

	Case Name: Mixed-use Building	Sector	Construction (Residential Building)
	OR-AS Operations Research - Applications and Solutions www.or-as.be info@or-as.be	Baseline Schedule Schedule with resources Schedule with costs	
Submitted by	N/A	Risk Analysis Random simulation One of nine std. scenarios User defined distributions	
Date	February 9, 2014		
File Name	C2014-01 Mixed-use Building.p2x	Project Control Automatic tracking Tracking based on user input	

1. Project description

Project authenticity

The construction of an eleven-storey mixed-use building that will accommodate both office spaces and residential units.

The project consists of activity and cost data that were obtained directly from the actual project owner.

2. Project properties

2.1. Baseline Schedule

General	
# Activities	52
Planned Duration (PD)	474 days*
Budget At Completion (BAC)	38,697,824 €
Renewable Resources	-
Consumable Resources	-

* standard eight-hour working days

Network topology	
Serial/Parallel (SP)	50%
Activity Distribution (AD)	38%
Length of Arcs (LA)	3%
Topological Float (TF)	49%

2.2. Risk Analysis

Random simulation by ProTrack was performed using the default symmetric triangular risk distribution profiles.

	Cost sensitivity		
	avg [%]	std dev [%]	skew [-]
CRI-r	52.8	49.9	-0.1
CRI-rho	100.0	0.0	N/A
CRI-tau	100.0	0.0	N/A

	Resource sensitivity		
	avg [%]	std dev [%]	skew [-]
CRI-r	N/A	N/A	N/A
CRI-rho	N/A	N/A	N/A
CRI-tau	N/A	N/A	N/A

	Time sensitivity		
	avg [%]	std dev [%]	skew [-]
CI	44.4	40.4	0.3
SI	35.3	39.4	0.4
SSI	6.7	9.9	2.3
CRI-r	10.7	10.9	1.2
CRI-rho	21.7	18.0	0.6
CRI-tau	29.5	38.7	1.2

The remarkable results for cost sensitivity can be explained by the absence of variable activity costs.

2.3. Project Control

2.3.1. Simulated forecasting accuracy

The accuracy of time and cost forecasting methods has been evaluated based on Monte Carlo simulation runs using the risk profiles described in section “2.2. Risk Analysis”. Based on these risk profiles, the Mean Absolute Percentage Error (MAPE) and Mean Percentage Error (MPE) has been calculated to evaluate the expected accuracy of the time and cost predictions, EAC(t) and EAC, respectively.

Simulated EAC(t) accuracy			Simulated EAC accuracy		
method - PF	MAPE [%]	MPE [%]	method (PF)	MAPE [%]	MPE [%]
PV - 1	4.4	0.4	1	N/A	N/A
PV - SPI	6.4	2.5	CPI	N/A	N/A
PV - SCI	6.4	2.5	SPI	N/A	N/A
ED - 1	4.4	0.5	SPI(t)	N/A	N/A
ED - SPI	6.3	2.4	SCI	N/A	N/A
ED - SCI	6.3	2.4	SCI(t)	N/A	N/A
ES - 1	3.1	-0.3	0.8 CPI + 0.2 SPI	N/A	N/A
ES - SPI(t)	7.3	-0.5	0.8 CPI + 0.2 SPI(t)	N/A	N/A
ES - SCI(t)	7.3	-0.5			

According to the MAPE values¹ the best performance for time forecasting can be expected from the unweighted Earned Schedule method. Cost forecasting is not relevant since there are only fixed activity costs in this project.

2.3.2. Tracking description

Tracking authenticity

Manual tracking was performed over 24 tracking periods with a length of approximately one month. The Real Duration and Real Cost mentioned in section “2.3.3. Earned Value Management” are based on manual user input.

The tracking information obtained from the project owner and introduced in ProTrack includes actual activity start dates, durations and costs.

¹ The MAPE gives the best indication for the forecast accuracy (the lower the MAPE, the more accurate the method) since all deviations from the targeted real duration (real cost) are cumulated, whereas for the MPE underestimates can be compensated by overestimates and vice versa, possibly leading to an overly positive evaluation of a certain method. However, the MPE can provide useful information about the nature of the deviations, i.e. does the method rather underestimate or overestimate the real duration (real cost)?

2.3.3. Earned Value Management

2.3.3.1. Performance metrics

	CV [€]	SV [€]	SV(t) [d]	CPI [-]	SPI [-]	SPI(t) [-]	p-factor [-]
avg	-2,006,174	715.086	3.01	0.93	1.05	1.00	0.98
std dev	1,753,597	2,748,810	18.91	0.04	0.18	0.07	0.07
final	-1,079,820	0	26.00	0.97	1.00	1.06	1.00

2.3.3.2. Time forecasting

PD	474 days
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Real Duration	474 days
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On Time	0.00%
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EAC(t)		Real Accuracy		
method - PF	avg [d]	std dev [d]	MAPE [%]	MPE [%]
PV - 1	468.16	36.28	7.8	4.5
PV - SPI	464.84	63.87	11.5	3.8
PV - SCI	505.14	64.92	18.2	12.8
ED - 1	466.13	41.36	8.5	4.0
ED - SPI	464.84	63.87	11.5	3.8
ED - SCI	483.89	65.69	14.8	8.0
ES - 1	474.99	22.00	6.3	6.0
ES - SPI(t)	478.61	38.88	8.4	6.8
ES - SCI(t)	498.94	38.52	11.6	11.4

2.3.3.3. Cost forecasting

BAC	38,697,824 €
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Real Cost	39,777,643 €
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Over Budget	2.79%
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EAC		Real Accuracy		
method (PF)	avg [€]	std dev [€]	MAPE [%]	MPE [%]
1	40,704,006	1,753,597	4.1	2.3
CPI	41,682,773	1,721,270	4.8	4.8
SPI	40,432,698	2,743,722	5.6	1.6
SPI(t)	41,112,580	1,816,902	4.8	3.4
SCI	41,346,403	2,669,709	6.2	3.9
SCI(t)	42,092,882	1,846,433	6.2	5.8
0.8 CPI + 0.2 SPI	41,323,917	1,575,009	4.3	3.9
0.8 CPI + 0.2 SPI(t)	41,540,029	1,573,640	4.5	4.4