BowTie Plugins

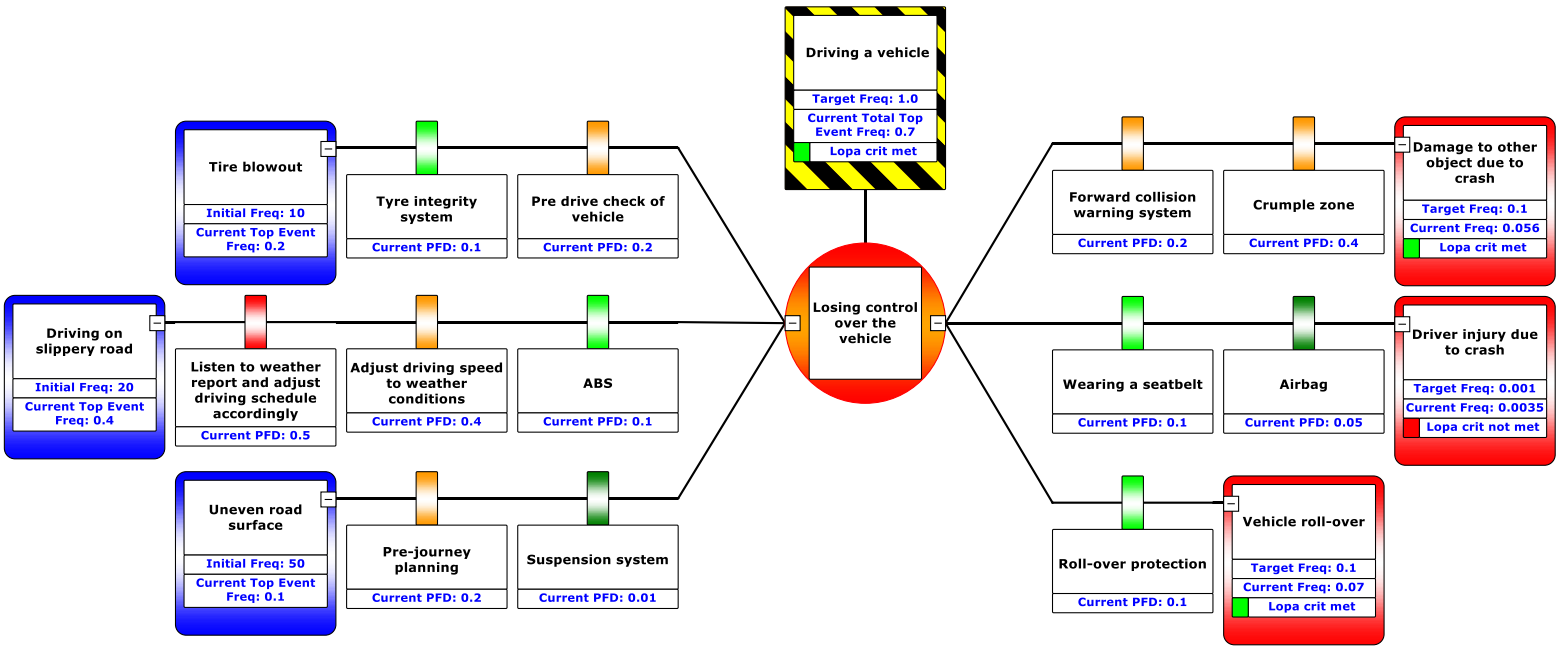
customized barrier solutions

LOPA plug-in

Quantify your bowtie diagram

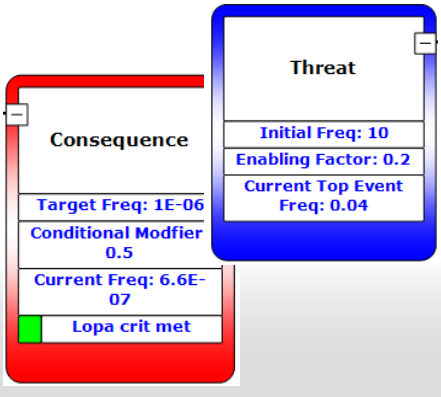
Bringing together quantitative and qualitative risk analysis

BowTie diagrams give a better understanding of your organisation's risk scenarios and visualises how these scenarios are controlled. In classic BowTie modelling, the decision as to whether there are sufficient effective barriers to control these scenarios is based on expert judgment. If your organisation has reliable and sufficient safety data available, the LOPA plug-in will allow you to use this data to make a more objective and substantiated decision.



Bowtie-based Layers of Protection Analysis

Layers of Protection Analysis (LOPA) is a semi-quantitative risk analysis methodology in which the frequency of a negative event is calculated according to the risk reduction delivered by the independent protection layers (barriers). The BowTieXP LOPA plug-in automatically calculates the frequency of a consequence, given the initial frequency of all the threats and the Probability of Failure on Demand (PFD) of the barriers. This allows you to easily compare the target consequence frequency with the actual consequence frequency.



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Visualising LOPA

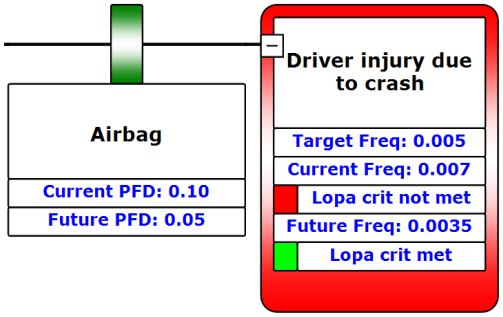
Traditional LOPA calculations are performed in spreadsheets. The LOPA plug-in makes the LOPA study visual and therefore easier to communicate.

Future frequency calculations

Frequencies and/or probabilities could change in the course of time. The LOPA plug-in allows you to calculate both current and future frequencies.

Multiple scenarios

Traditional LOPA calculations focus on one single scenario. The BowTieXP LOPA plug-in takes all bowtie scenarios into account while calculating the top event frequency.



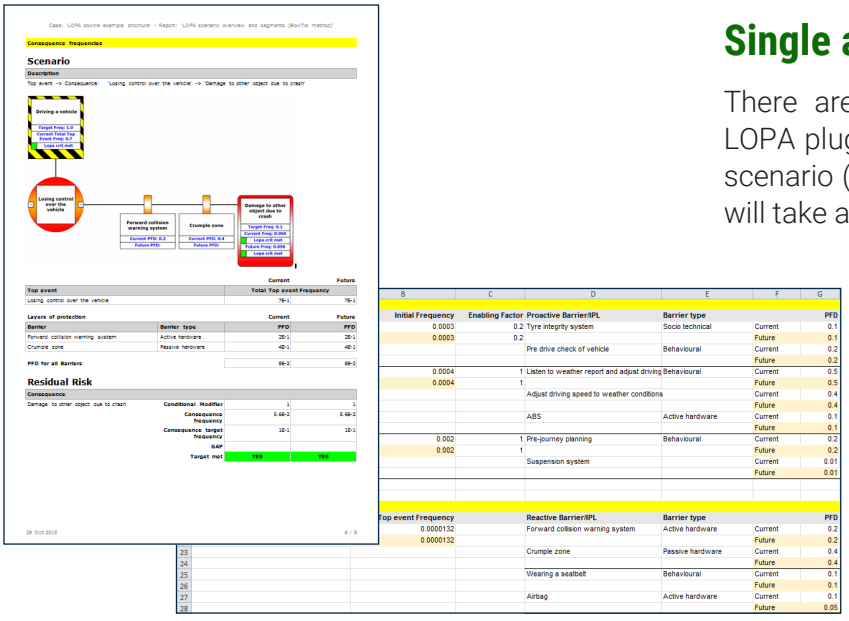
The (simplified) Formula

$$F_{TE} = \sum_{j=1}^{n} F_{T\,j} \left(\prod_{i=1}^{m} PFD_{\,i,j} \right)$$

FTE = Frequency of Top Event
FT_j = Frequency of Threat #j
$PFD_{i,j}$ = Probability of Failure on Demand of Barrier #i of Threat #j

New variables

The LOPA plug-in introduces a handful of new variables, such as: Probability of Failure on Demand (PFD), initial frequencies, top event frequency, consequence frequencies, target frequencies, future frequencies, conditional modifiers, enabling factors, and more.


Scenario

Residual Risk

Initial Frequency	Enabling Factor	Proactive Barrier/IPL	Barrier type		PFD
0.0003	0.2	Tyre integrity system	Socio technical	Current	0.1
0.0003	0.2			Future	0.1
		Pre drive check of vehicle	Behavioural	Current	0.2
				Future	0.2
0.0004	1	Listen to weather report and adjust driving	Behavioural	Current	0.5
0.0004	1			Future	0.5
		Adjust driving speed to weather conditions		Current	0.4
				Future	0.4
		ABS	Active hardware	Current	0.1
				Future	0.1
0.002	1	Pre-journey planning	Behavioural	Current	0.2
0.002	1			Future	0.2
		Suspension system		Current	0.01
				Future	0.01

Top event Frequency	Reactive Barrier/IPL	Barrier type		PFD
0.0000132	Forward collision warning system	Active hardware	Current	0.2
0.0000132			Future	0.2
	Crumple zone	Passive hardware	Current	0.4
			Future	0.4
	Wearing a seatbelt	Behavioural	Current	0.1
			Future	0.1
	Airbag	Active hardware	Current	0.1
			Future	0.05

Single and multiple scenario reports

There are multiple extra reports available in the LOPA plug-in. Some reports will be based on single scenario (traditional) LOPA calculation, while others will take all bowtie scenarios into account.

Plug-in

This plug-in can be added to both BowTieXP Standard or Advanced.

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