



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

SAFER-LC WORKSHOP 1 on end-user's requirements, 28th September 2017

WP1 - Task 1.1: Analysis of Level
Crossing Safety in Europe and beyond

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CONTENTS

▲ TASK 1.1 Background information

- ▲ Objective and rationale

- ▲ Methodology

▲ Lessons learnt in level crossing safety

- ▲ Facilitating factors and barriers to level crossing safety

▲ Experiences and best practice regarding level crossing safety

▲ Debate

Task 1.1: Analysis of LC safety in Europe and beyond (M1-M5). Ongoing

▲ **Participants:** FFE (leader); CEREMA; CERTH-HIT; INTADER; NTNU; SNCF; TRAINOSE; UNIROMA3; VTT; UIC; IRU; IFSTTAR.

▲ **Objectives:**

Identify the differences in LC environments between countries, in relation to the following aspects:

- LC legislation in selected countries.
- Division of responsibilities between stakeholders involved in safety at LC in selected countries.
- User requirements for safe access and use of LC in selected countries.
- Safety Arrangements (organizational and procedural; physical and technological; public awareness and educational; others)
- Examples of good practice and innovations related to LC safety arrangements.

▲ **Rationale:**

Create a knowledge base that will allow the proposal of security solutions at LC, focused on human processes and aimed at better coordination and cooperation between the managers of transport different modes. Contribution to Task 1.3.

▲ **Deliverable 1.1.** Analysis of LC safety in Europe and beyond.



Methodology

▲ SOURCE OF FUNDAMENTAL INFORMATION:

COUNTRY INFORMATION COLLECTION FORM

▲ Designed to obtain information related to:

1. **General Information**; LC and safety arrangements in different European and beyond countries.
2. **Legal Aspects of LC** (adherence or difference of countries to international legal regulations and regional variations).
3. **Division of Responsibilities between the Stakeholders Involved** (design, operation, management and enforcement of safety and the level of cooperation)
4. **User Requirements** at LC taking into account the different user groups, especially vulnerable users.
5. **Lessons Learnt** Regarding Safety at LC, specifically in factors related to the implementation of safety measures at LC.
6. **Experiences and Best Practice** Regarding LC Safety: project results, case studies and technological developments on LC safety arrangements.

Aspects
addressed
in current
Workshop

Methodology

▲ GEOGRAPHIC SCOPE OF STUDY: 20 countries

Partner countries

- Belgium
- Finland
- France
- Greece
- Italy
- Norway
- Spain
- Turkey

Other European countries

- Austria
- Ireland
- Latvia
- Lithuania
- Netherlands
- Romania
- Russia
- Slovak Republic
- Sweden
- Switzerland
- United Kingdom

Country beyond

- Canada

Methodology

▲ RESPONSE RATE

BY COUNTRY

- 40% (8 countries) answered 100% of the questions: AT, FI, FR, IE, LI, ES, CH and TR.
- 50% (10 countries) answered 91% of the questions: BE, CA, GR, IT, LV, NO, RO, SK, SE and the GB.
- RU: 86%.
- ND: 82%.

BY QUESTION

- *General Information: 99.2%.*
- *Legal Aspects: 83.6%.*
- *Division of Responsibilities between the Stakeholders: 100%.*
- *User Requirements: 83.6%.*
- *Lessons Learnt: 100%.*
- *Experiences and Best Practice: 42.5%*.*

* Countries that reported more than one experience and best practice: Austria (2), Finland (4), France (2) and Ireland (5).

Lessons learnt regarding level crossing safety

- ▲ Factors that **facilitate** the successful implementation of safety at level crossings.
- ▲ Factors that act as **barriers** to improving level crossing safety.



FACTORS FACILITATING LEVEL CROSSING SAFETY

Strategic

- Cross-agency working
- Political backing and investment
- Evidence based decision making
- Setting ambitious safety targets

Operational

- Investment in level crossing protection
- Investment in level crossing removal
- Effective programme of maintenance
- System to report crossing failures

Educational

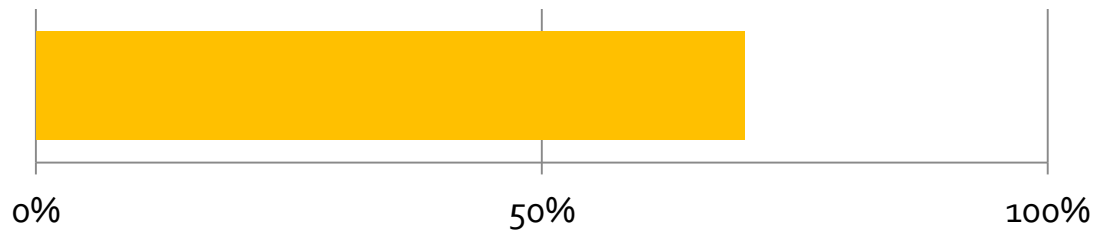
- Information and education

Enforcement

- Sanctioning level crossing misuse

STRATEGIC FACTORS: **Cross agency working**

70% of countries cited cross-agency working



Countries TR; AT; UK; NO; SE; FI; IE; CH; LV; SK; RO; EL; CA; BE.

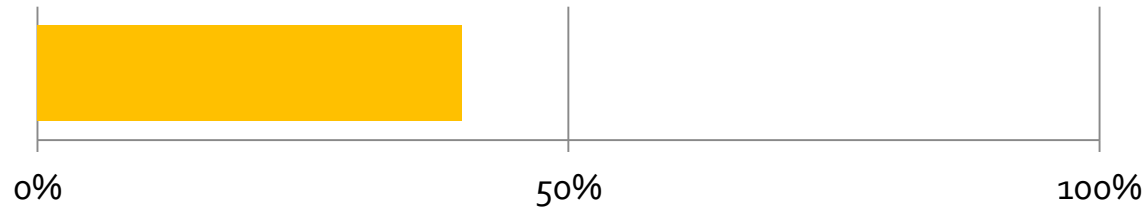
- ▲ Emphasis on **road and rail** collaboration.
- ▲ Clear **division of roles and responsibilities**.
- ▲ **Tools** to support **cross sector participation**: regular cross agency meetings; protocols for joint decision making, costs and responsibilities.
- ▲ Added value of **political and legal backing** in support of multi agency approach.



STRATEGIC FACTORS: **Political backing and investment**

40% of countries cited political backing and investment

Countries ND; UK; NO; IE; LV; RO; EL; FR

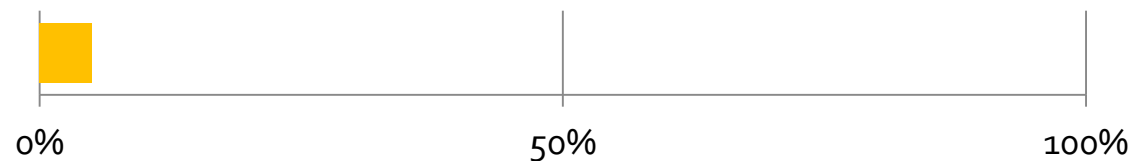


▲ Cross-cutting factor that **underpins all level crossing safety actions** in terms of both **funding** as well as support of **processes and operational issues** related to level crossing safety (e.g. division of stakeholder roles and responsibilities as established by law).

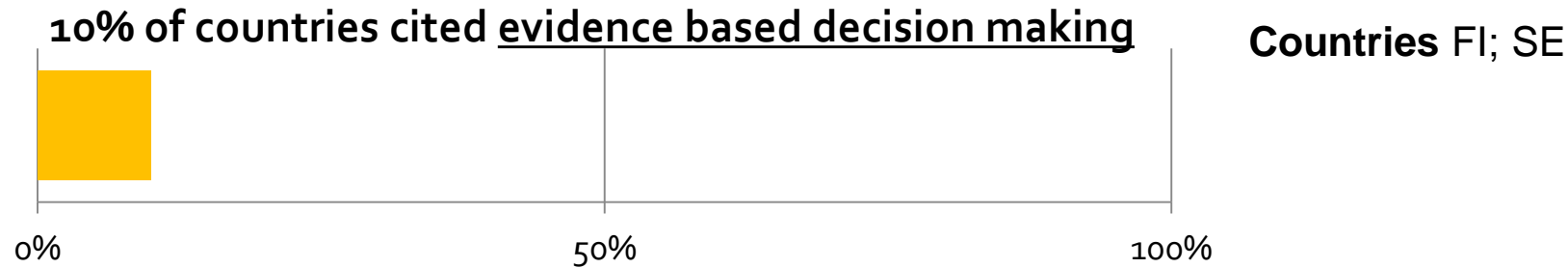
STRATEGIC FACTORS: **Ambitious safety targets: Vision zero**

5% of countries cite setting ambitious safety targets

Country: ND



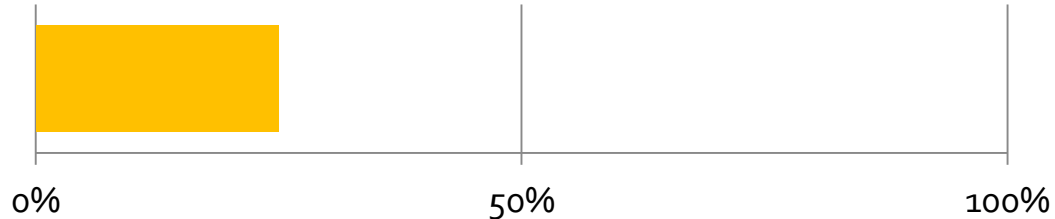
STRATEGIC FACTORS: Evidence based decision making



- ▲ Systematic monitoring activities: Level crossing safety database and inventory; dedicated level crossing e-mail box managed by group of experts; open weekly meetings to discuss level crossing issues with regional stakeholders.
- ▲ Integrated and systematic approach to addressing level crossing safety and budget decisions, taking into consideration different factors: infrastructure and operation; legislation; and human behaviour.

OPERATIONAL FACTORS: Investment in LC protection

25% of countries cite investment in LC protection

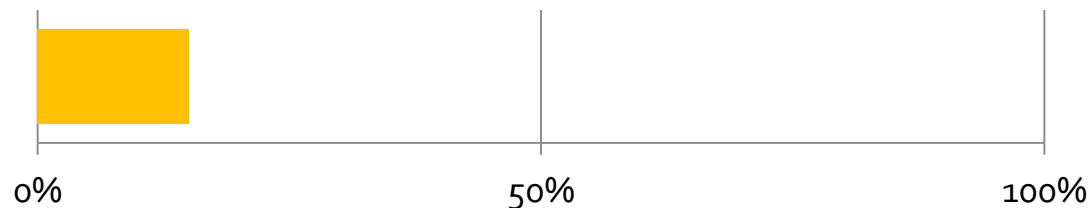


Countries ES; RU; ND; LT; IT

- ▲ Expand coverage of protection systems: upgrading unprotected crossings (equipping all level crossings with primary means of technical protection).
- ▲ Setting realistic targets for level crossing protection (not highest protection on all LCs).

OPERATIONAL FACTORS: Investment in LC removal

15% of countries cite investment in LC removal

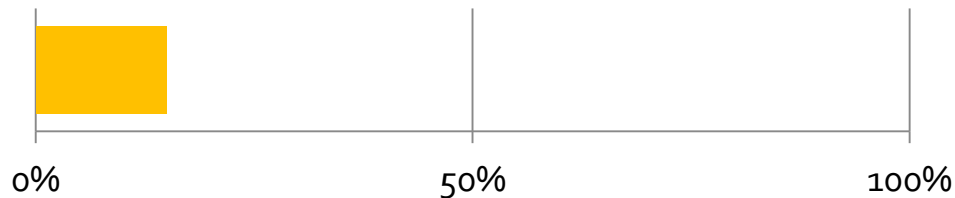


Countries ES; RU; ND

- ▲ Investing in grade separated crossings.
- ▲ Different removal philosophies: ambitious safety targets (long-term zero LC) versus realistic targets (no zero level crossing policy).

OPERATIONAL FACTORS: Investment in maintenance

15% of countries cite investment in maintenance

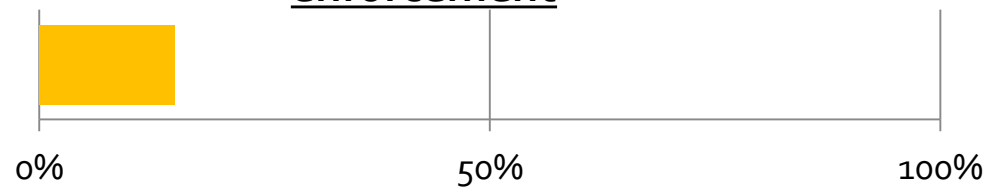


Countries NO; CA; IT

- ▲ Effective programme of maintenance.
- ▲ System to report crossing failures.

OPERATIONAL FACTORS: Education and enforcement

15% of countries cite education and enforcement



Countries IT; RU; FR

- ▲ Sanctioning level crossing misuse: penalization of road users for misuse in order to incentive correct use.
- ▲ Information and safety education.

BARRIERS TO LEVEL CROSSING SAFETY

Strategic

- Securing political acceptance and public investment
- Lack of cross-agency working

Operational

- Cost and complexity of LC removal and upgrade process
- Limitations of current protection arrangements
- Meeting maintenance requirements

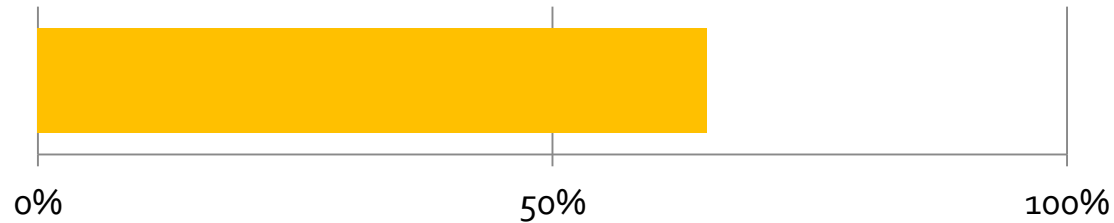
Human factors

- Gaining public acceptance
- Level crossing misuse
- Lack of public awareness around safety

STRATEGIC FACTORS: **Political acceptance and public investment**

**65% of countries cite political acceptance
and public investment**

Countries: ES; TR; UK; LT; CH; LV; BE;
RO; EL; CA; SE; FI; SK

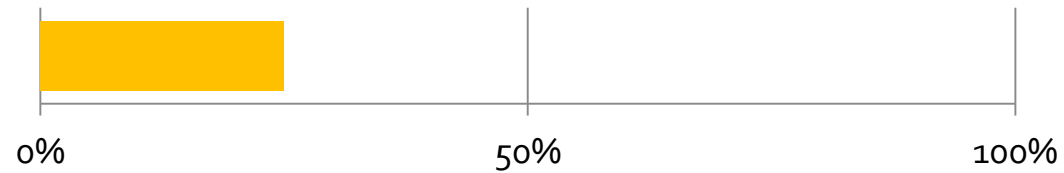


- ▲ Political will and interest impact public investment priorities and allocation of funding to support LC safety.
- ▲ Limited resources and budgetary restrictions.
- ▲ Capturing public appeal.
- ▲ Lack of coordination and overview from the government to ensure safety standards.

STRATEGIC FACTORS: **Cross agency working and collaboration**

Countries: LV; SK; BE; RO; UK.

25% of countries cite cross agency working

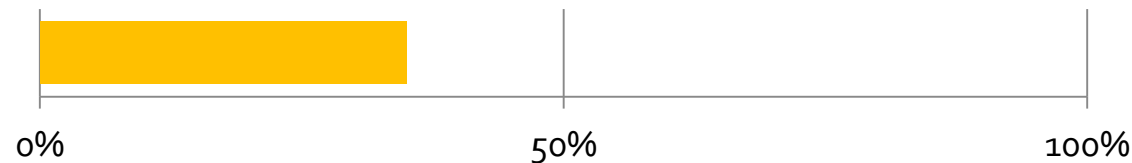


- ▲ Lack of collaboration and coordination between rail (IM), road (IM), road police and local authorities: impacts planning of road repairs, LC construction and implementation of technical roadside protection measures.
- ▲ Differing priorities between rail, road and local authorities: road versus rail perception of level crossing safety problem.
- ▲ Division of roles and responsibilities: more equitable share of responsibility between rail, road and local authorities, including financial commitment from roads and local authorities towards protection and maintenance costs.
- ▲ Lack government coordination and overview.

OPERATIONAL FACTORS: **Cost and complexity of level crossing removal and upgrade process**

Countries: AT; IE; IT; SE; SK; BE; TK.

35% of countries cite cost and complexity of LC removal and upgrade process

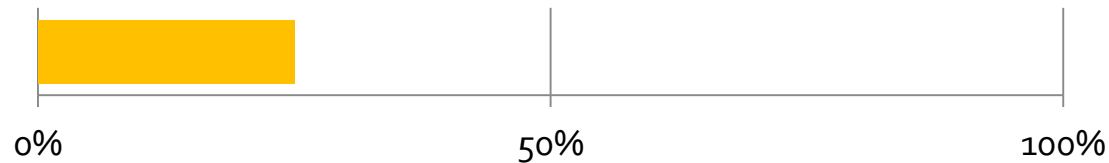


- ▲ High costs involved in removing LCs and constructing grade separated crossings.
- ▲ Long and complex (planning) process: reaching multilateral agreements and obtaining the consent of interested parties and planning permission to remove or upgrade level crossings, legal requirement and restrictions.
- ▲ Technical complexity.
- ▲ Construction related issues: problems with construction plans, disregard of planning approvals leading to unauthorized constructions and failure to comply with building conditions leading to potential LC safety issues.

OPERATIONAL FACTORS: **Limitations of current protection arrangements**

25% of countries cite limitations of protection

Countries: ES; RU; IE; EL; SK.

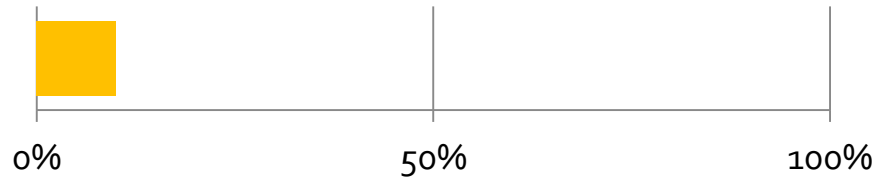


- ▲ Technical limitations of current protection: inflexible and unchanged nature of LC protection systems; high installation and maintenance costs.
- ▲ High costs of installing and maintaining protection equipment, particularly technical equipment (video, photo recording equipment).
- ▲ Inadequate levels of level crossing protection: situations where upgrades to the roads across passive crossings lead to increase in traffic; existence of “useless” level crossings that contribute heavily towards accidents and do not facilitate rail and road operations.

OPERATIONAL FACTORS: **Maintenance** particularly on local road networks. (SK)

HUMAN FACTORS

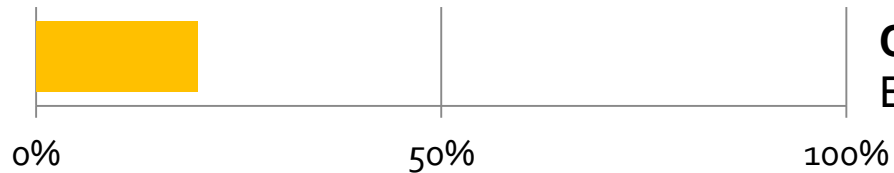
10% of countries cite public acceptance



Countries: ND; ES

Public acceptance: Resistance from action groups against the closure of crossings or building of grade separated crossings

20% of countries cite LC misuse

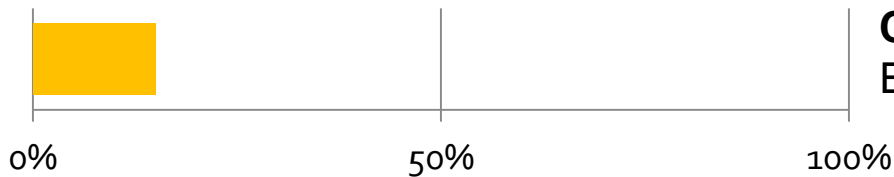


Countries: CH; SK; EL; FR

Level crossing misuse:

- Non compliance with road traffic legislation.
- Vandalism of protection devices.

15% of countries cite public awareness



Countries: FR; ND; ES

Public awareness: Lack of safety awareness amongst level crossing users (highlighting need for education and enforcement).

KEY CHALLENGES AND PROPOSALS...



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Challenge

Forge closer collaboration between road, rail, local authorities...



Address lack of shared vision and commitment to level crossing safety: road, rail, local authority, individual user

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Address lack of shared vision and commitment to level crossing safety: road, rail, local authority, individual user

Proposal to debate

How can a shared vision and commitment to LC safety be reached?

KEY CHALLENGES AND PROPOSALS...

Challenge

Forge closer collaboration between road, rail, local authorities...



Address lack of shared vision and commitment to level crossing safety: road, rail, local authority, individual user

Proposal to debate

How can a shared vision and commitment to LC safety be reached?

Cross-cutting support

Research, monitoring and evaluation



Identification of common priorities to shape shared vision and strategy



KEY CHALLENGES AND PROPOSALS...

Challenge

Secure political interest



Address investment and support in long term LC safety programmes

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Challenge

Secure political interest



Address investment and support in long term LC safety programmes

Proposal to debate

How can we draw on previous experiences of gaining political commitment to LC safety?

KEY CHALLENGES AND PROPOSALS...

Challenge

Secure political interest



Address investment and support in long term LC safety programmes

Proposal to debate

How can we draw on previous experiences of gaining political commitment to LC safety?

Cross-cutting support

Research, monitoring and evaluation



Highlight problem to be addressed using critical safety statistics and data.



KEY CHALLENGES AND PROPOSALS...

Challenge

LC removal and grade separation is high cost and complex, needing to account for multiple factors: economic, operational, political, human factors...



KEY CHALLENGES AND PROPOSALS...

Challenge

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Proposal to debate

How to define the path towards **zero level crossings?**

KEY CHALLENGES AND PROPOSALS...

Challenge

LC removal and grade separation is high cost and complex, needing to account for multiple factors: economic, operational, political, human factors...

Proposal to debate

How to define the path towards **zero level crossings**?

Cross-cutting support

Research, monitoring and evaluation



Applying data fed risk management models to inform decisions regarding safety at specific LCs.

KEY CHALLENGES AND PROPOSALS...

Challenge

Technical limitations of LC protection



Address high costs and complexity of installation and maintenance.



KEY CHALLENGES AND PROPOSALS...

Challenge

Technical limitations of LC protection



Address high costs and complexity of installation and maintenance.

Proposal to debate

What examples are there of low cost low impact safety solutions?

How can costs and complexity of installation and maintenance be reduced?

KEY CHALLENGES AND PROPOSALS...

Challenge

Technical limitations of LC protection



Address high costs and complexity of installation and maintenance.

Proposal to debate

What examples are there of low cost low impact safety solutions?

How can costs and complexity of installation and maintenance be reduced?

Cross-cutting support

Research, monitoring and evaluation



Evaluation of safety situation at level crossings and investment decisions regarding measures to address risk appropriately



KEY CHALLENGES AND PROPOSALS...

Challenge

Human factor at level crossings



Address public acceptance of LC safety measures; LC misuse; influencing attitudes and behaviour.

KEY CHALLENGES AND PROPOSALS...

Challenge

Human factor at level crossings



Address public acceptance of LC safety measures; LC misuse; influencing attitudes and behaviour.

Proposal to debate

1. How to get the end user and wider community on board with level crossing safety?
2. What examples of successful community involvement can be drawn on?

KEY CHALLENGES AND PROPOSALS...

Challenge

Human factor at level crossings



Address public acceptance of LC safety measures; LC misuse; influencing attitudes and behaviour.

Proposal to debate

1. How to get the end user and wider community on board with level crossing safety?
2. What examples of successful community involvement can be drawn on?

Cross-cutting support

Research, monitoring and evaluation



1. Research into human factors at LCs.
2. Local community involvement (participatory processes) leading to community focused safety interventions

Experiences and best practice regarding level crossing safety

▲ OBJECTIVES

- ▲ Collect synthesized information on successful experiences, projects, case studies and/or technological developments regarding LC safety.
- ▲ Identify the most innovative experiences carried out by the railway infrastructure managers, universities, technological centres and companies.
- ▲ To disseminate this information in the international railway sector.
- ▲ Generate shared knowledge and experience sharing.



Experiences and best practice regarding level crossing safety

▲ KEY INFORMATION

- ▲ Eighteen case studies or project results at a European level and international have been reviewed and analyzed.
- ▲ Thematic areas of projects and studies to promote security in LC:



ORGANISATIONAL AND PROCEDURAL PRACTICES

2 case studies (*MANEUVER project*; *Tarva LC tool*).



TECHNOLOGICAL AND PHYSICAL SOLUTIONS

15 case studies (*RÜTTLEX project*; *TEDS*; *JUNAVARO project*; *LeCross study*; *LC Attention Device*; *Radar camera*; *Lattice road markings*; *Sensor*; *Traffic Mirrors*; *White Stop Lines*; *Cattle Grids Alternatives*; *'V' Boards*; *Viaduct*; *ADIF type LC*; *MICRO*).



EDUCATIONAL CAMPAIGNS AND PROGRAMMES

1 case study (*Rules of the Road*).

Experiences and best practice regarding level crossing safety

▲ RESULTS OF THE EVALUATION

- ▲ Seventeen evaluations of the case studies or project results.
- ▲ Experts rated the safety arrangements in terms of different factors:
 - ▲ **Organizational and procedural:** level of cross-modal cooperation required; procedural complexity.
 - ▲ **Technological development:** level of technological development required.
 - ▲ **Safety:** effect on safety.
 - ▲ **Human factors:** level of social impact/acceptance of measure; the level of physical access to the LC by all types of users (including people with reduced mobility); the level of self-explaining nature.
 - ▲ **Economic and social impact:** economic cost of measure; cost-effectiveness of measure.

Experiences and best practice regarding level crossing safety

▲ ANALYSIS OF THE RESULTS. METHODOLOGY

▲ The results are interpreted using the colours of a traffic light: red, yellow and green.

Red

High level of difficulty or complexity in the implementation of the measure (according to the expert).

Yellow

Medium level of difficulty or complexity in the implementation of the measure (according to the expert).

Green

Low level of difficulty or complexity in the implementation of the measure (according to the expert).

Experiences and best practice regarding level crossing safety

- ▲ Results of the evaluation of **organisational and procedural** case studies and project results

	Maneuver project	Tarva toll
Organisational and procedural		
Level of cross-modal cooperation required	Yellow	Green
Procedural complexity	Yellow	Green
Technology		
Level of technological development required	Green	Green
Safety		
Effect on safety	Green	Green
Human factors		
Level of social impact/acceptance of measure	Green	Green
Level of physical access to the LC by all types of users	Yellow	
Level of self-explaining nature	Yellow	Yellow
Economic		
Economic cost of measure	Green	Yellow
Cost-effectiveness of measure	Green	Green



Experiences and best practice regarding level crossing safety

▲ Results of the evaluation of **physical and/ or technological** case studies and project results

	Ruttlex	Junavaro	LeCross	Attention device	Radar	Lattice	Mirrors	White lines	Cattle	Vegetation	Viaduct	Adif	Micro	Sensor
Organisational and procedural														
Level of cross-modal cooperation required	Yellow	Green	Green	Green	Yellow	Yellow	Green	Yellow	Green	Yellow	Red	Yellow	Red	Yellow
Procedural complexity	Yellow	Green	Green	Green	Red	Yellow	Green	Green	Green	Yellow	Red	Yellow	Red	Yellow
Technology														
Level of technological development required	Green	Red	Red	Yellow	Yellow	Green	Yellow	Green	Yellow	Green	Red	Red	Yellow	Yellow
Safety														
Effect on safety	Green	Yellow	Yellow	Yellow	Yellow	Red	Yellow	Yellow	Yellow	Green	Green	Green	Yellow	Yellow
Human factors														
Level of social impact/ acceptance of measure	Green	Yellow	Yellow	Green	Green	Red	Yellow	Green	Yellow	Yellow	Green	Green	Green	Yellow
Level of physical access to the LC by all types of users	Red	Green	Green	Green	Red	Red	Yellow	Yellow	Yellow	Red	Green	Green	Yellow	Yellow
Level of self-explaining nature	Green	Green	Green	Yellow	Yellow	Red	Red	Green	Yellow	Yellow	Yellow	Green	Yellow	Yellow
Economic														
Economic cost of measure	Green	Green	Green	Green	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Red	Yellow	Yellow	Yellow
Cost-effectiveness of measure	Green	Green	Green	Yellow	Yellow	Red	Yellow	Yellow	Yellow	Yellow	Green	Green	Yellow	Green

Experiences and best practice regarding level crossing safety

▲ Results of the evaluation of educational case studies and project results

	Rules of the Road-Safety at Level Crossings
Organisational and procedural	
Level of cross-modal cooperation required	Red
Procedural complexity	Yellow
Technology	
Level of technological development required	Green
Safety	
Effect on safety	Red
Human factors	
Level of social impact/acceptance of measure	Red
Level of physical access to the LC by all types of users	Green
Level of self-explaining nature	Yellow
Economic	
Economic cost of measure	Green
Cost-effectiveness of measure	Yellow

Experiences and best practice regarding level crossing safety

- ▲ These results are very general and only present some indicators.
- ▲ In addition, in order to understand the results in depth, other factors need to be taken into account such as the scale of the rail network, public investment, historical factors, socio-cultural factors, etc.



THANK YOU FOR YOUR ATTENTION.

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