

APPENDIX J

UITP Core Briefs

APPENDIX J.1

Operational Accident Statistics – An Essential
Element of Accident Prevention - 2014

Operational accident statistics

An essential element of accident prevention

Report prepared by the Working Group "Safety" of the UITP Light Rail Committee – 14 January 2014

Introduction

Tram accidents are relatively rare events (0.09 accidents per million p*km vs. 0.4 for cars)¹. Nevertheless, the public is more aware of tram accidents in comparison to accidents with private traffic because of the media coverage. This deteriorates the safety image of trams.

Therefore it is of significant importance to contribute to accident prevention with an integrated holistic approach. It has to encompass the traffic situation and include the configuration of stations and operation facilities, the vehicle's exterior and interior design, the training and education of tram drivers and the behavioural training for certain passenger groups and other road users (car drivers, cyclists and pedestrians). Only such an approach can bring essential insights on accident analysis to better identify accident causes and hot spots.

Within the UITP Light Rail Committee, the Working Group "Safety" focuses on accident data acquisition and accident analysis.

This core brief's objective is to communicate to LRT operators the importance of accident data acquisition and accident analysis for prevention of future accidents. The core brief should serve as a basis to initiate preventive measures for future accident prevention.

¹ LRT, a safe means of transport, UITP Core Brief, Dec; 2009

Acquisition of accident data on site

Accident prevention starts with careful line planning and design, sensible operating rules and appropriate driver training, but the acquisition of accident data on site is also essential to analyse return of experience and improve equipment design and operation practice. This task has to be executed with great accuracy. Every detail can be of crucial importance for subsequent investigations. An error during the acquisition can be hardly withdrawn at a later stage of data analysis.

The conservation of evidence builds the basis for any further legal claims concerning e.g. the clarification of liability and possible insurance claims. In general, the police undertake their sovereign task and also deal with accident data acquisition on site.



Figure 1: Overview of accident scenario and traffic signage, Wiener Linien

In case of light accidents without injuries and clear legal circumstances, data acquisition can be resolved without any involvement of the police, by staff of the operating company. Generally, it helps to minimize the operation disruption and shortens the recovery time of regular operation.

In case of serious accidents with injuries or heavy material damage and an unclear legal situation, the police execute data acquisition e.g. take pictures

of the accident scene, the traffic situation, signage and damage. In this case, accident data acquisition should be executed in close cooperation with employees of the operating company.

Internal accident data acquisition for LRT operators is the task of the operations supervisor. They have the duty to secure and document the exculpatory evidence for the company. This evidence demonstrates that the event was unavoidable for the tram driver. For many operators, the use of template checklists and accident report forms has been proven successful. Further additional documents include clear sketches of the accident scene, testimonies of the driving personnel and witnesses, black box recordings, pictures (survey of accident scenario, damage of vehicle and other details) and - if possible - video recordings.

The screenshot displays the 'Event data' form within the 'ResPublica Workflows' application. The form is organized into several sections. At the top, there's a navigation bar with 'Events > Event information'. Below this, the 'Event data' section is active, showing a tabbed interface with 'Basic data', 'After-effects', and 'Collision'. The 'Basic data' tab is selected, revealing a series of input fields and checkboxes. The 'Event-No.' field contains '53959'. The 'Type of event' section features a row of checkboxes: 'Collision' (checked), 'Emergency braking', 'Pers. accident', 'Derailment', 'Autom. train stop', and 'Others'. Below this, there are fields for 'Reported by' (Driver), 'Type of trip' (scheduled trip), 'Date' (05.06.2013), 'Time' (18:00), 'Transport mode' (tramway), 'Line' (U9), 'Direction' (U9: Hedelfingen -> Botnang (BT)), 'Route/Course' (09/01), 'Vehicle No.' (3053), 'Vehicle type' (DT8. 4-9), 'Staff-No.' (8275), and 'Position' (Hackstraße 7). A 'Comment' field is at the bottom. A 'Cancel' button is located at the very bottom of the form.

Figure 2: Screenshot accident file, "Intergraph" software, Stuttgarter Straßenbahnen

The checklist should show whether the acquired data is complete or not. The accident report forms should include the complete information about the incident, concerning every aspect of the obligation of operation (information,

which is provided during the further procedure to the regulatory authorities or other governmental institutions).

In theoretical and practical training, employees acquire the required abilities to take appropriate measures in case of an accident. Employees in charge have to drill and practice their skills in data acquisition to ensure quality of permanent and structured internal data acquisition. It is necessary to ensure consistent professional execution of data acquisition and data documentation for the operator. Appropriate commitment by the employees is required to avoid conflict between data acquisition and other duties on site (e.g. passenger information, organizing replacement services, driver's support).

Preparation of accident data

To analyse the accident cause and find clarification of the question of liability, all available information (e.g. accident protocol, photos and videos, driver's reports and a survey of the technical systems) has to be compiled in a comprehensive accident file.

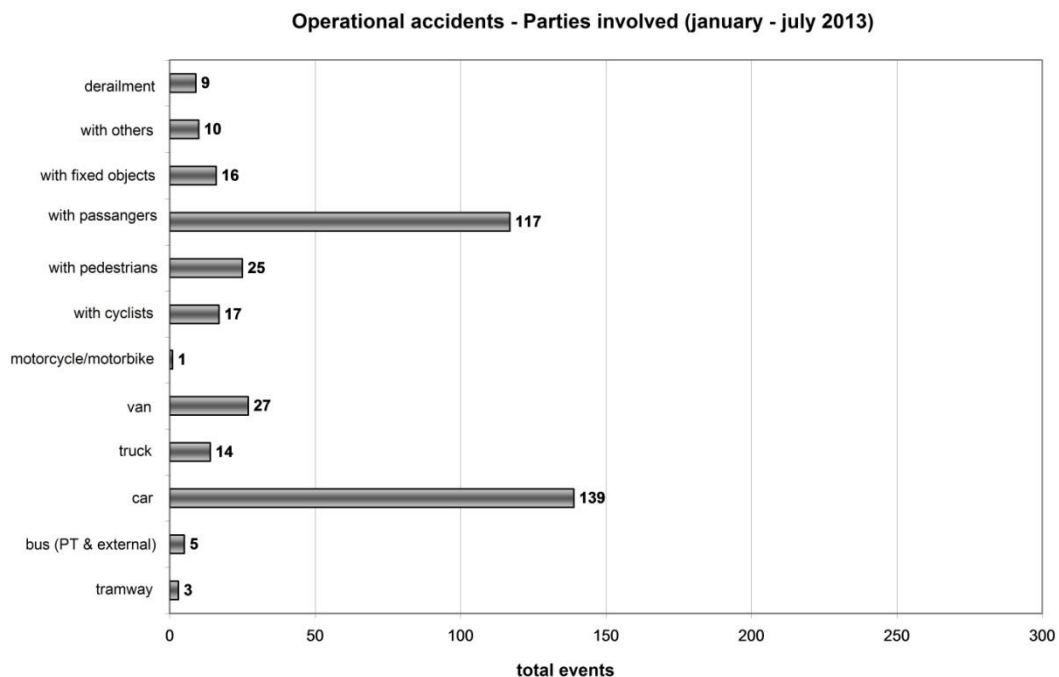


Figure 3: Diagram "parties involved – tram accidents" (January – July 2013), Berliner Verkehrsbetriebe

A qualified evaluation and analysis of an accident is only possible if all facts are available. In addition, the information has to be available as soon as possible after the accident.

Normally, accident data is collected in an IT-supported statistical data base by the operator. The data has to be structured accordingly to the operational needs for evaluation and reporting. The minimum information requires at least data on date, time, characteristic of the location (junction, track's characteristics, spatial situation), involved parties, accident cause, physical injury/fatality, material damage and question of liability. Additionally, it can be useful to acquire further aspects, e.g. line, age and gender of the victim and weather conditions.

Operational accident statistics are an essential requirement to derive preventive measures. Prevention can also be derived from analysis of technical safety related information collected even without the occurrence of an accident. For instance occurrences of emergency braking can help identify hot-spots of hazard or danger that should be particularly scrutinized.

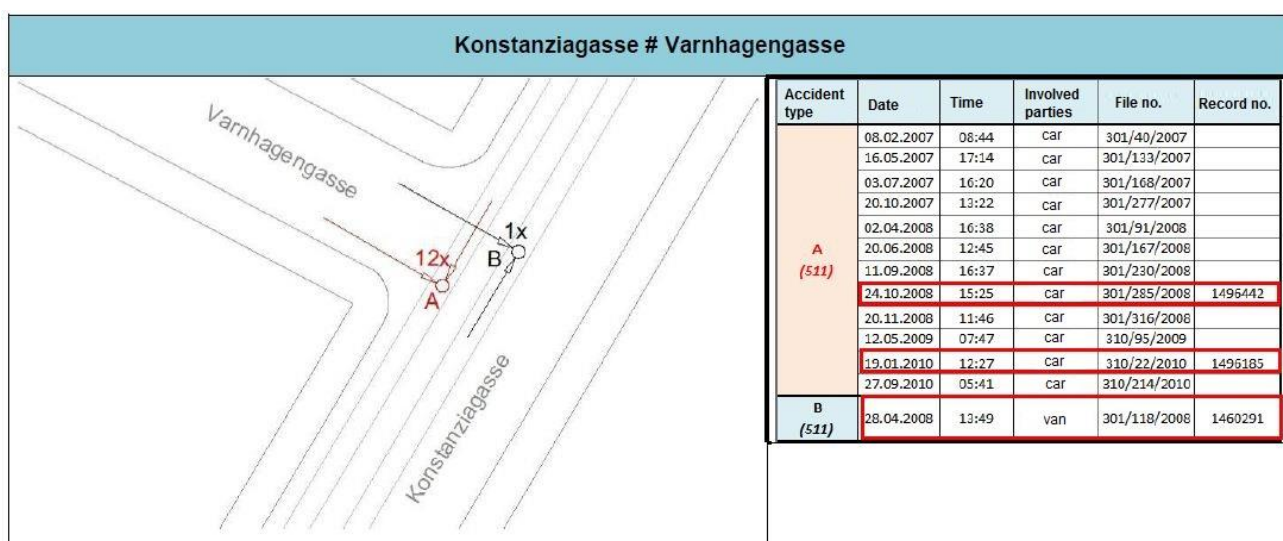


Figure 4: Hot spot analysis: types of car collisions 2006-2010, Epigus/Wiener Linien

Evaluation for accident prevention

Urban road safety is the joint concern of traffic planning, transport authority, police as well as LRT operators. Everybody has a responsibility. Therefore, an internal process has to be implemented which goes beyond the evaluation of single accident events. Furthermore permanent data evaluation covering all aspects is a duty of the company to prevent future accidents. Often this duty

is mandated by legal requirements or contractual obligations. Thereby the main goal is to detect and eliminate circumstances, which generate accidents, through adequate measures.

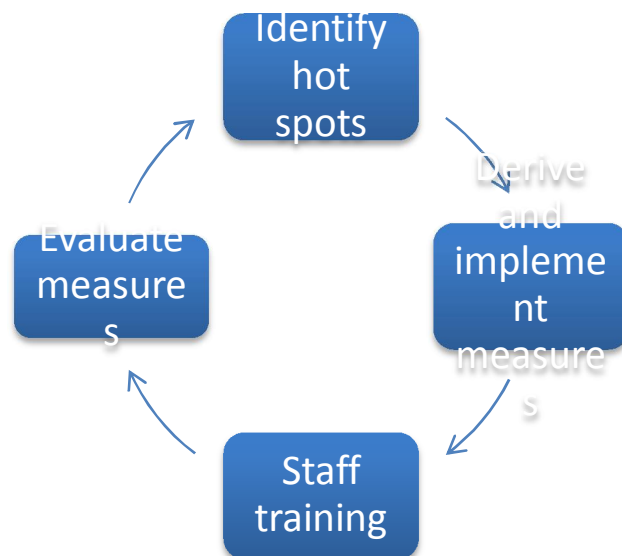


Figure 5: Closed loop for accident prevention

Necessary measures for accident prevention, especially the coordination and implementation, require an intensive and goal-orientated collaboration with third parties (e.g. regulatory authority, administration department).

It is worthwhile to generate operational accident statistics periodically (monthly, quarterly, annually). In any case, it is useful to illustrate the trend of development via a time series (months, years). Conclusions can be drawn directly from them. Maps of accident hot spots, which mark local points of frequent accidents in a city or network map, are well proven in practice. Additionally, diagrams can be arranged clearly to further communicate certain information and aspects about specific focal points.

Tendencies in accident occurrences can already be illustrated with the help of only a few significant indicators. To some extent, certain aspects can be derived from the existing framework of internal evaluation. E.g. the frequency of accidents of different lines, spots, days of the week and time of day can be observed.

Accidents have to be evaluated with the employee involved. In doing so, the determination of a reasonable employee training in the context of follow-up care and follow-up training can increase effectiveness. During periodical driving instructions accident situations have to be shared and discussed with drivers, also in view of finding practical operation improvements. Essential

implications and measures have to be addressed. Identified accident hot spots and accumulations of similar accidents should stand in the centre of attention.

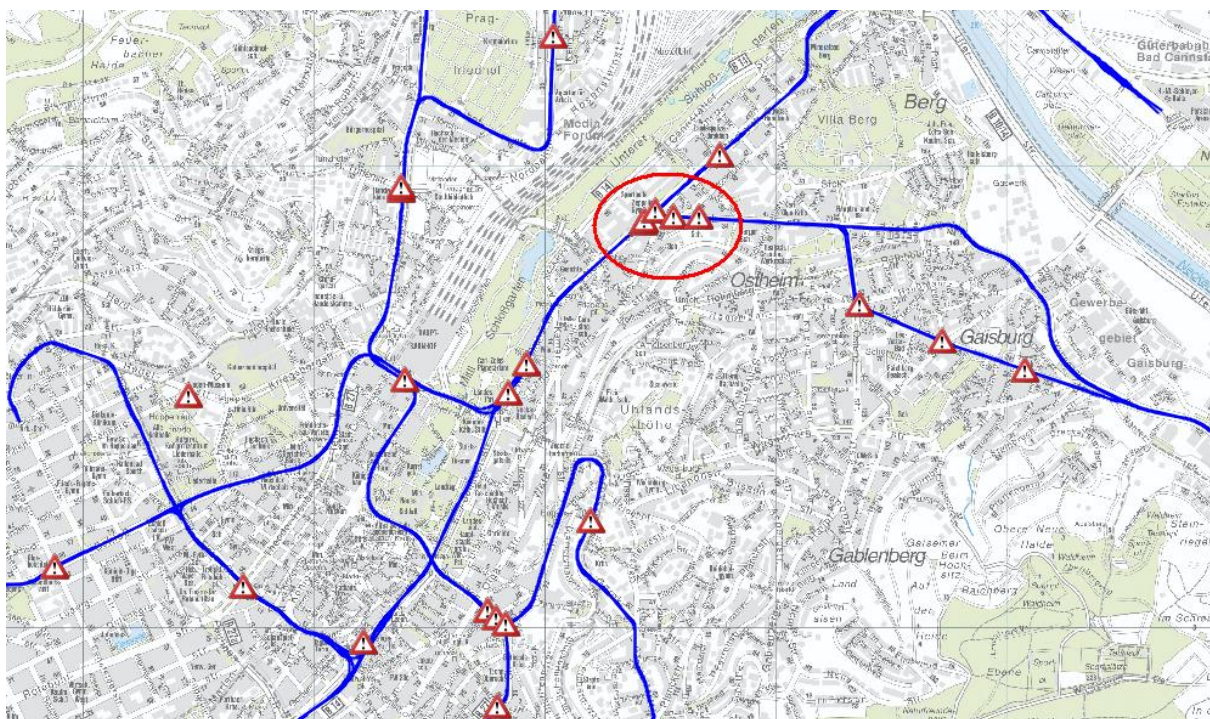


Figure 6: Map of accident hot spots, "Geotrams" software (1:20.000), Stuttgarter Straßenbahnen

The internal and external communication of the topic, "dealing with accidents", is a good possibility to report on the operator's activities of accident prevention. This should not only include internal media (e.g. house journal, IntraNet, bulletin board) but also external media (press and broadcasting media). It has to be stressed that overall, LRT remains a very safe form of transport, and regularly remind the travelling public that in general, road regulation gives priority to light rail vehicles over other types of street users.

Targeted campaigns on transport safety can lead to lasting effects, if they are approved by the general public and aimed directly at specific target groups (e.g. children, elderly persons and people with restricted mobility). "Road safety days", traffic education for children in day-care centres and primary school, poster campaigns and brochures, campaigns located at transport facilities, broadcasting commercials and similar marketing measures promote better mutual understanding.



Figure 7: Awareness raising campaign to promote safety on pedestrian crossings (Engl.: "Prick up your ears, Nico! Join in with your help."), Stuttgarter Straßenbahnen

Recommendations

In case of contractual obligations between several parties concerning LRT operation, interfaces for data acquisition, analysis and derivation of safety measures have to be clearly defined in the contract.

Due to the different characteristics of each network (e.g. length, operating performance, number of passengers or other specific particularities) and the differences in legal environment, the creation of an international benchmark system for LRT accident statistics would be very difficult to put in place; it would require substantial resources, methodology and data collection efforts to deliver marginal safety improvements .

However, it is useful to work together, especially with the police, and exchange information and experiences with other operators from different cities and countries, regarding the improvement of individual safety. Notably safe solutions for different urban configurations should be discussed on an international level. This knowledge can be integrated in the design of new networks and extensions or can be used for the implementation of corrective safety measures.



Summary

Appropriate structure of data acquisition and data preparation is essential to analyse accidents systematically and develop a strategy to prevent accidents in the future.

Accident analysis creates a very useful basis for increasing traffic safety. It can be reinforced by a targeted communication aimed at specific target groups.

It is recommended to discuss the results of accident analyses and exchange experiences from derived and implemented safety measures with other LRT operators.

The effort and work load of a proactive analysis of accident data and future accident prevention shall not be underestimated. Nevertheless, it is an essential task for any LRT operator.

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APPENDIX J.2

Light Rail Transit – A Safe Means of Transport -
2009

DECEMBER 2009

A UITP information sheet

Core Brief

Light Rail Transit – A Safe Means of Transport

IN THE PUBLIC OPINION AND THE MEDIA, ACCIDENTS INVOLVING TRAMS ARE FREQUENTLY REPORTED IN A VERY NEGATIVE WAY FOR TRAMS. THE MAIN REASON BEHIND THIS IS THAT DUE TO THE LIMITED NUMBER OF OCCURRENCES, PUBLIC OPINION TENDS TO REACT MORE EMOTIONALLY.

THE OBJECTIVE OF THIS DOCUMENT IS TO DEMONSTRATE THE OBJECTIVE REALITY OF SAFETY RECORDS OF LRT, BASED ON STATISTICAL DATA FROM A NUMBER OF CITIES.

1. Introduction

As a modern mode of transport, LRT is an essential element in meeting mobility requirements of citizens. In general, LRT – at least partially – shares street space with other modes and users. Older systems run in street operation, sharing the street space with individual transport. Newer systems tend to run on segregated right-of-way tracks.

Conflicts between LRT, cars, bikes and pedestrians are overcome by the use of warning signals or bells, as well as via a number of legal provisions.

LRT boarding stops are designed for an ever-increasing level of safety and in many cities, stops are modernised to offer easier boarding conditions for people with reduced mobility.

2. LRT accidents – part of the overall system

Whatever the measures in place, 'zero accidents' is not a realistic objective. The duty of city planners and LRT operators is to analyse accidents and propose measures to minimise their number and severity. All traffic planning measures related to alignment and rolling stock must be undertaken with a view to reducing the number of accidents and their severity.

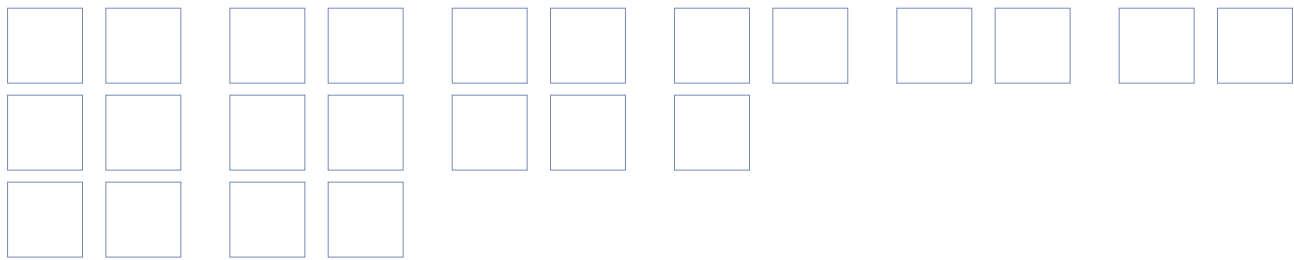
Needless to say, special care must be taken for the specific aspects of LRT as a rail mode.

When decisions are taken about the features of the alignment, the operating speed, as well as the choice of the fleet, an integrated approach including other street users is essential. Of course local conditions and features must also be taken into account.

3. Accident statistics

All operators systematically collect accident statistics. In general, the local police performs this task too. These figures include data about the nature of accidents and their severity, as well as data relating to the places where they occurred.

This data allows for an evaluation of the places and specific situations where accidents tend to occur and can be helpful in deriving improvement measures. Here we must distinguish between operative measures, strictly undertaken on the alignment of the trains, and measures involving the wider street landscape, which require coordination with other stakeholders.



4. UITP Working Group “Safety and Accidents”

In the UITP Light Rail Committee, a Working Group was established which dealt with the question: “How safe is the tram?”. The task of this Working Group was to prove the assumption: “The tram – a safe means of transport” by comparing it with other means of transport.

5. Evaluation of the results

Due to differences in data collection methodologies, not all cities could be retained in the sample.

The following cities were selected: Bremen, The Hague, Düsseldorf, Leipzig, Stuttgart and Vienna. Table 1 gives the route length, patronage, production (train*km) and population for each of these cities.

	Urban data			
	Route length [km]	Patronage [Mio]	Train*km [Million]	Population
Bremen	70	97	7.3	584,000
The Hague	103	90	9.0	700,000
Düsseldorf	146	130	13.6	581,000
Leipzig	148	102	13.1	503,000
Stuttgart	126	124	13.4	593,000
Vienna	227	208	25.0	1,630,000

Table 1

Table 2 indicates the occurrence of accidents involving LRT with other modes (cars, two-wheelers, bikes and pedestrians) as well as passengers falling inside the LRT.

	LRT accidents with									
	Cars		Two-wheelers		Bikes		Pedestrians		Inside falls	
	Number	Per million km	Number	Per million km	Number	Per million km	Number	Per million km	Number	Per million km
Bremen	227	31.1	5	0.7	16	2.2	49	6.7	34	4.7
The Hague	405	45.0	1	0.1	41	4.6	26	2.9	60	6.7
Düsseldorf	292	21.5	0	0.0	8	0.6	29	2.1	92	6.8
Leipzig	338	25.8	1	0.1	11	0.8	20	1.5	12	0.9
Stuttgart	135	10.1	1	0.1	2	0.1	10	0.7	64	4.8
Vienna	1581	63.2	19	0.8	21	0.8	72	2.9	114	4.6

Table 2

Table 3 then describes the severity of the accidents (casualties, total wounded, heavily wounded, and lightly wounded).

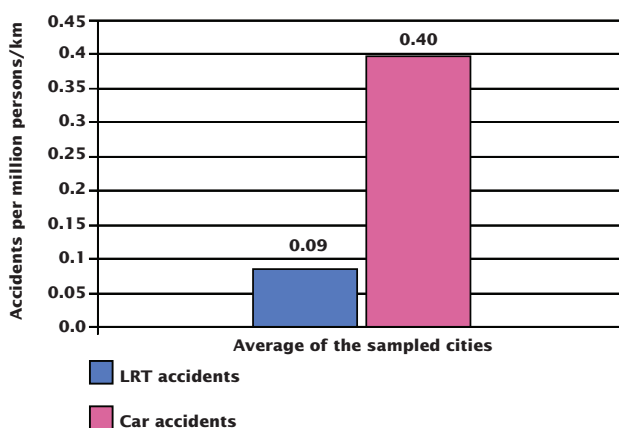
	Severity							
	Casualties		Total wounded		Heavily wounded		Lightly wounded	
	Number	Per million km	Number	Per million km	Number	Per million km	Number	Per million km
Bremen	0	0,0	48	6.6	10	1.4	38	5.2
The Hague	0	0,0	40	4.4	3	0.3	37	4.1
Düsseldorf	3	0,2	166	12.2	15	1.1	151	11.1
Leipzig	1	0,1	48	3.7	9	0.7	39	3.0
Stuttgart	3	0,2	82	6.1	13	1.0	69	5.1
Vienna	8	0,3	268	10.7	-	-	-	-

Table 3

For the public discussion, the crucial factor is accidents with injured persons. Graph 1 summarises the frequency of accidents per passenger/kilometre. We can easily recognise that LRT is a much safer means of transport than the car.

This shows also that the operation of LRT in a city contributes to reducing the number of traffic accidents. Consequently, any modal shift towards more LRT public transport (either through the extension of lines or through the creation of new lines) has a positive impact on the overall safety record of a city.

Graph 1:
LRT accidents compared to car accidents



6. Media and public information

Because accidents involving trams are often spectacular and generate heavy material damage or human toll, they attract the interest of media and are reported with a larger emphasis than they actually deserve. In addition, the majority of such accidents is caused by the bad behaviour of third parties (principally pedestrians or car drivers ignoring traffic lights).

In the local media, however, such accidents are often reported in a wrong perspective with quite dramatic headlines such as: "Tram collides with car" or "Child dragged by tram". If a child is involved in a collision with a car or a truck, the tone is often milder.

For example:

Differences in reporting an accident that happened on 4 March 2009:

- A) "Man runs into a tram – lightly wounded"
- B) "76-Year old man hit by a tram!"



Tram in Leidsestraat, Amsterdam

7. Extensive assessment procedure: “standardised evaluation”

The standardised evaluation of investments into public transport traffic routes offers a macroeconomic cost-benefit analysis of public transport projects, into which all external effects – also macroeconomic ones – of a project are included.

By performing a monetary assessment of damages due to accidents, the macroeconomic effects can be considered, with or without the execution of planned actions. The improvement of overall road safety by building further tramway networks can easily be proven and demonstrated.

This is an information sheet of UITP, the International Association of Public Transport. UITP has over 3,100 members in 90 countries throughout the world and represents the interests of key players in this sector. Its membership includes transport authorities, operators, both private and public, in all modes of collective passenger transport, and the industry. UITP addresses the economic, technical, organisation and management aspects of passenger transport, as well as the development of policy for mobility and public transport world-wide.

8. Further developments of safety topics

In various countries, developments to improve alignment safety, stop safety and train safety are performed separately.

The target is to reach a higher international level of safety for the LRT. The Light Rail Committee of UITP could start a number of activities: providing guidance and recommendations for achieving a higher level of safety (on alignment, stops, trains and operation) to member organisations and to cities that are developing LRT.

9. Summary

Accidents involving LRTs usually do stir the general public's emotions. A wrong perception of LRT as an unsafe system can emerge. Statistics indisputably show that LRT is safer than private cars. A large proportion of accidents with LRT are caused by third parties ignoring or overlooking rules and recommendations. Only in very rare cases are the LRT and/or the tram drivers themselves the causes of accidents.

When LRT is newly introduced in a city, the population has to learn how to behave and live with the new system. Experience shows that accidents are more frequent in the early stages of operation. It must be explained in the public discussion that, with time, the safety advantages will become more apparent. Measures such as information and awareness campaigns can help to convey this message before and after the opening of a new system or a new line.

This Core Brief has been prepared by the UITP Light Rail Committee Working Group “Safety and Accidents”.

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