OR-AS Operations Research Applications and Solutions	Case Name: **Tappan Zee Bridge**	Sector	Construction (Civil)	
	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	
Submitted by	Wolfgang Prestl		User defined distributions	
Date	December 13, 2012	Project Control	Automatic tracking	
File Name	C2012-05 Tappan Zee Bridge.p2x		Tracking based on user input	

1. Project description

Project authenticity

The construction of a dual-span twin bridge across the Hudson River in New York (USA) replacing the existing Tappan Zee Bridge, of which the demolition is part of the project.

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

2. Project properties

2.1. Baseline Schedule

General	
# Activities	19
Planned Duration (PD)	1,289 days*
Budget At Completion (BAC)	4,999,958,016 €
Renewable Resources	20
Consumable Resources	-

* standard eight-hour working days

Network topology	
Serial/Parallel (SP)	50%
Activity Distribution (AD)	44%
Length of Arcs (LA)	23%
Topological Float (TF)	4%

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	18.2	13.8	1.6
CRI-rho	11.6	12.1	1.9
CRI-tau	11.2	21.6	4.0

	Resource sensitivity		
	avg [%]	std dev [%]	skew [-]
CRI-r	51.7	25.7	-0.6
CRI-rho	53.1	21.1	-0.5
CRI-tau	44.8	24.8	0.8

	Time sensitivity		
	avg [%]	std dev [%]	skew [-]
CI	52.7	49.7	-0.1
SI	35.8	35.4	0.4
SSI	15.7	17.3	0.8
CRI-r	16.6	17.1	1.2
CRI-rho	16.3	16.5	1.2
CRI-tau	10.7	11.1	1.4

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	37.2	-34.2
PV - SPI	29.6	-24.1
PV - SCI	29.6	-24.0
ED - 1	40.4	-33.8
ED - SPI	29.6	-24.1
ED - SCI	29.6	-24.1
ES - 1	29.4	-29.1
ES - SPI(t)	30.7	-17.8
ES - SCI(t)	30.7	-17.7

Simulated EAC accuracy		
method (PF)	MAPE [%]	MPE [%]
1	0.1	0.0
CPI	0.2	0.0
SPI	7.0	6.0
SPI(t)	8.6	7.7
SCI	7.1	6.0
SCI(t)	8.7	7.7
0.8 CPI + 0.2 SPI	2.0	1.7
0.8 CPI + 0.2 SPI(t)	2.7	2.4

According to the MAPE values[1] the best performance for time forecasting can be expected from the unweighted Earned Schedule method and both the Planned Value and Earned Duration methods using SPI and SCI as performance factor. For cost forecasting the unweighted and CPI-weighted methods should yield the best results.

2.3.2. Tracking description

The user has not performed any project control and therefore no tracking periods have been defined. Tracking periods can now be generated automatically by ProTrack or by manually inputting tracking data period by period.

[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)?