

	Case Name: Building a House	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	Risk Analysis Random simulation One of nine std. scenarios User defined distributions
Submitted by	Charline Borsus		
Date	December 19, 2011		
File Name	C2011-10 Building a House.p2x	Project Control Automatic tracking Tracking based on user input	

1. Project description

Project authenticity

The building of a rather spacious house somewhere in Flanders.

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

2. Project properties

2.1. Baseline Schedule

General	
# Activities	32
Planned Duration (PD)	195 days*
Budget At Completion (BAC)	484.398 €
Renewable Resources	1
Consumable Resources	-

* standard eight-hour working days

Network topology	
Serial/Parallel (SP)	51%
Activity Distribution (AD)	47%
Length of Arcs (LA)	27%
Topological Float (TF)	10%

2.2. Risk Analysis

Use of many different non-standard triangular distribution profiles inputted by the user (mostly symmetrical), complemented by some predefined symmetrical and risk-free distributions.

	Cost sensitivity		
	avg [%]	std dev [%]	skew [-]
CRI-r	11.9	16.4	2.4
CRI-rho	24.4	20.9	0.6
CRI-tau	33.9	41.0	0.9

	Resource sensitivity		
	avg [%]	std dev [%]	skew [-]
CRI-r	100.0	0.0	N/A
CRI-rho	100.0	0.0	N/A
CRI-tau	100.0	0.0	N/A

	Time sensitivity		
	avg [%]	std dev [%]	skew [-]
CI	49.9	49.9	0.0
SI	59.2	40.1	-0.2
SSI	6.1	14.2	3.5
CRI-r	11.6	17.2	2.8
CRI-rho	24.4	21.9	0.8
CRI-tau	34.1	41.2	0.9

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) have been calculated to evaluate the expected accuracy of the time and cost predictions, EAC(t) and EAC, respectively.

Simulated EAC(t) accuracy		
method - PF	MAPE [%]	MPE [%]
PV - 1	9.1	8.9
PV - SPI	9.6	8.0
PV - SCI	10.3	4.8
ED - 1	7.9	7.8
ED - SPI	8.2	6.6
ED - SCI	8.8	6.1
ES - 1	7.2	7.1
ES - SPI(t)	8.2	6.0
ES - SCI(t)	9.1	5.5

Simulated EAC accuracy		
method (PF)	MAPE [%]	MPE [%]
1	3.6	3.6
CPI	3.7	3.4
SPI	4.4	2.5
SPI(t)	4.8	2.9
SCI	5.4	2.2
SCI(t)	5.8	2.6
0.8 CPI + 0.2 SPI	3.8	3.2
0.8 CPI + 0.2 SPI(t)	3.9	3.3

According to the MAPE values¹ the best performance for time forecasting can be expected from the unweighted Earned Schedule method. For cost forecasting the unweighted and CPI-weighted methods, or even the two methods using a composite performance factor, should yield the best results.

2.3.2. Tracking description

Automatic tracking by ProTrack was performed over 41 tracking periods with a length of approximately one week (can be significantly longer for some tracking periods because of the presence of user-defined non-working days). The Real Duration and Real Cost mentioned in section “2.3.3. Earned Value Management” are based on simulation results.

Tracking authenticity

Authenticity assessment is not relevant here as it is not possible to introduce any kind of tracking information obtained from the actual project owner when performing automatic tracking. Activity durations and corresponding costs were generated based on the distribution profiles described in section “2.2. Risk Analysis”.

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	-8.777	-28.745	-12.29	0.97	0.89	0.86	1.00
std dev	4.52	29.57	6.90	0.02	0.12	0.09	0.01
final	-10.549	0	-8.12	0.98	1.00	0.95	1.00

2.3.3.2. Time forecasting

PD	195 days	Real Duration	203 days	Late	4.10%
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EAC(t)		Real Accuracy		
method - PF	avg [d]	std dev [d]	MAPE [%]	MPE [%]
PV - 1	206.30	11.88	4.6	1.7
PV - SPI	224.95	51.55	12.5	10.9
PV - SCI	233.06	54.85	15.6	14.9
ED - 1	205.23	9.90	3.9	1.2
ED - SPI	225.34	51.35	12.4	11.1
ED - SCI	229.71	54.24	14.3	13.2
ES - 1	207.09	6.87	3.2	2.1
ES - SPI(t)	228.76	22.99	13.3	12.8
ES - SCI(t)	233.20	26.56	15.3	15.0

2.3.3.3. Cost forecasting

BAC	484.398 €	Real Cost	494.948 €	Over Budget	2.18%
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EAC		Real Accuracy		
method (PF)	avg [€]	std dev [€]	MAPE [%]	MPE [%]
1	493.175	4.52	0.7	-0.4
CPI	501.092	9.067	1.7	1.2
SPI	539.558	107.541	9.3	9.0
SPI(t)	542.328	43.266	9.7	9.6
SCI	549.553	113.852	11.3	11.0
SCI(t)	552.379	51.839	11.7	11.6
0.8 CPI + 0.2 SPI	506.258	15.969	2.7	2.3
0.8 CPI + 0.2 SPI(t)	508.085	13.215	2.9	2.7