COST ACTION TU1103:

OPERATION AND SAFETY OF TRAMWAYS

IN INTERACTION WITH PUBLIC SPACE

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Pedestrian Crossings

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

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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)

- Vienna
- Stuttgart
- Leipzig
- Dusseldorf
- The Hague
- Bremen

Accidents per million veh-km

- tram passenger
- moto
- pedestrian
- bicycle
- car
Accident analysis (2/2)

Repartition of tramway collisions by type of space users involved

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

- **WARNING**
  - Pavement markings
  - Vertical signs
  - Flashing and acoustic devices

- **PRESCRIPTIVE**
  - Clear identification of crossing location
  - No crossing signs
  - Traffic lights

- **FORCING**
  - Z-crossings
  - Chanelling
  - Barriers

**Tram speed/lack of visibility**

**Pedestrian flows**
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 markings
- Pavement colours and markings
- Pavement colours and signs
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.
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

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.
Thank you for your attention!

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