Schedule Risk Anaiysis Mini Masterclass



Content

- 1. Software
- 2. Schedule Risk Analysis
 - Schedule Sense Check
 - Duration Uncertainty Inputs
 - Correlations
 - Risk Inputs & Modelling
 - Distributions
- 3. Monte Carlo Risk Analysis
- 4. Results
 - What If / Stress Test
- 5. Benefits





Software

Schedule Risk Analysis

Software

Palisade @Risk

- Excel Based
- MSP
- SRA Limitations
- Cost Focused
- Significant



Oracle Primavera Risk Analysis

- Primavera, MSP, Others
- Manipulate Plan
- Large Schedules
- Limited Distributions
- Limited cost function







Schedule Risk Analysis

What is it?



Schedule Risk Analysis

- Software
- Schedule
- Risk & Uncertainty Analysis



Project Schedule

- A Project Schedule is a dynamic representation of the project activities and their execution sequence.
- Dynamic Model Not a Calendar
- Completion dates should be <u>OUTPUTS</u> not inputs



Why do we schedule a project?

- Plan out activities to understand realistic targets
- Understand resource requirements
- Forecast and record performance
- Compare performance against targets (baseline)
- Understand dynamics of plan and identify changes required to meet targets etc



Build A Schedule

Group Task

- Build This Hotel
- Less than 10
 Activities
- Durations
- Logic Links



Schedule Sense Check

What is it?

Project Schedule Best Practice

- Define WBS
- Set consistent coding strategy
- All tasks have dependencies
- No constrained dates (or Minimum use if legit)
- Activities based on work/durations not dates
- Realistic durations
- Realistic relationships
 - Not date driven
 - No lags or negative lags



Schedule issues

• Start to Start with Open End





Schedule issues

• Finish to Finish with Open End



• Engineering completion becomes constrained by Design and Construction constrained by Engineering





Constraints

- Often used to set dates
 - Targets, contract dates, management dates
 - This is incorrect use and poor planning
 - 'looks fine' but negative float builds up
- Constraints can be legitimate
 - Date land access is to be granted
 - Date Vendor/Sub-Con has agreed to start
 - Resource leveling constraints
- Completion dates are OUTPUTS not inputs



Duration Uncertainty

Building A Model

Duration Uncertainty

- Review Activity Durations
 - Are they realistic?
 - Optimistic? Pessimistic?
 - Durations are not always certain
 - Activities have natural variance.
 - 3 point range for better accuracy. Min, Most Likely and Maximum durations
- Interview/Workshop with Planner, PM, Eng etc





Risk & Uncertainty







Estimating Impacts











H&S? Reputation? Quality? Environment?



Group Task

 Build Uncertainty in your durations



PEARSON CORRELATION (r) VISUALIZED AS SCATTERPLOT





Risk Inputs

Identify & Quantify



Quantifying Risk Events

- Each Risk given a Min,
 Most Likely & Max impact
- Min = Optimistic but realistic outcome
- Most Likely (ML) = Expected most probable outcome
- Max = Pessimistic worst case outcome
 - Should not include force majeure or project stopping outcome



Probability	Min	Most Likely	Max
30%	1 week	4 weeks	8 weeks

Triangular Distribution





Distributions



Distributions



Monte Carlo

Schedule Risk Analysis

Quantitative Risk Analysis - Distribution

What is a Distribution?

- Graphical representation of occurrences of a variable, e.g. cost, duration, date, etc.
- Example: "Two Dice" ullet

Sum Dice#1 + Dice#2	# Occurrences Dice#1 + Dice#2	Combinations	# Comb.
2	136	1+1	1
3	264	1+2; 2+1	2
4	425	1+3; 3+1; 2+2	3
5	513	1+4; 4+1; 2+3; 3+2	4
6	703	1+5; 5+1; 2+4; 4+2; 3+3	5
7	857	1+6; 6+1; 2+5; 5+2; 3+4; 4+3	6
8	690	2+6; 6+2; 3+5; 5+3; 4+4	5
9	600	3+6; 6+3; 4+5; 5+4	4
10	373	4+6; 6+4; 5+5	3
11	307	5+6; 6+5	2
12	132	6+6	1
Grand Total	5000		

"Two Dices" - Histogram Simulation (5000x)









Risk Mapping to Plan

-64

- Can be multiple activities
- Entering Schedule Delay impacts (Min, ML, Max)





• Duration Uncertainty + Assigned Risks

🖲 Pr	imavera Risk Analysis	- [P:\ \Oct 13\Construction of GTP (34,5)v2-	Pre-mitigat	ed.plan - Prin	navera Gantt	*]		ALC: No. 14		and grant to	 Tage No.	والمسارين						
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	D	Description	Duration	Start	Finish	9 16		6 13		6 13	7 3 10		1	8 15	5 12 1	c Duration	Likely	Duration
	2TNU12501	Train 1 Start up	15	10/12/2017	24/12/2017											12	15	20
-	Q-26-006-002.0002	200 - Process	1056	19/01/2015	09/12/2017				-									
-	Q-26-006-002.0002.F	Procurement LLI	719	19/01/2015	06/01/2017													
	206P09303	Centrifugal Pumps (Process): PO Placement	90	25/03/2015	03/08/2015											81	90	99
	206P09307	Centrifugal Pump (Process): Main Vend Dwgs	38	04/08/2015	28/09/2015											34	38	42
	206P09311	Centrifugal Pumps (Process): fabric.	300	04/08/2015	26/09/2016											270	300	330
$\overline{}$	206P09313	Centrifugal Pumps (Process) : transport	152	05/07/2016	03/12/2016													
	206P09313; B	Centrifugal Pumps (Process) : transport	152	05/07/2016	03/12/2016											137	152	167
	206P09313:017	Traffic accidents	0	04/12/2016	03/12/2016											1	2	7
	206P09313:020	Terrorist attak on convoy (during transportatio	0	04/12/2016	03/12/2016											7	14	48
-	Q-26-006-002.0002.F	Procurement Bulk Materials	584	12/03/2015	15/10/2016													
	2TNP13051	Inquiry/ Order Piping TO IDD	20	24/11/2015	22/12/2015											18	20	22
	2TNP13053	Piping fabric. TO IDD	140	23/12/2015	05/07/2016											126	140	154
$\overline{}$	2TNP13061	Transport Piping TO IDD 1st -last	150	17/04/2016	13/09/2016													
	2TNP13061: B	Transport Piping TO IDD 1st -last	150	17/04/2016	13/09/2016											135	150	165
	2TNP13061:017	Traffic accidents	0	14/09/2016	13/09/2016											1	2	7
	2TNP13061:020	Terrorist attak on convoy (during transportatio	0	14/09/2016	13/09/2016											7	14	48
-	Q-26-006-002.0002.0	Construction	766	06/10/2015	09/11/2017						 				 			
\square	21N113017	Piping erection around equipment	240	19/12/2016	24/09/2017													
	21N113017: B	Piping erection around equipment	240	19/12/2016	24/09/2017						 				 	192	240	312
	21N113017:018	Poor discipline of local staff and lak of HSE a		25/09/2017	24/09/2017											1	3	
	210113017:019	remonistrattak on facity (site)	200	25/09/2017	24/09/2017											5	200	28
	211123003	Process Modules Febrication	166	14/00/2016	42020047										 	104	165	202
	2111100430	Process Modules Transport	90	13/02/2010	13/05/2017				1 1							124	155	202
	2TNT68435 B	Process Modules Transport	90	13/02/2017	1305/2017					-			-			72	90	117
	211168435:017	Traffic accidents		14/05/2017	1305/2017								-			12	20	7
	2TNT68435:020	Terrorist attak on convoy (during transportatio	0	14/05/2017	13/05/2017						 					7	14	48
	2TNT68440	Process Modules Frection&Hookup	150	16/03/2017	06/09/2017									.0 %				
	2TNT68440: B	Process Modules Frection&Hookup	150	16/03/2017	06/09/2017											120	150	195
	2TNT68440:008	Civil riots and turmoils	0	07/09/2017	06/09/2017											7	14	28
	2TNT68440:018	Poor discipline of local staff and lak of HSE a	0	07/09/2017	06/09/2017											1	3	7
	2TNT68440:019	Terrorist attak on facity (site)	0	07/09/2017	06/09/2017											5	7	28
-	Q-26-006-002.0002.F	Precommissioning	121	12/07/2017	09/11/2017													
-	2TNU12547	Condensate Stripping System PRECOMM.	60	11/09/2017	09/11/2017													
	2TNU12547: B	Condensate Stripping System PRECOMM.	60	11/09/2017	09/11/2017											48	60	78
	2TNU12547:013	Insufficient amount of spare parts for equipm	0	10/11/2017	09/11/2017											7	14	28
	0-26-006-002 0002 F	Commissioning	84	17/09/2017	09/12/2017													



• Montecarlo Analysis plots potential finish dates for each activity/milestone over 1000 iterations and creates an S-curve of probabilistic outcomes.





 Analysis calculates the <u>probabilistic</u> (Not actual) completion dates of milestones/activities



• Therefore P50, P90 etc are created from statistical outputs of 5000 different randomly generated outcomes based on input data.



Top Risks & Top sensitive Activities Identified

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206905311	Centrituga Punes (Process) 100rd.	330	0408/2015	25032316																	270	300	330
206240313	Centritugal Pumps (Process) : transport	152	05-01-2454	43/12/2016	_	-	_	-	-	_	1										-		
205909313.8	Celenuga Paros (Process), barsport	152	050002818	03/ 22018																	197	12	167
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2TNP13053	Piging fabric, TO EO	140	2312/2015	05407.2016																	126	140	154
2THP13661	Transport Piping TO D0 1st -last	150	17642916	13,49,2466	_	-	-	-	-	_		-	-	_	-	-		-	-	-			
2TMP130818	Transport Piping TO DD 1st wart	150	1704/2016	13092016																	135	190	165
2TVP1306/-017	Traffic accidente	0	1406/2916	13092015																	1	2	3
27xP13361:000	Terrorist latest on convey (during transportatio	0	14060916	13/09/2016																	7	- 14	48
0.56-016-002,0062.8	Construction	716	66162915	49-15 2017	_	-	-		-				-	_	-	_	_			_			
200713017	Piping erection around equipment	240	19122014	2449.2417	-	-	-	11.1	-	-				-		-	-			-			
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711168-05	Process Modules Transport	38	1382/2017	13452917	_	-		-		-				-	-	-							
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271738435.000	Terrorist adult on convey (during barsportado	0	14052017	13452017												20%	+			_	7	14	48
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2TNT58449:018	Poor discipline of local staff and lak of HSE a	0	0705/2017	(6092017																	1	3	2
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0-26-016-002.0002.F	Precommissioning	121	12012017	19112017																			
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- These can then be areas of focus for improvement and mitigation
- These can named or omitted on Insurance policies





- "What If" Scenarios
 - Tool to understand effect of mitigations and schedule changes
- Change Risk Profile and Run analysis to understand effect of mitigation of key risks
 - Omitted risks etc
- Value Management
 - Option Selection/analysis
 - Identify key activities (Critical and Duration)
 - Change Schedule (parallel working, additional resource, reduced scope etc)
 - Reduce Schedule



Post Mitigated / Target

• Pre and Post mitigated probabilistic S-Curves





Benefits

Projects



Project Benefits

- Key to ensuring project success
 - Identification of project interdependencies
 - Management of Risk to allow project completion of time and on budget
 - Helps control the cost of a project
 - Validation of Project Information
 - Fosters a Clear Understanding of Challenges ahead
 - Improved Project Communication
 - Improved Schedule / Cost Performance





1. Software

- 2. Schedule Risk Analysis
 - Project Schedule Review
 - Duration Uncertainty Inputs
 - Correlations
 - Risk Inputs & Modelling
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- 3. Monte Carlo Risk Analysis
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 - What If / Stress Test
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Training Courses

- Project Risk Management
- Quantitative Risk (Cost & Schedule)
- @Risk Software

Public & In House



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