

Optimize Controls to be in effect

After identifying and measuring all the potential controls, you can now select which of these controls will be in effect either:

- manually, or
- by optimization

On this page, we will determine the controls to be funded by Optimization.

The Portfolio View displays a similar grid as with the [manually select control](#) grid.

On the Optimization page, we can define the **Budget Limit** and other **constraints** (Musts, Must Not, Groups, Dependencies, Funding Pools) to be used or ignored in order to determine the controls to be in effect.

The screenshot shows the 'Controls optimization' interface. At the top, there are tabs for 'MANAGE MODELS', 'IDENTIFY/STRUCTURE', 'LIKELIHOOD OF EVENTS', 'IMPACT OF EVENTS', 'RISKS', 'CONTROLS', and 'CONTROLLED RISKS'. The 'CONTROLS' tab is active. Below the tabs, there are buttons for 'Identify', 'Measure', 'Manually Select', 'Optimize', and 'Efficient Frontier'. The 'Optimize' button is highlighted. The main area displays the title 'Controls optimization for "Intelligent Event London Underground Monitoring" Default Scenario'. It shows 'Total Risk: 38.84%' and 'Selected controls: 13'. A 'Budget Limit' of \$100,000 is entered. There are also 'Ignore' options for 'Musts', 'Must Not', 'Groups', 'Dependencies', and 'Funding Pools'. A table of controls is shown below, with columns for 'In...', 'Sele...', 'Ac...', 'Control Name', 'Control for', 'Sele...', 'Disa...', 'Cost', 'Appli...', 'Cate...', and 'M'. The table lists 14 controls, with the first two selected.

In...	Sele...	Ac...	Control Name	Control for	Sele...	Disa...	Cost	Appli...	Cate...	M
01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Monthly Performance Review	Likelihood Of Sources	Yes	<input type="checkbox"/>	10000	2		<input type="checkbox"/>
02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Schedule Proper Maintenance	Likelihood Of Sources	Yes	<input type="checkbox"/>	10000	4		<input type="checkbox"/>
03	<input type="checkbox"/>	<input type="checkbox"/>	Upgrade Signals	Likelihood Of Sources		<input type="checkbox"/>	10000	1		<input type="checkbox"/>
04	<input type="checkbox"/>	<input type="checkbox"/>	Mandatory Training for Engineers	Likelihood Of Sources		<input type="checkbox"/>	60000	1		<input type="checkbox"/>
05	<input type="checkbox"/>	<input type="checkbox"/>	Periodic Proficiency Training	Likelihood Of Sources		<input type="checkbox"/>	20000	3		<input type="checkbox"/>
06	<input type="checkbox"/>	<input type="checkbox"/>	Identify Staff requiring additional training	Likelihood Of Sources		<input type="checkbox"/>	15000	1		<input type="checkbox"/>
07	<input type="checkbox"/>	<input type="checkbox"/>	Update Sensor	Likelihood Of Sources		<input type="checkbox"/>	50000	1		<input type="checkbox"/>
08	<input type="checkbox"/>	<input type="checkbox"/>	Back-up Generator Power	Likelihood Of Sources		<input type="checkbox"/>	15000	1		<input type="checkbox"/>
09	<input type="checkbox"/>	<input type="checkbox"/>	Periodic Inspection/Maintenance of Power Rela...	Likelihood Of Sources		<input type="checkbox"/>	15000	2		<input type="checkbox"/>
10	<input type="checkbox"/>	<input type="checkbox"/>	Predeployment Software Testing	Likelihood Of Sources		<input type="checkbox"/>	72000	1		<input type="checkbox"/>
11	<input type="checkbox"/>	<input type="checkbox"/>	Quality Control of Cables	Likelihood Of Sources		<input type="checkbox"/>	2000	1		<input type="checkbox"/>
12	<input type="checkbox"/>	<input type="checkbox"/>	Employ Higher Security	Likelihood Of Sources		<input type="checkbox"/>	4000	1		<input type="checkbox"/>
13	<input type="checkbox"/>	<input type="checkbox"/>	Increase physical security	Likelihood Of Sources		<input type="checkbox"/>	19000	1		<input type="checkbox"/>
14	<input type="checkbox"/>	<input type="checkbox"/>	Emplace flood prevention material	Likelihood Of Sources		<input type="checkbox"/>	13000	1		<input type="checkbox"/>

The **Must** and **Must Not** are defined from the controls grid by checking from the "Must" and "Must Not" columns.

- **Must** - the control must be selected on the optimization. This setting is ignored when manually selecting a control.
- **Must Not** - the control must not be selected on the optimization. This setting is ignored when manually selecting a control.

Other constraints are defined from their specific pages ([Dependencies](#), Groups, Funding Pools)

The budget limit is entered here:

Budget Limit \$

This means that the solution should have total costs for the funded controls not exceeding the specified budget limit.

In our example above, we do not have any other constraints defined as determined from the Ignore options:

Ignore:
 Musts Must Not Groups
 Dependencies
 Funding Pools

When a constraint is defined, the constraint name will be **bold**, see Groups and Dependencies.

Ignore:

Musts **Must Not** **Groups**

Dependencies

Funding Pools

You can check the constraints you want to ignore in the optimization.

Click  to solve.

The funded controls are selected and will have a green background color. If you have many controls, use the scroll to the right of the grid to view more controls.

Controls optimization for "Intelligent Event London Underground Monitoring" Default Scenario

Total Risk: 38.84%
Risk With Selected Controls: 1.68% (Δ: 37.16%)
Risk With All Controls: 0.23% (Δ: 38.61%)

Selected controls: 13
Cost Of Selected Controls: \$98,200 (unfunded: \$51,604,000)
Total Cost Of All Controls: \$51,702,200 (with applications: \$51,702,200)

Budget Limit: \$

Ignore:
 Musts **Must Not** **Groups**
 Dependencies
 Funding Pools

Simulations Settings
 Number of trials:
 Seed: **Keep Seed**

Select: All | None Show Monetary Values (Value of Enterprise: \$1,384,653,606.36, Value of "Financial": \$100,000,000) Search...

In...	Sele...	Ac...	Control Name	Control for	Sele...	Disa...	Cost	Appli...	Cate...	M	M
01	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Monthly Performance Review	Likelihood Of Sources	Yes	<input type="checkbox"/>	10000	2		<input type="checkbox"/>	<input type="checkbox"/>
02	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Schedule Proper Maintenance	Likelihood Of Sources	Yes	<input type="checkbox"/>	10000	4		<input type="checkbox"/>	<input type="checkbox"/>
03	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Upgrade Signals	Likelihood Of Sources		<input type="checkbox"/>	10000	1		<input type="checkbox"/>	<input type="checkbox"/>
04	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Mandatory Training for Engineers	Likelihood Of Sources		<input type="checkbox"/>	60000	1		<input type="checkbox"/>	<input type="checkbox"/>
05	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Periodic Proficiency Training	Likelihood Of Sources		<input type="checkbox"/>	20000	3		<input type="checkbox"/>	<input type="checkbox"/>
06	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Identify Staff requiring additional training	Likelihood Of Sources		<input type="checkbox"/>	15000	1		<input type="checkbox"/>	<input type="checkbox"/>
07	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Update Sensor	Likelihood Of Sources		<input type="checkbox"/>	50000	1		<input type="checkbox"/>	<input type="checkbox"/>
08	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Back-up Generator Power	Likelihood Of Sources		<input type="checkbox"/>	15000	1		<input type="checkbox"/>	<input type="checkbox"/>
09	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Periodic Inspection/Maintenance of Power Rel...	Likelihood Of Sources		<input type="checkbox"/>	15000	2		<input type="checkbox"/>	<input type="checkbox"/>
10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Predeployment Software Testing	Likelihood Of Sources		<input type="checkbox"/>	72000	1		<input type="checkbox"/>	<input type="checkbox"/>
11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Quality Control of Cables	Likelihood Of Sources		<input type="checkbox"/>	2000	1		<input type="checkbox"/>	<input type="checkbox"/>
12	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Employ Higher Security	Likelihood Of Sources		<input type="checkbox"/>	4000	1		<input type="checkbox"/>	<input type="checkbox"/>
13	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Increase physical security	Likelihood Of Sources		<input type="checkbox"/>	19000	1		<input type="checkbox"/>	<input type="checkbox"/>
14	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Emplace flood prevention material	Likelihood Of Sources		<input type="checkbox"/>	13000	1		<input type="checkbox"/>	<input type="checkbox"/>
15	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Employ Water Pumps	Likelihood Of Sources		<input type="checkbox"/>	4000	1		<input type="checkbox"/>	<input type="checkbox"/>

Additional information is also displayed at the top of the grid. The data are changing automatically whenever the selection of the controls is changed, as applicable

<p>Total Risk: 38.84% Risk With Selected Controls: 1.68% (Δ: 37.16%) Risk With All Controls: 0.23% (Δ: 38.61%)</p>	<p>Selected controls: 13 Cost Of Selected Controls: \$98,200 (unfunded: \$51,604,000) Total Cost Of All Controls: \$51,702,200 (with applications: \$51,702,200)</p>
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- **Total Risk** - the sum of all the risks without controls $\sum(\text{Likelihood} * \text{Impact})$
- **Risk With Selected Controls** - Total risk when the selected controls are applied (delta = Total Risk - Risk with selected controls)
- **Risk With All Controls** - Total risk if All the Controls are applied, excluding the disabled control(s)
- **Selected controls** - Total number of the currently selected controls
- **Cost Of Selected Controls** - Sum of costs of the currently selected controls (Sum Costs of the unfunded controls)
- **Total Cost of All Controls** -- Total cost of all the controls, excluding the disabled control(s)

Other than the Budget Limit, you can also optimize by " Risk" and "Risk Reduction ".

These two options can be enabled from Options > Show Risk Reduction Options:

Options ▾

- Show descriptions
- S.A. Reduction
- Show Risk Reduction Options

By doing so, you will see two tabs to the right of Budget:

 Budget	 Risk	 Risk Reduction
Budget Limit: \$	<input type="text" value="100000"/>	

- **Risk** - instructs the optimizer that the resulting solution should have Risk with controls should not exceeding %risk you specified

 Budget	 Risk	 Risk Reduction
Risk with controls should not exceed:	<input type="text" value="0"/>	%

- **Risk Reduction** - instructs the optimizer that the resulting solution's Risk (Total Risk - Risk with Selected Controls) should be reduced by X%.

 Budget	 Risk	 Risk Reduction
Risk should be reduced at least by:	<input type="text" value="0"/>	%
