WP59

Cost Benefit Comparisons for Security Measures against Terrorist Incidents

Methodology, Data, Main Results

Peter.Klein@ductis.de

Introduction

General Definition:

Cost-Benefit Comparison is the comparison

Complete costs of a security measure (all kinds of costs during the lifetime)

Amount of avoided damage

- either in the case of one incident or
- for an expected number of incidents (in different dimensions during the lifetime)

Introduction (cont'd)

There are several specific conditions in the context of PROTECTRAIL:

- Normally only a **system of security measures with personnel support** can protect against a given threat.
- One installation protects **one** asset of given type (e.g. one station hall), but a national level protection requires **all** assets to be protected.
- The national railway infrastructures are very different, especially their sizes.
- Information about terrorist incident probability is difficult.

Cost-Benefit Comparison here

Definition to apply for Railway Security Measures:

Cost-Benefit comparison is the country oriented comparison (related to a given threat)

Complete costs of a defined set of security measures against a given threat for a defined time period in a country wide installation.

Amount of country wide avoided damage in the case of one incident or for an expected number of incidents in the same time period.

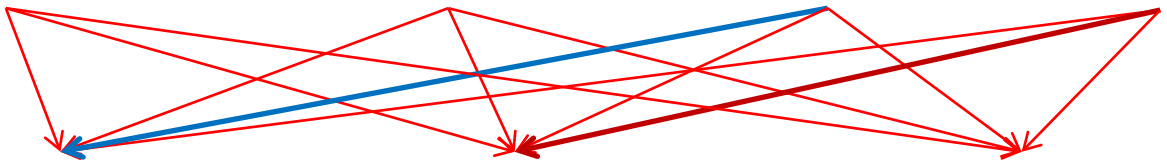
Goals to reach

- Four national railway infrastructures have been considered:
  - France, Germany, Italy, Poland
- Three different threat scenarios and associated sets of security measures have been investigated:
  - Attack within a station hall (person tracking), Intrusion into a train depot, CBRNe on-board attack.
- Two different types of cost-benefit comparisons (used in the scientific literature) have been applied:
  - Direct ratio of amount of benefits of one incident and costs, e.g. (number of saved lives) /(Million € costs) -> CEA
  - Expression of all benefits in € and then calculate a number of incidents for which the security measures are economically viable -> CBA

Goals to reach

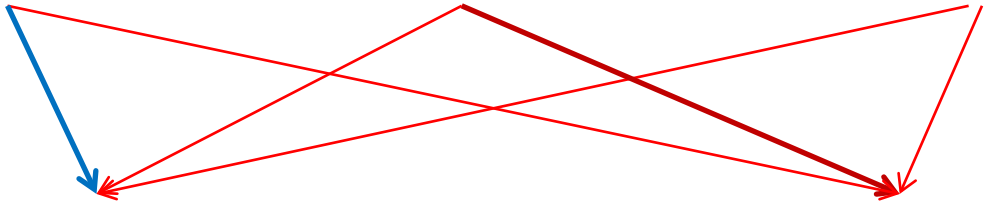
Countries

France Germany Italy Poland



Attack types

Station Hall Depot Intrusion CBRNe On-board



Analysis types

CEA: e.g. saved lives per M€ investment after one attack

CBA: Minimum number of attacks which make investment economically viable

Additionally: calculation variants concerning average/worst case and more

How to achieve the goals

The following classes of **cost related** data had to be acquired:

Data Class		Data Source
• Suitable set of threat scenarios and associated sets of security measures	←	• PROTECTRAIL demonstrations, scenario descriptions including security measures
• Complete costs for one installation per set	←	• Providers, PROTECTRAIL partners
• Number of necessary installations, depending on the country specific infrastructure	←	• WP partners, Official RU documents, Internet

Keep in mind: The collected costs are not necessarily representative!

How to achieve the goals (cont'd)

The following classes of **benefit related** data had to be acquired and structured:

Data Class	Data Source
• Amount of damage after a successful attack, numbers of deaths and injuries, economic losses	• Historical databases, analytic tool from TNO, reports from catastrophic events
• Effectivity of each set of technical security measures, relationship with human actions	• Plausible assumptions, accepted calculation methods

Calculation methods

A calculation example for the analysis type CEA (blue path)

Country	Italy	
Attack scenario	Station Hall Person Tracking	
Complete Costs for country wide protection	142 M€	
After a completely prevented attack:		
Saved lives absolutely	25	
per M€ security investment		0,18
Avoided injuries absolutely	120	
per M€ security investment		0,84
Avoided economic loss absolutely	30 M€	
per M€ security investment		0,28 M€

Calculation methods (cont‘d)

Calculation method for the analysis type CBA

Prerequisite: All considered benefits (avoided damages) can be expressed in €. Then, according to a usually applied definition:

NetBenefit :=
AttackFrequency * AvoidedDamages * MeasureEffectivity – TotalCosts > 0

Problem: AttackFrequency can hardly be identified for terrorist attacks (HILP)

But transformation of the above formula yields:

NetBenefit **>** 0 ⟺
AttackFrequency **>** TotalCosts**/**(AvoidedDamages*MeasureEffectivity)

Threshold attack frequency for economic viability

Calculation methods (cont‘d)

A calculation example for the analysis type CBA (brown path)

Country	Poland
Attack scenario	Depot Intrusion
Total Costs for country wide protection	26,5 M€
After a completely prevented attack:	
Sum of avoided monetizable damages (calculated from data)	29,5 M€
Measure effectivity (calculated from plausible assumptions)	0,6
Threshold attack frequency for economic viability (in 10 years)	26,9 M€/(29,5 M€*0,6) = 1,49

Calculation methods (cont‘d)

Explanation concerning Sum of avoided monetizable damages

In the previous calculation:

Monetizable damages contain several categories:

- Material damages
- Liability costs
- Loss of revenue
- Lost lives
- Injuries

The last two categories are used by transforming a human life or an injury into a money value via a concept known as “Value of a statistical life”, VSL.

-> Sometimes criticized for ethical reasons

-> but used within the EU and within different EU country adminstrations.

CBA Calculations

Overview of all calculations with CBA:

Threshold attack frequencies for economic viability in 10 years

Country / **Scenario**	France	Germany	Italy	Poland
Station Hall	1,39	1,27	1,38	0,32
Depot Intrusion	1,91	1,84	2,14	1,49
On-board CBRNe	0,85	0,97	0,93	0,17

Intangible Costs and Benefits

All methods and calculations so far refer to tangible costs and benefits (= can be characterized by numerical values).

- An overview in chapter 6 of the report shows that comparable systematic approaches for intangible costs and benefits are very rare.
- One approach has been developed in an FP7 security project ValueSec
- This approach consists of
  - Identifying a large number of social, political, ethical, legal and other assessment criteria
  - Structuring them in a 2 or 3-level hierarchy (groups)
  - Assigning scaling values (-10 to +10) to each criterion
  - Assigning relative weights to each criterion and to each group
- Problem of the approach: How to find the right experts to assign realistic values to the criteria.
- **->** Approach was **not** applied to the PROTECTRAIL security measures.

Conclusions

The report provides:

- Based on accepted general econometric methods
  - A transparent methodology for structuring and calculation of security costs in a country wide infrastructure
  - A transparent methodology for structuring and calculation of benefits in different dimensions
  - Application of these methodologies for two types of cost-benefit comparisons related to the issues of Protectrail and with data collected here.

- For professional users the option to apply the methodology
  - To other countries and/or other security measures in the railway area
  - To other country wide infrastructures (after appropriate adjustments)

- Hints how intangible costs and benefits could be dealt with (without detailed calculations)