Economic Commission for Europe

Inland Transport Committee

Working Party on Road Traffic Safety

Group of Experts on Improving Safety at Level Crossings
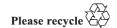
Fourth session
Geneva, 29-30 January 2015
Item 2 (f) of the provisional agenda

Identification of the key causes and possible solutions related to human factors contributing to unsafe conditions at level crossings

Submitted by Austria, German Aerospace Center and Cognito Ltd

This informal document submitted by Austria, German Aerospace Center and Cognito Ltd summarizes the following actions undertaken by the human factors subgroup prior to the fourth session of the Group of Experts:

- an analysis of the questionnaire on human factors at level crossings answered by participating countries of the UN ECE Level Crossing Expert Group;

- the development of a tailored tool for level crossings ('toolbox') by using the model as a theoretical framework; and

- Proposed next steps.

Please recycle

I.   Background

It is a common knowledge – supported by numerous analyses and statistics from all over the world – that almost all - more than 90% - accidents at level crossings are due to motorists and pedestrians incorrectly using level crossings. On the other hand, level crossing accidents are largely perceived as a rail problem by the public and media.

In 2011 the Inland Transport Committee recommended establishing a "Group of Experts of limited duration to work on enhancing safety at level crossings. […] The Expert Group, in general, will aim at bringing together safety specialists from the road and rail sectors so as to better understand the issues at this intermodal interface." (ECE/TRANS/WP.1/2011/6/Rev.1)

The Terms of Reference of the Group of Experts on Safety at Level Crossings states the overall aim of work is to "describe, assess and better understand the safety issues at a road/rail interface as well as to develop a multidisciplinary strategic plan aimed at reducing the risk of death and/or injury at level crossings."

In its first session the Group of Experts decided on the programme of work, where one established subgroup is dedicated to "The identification of the key causes and possible solutions related to human factors contributing to unsafe conditions at level crossings" (ECE/TRANS/WP1/GE.1/2).

Participants of the subgroup are Mr Günter DInhobl, Austrian Federal Railway-Infrastructure Company, Austria, Mr Jan Grippenkoven, German Aerospace Center, Gemany, and Mr. Michael CALE, Cognito Ltd., Israel.

II.   Analysis of the questionnaire on human factors

The questionnaire (issued by the Group of Experts on Improving Safety at Level Crossing in 2014) answered by 22 participating countries identified human factors as an extremely important topic in level crossing safety. Nevertheless, there was no clear consensus about how to approach this topic, what factors were important, how they should be recorded and how enduring changes in road user behavior could be achieved.

It has also to be noted that existing tools and solutions to reduce level crossing accidents are not theory driven, but are based on the 'trial & error'-method. Additionally, these tools and solutions often have a technological focus and do not often consider human factors in an appropriate manner. It was also stated that in many cases education and campaigns on risk awareness and care are not especially dedicated to Level Crossings.

The following section summarizes the replies to the questionnaires as received by mid of September 2014. Altogether 24 replies were available coming from 22 UNECE countries. Not included here are issues on 'survey of technology and technological solutions' (see Section III-e of report of last meeting, see (ECE/TRANS/WP1/GE.1/3).

The main causes behind level crossing accidents were failure and a lack of risk awareness of driver/pedestrians, followed lack of care/distraction. Education and legal issues were named a few times. Two-thirds of the countries which sent replies stated that they had solutions and/or creative and innovative countermeasures to solve these problems; whilst one-third of the countries stated they did not have solutions. Awareness raising campaigns and the removal of level crossings through closure and/or building an over or underpass were often mentioned. It should be noted that the awareness raising campaigns referred to were often general awareness raising campaigns which not only address level crossing issues.

Research studies or papers on human factors relating to the behaviour of road users around level crossings were nearly completely missing – more than three-quarters of the replies of the countries declared that there were no such surveys. This is quite remarkable because human factors are identified as a key factor behind level crossing accidents.

Regarding educational programmes that focus on the awareness of the road users concerning level crossings safety, around two-thirds of the responses declared that no such programmes exist, while most of the positive responses declared that such programmes were included as part of general awareness raising campaigns.

The responses to the question if any action to improve safety at level crossings on the basis of causative human factors had been taken show the following: one third is dedicated to 'no actions taken', one third to 'included into general awareness campaigns', and the remaining one third divided up between different measures to enhance visibility and to strengthen (police) control.

III. Issues

After developing a theoretical framework of accidents at level crossings (LCs), based on a five step model of human information processing which the subgroup developed and presented at the third session of the Expert Group, a significant number of the accident reports provided on the website of ERA, as well as some accident reports from Austria, Belgium, Germany, the European data base and Canada were analyzed. This was done in to the hope of filling a toolbox with countermeasures based on detailed accident descriptions.

It turned out that this was not possible. From the viewpoint of the experts in the human factors subgroup the general impression was that there are massive shortcomings in the analysis and documentation of level crossing accidents in all cases. The focus of the accident reports was often set on examining if the protective elements of the railways were functioning correctly and if the train driver behaved as required. Factors relating to human behavior including errors of road traffic participant were neither analyzed in depth, nor even documented in a way that could enable an expert from the human factors domain to draw conclusions from it or even derive tailored measures to increase the safety in general of or the area around a particular LC. Despite the fact that many, if not most, reported accidents involved dangerous or negligent behavior of other road users, most accident reports concentrated on the formally required task of completion of the report by railway personnel.   In many ways the accident reports provided read more like a formally required document to free train drivers and the railways of any guilt and not a real attempt to understand what led to the disaster and to learn from it in order to prevent future accidents. Therefore it is essential to ask intelligent questions when analyzing accidents, because otherwise one cannot expect to receive useful answers why level crossing accidents happen.

The human factors subgroup feels confident that an in depth human factors analysis of accidents in general and at level crossings in particular can provide insight and comprehension and thus form the necessary groundwork to prevent future accidents.

At the moment it is too early to present our documented attempts of categorizing accidents based on these traditional recordings because of work-in-progress of data analysis. Therefore this document does not deliver great insights, it serves to illustrate the existing shortcomings that customary ways of accident reporting have (which is not the charta of the human factors subgroup).

Finally the human factors subgroup continues to establish an accident categorization schema which will provide a useful level crossings human factors recording toolbox. The main categories of the toolbox are listed in the table below. The toolbox enables authorities

and experts to evaluate level crossings accidents in a more elaborate way that facilitates learning from it.

The human factors subgroup suggests using the level crossings human factors recording toolbox with more than 150 items included which is based on the five function model of human factors presented at the 3rd session of the Expert Group. It is to become a in-depth understanding to improve safety at existing level crossings and also to create a database of affective interventions and preventable dangers. If accidents are categorized in this way, it could be possible to come up with a proactive toolbox that is based on sound data in the future.

1	Attention	Is there evidence of cell phone use or SMS? Were there small children in the car? Was there something visually tempting in the surroundings?
2	Perception	How far ahead can you recognize the LC. Was there fog or overgrowth disturbing? Were the windshields dirty? Were opposing vehicles blinding the driver?
3	Cognition	Is the driver familiar or used to such level crossings ? Do average drivers comprehend the setting including speed requirements and looking out for indications of danger ?
4.	Motivation	Was the driver under time or social pressure? What driving norms are standard in the area around the level crossing and social class? Are there signs of depression?
5.	Performance	When as the driver trained re level crossings. Did he overtake traffic build up on the rails? Did driver try to get in in the last second and overestimate his control of the situation?

The subgroup wishes to emphasize the fact that currently available tools were not, are not and will not be able to analyze level crossings -accident related information and to offer improved and safer solutions for the future. It is recommended to continue the development of the above suggested level crossings -human factors recording toolbox by testing it and analyzing an initial number of accidents with it.
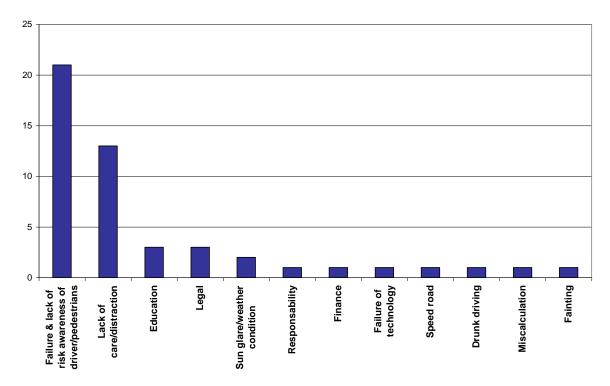
IV. Proposed next steps

(a)   The subgroup has decided to continue the development of the above suggested LC-human factors recording toolbox by first testing with a limited number of accidents.

(b)   formulate a final report of the human factors subgroup, including suggestion(s) for further work/research (see also the proposed next step)

(c)   The human factors subgroup requires one or more strong partners (e.g. railway authorities, railway companies, accident investigation bodies) with whose logistical, administrative and if necessary, financial assistance the level crossings -human factors recording toolbox will be validated. It is recommended to establish a research project to do this, where members of the subgroup will actually go to the sites of accidents which occurred in the past two months, prepare a human factors accident causation report and evaluate the efficiency of the new level crossings -human factors recording toolbox and refine it if necessary.
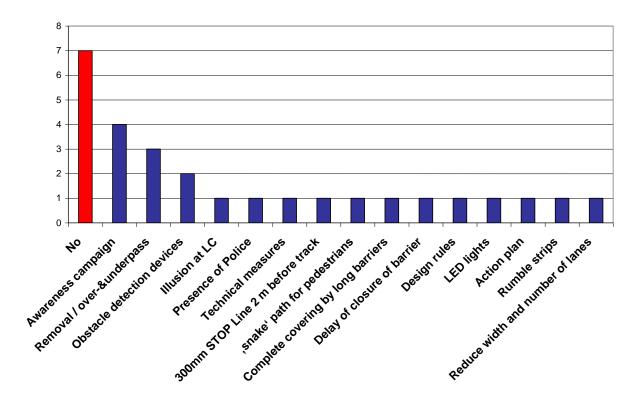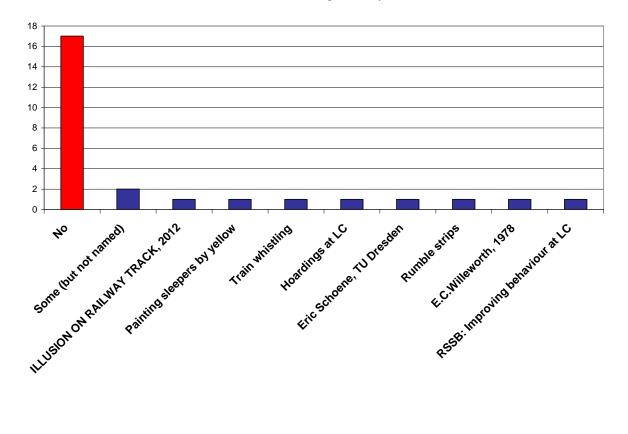
Annex

A: Questionnaire responses

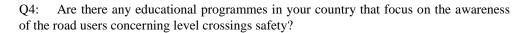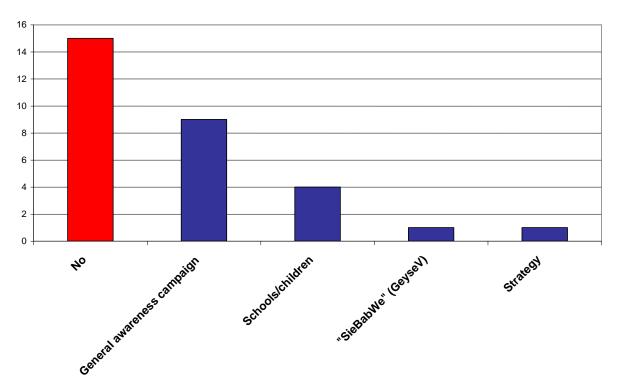Q1: What are the three main causes behind level crossing accidents in your country?

Q2: Does your country have any solutions and/or creative and innovative countermeasures to solve these problems?
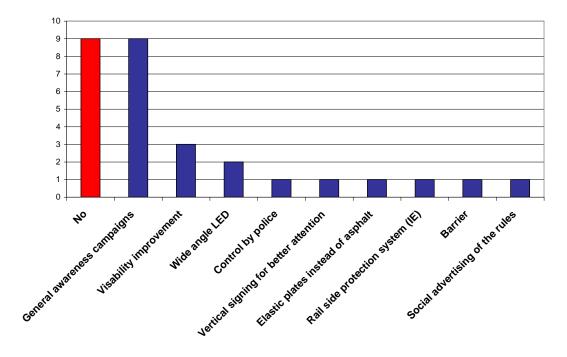
Q3:	Do you have any research studies or papers on human factors relating to the behaviour of road users around level crossings which you could share?

Q4:   Are there any educational programmes in your country that focus on the awareness of the road users concerning level crossings safety?

Q5:   Referring to the list of human factors at the start of this section E, has your country taken any action to improve safety at level crossings on the basis of these causative factors?

B: List of studies

- Finalmile Consulting Ltd. (India): LC on Zonal Railway (Central Railway), 2010

- Illusion on railway track (presented at GLXS- 2012 at London, 2nd global meet and ILCAD-2013 at UNECE Geneva, WP-1 meet at New Delhi in December, 2013)

- Painting of sleepers by yellow in approach of level crossing

- Intermittent pattern of train whistling

- Placing hoardings of dying man on level crossing

- URL:*http://2013.wsmconference.co.uk/downloads/wsm_presentations/monday/Biju%20Dominic%20-%20Neuroscience%20based%20approach%20to%20safety.pdf*, 8.1.2015

- URL: *http://forbesindia.com/article/work-in-progress/how-unmanned-level-crossings-spell-danger/34303/0*, 8.1.2015

- **Dr Eric Schöne, TU Dresden: list of resaerch studies see URL:** *http://tu-dresden.de/Members/eric.schoene/veroeffentlichungen*, 9.1.2015, in german

- **E.C. Wigglesworth: Human factors in level crossing accidents, in: Accident Analysis & Prevention, Volume 10, Issue 3, Pages 229-240**

Abstract:

Eighty percent of the fatalities at road-rail crossings in Victoria between 1969 and 1974 occurred either at crossings protected by flashing lights in major urban areas, or at "open" crossings (i.e. protected only by signs and with no form of active device) in rural areas. This paper is principally devoted to an examination of the (different) human factors thought to be associated with accidents at these two types of crossing. In the first category, the stimulus afforded by twin alternating flashing lights is deemed inadequate for many road vehicle drivers, already overloaded by the complexities of the major urban road traffic systems. In the second category, the absence of advance warning signs on one or more approach roads to the majority of crossings surveyed in a rural field study is thought significant. Moreover, at crossings where advance warning signs are provided, the one most frequently in use (the Railway Crossing Warning Assembly) is deemed inappropriate as it permits ambiguous interpretation and does not stimulate the desired response. see URL: http://www.sciencedirect.com/science/journal/00014575/10/3#

- RSSB: Improving road user and pedestrian behaviour at level crossings, see URL: *http://www.rssb.co.uk/research-development-and-innovation/research-and-development/research-project-catalogue/t335*, 8.1.2015

- **RSSB – general list of documents and research on LC**: see URL http://www.rssb.co.uk/pages/search-results.aspx?k=level crossing#Default=%7B%22k%22%3A%22level%20crossing%22%2C%22r%22%3A%5B%7B%22n%22%3A%22SPContentType%22%2C%22t%22%3A%5B%22%5C%22%C7%82%C7%825265736561726 3682050726f6a656374%5C%22%22%2C%22%5C%22%C7%82%C7%8252657365617263 6820507562 6c69636174696f6e%5C%22%22%2C%22%5C%22%C7%82%C7%8252737362446f63756d656e74%5C %22%22%5D%2C%22o%22%3A%22OR%22%2C%22k%22%3Afalse%2C%22m%22%3A%7B%22% 5C%22%C7%82%C7%825265736561726368205072 6f6a656374%5C%22%22%3A%22Research%20Pr oject%22%2C%22%5C%22%C7%82%C7%8252657365617263682050756c69636174696f6e%5C%2 2%22%3A%22Research%20Publication%22%2C%22%5C%22%C7%82%C7%8252737362446f63756d 656e74%5C%22%22%3A%22RssbDocument%22%7D%7D%5D%7D, 8.1.2015

- **KfV (Ed.): MANEUVER. Entwicklung von Maßnahmen zur** Vermeidung von Fehlverhalten an Eisenbahnkreuzungen mit Hilfe von Verkehrspsychologie, Vienna 2013; Abstract (english): URL: *http://www2.ffg.at/verkehr/projektpdf.php?id=909&lang=en*, 9.1.2015; Full study (german):URL: *http://www2.ffg.at/verkehr/file.php?id=518*, 9.1.2015

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