

	Case Name: Sewage Plant Hove	Sector	Construction (Civil)	
	OR-AS Operations Research - Applications and Solutions www.or-as.be info@or-as.be	Baseline Schedule	Schedule with resources	
Submitted by	Tim Vandenbussche	Risk Analysis	Schedule with costs	
Date	February 2, 2013		Random simulation	
File Name	C2013-02 Sewage Plant Hove.p2x	Project Control	One of nine std. scenarios	
			User defined distributions	
			Automatic tracking	
			Tracking based on user input	

1. Project description

Project authenticity

The construction of a small sewage plant in Hove (Belgium).

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	181
Planned Duration (PD)	403 days*
Budget At Completion (BAC)	1,236,604 €
Renewable Resources	-
Consumable Resources	-

* standard eight-hour working days

Network topology	
Serial/Parallel (SP)	12%
Activity Distribution (AD)	38%
Length of Arcs (LA)	0%
Topological Float (TF)	62%

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	6.2	8.8	4.4
CRI-rho	22.2	20.7	0.6
CRI-tau	39.7	42.4	0.7

	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	0.6	7.4	13.5
SI	3.0	7.6	11.8
SSI	0.6	7.4	13.5
CRI-r	8.7	8.9	6.1
CRI-rho	8.8	9.1	5.9
CRI-tau	10.8	11.8	3.1

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			Simulated EAC accuracy		
method - PF	MAPE [%]	MPE [%]	method (PF)	MAPE [%]	MPE [%]
PV - 1	17.7	17.5	1	0.6	-0.2
PV - SPI	25.9	25.7	CPI	0.6	0.0
PV - SCI	26.6	26.6	SPI	7.9	7.9
ED - 1	11.4	11.0	SPI(t)	8.5	8.5
ED - SPI	25.8	25.6	SCI	8.0	8.0
ED - SCI	26.0	25.8	SCI(t)	8.6	8.6
ES - 1	26.5	26.2	0.8 CPI + 0.2 SPI	3.4	3.3
ES - SPI(t)	37.8	37.7	0.8 CPI + 0.2 SPI(t)	3.3	3.3
ES - SCI(t)	37.9	37.8			

According to the MAPE values¹ the best performance for time forecasting can be expected from the unweighted Earned Duration method. For cost forecasting the unweighted and CPI-weighted methods should yield the best results.

2.3.2. Tracking description

Tracking authenticity

Manual tracking was performed over 17 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	60.789	-58.843	-11.60	1.09	0.88	0.88	0.92
std dev	23.225	88.481	24.47	0.02	0.17	0.17	0.05
final	90.16	0	0.00	1.08	1.00	1.00	1.00

2.3.3.2. Time forecasting

PD	403 days
----	----------

Real Duration	403 days
---------------	----------

On Time	0.00%
---------	-------

EAC(t)		Real Accuracy		
method - PF	avg [d]	std dev [d]	MAPE [%]	MPE [%]
PV - 1	422.16	28.85	6.1	4.8
PV - SPI	477.96	109.58	20.1	18.6
PV - SCI	439.45	98.57	18.2	9.0
ED - 1	413.10	16.95	3.7	2.5
ED - SPI	477.96	109.58	20.1	18.6
ED - SCI	456.37	92.40	16.4	13.2
ES - 1	414.60	24.47	5.4	2.9
ES - SPI(t)	475.69	95.05	21.2	18.0
ES - SCI(t)	454.67	80.83	17.3	12.8

2.3.3.3. Cost forecasting

BAC	1,236,604 €
-----	-------------

Real Cost	1,146,444 €
-----------	-------------

Under Budget	7.29%
--------------	-------

EAC		Real Accuracy		
method (PF)	avg [€]	std dev [€]	MAPE [%]	MPE [%]
1	1,175,815	23.225	2.6	2.6
CPI	1,138,593	21.181	1.1	-0.7
SPI	1,346,976	290.701	17.5	17.5
SPI(t)	1,324,343	225.045	15.6	15.5
SCI	1,295,176	245.4	13.3	13.0
SCI(t)	1,274,868	187.394	11.8	11.2
0.8 CPI + 0.2 SPI	1,165,514	35.527	1.7	1.7
0.8 CPI + 0.2 SPI(t)	1,164,146	32.09	1.7	1.5