SAFER LEVEL CROSSING BY INTEGRATING AND OPTIMIZING ROAD-RAIL INFRASTRUCTURE MANAGEMENT AND DESIGN

LCs in Europe and beyond: Rail and road safety management requirements

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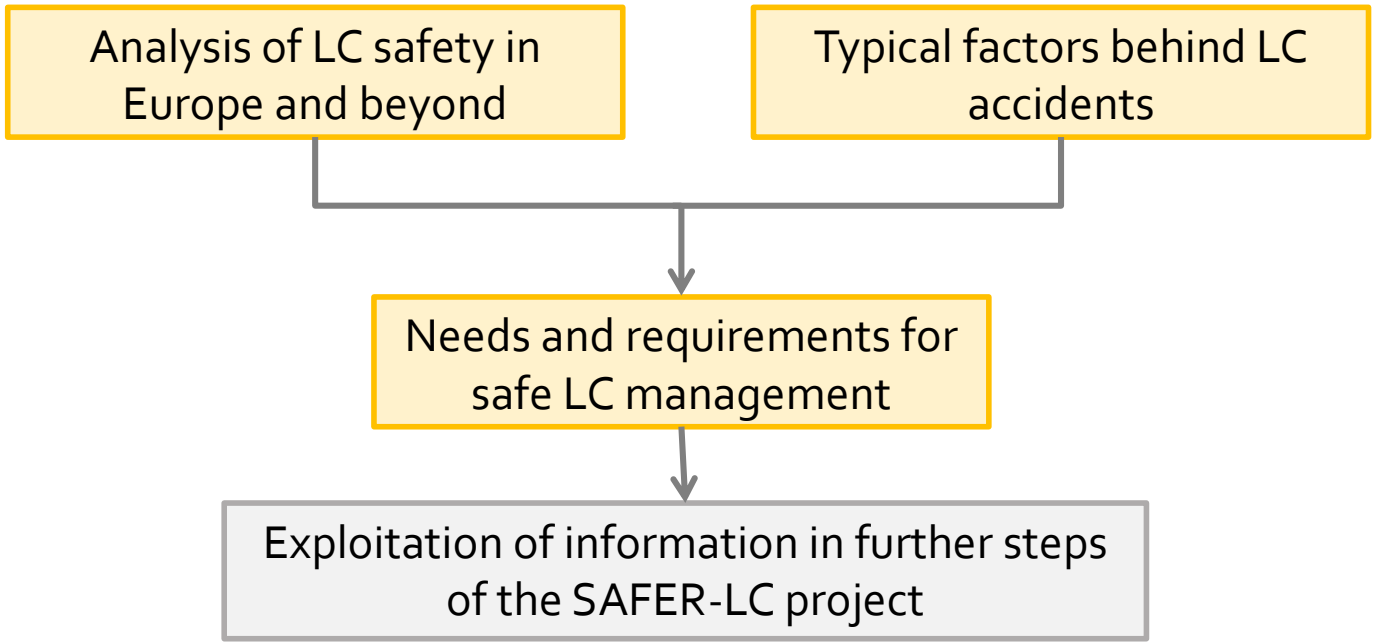
Overall objective

- To collect and produce information
  - To identify needs and requirements for improving level crossing (LC) safety
  - To define selected scenarios to be tested and evaluated



Analysis of LC safety in Europe and beyond

- Objective: To identify differences in LC environments
- Method
  - A questionnaire (*Country Information Collection Form*) designed to collect information on different aspects of LC safety
  - Data collection: project partners and UIC collaborators
- Information was received from twenty-four countries
  - Partner countries (n=8): Belgium, Finland, France, Greece, Italy, Norway, Spain, Turkey
  - Other European countries (n=15): Albania, Austria, Ireland, Latvia, Lithuania, Macedonia, Montenegro, Netherlands, Romania, Russia, Serbia, Slovak Republic, Sweden, Switzerland, United Kingdom
  - Beyond (n=1): Canada

Main results (1/2)

- LC safety arrangements: Do not differ greatly; a common trend to increase active (automatic) forms of protection
- Decisions are made based on a combined set of criteria: Volume of road and rail traffic, and maximum train speed; Local circumstances
- Additional safety arrangement: Physical and technological measures with cameras, rubber panels and warning lights; Public awareness and educational measures
- LC safety policy: LC removal as primary policy, followed by improved protection

Main results (2/2)

- LC legislation: A greater level of harmonisation with road side rules than those applied specifically to the operation and management of LCs
- Division of responsibilities: Main responsibility is held by the rail infrastructure manager; Need to balance the interest of different parties involved
- User requirements: Strong focus on education and awareness raising actions; Research-based action
- Best practices on LC safety: Twenty case studies and/or project results were reported

Typical factors behind LC accidents

- Objective: To produce an in-depth review of LC accident data
- Method
  - The review covered railway accident databases from seven countries, namely Greece, Finland, France, Italy, Norway, Spain and Turkey
  - The involved partners were responsible for collecting the data from relevant sources in their country
  - The main data sources were accident investigation reports from railway operators and national accident investigation bodies

Available variables by country

x = Available,

(x) = Available only in few cases

NA = Not available

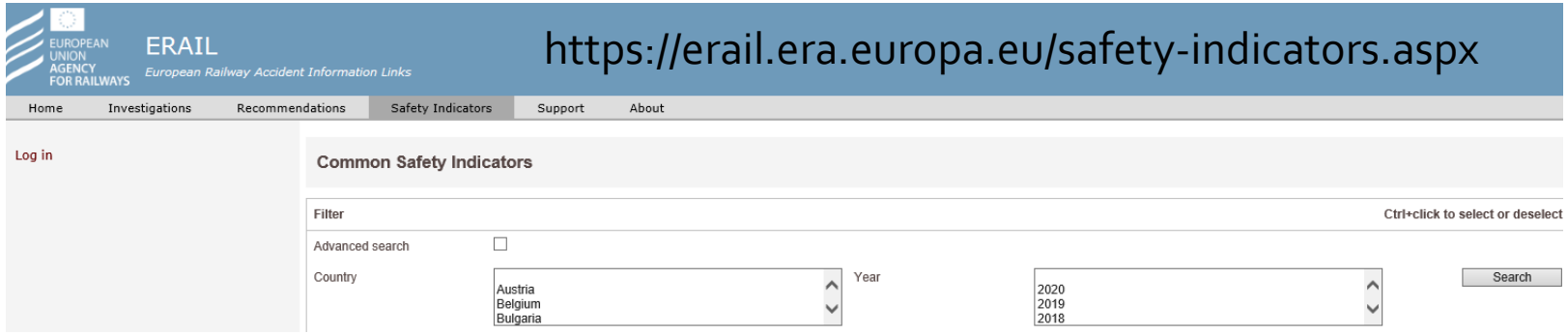
Title	Variable	Country						
		Greece	Finland	France	Italy	Norway	Spain	Turkey
Collision	Outcome	X	X	X	X	X	X	X
	Type of road vehicle	X	X	X	X	X	X	X
	Month	X	X	X	X	X	X	X
	Day of the week	X	X	X	X	X	X	X
	Hour	X	X	X	X	X	X	X
	Year	X	X	X	X	X	X	X
Victim	Type of victim	X	X	X	X	X	X	X
	Type of road user	X	X	X	X	NA	NA	X
	Outcome	X	X	X	X	X	NA	X
	Gender	(X)	X	X	(X)	NA	NA	X
	Age	NA	X	X	X	NA	NA	X
	Intentionality	(X)	X	NA	X	X	NA	X
	Involvement in secondary tasks	NA	X	NA	X	NA	NA	X
	Intoxication	(X)	X	(X)	(X)	NA	NA	(X)
Road environment	Road traffic volume (AADT)	X	X	X	X	X	NA	X
	Type of road	X	X	X	X	X	X	X
	Road speed limit	X	X	X	X	X	NA	X
	Number of lanes per direction	X	X	NA	X	X	NA	X
	Type or road surface	X	X	NA	X	X	X	X
	Existence of level crossing sign before LC	X	X	NA	X	X	(X)	X
	Inclination	X	X	NA	X	X	NA	X
	Crossing angle (between road and track)	X	X	X	X	X	NA	X
Railway environment	Daily train volume (passenger + freight)	X	X	X	X	X	X	X
	Speed limit for person trains (km/h)	X	X	X	X	X	NA	X
	Speed limit for freight trains (km/h)	X	X	X	X	X	NA	X
	Condition of wait platform	X	X	NA	X	NA	X	X
	Number of tracks	X	X	X	X	X	X	X
LC characteristics	Type of LC	X	X	X	X	X	X	X
	Location of LC	X	NA	X	X	X	X	X
	Sight distances (from the road)	NA	X	NA	X	X	NA	X
Circumstances	Weather	(X)	X	(X)	X	NA	NA	X
	Lighting conditions	(X)	X	NA	X	NA	NA	X
Train	Train	X	NA	NA	X	X	(X)	X
Effect	Delay (number of minutes)	(X)	NA	NA	X	NA	NA	X
	Delay (number of trains cancelled)	NA	NA	NA	NA	NA	NA	X
	Costs (euros)	NA	NA	NA	X	NA	NA	X
Main factors affecting the accident		X	NA	X	X	X	NA	X

Main findings – LC accidents

- Fairly evenly distributed throughout the year and all days of the week
- Victims: usually car drivers or pedestrians, and typically local inhabitants
- A large share occurred in areas where the road speed limit was rather low
- Some main factors contributing to LC accidents were breakdown of the car at the LC, car violating the barriers, non-observation of road signage, distraction, and limited visibility due to glare from the sun
- Analysis highlighted the differences between railway environments
  - High share of LC accidents at active LCs in Italy (92%), France (86%) and Greece (73%)
  - France: 24% of accidents occur at LCs where road traffic volume is higher than 5 000 road vehicles per day

Conclusions

- The coverage of victim details varied between countries and in several cases they are missing
- The exploitation of in-depth LC accident data is not possible if the data is not available to the interested organisations
- The yearly number of fatalities and serious injuries did not perfectly match with the number of cases reported to the ERA database



Needs and requirements for safe LC management

- Objective: To produce a list of needs and requirements which should be satisfied by LCs both during normal operations and degraded modes
- Method
  - Literature review
  - In-depth interviews with experts
  - Workshop on end-user requirements. Around 40 questionnaires were collected.

Main findings

- Legal, organizational and technical requirements: International cooperation; Need of a harmonized accident database
- Identified risks
  - Human factors: distraction, inattentiveness, speeding, rule violation
  - LC: location, profile, visibility
  - Railway operation: vehicle stuck, long closure time, failures
- Innovative solutions: Inform road users, risk monitoring, object recognition, predictive maintenance
- List of scenarios to be further developed later in the project

Main outputs

- Information on LC safety in different countries
- More insights into LC accidents, and risks at LCs
- Information on best practices, and (innovative) safety solutions

- Input for further development of scenarios
- Input for the estimation of safety potential of piloted measures

Main reports

- Reports are online at https://safer-lc.eu/
  - D1.1: Analysis of level crossing safety in Europe and beyond
  - D1.2: Level crossing accidents and factors behind them
  - D1.3: Needs and requirements for improving level crossing safety

Main contacts

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- Anne Silla, VTT : anne.silla@vtt.fi for "Typical factors behind LC accidents"
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Thank you for your attention!