Safety and Operation of Tramways in Interaction with Public Space

COST Action TU1103

Reddy Morley

Head of Rail Safety and Occupational Health & Safety

Transport Infrastructure Ireland (TII)

Day 2 – Tuesday 23rd October 2018 –
Theme: Organisational initiatives and innovations to improve railway safety.

TII
Bonneagar Iompair Éireann
Transport Infrastructure Ireland

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

Transport Infrastructure Ireland (TII)

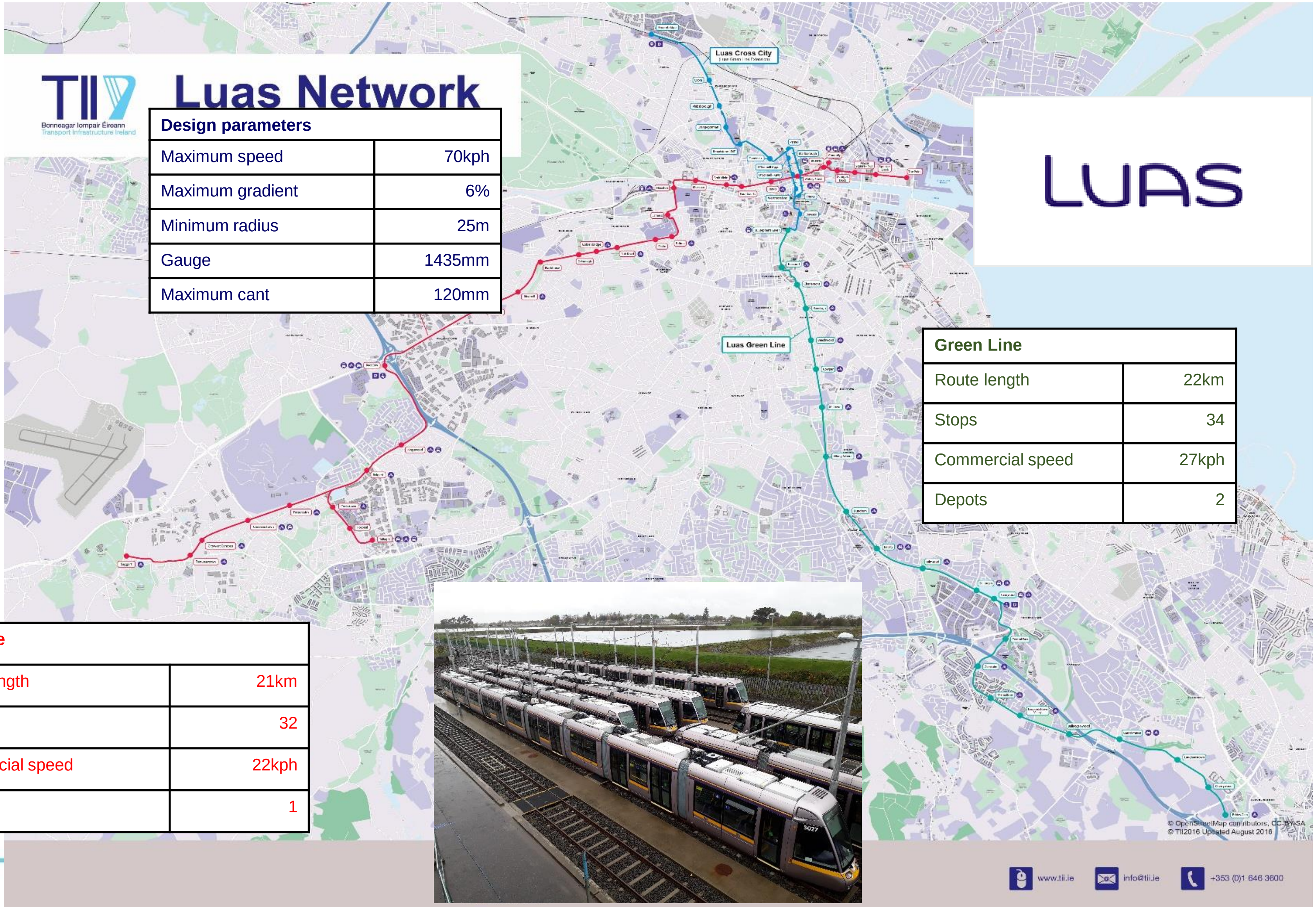
TII's primary function is to provide an integrated approach to the future development and operation of the national roads network and light rail infrastructure throughout Ireland.

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.

TII
Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Luas Network

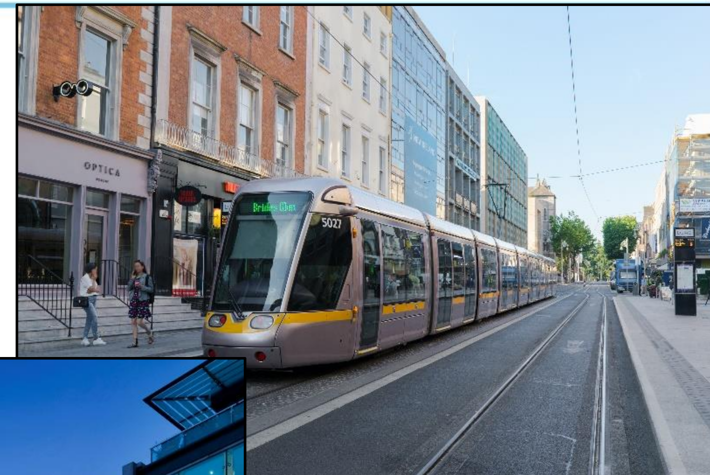


Design parameters	
Maximum speed	70kph
Maximum gradient	6%
Minimum radius	25m
Gauge	1435mm
Maximum cant	120mm

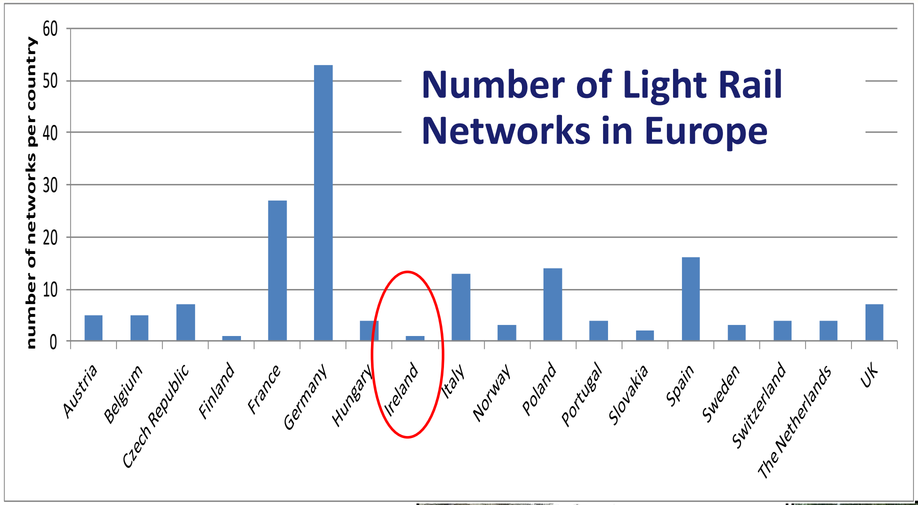
Green Line	
Route length	22km
Stops	34
Commercial speed	27kph
Depots	2

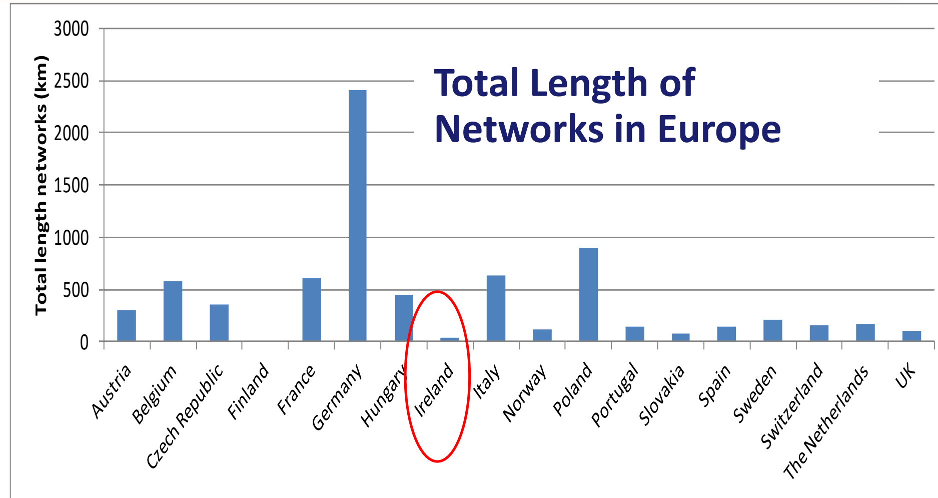
Red Line	
Route length	21km
Stops	32
Commercial speed	22kph
Depots	1

Luas Network

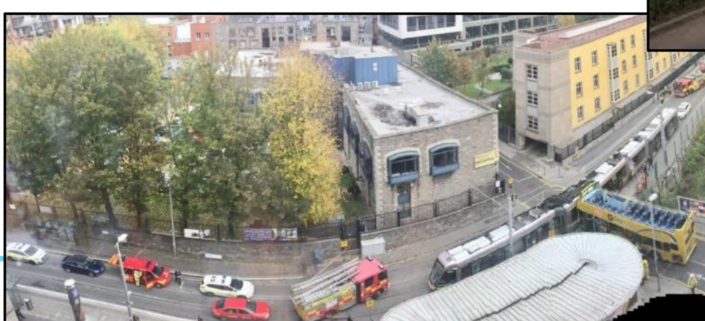


European Tram Systems



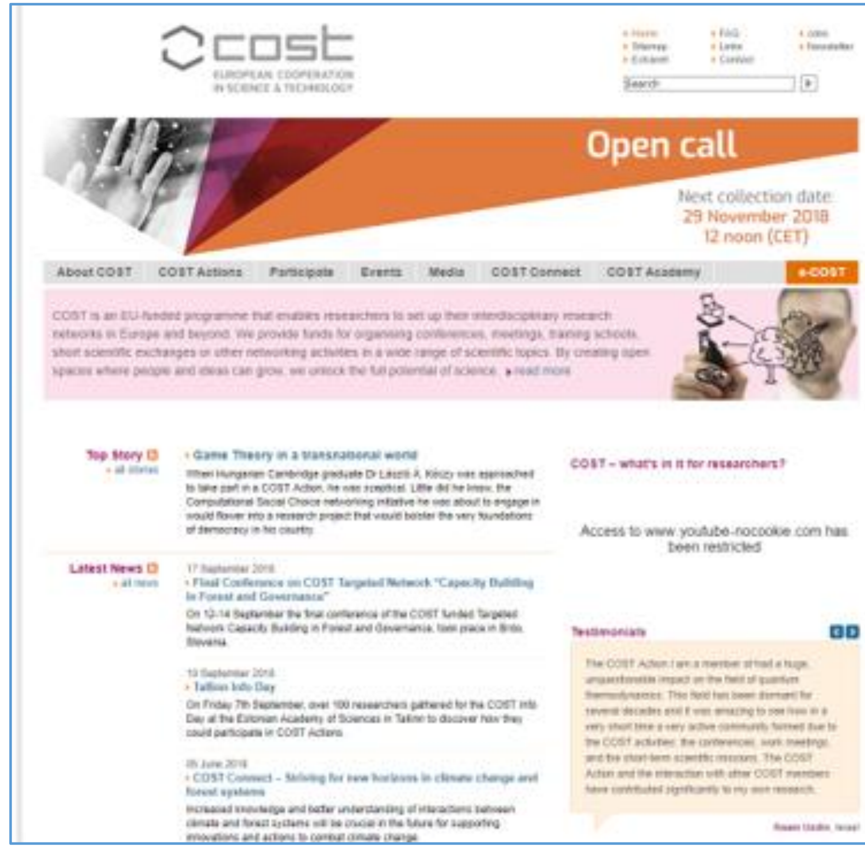


Accidents



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.

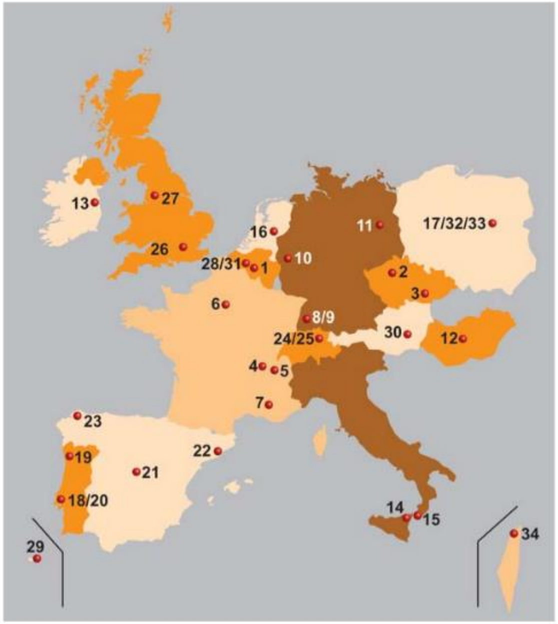


http://www.cost.eu/

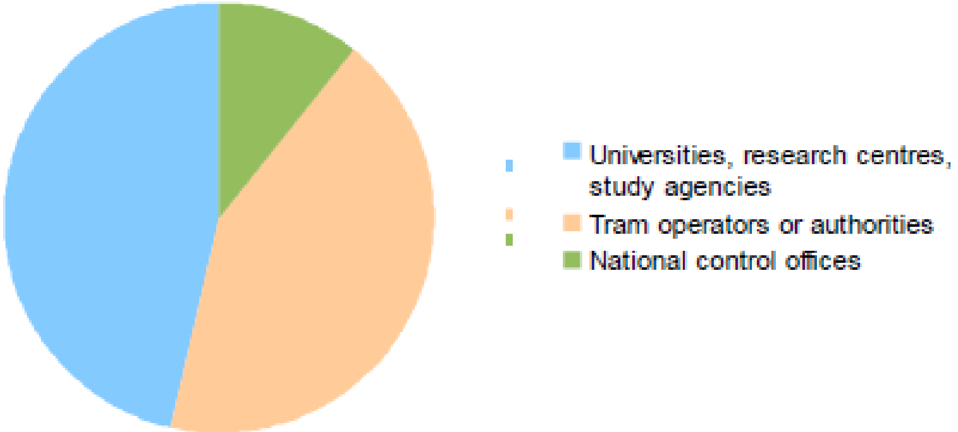
COST Action TU1103 “Operation and safety of tramways in interaction with public space”

What is COST Action TU1103 about?

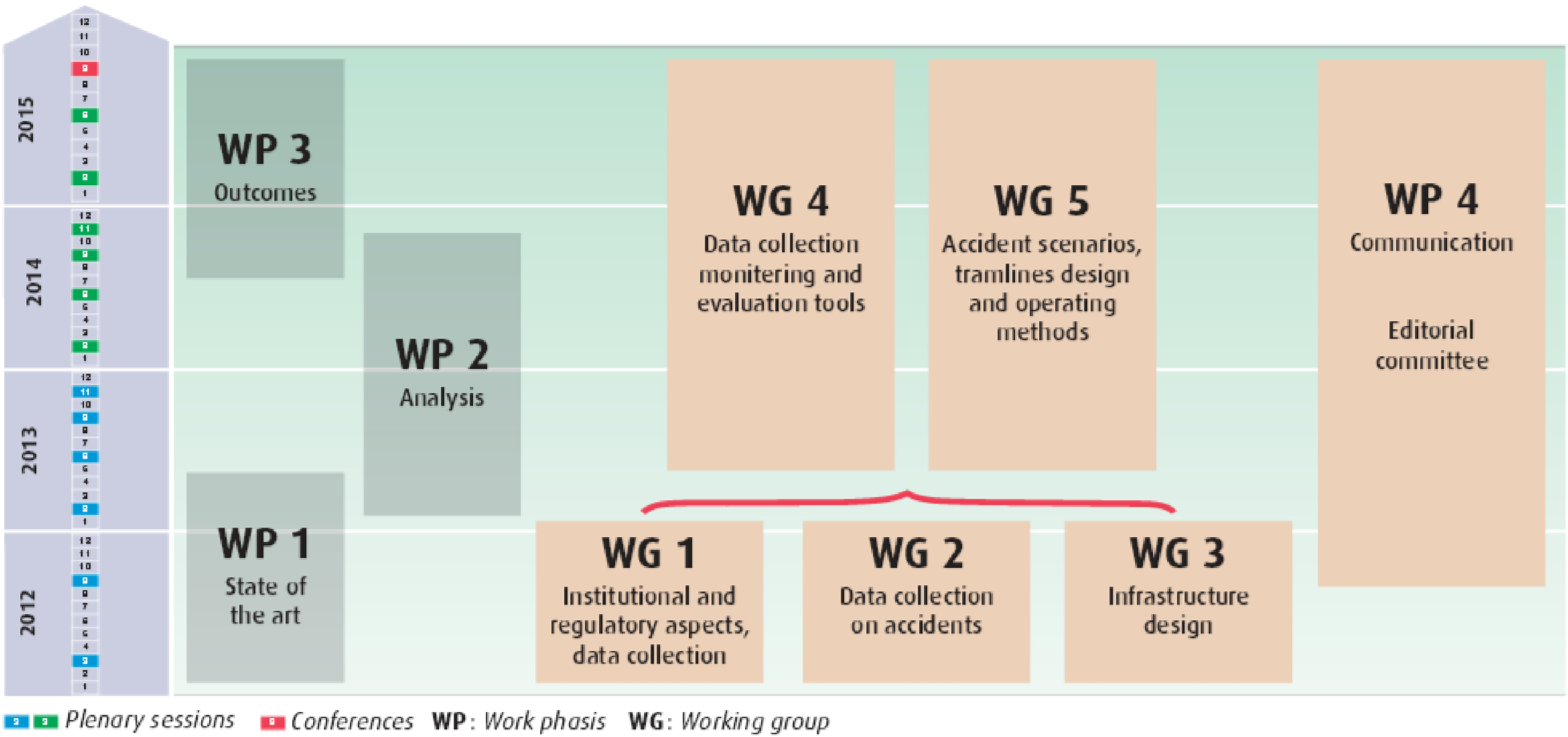
- Improvement of tramway safety through a better management of their insertion into urban paces.
- A better understanding of problems, solutions, and a shared feedback, at a European scale.
- Because urban insertion of LRTs is not an exact science, the sharing of information, practical solutions and 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 implemente 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.

7.2 Glossary – main terms and their definitions in English – in alphabetic order

As we have detected a language issue and the potential for misunderstandings or mistranslations, we have included a glossary (not a dictionary) on main terms in the original language and their descriptions in English (tramway, LRT, mixed zones, segregated lines…). Here, we present the terms, their meanings and related photos. In the appendices, we present the global table with all translations.

Globally, no complicated issue occurred but terms as "Metrobus" or "local authority" have appeared to mean slightly different ideas.

In appendix, you will find a complete table with towards each term, its translation in the various languages used by the participants with comments, interesting issues but quite small and detailed.

Accident: collision that involves the tram and a third party (car, pedestrian, bicycle…) with contact, or contact with a fixed object or structure.

Figure 6 a- accident with a car in Berlin, b- car crash demonstration in Warsaw, c- collision in Brussels, d- collision with a bus in Berlin

Figure 7 - Portugal

Capacity (vehicle/h/direction): maximum volume can be offered per unit time.

Code: any set of standards set forth and enforced by a local government agency for the protection of public safety, health, etc., e.g. in the structural safety of buildings (building code).

Congestion: equivalent to Level of Service when Demand approaches Capacity.

26

Crossroad, junction or intersection: crossing between the tram lane and one or many roads, mainly managed by road signals, including for the tram. The urban crossroads are generally crossed in speeds between 20 and 40 kph.

Figure 23 – shared space with bus in Warsaw

Figure 24 a- UK, b- UK, c- Italy, d- Italy

Figure 25 – Czech Republic

We will deal in this Action with traffic signals, not railway signals.

33

27

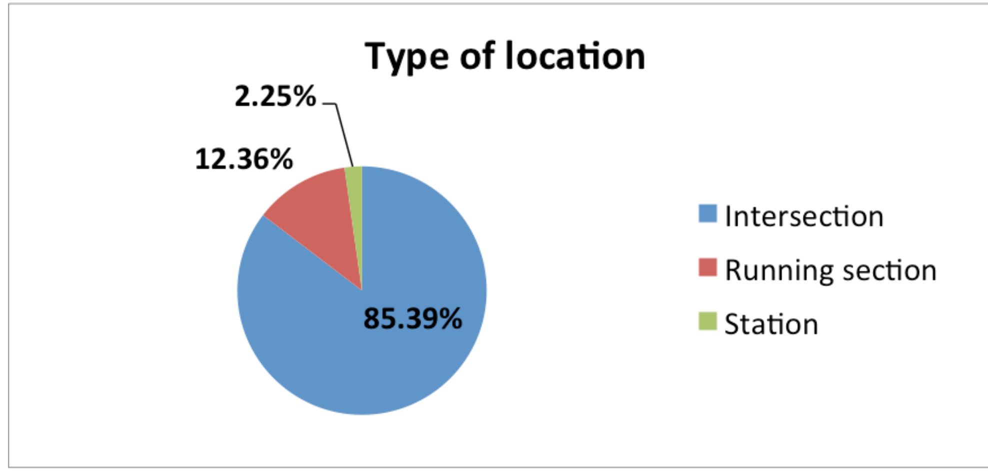
Outcomes and Findings of the Action

- 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.



How This Information Can be Used

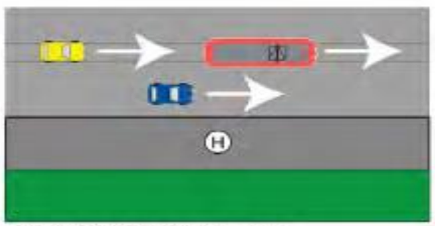
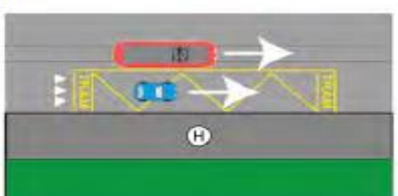
The compilation and analysis of good and bad practices in relation to safety when trams interact with other street users (pedestrians, cyclists and road vehicle users).

PT1_3	Metro do Porto: Jardim do Morro_intersection			
Location	City	Network	Line	Section
	Gaia	Metro do Porto	D	S.Bento - Jardim do Morro
Operation Mode	segregated tramway	mixed zone	banalized space	
	x			
Hotspot Interaction	pedestrians	cars	cyclists	
		Road junctions (cars and cyclists) with a left turn		
Landscape and surrondings context	Description			
	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 na 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.			
Location	station		between stations	
			x	
Description	type of solution_configuration			
	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 movemet 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.			
	advantages			
	Forcing cars to intersect tramway perpendicularly trough the urban design chosen for the road and the materials to define it garantees the use of space as planned. It is a simple and easy to implement (if you have space for it) solution wich do not requires expensive investment. In case, as it was something implanted "with" the tramway has not involved extra costs or works.			
	disadvantages			
	innovation aspects			
	Transforming the left turn in a perpendicular intersection by the urban definition of LRT green bounderies.			
Images + Plans				

How This Information Can be Used

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Configuration	Hazards	Objective	Measures	References
3.1 Tracks are located in **central** position. There is **no dedicated platform**. Tram **shares** the traffic lanes with road traffic. **3.1.1**	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.	Safe passenger interchange	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.)*	IT1_1 (stations); IT1_3 (stations); AT2_1 (stations) 

Configuration	Hazards	Objective	Measures	References
 3.1.1. no dedicated platform - mixed	Several cars blocking the lane and also the exits of the tram vehicle leads to bulking of passengers on the lane	Clear motorized traffic from the boarding area between tram vehicle and sidewalk	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").	AT2_3 (stations) 
	Awareness of car drivers to adapt their driving speed or stop their vehicle accordingly to the situation.	Safe passenger boarding	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")	AT2_3 (stations) 
3.1.2 the driving lane at the tram stop is elevated to sidewalk level to form a boarding area  3.1.2. no dedicated platform - mixed	Individual traffic crossing the boarding area and endangering boarding or alighting passengers	Reduce the hazard of individual traffic crossing the passengers' boarding area	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.	AT2_3 (stations) 

How This Information Can be Used

Lessons learnt

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

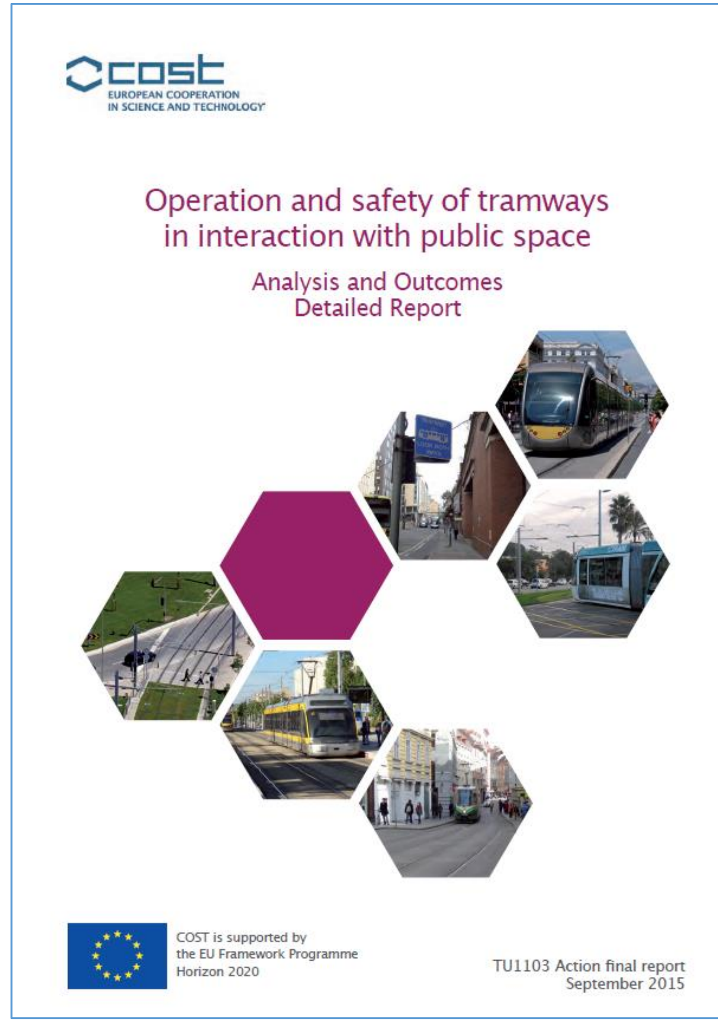
Lessons learnt

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

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

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.

COST Action TU1103 “Operation and safety of tramways in interaction with public space

Thank you!