

	Case Name: Recreation Complex	Sector	Construction (Civil)	
	OR-AS Operations Research - Applications and Solutions www.or-as.be info@or-as.be	Baseline Schedule	Schedule with resources	
		Risk Analysis	Schedule with costs	
			Random simulation	
Submitted by	N/A		One of nine std. scenarios	
Date	June 28, 2013		User defined distributions	
File Name	C2013-11 Recreation Complex.p2x	Project Control	Automatic tracking	
			Tracking based on user input	

1. Project description

Project authenticity

The enhancement of a sports and recreation complex by the build of a new sustainable sports hall and the refurbishment of the fences and pathways in the surrounding park.

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	167
Planned Duration (PD)	359 days*
Budget At Completion (BAC)	5,480,520 €
Renewable Resources	-
Consumable Resources	-

* standard eight-hour working days

Network topology	
Serial/Parallel (SP)	27%
Activity Distribution (AD)	44%
Length of Arcs (LA)	0%
Topological Float (TF)	32%

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	1.8	13.3	7.3
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	22.2	40.1	1.4
SI	33.5	39.1	0.9
SSI	2.4	5.9	2.9
CRI-r	8.3	7.7	1.7
CRI-rho	10.8	10.8	2.3
CRI-tau	16.0	20.5	2.9

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	24.0	3.4	1	N/A	N/A
PV - SPI	49.6	44.7	CPI	N/A	N/A
PV - SCI	49.6	44.7	SPI	N/A	N/A
ED - 1	56.6	50.5	SPI(t)	N/A	N/A
ED - SPI	49.6	44.7	SCI	N/A	N/A
ED - SCI	49.6	44.7	SCI(t)	N/A	N/A
ES - 1	9.9	-5.3	0.8 CPI + 0.2 SPI	N/A	N/A
ES - SPI(t)	23.5	23.0	0.8 CPI + 0.2 SPI(t)	N/A	N/A
ES - SCI(t)	23.5	23.0			

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 20 tracking periods with irregular lengths varying from approximately a couple of days to three months. 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	2.44	172.182	9.38	1.01	1.10	1.04	0.94
std dev	39.796	210.593	15.16	0.02	0.22	0.07	0.04
final	29.491	88.408	41.00	1.01	1.02	1.13	1.00

2.3.3.2. Time forecasting

PD	359 days
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Real Duration	331 days
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Early	7.80%
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EAC(t)		Real Accuracy		
method - PF	avg [d]	std dev [d]	MAPE [%]	MPE [%]
PV - 1	347.73	13.80	9.4	9.4
PV - SPI	335.18	46.13	12.5	5.4
PV - SCI	332.49	44.50	12.1	4.6
ED - 1	345.24	18.16	9.2	8.6
ED - SPI	335.18	46.13	12.5	5.4
ED - SCI	333.09	44.65	12.1	4.7
ES - 1	350.27	14.04	10.4	10.2
ES - SPI(t)	347.99	20.70	10.1	9.4
ES - SCI(t)	345.91	19.33	9.5	8.8

2.3.3.3. Cost forecasting

BAC	5,480,520 €
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Real Cost	5,451,028 €
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Under Budget	0.54%
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EAC		Real Accuracy		
method (PF)	avg [€]	std dev [€]	MAPE [%]	MPE [%]
1	5,451,030	39.796	0.6	0.5
CPI	5,439,911	91.231	1.1	-0.2
SPI	5,286,777	612.125	5.8	-3.0
SPI(t)	5,450,100	192.068	2.4	0.0
SCI	5,247,999	596.523	5.6	-3.7
SCI(t)	5,411,477	190.896	2.4	-0.7
0.8 CPI + 0.2 SPI	5,388,145	190.965	2.0	-1.2
0.8 CPI + 0.2 SPI(t)	5,440,081	82.756	1.1	-0.2