



EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

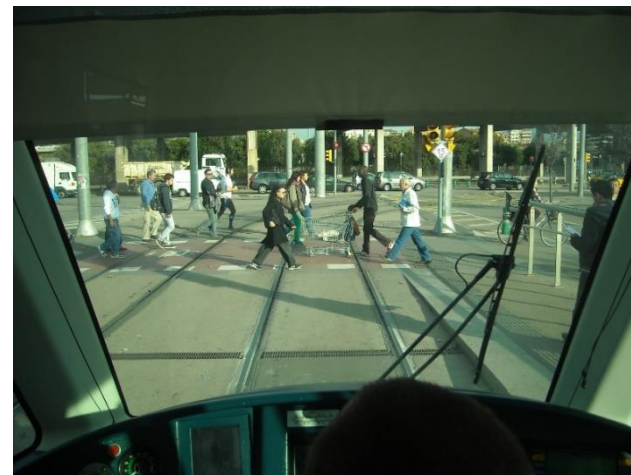


COST ACTION TU1103:

**OPERATION AND SAFETY OF TRAMWAYS
IN INTERACTION WITH PUBLIC SPACE**

Pedestrian Crossings

- Specifically designed point of the tramway line where pedestrians are authorised to cross.



Giuseppe Inturri (University of Catania)

Reddy Morley (Transport Infrastructure Ireland, Dublin)

Contents

1. General issues and figures
2. Main hazards
3. Main objectives to improve safety
4. Some measures
5. One success story

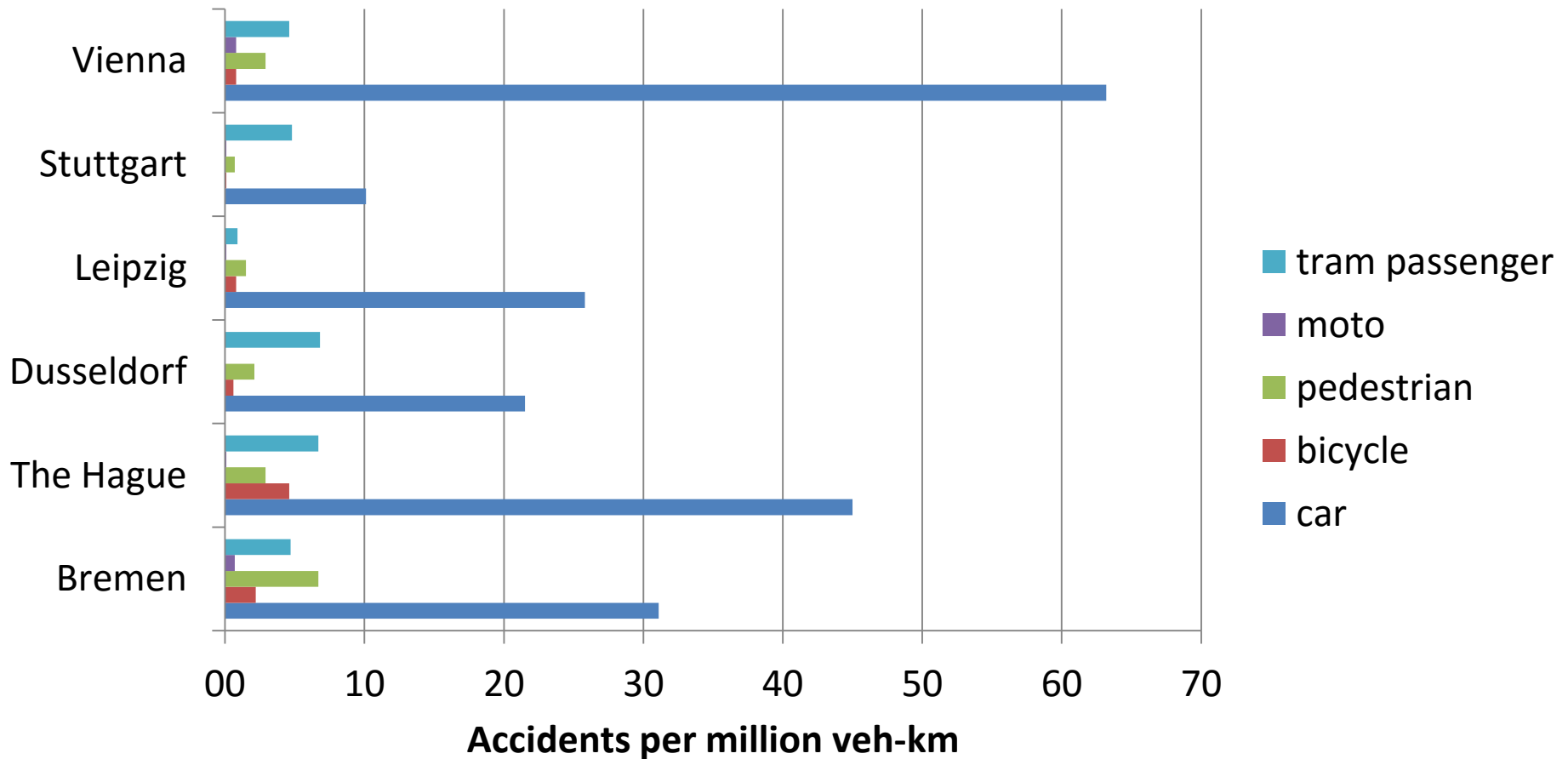
General issues

- Pedestrians are vulnerable public space users but at the same time difficult to constrain.
- A trade-off between pedestrian permeability of public spaces and tramway performance is a challenging goal
- Pedestrian behaviour may be unpredictable and in general they prefer to cross by the shortest place and this must be taken into account.
- When dealing with the interaction between pedestrian and trams, it is important to consider the interaction with cars and other modes at the same time



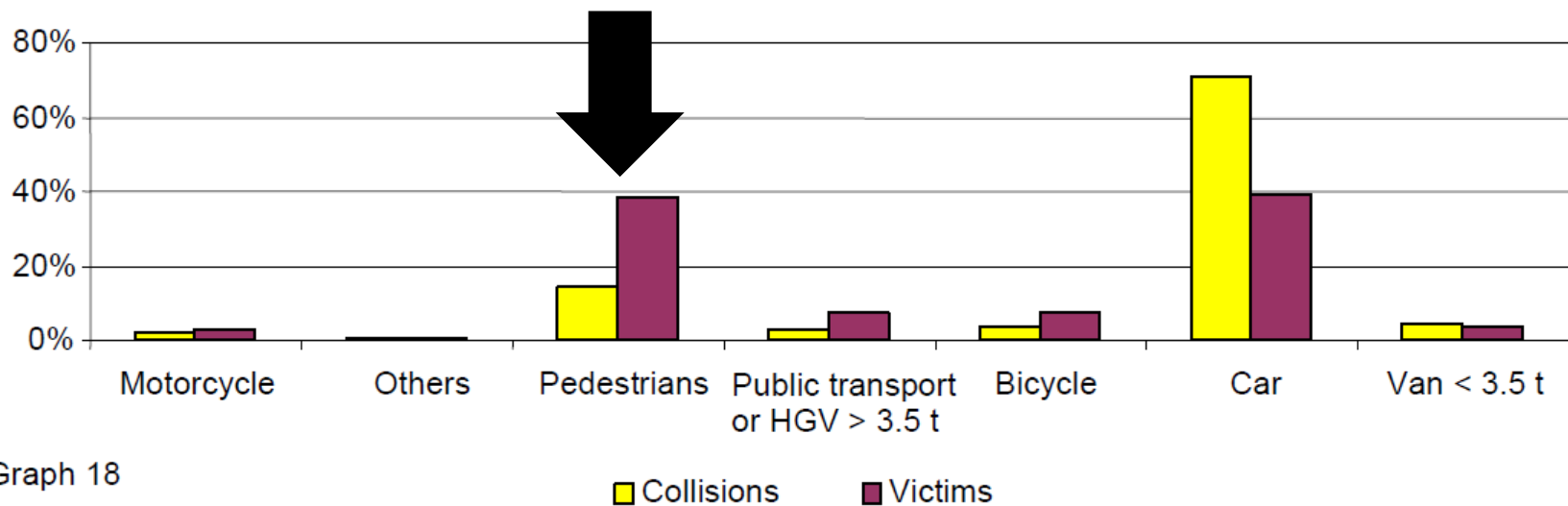
Accident analysis 1/2

Tram accident rate (UITP, 2009)



Accident analysis (2/2)

Repartition of tramway collisions by type of space users involved



Source: French National Report on Accidentology of Tramways – 2003-2009. STRMTG 2010.

HAZARDS

- behaviour
 - unawareness of the presence of tramway
 - pedestrian dangerous behaviour due to lack of care
 - pedestrians violating signs, signals and warning devices
- infrastructure
 - absence of adequate sidewalks, platforms and refuge areas,
 - lack of visibility or more generally a wrong infrastructure location or layout configuration

Unawareness



Lack of knowledge or awareness of the tramway presence

Lack of care



Failure to pay due attention because of headphones, mobile phones, etc.

A general distracted behaviour, which is a common feature of people walking

Violating rules



People are well aware of the presence of tram, nevertheless take a voluntary decision to violate a traffic rule.

Crossing anywhere or violating red light signals are causes of many accidents.

SAFETY IMPROVEMENTS

OBJECTIVES

Awareness

Rules

Protection

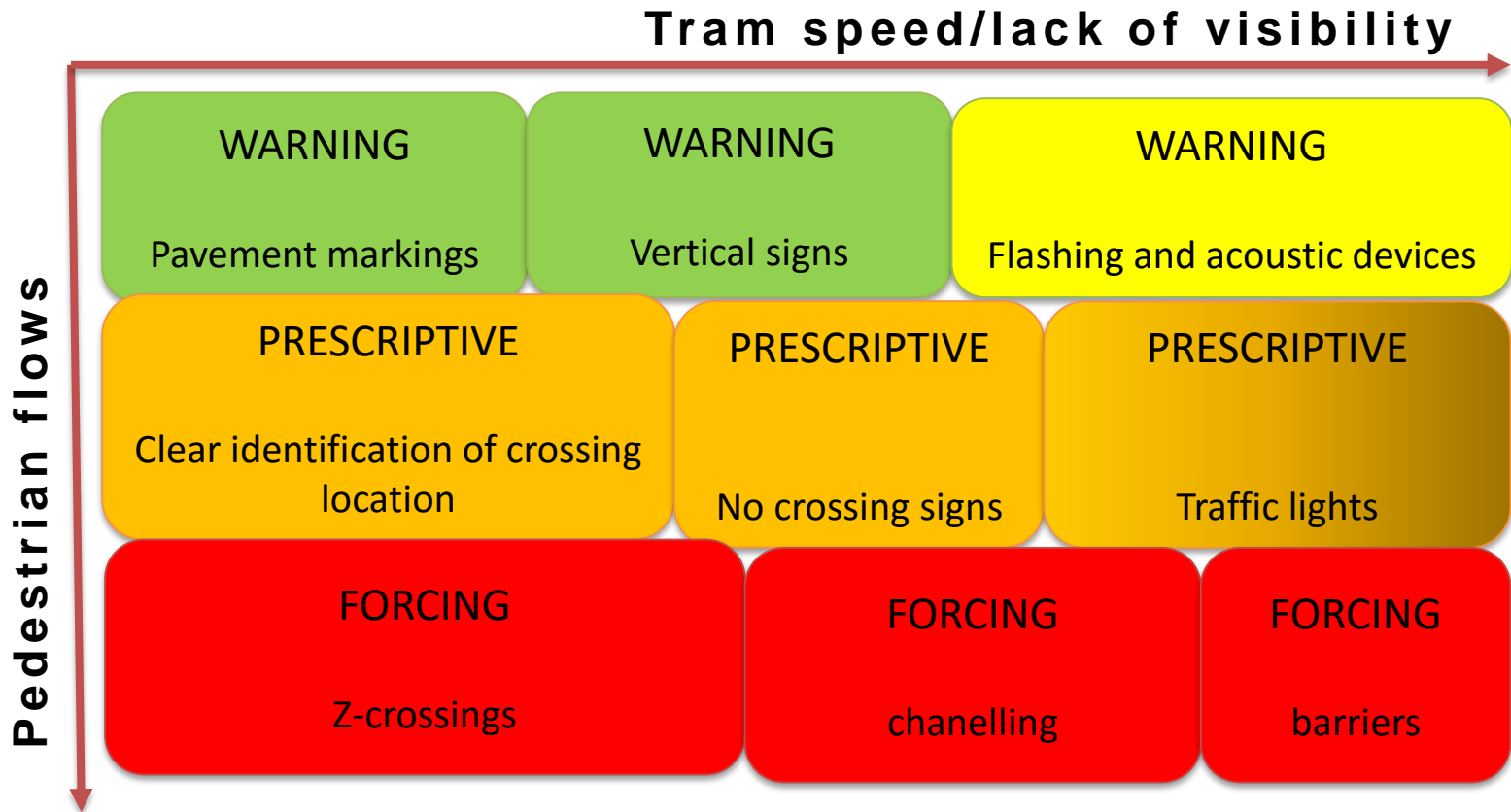
MEASURES

Warning

Prescriptive

Forcing

Crossing Safety Measures



Hazard: Pedestrians not aware of tramway presence

Measures

- Use of passive warning measures:
 - Vertical signs indicating the presence of a tramway.
 - Markings in the pavement, pavement texture and colour differentiation.
 - Tactile warning strips (specific for visually impaired persons).



Hazard: Pedestrians not aware of tramway presence

Pavement texture



Pavement colours and markings



Pavement markings



Pavement colours and signs



warning passive measures

Hazard: Pedestrians not aware of tram approaching

Measures

- Use of:
 - Z-Crossings
 - Channelling barriers



Hazard: Pedestrians not aware of tram approaching

Measures

- Use of active warning measures
 - Flashing lights or signs, acoustic signals.
 - LED pavement lights.
- It is necessary to prove the maintainability of the elements before using this solution.



Hazard: Pedestrians not aware of tram approaching

Measures

- Use of
 - Controlled pedestrian crossing
 - Automatic barriers activated by the approaching tram, used both for cars and pedestrians.
 - Not a frequently used measure, only in special situations when tram speed is very high, there is a high pedestrian activity or a unsolvable lack of visibility



Hazard: Pedestrians crossing tramway everywhere

Measures

- Use of
 - Passive warning and prescriptive measures as listed before to favour people crossing in the designated location.
 - Deterrent pavement in the tramway line, except in the designated crossing.
 - Barriers.



Hazard: Length of the crossing (car and tram lanes)

Measures

- Provide
 - Adequate refuge areas.
 - Channelling barriers.



Hazard: Lack of visibility

Measures

- Remove the visibility obstacles or change the location of the pedestrian crossing, if possible.
- Use operational measures: tram speed, using the tram horn, provide information to tram drivers.



Hazard: Slips & Trips on tram pedestrian crossings

warning passive measures

Measures

- Ensure proper maintenance of the interface between rail and street pavement.
- Avoid the combination of switches and crossings in the same location



SUCCESS STORY: Z-CROSSING

- Many of the 500 pedestrian level crossings in Stuttgart have been designed or rebuilt to the so-called “Z” standard, forcing pedestrians to walk first towards the closest oncoming tram and thus guiding their attention towards the imminent danger.
- The safety element “Visibility/Guidance/Attention” dominates the design pattern of this type of level crossings.





EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY



Thank you for your attention !

Giuseppe Inturri (University of Catania, Italy)

Reddy Morley (Transport Infrastructure Ireland, Dublin, Ireland)

www.tram-urban-safety.eu