Implementation of LX protection in ERTMS L2 baseline 3

Finding a balance between blocking road traffic and train traffic

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Danish ERTMS deployment

- 2100 km of mixed operation railway, 3 existing national borders and one future border

- Renewal of all signalling assets
  - Traffic management and new Traffic Control Centres
  - Train control and Train radio
  - Interlocking, Point machines, train detection, Level crossing protection, Passenger warning and staff crossing systems
  - Updated fibre backbone and renewed active network

- Functional requirements – two different trackside solutions
  - Thales
  - Alstom

- Approx. 400 level crossings with LX protection systems on the national network

Strækninger
Stationsnavne med * indikerer, at udstyrning af signaler på denne station ikke er centrale af pågældende strækning.

- Frederikshavn-Lindholm 2019
  - (Rubjerg) - (Koge) 2019
  - (Rubjerg) - (Shaan) 2020
  - (Lund) - (Shaan) 2021

- Koge - (Ringe) 2021
  - Magenstrup-Ribeby 2021

- (Vejle) - Holstebro-Herning (Skanderborg) 2022
  - (Viger) - (Ringe) 2022

- (Søby) - (Mols) - (Skive) 2023
  - Mols-by-Nørreby 2024

- (Kolding) - Kalundborg 2024
  - (Aarhus) - Aalborg (Luften) 2024
  - (Lund) - (Søby) 2024
  - Branderup - Tand 2024

- (Kolben) - (Fossa) 2025
  - (Frederik)-Hans 2026
  - (Ringe) - (Vigerslev) 2026

- (Kolben) - (Vigerslev) 2026
  - (Kolben) - (Ribe) 2028

- (Kolben) - (Fossa) 2029

- (Kolben) - (Helsinge) 2029

- (Kolben) - (Fossa) 2030
LX protection, operational context and needs

On main lines and some secondary lines the LX protection systems are covered by national ATP protection

- LX protection systems normal max line speed 120 km/h
- With special provisions up to 140 km/h

Functional and performance requirements for LX optimisation (activation and deactivation)

- Optimisation towards route setting to avoid braking and showing LX icon on DMI
- Attempts at using speed dependent (MRSP) activation based in trains MA-request. The choice of activation is done by BDK at the TMS level.
- E.g. some LX are equipped with road clearance sensors which could stay occupied and delay the LX protection
- Speed over non protected LX will be restricted to 10 km/h to allow to approach, with a strict stopping requirement the train would not be able to approach the LX effectively
Solution Evolution v0.1

- Connect LX to interlocking
- Rely on MA request for temporary EoA

Withdrawn due to the fact that it was not 100% crystal clear that an MA Request is sent for the temp. EoA in SV2.0
Solution Evolution v1.0

- Place Marker Board in approach of LX

- Additionally optimise closing trigger via information in the system
  - Specific delay after route setting based on topology, time table, LX type, ...
  - Rules depending on traffic pattern, train type, max train speed, distance between LXs... configurable in our TMS
What happened next

- Clearance of LX led to non protected state of LX since system detected that this was done by the train → no reaction

- With next MA extension, MA with current LX state was sent to train and was considered instantly as new temp. EoA → tripped
Feedback from operation

General LX blocking time performance:

➢ Open line 60-70 secs
➢ Stations 90-120 sec

➢ Finetuning of triggers by operator in TMS to ensure that typical traffic works well

Future developments:

➢ Possible upgrade to SV2.1 – small improvement due to the introduction of the perturbation point. MA-request more well-defined in SV2.1

➢ Introduction of ATO, use of the journey profile estimation for activation of LX
Questions or still non-protected level crossings?