COST ACTION TU1103:

OPERATION AND SAFETY OF TRAMWAYS

IN INTERACTION WITH PUBLIC SPACE

Final conference – Frankfurt, Germany – 29 September 2015
Indicators

3.2 Summary of all accidents and incidents

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Train million km</td>
<td>2.47</td>
<td>2.47</td>
<td>2.74</td>
<td>2.73</td>
<td>2.61</td>
<td>3</td>
<td>3.68</td>
<td>3.96</td>
<td>3.81</td>
</tr>
<tr>
<td>% change</td>
<td>-0.8%</td>
<td>-2.8%</td>
<td>-1.0%</td>
<td>-2.3%</td>
<td>+12.8%</td>
<td>+26.3%</td>
<td>-2.2%</td>
<td>-2.7%</td>
<td></td>
</tr>
<tr>
<td>Road traffic collisions (RTC)</td>
<td>36</td>
<td>24</td>
<td>29</td>
<td>32</td>
<td>23</td>
<td>30</td>
<td>30</td>
<td>24</td>
<td>38</td>
</tr>
<tr>
<td>Collision between two trains</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Derailment in depot</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Derailment in service</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SPADS</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>24</td>
</tr>
</tbody>
</table>

Dominique BERTRAND, Cerema, Lyon (France)
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Contents

- indicators: what are we talking about?
- different types of indicators for tram safety
- uses and limits of indicators
- most useful indicators and their pro/cons
Indicators: what are we talking about?

using some data to assess a situation...

- in our case: **measure a level of safety**
- behind this general goal, the idea of **comparing situations**...

Indicators may be

- **raw data** (i.e. *number of events, of casualties*)
- **calculated figures** (i.e. *Percentage of collisions per third parties, ratio per kilometers run*)

<table>
<thead>
<tr>
<th>Accidents</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Serious</td>
<td>7</td>
<td>10</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Slight</td>
<td>30</td>
<td>15</td>
<td>19</td>
<td>16</td>
<td>25</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>26</td>
<td>25</td>
<td>23</td>
<td>33</td>
<td>24</td>
<td>23</td>
</tr>
</tbody>
</table>
Indicators: what are we talking about?

A useful tool for tramway safety,

- to give general information
- to show trends in terms of safety
- to identify and rank the issues
- to assess the strategy and implemented actions
- to improve the knowledge for planning and upgrading of systems
Different kinds of indicators for tram safety

3 main categories, based on:
- the field they apply to
- the nature of information used ...

- global indicators
- geographical indicators
- typological indicators

some other indicators are linked to safety, when concerning:

degradation of level of service
social or economic costs

} due to impact of accidents
Global indicators for tram safety

When concerning ...
- the whole line or networks
- the whole period of operation
- all types of accidents and whatever the severity is

Then, no reference is made to...
- the location of events
- the dates or time of occurrence
- causes, types of involved users

The number of events is a global indicator which leads us to say urban insertion is the main stakes of tram safety.
**Geographical indicators for tram safety**

When these are calculated while looking at ...  
- different part of networks  
- various types of places (junctions, stops, ...)
- spatial location of accidents

Then, a reference is made to ...  
- the location of events

*The identification of hotspots* is a good example of use of geographical indicators!
**Typological indicators for tram safety**

When these are calculated while looking at...
- circumstances of accidents
- types of users involved
- context

Then, a reference is made to...
- categories of involved users
- date or time of occurrence
- causes of accidents

*Example of Typological indicator: types of victims*
Use and limits of indicators for tram safety

Indicators are most often used in a comparing process, in order to determine ...
- how things are evolving in time,
- how the safety level of a system is, compared to an external reference,
- what the main safety issues are on a network,
- how, when and where most frequent accidents occur.

However, to be (properly) compared, things need to be comparable!

- homogeneous data and way of calculation
- similar contexts and equal other parameters
Use and limits of indicators for tram safety

In such a comparing process, indicators should not be used in order to ...
- rank the networks or the tramlines,
- understand why accidents occur,
- choose signalling tools or layout design

*Indicators are a useful tools in a quantitative approach to get general conclusions and help to identify main core issues*

*They are complementary with detailed and qualitative assessments of accidents*
Use and limits of indicators for tram safety

- Making *comparisons* between tram *networks*, *tramlines* or *layouts* is *not* often relevant.

- One should rather try to *follow things in time on each network*.

- So, *no requirement* for authorities, operators nor regulation bodies to produce and use exactly the same indicators.

- However, the same problems and limits are encountered, and coherent and homogeneous approaches are desired.
The main limitations of indicators for tram safety

- availability of data required to produce safety indicators
  - main accident data come from the drivers, but data collection is not their 1st task after an accident

- existing differences about definitions in safety data
  - e.g. “injured” people, “passenger”

- differences of contexts of accidents and conditions of operation
  - frequencies, traffic level, layouts, road regulation and signalling, behaviours

- unavailability of additional but essential data to objectivize comparisons
  - data regarding car traffic in junctions, speed, ...
The main limits of indicators for tram safety

Be careful, comparing networks based on raw data is not relevant:

- no information on the size of the networks, the vehicle-km run or the number of junctions
- various periods (years) of operation

<table>
<thead>
<tr>
<th>City</th>
<th>Period of reference</th>
<th>Number of accidents</th>
<th>injured</th>
<th>death</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>slightly</td>
<td>seriously</td>
</tr>
<tr>
<td>Bergamo</td>
<td>2009-2011</td>
<td>9</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Florence</td>
<td>2009-2011</td>
<td>9</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Mestre (Venice)</td>
<td>2010-2012</td>
<td>6</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Milan</td>
<td>1995-2012</td>
<td>161</td>
<td>436</td>
<td>36</td>
</tr>
<tr>
<td>Padua</td>
<td>2007-2011</td>
<td>6</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Rome</td>
<td>1997-2011</td>
<td>107</td>
<td>314</td>
<td>38</td>
</tr>
<tr>
<td>Turin</td>
<td>2000-2011</td>
<td>33</td>
<td>113</td>
<td>6</td>
</tr>
</tbody>
</table>
Most useful indicators and their pros and cons

**Global indicators**
1. Number of accidents
2. Number of fatalities, injured persons
3. Accidents per km per year

**Geographical indicators**
4. Number of accidents by location
5. Distribution of accidents by type of location (relative)
6. Distribution of casualties (fatalities, injured) by type of location (relative)
7. Number of accidents per number of type of location

**Typological indicators**
8. Distribution of accidents by third parties (relative)
9. Distribution of casualties by third parties (relative)
10. Number of lost km / number of planned km
**Most useful indicators and their pros and cons**

An example of *global* indicator: the *number of accidents*

<table>
<thead>
<tr>
<th>Definition and nature</th>
<th>Raw data: counted accidents(^4) during the period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td>Global indicator</td>
</tr>
<tr>
<td><strong>Representation</strong></td>
<td>Tables</td>
</tr>
<tr>
<td><strong>Spatial field of application</strong></td>
<td>Line(s), network(s)</td>
</tr>
<tr>
<td><strong>Period</strong></td>
<td>Relevant to distribute it more than one time per year (monthly, ...)</td>
</tr>
<tr>
<td><strong>Relevant for</strong></td>
<td>Measuring the stakes, getting a general overview of safety on a network or a line Reporting to the authorities</td>
</tr>
<tr>
<td><strong>Not relevant for</strong></td>
<td>Comparing with other domains (road safety, heavy rail, etc.), due to the different operation conditions Comparing networks Not reflecting the safety level of the tram network (shows no evolution, no gravity, no type of accidents). A pure figure.</td>
</tr>
</tbody>
</table>
Most useful indicators and their pros and cons

An example of geographical indicator: number of accidents per number of types of location
Most useful indicators and their pros and cons

An example of typological indicator: distribution of injured and fatalities by third parties (relative)
Indicators

Any questions ?...
Thank you for your attention!

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www.tram-urban-safety.eu