Safety and Operation of Tramways in Interaction with Public Space

COST Action TU1103

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Transport Infrastructure Ireland (TII)

Day 2 – Tuesday 23rd October 2018 – Theme: Organisational initiatives and innovations to improve railway safety.
Safety and Operation of Tramways in Interaction with Public Space
COST Action TU1103

What was the COST Action About

• Improvement of tramway safety in urban paces.

• A better understanding of problems, solutions, and a shared feedback, at a European scale.

• The sharing of information, practical solutions and experiences.

• Strategies and ideas implemented in one country have the potential to be transferred and implemented in other countries.
Presentation

- Transport Infrastructure Ireland (TII) and the Luas Light Rail System
- European Cooperation in Science and Technology (COST)
- Safety and Operation of Tramways in Interaction with Public Space, COST Action TU1103
- Outcomes and findings of the COST Action TU1103.
- How this information can be used to improve the safety of LRT systems operating in the public space
TII's primary function is to provide an integrated approach to the future development and operation of the national roads network and light rail infrastructure throughout Ireland.

Our Vision is:

• To be leaders in the delivery and operation of transport infrastructure.

• To ensure that Ireland’s national road and light rail infrastructure is safe, sustainable and resilient, delivering better accessibility and mobility for people and goods.

• To be recognised as an organisation that values its people, customers and partners.
Luas Network

**Design parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum speed</td>
<td>70kph</td>
</tr>
<tr>
<td>Maximum gradient</td>
<td>6%</td>
</tr>
<tr>
<td>Minimum radius</td>
<td>25m</td>
</tr>
<tr>
<td>Gauge</td>
<td>1435mm</td>
</tr>
<tr>
<td>Maximum cant</td>
<td>120mm</td>
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</table>

**Green Line**

<table>
<thead>
<tr>
<th>Route length</th>
<th>22km</th>
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<tbody>
<tr>
<td>Stops</td>
<td>34</td>
</tr>
<tr>
<td>Commercial speed</td>
<td>27kph</td>
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<tr>
<td>Depots</td>
<td>2</td>
</tr>
</tbody>
</table>

**Red Line**

<table>
<thead>
<tr>
<th>Route length</th>
<th>21km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stops</td>
<td>32</td>
</tr>
<tr>
<td>Commercial speed</td>
<td>22kph</td>
</tr>
<tr>
<td>Depots</td>
<td>1</td>
</tr>
</tbody>
</table>
Luas Network
European Tram Systems

Number of Light Rail Networks in Europe

Total Length of Networks in Europe
European Cooperation in Science and Technology (COST).

- COST is an EU-funded programme that enables researchers to set up their interdisciplinary research networks in Europe.
- "Networks of Excellence": Biomedicine; Food and Agriculture; Environmental Management; Information and Communication Technologies; Transport and Urban Development.
- COST is the oldest and widest European intergovernmental network for cooperation in research.
- COST provide funds for organising conferences, meetings, training schools, short scientific exchanges or other networking activities.
- This Action 1103 was funded by COST. It started on 2011 and the final report was published in September 2015.

http://www.cost.eu/
COST Action TU1103 “Operation and safety of tramways in interaction with public space”

What is COST Action TU1103 about?

• Improvement of tramway safety through a better management of their insertion into urban paces.

• A better understanding of problems, solutions, and a shared feedback, at a European scale.

• Because urban insertion of LRTs is not an exact science, the sharing of information, practical solutions and experiences is one of the best ways to improve the safety of design and operation of tram systems.

• Strategies and ideas implemented in one country have the potential to be transferred and implemented in other countries.

34 participants from 15 countries + UITP
COST Action TU1103 “Operation and safety of tramways in interaction with public space”
Outcomes and Findings of the Action

Tramway Glossary

A common glossary was established to check if there was any language issue and no potential misunderstandings or mistranslations.
Outcomes and Findings of the Action

• Old and new systems.
• Statistical comparison of different Tram systems difficult.
• There is a wide range in the manner and level of regulation and standardization for light rail systems between countries.
• There is a great variety of data and means of data recording and analysis.
• Every country’s systems face similar kinds of issues.
Outcomes and Findings of the Action

Accident Hotspots

• An Hotspot, is a specific location on the tram network defined as a place in the urban area where the most accidents (collisions) occurred.

![Diagram showing the type of location with 85.39% intersections, 12.36% running sections, and 2.25% stations.]
The compilation and analysis of good and bad practices in relation to safety when trams interact with other street users (pedestrians, cyclists and road vehicle users).

**How This Information Can be Used**

<table>
<thead>
<tr>
<th>PT1_3</th>
<th>Metro do Porto: Jardim do Morro_intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>City</td>
</tr>
<tr>
<td></td>
<td>Gaia</td>
</tr>
<tr>
<td><strong>Operation Mode</strong></td>
<td>segregated tramway</td>
</tr>
<tr>
<td><strong>Hotspot Interaction</strong></td>
<td>pedestrians</td>
</tr>
<tr>
<td></td>
<td>Road junctions (cars and cyclists) with a left turn</td>
</tr>
<tr>
<td><strong>Landscape and surroundings context</strong></td>
<td>Description</td>
</tr>
<tr>
<td></td>
<td>left turn Jardim do Morro: the section between S.Bento and Jardim do Morro stations links the two cities Porto and Gaia across an existing bridge that has seen its upper level reserved for LRT and pedestrian crossing. Cars can not cross the bridge at this level so an intersection over the tramway had to be created to allow cars reverse their direction. The left turn has been designed with a smooth curve to soften the intersection.</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>station</td>
</tr>
<tr>
<td></td>
<td>x</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>type of solution_configuration</td>
</tr>
<tr>
<td></td>
<td>urban design_turning left perpendicularly: once this left turn was necessary, the solution was to design it perpendicularly to the tramway. A green space designs the movement cars should do forcing drivers looking metro channel and being aware of vehicles passage. In this case the urban design has been extremely important to define the way intersection is made.</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>advantages</td>
</tr>
<tr>
<td></td>
<td>Forcing cars to intersect tramway perpendicularly trough the urban design chosen for the road and the materials to define it guarantees the use of space as planned. It is a simple and easy to implement [if you have space for it] solution which do not requires expensive investment. In case, as it was something implanted &quot;with&quot; the tramway has not involved extra costs or works.</td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>disadvantages</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Innovation aspects</strong></td>
<td>innovation aspects</td>
</tr>
<tr>
<td></td>
<td>Transforming the left turn in a perpendicular intersection by the urban definition of LRT green bounderies.</td>
</tr>
</tbody>
</table>

Images + Plans
The use of a universal language (red for warning) turn those elements an easy to understand tool.

The separation of the platform with the triangular stone piece is very useful to mark the "tramway zone".

The layout reduces, the risk of contact between the train and a cyclist, and cyclists crossing the tracks at a right angle.

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The alignment of the cycle path moves the crossing point to a safer location and is oriented to approach the tram tracks at right angles.

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<table>
<thead>
<tr>
<th>Configuration</th>
<th>Hazards</th>
<th>Objective</th>
<th>Measures</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Tracks are located in central position.</td>
<td>Pedestrians have to cross at least one driving lane to board the tram vehicle (after leaving the platform/sidewalk). Handicapped accessibility requirements cannot be met.</td>
<td>Safe passenger interchange</td>
<td>Widening the sidewalk thus reducing the width of the carriageway: it could be necessary to create a refuge for pedestrians in order to avoid interaction with cars. This can be achieved by widening the sidewalk for a distance which covers at least the tram length. The width of the carriageway will be reduced, in order to avoid the presence of cars alongside the tram lane, avoiding the risk of collision with pedestrians. (this actually leads to the creation of a platform; see tracks in central position, with dedicated platform, mixed road traffic.)</td>
<td>IT1_1 (stations); IT1_3 (stations); AT2_1 (stations)</td>
</tr>
<tr>
<td>3.1.1. no dedicated platform - mixed</td>
<td>Several cars blocking the lane and also the exits of the tram vehicle leads to blocking of passengers on the lane</td>
<td>Clear motorized traffic from the boarding area between tram vehicle and sidewalk</td>
<td>On demand traffic lights, which block the driving lane for individual traffic at a safe distance to the station for the entire dwell time (“time island”).</td>
<td>AT2_3 (stations)</td>
</tr>
<tr>
<td>3.1.2 the driving lane at the tram stop is elevated to sidewalk level to form a boarding area</td>
<td>Awareness of car drivers to adapt their driving speed or stop their vehicle accordingly to the situation.</td>
<td>Safe passenger boarding</td>
<td>Different surface types, textures and colours on the driving lane at the beginning of the stop (possible stop line). Combination with aforementioned additional on-demand traffic lights (“time island”)</td>
<td>AT2_3 (stations)</td>
</tr>
<tr>
<td>3.1.2. no dedicated platform - mixed</td>
<td>Individual traffic crossing the boarding area and endangering boarding or alighting passengers</td>
<td>Reduce the hazard of individual traffic crossing the passengers’ boarding area</td>
<td>Raising the roadway so that the roadway is level with the platform enables (a) improved access for persons of reduced mobility, (b) makes a “speed hump” to slow drivers. Additionally, a stopping line directly before the levelled boarding area brings individual traffic to a safe distance from boarding passengers. Due to the levelling of the driving lane, accessibility requirements for passengers with reduced mobility can be met.</td>
<td>AT2_3 (stations)</td>
</tr>
</tbody>
</table>
How This Information Can be Used

Lessons learnt
Example of simple 'common sense' solution to basic sightlines problem which needed negotiations with several parties.

Lessons learnt
An effective method of eliminating hazard of collisions is to prohibit the left turn traffic movement.
Conclusion

• A greater understanding of the regulatory environments and safety requirements for LRT systems in different European countries.

• A review of how accident data is collected and root cause analysed by the different tram systems.

• A greater understanding of the advantages and difficulties of using common KPI’s and how these can be applied to the measurement of safety performance of LRT systems.

• The identification of good and bad examples of infrastructure design in relation to safety of LRT systems interaction with the public space.

http://www.iutcs.fr/spip.php?rubrique611
Urban Tram Forum (UTF)

- The Urban Tram Forum (UTF) group was founded after the completion of the COST Action TU1103.
- Members of the COST Action found the project to be extremely beneficial and did not want to lose the benefits of tramway safety professionals keeping in touch, getting together and openly discussing safety topics and issues.
- At the end of the COST Action, a number of members formed a group called the Urban Tram Forum (UTF).
- It was agreed that the UTF would meet once a year.
- The group is voluntary and not funded by any companies, organizations or state bodies. It relies on the meeting host organization to provide meeting facilities.
- The meetings are based on the Chatham House Rules. This facilitates open and frank discussions on tramway safety.
- The UTF also provides a networking opportunity and is very useful when trying to find out how other tramway systems solve/deal with particular safety issues.
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