SAFER-LC

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

SAFER-LC toolbox overview and online training

Grigore Havarneanu
Senior Research Advisor – UIC Security Division

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723205


TOOLBOX ?

Support in selecting optimal safety measures

Detailed guidance on measure implementation

Framework for structuring resources

Systematic process

Keyword index

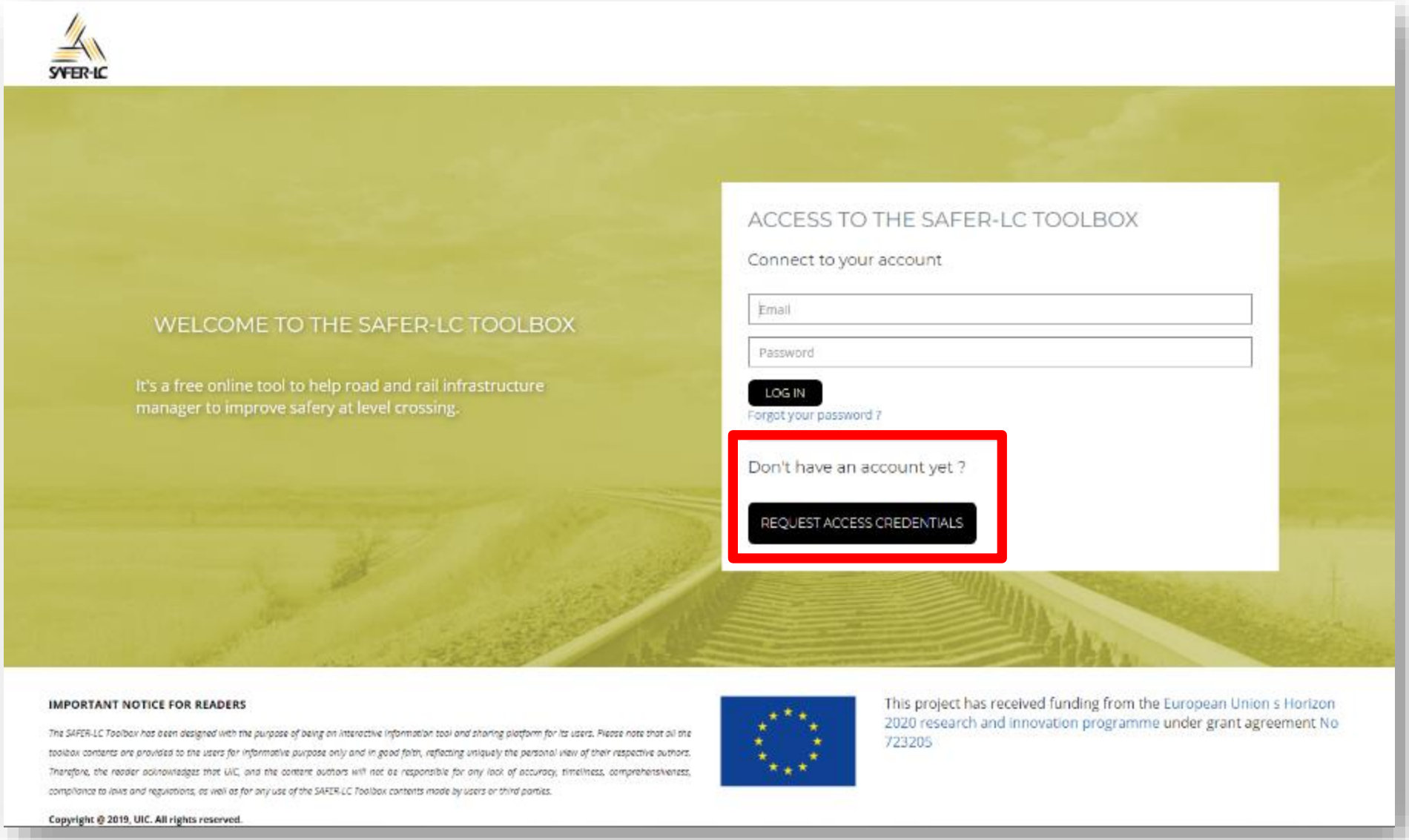
Tips & examples

Evaluation studies

Attached resources

User feedback

URL: http://toolbox.safer-lc.eu/



Online demo

SAFER-LC

Search

ACCOUNT MENU

SAFETY MEASURES

LAST SAFETY MEASURES

- Digital train arrival countdown timer display
- Camera based enforcement (prosecution of violations)
- Blinking lights on locomotive
- Extended barriers

HIGHLIGHTS

- Risk Assessment methodology for Level crossings
- Human Factors Methodological Framework

NEWS

ILCAD 2020 launch conference in York postponed to June 2021 ...

EVENTS

22 Apr 2020

SAFER-LC Final conference

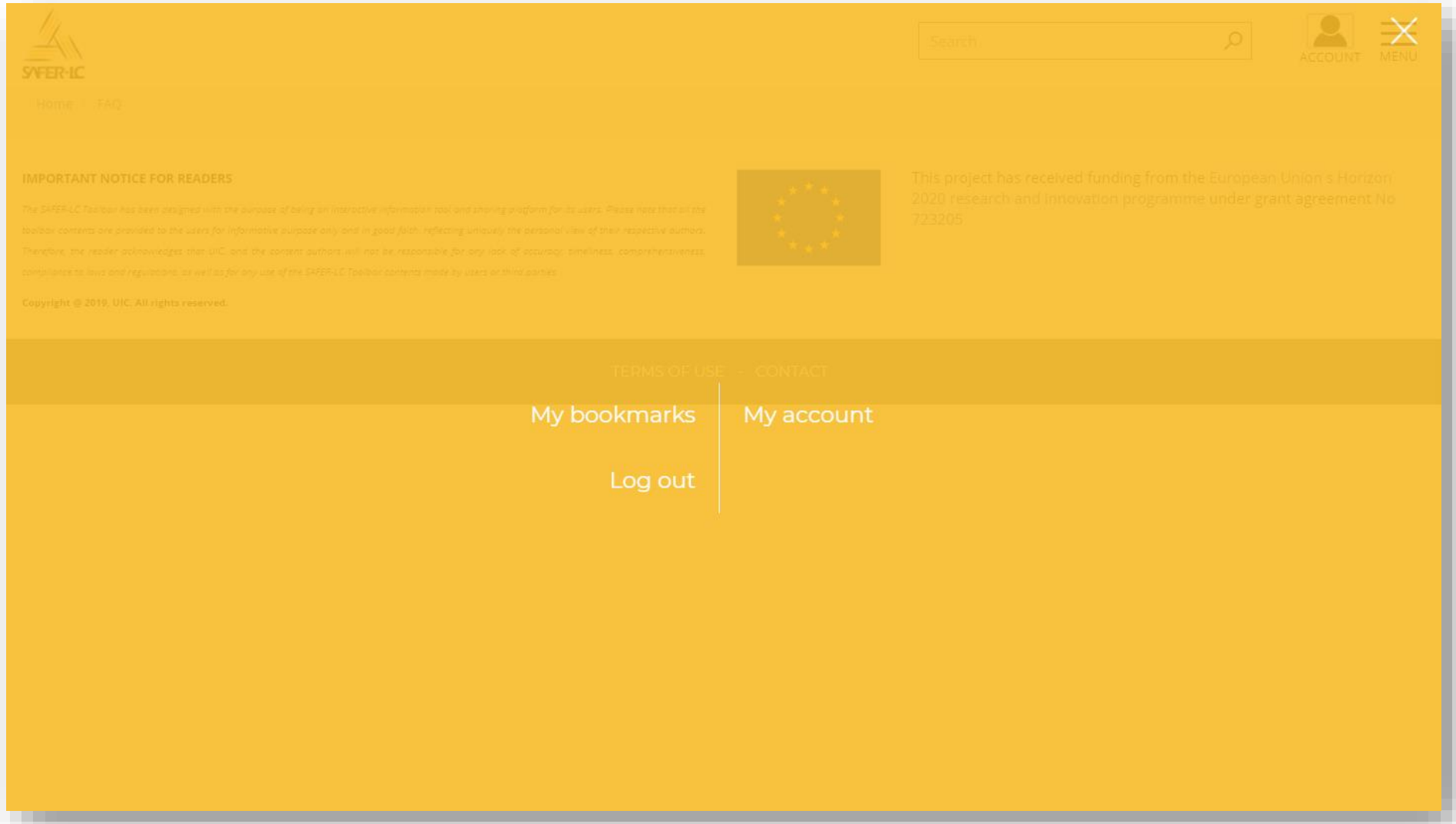
Paris, UIC HQ

TWITTER

Project SAFER-LC Retweeted

Grigore Havarneanu
@grighav

A week to go until the @SAFERLC final conference: next Wednesday 11:00-16:30 (CET). We look forward to discussing the project results with external experts and to showcase the online #SAFERLC toolbox.


Search
ACCOUNT
MENU
Home / FAQ
IMPORTANT NOTICE FOR READERS
The SAFER-LC Toolbar has been designed with the purpose of being an interactive information tool and sharing platform for its users. Please note that all the toolbar contents are provided to the users for informative purpose only and in good faith, reflecting uniquely the personal view of their respective authors. Therefore, the reader acknowledges that UIC and the content authors will not be responsible for any lack of accuracy, timeliness, comprehensiveness, compliance to laws and regulations, as well as for any use of the SAFER-LC Toolbar contents made by users or third parties.
Copyright @ 2019, UIC. All rights reserved.
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723205
TERMS OF USE
CONTACT
My bookmarks
My account
Log out

Invitation: ILCAD Launch Conference to be held on 11 June 20...

showcase the online #SAFERLC toolbox. @inea_eu @ERA_railways @EU_H2020 safer-lc.eu

QUICK ACCESS

Glossary

Contact Us

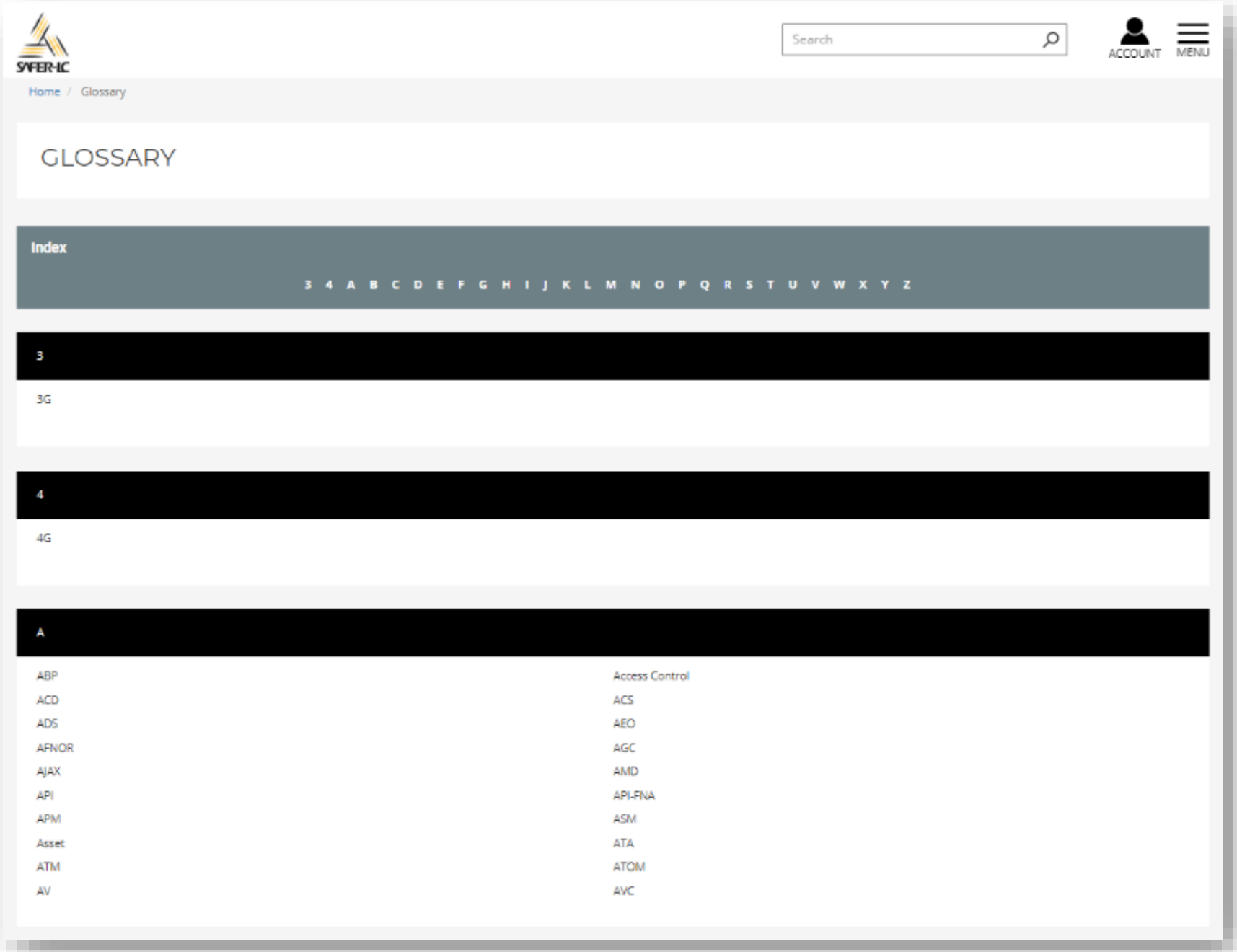
Bookmarks

IMPORTANT NOTICE FOR READERS

The SAFER-LC Toolbox has been designed with the purpose of being an interactive information tool and sharing platform for its users. Please note that all the toolbox contents are provided to the users for informative purpose only and in good faith, reflecting uniquely the personal view of their respective authors. Therefore, the reader acknowledges that UIC, and the content authors will not be responsible for any lack of accuracy, timeliness, comprehensiveness, compliance to laws and regulations, as well as for any use of the SAFER-LC Toolbox contents made by users or third parties.

This project has received funding from the European Union s Horizon 2020 research and innovation programme under grant agreement No 723205

TERMS OF USE - CONTACT


SAFER-LC
Search
ACCOUNT
MENU
Home / Glossary
GLOSSARY
Index
3 4 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
3
3G
4
4G
A
ABP
ACD
ADS
AFNOR
AJAX
API
APM
Asset
ATM
AV
Access Control
ACS
AEO
AGC
AMD
API-FNA
ASM
ATA
ATOM
AVC

Invitation: ILCAD Launch Conference to be held on 11 June 20...

showcase the online #SAFERLC toolbox. @inea_eu @ERA_railways @EU_H2020 safer-lc.eu

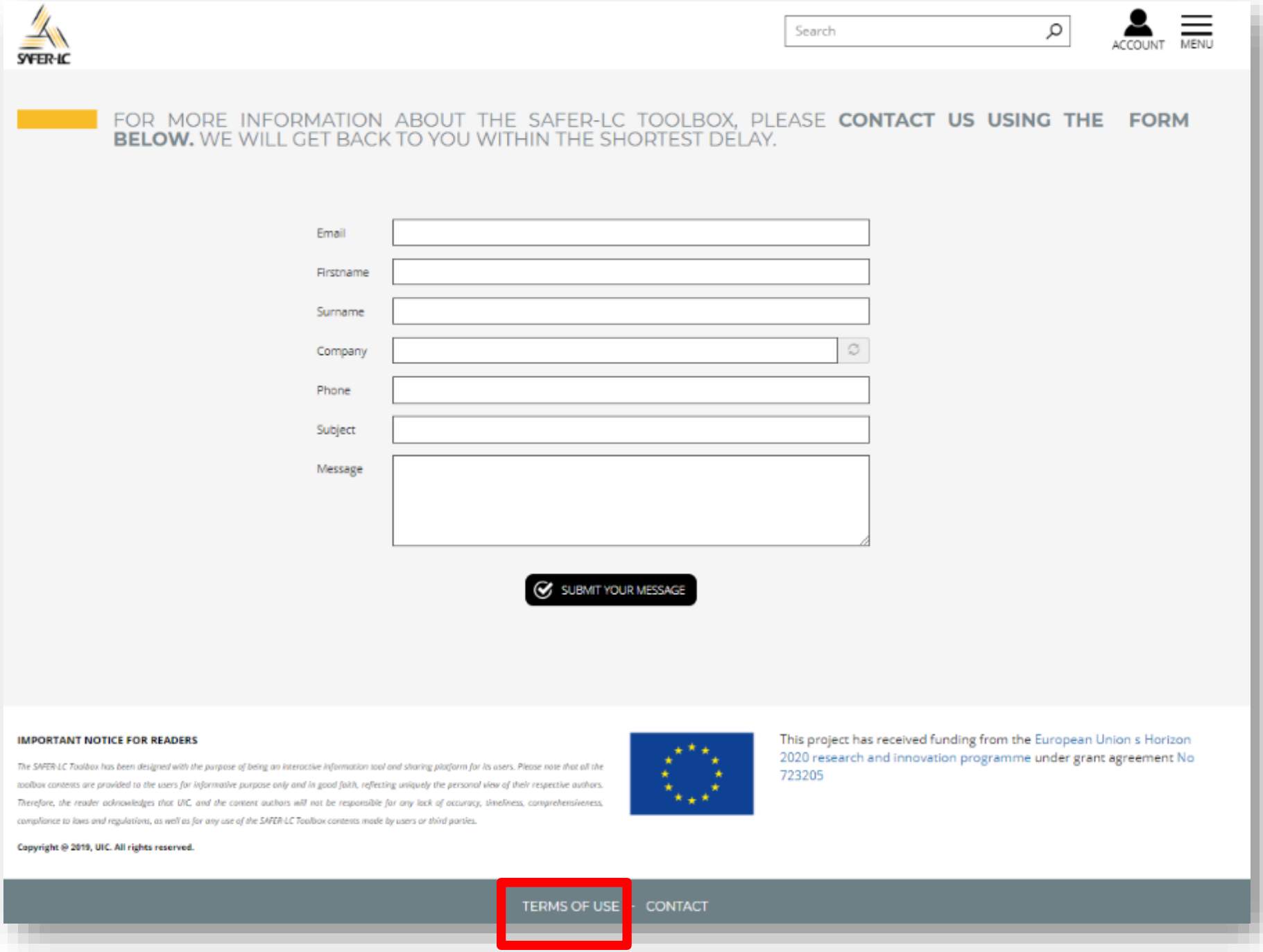
QUICK ACCESS

Glossary

Contact Us

Bookmarks

This project has received funding from the European Union s Horizon 2020 research and innovation programme under grant agreement No 723205


SAFER-LC
Search
ACCOUNT
MENU
FOR MORE INFORMATION ABOUT THE SAFER-LC TOOLBOX, PLEASE CONTACT US USING THE FORM BELOW. WE WILL GET BACK TO YOU WITHIN THE SHORTEST DELAY.
Email
Firstname
Surname
Company
Phone
Subject
Message
SUBMIT YOUR MESSAGE
IMPORTANT NOTICE FOR READERS
The SAFER-LC Toolbox has been designed with the purpose of being an interactive information tool and sharing platform for its users. Please note that all the toolbox contents are provided to the users for informative purpose only and in good faith, reflecting uniquely the personal view of their respective authors. Therefore, the reader acknowledges that UIC, and the content authors will not be responsible for any lack of accuracy, timeliness, comprehensiveness, compliance to laws and regulations, as well as for any use of the SAFER-LC Toolbox contents made by users or third parties.
Copyright @ 2019, UIC. All rights reserved.
This project has received funding from the European Union s Horizon 2020 research and innovation programme under grant agreement No 723205
TERMS OF USE
CONTACT

SAFER-LC

Search

ACCOUNT MENU

SAFETY MEASURES

LAST SAFETY MEASURES

- Digital train arrival countdown timer display
- Camera based enforcement (prosecution of violations)
- Blinking lights on locomotive
- Extended barriers

HIGHLIGHTS

- Risk Assessment methodology for Level crossings
- Human Factors Methodological Framework

NEWS

ILCAD 2020 launch conference in York postponed to June 2021 ...

EVENTS

22 Apr 2020

SAFER-LC Final conference

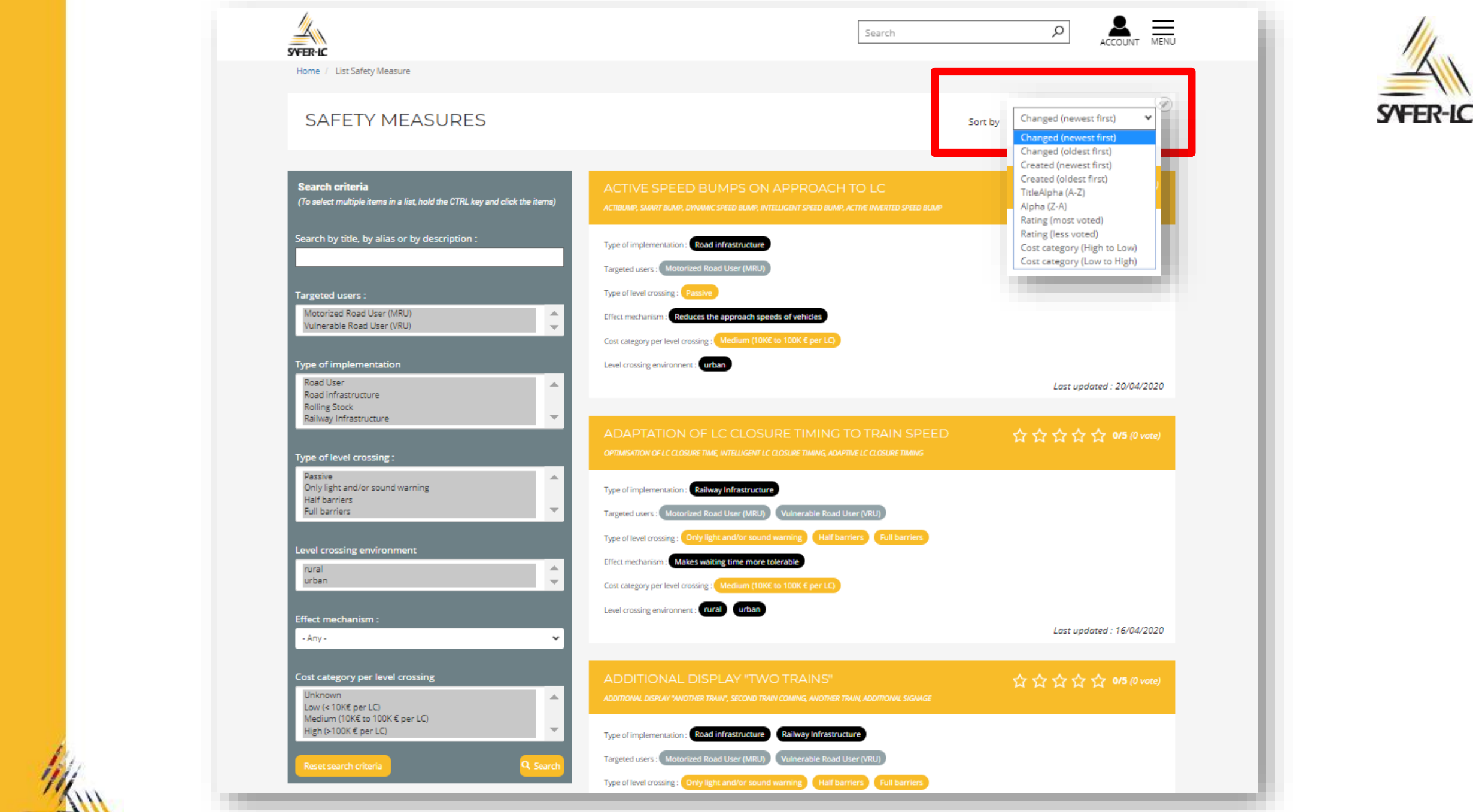
Paris, UIC HQ

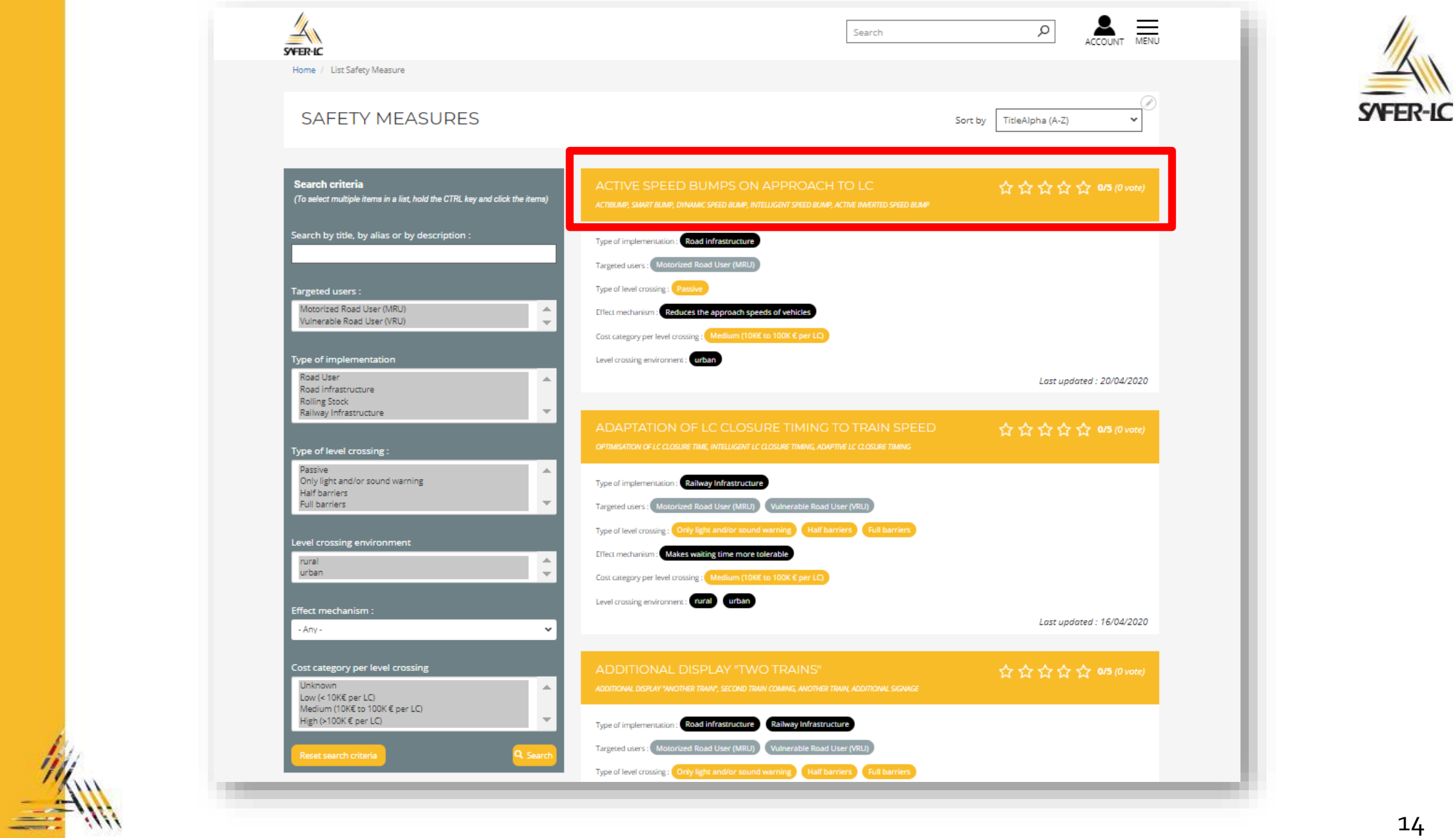
TWITTER

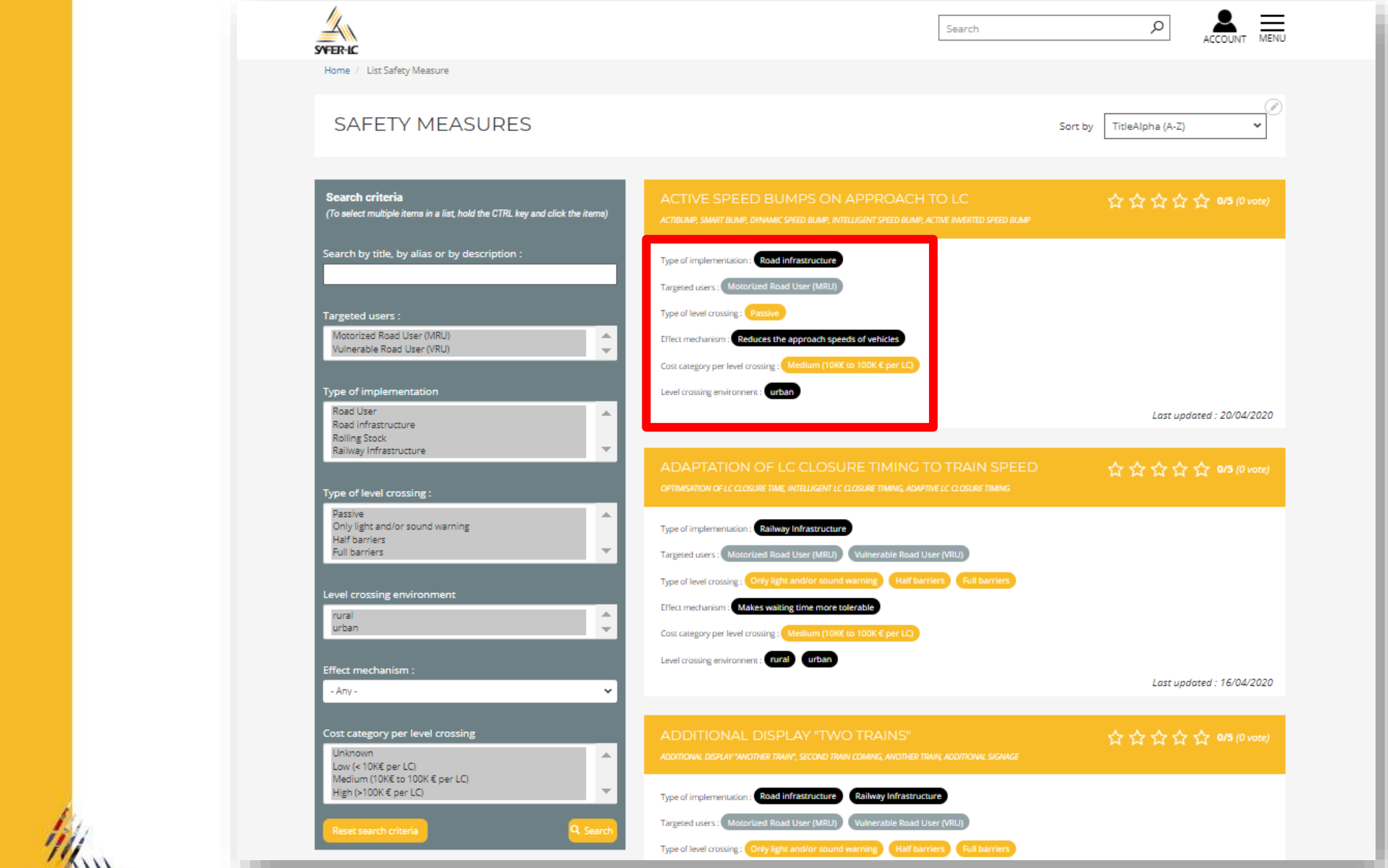
Project SAFER-LC Retweeted

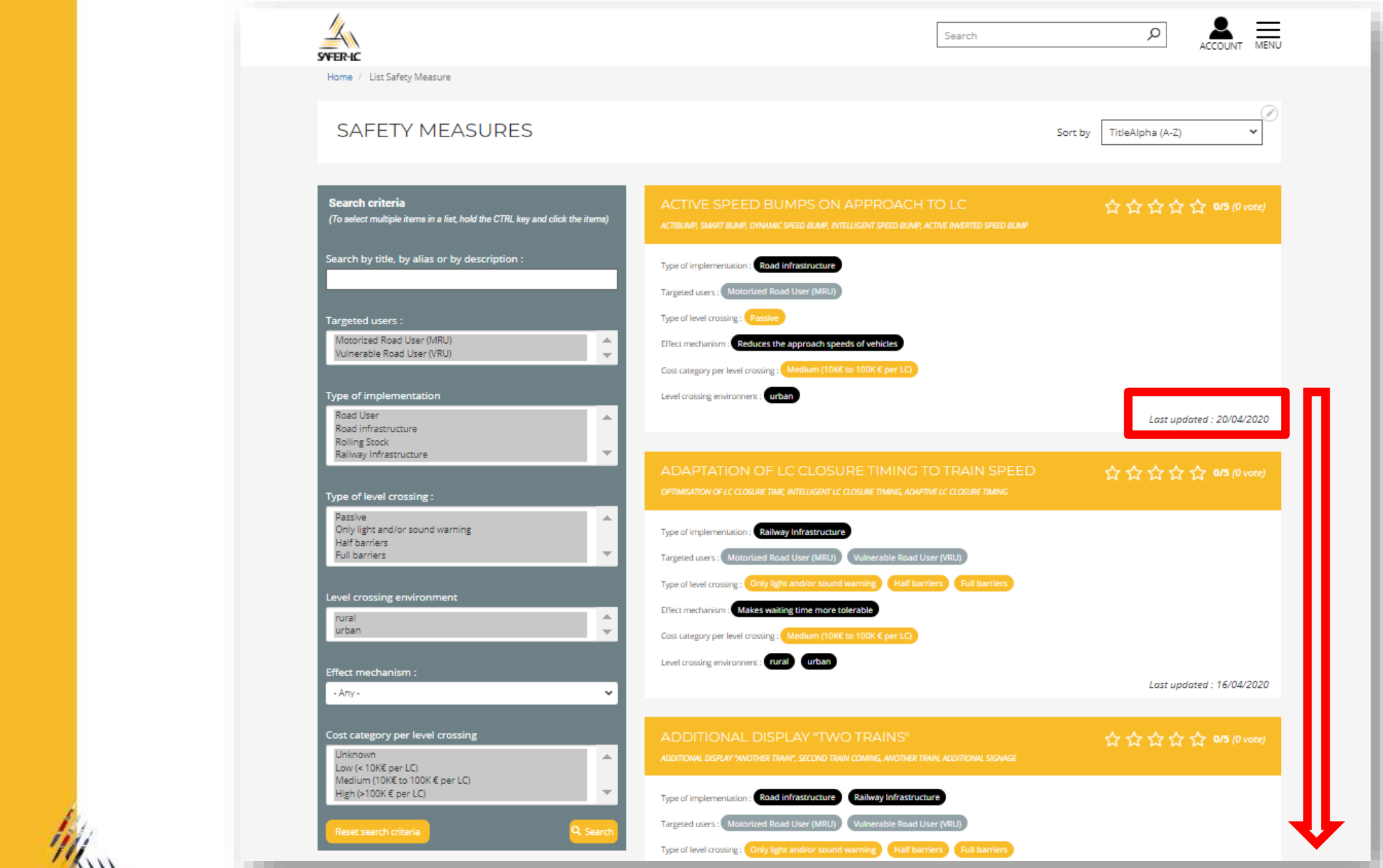
Grigore Havarneanu
@grighav

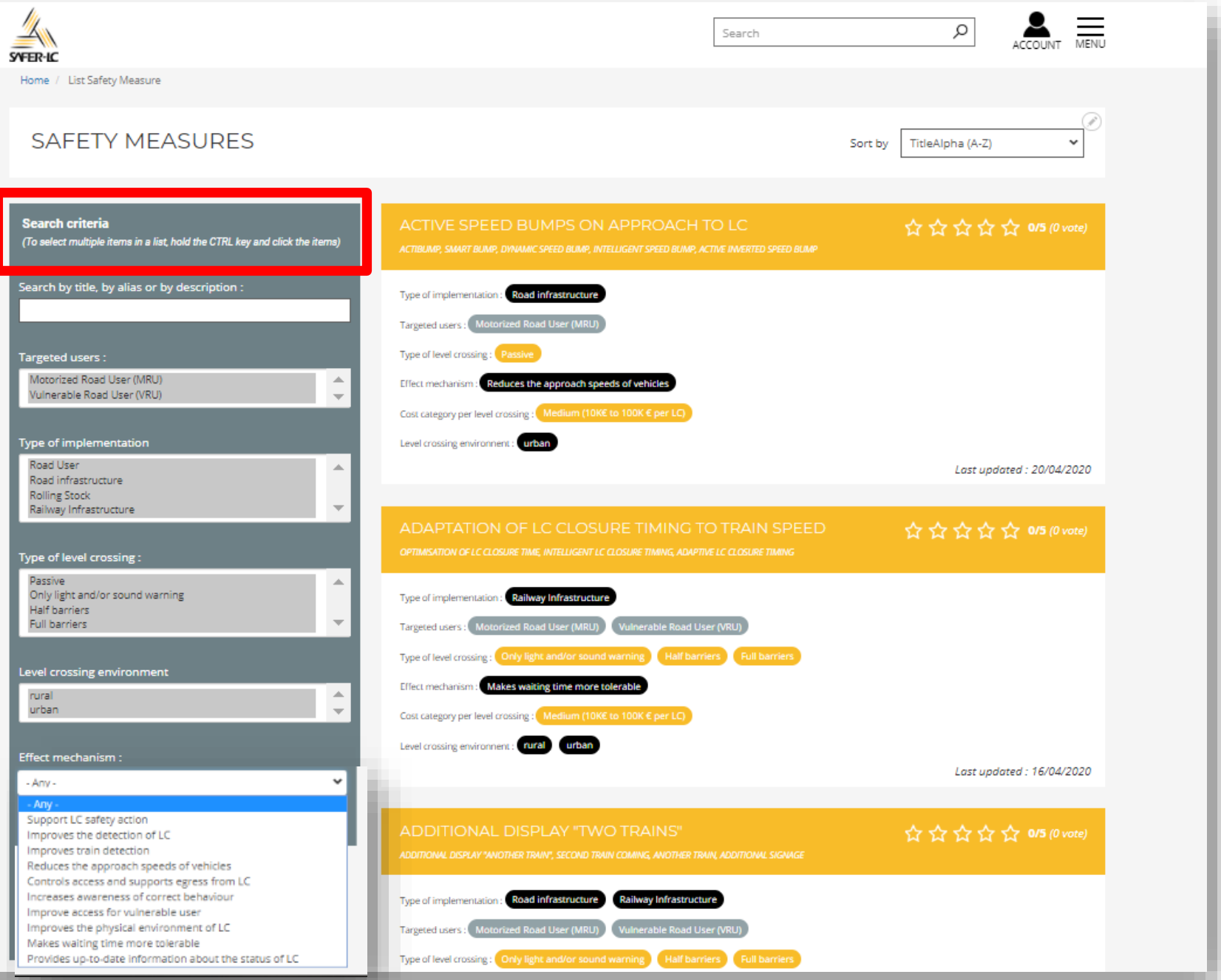
A week to go until the @SAFERLC final conference: next Wednesday 11:00-16:30 (CET). We look forward to discussing the project results with external experts and to showcase the online #SAFERLC toolbox.


SYFER-LC
Search
ACCOUNT
MENU
Home / List Safety Measure
SAFETY MEASURES
Sort by
Changed (newest first)
Changed (newest first)
Changed (oldest first)
Created (newest first)
Created (oldest first)
TitleAlpha (A-Z)
Alpha (Z-A)
Rating (most voted)
Rating (less voted)
Cost category (High to Low)
Cost category (Low to High)
Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
ACTIVE SPEED BUMPS ON APPROACH TO LC
ACTIBUMP, SMART BUMP, DYNAMIC SPEED BUMP, INTELLIGENT SPEED BUMP, ACTIVE INVERTED SPEED BUMP
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : urban
Last updated : 20/04/2020
ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED
0/5 (0 vote)
OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING
Type of implementation : Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Makes waiting time more tolerable
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 16/04/2020
ADDITIONAL DISPLAY "TWO TRAINS"
0/5 (0 vote)
ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE
Type of implementation : Road infrastructure Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers

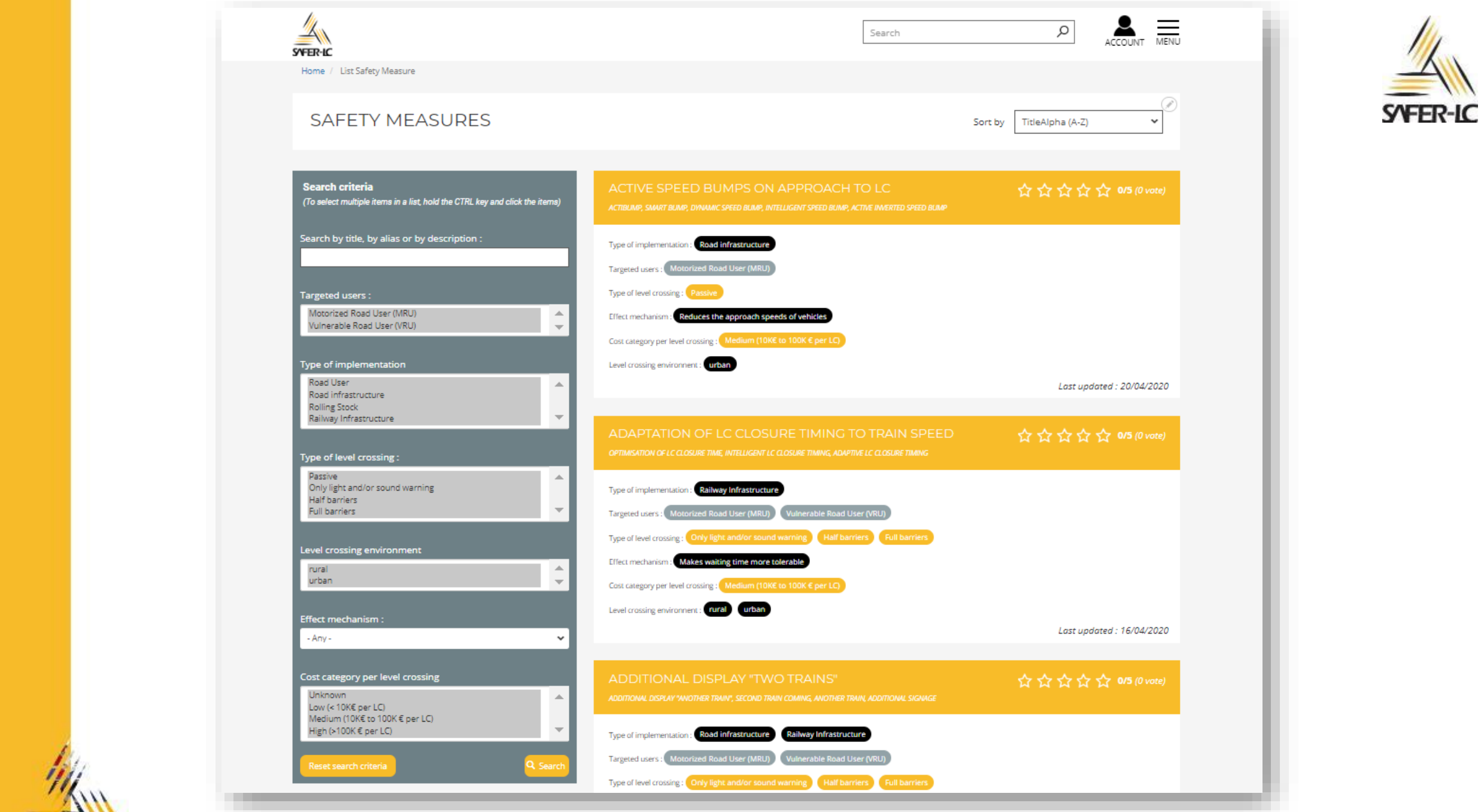

SYFER-LC
Search
ACCOUNT
MENU
Home / List Safety Measure
SAFETY MEASURES
Sort by
TitleAlpha (A-Z)
Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
ACTIVE SPEED BUMPS ON APPROACH TO LC
0/5 (0 vote)
ACTIBUMP, SMART BUMP, DYNAMIC SPEED BUMP, INTELLIGENT SPEED BUMP, ACTIVE INVERTED SPEED BUMP
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : urban
Last updated : 20/04/2020
ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED
0/5 (0 vote)
OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING
Type of implementation : Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Makes waiting time more tolerable
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 16/04/2020
ADDITIONAL DISPLAY "TWO TRAINS"
0/5 (0 vote)
ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE
Type of implementation : Road infrastructure Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers

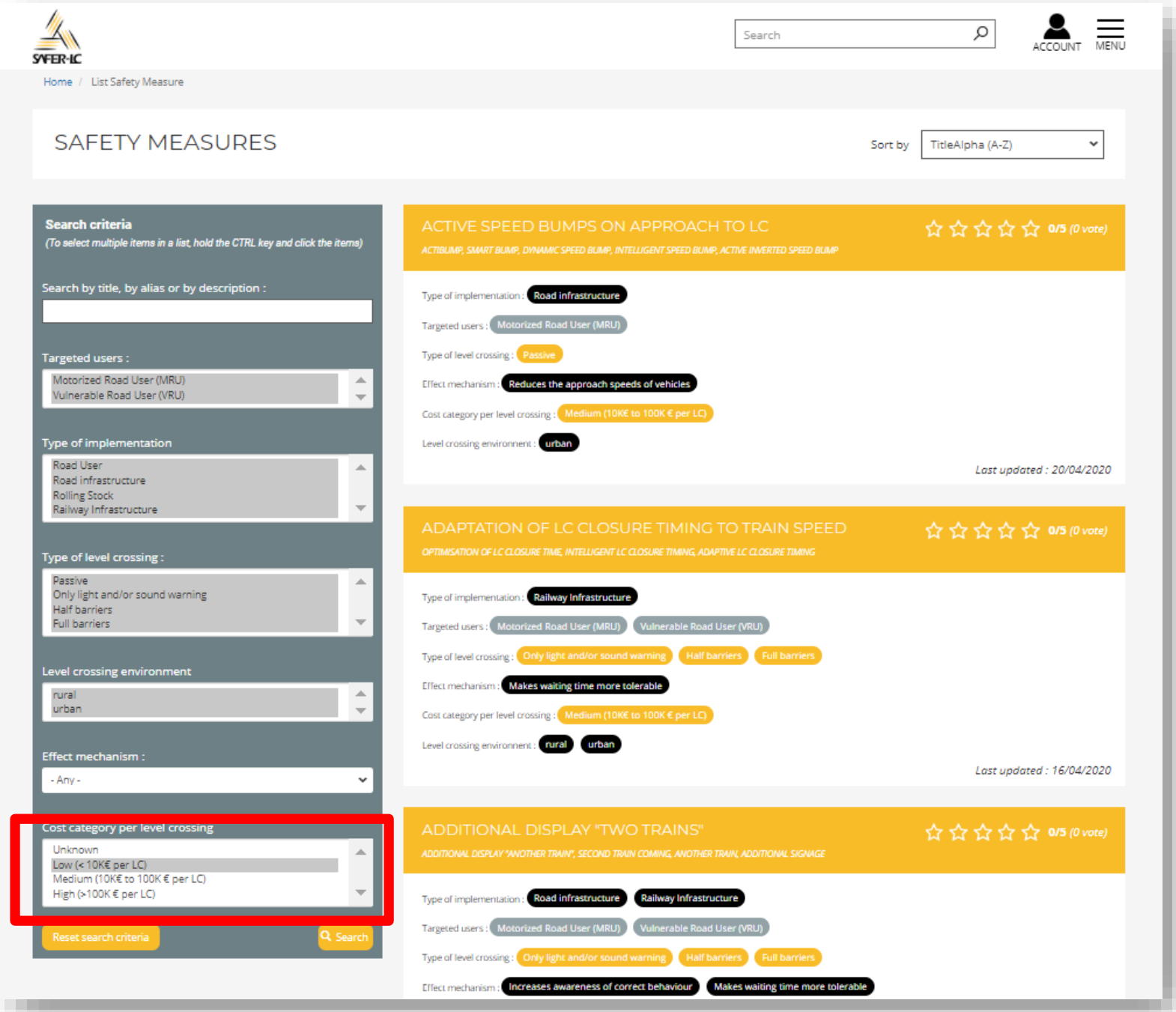

SYFER-LC
Search
ACCOUNT
MENU
Home / List Safety Measure
SAFETY MEASURES
Sort by
TitleAlpha (A-Z)
Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
ACTIVE SPEED BUMPS ON APPROACH TO LC
ACTIBUMP, SMART BUMP, DYNAMIC SPEED BUMP, INTELLIGENT SPEED BUMP, ACTIVE INVERTED SPEED BUMP
0/5 (0 vote)
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : urban
Last updated : 20/04/2020
ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED
OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING
0/5 (0 vote)
Type of implementation : Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Makes waiting time more tolerable
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 16/04/2020
ADDITIONAL DISPLAY "TWO TRAINS"
ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE
0/5 (0 vote)
Type of implementation : Road infrastructure Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers

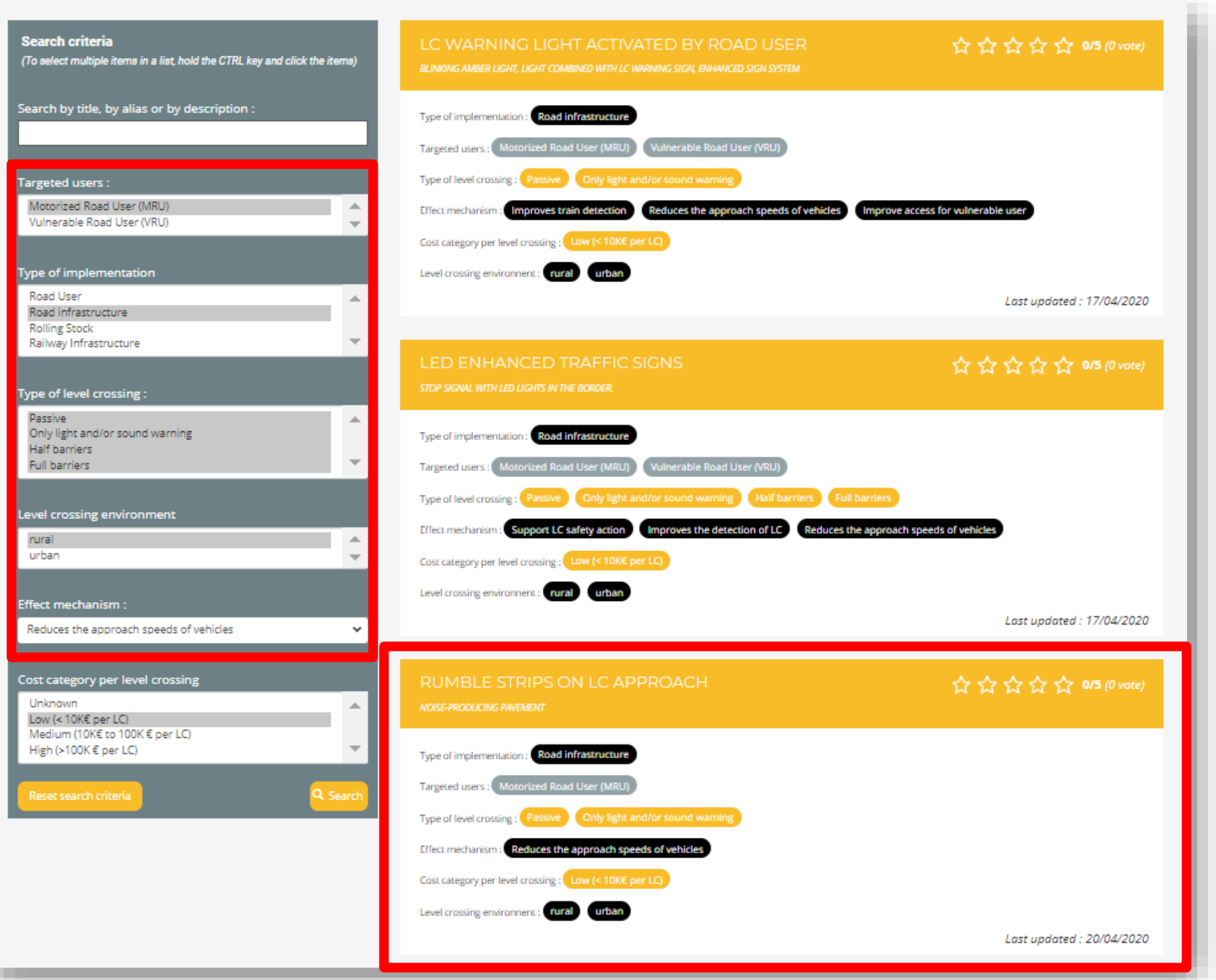

SYFER-LC
Search
ACCOUNT
MENU
Home / List Safety Measure
SAFETY MEASURES
Sort by
TitleAlpha (A-Z)
Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
ACTIVE SPEED BUMPS ON APPROACH TO LC
0/5 (0 vote)
ACTIBUMP, SMART BUMP, DYNAMIC SPEED BUMP, INTELLIGENT SPEED BUMP, ACTIVE INVERTED SPEED BUMP
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : urban
Last updated : 20/04/2020
ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED
0/5 (0 vote)
OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING
Type of implementation : Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Makes waiting time more tolerable
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 16/04/2020
ADDITIONAL DISPLAY "TWO TRAINS"
0/5 (0 vote)
ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE
Type of implementation : Road infrastructure Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers


SYFER-LC
Search
ACCOUNT
MENU
Home / List Safety Measure
SAFETY MEASURES
Sort by
TitleAlpha (A-Z)
Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
- Any -
Support LC safety action
Improves the detection of LC
Improves train detection
Reduces the approach speeds of vehicles
Controls access and supports egress from LC
Increases awareness of correct behaviour
Improve access for vulnerable user
Improves the physical environment of LC
Makes waiting time more tolerable
Provides up-to-date information about the status of LC
ACTIVE SPEED BUMPS ON APPROACH TO LC
0/5 (0 vote)
ACTIBUMP, SMART BUMP, DYNAMIC SPEED BUMP, INTELLIGENT SPEED BUMP, ACTIVE INVERTED SPEED BUMP
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : urban
Last updated : 20/04/2020
ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED
0/5 (0 vote)
OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING
Type of implementation : Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Makes waiting time more tolerable
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 16/04/2020
ADDITIONAL DISPLAY "TWO TRAINS"
0/5 (0 vote)
ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE
Type of implementation : Road infrastructure Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers

Break


SYFER-LC
Search
ACCOUNT
MENU
Home / List Safety Measure
SAFETY MEASURES
Sort by
TitleAlpha (A-Z)
Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
ACTIVE SPEED BUMPS ON APPROACH TO LC
ACTIBUMP, SMART BUMP, DYNAMIC SPEED BUMP, INTELLIGENT SPEED BUMP, ACTIVE INVERTED SPEED BUMP
0/5 (0 vote)
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : urban
Last updated : 20/04/2020
ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED
OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING
0/5 (0 vote)
Type of implementation : Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Makes waiting time more tolerable
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 16/04/2020
ADDITIONAL DISPLAY "TWO TRAINS"
ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE
0/5 (0 vote)
Type of implementation : Road infrastructure Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers


SYFER-LC
Search
ACCOUNT
MENU
Home / List Safety Measure
SAFETY MEASURES
Sort by
TitleAlpha (A-Z)
Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
ACTIVE SPEED BUMPS ON APPROACH TO LC
ACTIBUMP, SMART BUMP, DYNAMIC SPEED BUMP, INTELLIGENT SPEED BUMP, ACTIVE INVERTED SPEED BUMP
0/5 (0 vote)
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : urban
Last updated : 20/04/2020
ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED
OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING
0/5 (0 vote)
Type of implementation : Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Makes waiting time more tolerable
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 16/04/2020
ADDITIONAL DISPLAY "TWO TRAINS"
ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE
0/5 (0 vote)
Type of implementation : Road infrastructure Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Increases awareness of correct behaviour Makes waiting time more tolerable


Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
Reduces the approach speeds of vehicles
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
LC WARNING LIGHT ACTIVATED BY ROAD USER
0/5 (0 vote)
BLINKING AMBER LIGHT, LIGHT COMBINED WITH LC WARNING SIGN, ENHANCED SIGN SYSTEM
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Passive Only light and/or sound warning
Effect mechanism : Improves train detection Reduces the approach speeds of vehicles Improve access for vulnerable user
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 17/04/2020
LED ENHANCED TRAFFIC SIGNS
0/5 (0 vote)
STOP SIGNAL WITH LED LIGHTS IN THE BORDER.
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Passive Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Support LC safety action Improves the detection of LC Reduces the approach speeds of vehicles
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 17/04/2020
RUMBLE STRIPS ON LC APPROACH
0/5 (0 vote)
NOISE-PRODUCING PAVEMENT
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive Only light and/or sound warning
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 20/04/2020

< Back

RUMBLE STRIPS ON LC APPROACH

Noise-producing pavement

☆ ☆ ☆ ☆ ☆ 0/5 *(0 vote)*

Add to Bookmarks

Publication : 16/04/2020 - Last updated: 20/04/2020

Type of implementation : Road infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Passive

Only light and/or sound warning

Effect mechanism :

Reduces the approach speeds of vehicles

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural urban

DESCRIPTION

Application of structured or milled markings in the road surface on approach to the **LC**. Aimed to induce speed reduction and enhance alertness in motorized road users.

POTENTIAL BENEFITS

- Rumble strips have been shown to induce speed reduction in drivers when applied in appropriate design. This effect can be used on approach to LCs to prolong the time drivers have to gather visual information whether a train is coming.
- The rumbling is also likely to enhance drivers' general alertness. It is controversial whether it is also suitable to enhance drivers' awareness of the hazard of approaching trains and the necessity to look for a train (see study results).

POTENTIAL CRITICALITIES

- Road users may try to circumvent the rumble strips. To prevent this, e.g., the strips may be applied to the whole width of the road, or the measure may be combined with physical lane separation
- If road users do not mentally connect the rumble strips to the **LC**, the effect may diminish, or they may even be distracted from trying to figure out the meaning of the rumble strips.
- The strips may disturb or impede road users such as bicyclists and motorcyclists.

RECOMMENDATIONS

To help road users establish the connection between the rumble strips on the one hand and the **LC** and the hazard of approaching trains on the other, the strips should not be used in an "uncommented" way. The strips themselves should be clearly visible on approach, and a connection to the LC should be established by combining them with additional explanatory measures, giving clear hints to the relevant hazard and the recommended behavior.

STUDY RESULTS & REFERENCES

Quick Access

< Back

RUMBLE STRIPS ON LC APPROACH

Noise-producing pavement

☆ ☆ ☆ ☆ ☆ 0/5 *(0 vote)*

Add to Bookmarks

Publication : 16/04/2020 - Last updated: 20/04/2020

Type of implementation : Road infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Passive

Only light and/or sound warning

Effect mechanism :

Reduces the approach speeds of vehicles

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural urban

DESCRIPTION

Application of structured or milled markings in the road surface on approach to the **LC**. Aimed to induce speed reduction and enhance alertness in motorized road users.

POTENTIAL BENEFITS

- Rumble strips have been shown to induce speed reduction in drivers when applied in appropriate design. This effect can be used on approach to LCs to prolong the time drivers have to gather visual information whether a train is coming.
- The rumbling is also likely to enhance drivers' general alertness. It is controversial whether it is also suitable to enhance drivers' awareness of the hazard of approaching trains and the necessity to look for a train (see study results).

POTENTIAL CRITICALITIES

- Road users may try to circumvent the rumble strips. To prevent this, e.g., the strips may be applied to the whole width of the road, or the measure may be combined with physical lane separation
- If road users do not mentally connect the rumble strips to the **LC**, the effect may diminish, or they may even be distracted from trying to figure out the meaning of the rumble strips.
- The strips may disturb or impede road users such as bicyclists and motorcyclists.

RECOMMENDATIONS

To help road users establish the connection between the rumble strips on the one hand and the **LC** and the hazard of approaching trains on the other, the strips should not be used in an "uncommented" way. The strips themselves should be clearly visible on approach, and a connection to the LC should be established by combining them with additional explanatory measures, giving clear hints to the relevant hazard and the recommended behavior.

STUDY RESULTS & REFERENCES

Quick Access

< Back

RUMBLE STRIPS ON LC APPROACH

Noise-producing pavement

☆ ☆ ☆ ☆ ☆ 0/5 *(0 vote)*

Add to Bookmarks

Publication : 16/04/2020 - Last updated: 20/04/2020

Type of implementation : Road infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Passive

Only light and/or sound warning

Effect mechanism :

Reduces the approach speeds of vehicles

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural urban

DESCRIPTION

Application of structured or milled markings in the road surface on approach to the **LC**. Aimed to induce speed reduction and enhance alertness in motorized road users.

POTENTIAL BENEFITS

- Rumble strips have been shown to induce speed reduction in drivers when applied in appropriate design. This effect can be used on approach to LCs to prolong the time drivers have to gather visual information whether a train is coming.
- The rumbling is also likely to enhance drivers' general alertness. It is controversial whether it is also suitable to enhance drivers' awareness of the hazard of approaching trains and the necessity to look for a train (see study results).

POTENTIAL CRITICALITIES

- Road users may try to circumvent the rumble strips. To prevent this, e.g., the strips may be applied to the whole width of the road, or the measure may be combined with physical lane separation
- If road users do not mentally connect the rumble strips to the **LC**, the effect may diminish, or they may even be distracted from trying to figure out the meaning of the rumble strips.
- The strips may disturb or impede road users such as bicyclists and motorcyclists.

RECOMMENDATIONS

To help road users establish the connection between the rumble strips on the one hand and the **LC** and the hazard of approaching trains on the other, the strips should not be used in an "uncommented" way. The strips themselves should be clearly visible on approach, and a connection to the LC should be established by combining them with additional explanatory measures, giving clear hints to the relevant hazard and the recommended behavior.

STUDY RESULTS & REFERENCES

Quick Access

could be used to induce a speed reduction where needed, but should be combined with additional measures that enhance visual search for a train.

References:

Grippenkoven, J., & Dietsch, S. 2015. Gaze direction and driving behavior of drivers at level crossings. Journal of Transportation Safety & Security, 8(sup1), 4–18. (link)

Hore-Lacy, W. 2008. Rumble strip effectiveness at rural intersections and railway level crossings. Research report on behalf of VicRoads. (link)

Laapotti, S. 2016. Comparison of fatal motor vehicle accidents at passive and active railway level crossings in Finland. IATSS Research 40(1), 1–6. doi:10.1016/j.iatssr.2015.12.003 (link)

Radalj, T., & Kidd, B. A. 2005. A Trial with Rumble Strips as a Means of Alerting Drivers to Hazards at Approaches to Passively Protected Railway Level Crossings on High Speed Western Australian Rural Roads. Research Report. Main Roads Western Australia.

Silla, A., Virtanen, A., Lehtonen, E., Boufidis, N., Salanova Grau, J. M., Dressler, A., Grippenkoven, J., Taillandier, V., Khoudour, L., Bakey, C., Garrigos, J-p., Françoise, C., Jacqueline, D., Antoine, R., Boukour, F. Edelmayer, A., Ruffin, C., Zotos, T. 2019. Results of the evaluation of the pilot tests. Deliverable D4.4 of the SAFER-LC project. (link)

Skládaný, P., Tučka, P., Skládaná, P., Šimeček, M., Bidovský, M., & Křivánek, V. 2016. Entwicklung von Rüttelstreifen zur Vermeidung von Fehlverhalten an Eisenbahnkreuzungen: Ergebnisbericht zum Forschungsprojekt „RÜTTLEX". Wien: Bundesministerium für Verkehr, Innovation und Technologie. (link)

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Execution (focus on motor execution of action)

DOCUMENTS

RELATED MEASURES

- Sign "Is a train coming?"
- Peripheral blinking lights

GALLERY

COMMENTS

Comment ...

Submit comment

could be used to induce a speed reduction where needed, but should be combined with additional measures that enhance visual search for a train.

References:

Grippenkoven, J., & Dietsch, S. 2015. Gaze direction and driving behavior of drivers at level crossings. Journal of Transportation Safety & Security, 8(sup1), 4–18. (link)

Hore-Lacy, W. 2008. Rumble strip effectiveness at rural intersections and railway level crossings. Research report on behalf of VicRoads. (link)

Laapotti, S. 2016. Comparison of fatal motor vehicle accidents at passive and active railway level crossings in Finland. IATSS Research 40(1), 1–6. doi:10.1016/j.iatssr.2015.12.003 (link)

Radalj, T., & Kidd, B. A. 2005. A Trial with Rumble Strips as a Means of Alerting Drivers to Hazards at Approaches to Passively Protected Railway Level Crossings on High Speed Western Australian Rural Roads. Research Report. Main Roads Western Australia.

Silla, A., Virtanen, A., Lehtonen, E., Boufidis, N., Salanova Grau, J. M., Dressler, A., Grippenkoven, J., Taillandier, V., Khoudour, L., Bakey, C., Garrigos, J-p., Françoise, C., Jacqueline, D., Antoine, R., Boukour, F. Edelmayer, A., Ruffin, C., Zotos, T. 2019. Results of the evaluation of the pilot tests. Deliverable D4.4 of the SAFER-LC project. (link)

Skládaný, P., Tučka, P., Skládaná, P., Šimeček, M., Bidovský, M., & Křivánek, V. 2016. Entwicklung von Rüttelstreifen zur Vermeidung von Fehlverhalten an Eisenbahnkreuzungen: Ergebnisbericht zum Forschungsprojekt „RÜTTLEX". Wien: Bundesministerium für Verkehr, Innovation und Technologie. (link)

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Execution (focus on motor execution of action)

DOCUMENTS

RELATED MEASURES

- Sign "Is a train coming?"
- Peripheral blinking lights

GALLERY

COMMENTS

Comment ...

Submit comment

could be used to induce a speed reduction where needed, but should be combined with additional measures that enhance visual search for a train.

References:

Grippenkoven, J., & Dietsch, S. 2015. Gaze direction and driving behavior of drivers at level crossings. Journal of Transportation Safety & Security, 8(sup1), 4–18. (link)

Hore-Lacy, W. 2008. Rumble strip effectiveness at rural intersections and railway level crossings. Research report on behalf of VicRoads. (link)

Laapotti, S. 2016. Comparison of fatal motor vehicle accidents at passive and active railway level crossings in Finland. IATSS Research 40(1), 1–6. doi:10.1016/j.iatssr.2015.12.003 (link)

Radalj, T., & Kidd, B. A. 2005. A Trial with Rumble Strips as a Means of Alerting Drivers to Hazards at Approaches to Passively Protected Railway Level Crossings on High Speed Western Australian Rural Roads. Research Report. Main Roads Western Australia.

Silla, A., Virtanen, A., Lehtonen, E., Boufidis, N., Salanova Grau, J. M., Dressler, A., Grippenkoven, J., Taillandier, V., Khoudour, L., Bakey, C., Garrigos, J-p., Françoise, C., Jacqueline, D., Antoine, R., Boukour, F. Edelmayer, A., Ruffin, C., Zotos, T. 2019. Results of the evaluation of the pilot tests. Deliverable D4.4 of the SAFER-LC project. (link)

Skládaný, P., Tučka, P., Skládaná, P., Šimeček, M., Bidovský, M., & Křivánek, V. 2016. Entwicklung von Rüttelstreifen zur Vermeidung von Fehlverhalten an Eisenbahnkreuzungen: Ergebnisbericht zum Forschungsprojekt „RÜTTLEX". Wien: Bundesministerium für Verkehr, Innovation und Technologie. (link)

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Execution (focus on motor execution of action)

DOCUMENTS

RELATED MEASURES

- Sign "Is a train coming?"
- Peripheral blinking lights

GALLERY

COMMENTS

Comment ...

Submit comment

could be used to induce a speed reduction where needed, but should be combined with additional measures that enhance visual search for a train.

References:

Grippenkoven, J., & Dietsch, S. 2015. Gaze direction and driving behavior of drivers at level crossings. Journal of Transportation Safety & Security, 8(sup1), 4–18. (link)

Hore-Lacy, W. 2008. Rumble strip effectiveness at rural intersections and railway level crossings. Research report on behalf of VicRoads. (link)

Laapotti, S. 2016. Comparison of fatal motor vehicle accidents at passive and active railway level crossings in Finland. IATSS Research 40(1), 1–6. doi:10.1016/j.iatssr.2015.12.003 (link)

Radalj, T., & Kidd, B. A. 2005. A Trial with Rumble Strips as a Means of Alerting Drivers to Hazards at Approaches to Passively Protected Railway Level Crossings on High Speed Western Australian Rural Roads. Research Report. Main Roads Western Australia.

Silla, A., Virtanen, A., Lehtonen, E., Boufidis, N., Salanova Grau, J. M., Dressler, A., Grippenkoven, J., Taillandier, V., Khoudour, L., Bakey, C., Garrigos, J-p., Françoise, C., Jacqueline, D., Antoine, R., Boukour, F. Edelmayer, A., Ruffin, C., Zotos, T. 2019. Results of the evaluation of the pilot tests. Deliverable D4.4 of the SAFER-LC project. (link)

Skládaný, P., Tučka, P., Skládaná, P., Šimeček, M., Bidovský, M., & Křivánek, V. 2016. Entwicklung von Rüttelstreifen zur Vermeidung von Fehlverhalten an Eisenbahnkreuzungen: Ergebnisbericht zum Forschungsprojekt „RÜTTLEX". Wien: Bundesministerium für Verkehr, Innovation und Technologie. (link)

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Execution (focus on motor execution of action)

DOCUMENTS

RELATED MEASURES

- Sign "Is a train coming?"
- Peripheral blinking lights

GALLERY

COMMENTS

Comment ...

Submit comment

< Back

RUMBLE STRIPS ON LC APPROACH

Noise-producing pavement

☆ ☆ ☆ ☆ ☆ 0/5 *(0 vote)*

Add to Bookmarks

Publication : 16/04/2020 - Last updated: 20/04/2020

Type of implementation : Road infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Passive

Only light and/or sound warning

Effect mechanism :

Reduces the approach speeds of vehicles

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural urban

DESCRIPTION

Application of structured or milled markings in the road surface on approach to the **LC**. Aimed to induce speed reduction and enhance alertness in motorized road users.

POTENTIAL BENEFITS

- Rumble strips have been shown to induce speed reduction in drivers when applied in appropriate design. This effect can be used on approach to LCs to prolong the time drivers have to gather visual information whether a train is coming.
- The rumbling is also likely to enhance drivers' general alertness. It is controversial whether it is also suitable to enhance drivers' awareness of the hazard of approaching trains and the necessity to look for a train (see study results).

POTENTIAL CRITICALITIES

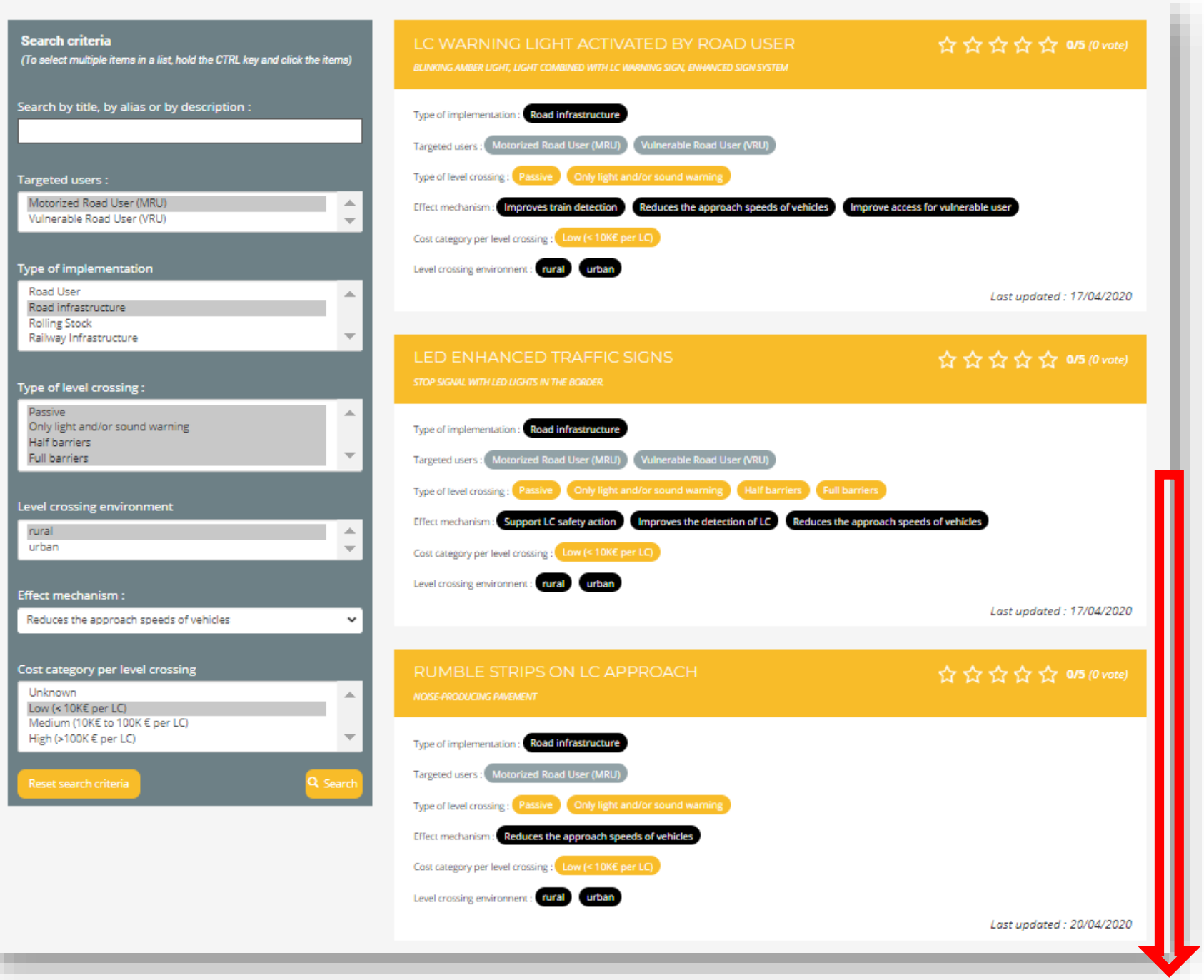
- Road users may try to circumvent the rumble strips. To prevent this, e.g., the strips may be applied to the whole width of the road, or the measure may be combined with physical lane separation
- If road users do not mentally connect the rumble strips to the **LC**, the effect may diminish, or they may even be distracted from trying to figure out the meaning of the rumble strips.
- The strips may disturb or impede road users such as bicyclists and motorcyclists.

RECOMMENDATIONS

To help road users establish the connection between the rumble strips on the one hand and the **LC** and the hazard of approaching trains on the other, the strips should not be used in an "uncommented" way. The strips themselves should be clearly visible on approach, and a connection to the LC should be established by combining them with additional explanatory measures, giving clear hints to the relevant hazard and the recommended behavior.

STUDY RESULTS & REFERENCES

Quick Access


Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
Reduces the approach speeds of vehicles
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
LC WARNING LIGHT ACTIVATED BY ROAD USER
0/5 (0 vote)
BLINKING AMBER LIGHT, LIGHT COMBINED WITH LC WARNING SIGN, ENHANCED SIGN SYSTEM
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Passive Only light and/or sound warning
Effect mechanism : Improves train detection Reduces the approach speeds of vehicles Improve access for vulnerable user
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 17/04/2020
LED ENHANCED TRAFFIC SIGNS
0/5 (0 vote)
STOP SIGNAL WITH LED LIGHTS IN THE BORDER.
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Passive Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Support LC safety action Improves the detection of LC Reduces the approach speeds of vehicles
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 17/04/2020
RUMBLE STRIPS ON LC APPROACH
0/5 (0 vote)
NOISE-PRODUCING PAVEMENT
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive Only light and/or sound warning
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 20/04/2020

< Back

SPEED BUMPS ON APPROACH TO LC

hump, road profile, road obstacle

☆ ☆ ☆ ☆ ☆ **0/5** *(0 vote)*

Add to Bookmarks

Publication : 04/09/2019 - Last updated: 21/04/2020

Type of implementation : Road infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Passive

Effect mechanism :
Reduces the approach speeds of vehicles

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural urban

DESCRIPTION

A speed bump is a small structure installed on the road surface or a small raised area built across a road within the approach zone of the **LC** to force road users to drive slower. The installation of well-marked speed bumps within the LC approach zone to reduce road vehicle speed, also aims to maximise the time available to the driver to process information and make (correct) decision.

POTENTIAL BENEFITS

- Increased safety margins due to reduced approach speeds at **LC**.
- Can have many shapes and colors.
- If not for safety reasons, some MRU will still reduce speed not to damage their vehicles (e.g. suspension systems).
- In specific contexts it may also be effective on cyclists.
- Rubber speed bumps can be easily installed on the road surface and removed or moved when necessary.

POTENTIAL CRITICALITIES

- Enhanced noise pollution, especially in unloaded trucks and tractors (proportion should be checked before implementation)
- According to a Finnish study (Seise et al. 2009) roughly half of the people who live near the **LC** equipped with speed bumps and use it frequently considered speed bumps very unpleasant, while the other half did not see any significant disadvantages.
- Due to the potentially poor road user acceptance of this speed calming measure, their attention may not be so directed towards safety signage or safe actions, but toward feeling frustrated or on how to avoid the bumps

RECOMMENDATIONS

- It is advisable to conduct a trial of speed bumps before any widespread installation. Speed bumps may be contraindicated when the road surface type and the use of snow removal machinery make them impractical
- Layout must prevent driving around bump (Aigner-Breuss et al. 2013). Consider covering the whole width of the road. This way road users cannot avoid the bump, and the measure will implicitly target two-wheelers as well: motorbikes, mopeds, and even cyclists
- Choose distance to prevent distraction directly ahead of **LC** (Aigner-Breuss et al. 2013)
- Choose height of bump according to speed reduction needed (Ibid.)
- Specific guidelines are needed for the maintenance of speed bumps if installed on gravel roads, which also involves manual work (Seise et al. 2009).

Quick Access

- Specific guidelines are needed for the maintenance of speed bumps if installed on gravel roads, which also involves manual work (Seise et al. 2009).
- More studies are needed to determine what kinds of LC are best suited to speed bumps, how they should be fastened to different kinds of gravel surfaces, what the proper dimensions of the bumps would be to effectively reduce speeds while being acceptable to road users, and how their maintenance should be organised. (ibd).

STUDY RESULTS & REFERENCES

References:

- Aigner-Breuss, E., Aleksa, M., Braun, E., Machata, K., Knowles, D., et al. (2013). MANEUVER: Ein Handbuch für PraktikerInnen und EntscheidungsträgerInnen. Vienna: Bundesministerium für Verkehr, Innovation und Technologie.
- Seise, A., Poutanen, M., & Kallberg, V-P. (2009). Hidastetöyssyjen vaikutus ajonopeuksiin sorateiden vartioimattomissa tasoristeyksissä [The effect of speed bumps on driving speeds at road-railway level crossings]. Espoo: VTT Technical Research Centre of Finland. VTT Tiedotteita - Research Notes, No. 2520.

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Decision-making (focus on risk-perception, subjective judgment, and motivational factors)
Execution (focus on motor execution of action)

DOCUMENTS

RELATED MEASURES

Active speed bumps on approach to LC

GALLERY

< Back

ACTIVE SPEED BUMPS ON APPROACH TO LC

Actibump, Smart bump, dynamic speed bump, intelligent speed bump, active inverted speed bump

☆ ☆ ☆ ☆ ☆ **0/5** *(0 vote)*

Add to Bookmarks

Publication : 28/05/2019 - Last updated: 20/04/2020

Type of implementation : Road infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Passive

Effect mechanism :

Reduces the approach speeds of vehicles

Cost category per level crossing :

Medium (10K€ to 100K € per LC)

Level crossing environment : urban

DESCRIPTION

An active speed bump will be activated only if an approaching vehicle exceeds a defined speed. This type of speed bump disrupts traffic less than traditional speed bumps as non-speeding vehicles may pass unaffected. The measure may also remain inactive for emergency vehicles with the use of a transponder.

Two types of active speed bumps can be used:

1. **"Traditional" bumps** - during the activation a bump will go up a few centimetres and then will lower back down to the level of the road surface.
2. **Inverted "bumps"** - during the activation a hatch (integrated into the road) lowers the pavement surface by a few centimetres, creating an inverted speed bump. The hatch will then rise again to the level of the road surface.

POTENTIAL BENEFITS

- Safety benefits of passive speed bumps, but less disruption for vehicles not violating speed limit.
- Although speed bumps are theoretically useful mainly before passive LCs, they can also be implemented before active LCs where a speed reduction of approaching road vehicles is necessary.

POTENTIAL CRITICALITIES

- More difficult to implement in areas with heavy snow, unknown yet how the structure deals with adverse weather conditions (e.g. excessive rainfall, snow and ice).
- Difficult if not impossible to implement in rural roads.
- Requires more frequent maintenance and is more expensive than a conventional bump.
- Safety considerations for vulnerable road users such as motorcyclists and cyclists (e.g., might the dip, surface material and surprise element of encountering this measure destabilise these road users?).
- Road users should be made aware of the measure.
- Most common problem regarding active speed bumps by Bagdadi & Patten (2014) concerns reliability. In an installation of active bumps in Sweden, the measure malfunctioned so that it was always engaged. Poor reliability could negatively influence public acceptance of the measure.

Quick Access

RECOMMENDATIONS

- Specific guidelines might be needed for the maintenance of actively inverted speed bumps.
- Road users should be made aware of the active inverted speed bumps well in advance.

STUDY RESULTS & REFERENCES

- Speeding generally decreases gradually over the first year of installation as drivers become accustomed to the bumps (Edeva, 2018).
- 85th percentile speed equalled ±3 km/h of all test road speed limits in a 2017 test of the measure in Malmö (Edeva, 2017).
- Active bumps may produce less noise than conventional bumps (Bagdadi & Patten, 2014).
- Active bumps may be better suited to roads featuring large traffic volumes, as the bump will not disrupt traffic if vehicles drive at the speed limit (Bagdadi & Patten, 2014).

References:

- Edeva. 2017. Evaluation of three sites in Malmö. Actibump - Evaluation Summary Malmö. Linköping, Sweden.
- Edeva. 2018. Evaluation of four actibumps at Curtin University, Perth, Australia. Actibump - Evaluation Curtin University. Linköping, Sweden.
- Bagdadi, O. & Patten, C. 2014. Dynamiska farthinder En litteraturstudie. VTI Rapport 823.

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Decision-making (focus on risk-perception, subjective judgment, and motivational factors)
Execution (focus on motor execution of action)

LINKS

Smart bumps

ActiBumps

Smarter bumps

DOCUMENTS

RELATED MEASURES

Speed bumps on approach to LC

GALLERY

Search criteria

(To select multiple items in a list, hold the CTRL key and click the items)

Search by title, by alias or by description :

Targeted users :

- Motorized Road User (MRU)
- Vulnerable Road User (VRU)

Type of implementation

- Road User
- Road infrastructure
- Rolling Stock
- Railway Infrastructure

Type of level crossing :

- Passive
- Only light and/or sound warning
- Half barriers
- Full barriers

Level crossing environment

- rural
- urban

Effect mechanism :

- Any -

Cost category per level crossing

- Unknown
- Low (< 10K€ per LC)
- Medium (10K€ to 100K € per LC)
- High (>100K € per LC)

Reset search criteria | Search

AWARENESS - EDUCATION CAMPAIGN

0/5 (0 vote)

ILCAD, AWARENESS, EDUCATION, GRADE CROSSING, SAFETY, CAMPAIGN

Type of implementation : Road User

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Support LC safety action | Increases awareness of correct behaviour

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 21/04/2020

LC IDENTITY CARDS TO FACILITATE EMERGENCY RESPONSE

0/5 (0 vote)

SAFETY, IDENTIFICATION, CALL, EMERGENCY, RESCUE TEAM, REPORT

Type of implementation : Road User | Road infrastructure | Rolling Stock | Railway Infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Support LC safety action

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 20/04/2020

SMARTPHONE/WATCH MESSAGE WARNING OF APPROACHING LC

0/5 (0 vote)

WEARABLE DEVICE

Type of implementation : Road User

Targeted users : Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Improves the detection of LC | Improves train detection | Provides up-to-date information about the status of LC

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 17/04/2020

SAFER-LC

< Back

AWARENESS - EDUCATION CAMPAIGN

ILCAD, awareness, education, grade crossing, safety, campaign

☆ ☆ ☆ ☆ ☆ **0/5** *(0 vote)*

Add to Bookmarks

Publication : 17/04/2020 - Last updated: 21/04/2020

Type of implementation : Road User

Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)

Type of level crossing : Passive Only light and/or sound warning Half barriers Full barriers

Effect mechanism : Support LC safety action Increases awareness of correct behaviour

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural urban

DESCRIPTION

Most railway companies around the world organize level crossing safety awareness campaigns on a national level with the collaboration of road safety advocates, local authorities.

In 2009 it was decided in a working group on level crossing safety, ELCF, the European Level Crossing Forum, composed of actors from different sectors to organize on the basis of already existing national campaigns a worldwide campaign: the International Level Crossing Awareness Day taking place once a year in June.

ILCAD, the International Level Crossing Awareness campaign, led by the International Union of Railways (UIC), brings together railway industry representatives, road authorities, academics and more from around the world.

ILCAD aims to raise awareness about the dangers associated with the road/rail interfaces (level crossings). ILCAD is a joint commitment that began in 2009 with ELCAD (EU countries + Israel). Since then, UIC has been coordinating this worldwide event to raise public awareness about the dangers at level crossings.

Each year the campaign targets a specific public or topic. We celebrated the 12th edition in 2019

POTENTIAL CRITICALITIES

Safety messages may be forgotten, therefore they have to be repeated.

RECOMMENDATIONS

- Awareness campaigns should target the right public with the right messages otherwise the message does have any effects.
- Awareness campaigns shall be repeated otherwise the safety message is easily forgotten.

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Decision-making (focus on risk-perception, subjective judgment, and motivational factors)

LINKS

Quick Access

Search criteria

(To select multiple items in a list, hold the CTRL key and click the items)

Search by title, by alias or by description :

Targeted users :

- Motorized Road User (MRU)
- Vulnerable Road User (VRU)

Type of implementation

- Road User
- Road infrastructure
- Rolling Stock
- Railway Infrastructure

Type of level crossing :

- Passive
- Only light and/or sound warning
- Half barriers
- Full barriers

Level crossing environment

- rural
- urban

Effect mechanism :

- Any -

Cost category per level crossing

- Unknown
- Low (< 10K€ per LC)
- Medium (10K€ to 100K € per LC)
- High (>100K € per LC)

Reset search criteria | Search

AWARENESS - EDUCATION CAMPAIGN

0/5 (0 vote)

ILCAD, AWARENESS, EDUCATION, GRADE CROSSING, SAFETY, CAMPAIGN

Type of implementation : Road User

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Support LC safety action | Increases awareness of correct behaviour

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 21/04/2020

LC IDENTITY CARDS TO FACILITATE EMERGENCY RESPONSE

0/5 (0 vote)

SAFETY, IDENTIFICATION, CALL, EMERGENCY, RESCUE TEAM, REPORT

Type of implementation : Road User | Road infrastructure | Rolling Stock | Railway Infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Support LC safety action

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 20/04/2020

SMARTPHONE/WATCH MESSAGE WARNING OF APPROACHING LC

0/5 (0 vote)

WEARABLE DEVICE

Type of implementation : Road User

Targeted users : Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Improves the detection of LC | Improves train detection | Provides up-to-date information about the status of LC

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 17/04/2020

SMARTPHONE/WATCH MESSAGE WARNING OF APPROACHING LC

wearable device

☆ ☆ ☆ ☆ ☆ 0/5 *(0 vote)*

Add to Bookmarks

Publication : 05/09/2019 - Last updated: 17/04/2020

Type of implementation : Road User

Targeted users : Vulnerable Road User (VRU)

Type of level crossing : Passive

Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Improves the detection of LC

Improves train detection

Provides up-to-date information about the status of LC

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

DESCRIPTION

Message to smartphone/-watch warning road users of an approaching **LC** (and potentially approaching train). Message could interrupt all other applications (such as radio) or transmissions (such as Wifi, Bluetooth) and sound an alarm (and/or jam the connections) when it detects an approaching LC and a potentially approaching train. This measure is aimed at pedestrians and cyclists.

The functioning of the system requires that pedestrians and cyclists have a dedicated application downloaded and running in their smartphone/-watch (otherwise no warnings can be generated). The application needs to track the road user movement to confirm that the road user is near the LC and aiming to cross the railway lines.

Requirements to produce information on approaching train: In order to ascertain the correct and on time delivery of information on approaching trains, the application/system sends requests containing the LC id to the back office system and receives a response of the LC status and information on potentially approaching trains. The system requires that train-tracking system (Junavaro or equivalent; see e.g. Öörni & Virtanen, 2007) is implemented and data is publicly available from the server.

POTENTIAL BENEFITS

Warn pedestrians and cyclists of nearby **LC** via personal smart device. Disruptive nature of warning could effectively reach users concentrating on their devices instead of traffic.

POTENTIAL CRITICALITIES

- The application could create an additional source of distraction in road users who are not already looking at the mobile device.
- Potential overreliance on this type of measure could take the road user´s attention away from observing the road and level crossing.
- Users would have to download an application, activate location tracking and allow the application to run in the device background while walking/cycling near LCs (otherwise no warnings can be generated).

RECOMMENDATIONS

- To avoid negative side effects, the technology could contain a use detection and issue a warning only in case the device is currently being handled by the user.
- Moreover, the output should optimally not stress visual processing resources (Wickens & McCarley, 2008), but should facilitate a quick orientation of visual attention to the **LC** (e.g. by arrows, speech output).
- Users should be reminded that the system is not fail-safe (e.g. when starting the application).

Quick Access

STUDY RESULTS & REFERENCES

Öörni, R. and Virtanen, A. 2007. 'In-vehicle warning system for railway level crossings'. Proceedings of the 6th European Congress and Exhibition on Intelligent Transport Systems and Services, 2007, Aalborg, Denmark.

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Identification (focus on attention and workload)

LINKS

Rail Crossing Locator Mobile Application used in the US (link)

DOCUMENTS

RELATED MEASURES

In-vehicle LC and train proximity warning

GALLERY

COMMENTS

Comment ...

Submit comment

IN-VEHICLE LC AND TRAIN PROXIMITY WARNING

Proximity message, connected vehicle, satnav, mobile device

★★★☆☆ 3/5 *(1 vote)*

Add to Bookmarks

Publication : 23/05/2019 - Last updated: 17/04/2020

Type of implementation : Road User | Rolling Stock | Railway Infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Improves the detection of LC | Improves train detection | Provides up-to-date information about the status of LC

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

DESCRIPTION

Detection of approaching **LC** (and potentially detection of approaching/oncoming trains) and provision of warnings to car drivers. The warnings can be delivered to the car drivers e.g. via existing or additional in-vehicle displays (approach 1 or 2) or mobile devices (approach 1). Depending on the implementation, the connected vehicle should be equipped with the appropriate device to receive the messages.

The provision of warnings can be done in two different ways:

- Approach 1: In order to ascertain the correct and on time delivery of information on approaching LCs (and trains) to car drivers, the vehicle movement needs to be tracked to detect the intention to pass the LC. Specifically, this means that the location data should contain POI data (list of LC locations) in order to identify LCs. Then the system sends requests containing LC id to back office system and receives a response of the LC status and approaching trains. The system requires that train-tracking system (Junavaro or equivalent; see e.g. Öörni & Virtanen, 2007) is implemented and data is publicly available from the server.
- Approach 2: ITS-G5 road side unit is installed in connection with the LC to deliver information to the vehicles on the existence of the LC and potentially approaching trains. All connected vehicles (with the ability to receive information) near the LC would receive the warnings. This type of warning would only work in LCs which are equipped with the ITS-G5 road side unit.

The measure tested in the SAFER-LC pilot (In-vehicle train and LC proximity alert) was a mobile application that could be installed on any common mobile device such as a smartphone or tablet, and it warned the road users about the presence of a LC through a dedicated pop-up window and a short audio alert, whenever they approached a LC. The warning also included the estimated time of train arrival, whenever an incoming train was expected to reach the LC within one minute.

Train detection can be achieved using different technologies, e.g. sensors installed in the tracks upstream of the LC (axle counters, radar, ultrasonic sensors or other) or geo-localization of the train and ITS (intelligent transportation system) to transmit information.

POTENTIAL BENEFITS

Can alert driver to nearby **LC** with in-vehicle warning. Ambient noise is less likely to mask audible alert, and in-car display may be more noticeable than traffic sign.

POTENTIAL CRITICALITIES

- The display of information and warnings could contribute to driver distraction by directing attention away from the road. Negative effects can be avoided by ergonomic interface design (e.g. audio instead of visual output). In a simulator study (Larue, et al. 2015) a proximity message did not result in significant changes in cognitive load while approaching crossings.
- At passive LCs, complacency or over-trust effects could occur if the system fails to give a warning (miss).
- User trust and use will decrease in case many false alarms are issued.
- At passive LCs, the electrical power needed for the road side unit may not be available.

Quick Access

RECOMMENDATIONS

- The messages sent should be adapted to the type of **LC** in terms of the recommended behaviour (e.g. passive: drive slow and look left and right, barriers: please wait, adding information on prospective time of continuation of the journey if available).
- As an alternative to triggering such a system by train proximity, it would also be supportive to provide information based on LC proximity alone if the technical implementation of the train detection appears too challenging.
- User should be informed that the system is not fail-proof.
- An implementation that includes warnings for oncoming trains must facilitate a reliable train detection method, in order to avoid false negatives cases (where oncoming trains are not detected and therefore no message produced).

STUDY RESULTS & REFERENCES

Main findings of the SAFER-**LC** pilot (Silla et al., 2019), where such a system was tested by taxi drivers:

- LCs usage: ~600 vehicles and more than 200k registered trajectories in ~6 months.
- No significant differentiations in aggregated speed and acceleration profiles identified in the pre-post system comparison.
- There are no indications of distinct and characteristic driving behaviors amongst the taxi drivers.
- Disaggregated examination of trajectories reveals improvements in five safety related **KPIs** for the case when the barriers are open. "Safety checks" with the warning system enabled appear to be more frequent, longer and at safer spatial distance to the rail line.
- The Artificial Neural Network predictive algorithm is capable of highly accurate predictions on the estimated time of train arrival to LC.
- Encouraging feedback from the questionnaires answered by taxi drivers. Before deploying the piloted system, the majority stated that LC safety infrastructure in Thessaloniki is inadequate. After its deployment, most drivers reported that they felt safer and that they trust the provided information; many of them would be interested in using the system in the future.

Other study results:

- An Australian simulator study by Larue et al. (2015) showed that stopping compliance at LCs was improved with both visual and audio-based in-vehicle ITS, in cases where a train was arriving to the LC. Audio-based ITS resulted in higher compliance. Stopping compliance fell when the system was in use but no train was arriving. Audio ITS also reduced speeds 20 meters from the LC by 3 km/h, while visual ITS did not lead to any speed reduction.
- In another simulator study by Larue & Wullems (2015), stop sign compliance reduced by 16.5% when the technology was installed.
- Larue & Wullems (2015) tested driver compliance at LCs in a scenario where the in-vehicle system fails. Results show that drivers continue to look for trains themselves even when the system is installed but fails to activate.
- Landry et al. (2019) conducted a simulator study in the USA regarding road user behaviour with in vehicle auditory alerts. Results show that the system reminds and informs road users how to comply with level crossings. Additionally, a lasting positive effect on driver compliance remaining after the system was no longer active, was also found. Highest compliance occurred when the system was combined with conventional LC warning signs such as crossbucks. The system was found to be effective at both passive and active LCs.

References:

- Silla, A., Virtanen, A., Lehtonen, E., Boufidis, N., Salanova Grau, J. M., Dressler, A., Grippenkoven, J., Taillandier, V., Khoudour, L., Bakey, C., Garrigos, J-p., Françoise, C., Jacqueline, D., Antoine, R., Boukour, F. Edelmayer, A., Ruffin, C., Zotos, T. 2019. Results of the evaluation of the pilot tests. Deliverable D4.4 of the SAFER-LC project. Submitted 20th December, 2019.
- Larue, G.S., Kim, I., Rakotonirainy, A., Haworth, N.L. & Ferreira, L. 2015. Driver's behavioural changes with new intelligent transport system interventions at railway level crossings –A driving simulator study. Accident Analysis & Prevention. 81. 74–85.
- Larue, G.S. & Wullems, C. 2015. Driving Simulator Evaluation of the Failure of an Audio In-vehicle Warning for Railway Level Crossings. Urban Rail Transit. 1. 139–148.
- Landry, S., Myounghoon, J., Lautala, P. & Nelson, D. 2019. Design and assessment of in-vehicle auditory alerts for highway-rail grade crossings. Transportation Research Part F. 62. 228–245.
- Öörni, R. and Virtanen, A. 2007. 'In-vehicle warning system for railway level crossings'. Proceedings of the 6th European Congress and Exhibition on Intelligent Transport Systems and Services, 2007, Aalborg, Denmark.

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Rule knowledge (focus on knowledge retrieval)
Decision-making (focus on risk-perception, subjective judgment, and motivational factors)

LINKS

Example of an application that was launched in France. It uses **GPS** and alerts drivers that they are approaching a **LC**. The alert distance can be adjusted between 50 and 1000 meters.

- Link YouTube video (only in French)
- Link mobile app download

Rail Crossing Locator Mobile Application used in the US (link)

DOCUMENTS

RELATED MEASURES

Smartphone/watch message warning of approaching LC

GALLERY

COMMENTS

Comment ...

Submit comment

Search criteria

(To select multiple items in a list, hold the CTRL key and click the items)

Search by title, by alias or by description :

zig zagging

Targeted users :

- Motorized Road User (MRU)
- Vulnerable Road User (VRU)

Type of implementation

- Road User
- Road infrastructure
- Rolling Stock
- Railway Infrastructure

Type of level crossing :

- Passive
- Only light and/or sound warning
- Half barriers
- Full barriers

Level crossing environment

- rural
- urban

Effect mechanism :

- Any -

Cost category per level crossing

- Unknown
- Low (< 10K€ per LC)
- Medium (10K€ to 100K € per LC)
- High (>100K € per LC)

Reset search criteria | Search

EXTENDED BARRIERS

★☆☆☆☆ 1/5 *(1 vote)*

BARRIER, GATE ARM, EXTENSION, LONGER GATE ARM, LONGER BARRIER, ZIG-ZAGG, ZIG ZAGG, ZIG-ZAGGING, ZIG ZAGGING

Type of implementation : Railway Infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Half barriers

Effect mechanism : Controls access and supports egress from LC

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 21/04/2020

PHYSICAL LANE SEPARATION IN FRONT OF HALF BARRIERS

☆☆☆☆☆ 0/5 *(0 vote)*

MEDIAN SEPARATORS, INTERMEDIATE SEPARATION, ZIG-ZAGG, ZIG ZAGG, ZIG-ZAGGING, ZIG ZAGGING

Type of implementation : Road infrastructure | Railway Infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Half barriers

Effect mechanism : Controls access and supports egress from LC | Improves the physical environment of LC

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 21/04/2020

EXTENDED BARRIERS

Barrier, gate arm, extension, longer gate arm, longer barrier, zig-zagg, zig zagg, zig-zagging, zig zagging

★ ☆ ☆ ☆ ☆ 1/5 (1 vote)

Add to Bookmarks

Publication : 05/09/2019 - Last updated: 21/04/2020

Type of implementation :
Railway infrastructure

Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)

Type of level crossing : Half barriers

Effect mechanism :
Controls access and supports egress from LC

Cost category per level crossing :
Low (< 10K€ per LC)

Level crossing environment : rural urban

Quick Access
- Description
- Potential benefits
- Potential criticalities
- Recommendations
- Study results & references
- Main psychological functions involved
- Documents
- Related measures
- Comments

DESCRIPTION

This measure refers to the increase of the length of the first barrier of the level crossing, making the gate arm longer. A longer barrier complicates and discourages the zig-zagging of vehicles by reducing the drivers' ability to run around the gates.

POTENTIAL BENEFITS

Discourage road user from passing closed barrier.

POTENTIAL CRITICALITIES

- Motorists with narrow vehicles (e.g. motorcyclists) could still circumvent the barrier.
- The extension of gate arms may imply the need of adjustment of the counterweight to achieve the balance of weights, which is an easy intervention. Motors of modern barriers, without counterweight, may have able to lift the counter barrier without the need of adjustment.

RECOMMENDATIONS

The measure here considered is initially targeted to Motorised Road Users, as the gate considered is the one located on the road. Depending on the configuration of the barriers a similar idea could also be implemented addressed to vulnerable road users.

STUDY RESULTS & REFERENCES

- Before-and-after tests for longer gate arms were carried out at an LC on a busy road (11,000 vehicles per day) in North Carolina, USA. The gate arms extend approximately three quarters of the road's total width. LC violations reduced by 67% immediately after the longer gate arms were installed. A follow-up test one year later showed that LC violations reduced by 84% compared to the before test (Federal Railroad Administration, 2001).

References:

- Federal Railroad Administration. 2001. North Carolina "Sealed Corridor" Phase I. US DOT Assessment Report. Washington, D.C.: U.S. Department of Transportation. (link)

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Decision-making (focus on risk-perception, subjective judgment, and motivational factors)
Execution (focus on motor execution of action)

DOCUMENTS

RELATED MEASURES

Physical lane separation in front of half barriers

COMMENTS

Comment ...

Submit comment

PHYSICAL LANE SEPARATION IN FRONT OF HALF BARRIERS

median separators, intermediate separation, zig-zagg, zig zagg, zig-zagging, zig zagging

☆ ☆ ☆ ☆ ☆ 0/5 (0 vote)

Add to Bookmarks

Publication : 23/05/2019 - Last updated: 21/04/2020

Type of implementation :
Road infrastructure
Railway infrastructure

Targeted users :
Motorized Road User (MRU)

Type of level crossing : Half barriers

Effect mechanism :
Controls access and supports egress from LC
Improves the physical environment of LC

Cost category per level crossing :
Low (< 10K€ per LC)

Level crossing environment : rural urban

Quick Access
- Description
- Potential benefits
- Potential criticalities
- Recommendations
- Study results & references
- Main psychological functions involved
- Links
- Documents
- Comments

DESCRIPTION

Installation of elements (delineator posts, rods, traffic islands, etc.) to physically separate lanes immediately in front of half-barriers to prevent road users from driving around closed or closing half-barriers (prevention of zig-zagging).

POTENTIAL BENEFITS

Reduces violations at LCs by increasing difficulty of passing barriers.

POTENTIAL CRITICALITIES

- Depending on the design and climatic situation, the measure may cause challenges in snow clearance in winter.
- Cannot be applied when another road intersects the road ahead of the LC.

RECOMMENDATIONS

- The elements used should be designed such as not to disrupt normal traffic flow or introduce a new danger.

STUDY RESULTS & REFERENCES

- A before-and-after study concerning the safety effects of median barriers installed on approach to a LC with gates was conducted in Spokane, Washington. Video cameras recorded all gate activations and accidents four months before and four months after median barrier installation. The measure reduced incidents from 9 per 100 gate activations to 0.65 per 100 gate activations. "Risky" violations, wherein the violating vehicle crossed the LC within 10 seconds before the trains arrival, reduced from 41 to none. (Applied System Technologies. 2002, cited in Yeh & Multer (2008))
- At one half-barrier LC in North Carolina, USA, the addition of median barriers reduced "close call" violations from 10 per week by 77 % in a before-and-after comparison (Federal Railroad Administration, 2001).

References:

- Federal Railroad Administration. 2001. *North Carolina "Sealed Corridor" Phase I. US DOT Assessment Report.* Washington, D.C.: U.S. Department of Transportation.
- Yeh, M. & Multer, J. 2008. *Driver Behaviour at Highway-Railroad Grade Crossings. A Literature Review from 1990–2006.* U.S. Department of Transportation. Federal Railroad Administration. Cambridge, MA. (link)

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Execution (focus on motor execution of action)

LINKS

Handout with summary of the results of the North Carolina "Sealed corridor" project.

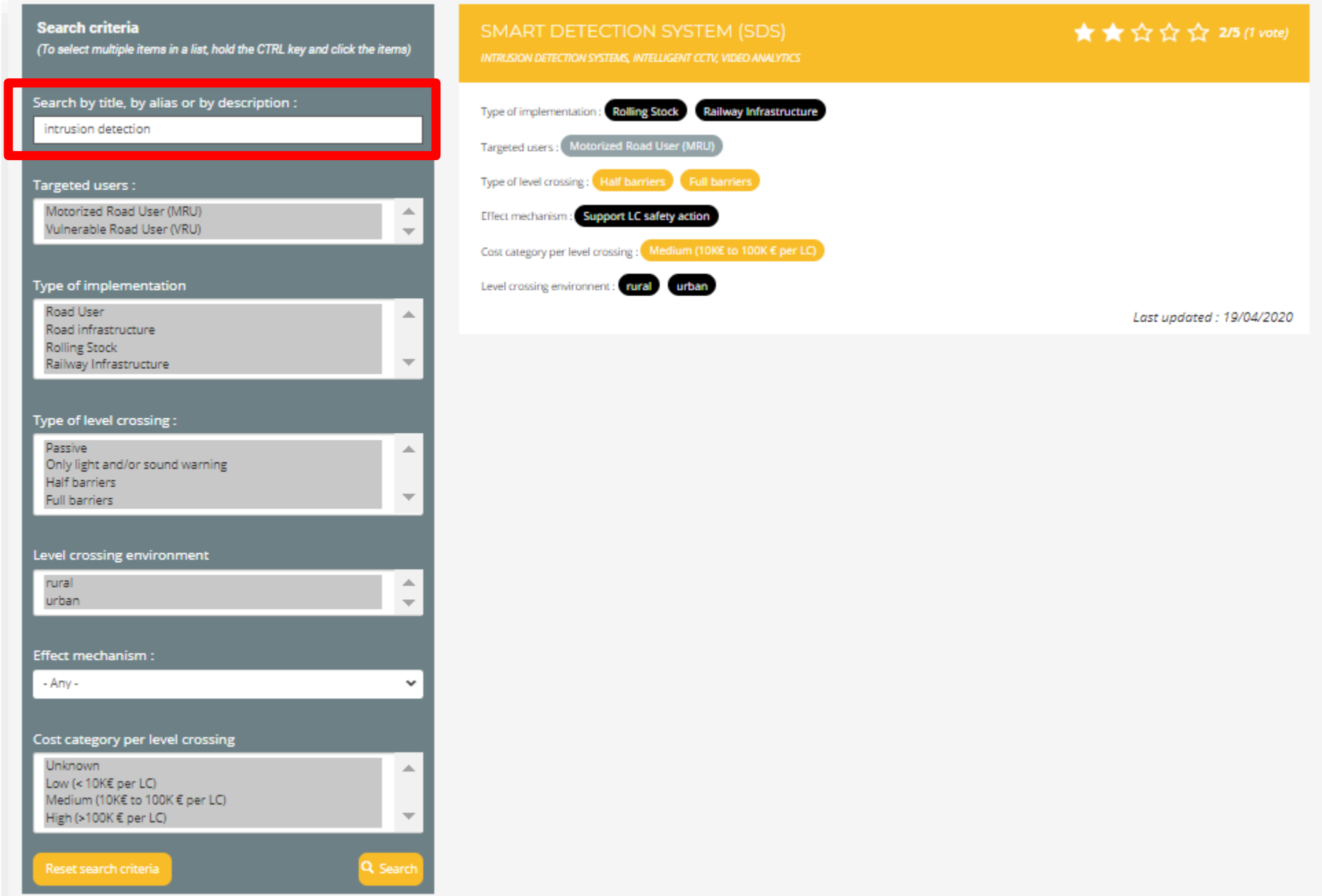
DOCUMENTS

DOCUMENT	DATE	FILE
Federal Railroad Administration. 2001. North Carolina "Sealed Corridor" Phase I. US DOT Assessment Report. Washington, D.C.: U.S. Department of Transportation.	16/04/2020	
Handout with summary of the results of the North Carolina "Sealed corridor" project.	16/04/2020	

COMMENTS

Comment ...

Submit comment

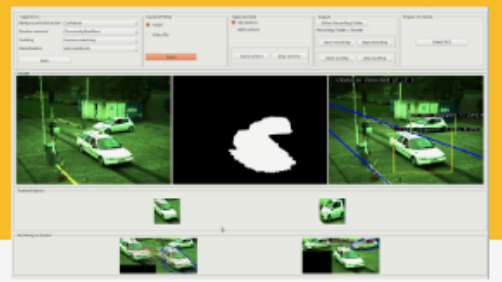

Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
intrusion detection
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
SMART DETECTION SYSTEM (SDS)
INTRUSION DETECTION SYSTEMS, INTELLIGENT CCTV, VIDEO ANALYTICS
2/5 (1 vote)
Type of implementation : Rolling Stock Railway Infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Half barriers Full barriers
Effect mechanism : Support LC safety action
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 19/04/2020

SMART DETECTION SYSTEM (SDS)

Intrusion Detection Systems, Intelligent CCTV, video analytics

★★☆☆☆ 2/5 *(1 vote)*

Add to Bookmarks



Publication : 20/05/2019 - Last updated: 19/04/2020

Type of implementation : Rolling Stock | Railway Infrastructure

Targeted users : Motorized Road User (MRU)

Type of level crossing : Half barriers | Full barriers

Effect mechanism : Support LC safety action

Cost category per level crossing : Medium (10K€ to 100K € per LC)

Level crossing environment : rural | urban

DESCRIPTION

The "Smart Detection System (SDS)" is a warning system based on intelligent video detection of potentially dangerous situations occurring at LCs. An optimized Automatic Incident Detection is specified, implemented, and evaluated. The SDS allows for the accurate detection of hazardous events and localization of obstacles which are blocking the LC and that could jeopardize the safety of users especially vulnerable users.

The global architecture of the system used for the final test is represented below. It includes the smart detection system and the smart Roadside Unit with an interface which is able to send information to surroundings cars or to the train. The interface is connected also to a communication system:

- The SDS is implemented on a personal computer with Linux as operating system connected to an **IP** camera. The SDS processes data flows coming from the video sensor in order to detect events occurring in the field of view of the camera.
- The video flow is stored in a video dataset.
- The events detected by the SDS are registered using Linux Syslog standard process. This process is configured for using documents-oriented dataset, mongolb.
- The process (Event Proxy process) developed allows to send events stored in the database, via Road Side Unit (RSU) network.
- The process (Video Proxy process) allows to send video flows stored in the video database via RSU network

The RSU receives all the information: events detected by the SDS, the corresponding video flow, the state of the lights, the state of the barriers. Then the principle is the following. According to the status of the lights and the status of the barriers, the RSU is choosing the adequate alerts to send to the control room or to the Onboard Unit installed in cars. Every alert sent to the control room is accompanied by the related piece of video.

POTENTIAL BENEFITS

An Intelligent Level-Crossing is a system which integrates functions of modern sensors, communications and information technologies in order to improve safety and operational efficiency at rail-road crossings.

The main benefits offered by a well-designed Intelligent Level-Crossing system are (i) increased security and safety of the road users, train passengers and rail staff, (ii) improved efficiency of the rail and road traffic management by provision of real-time information to rail and road users on the status of the traffic network (for example, possible route alterations due to traffic jams at level-crossings).

Such system has the capability to detect the conditions at the level-crossing, identify potentially hazardous situations, notify the local traffic management system, trigger the system response accordingly, and provide advanced warnings to the vehicle users and train drivers.

POTENTIAL CRITICALITIES

The video-based systems need to be evaluated in a long-term manner. A very good perspective could be to obtain from the railway companies the authorization to test a video imaging and communication systems during real exploitation periods. If we manage to do that, we will be able to measure the impact of these

Quick Access

Search criteria

(To select multiple items in a list, hold the CTRL key and click the items)

Search by title, by alias or by description :

risk assessment

Targeted users :

- Motorized Road User (MRU)
- Vulnerable Road User (VRU)

Type of implementation

- Road User
- Road infrastructure
- Rolling Stock
- Railway Infrastructure

Type of level crossing :

- Passive
- Only light and/or sound warning
- Half barriers
- Full barriers

Level crossing environment

- rural
- urban

Effect mechanism :

- Any -

Cost category per level crossing

- Unknown
- Low (< 10K€ per LC)
- Medium (10K€ to 100K € per LC)
- High (>100K € per LC)

Reset search criteria | Search

LC RISK ASSESSMENT USING VIDEO ANALYSIS AND MACHINE LEARNING

0/5 (0 vote)

VIDEO ANALYTICS, VA

Type of implementation : Road infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Support LC safety action

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 20/04/2020

INSTALLATION OF AUTOMATIC HALF-BARRIERS (CONVENTIONAL UPGRADE)

0/5 (0 vote)

HALF BARRIERS, SEMI BARRIERS, SHORT BARRIER, TWO HALF BARRIERS, 2 HALF BARRIERS, BOOM BARRIER, ACTIVE LEVEL CROSSING

Type of implementation : Railway Infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning

Effect mechanism : Improves the detection of LC | Controls access and supports egress from LC | Increases awareness of correct behaviour

Cost category per level crossing : High (>100K € per LC)

Level crossing environment : rural | urban

Last updated : 19/04/2020

REMOVAL OF LC

0/5 (0 vote)

REMOVING LC, LC ELIMINATION, CLOSING LC, CLOSED LC, LC CLOSURE, LC CANCELLATION, ROAD-RAIL GRADE SEPARATION, OVERPASS, UNDERPASS

Type of implementation : Road infrastructure | Railway Infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Support LC safety action

Cost category per level crossing : High (>100K € per LC)

Level crossing environment : rural | urban

Last updated : 17/04/2020

LC RISK ASSESSMENT USING VIDEO ANALYSIS AND MACHINE LEARNING

video analytics, VA

☆ ☆ ☆ ☆ ☆ 0/5 *(0 vote)*

Add to Bookmarks

Publication : 17/04/2020 - Last updated: 20/04/2020

Type of implementation : Road infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Support LC safety action

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Quick Access

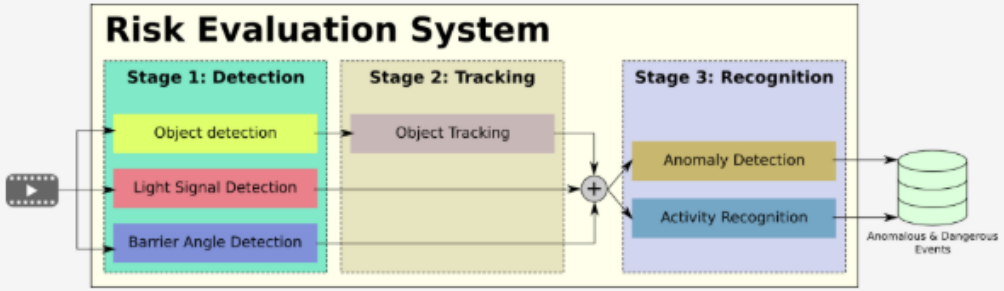
DESCRIPTION

This measure which was developped within SAFER-**LC** project is a software application that analyses video recordings of level crossings and their surroundings, and extracts data about the occurrence of dangerous and/or anomalous behaviours.

This analysis is performed off-line in a semi-supervised fashion and focuses on general motion, i.e., the analysis operates on space-time trajectories instead of directly analysing the images to recognize activities.

The system builds a database of detected dangerous events and can export them in a format allowing a human operator to evaluate the dangerousness of the observed level crossings, calculate statistics and monitor the evolution of these events over time. It can also be used to evaluate the effectiveness of other safety measures implemented on the level crossings, by monitoring the evolution of the number and types of dangerous behaviours that occur before and after the implementation of the measures.

Architecture of the risk assessment system :

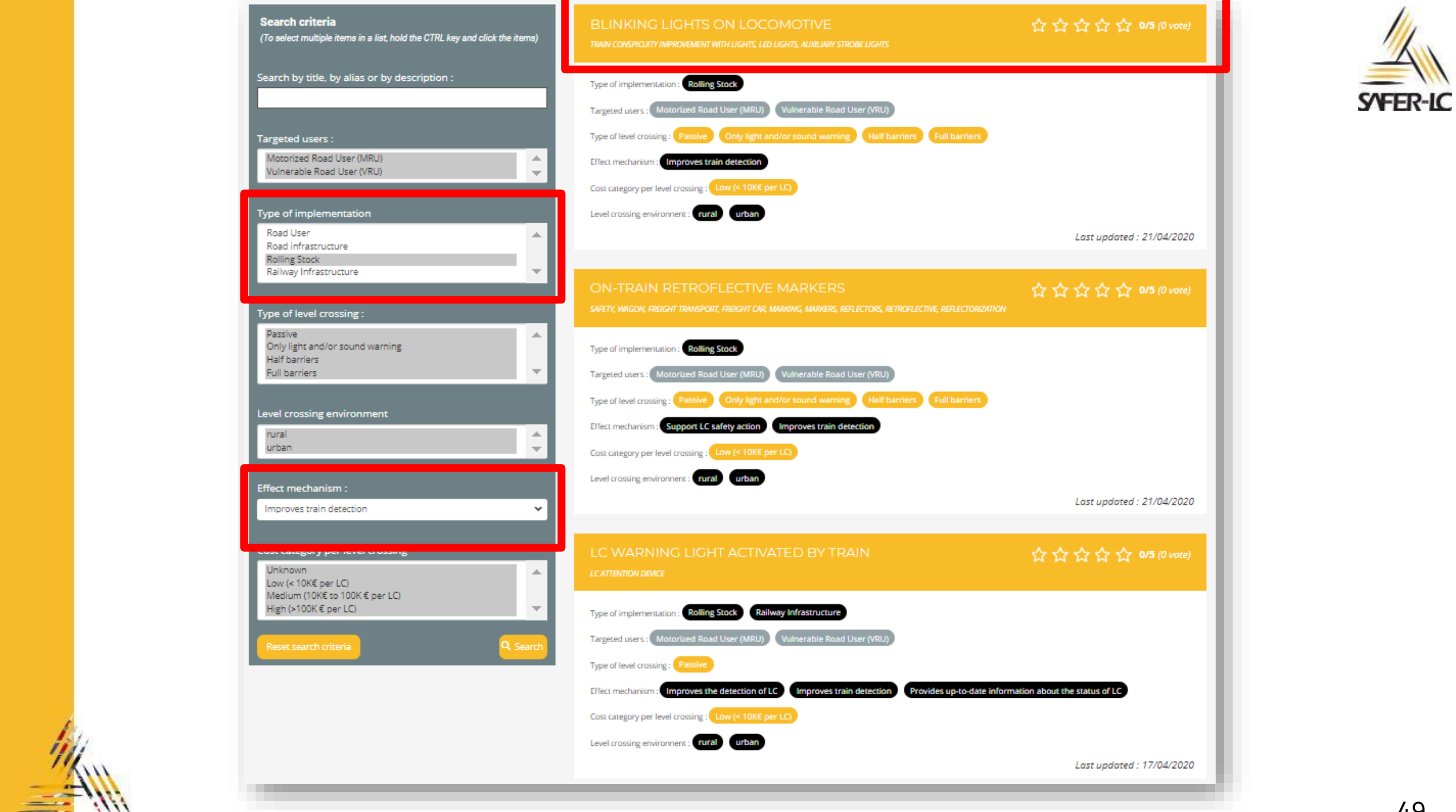


POTENTIAL BENEFITS

- Extracting data about the occurrence of dangerous and/or anomalous behaviors
- Evaluating the effectiveness of other safety measures

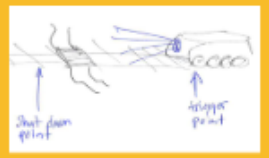
POTENTIAL CRITICALITIES

- Malfunction of the light system on a **LC** with no barrier will make the system ignore some dangerous events


Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
Improves train detection
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
BLINKING LIGHTS ON LOCOMOTIVE
TRAIN CONSPICUITY IMPROVEMENT WITH LIGHTS, LED LIGHTS, AUXILIARY STROBE LIGHTS
0/5 (0 vote)
Type of implementation : Rolling Stock
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Passive Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Improves train detection
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 21/04/2020
ON-TRAIN RETROFLECTIVE MARKERS
SAFETY, WAGON, FREIGHT TRANSPORT, FREIGHT CAR, MARKING, MARKERS, REFLECTORS, RETROFLECTIVE, REFLECTORIZATION
0/5 (0 vote)
Type of implementation : Rolling Stock
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Passive Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Support LC safety action Improves train detection
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 21/04/2020
LC WARNING LIGHT ACTIVATED BY TRAIN
LC ATTENTION DEVICE
0/5 (0 vote)
Type of implementation : Rolling Stock Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Passive
Effect mechanism : Improves the detection of LC Improves train detection Provides up-to-date information about the status of LC
Cost category per level crossing : Low (< 10K€ per LC)
Level crossing environment : rural urban
Last updated : 17/04/2020

BLINKING LIGHTS ON LOCOMOTIVE

Train conspicuity improvement with lights, LED lights, auxiliary strobe lights



☆ ☆ ☆ ☆ ☆ **0/5** *(0 vote)*

Add to Bookmarks

Publication : 05/09/2019 - Last updated: 21/04/2020

Type of implementation : Rolling Stock

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Passive | Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Improves train detection

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

DESCRIPTION

Improvement of train detectability using lights. This system enhances the detection of a train by road users especially at passive LCs.

Different implementations are possible, e.g. improving the front lights of trains with LED technology (or by using eye-safe laser on train front). Lights will flash when the train is coming to the LC and the flashing frequency can be adapted to the distance (triggering of lights can be done with GNSS). The train could emit a visible trace beyond its actual dimensions. This could, e.g. be a laser / light beam facing upward.

The measure tested in the SAFER-LC project included additional blinking lights which were installed to the train according to the prevailing regulations (e.g. below the head lights). The blinking lights are activated automatically at a set distance from the LC and they shut down when the LC has been passed. A technical prototype consisted of three high-intensity LED lights which were developed and tested in a real rail environment and in a driving simulator.

POTENTIAL BENEFITS

- Improves road user detection of arriving train. Road users often cross passive LCs without having visually checked before whether a train is approaching (Grippenkoven & Dietsch, 2015). The blinking (or otherwise additional) lights are estimated to improve visibility and detectability of trains as well as LC safety.
- Based on the SAFER-LC pilots, the blinking lights appear to be a promising way to increase the detectability of approaching trains, especially in daytime conditions (Silla et al., 2019).
- The system takes advantage of an autonomous physiological mechanism, and therefore does not require any conscious effort of the road user to be effective. Moreover, the detection of blinking lights should not be subject to any considerable habituation effects, as the attraction of attention by flickering peripheral stimuli is a hard-wired feature of the nervous system that evolved because it represented an evolutionary advantage.

POTENTIAL CRITICALITIES

- Highly salient visual stimuli associated with an approaching train could facilitate the diversion of attention from other relevant aspects of the road, especially if they are extraordinarily novel compared to stimuli usually observed in traffic.
- In a situation where only a part of all trains are equipped with the measure, the detection of trains that are not equipped could deteriorate (complacency).
- Local residents at **LC** might feel disturbed, depending on light intensity, especially at night. The blinking lights could also cause glare.

Concerns on misinterpreting the flashing lights were raised during the SAFER-LC pilots (Silla et al., 2019). The blinking lights were considered potentially disturbing or misleading especially in the night-time conditions. This could be addressed by appropriate design, e.g. by focusing the lights and adapting them to the prevalent lighting conditions. More research on this is needed.

Quick Access

Based on the judgements on video data, the videos with the blinking lights were evaluated as better than the regular headlights. In daytime conditions, the experts clearly preferred the warnings lights with three consecutive blinks followed by a 3-s break (instead single blink every 1 s or double blink in every 2 s). In the night-time condition, none of the configurations was clearly preferred. The results suggest that the blinking lights caused more glare or were more disturbing during darkness. Also, in the night-time the train can be easily detected even without blinking lights. Among non-experts, the configuration 3 (triple blink every 3 s) was most preferred both in the daytime and in the night-time, but the configuration 2 (double blink every 2 s) was also popular.

Based on the questionnaire results, the blinking lights appear to be a promising way to increase the detectability of approaching trains, especially under daytime conditions. During darkness, the flashing lights might be disturbing or misleading. While blinking lights may improve detection of approaching trains, the results do not clearly show any influence on the reported crossing margins (the time at which road users would not cross the rails anymore).

The subjective ratings of the participants in the driving simulator study are in line with the subjective ratings of the video survey. Participants recognised the safety potential of the blinking lights mounted at the locomotive and estimated that this system supports an early detection of approaching trains. Specifically, the participants in the simulator study detected the train that was equipped with blinking lights earlier than the train with the regular headlights. Due to the earlier detection, the approach speed of the vehicle was reduced earlier as well.

References:

- Grippenkoven, J., & Dietsch, S. 2015. Gaze direction and driving behavior of drivers at level crossings. Journal of Transportation Safety & Security, 8(sup1), 4–18. doi:10.1080/19439962.2015.1046620.
- Silla, A., Virtanen, A., Lehtonen, E., Boufidis, N., Salanova Grau, J. M., Dressler, A., Grippenkoven, J., Taillandier, V., Khoudour, L., Bakey, C., Garrigos, J-p., Françoise, C., Jacqueline, D., Antoine, R., Boukour, F. Edelmayer, A., Ruffin, C., Zotos, T. 2019. Results of the evaluation of the pilot tests. Deliverable D4.4 of the SAFER-LC project. Submitted 20th December, 2019.

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Detection (focus on visual / auditory perception)

LINKS

Video on the Finnish pilot

DOCUMENTS

RELATED MEASURES

Peripheral blinking lights

COMMENTS

Comment ...

Submit comment

PERIPHERAL BLINKING LIGHTS

PeriLight, blinking lights drawing driver attention

☆ ☆ ☆ ☆ ☆ **0/5** *(0 vote)*

Add to Bookmarks

Publication : 02/09/2019 - Last updated: 17/04/2020

Type of implementation : Railway Infrastructure

Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)

Type of level crossing : Passive Only light and/or sound warning

Effect mechanism : Improves train detection

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural urban

DESCRIPTION

A system for passive LCs to enhance the probability that road users detect oncoming trains. When a road user passes a sensor on approach to the LC, two lights located in the periphery of the LC start blinking. The light sources appear in the driver's peripheral vision. The salient blinking evokes an automatic and effortless visual orientation reaction towards the regions of the tracks that road users need to look at to detect a train (exogenous attraction of attention, physiological mechanism).

POTENTIAL BENEFITS

- The main safety problem at passive LCs is that road users often cross without having looked out for a train. The peripheral blinking lights facilitate the direction of visual attention to the relevant parts of the tracks (cf. section "study results") and thus reduce the probability of incidents caused by road users who failed to see an approaching train.
- The system takes advantage of an autonomous physiological mechanism and therefore does not require any conscious effort of the road user to be effective. The reaction is not expected to be subject to any considerable habituation effects, as the attraction of attention by flickering peripheral stimuli is a hard-wired feature of the nervous system (Yantis, 2000).Though the application is recommended to LCs with a roughly perpendicular crossing angle, the measure can still be effective when the angle between road and rail tracks is not perpendicular, as long as the blinking lights appear within the maximum field of vision that extends up to 110° to the left and right from the center axis of the visual field.
- On the implementation side, as the measure is actuated on road user approach, it requires no connection to the railway signaling system and therefore needs no validation according to railway standards. This allows for easy and low-cost application.

POTENTIAL CRITICALITIES

- If there residents around the **LC**, they might feel disturbed by light emission during night times. Shading equipment can be added to avoid this issue. Another useful design feature would be to adapt light intensity to the environmental lighting conditions.
- The applicability of the measure is restricted to situations that provide the minimum necessary sight conditions, i.e., the measure cannot be applied when heavy vegetation, buildings or other objects cover the view on the tracks. However, as road and rail regulations allow passive protection only at LCs where it is possible in principle to visually detect an approaching train in time, these restrictions will typically not apply to the envisaged application environments to an extent that would render the measure ineffective.

RECOMMENDATIONS

- The position of the blinking lights should be adjusted to the respective crossing to optimize the visibility from vehicles with different heights and front vehicle structure.
- Optimal application at level crossings with a crossing angle around 90°.

Quick Access

Search criteria

(To select multiple items in a list, hold the CTRL key and click the items)

Search by title, by alias or by description :

Targeted users :

- Motorized Road User (MRU)
- Vulnerable Road User (VRU)

Type of implementation

- Road User
- Road infrastructure
- Rolling Stock
- Railway Infrastructure

Type of level crossing :

- Passive
- Only light and/or sound warning
- Half barriers
- Full barriers

Level crossing environment

- rural
- urban

Effect mechanism :

Makes waiting time more tolerable

- - Any -
- Support LC safety action
- Improves the detection of LC
- Improves train detection
- Reduces the approach speeds of vehicles
- Controls access and supports egress from LC
- Increases awareness of correct behaviour
- Improve access for vulnerable user
- Improves the physical environment of LC
- Makes waiting time more tolerable
- Provides up-to-date information about the status of LC

ADDITIONAL DISPLAY "TWO TRAINS"

0/5 (0 vote)

ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE

Type of implementation : Road infrastructure | Railway Infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Increases awareness of correct behaviour | Makes waiting time more tolerable | Provides up-to-date information about the status of LC

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

Last updated : 17/04/2020

ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED

0/5 (0 vote)

OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING

Type of implementation : Railway Infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Makes waiting time more tolerable

Cost category per level crossing : Medium (10K€ to 100K € per LC)

Level crossing environment : rural | urban

Last updated : 16/04/2020

ADDITIONAL DISPLAY "TWO TRAINS"

additional display "Another Train", second train coming, another train, additional signage

☆ ☆ ☆ ☆ ☆ **0/5** *(0 vote)*

Add to Bookmarks

Publication : 05/09/2019 - Last updated: 17/04/2020

Type of implementation : Road infrastructure | Railway Infrastructure

Targeted users : Motorized Road User (MRU) | Vulnerable Road User (VRU)

Type of level crossing : Only light and/or sound warning | Half barriers | Full barriers

Effect mechanism : Increases awareness of correct behaviour | Makes waiting time more tolerable | Provides up-to-date information about the status of LC

Cost category per level crossing : Low (< 10K€ per LC)

Level crossing environment : rural | urban

DESCRIPTION

When two (or more) trains arrive at a **LC** with barriers or automatic lights in close succession, the LC will remain closed after the first train has passed. Road users who do not know that another train will follow may wrongly assume that the LC controls do not work correctly or become frustrated due to the long waiting time and feel compelled to cross the closed LC. The sign indicating that another train is approaching the LC is designed to prevent road users from crossing early, i.e. before red light has gone out / second train has passed.

POTENTIAL BENEFITS

Reduces road user uncertainty of why **LC** remains closed.

POTENTIAL CRITICALITIES

- Visibility could be reduced under certain lighting conditions (e.g. glare); shading equipment or dynamic adjustment of brightness can be used to mitigate this.

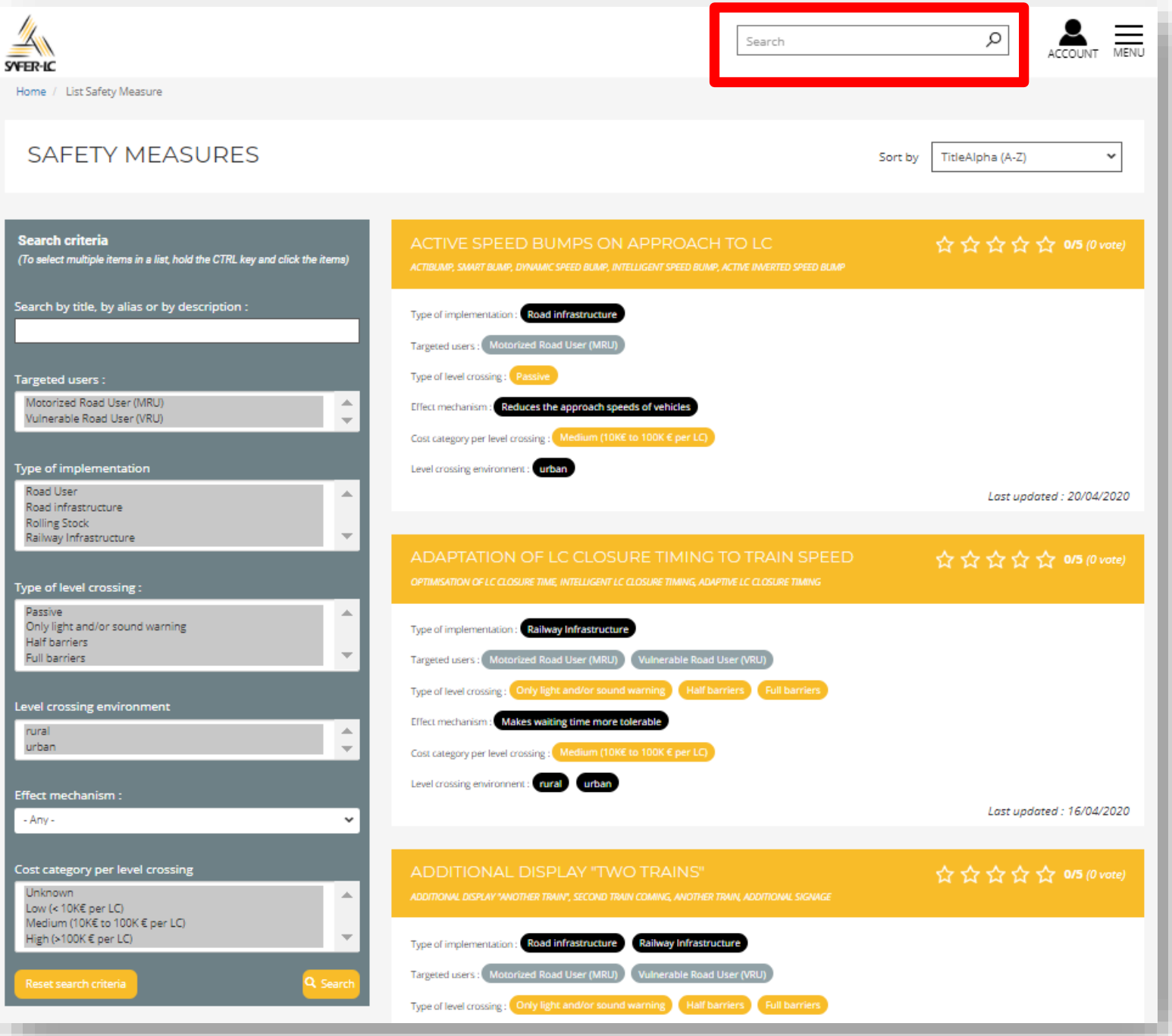
RECOMMENDATIONS

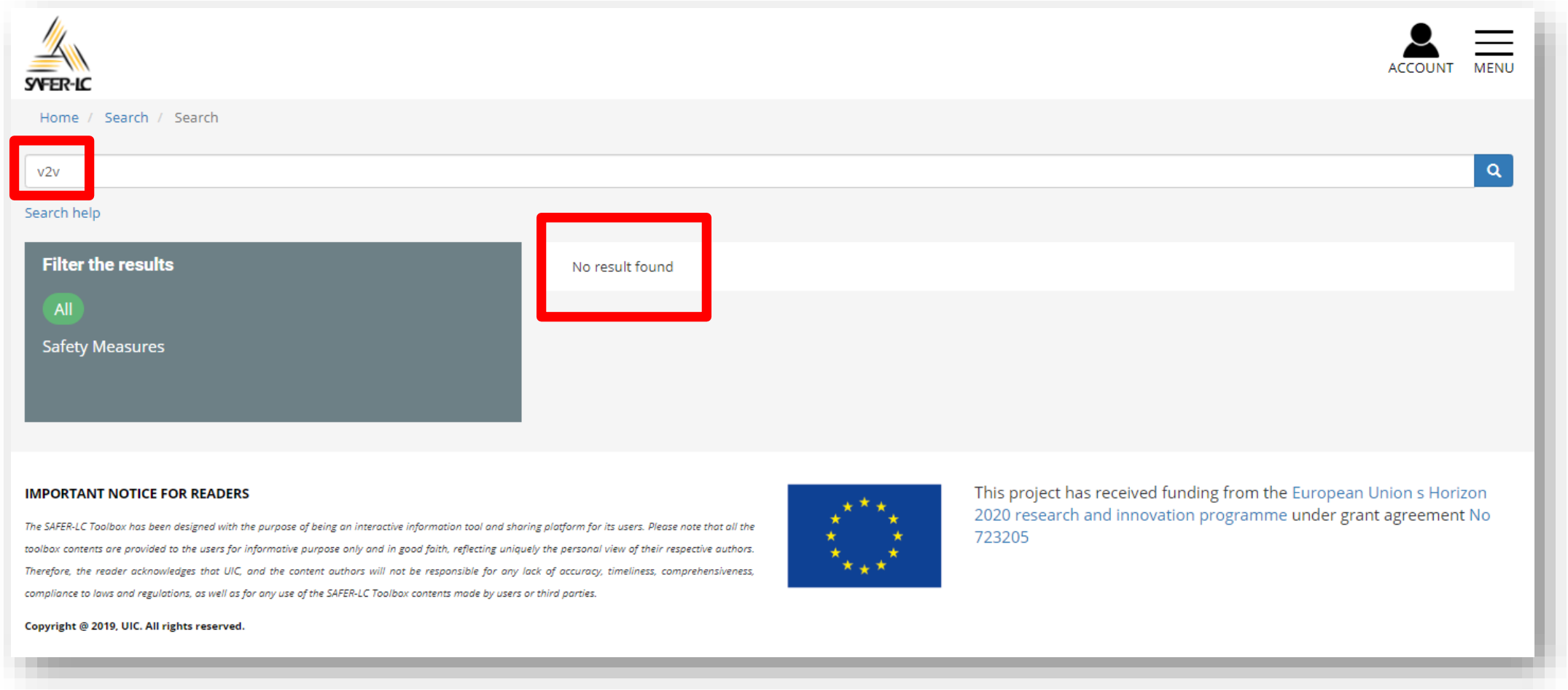
- The time interval between the two trains and the overall waiting time should not be too long (cf. measure "Adaptation of **LC** closure timing to train speed").
- Accompanying the implementation of the measure, LC users should be informed on this change and what this new message means so that they do not disregard it (e.g. through media involvement; additional temporary signage).

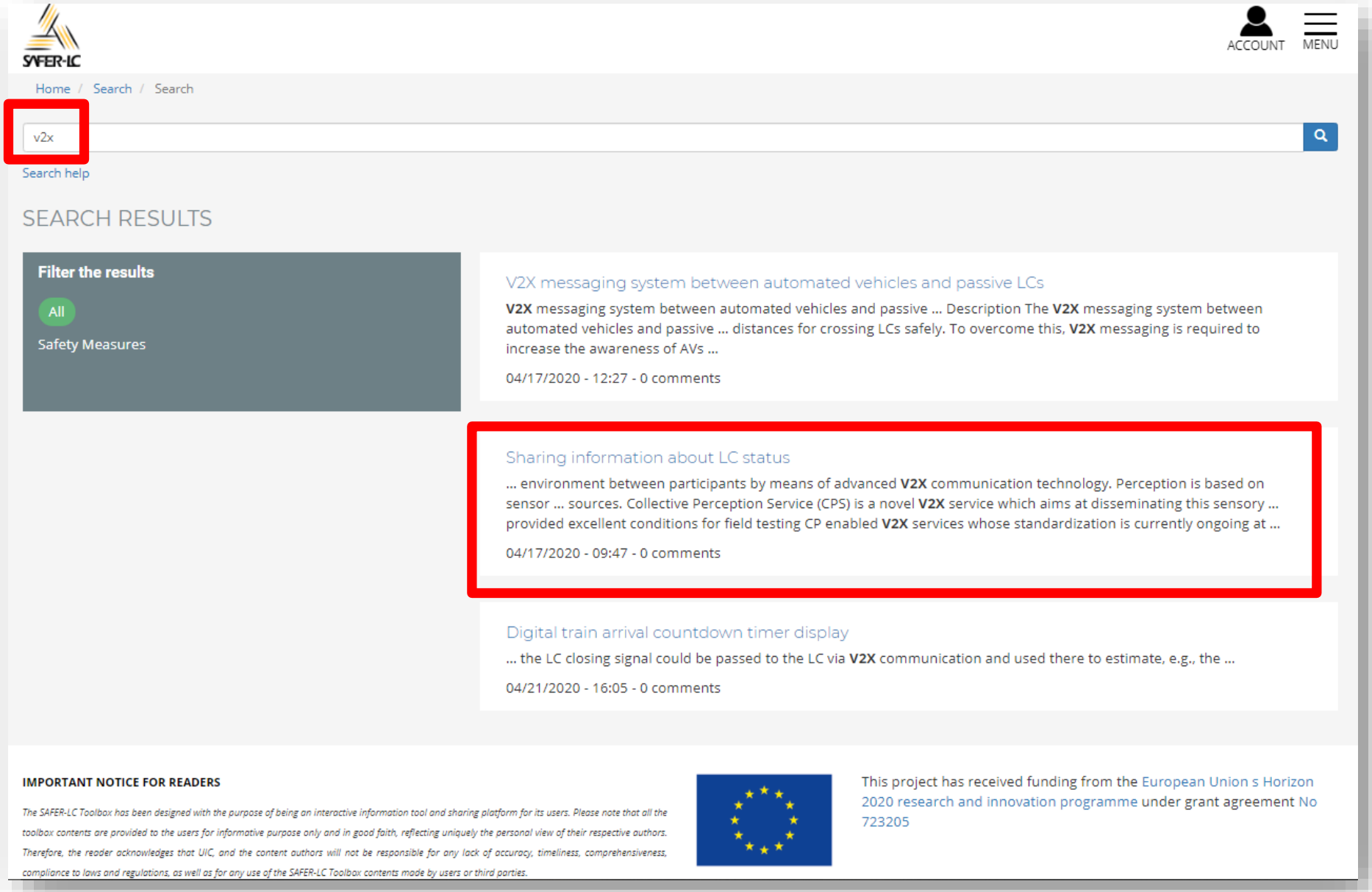
STUDY RESULTS & REFERENCES

- The effectiveness of a "second train coming" for reducing pedestrian violations was tested in Los Angeles at a double track **LC** in a video-based before-and-after study. After installing the sign, the number of pedestrians violating the LC were reduced as follows: 14% for violations occurring under 15 seconds before train arrival, 32% for violations under 6 seconds before train arrival and 73% for violations under 4 seconds before train arrival. A pedestrian survey conducted three years after installation revealed that 77% of respondents were aware of the sign. Although only 4% of respondents knew the accurate meaning of the sign, an overwhelming majority understood that the sign indicated some form of danger. This final point underlines the significance of the exact message provided by the sign. (FTA 2002).
- The effectiveness of signage alerting road users to the second train coming phenomenon was also tested in Baltimore, Maryland at a

Quick Access


SAFER-LC
Search
ACCOUNT
MENU
Home / List Safety Measure
SAFETY MEASURES
Sort by
TitleAlpha (A-Z)
Search criteria
(To select multiple items in a list, hold the CTRL key and click the items)
Search by title, by alias or by description :
Targeted users :
Motorized Road User (MRU)
Vulnerable Road User (VRU)
Type of implementation
Road User
Road infrastructure
Rolling Stock
Railway Infrastructure
Type of level crossing :
Passive
Only light and/or sound warning
Half barriers
Full barriers
Level crossing environment
rural
urban
Effect mechanism :
- Any -
Cost category per level crossing
Unknown
Low (< 10K€ per LC)
Medium (10K€ to 100K € per LC)
High (>100K € per LC)
Reset search criteria
Search
ACTIVE SPEED BUMPS ON APPROACH TO LC
0/5 (0 vote)
ACTIBUMP, SMART BUMP, DYNAMIC SPEED BUMP, INTELLIGENT SPEED BUMP, ACTIVE INVERTED SPEED BUMP
Type of implementation : Road infrastructure
Targeted users : Motorized Road User (MRU)
Type of level crossing : Passive
Effect mechanism : Reduces the approach speeds of vehicles
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : urban
Last updated : 20/04/2020
ADAPTATION OF LC CLOSURE TIMING TO TRAIN SPEED
0/5 (0 vote)
OPTIMISATION OF LC CLOSURE TIME, INTELLIGENT LC CLOSURE TIMING, ADAPTIVE LC CLOSURE TIMING
Type of implementation : Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers
Effect mechanism : Makes waiting time more tolerable
Cost category per level crossing : Medium (10K€ to 100K € per LC)
Level crossing environment : rural urban
Last updated : 16/04/2020
ADDITIONAL DISPLAY "TWO TRAINS"
0/5 (0 vote)
ADDITIONAL DISPLAY "ANOTHER TRAIN", SECOND TRAIN COMING, ANOTHER TRAIN, ADDITIONAL SIGNAGE
Type of implementation : Road infrastructure Railway Infrastructure
Targeted users : Motorized Road User (MRU) Vulnerable Road User (VRU)
Type of level crossing : Only light and/or sound warning Half barriers Full barriers


SAFER-LC
ACCOUNT
MENU
Home / Search / Search
v2v
Search help
Filter the results
All
Safety Measures
No result found
IMPORTANT NOTICE FOR READERS
The SAFER-LC Toolbox has been designed with the purpose of being an interactive information tool and sharing platform for its users. Please note that all the toolbox contents are provided to the users for informative purpose only and in good faith, reflecting uniquely the personal view of their respective authors. Therefore, the reader acknowledges that UIC, and the content authors will not be responsible for any lack of accuracy, timeliness, comprehensiveness, compliance to laws and regulations, as well as for any use of the SAFER-LC Toolbox contents made by users or third parties.
Copyright @ 2019, UIC. All rights reserved.
This project has received funding from the European Union s Horizon 2020 research and innovation programme under grant agreement No 723205

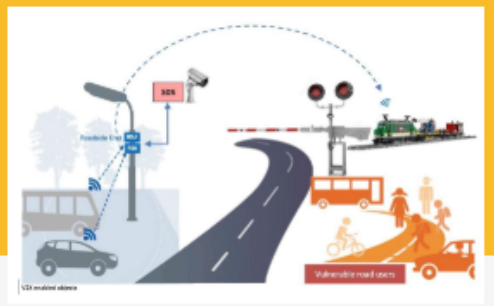

SAFER-LC
ACCOUNT
MENU
Home / Search / Search
v2x
Search help
SEARCH RESULTS
Filter the results
All
Safety Measures
V2X messaging system between automated vehicles and passive LCs
V2X messaging system between automated vehicles and passive ... Description The V2X messaging system between automated vehicles and passive ... distances for crossing LCs safely. To overcome this, V2X messaging is required to increase the awareness of AVs ...
04/17/2020 - 12:27 - 0 comments
Sharing information about LC status
... environment between participants by means of advanced V2X communication technology. Perception is based on sensor ... sources. Collective Perception Service (CPS) is a novel V2X service which aims at disseminating this sensory ... provided excellent conditions for field testing CP enabled V2X services whose standardization is currently ongoing at ...
04/17/2020 - 09:47 - 0 comments
Digital train arrival countdown timer display
... the LC closing signal could be passed to the LC via V2X communication and used there to estimate, e.g., the ...
04/21/2020 - 16:05 - 0 comments
IMPORTANT NOTICE FOR READERS
The SAFER-LC Toolbox has been designed with the purpose of being an interactive information tool and sharing platform for its users. Please note that all the toolbox contents are provided to the users for informative purpose only and in good faith, reflecting uniquely the personal view of their respective authors. Therefore, the reader acknowledges that UIC, and the content authors will not be responsible for any lack of accuracy, timeliness, comprehensiveness, compliance to laws and regulations, as well as for any use of the SAFER-LC Toolbox contents made by users or third parties.
This project has received funding from the European Union s Horizon 2020 research and innovation programme under grant agreement No 723205

SHARING INFORMATION ABOUT LC STATUS

smart communication systems, ITS-G5, LTE, CPM, Collective Perception

☆ ☆ ☆ ☆ ☆ **0/5** *(0 vote)*

Add to Bookmarks



Publication : 17/04/2020 - Last updated: 17/04/2020

Type of implementation : **Road infrastructure** **Rolling Stock** **Railway Infrastructure**

Targeted users : **Motorized Road User (MRU)**

Type of level crossing : **Passive** **Only light and/or sound warning** **Half barriers** **Full barriers**

Effect mechanism : **Provides up-to-date information about the status of LC**

Cost category per level crossing : **Medium (10K€ to 100K € per LC)**

Level crossing environment : **rural** **urban**

DESCRIPTION

The smart communication systems allow sharing information concerning the Level crossing **LC** status between LC, control room, train and road drivers. The smart communication system is realized using the communication technology (ITS-G5, **LTE**) and the new Cooperative Perception Messages (CPM)

ITS G5 standards defines the facilities layer which specifies requirements and functions supporting applications, communication, and information maintenance. Its most relevant standards cover messaging for ITS applications, such as CAM and DENM.

Cooperative Awareness Message (CAM) is a periodic message exchanged between ITS stations to maintain awareness of each other and support cooperative performance of vehicles. It is composed of several containers; the basic container conveys the station type and its position. Decentralized Environmental Notification Message (DENM) is an event driven safety information, exchanged in a specific geographical area surrounding the event. When an ITS station detects a dangerous situation, a DENM message is generated defining the specific event, its detecting ITS station, its lifetime and relevance area, among many others.

Collective Perception (CP) is the concept of actively exchanging information about locally perceived objects in the traffic environment between participants by means of advanced V2X communication technology. Perception is based on sensor data, provided by on-board and infrastructure sensors e.g., cameras, such as the one included in SDS, intersection surveillance systems, radars, lidars and other information sources. Collective Perception Service (CPS) is a novel V2X service which aims at disseminating this sensory information by letting vehicles and road infrastructure elements transmit data about detected objects (e.g., about the behaviour of other road participants, obstacles and dynamic road hazards) in abstract descriptions. These descriptions then will be included in broadcast messages called CP messages. SAFER-LC provided excellent conditions for field testing CP enabled V2X services whose standardization is currently ongoing at **ETSI** ITS

POTENTIAL BENEFITS

The smart communication system allows:

- To transmit the incident information and its position to the road users
- To share information concerning the **LC** statue to trains/vehicles drivers approaching/arriving to level crossings and to workers at or near train passing zones.
- To inform all vehicle approaching to LC using multi hope approach: this approach allows to increase the range communication.

CPS decreases the ambient uncertainty of ITS communication stations by contributing information to their Field-of-Views, mutually, which may result in the improvement of the following collective safety capabilities:

1. Detection of not connected road users: Road users, typically not V2X capable and Vulnerable Road Users (VRUs), which are not able to signal their presence can be perceived by other road users' perception sensors.
2. Detection of safety incidents: there may be not wanted objects on the road or its immediate environment causing a potential safety risk for the traffic and the road users themselves. Road users which are not equipped with sensors or whose sensors are not able to detect non desirable objects locally are prone to accidents and represent a risk for the traffic.
3. Increased awareness: Information aggregation about the behaviour of other traffic participants in real time increases awareness of drivers.

Quick Access

POTENTIAL CRITICALITIES

- Sensor data fusion and the overall concept of message dissemination are critical part of the mechanism which influence the performance of the whole V2X ecosystem. The evaluation of the results of field test trials, such as provided by SAFER-**LC** test sites, effectively contribute to the completion of the idea which can be utilized for the finalisation of the standards.

STUDY RESULTS & REFERENCES

In the SAFER-**LC** project, ITS G5 communication systems was tested and evaluated in different scenarios in Aachen site. These tests show that these solutions respond according to the restrictions imposed by application. The methodology and key performance indicators (KPI) of these communication technologies were defined. The project provided excellent conditions for field testing CP enabled V2X services whose standardization is currently ongoing at **ETSI** ITS.

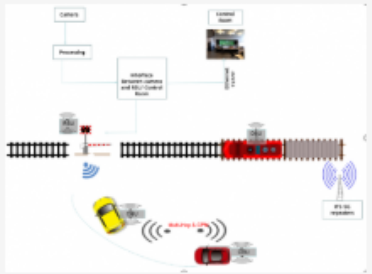
CPS was also extensively tested and evaluated in different LC traffic scenarios in the SAFER-LC field test environment Aachen. It was shown that CPS can effectively be used not only in native road environment but in intersection scenarios shared with rail systems and as such, the evaluation results will be disseminated in wide technology domains involving the design and harmonization of future rail-road communications.

MAIN PSYCHOLOGICAL FUNCTIONS INVOLVED

Rule knowledge (focus on knowledge retrieval)

DOCUMENTS

GALLERY



COMMENTS

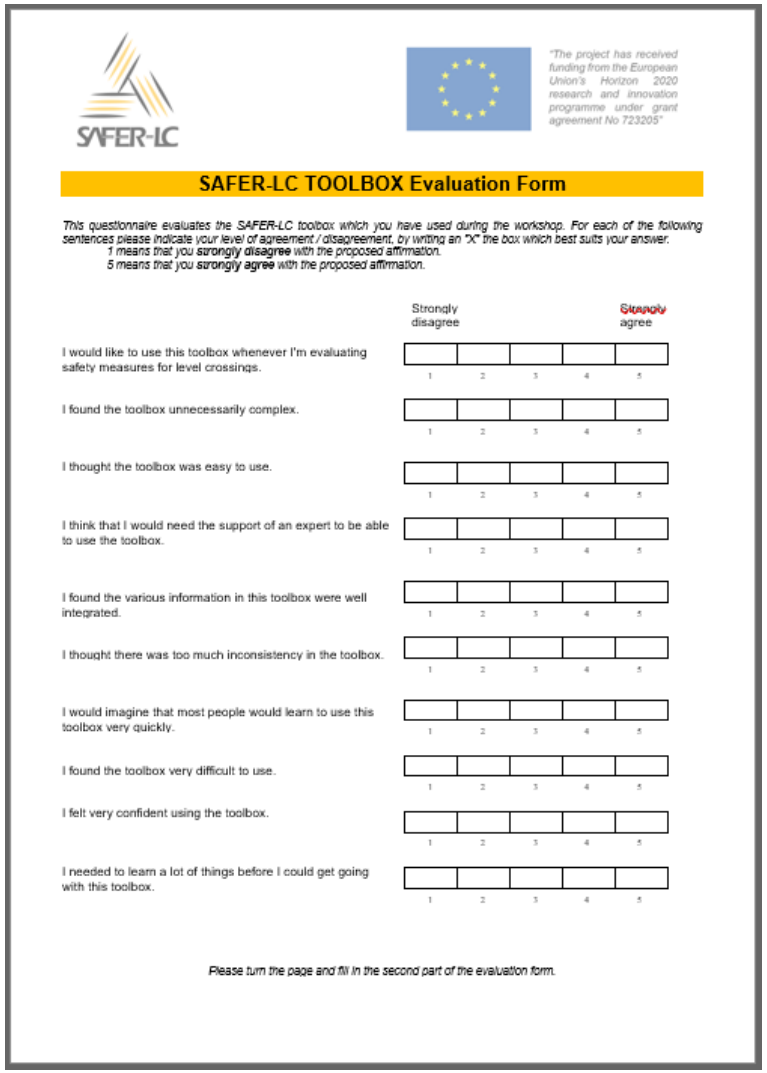
Comment ...

Concluding remarks

- The work on the toolbox is not over and it will never be!
- Initial evaluation workshop (5 Feb. 2020, Madrid):
  1. Get new expert input, ideas to improve the existing content
  2. Get expert feedback about the user interface
- Ongoing tests and minor improvements (bugs, links, etc.)
- Content under continuous update

End-users are welcome to contribute

- Feedback on the usability
  - Problems, errors, etc.
  - New features
- Content inputs
  - Missing information
  - More examples
  - New evaluation studies
  - New measures



SAFER-LC

"The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723205"

SAFER-LC TOOLBOX Evaluation Form

This questionnaire evaluates the SAFER-LC toolbox which you have used during the workshop. For each of the following sentences please indicate your level of agreement / disagreement, by writing an "X" the box which best suits your answer.
*1 means that you **strongly disagree** with the proposed affirmation.*
*5 means that you **strongly agree** with the proposed affirmation.*

	Strongly disagree				Strongly agree
I would like to use this toolbox whenever I'm evaluating safety measures for level crossings.	1	2	3	4	5
I found the toolbox unnecessarily complex.	1	2	3	4	5
I thought the toolbox was easy to use.	1	2	3	4	5
I think that I would need the support of an expert to be able to use the toolbox.	1	2	3	4	5
I found the various information in this toolbox were well integrated.	1	2	3	4	5
I thought there was too much inconsistency in the toolbox.	1	2	3	4	5
I would imagine that most people would learn to use this toolbox very quickly.	1	2	3	4	5
I found the toolbox very difficult to use.	1	2	3	4	5
I felt very confident using the toolbox.	1	2	3	4	5
I needed to learn a lot of things before I could get going with this toolbox.	1	2	3	4	5

Please turn the page and fill in the second part of the evaluation form.

Q&A

Thank you for your kind attention!

http://toolbox.safer-lc.eu/