio	5.10d	6d	7.50d	Triangular	False
1.2.2.3	Conduct SFR/SRR	2.55d	3d	3.75d	Triangular	False
1.2.3	Critical Design Review	42.50d	50d	62.50d	Triangular	False
1.2.3.1	Prepare for CDR	25.50d	30d	37.50d	Triangular	False
1.2.3.2	Finalize CDR Presentation	12.75d	15d	18.75d	Triangular	False
1.2.3.3	Conduct CDR	4.25d	5d	6.25d	Triangular	False
1.2.4	Interface Control Agreement	72.25d	85d	106.25d	Triangular	False
1.2.4.1	Draft ICA	25.50d	30d	37.50d	Triangular	False
1.2.4.2	Conduct Negotiations for ICA	29.75d	35d	43.75d	Triangular	False
1.2.4.3	Finalize ICA	12.75d	15d	18.75d	Triangular	False
1.2.4.4	Aquire Signature for ICA	4.25d	5d	6.25d	Triangular	False
1.2.5	Design Control Agreement	72.25d	85d	106.25d	Triangular	False
1.2.5.1	Draft DCA	25.50d	30d	37.50d	Triangular	False
1.2.5.2	Conduct Negotiations for DCA	29.75d	35d	43.75d	Triangular	False
1.2.5.3	Finalize DCA	12.75d	15d	18.75d	Triangular	False
1.2.5.4	Aquire Signature for DCA	4.25d	5d	6.25d	Triangular	False

Changes to Optimistic Durations, Pessimistic Durations and Distribution Types Based on Batch Global Edit

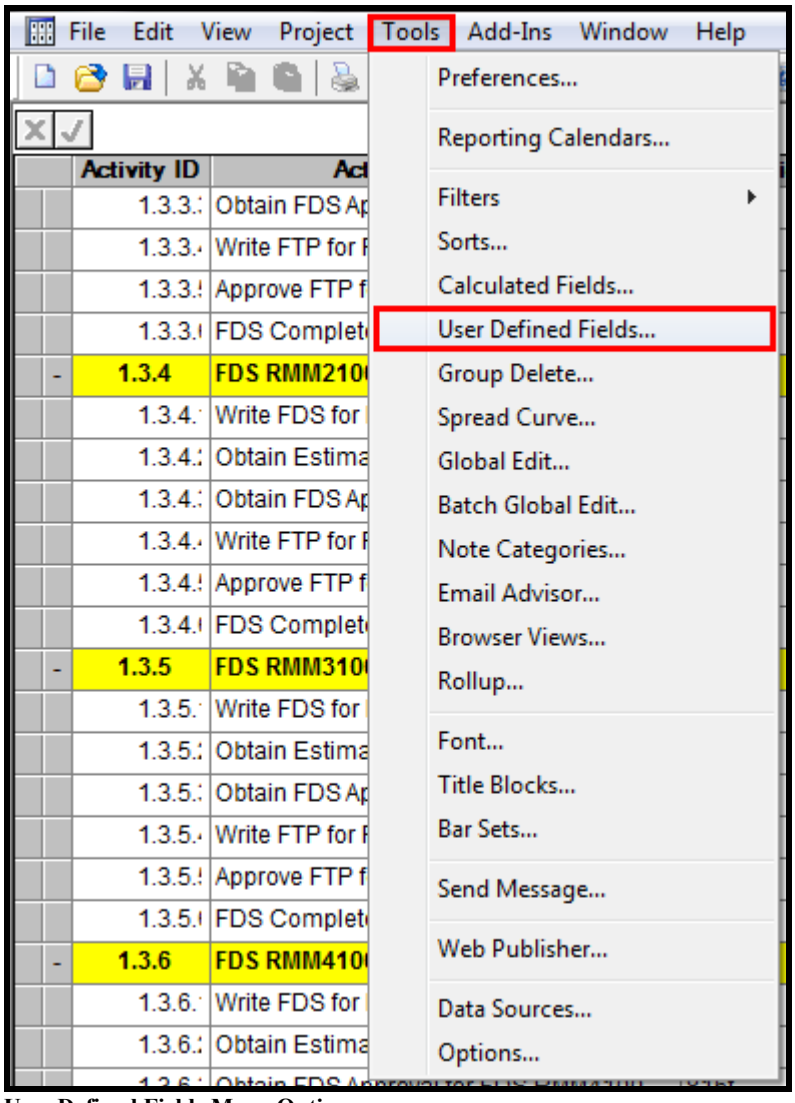
Refine Risk Parameters

Global Editing

Risk parameters may be further refined by applying global edits to a select group of tasks.

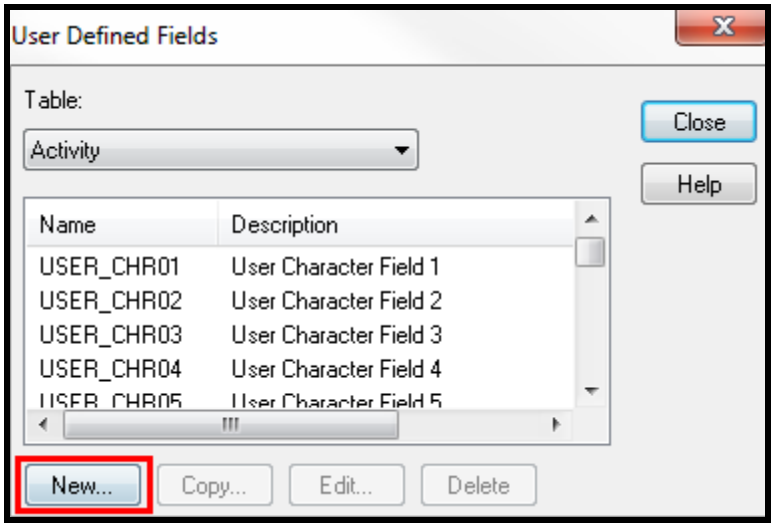
Create Global Edit Field

1. Create a field to flag the activities for refining risk parameters by selecting *Tools* > *User Defined Fields*.



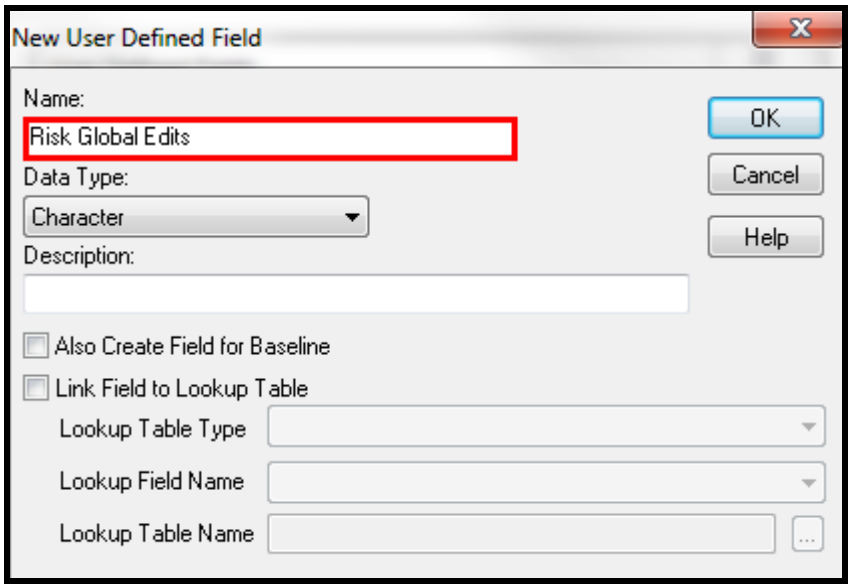
User Defined Fields Menu Option

2. Select *New.*



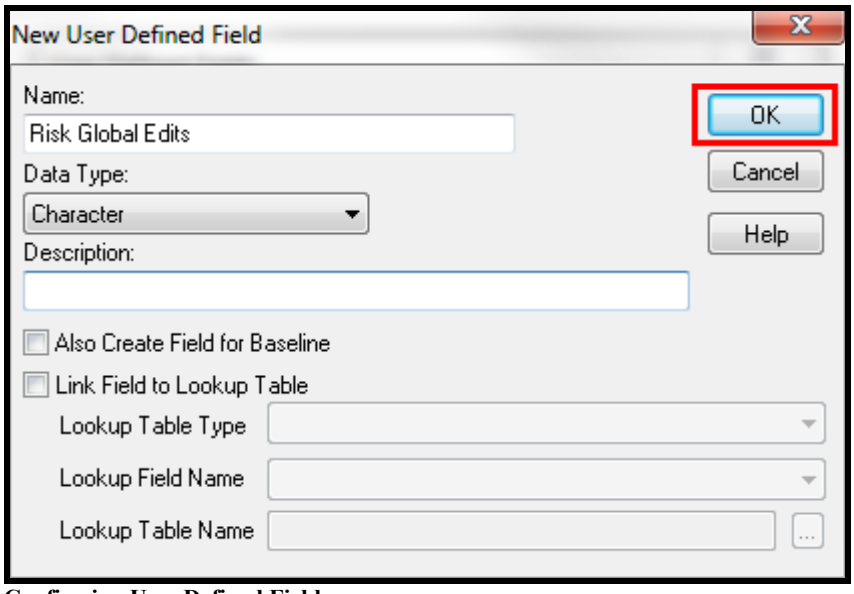
New User Defined Field Selection

3. Name the new user defined field *Risk Global Edits.*



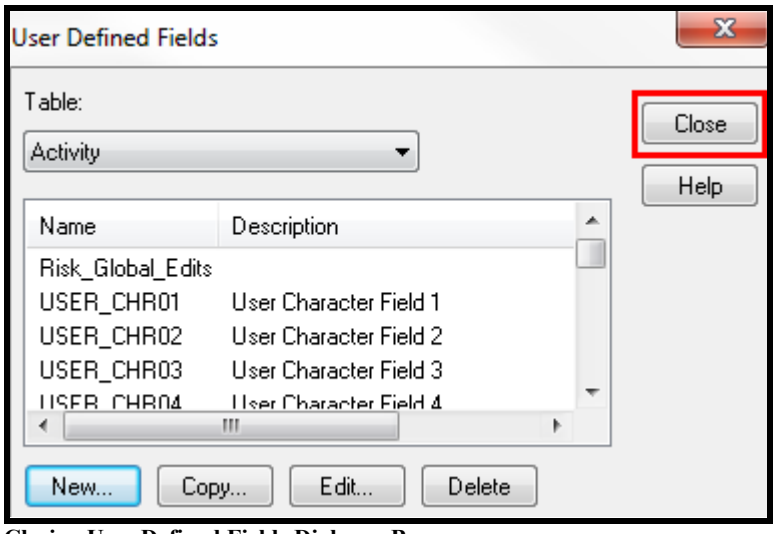
Naming User Defined Field

4. Select *OK*.



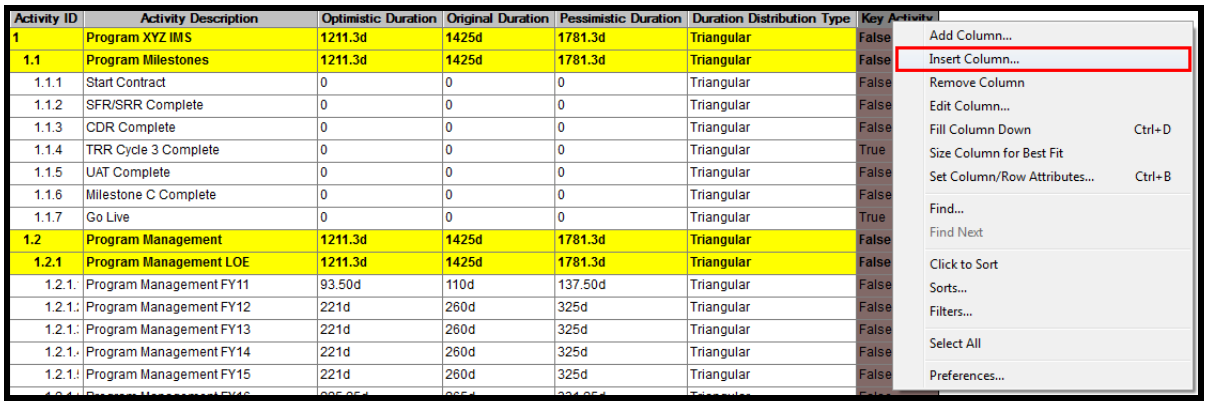
Confirming User Defined Field

5. Select *Close*.



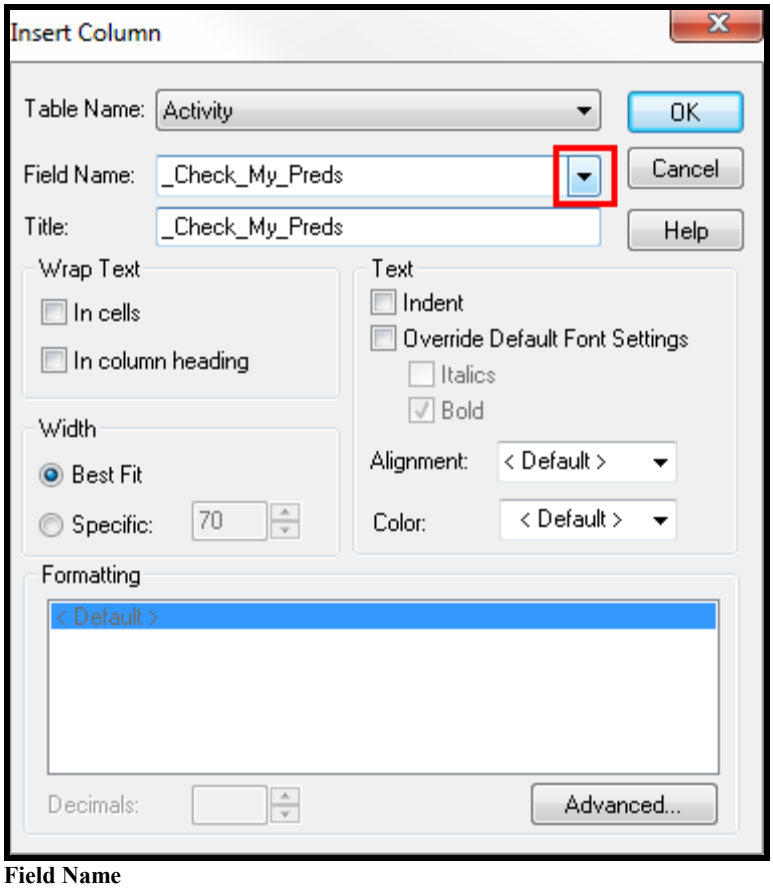
Closing User Defined Fields Dialogue Box

6. Select the last column, right click and select *Insert Column.*



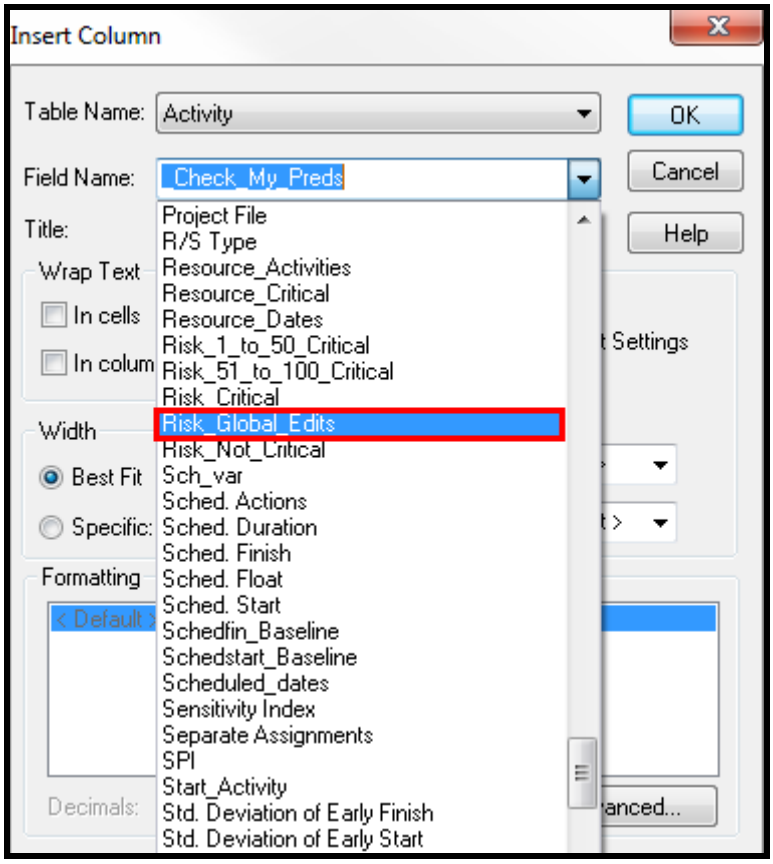
Inserting Column

7. Select the dropdown beside *Field Name.*



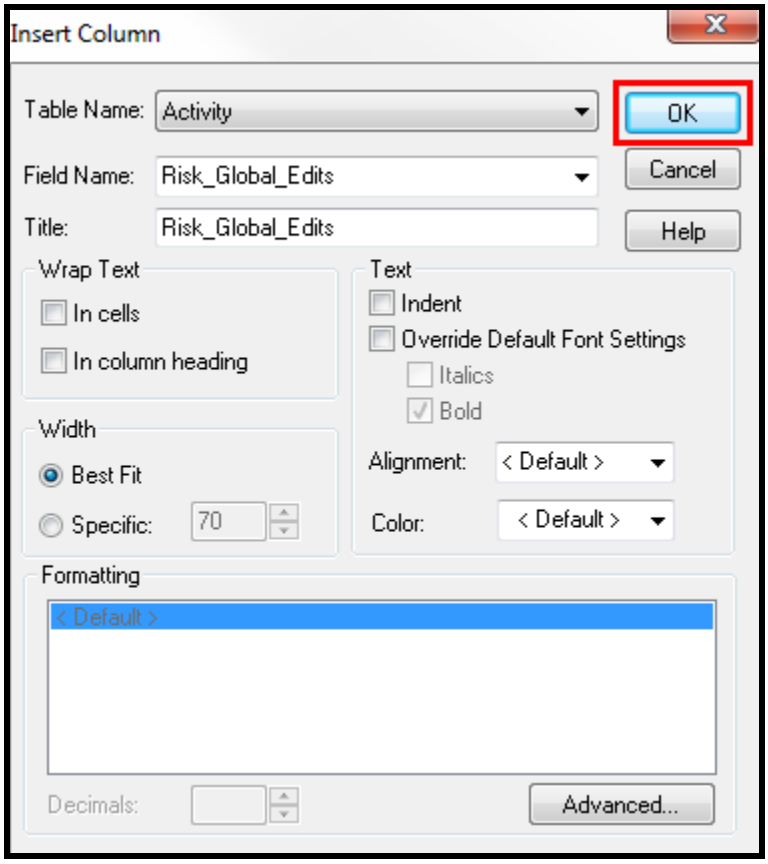
Field Name

8. Scroll down and select the new user defined field, *Risk Global Edits*.



Field Name Selection

9. Select *OK*.



Confirming Column

10. The *Risk Global Edits* column now appears.

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Risk_Global_Edits	Key Activity
1	Program XYZ IMS	1211.3d	1425d	1781.3d	Triangular		False
1.1	Program Milestones	1211.3d	1425d	1781.3d	Triangular		False
1.1.1	Start Contract	0	0	0	Triangular		False
1.1.2	SFR/SRR Complete	0	0	0	Triangular		False
1.1.3	CDR Complete	0	0	0	Triangular		False
1.1.4	TRR Cycle 3 Complete	0	0	0	Triangular		True
1.1.5	UAT Complete	0	0	0	Triangular		False
1.1.6	Milestone C Complete	0	0	0	Triangular		False
1.1.7	Go Live	0	0	0	Triangular		True
1.2	Program Management	1211.3d	1425d	1781.3d	Triangular		False
1.2.1	Program Management LOE	1211.3d	1425d	1781.3d	Triangular		False
1.2.1.	Program Management FY11	93.50d	110d	137.50d	Triangular		False
1.2.1.	Program Management FY12	221d	260d	325d	Triangular		False
1.2.1.	Program Management FY13	221d	260d	325d	Triangular		False
1.2.1.	Program Management FY14	221d	260d	325d	Triangular		False
1.2.1.	Program Management FY15	221d	260d	325d	Triangular		False
1.2.1.	Program Management FY16	225.25d	265d	331.25d	Triangular		False
1.2.1.	Program Management FY17	8.50d	10d	12.50d	Triangular		False

Risk Global Edits Column

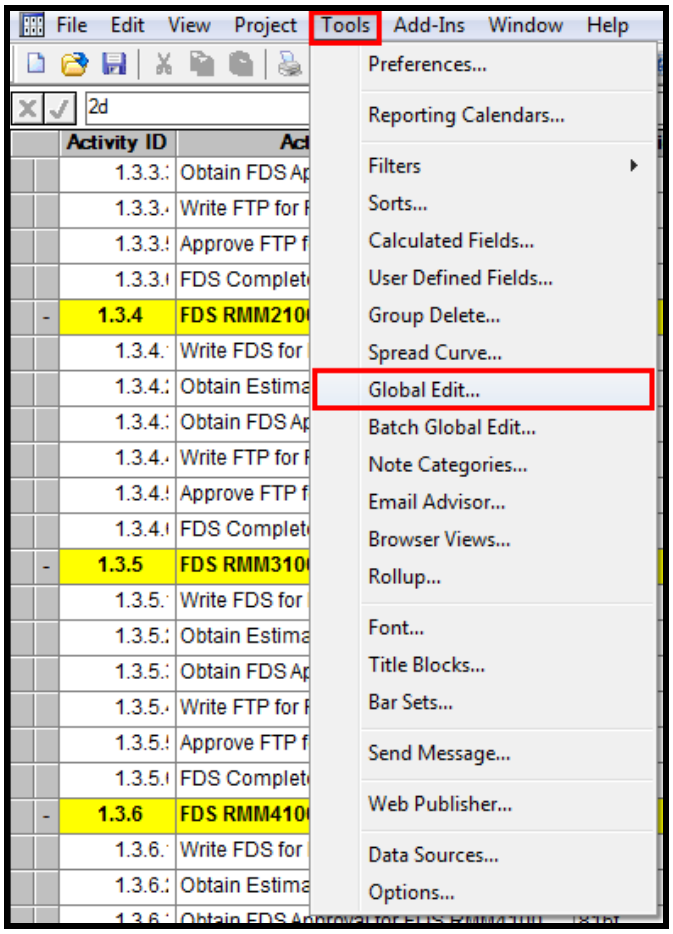
11. Flag the activities to be refined by applying additional global edits based on the assigned risk levels of low, medium or high.

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Risk_Global_Edits	Key Activity
1.7.3	**FDS RMM1100**	**21.25d**	**25d**	**31.25d**	**Triangular**		**False**
1.7.3.	Extract FDS for FDS RMM1100	4.25d	5d	6.25d	Triangular	Low	False
1.7.3.:	Execute Mock for FDS RMM1100	8.50d	10d	12.50d	Triangular	Medium	False
1.7.3.:	Defect Resolution for FDS RMM1100	4.25d	5d	6.25d	Triangular	Medium	False
1.7.3.·	Configure Client for FDS RMM1100	4.25d	5d	6.25d	Triangular	High	False
1.7.4	**FDS RMM2100**	**21.25d**	**25d**	**31.25d**	**Triangular**		**False**
1.7.4.	Extract FDS for FDS RMM2100	4.25d	5d	6.25d	Triangular	Low	False
1.7.4.:	Execute Mock for FDS RMM2100	8.50d	10d	12.50d	Triangular	Medium	False
1.7.4.:	Defect Resolution for FDS RMM2100	4.25d	5d	6.25d	Triangular	Medium	False
1.7.4.·	Configure Client for FDS RMM2100	4.25d	5d	6.25d	Triangular	High	False
1.7.5	**FDS RMM3100**	**21.25d**	**25d**	**31.25d**	**Triangular**		**False**
1.7.5.	Extract FDS for FDS RMM3100	4.25d	5d	6.25d	Triangular	Low	False
1.7.5.:	Execute Mock for FDS RMM3100	8.50d	10d	12.50d	Triangular	Medium	False
1.7.5.:	Defect Resolution for FDS RMM3100	4.25d	5d	6.25d	Triangular	Medium	False
1.7.5.·	Configure Client for FDS RMM3100	4.25d	5d	6.25d	Triangular	High	False

Activity Flagging for Global Edits

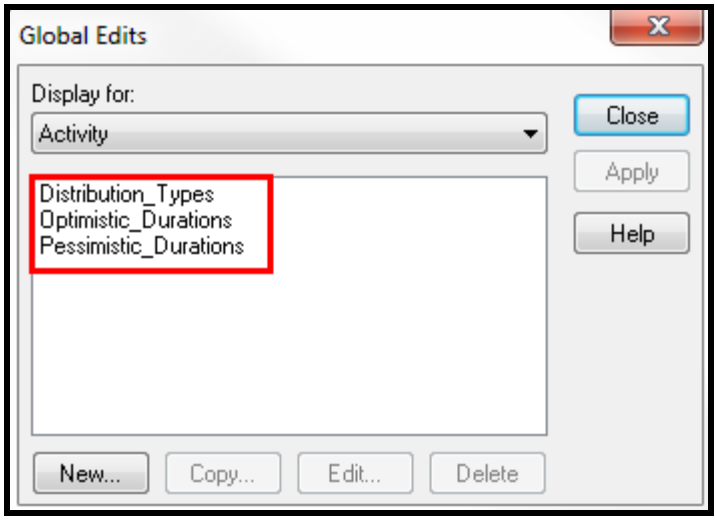
Create Global Edit

12. Select *Tools* > *Global Edit.*



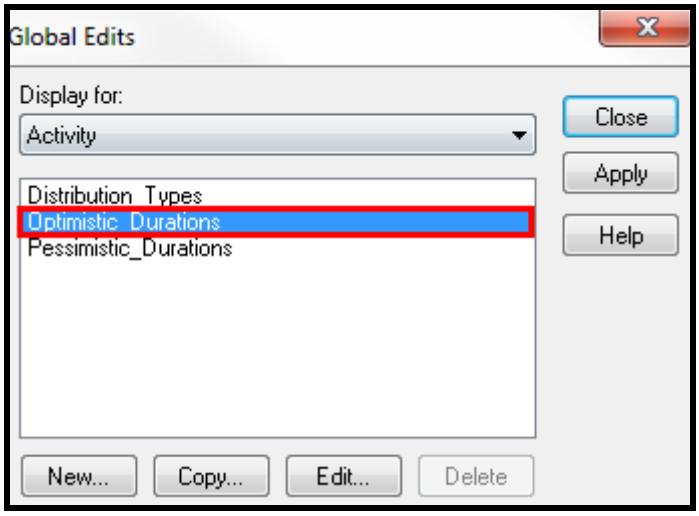
Global Edit Menu Selection

13. The previously created global edits now appear.



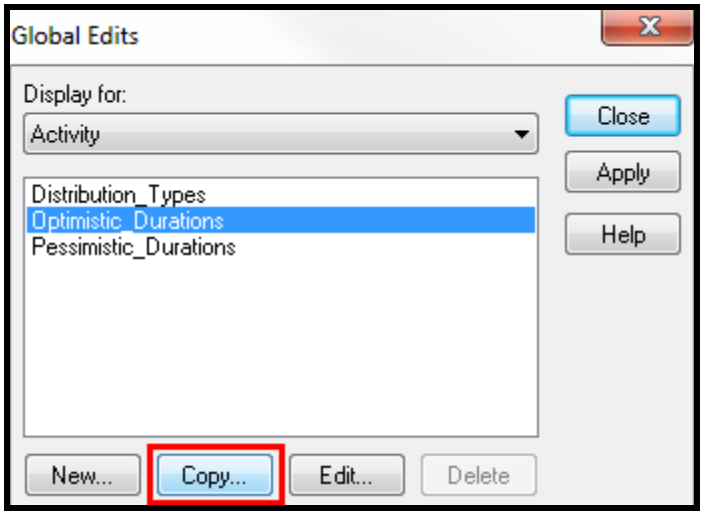
Global Edits

14. Select the first global edit to modify.



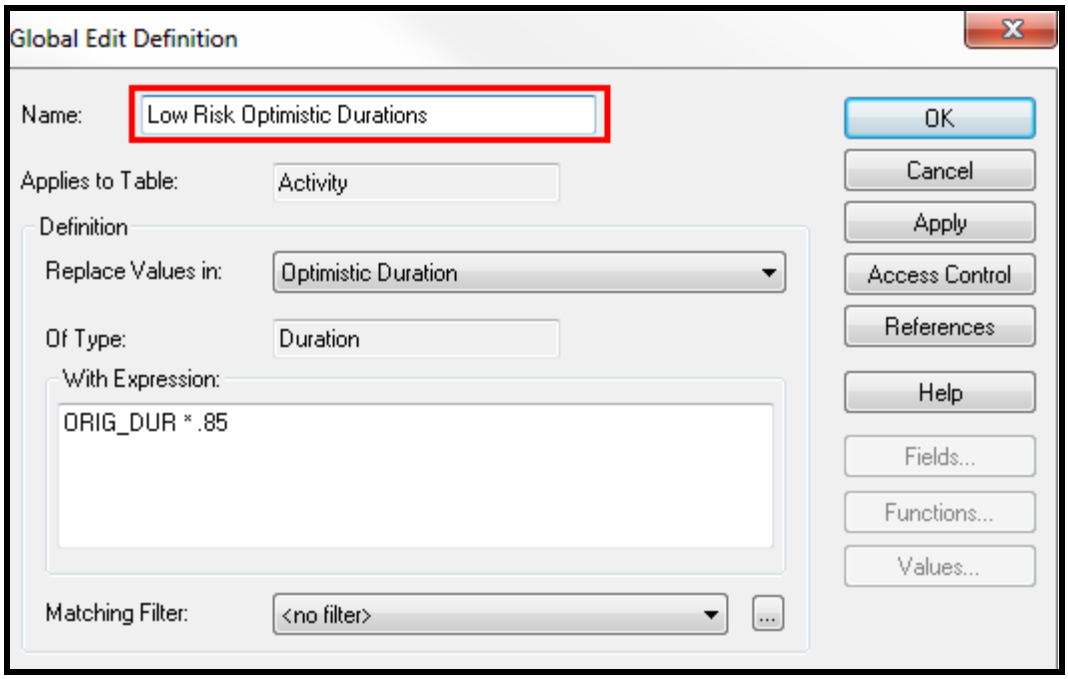
Optimistic Durations Global Edit

15. Select *Copy*.



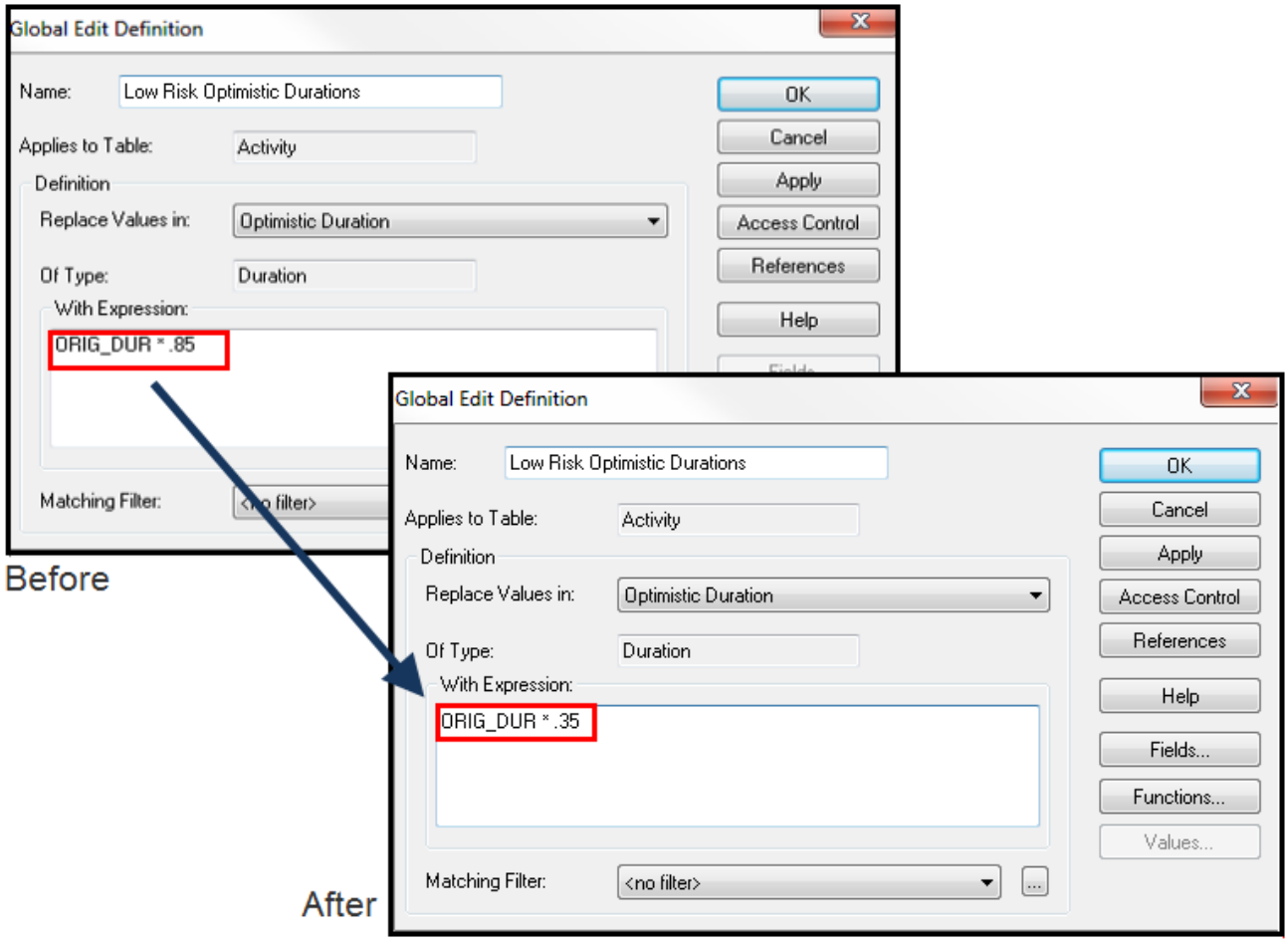
Copying Global Edit

16. Name the new global edit *Low Risk Optimistic Durations*.



Naming New Global Edit

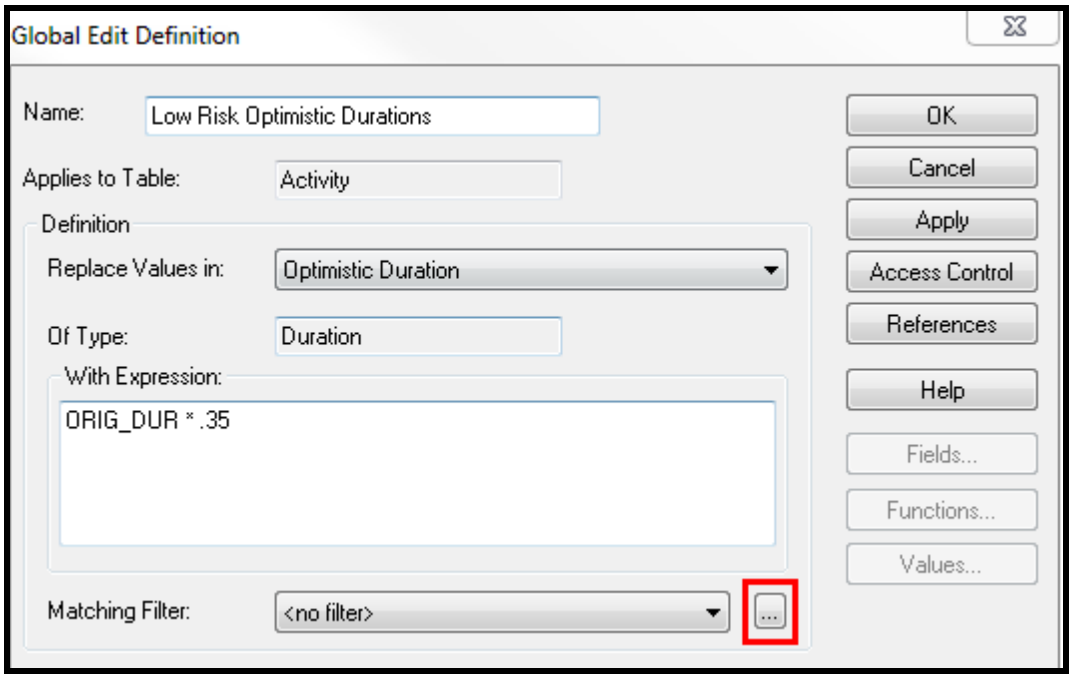
17. Under *With Expression*, change the value to *ORIG_DUR * .35* to subtract 65% from the original duration and use this as the optimistic duration for all activities determined to be low risk. Note: There are spaces before and after *.



With Expression Command Change for Optimistic Duration

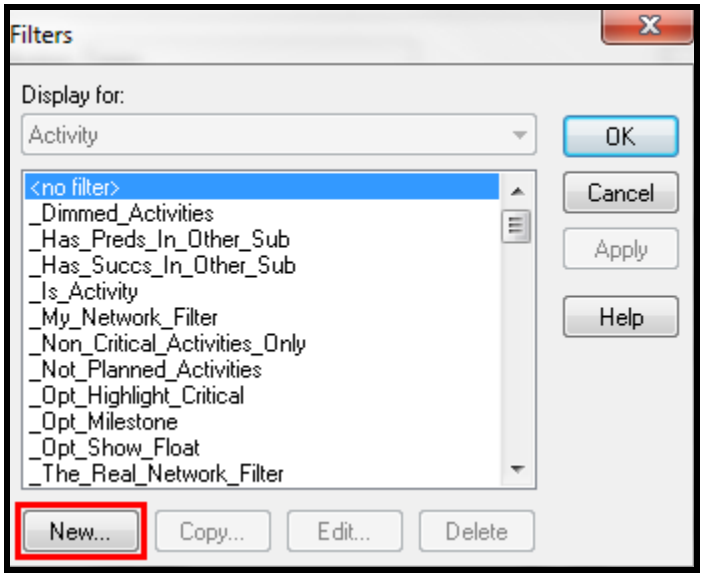
Create Global Edit Filter

18. Filter for the activities to apply this global edit to by selecting the *Matching Filter* menu.



Matching Filter Menu Selection

19. Select *New* to create a new filter.

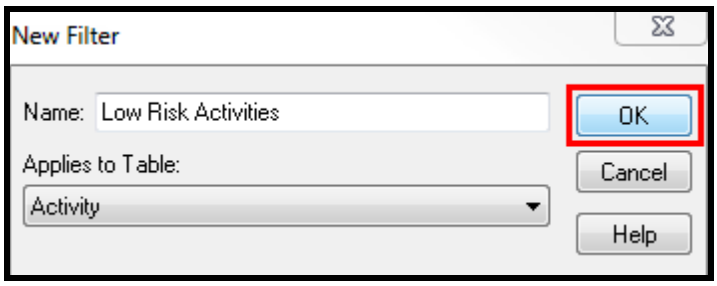


New Filter Selection

20. Name the new filter *Low Risk Activities*.

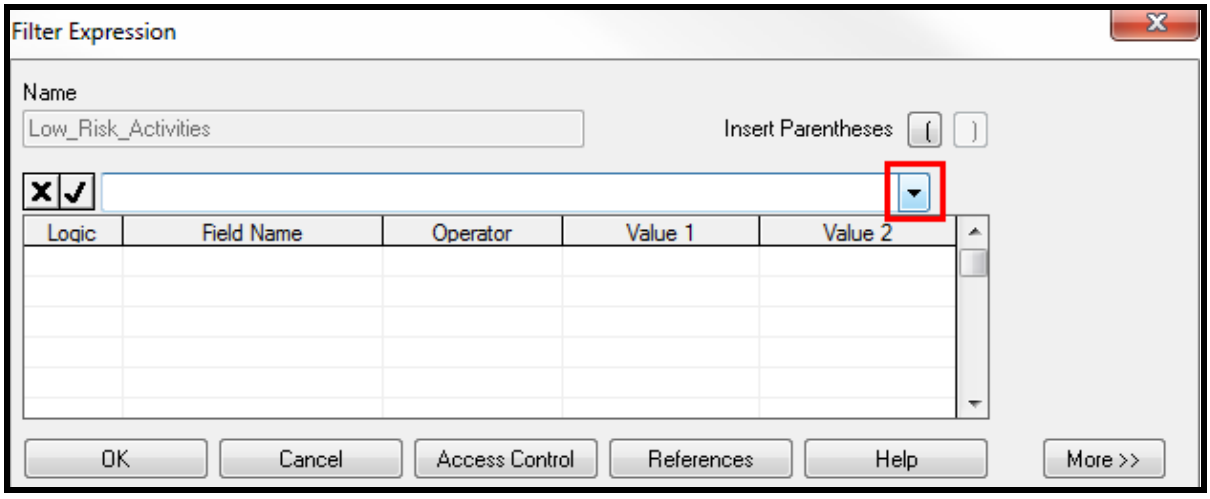
Naming New Filter

21. Select *OK*.



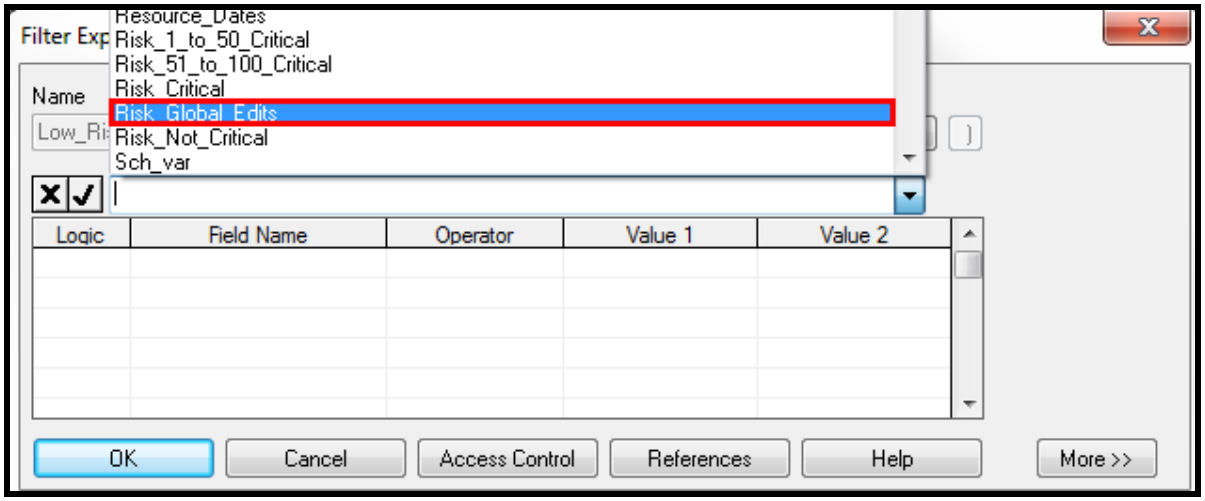
Confirming New Filter

22. Select the dropdown.



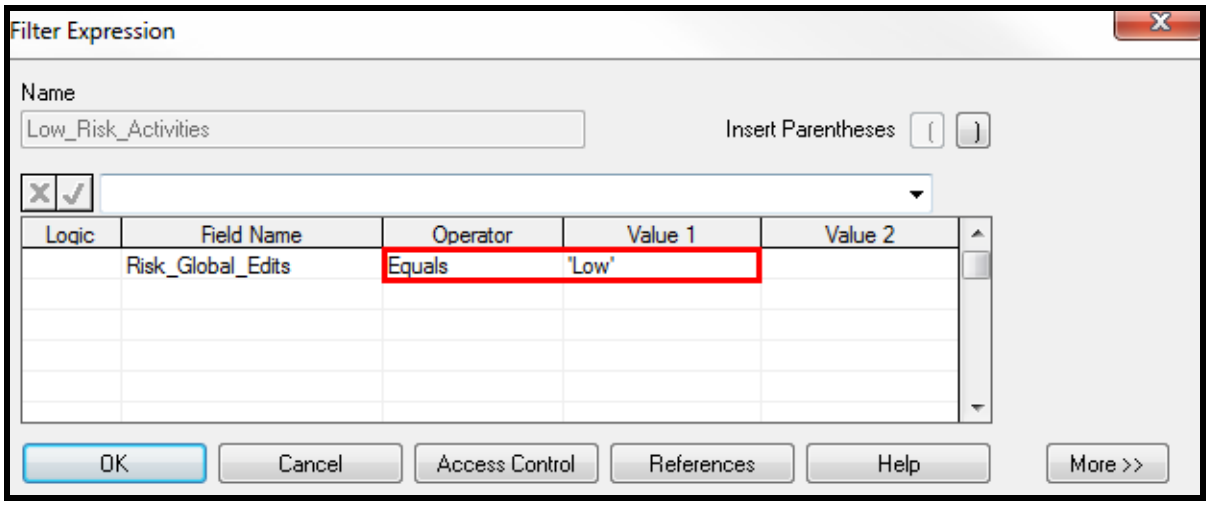
Filter Expression

23. Scroll down and select *Risk Global Edits.*



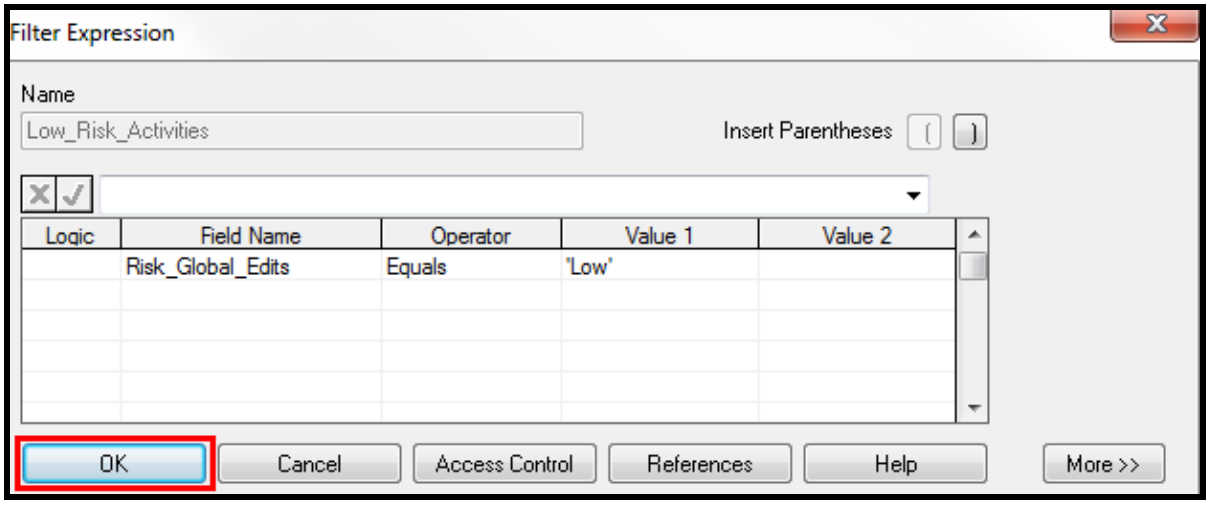
Filter Expression Selection

24. Under *Operator*, type *Equals* and under *Value 1*, type "*Low"*.



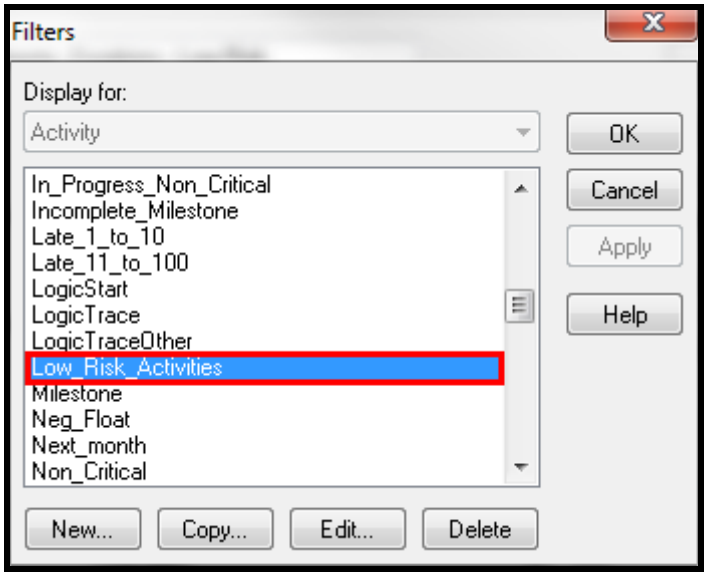
Filter Expression Command

25. Select *OK*.



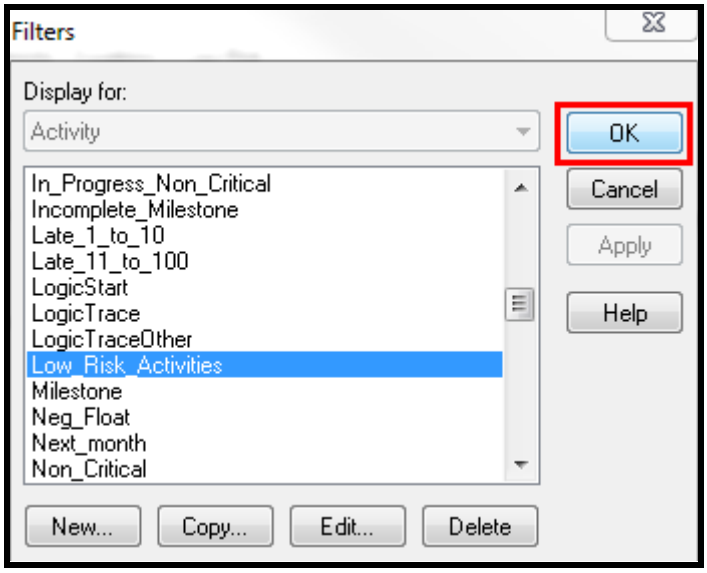
Confirming Filter Expression

26. Scroll down and select *Low Risk Activities*.



Low Risk Activities Filter

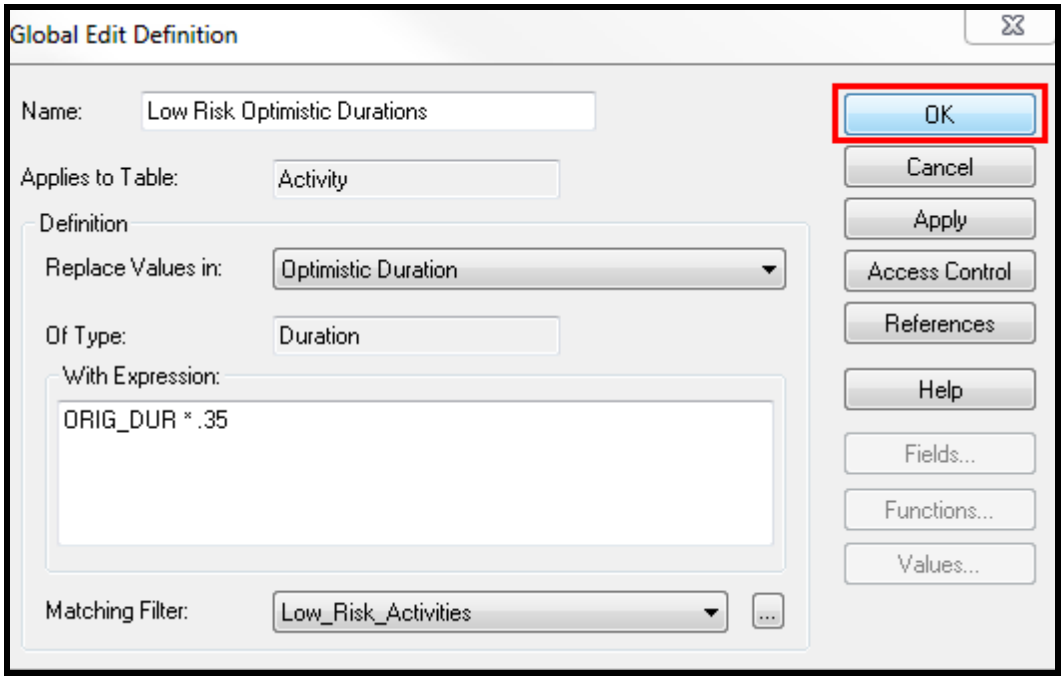
27. Select *OK*.



Confirming Filter Selection

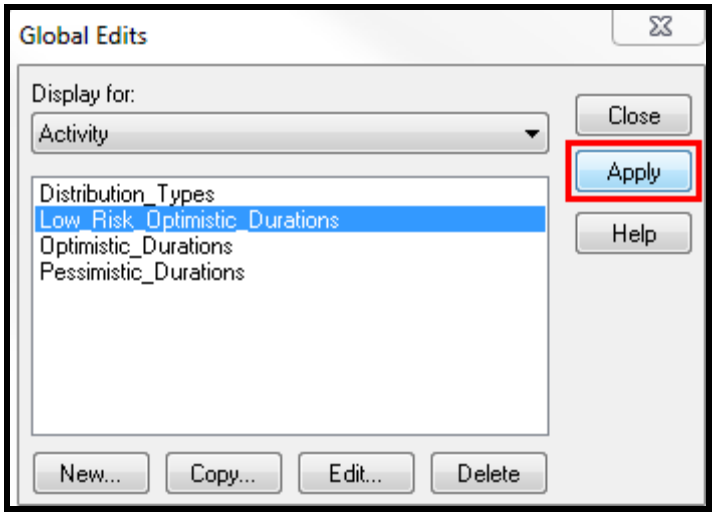
Apply Global Edit

28. Select *OK*.



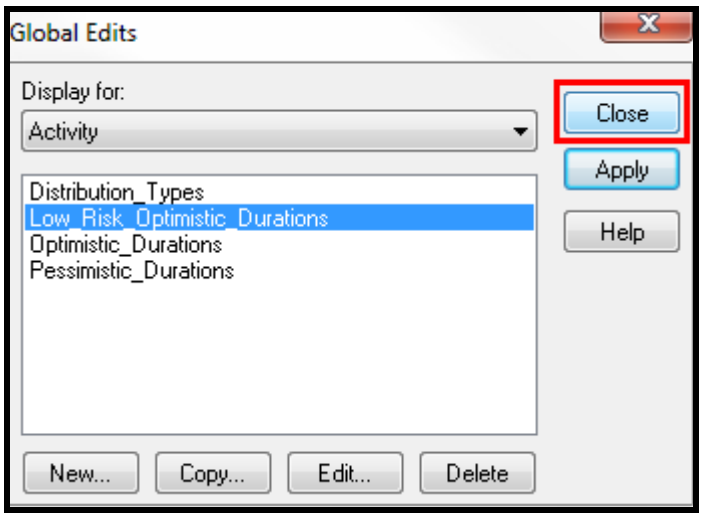
Confirming Global Edit Definition

29. Select *Apply*.



Applying Global Edit

30. Select *Close*.



Closing Global Edits Dialogue Box

31. The optimistic durations for low risk activities now reflect 35% of the original durations.

Before

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Risk_Global_Edits	Key Activity
1.7.3	FDS RMM1100	21.25d	25d	31.25d	Triangular		False
1.7.3.	Extract FDS for FDS RMM1100	4.25d	5d	6.25d	Triangular	Low	False
1.7.3.	Execute Mock for FDS RMM1100	8.50d	10d	12.50d	Triangular	Medium	False
1.7.3.	Defect Resolution for FDS RMM1100	4.25d	5d	6.25d	Triangular	Medium	False
1.7.3.	Configure Client for FDS RMM1100	4.25d	5d	6.25d	Triangular	High	False
1.7.4	FDS RMM2100	21.25d	25d	31.25d	Triangular		False
1.7.4.	Extract FDS for FDS RMM2100	4.25d	5d	6.25d	Triangular	Low	False
1.7.4.	Execute Mock for FDS RMM2100	8.50d	10d	12.50d	Triangular	Medium	False
1.7.4.	Defect Resolution for FDS RMM2100	4.25d	5d	6.25d	Triangular	Medium	False
1.7.4.	Configure Client for FDS RMM2100	4.25d	5d	6.25d	Triangular	High	False
1.7.5	FDS RMM3100	21.25d	25d	31.25d	Triangular		False
1.7.5.	Extract FDS for FDS RMM3100	4.25d	5d	6.25d	Triangular	Low	False
1.7.5.	Execute Mock for FDS RMM3100	8.50d					
1.7.5.	Defect Resolution for FDS RMM3100	4.25d					
1.7.5.	Configure Client for FDS RMM3100	4.25d					

After

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Risk_Global_Edits	Key Activity
1.7.3	FDS RMM1100	21.25d	25d	31.25d	Triangular		False
1.7.3.	Extract FDS for FDS RMM1100	1.75d	5d	6.25d	Triangular	Low	False
1.7.3.	Execute Mock for FDS RMM1100	8.50d	10d	12.50d	Triangular	Medium	False
1.7.3.	Defect Resolution for FDS RMM1100	4.25d	5d	6.25d	Triangular	Medium	False
1.7.3.	Configure Client for FDS RMM1100	4.25d	5d	6.25d	Triangular	High	False
1.7.4	FDS RMM2100	21.25d	25d	31.25d	Triangular		False
1.7.4.	Extract FDS for FDS RMM2100	1.75d	5d	6.25d	Triangular	Low	False
1.7.4.	Execute Mock for FDS RMM2100	8.50d	10d	12.50d	Triangular	Medium	False
1.7.4.	Defect Resolution for FDS RMM2100	4.25d	5d	6.25d	Triangular	Medium	False
1.7.4.	Configure Client for FDS RMM2100	4.25d	5d	6.25d	Triangular	High	False
1.7.5	FDS RMM3100	21.25d	25d	31.25d	Triangular		False
1.7.5.	Extract FDS for FDS RMM3100	1.75d	5d	6.25d	Triangular	Low	False
1.7.5.	Execute Mock for FDS RMM3100	8.50d	10d	12.50d	Triangular	Medium	False
1.7.5.	Defect Resolution for FDS RMM3100	4.25d	5d	6.25d	Triangular	Medium	False
1.7.5.	Configure Client for FDS RMM3100	4.25d	5d	6.25d	Triangular	High	False

Changes to Optimistic Durations for Low Risk Activities

32. Steps 12-31 may be repeated to create global edits and the corresponding filters for the following risk level assignments:

- Low Risk Optimistic Durations
- Medium Risk Optimistic Durations
- High Risk Optimistic Durations

- Low Risk Pessimistic Durations
- Medium Risk Pessimistic Durations
- High Risk Pessimistic Durations

In addition, these steps may be repeated to refine the distribution curves assigned to activities, if needed.

Individually Assigned Three Point Estimates

Risk information at the activity level may be viewed and edited using the Risk Identification Spreadsheet or the Risk tab of the Activity Details dialog box.

Risk Identification Spreadsheet

1. Reference the CAM / IPT data spreadsheet to assign the individually determined optimistic and pessimistic duration estimates.

Activity ID	Activity Description	Optimistic Dur	Original Dur	Pessimistic Dur
1.3.4.1	Write FDS for FDS RMM2100	9	10 days	12
1.3.4.2	Obtain Estimates for FDS RMM2100	1	2 days	4
1.3.4.3	Obtain FDS Approval for FDS RMM2100	1	2 days	5
1.3.4.4	Write FTP for FDS RMM2100	18	20 days	22
1.3.4.5	Approve FTP for FDS RMM2100	5	10 days	12

CAM/IPT Spreadsheet

2. Select the corresponding cells for the optimistic and pessimistic durations and enter the values for each activity based on the CAM/IPT data spreadsheet.

Before

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Risk_Global_Edits	Key Activity
1.3.4	FDS RMM2100	72.25d	85d	106.25d	Triangular		False
1.3.4.1	Write FDS for FDS RMM2100	8.50d	10d	12.50d	Triangular		False
1.3.4.2	Obtain Estimates for FDS RMM2100	1.70d	2d	2.50d	Triangular		False
1.3.4.3	Obtain FDS Approval for FDS RMM210	1.70d	2d	2.50d	Triangular		False
1.3.4.4	Write FTP for FDS RMM2100	17d	20d	25d	Triangular		False
1.3.4.5	Approve FTP for FDS RMM2100	8.50d	10d	12.50d	Triangular		False

After

Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Risk_Global_Edits	Key Activity
1.3.4	FDS RMM2100	72.25d	85d	106.25d	Triangular		False
1.3.4.1	Write FDS for FDS RMM2100	9d	10d	12d	Triangular		False
1.3.4.2	Obtain Estimates for FDS RMM2100	1d	2d	4d	Triangular		False
1.3.4.3	Obtain FDS Approval for FDS RMM210	1d	2d	5d	Triangular		False
1.3.4.4	Write FTP for FDS RMM2100	18d	20d	22d	Triangular		False
1.3.4.5	Approve FTP for FDS RMM2100	5d	10d	12d	Triangular		False

Optimistic and Pessimistic Duration Entries

Activity Details Dialog Box

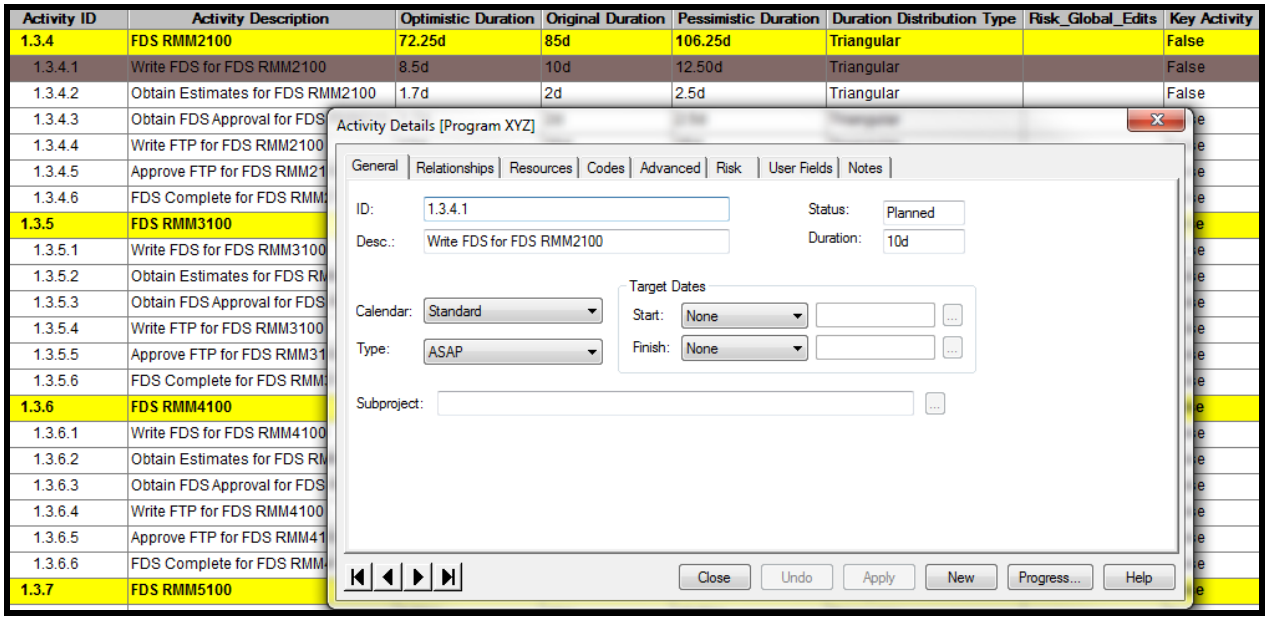
Risk information may also be viewed and edited using the Risk tab of the Activity Details dialog box.

1. Reference the CAM / IPT data spreadsheet to assign the individually determined optimistic and pessimistic duration estimates.

Activity ID	Activity Description	Optimistic Dur	Original Dur	Pessimistic Dur
1.3.4.1	Write FDS for FDS RMM2100	9	10 days	12
1.3.4.2	Obtain Estimates for FDS RMM2100	1	2 days	4
1.3.4.3	Obtain FDS Approval for FDS RMM2100	1	2 days	5
1.3.4.4	Write FTP for FDS RMM2100	18	20 days	22
1.3.4.5	Approve FTP for FDS RMM2100	5	10 days	12

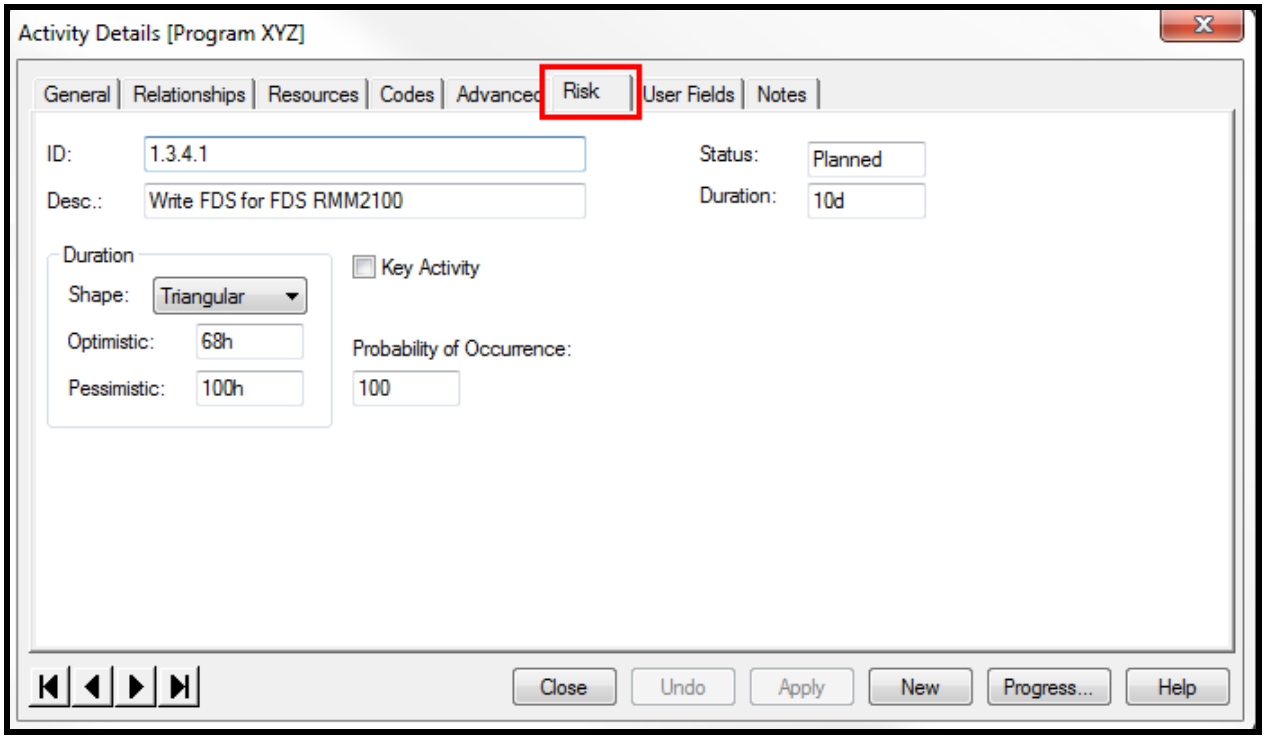
CAM/IPT Spreadsheet

2. Double click on an activity to open the Activity Details dialog box.



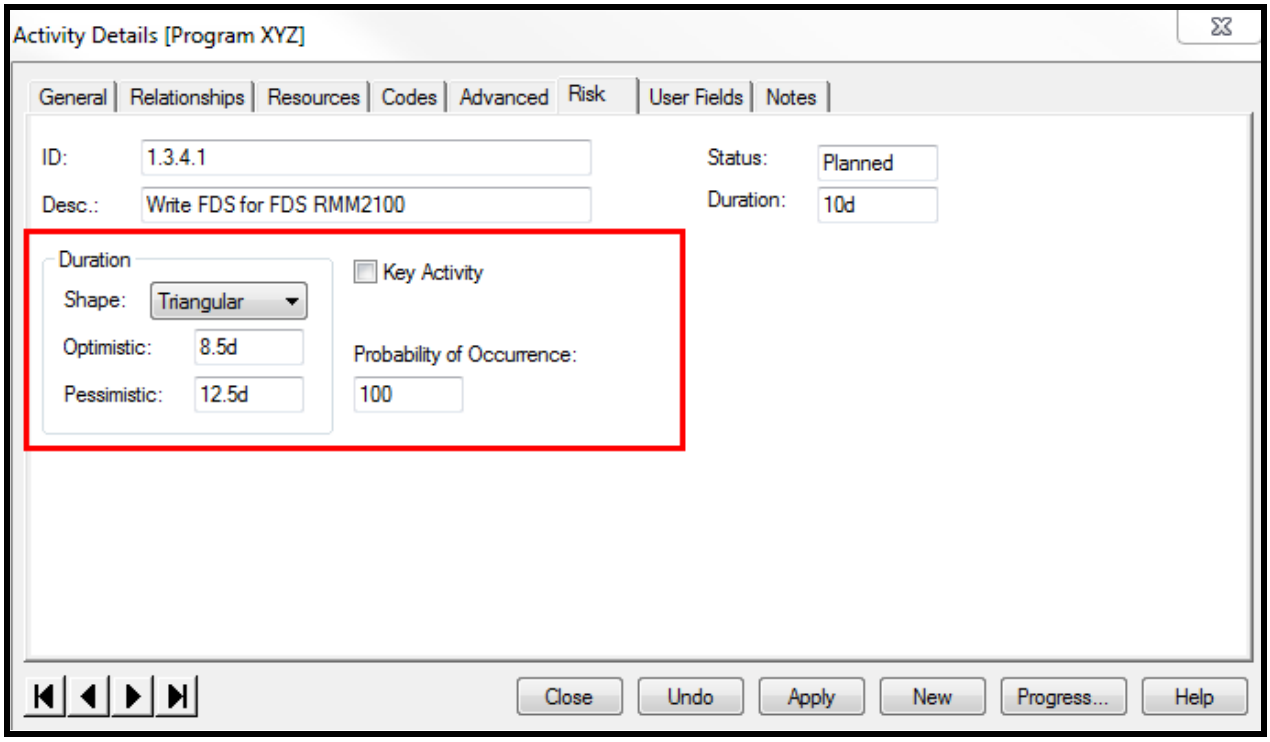
Activity Details Dialogue Box

3. Select the *Risk* tab.



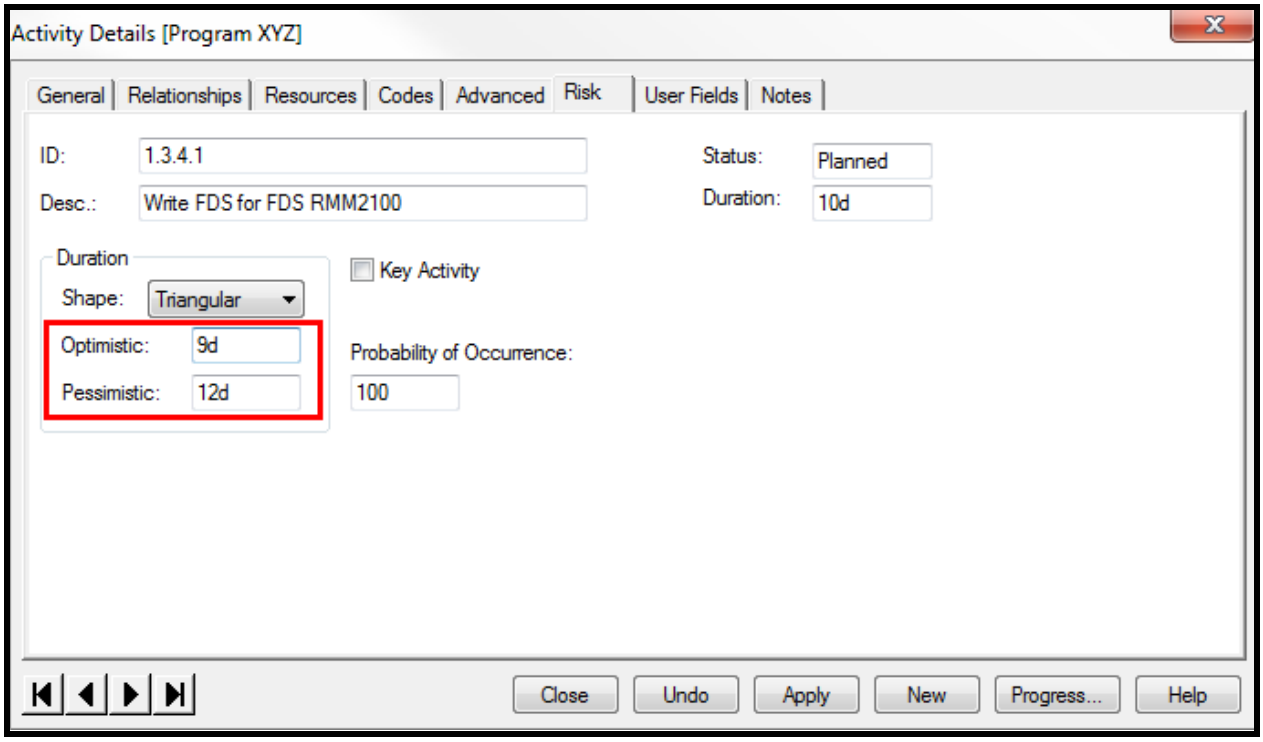
Risk Tab

4. Risk information may be viewed and edited for the activity.



Risk Information

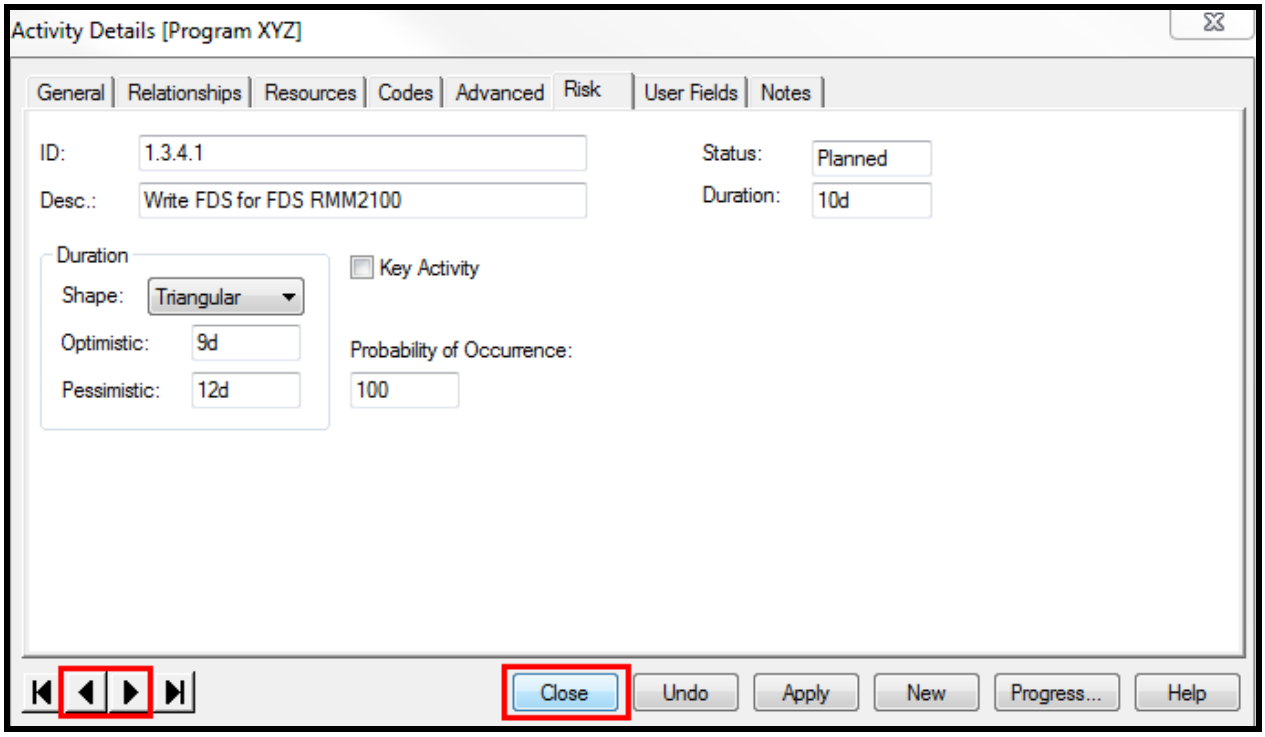
5. Enter the new optimistic and pessimistic durations for the activity.



Optimistic and Pessimistic Durations

Note that the distribution shape, key activity identification, and Probability of Occurrence may also be edited. The Probability of Occurrence indicates the probability that the activity occurs at all. See the Probabilistic Branching section for more information.

6. When finished editing risk information for the activity, select *Close* or *Left Arrow* to jump to the previous activity or *Right Arrow* to jump to the next activity.



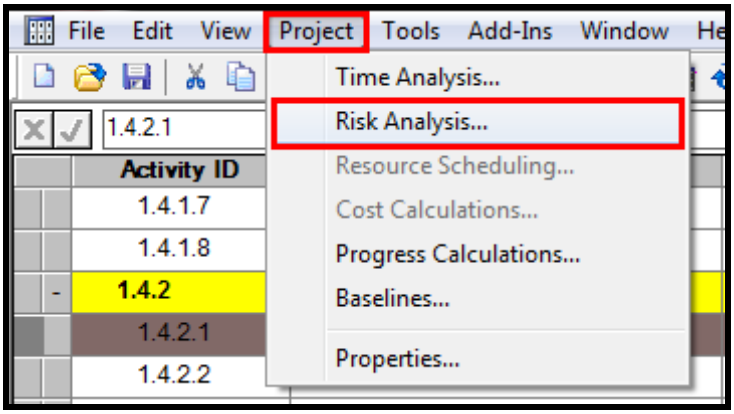
Confirming Duration Changes

Run Risk Simulation

The following steps are required to run a Monte Carlo simulation using Open Plan Professional.

Select Risk Analysis

Select *Project* > *Risk Analysis*.



Risk Analysis Menu Option

Specify Risk Analysis Options

Options Tab

Specify the following options in the Risk Analysis dialogue box:

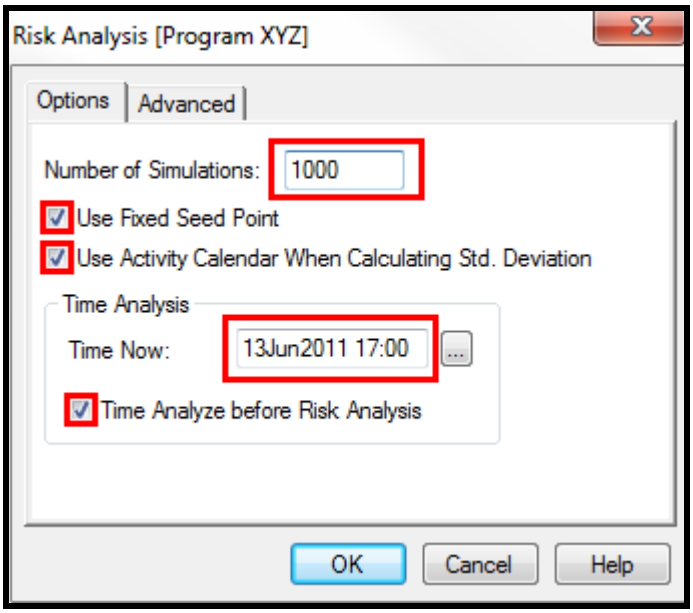
- **Number of Simulations**: This indicates the number of simulations to perform. It is important that enough simulations are run for results to be statistically significant. The risk analysis results are more accurate as more simulations are performed. In addition, the time it takes to run the analysis increases as more simulations are performed.

- **Fixed Seed Point**: Select this setting so the same starting point is used each time when generating random activity durations during the trial simulations. As a result, multiple risk analyses of identical project information produce identical results each time, minimizing any variations due to randomness.

- **Use Activity Calendar When Calculating Std. Deviation**: Leave selected so the activity calendar is used when calculating standard deviations and dates. Otherwise, elapsed time is used for calculations.

- **Time Now**: The *Time Now* date should be the current status date as originally reflected and verified for the SRA schedule submittal. No change should be necessary.

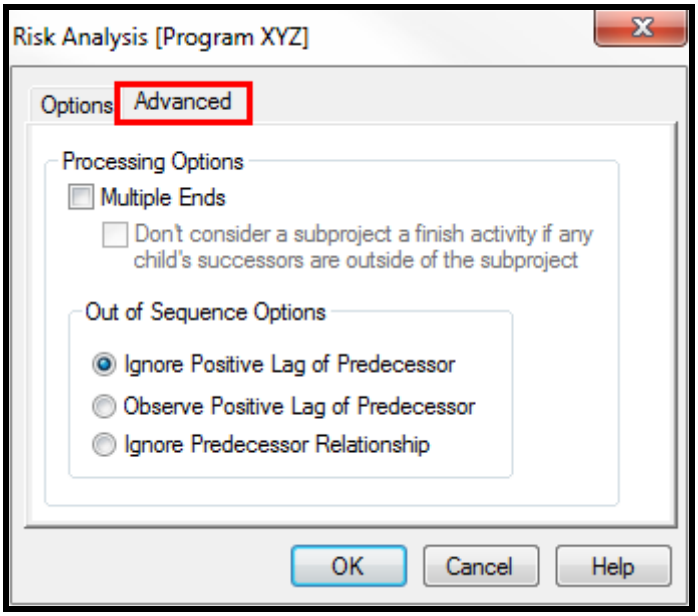
- **Time Analyze before Risk Analysis:** Select this setting to ensure any schedule adjustments have been processed up to Time Now. A time analysis for the current project information is conducted prior to any risk analysis calculations.



Risk Analysis Options

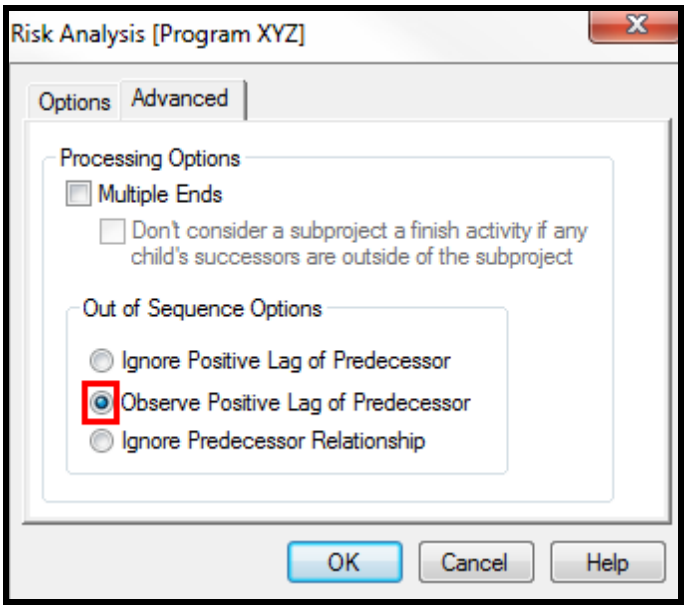
Advanced Tab

Select the *Advanced* tab.



Risk Analysis Advnaced Options

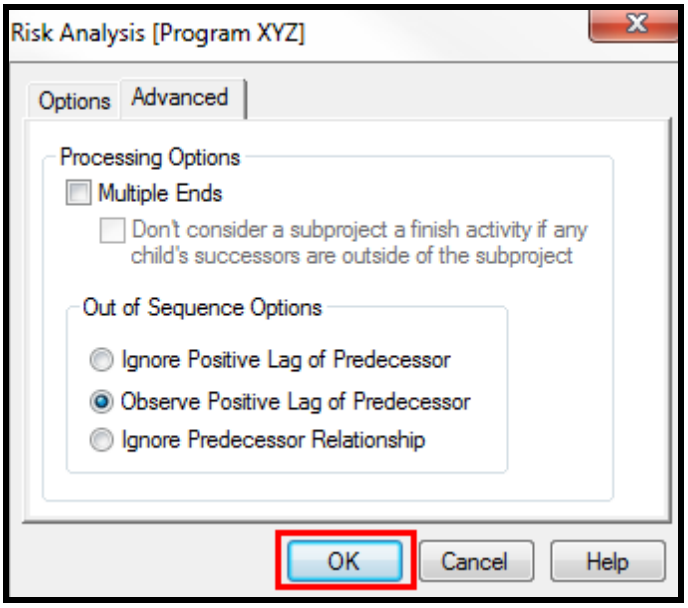
Select *Observe Positive Lag of Predecessor* so all relationships with lags leading into any out-of-sequence events are observed.



Out of Sequence Options

Start Risk Simulation

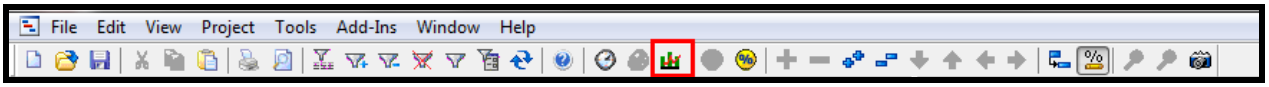
Select *OK* to start the risk simulation.



Risk Analysis Start

Each time a risk analysis is performed, a session log file that records any system or error messages issued during the operation is created. This file (Opp_risk.log) is saved to be reviewed later if necessary.

The risk analysis icon on the Open Plan toolbar may also be used to perform a risk analysis. However, this method does not display the Risk Analysis dialog box. The settings last stored in the Risk Analysis dialog box are used for the risk analysis when the icon is selected.



Risk Analysis Button on Toolbar

Analyze Results

After the simulation has been run, the following views are available for analysis:

- Risk Spreadsheet View
- Risk Histogram View
- Activity Spreadsheet View
- Tornado View

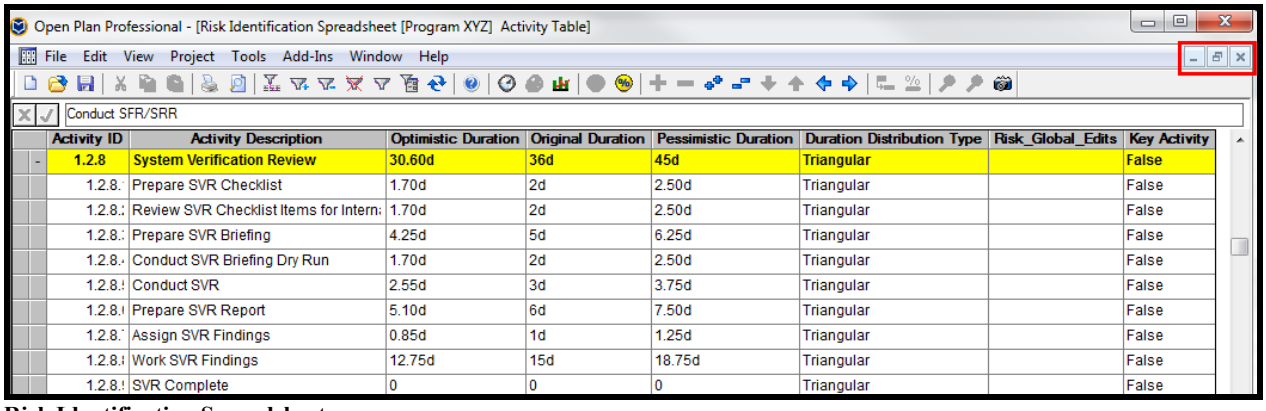
In addition, there may also be an SRA Trend Analysis available if a chart has been created and maintained to document the results of previous SRAs. This is not an output that Open Plan Professional provides.

With this data, the analyst should seek to develop answers for the following questions:

- What is the probability of completing the project or a specific milestone by a particular date?
- What tasks have the greatest likelihood of delaying the project?
- What tasks not currently on the critical path have the greatest chance of appearing on the critical path sometime in the future?
- Does the project have adequate schedule margin?
- What is the trend of the simulation results? Is the completion projection slipping each time an SRA is run?
- Are there any trends in the three point estimates for individual tasks on the critical path?
- How do the three point estimates compare with actually observed duration variances? Duration variance analysis helps to validate the three point estimates.

The analysis results are selected through Open Plan Explorer.

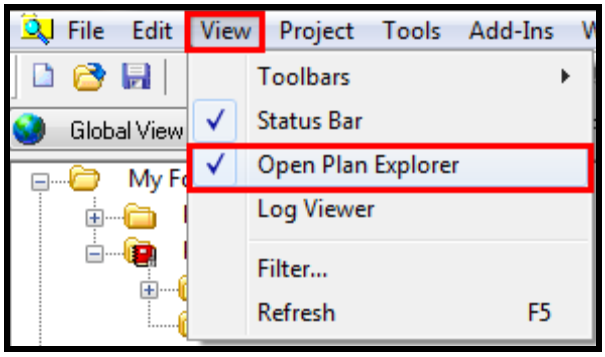
1. Close or minimize current view.



Activity ID	Activity Description	Optimistic Duration	Original Duration	Pessimistic Duration	Duration Distribution Type	Risk_Global_Edits	Key Activity
1.2.8	System Verification Review	30.60d	36d	45d	Triangular		False
1.2.8.	Prepare SVR Checklist	1.70d	2d	2.50d	Triangular		False
1.2.8.	Review SVR Checklist Items for Intern	1.70d	2d	2.50d	Triangular		False
1.2.8.	Prepare SVR Briefing	4.25d	5d	6.25d	Triangular		False
1.2.8.	Conduct SVR Briefing Dry Run	1.70d	2d	2.50d	Triangular		False
1.2.8.	Conduct SVR	2.55d	3d	3.75d	Triangular		False
1.2.8.	Prepare SVR Report	5.10d	6d	7.50d	Triangular		False
1.2.8.	Assign SVR Findings	0.85d	1d	1.25d	Triangular		False
1.2.8.	Work SVR Findings	12.75d	15d	18.75d	Triangular		False
1.2.8.	SVR Complete	0	0	0	Triangular		False

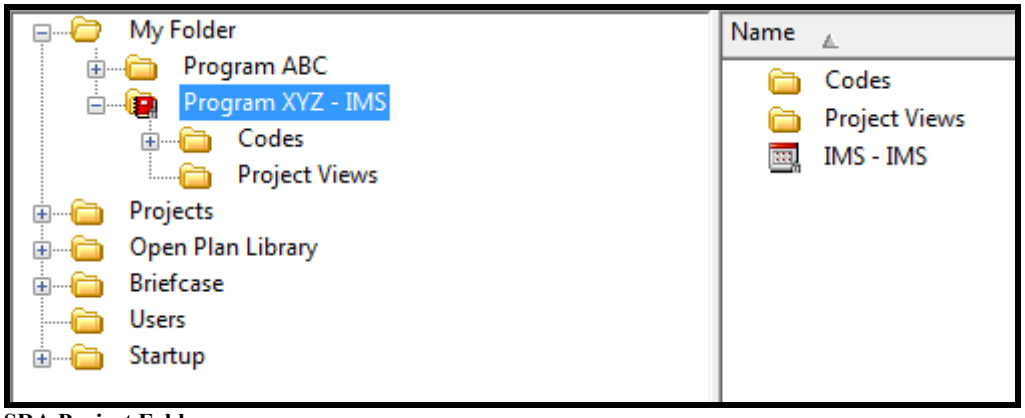
Risk Identification Spreadsheet

2. Open Plan Explorer should appear. If not, select *View* and check *Open Plan Explorer*. Open Plan Explorer may also need to be maximized.



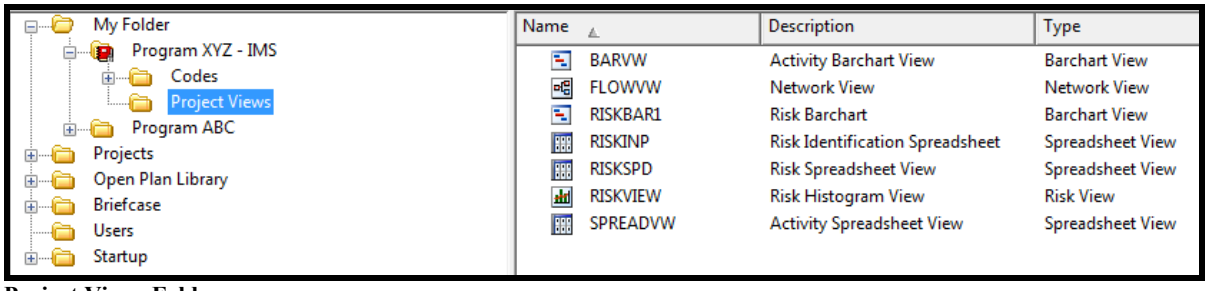
Open Plan Explorer Menu Option

3. Select the project folder.



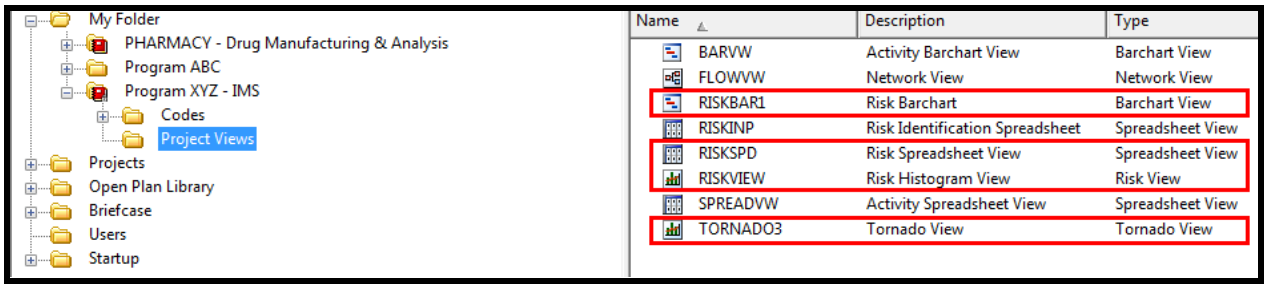
SRA Project Folder

4. Select *Project Views* under the project folder.



Project Views Folder

5. The four views for the risk analysis results are included in the project views list. If not, they still need to be copied from the Open Plan Library (see Add Risk Analysis Views section for more information).

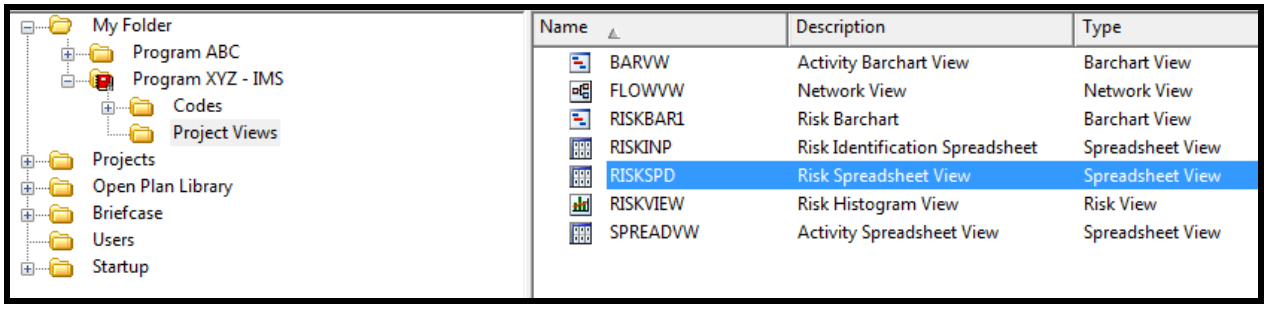


Risk Analysis Views

Risk Spreadsheet

Follow the steps below to view the Risk Spreadsheet:

1. Double click on *Risk Spreadsheet View* in Open Plan Explorer.



Risk Spreadsheet Selection

2. The Risk Spreadsheet appears.

Activity ID	Activity Desc.	Mean Early Start	Mean Early Finish	Std. Dev. of Early Start	Std. Dev. of Early Finish	Mean Late Start	Mean Late Finish	Std. Dev. of Late Start	Std. Deviation of Late Finish	Std. Dev. of Total Float	Std. Dev. of Free Float
1	Program XYZ IMS	02May2011	17Jan2017	0	29d	02May2011	19Jun2017	0	74d	80d	0
1.1	Program Milestones	02May2011	21Dec2016	0	13d	02May2011	19Jun2017	0	74d	76d	0
1.1.1	Start Contract	02May2011	02May2011	0	0	02May2011	02May2011	0	0	0	0
1.1.2	SFR/SRR Complete	09Jun2011	09Jun2011	0	0	09Jun2011	09Jun2011	0	0	0	0
1.1.3	CDR Complete	18Aug2011	18Aug2011	22h	22h	21Feb2012	21Feb2012	76d	76d	76d	0
1.1.4	TRR Cycle 3 Complete	07Nov2013	07Nov2013	60h	60h	06May2014	06May2014	75d	75d	76d	0
1.1.5	UAT Complete	27Jan2014	27Jan2014	67h	67h	24Jul2014	24Jul2014	75d	75d	76d	0
1.1.6	Milestone C Complete	18Mar2014	18Mar2014	69h	69h	12Sep2014	12Sep2014	75d	75d	76d	0
1.1.7	Go Live	21Dec2016	21Dec2016	13d	13d	19Jun2017	19Jun2017	74d	74d	76d	76d
1.2	Program Management	02May2011	19Dec2016	0	47d	02May2011	19Jun2017	0	74d	80d	0
1.2.1	Program Management LOE	02May2011	19Dec2016	0	47d	02May2011	19Jun2017	0	74d	85d	0
1.2.1.1	Program Management FY11	02May2011	05Oct2011	0	52h	02May2011	04Apr2012	0	85d	85d	85d
1.2.1.2	Program Management FY12	05Oct2011	17Oct2012	52h	22d	04Apr2012	16Apr2013	85d	83d	85d	0
1.2.1.3	Program Management FY13	17Oct2012	28Oct2013	22d	31d	16Apr2013	28Apr2014	83d	81d	85d	0

Risk Spreadsheet

3. It may be necessary to adjust the duration types for each standard deviation column. If so, highlight the first standard deviation column, *Std. Dev. of Early Start*.

Activity ID	Activity Desc.	Mean Early Start	Mean Early Finish	Std. Dev. of Early Start	Std. Dev. of Early Finish	Mean Late Start	Mean Late Finish	Std. Dev. of Late Start	Std. Deviation of Late Finish	Std. Dev. of Total Float	Std. Dev. of Free Float
1	Program XYZ IMS	02May2011	17Jan2017	0	29d	02May2011	19Jun2017	0	74d	80d	0
1.1	Program Milestones	02May2011	21Dec2016	0	13d	02May2011	19Jun2017	0	74d	76d	0
1.1.1	Start Contract	02May2011	02May2011	0	0	02May2011	02May2011	0	0	0	0
1.1.2	SFR/SRR Complete	09Jun2011	09Jun2011	0	0	09Jun2011	09Jun2011	0	0	0	0
1.1.3	CDR Complete	18Aug2011	18Aug2011	22h	22h	21Feb2012	21Feb2012	76d	76d	76d	0
1.1.4	TRR Cycle 3 Complete	07Nov2013	07Nov2013	60h	60h	06May2014	06May2014	75d	75d	76d	0
1.1.5	UAT Complete	27Jan2014	27Jan2014	67h	67h	24Jul2014	24Jul2014	75d	75d	76d	0
1.1.6	Milestone C Complete	18Mar2014	18Mar2014	69h	69h	12Sep2014	12Sep2014	75d	75d	76d	0
1.1.7	Go Live	21Dec2016	21Dec2016	13d	13d	19Jun2017	19Jun2017	74d	74d	76d	76d
1.2	Program Management	02May2011	19Dec2016	0	47d	02May2011	19Jun2017	0	74d	80d	0

Duration Types in Risk Spreadsheet

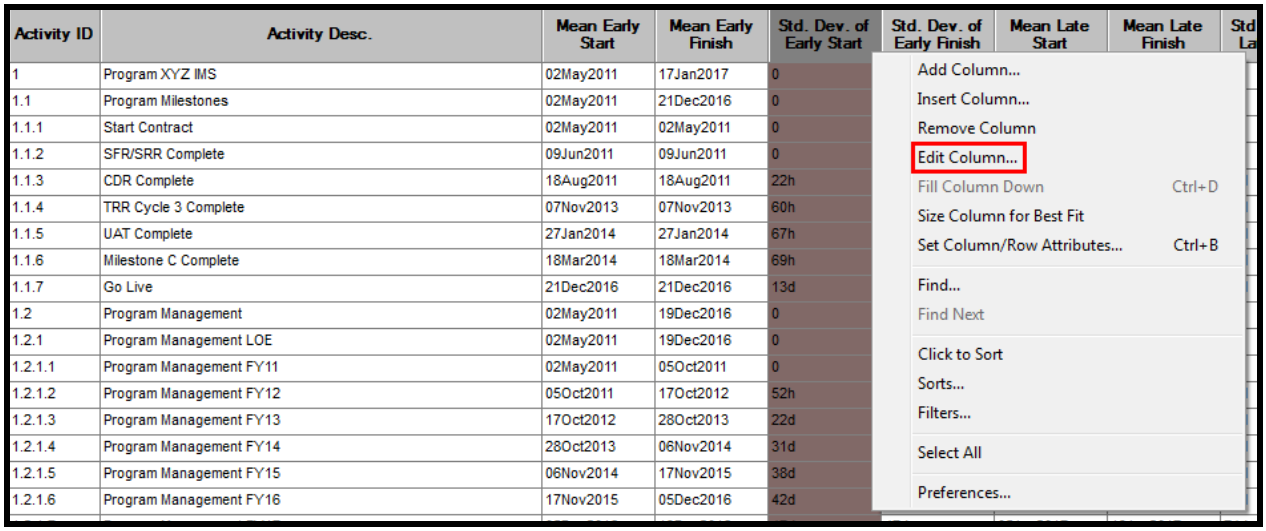
4. With mouse hovering over header, Right Click.

Activity ID	Activity Desc.	Mean Early Start	Mean Early Finish	Std. Dev. of Early Start	Std. Dev. of Early Finish	Mean Late Start	Mean Late Finish	Std La
1	Program XYZ IMS	02May2011	17Jan2017	0				
1.1	Program Milestones	02May2011	21Dec2016	0				
1.1.1	Start Contract	02May2011	02May2011	0				
1.1.2	SFR/SRR Complete	09Jun2011	09Jun2011	0				
1.1.3	CDR Complete	18Aug2011	18Aug2011	22h				
1.1.4	TRR Cycle 3 Complete	07Nov2013	07Nov2013	60h				
1.1.5	UAT Complete	27Jan2014	27Jan2014	67h				
1.1.6	Milestone C Complete	18Mar2014	18Mar2014	69h				
1.1.7	Go Live	21Dec2016	21Dec2016	13d				
1.2	Program Management	02May2011	19Dec2016	0				
1.2.1	Program Management LOE	02May2011	19Dec2016	0				
1.2.1.1	Program Management FY11	02May2011	05Oct2011	0				
1.2.1.2	Program Management FY12	05Oct2011	17Oct2012	52h				
1.2.1.3	Program Management FY13	17Oct2012	28Oct2013	22d				
1.2.1.4	Program Management FY14	28Oct2013	06Nov2014	31d				
1.2.1.5	Program Management FY15	06Nov2014	17Nov2015	38d				
1.2.1.6	Program Management FY16	17Nov2015	05Dec2016	42d				

Add Column...
Insert Column...
Remove Column
Edit Column...
Fill Column Down Ctrl+D
Size Column for Best Fit
Set Column/Row Attributes... Ctrl+B
Find...
Find Next
Click to Sort
Sorts...
Filters...
Select All
Preferences...

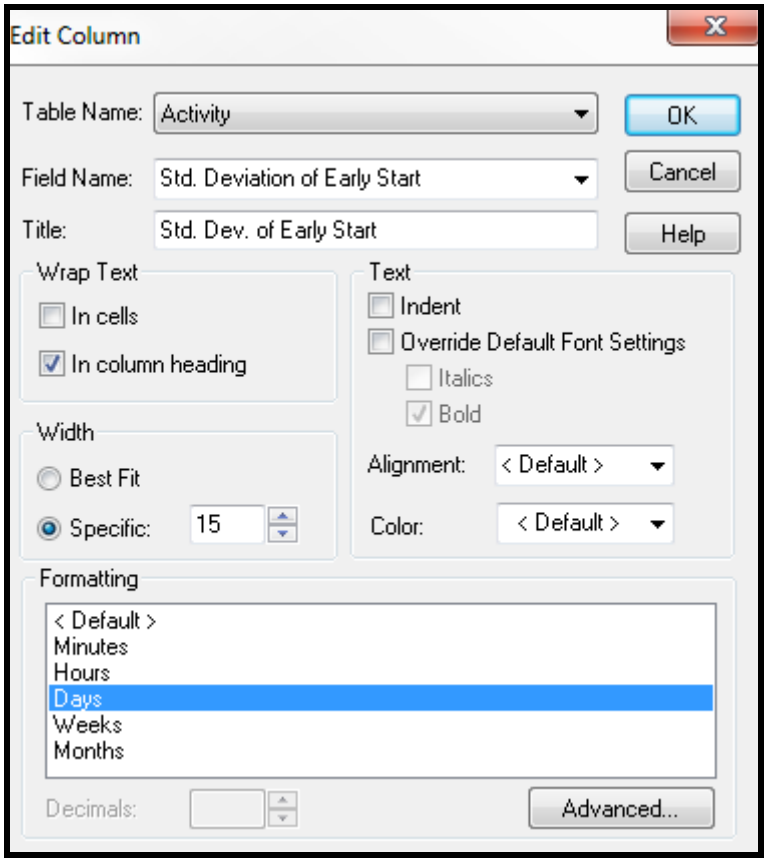
Column Selection

5. Select *Edit Column.*



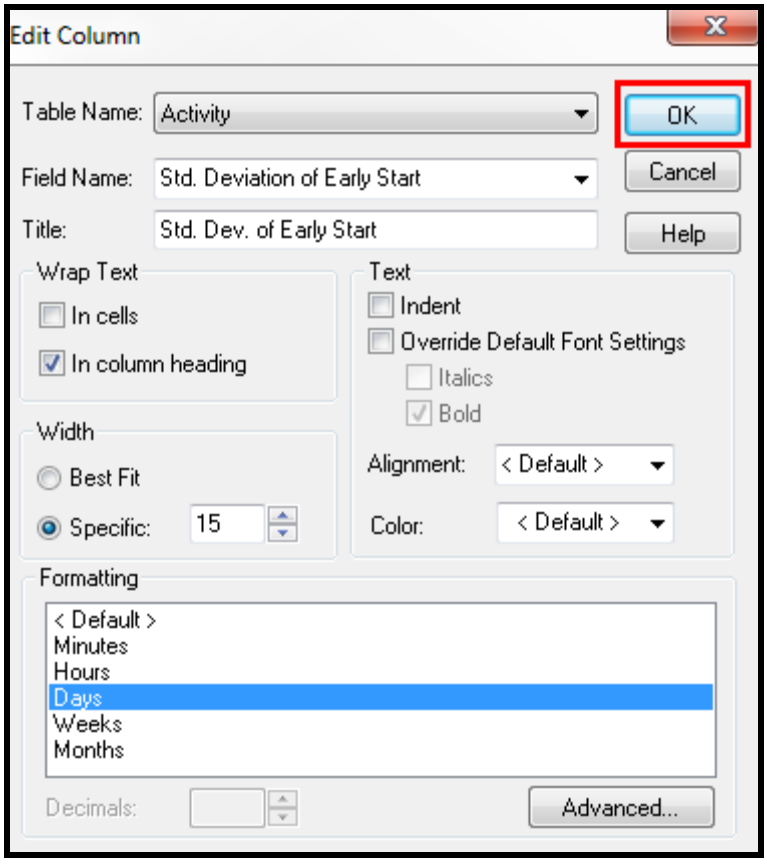
Edit Column Menu Option

6. Under *Formatting*, select *Days*.



Duration Formatting

7. Select *OK*.



Confirming Duration Formatting

8. Repeat Steps 3-7 for the remaining standard deviation columns.

The dates and values for early dates, late dates, and activity floats are not calculated as single, deterministic values. Instead, statistical means and standard deviations are used to express these values. This analysis provides the means and standard deviations for the early start dates, late start dates, early finish dates and late finish dates in the presence of risk for each task. It also provides the standard deviations for total float and free float.

This technique only provides an approximation. The actual distribution is often skewed in one direction or the other, resulting in confidence estimates based on mean and standard deviation values to be less accurate. To get a better estimate, an activity should be selected as a key activity with results shown in a risk histogram.

Activity ID	Activity Desc.	Mean Early Start	Mean Early Finish	Std. Deviation of Early Start	Std. Dev. of Early Finish	Mean Late Start	Mean Late Finish	Std. Dev. of Late Start	Std. Deviation of Late Finish	Std. Dev. of Total Float	Std. Dev. of Free Float
1	Program XYZ IMS	02May2011	17Jan2017	0	29d	02May2011	19Jun2017	0	74d	80d	0
1.1	Program Milestones	02May2011	21Dec2016	0	13d	02May2011	19Jun2017	0	74d	76d	0
1.1.1	Start Contract	02May2011	02May2011	0	0	02May2011	02May2011	0	0	0	0
1.1.2	SFR/SRR Complete	09Jun2011	09Jun2011	0	0	09Jun2011	09Jun2011	0	0	0	0
1.1.3	CDR Complete	18Aug2011	18Aug2011	2.75d	2.75d	21Feb2012	21Feb2012	76d	76d	76d	0
1.1.4	TRR Cycle 3 Complete	07Nov2013	07Nov2013	7.50d	7.50d	06May2014	06May2014	75d	75d	76d	0
1.1.5	UAT Complete	27Jan2014	27Jan2014	8.38d	8.38d	24Jul2014	24Jul2014	75d	75d	76d	0
1.1.6	Milestone C Complete	18Mar2014	18Mar2014	8.63d	8.63d	12Sep2014	12Sep2014	75d	75d	76d	0
1.1.7	Go Live	21Dec2016	21Dec2016	13d	13d	19Jun2017	19Jun2017	74d	74d	76d	76d
1.2	Program Management	02May2011	19Dec2016	0	47d	02May2011	19Jun2017	0	74d	80d	0
1.2.1	Program Management LOE	02May2011	19Dec2016	0	47d	02May2011	19Jun2017	0	74d	85d	0
1.2.1.1	Program Management FY11	02May2011	05Oct2011	0	6.50d	02May2011	04Apr2012	0	85d	85d	85d
1.2.1.2	Program Management FY12	05Oct2011	17Oct2012	6.50d	22d	04Apr2012	16Apr2013	85d	83d	85d	0

Risk Spreadsheet

Mean

- The mean is the average or norm.

Standard Deviation

- Standard deviation indicates the degree of clustering around the mean (average) value.
- The greater the standard deviation, the less clustering. Therefore, possible dates are spread further apart in time.
- The greater the standard deviation, the mode, median, and mean values are less pronounced and other dates have a greater likelihood of occurring.

For activity 1.3.4.1 shown below, an early start standard deviation equaling 1.75 days indicates that the time between the mean early start of Aug 23, 2011, +/- 1.75 days accounts for 68.3% of all probable start dates for this activity. There is a 68.3% chance of this activity starting within this timeframe.

Activity ID	Activity Desc.	Mean Early Start	Mean Early Finish	Std. Deviation of Early Start	Std. Dev. of Early Finish	Mean Late Start	Mean Late Finish	Std. Dev. of Late Start	Std. Deviation of Late Finish	Std. Dev. of Total Float	Std. Dev. of Free Float
1.3.3.6	FDS Complete for FDS RMM1100	23Aug2011	23Aug2011	1.75d	1.75d	22Feb2012	22Feb2012	76d	76d	76d	0
1.3.4	FDS RMM2100	23Aug2011	23Dec2011	1.75d	3d	22Feb2012	25Jun2012	76d	76d	76d	0
1.3.4.1	Write FDS for FDS RMM2100	23Aug2011	06Sep2011	1.75d	1.85d	22Feb2012	08Mar2012	76d	76d	76d	0
1.3.4.2	Obtain Estimates for FDS RMM2100	06Sep2011	08Sep2011	1.85d	1.88d	08Mar2012	12Mar2012	76d	76d	76d	0
1.3.4.3	Obtain FDS Approval for FDS RMM2100	08Sep2011	12Sep2011	1.88d	1.88d	12Mar2012	14Mar2012	76d	76d	76d	0
1.3.4.4	Write FTP for FDS RMM2100	12Sep2011	11Oct2011	1.88d	2.50d	18Apr2012	16May2012	76d	76d	76d	0
1.3.4.5	Approve FTP for FDS RMM2100	25Oct2011	09Nov2011	2.63d	2.75d	31May2012	14Jun2012	76d	76d	76d	3d

Risk Spreadsheet Example

Total Float

There is a relationship between total float mean and standard deviation and the criticality index for an activity. Activities whose total float values have large standard deviations relative to their means are more likely to be critical than activities with relatively small standard deviations.

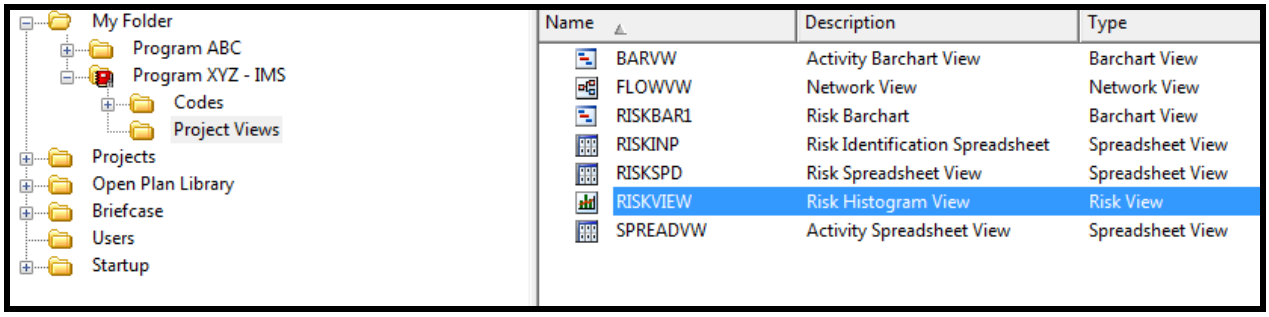
Activity ID	Activity Desc.	Mean Early Start	Mean Early Finish	Std. Deviation of Early Start	Std. Dev. of Early Finish	Mean Late Start	Mean Late Finish	Std. Dev. of Late Start	Std. Deviation of Late Finish	Std. Dev. of Total Float	Std. Dev. of Free Float
1.3.3.6	FDS Complete for FDS RMM1100	23Aug2011	23Aug2011	1.75d	1.75d	22Feb2012	22Feb2012	76d	76d	76d	0
1.3.4	FDS RMM2100	23Aug2011	23Dec2011	1.75d	3d	22Feb2012	25Jun2012	76d	76d	76d	0
1.3.4.1	Write FDS for FDS RMM2100	23Aug2011	06Sep2011	1.75d	1.85d	22Feb2012	08Mar2012	76d	76d	76d	0
1.3.4.2	Obtain Estimates for FDS RMM2100	06Sep2011	08Sep2011	1.85d	1.88d	08Mar2012	12Mar2012	76d	76d	76d	0
1.3.4.3	Obtain FDS Approval for FDS RMM2100	08Sep2011	12Sep2011	1.88d	1.88d	12Mar2012	14Mar2012	76d	76d	76d	0
1.3.4.4	Write FTP for FDS RMM2100	12Sep2011	11Oct2011	1.88d	2.50d	18Apr2012	16May2012	76d	76d	76d	0
1.3.4.5	Approve FTP for FDS RMM2100	25Oct2011	09Nov2011	2.63d	2.75d	31May2012	14Jun2012	76d	76d	76d	3d

Total Float in Risk Spreadsheet

Risk Histogram

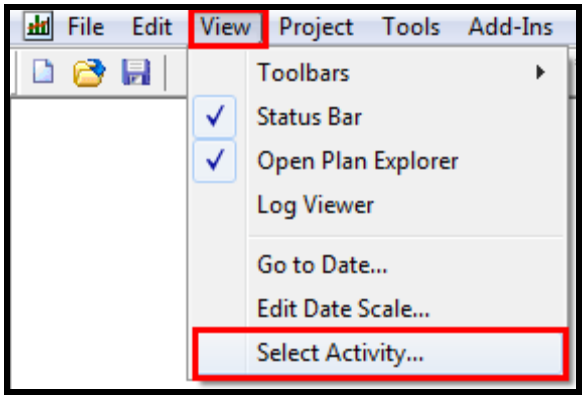
Follow the steps below to view the Risk Histogram results:

1. Double click on *Risk Histogram View* in Open Plan Explorer.



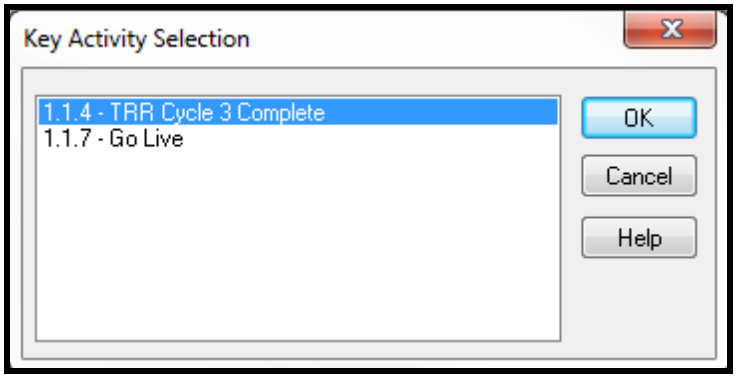
Risk Histogram Selection

2. Select *View* > *Select Activity*.



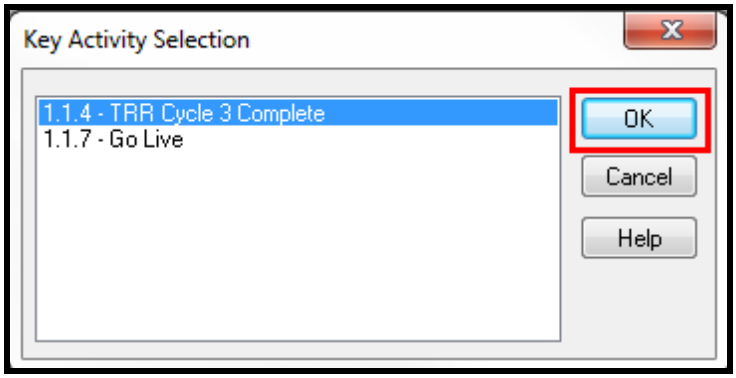
Select Activity Menu Option

3. Highlight a key activity.



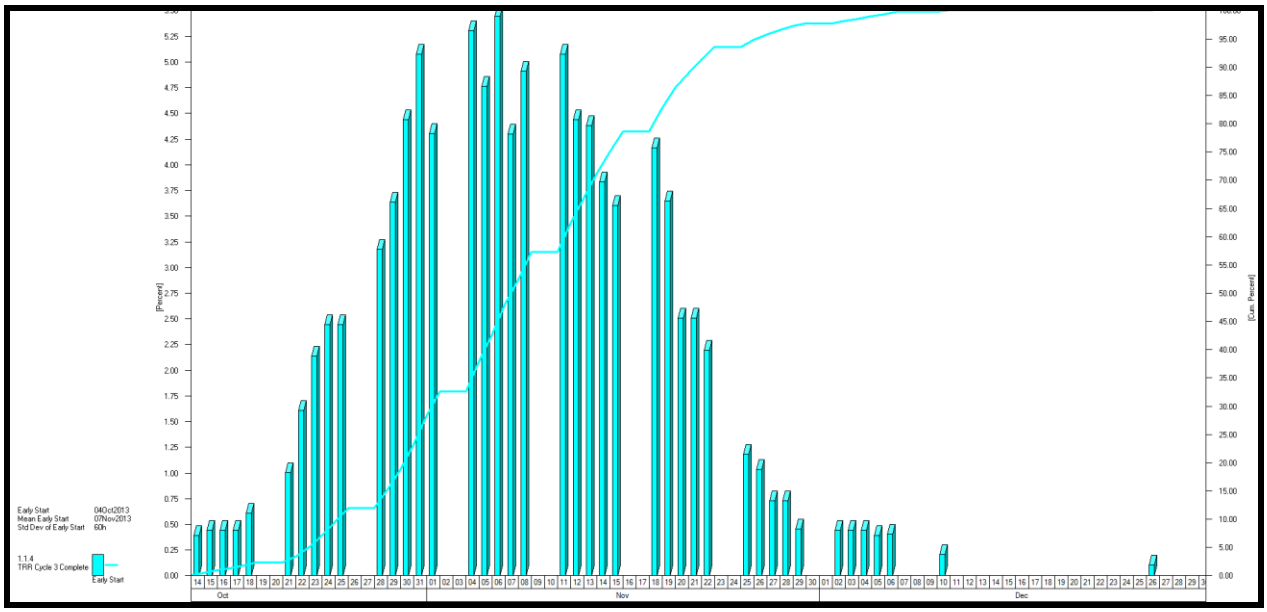
Key Activity Selection

4. Select *OK*.



Confirming Key Activity

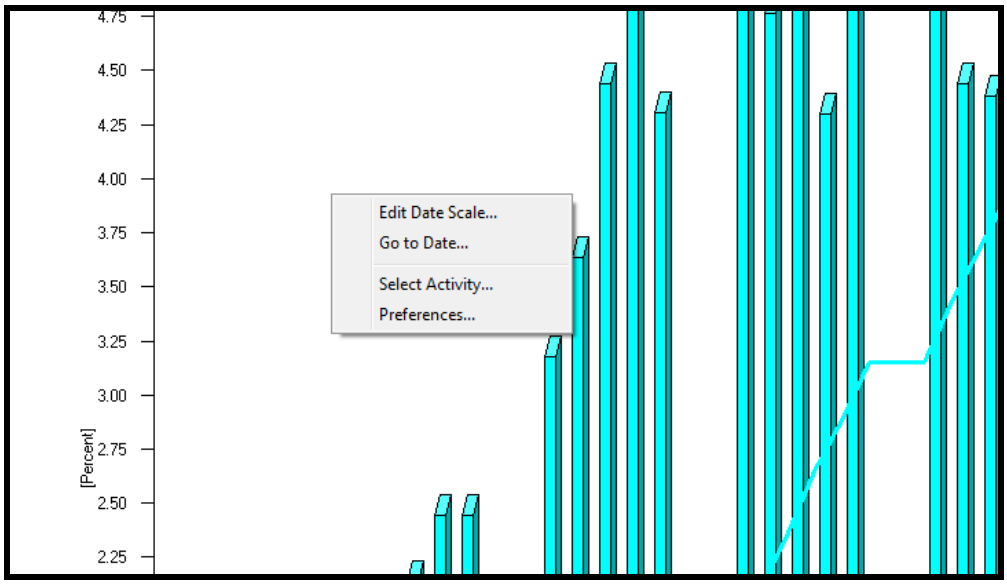
5. The risk histogram for the selected key activity appears.



Risk Histogram

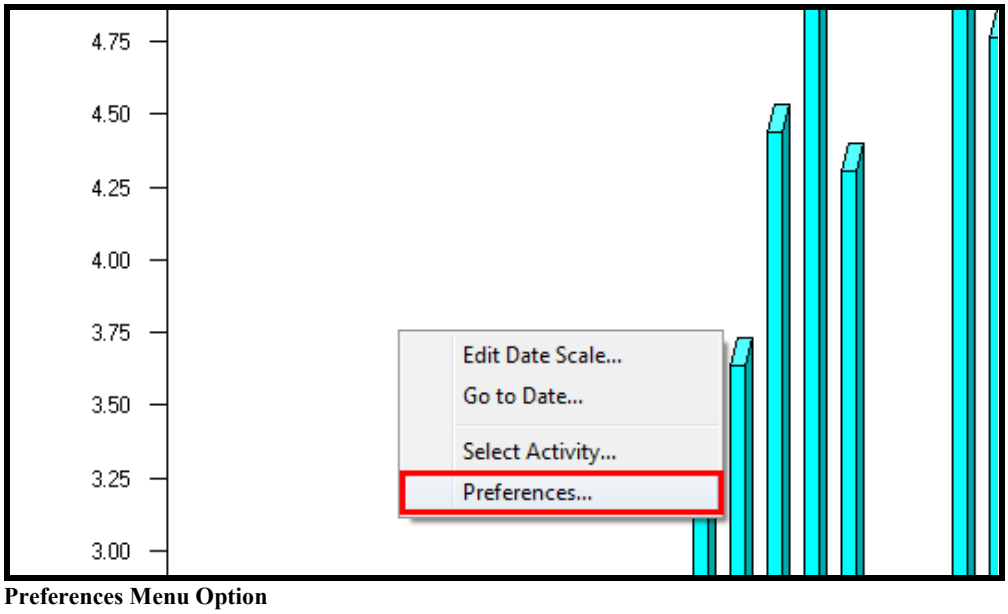
Histograms for the early start date, late start date, early finish date and late finish date for each key activity are available. Follow the steps below to view histograms for each of these date types:

1. Right Click anywhere within the Risk Histogram View.



Risk Histogram Menu

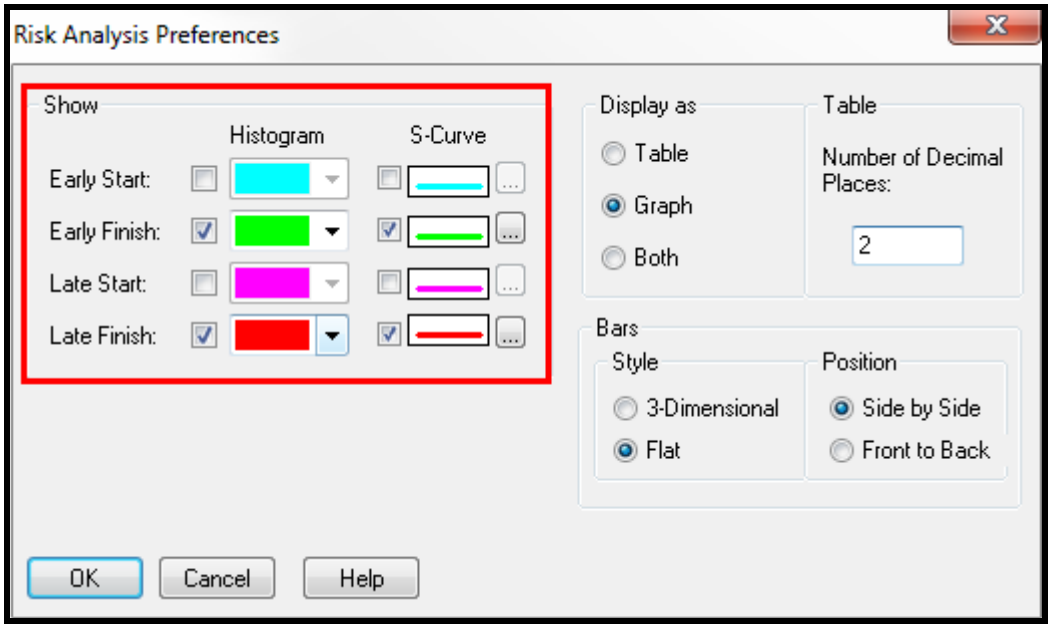
2. Select *Preferences.*



Preferences Menu Option

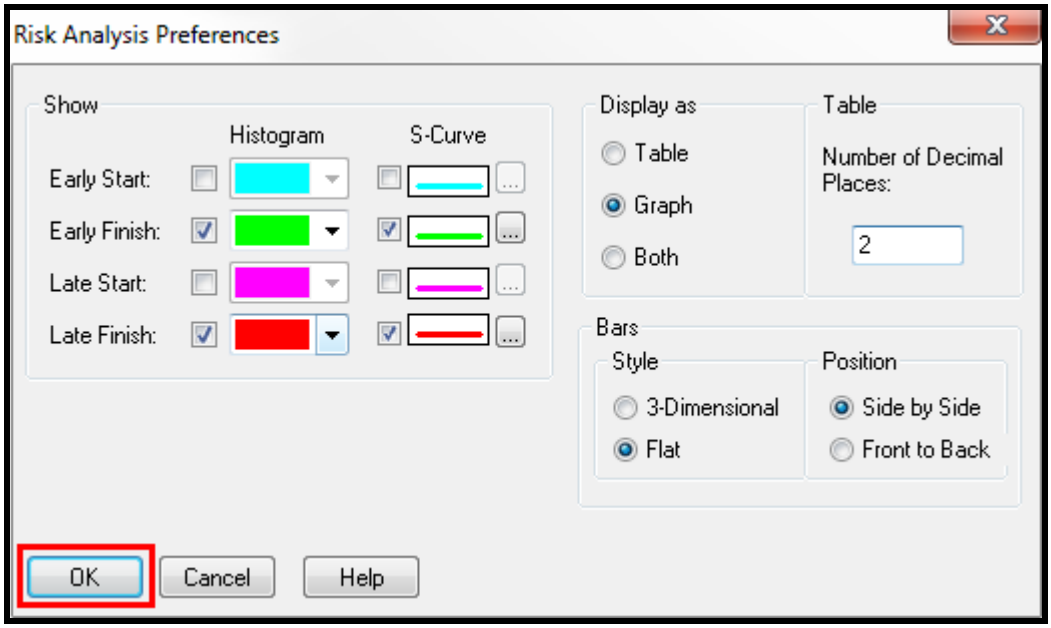
3. Select the desired date types to display risk analysis results.

   Note that other view options may be indicated as well. When displaying histograms, colors of the histogram bars and corresponding S-curves may be selected. The bar style (3-dimensional or flat) may also be specified. If multiple bars are displayed, their display may be specified as either side-by-side or front-to-back. A tabular view of the data may also be added to the histogram or viewed on its own and the number of decimal places may be indicated for the table.



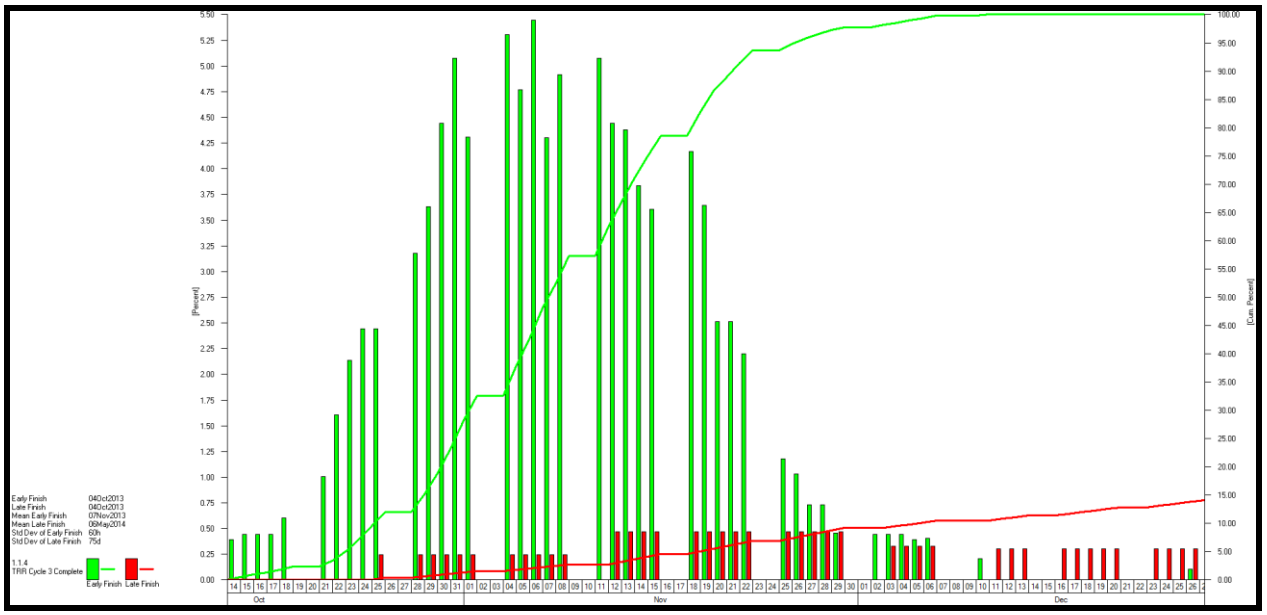
Risk Analysis Preferences

4. Select *OK*.



Confirming Date Types to Display

5. The results for the selected date types are displayed.



Risk Histogram with Early Finish and Late Finish Displayed

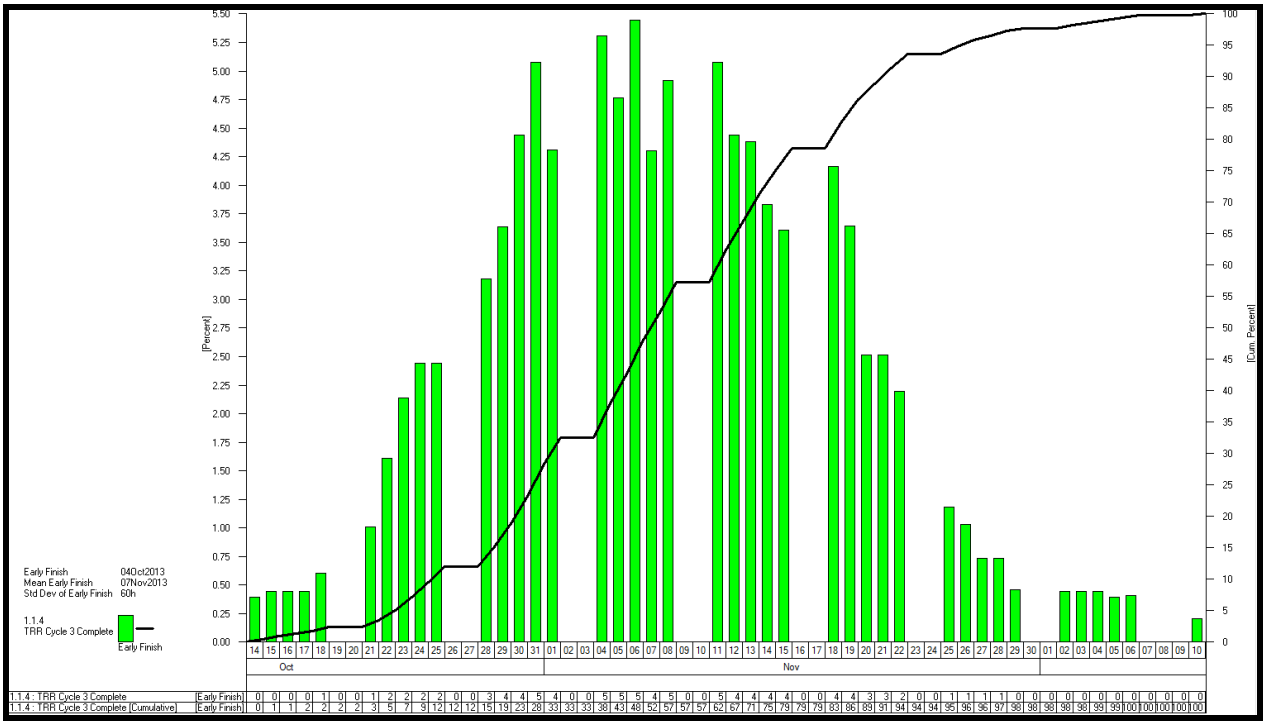
This analysis provides the probability distribution for the early start date, late start date, early finish date and late finish date for each key activity. Typically, the early finish and late finish dates are shown to compare the difference when determining the expected finish date.

The histogram represents the percentage of trials that resulted within each date interval. A scale representing the percentage of time a specific date interval is recorded for the key activity during the simulation is along the left-hand axis. The sum of the column percentages total 100%. In the histogram below, the mode is November 6. This date resulted in 5.5% of the trials.

The right-hand axis represents the cumulative distribution for dates. In the example below, 50% of the simulations resulted in dates on or before November 7, making it the median early finish date. November 7 is also the mean early finish date.

In the example below that displays early finish data, the following information is displayed to the left of the histogram:

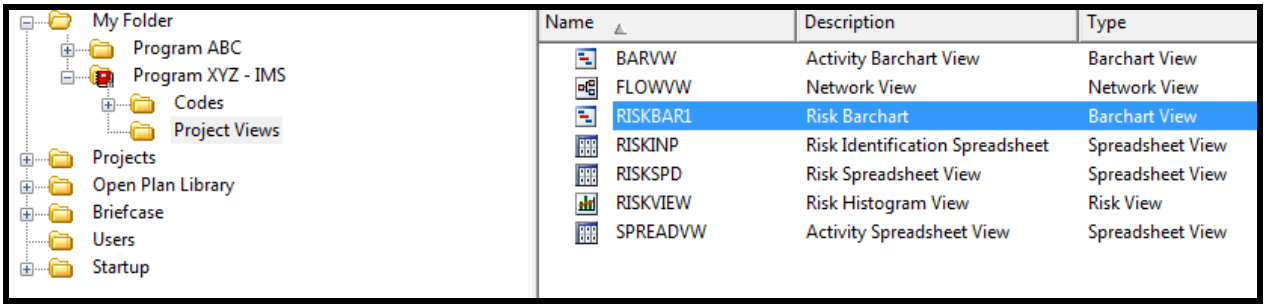
- The early finish date
- The mean early finish date
- The standard deviation for the mean early finish



Risk Histogram Example

Risk Barchart

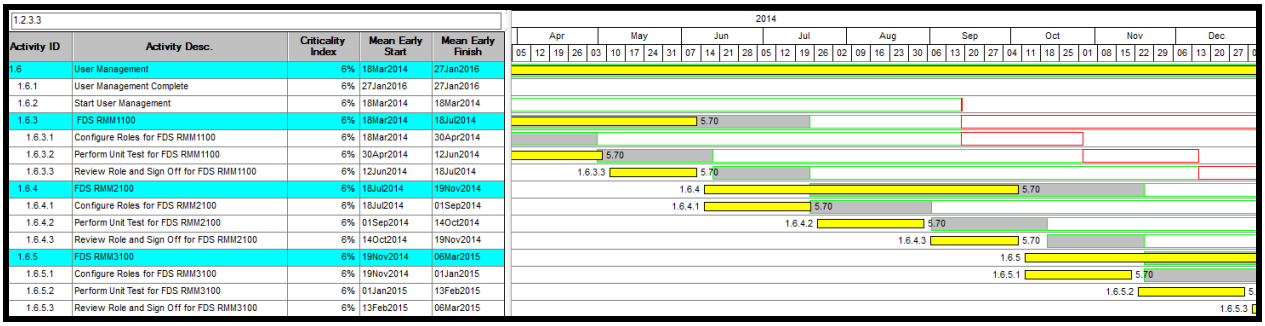
To view the Risk Barchart, double click on *Risk Barchart* in Open Plan Explorer.



Risk Barchart Selection

This view provides information about risk criticality. A task is risk critical if it is not normally on the critical path in the absence of risk, but appears on the critical path during a risk analysis.

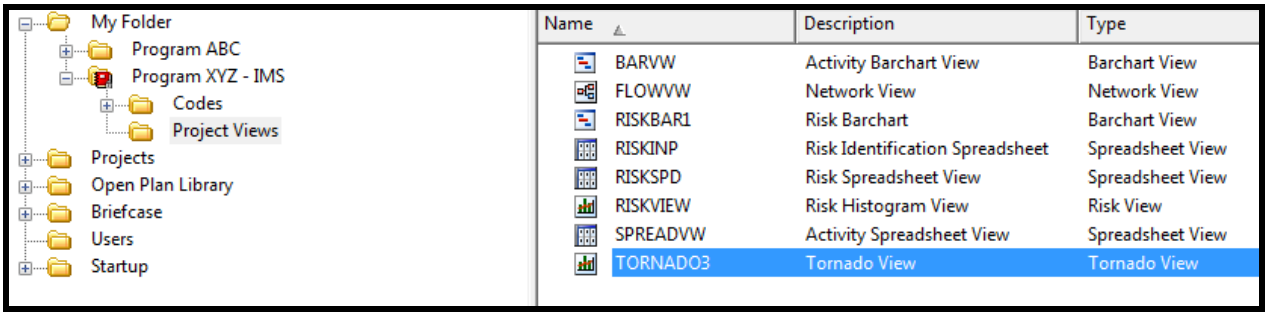
The table shows the percentage of simulation trials that resulted in the activity's presence on the critical path. The Gantt chart identifies activities that are not risk critical (green), risk critical 1-50% of the time (yellow) and activities that are risk critical 51-100% of the time (red), along with mean early and late date spans.



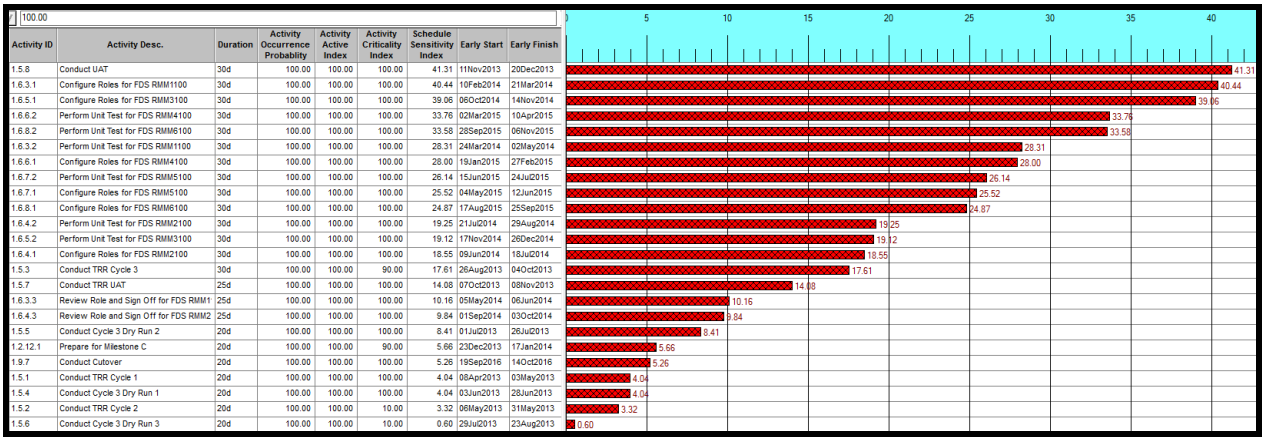
Risk Barchart

Tornado View

To view the Tornado Chart, double click on *Tornado View* in Open Plan Explorer.



This view shows the degree that activities influence the project finish date. This is called the Schedule Sensitivity Index. Activities are arranged by their Schedule Sensitivity Index in descending order, giving the chart a 'tornado' appearance. By identifying the activities that have the greatest impact on the finish date of the project, a tornado view helps direct risk mitigation efforts to areas where they are most effective.



Tornado View

Results Phase

Produce SRA Outbrief

The output of the SRA should include a report with the following content:

- Executive Summary with conclusions, recommendations, and an SRA trend chart if SRA history is available. The Executive Summary should be in both MS Word and PowerPoint formats.
- SRA Ground Rules and Assumptions including scope, schedule used, status date, and methodology.
- Results including histogram(s) and any other analyses run.
- Conclusions that answer the following questions, depending on the tool used and analyses run:
  - What is the probability of completing the project or a specific milestone by a particular date?
  - What tasks have the greatest likelihood of delaying the project?
  - What tasks not currently on the critical path have the greatest chance of appearing on the critical path sometime in the future?
  - Does the project have adequate schedule margin?
  - What is the trend of the simulation results? Is the completion projection date slipping each time an SRA is run?
  - Are there specific control accounts or WBS elements that most impact the project completion prediction?
  - Are there any trends in the three point estimates for individual tasks on the critical path?
  - How do the three point estimates compare with actually observed duration variances?
- Attachments including three point estimates with rationale and global edits used with rationale.

PMO Follow Up

The Government PMO should follow up with the Supplier to monitor progress and ensure new goals for reducing or eliminating risks are successful.

Managing the Schedule Based on SRA Output

Improving the Schedule Completion Date

An SRA may show a probability for project completion that is unacceptable to the program manager and she / he may request that the schedule be improved to have an earlier completion date. To reduce the time a particular effort takes usually cost more money. Spending more money to get something done more quickly is called Crashing. There are various methods of project schedule crashing, and the decision to crash should only take place after all of the possible alternatives have been analyzed. The key is to attain maximum decrease in schedule time with minimum cost. The time to stop crashing is when it no longer becomes cost effective. A simple guideline is:

- Crash only activities that are critical.
- Crash from the least expensive to most expensive based on the cost to crash.
- Crash an activity only until:
  - It reaches its maximum time reduction. Engineering and program management judgment is often needed to make this determination.
  - It causes another path to also become critical.

The following are techniques used to crash a schedule.

Adding Resources

One technique is to increase the resources for selected tasks, particularly those on the current critical path. This essentially means decreasing the time it takes to perform individual activities by increasing the number of people working on those activities. There are pros and cons to this approach:

Pros:

- This makes sense, at first glance. For example, if it takes Bob 4 hours to complete an activity, it would logically take Bob and Sue 2 hours to complete the same activity.

Cons:

- Adding resources isn't always the best solution. Sometimes it ends up taking more time in the long run. Consider the following:
  - New resources aren't going to be familiar with the tasks at hand, so they are expected to be less productive than current team members.
  - Who guides the new members up the learning curve? Usually it is the most productive members of the team, who could themselves be working to get the task finished more quickly.
  - Availability does not equal qualification. Not even the best neurosurgeon in the world helps if you need a programmer. Sometimes extra hands are only tangentially qualified for the work, and even if the new resources have the right skills, they may not be on the same caliber as the current team members (too many cooks spoil the soup!).

Fast Tracking

Another technique is fast-tracking that involves over-lapping tasks that are currently scheduled sequentially. This is done by changing the logic of the schedule activities and by reducing the lag times between tasks.

De-Scoping

Another technique is to de-scope some efforts. Perhaps a task accomplishes more than required by the exit criteria. The scope could be reduced and the duration potentially shortened.

Managing Schedule Margin

Schedule margin / reserve is defined in DID DI-MGMT-81650 as: "A management method for accommodating schedule contingencies. It is a designated buffer and shall be identified separately and considered part of the baseline."

Schedule margin is a defined / visible critical path activity planned during normal work hours with no defined scope. Schedule margin is defined / allocated / managed in direct correlation to known schedule risk. If consumed, it is done so to retire risk, not used to fix schedule performance degradation. Schedule margin cannot be negative.

Schedule margin burn-down is tied to successful key event / milestone completion and retirement of associated schedule risk. Margin must be managed to provide a reasonable probability of schedule success.

The schedule margin management process should define:

- How the total amount of schedule margin is determined and allocated (according to schedule risk and schedule performance objectives).
- Conditions for determining schedule margin ratings and associated recovery actions.
- Conditions for allowable margin use (and who owns it).
- How unused margin is conserved, reallocated or spent as risk is retired.
- What, when, how, and by whom contingency actions are implemented to immediately address schedule performance issues.

Schedule margin can be determined using the SRA process. The difference between simulation results and the current forecast completion date gives insight to the amount of schedule margin required by the project.

In summary, implementing a schedule margin management process helps reduce chaos, variability, unpredictability, and dependence on individual heroism, ultimately resulting in better schedule performance.

Advanced Risk Modeling Using Risk+

The following are advanced SRA techniques:

Probabilistic Branching

Probabilistic Branching is performed when certain tasks or groups of tasks are executed or not, depending on a specified probability of occurrence. For example, a test plan might have two possible outcomes: a 70% chance of getting approved, leading directly to testing; and a 30% chance of getting rejected, requiring rework before testing can begin.

Conditional Branching

Conditional Branching allows for conditional changes to be applied to a schedule during simulation, based on how risk has materialized. For example, a conditional statement could be added specifying that if a task isn't completed by late summer, then its successor tasks must be delayed until the following spring.

Correlated Risks

Correlated Risks refers to multiple tasks with risk that is largely related to the same underlying factor. For example the task duration to prepare an item for painting and the task duration to paint the item may have been historically determined to be directly correlated. During the simulation it would be important to have a longer paint duration for each trial that has a longer preparation duration. Risk+ has an advanced capability to correlate task durations or costs. Even if the tasks are not identically affected by the factor, it is likely that some degree of risk should materialize in both tasks if it materializes in either.

Acronyms

AECO	Acquisition Excellence and Change Office
CAM	Control Account Manager
CDRL	Contract Deliverable Requirements List
CPR	Contract Performance Report
DID	Data Item Description
EAC	Estimate at Completion
EV	Earned Value
IAW	In Accordance With
IMS	Integrated Master Schedule
IPT	Integrated Product Team
IRA	Integrated Risk Assessment
LOE	Level Of Effort
MFO	Must Finish On
MSO	Must Start On
MSP	Microsoft Project
PASEG	Planning and Scheduling Excellence Guide
PMO	Program Management Office
RMP	Risk Management Plan
ROMP	Risk and Opportunity Management Plan
SOW	Statement of Work
SRA	Schedule Risk Assessment
WBS	Work Breakdown Structure