



No barriers for level crossings with ERTMS

IRSE ASPECT conference 2019

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ProRail

Level crossings with ERTMS

- Challenges
- Method
- Scenario's
- Conclusion

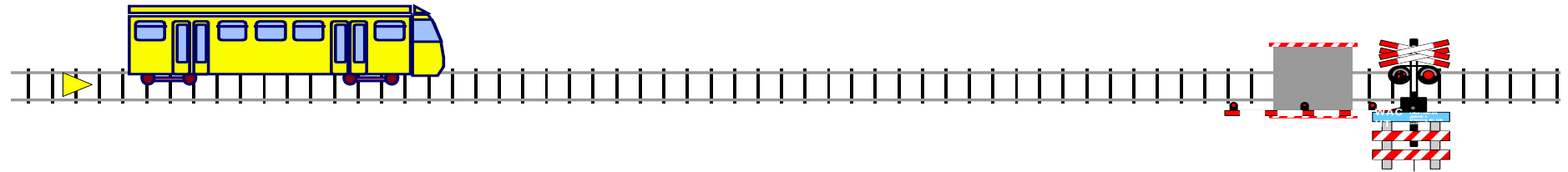
Level crossing (LX) challenges

Waiting times for level crossings vary considerably, due to:

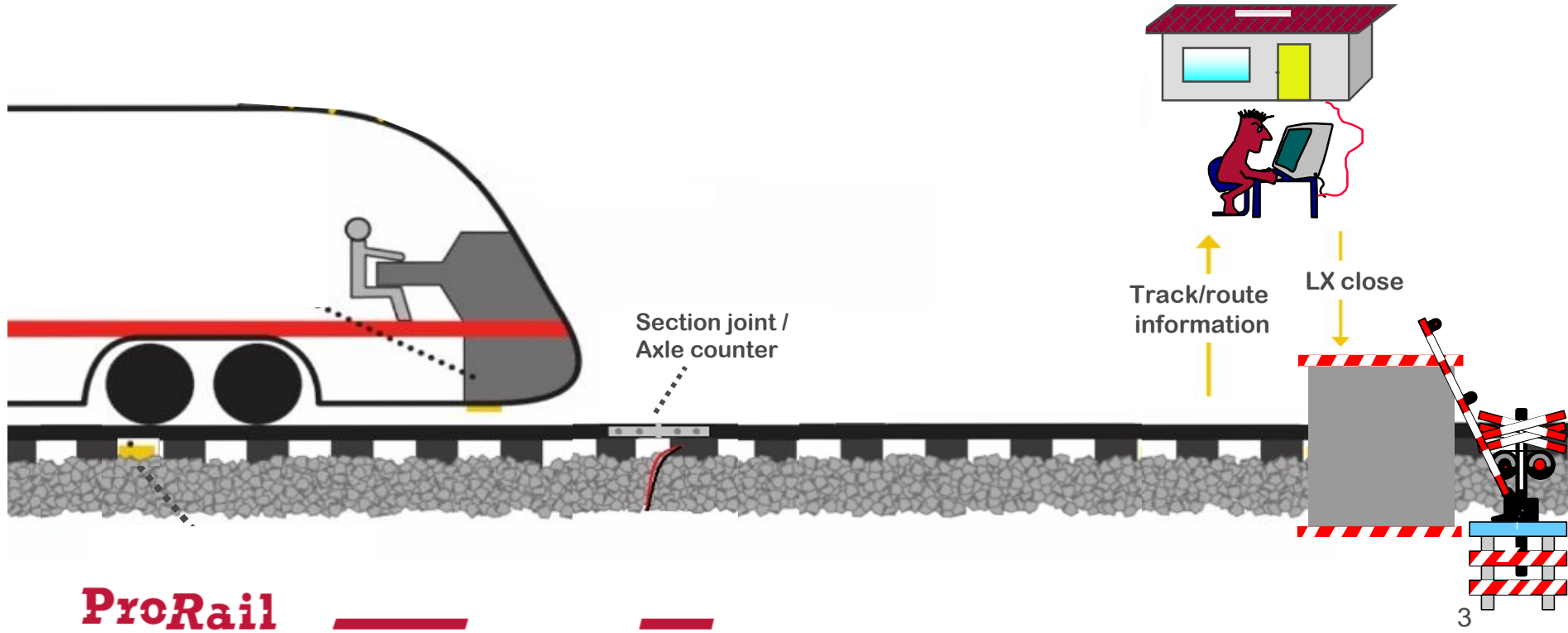
- Different train approaching speeds
- Variations in dwelling processes
- Unplanned stops

Observation: with long(er) waiting times; road users are tempted to cross the LX

Can ERTMS realize a more constant and even reduce the warning time?



ERTMS Level 2/3 (radio communication)

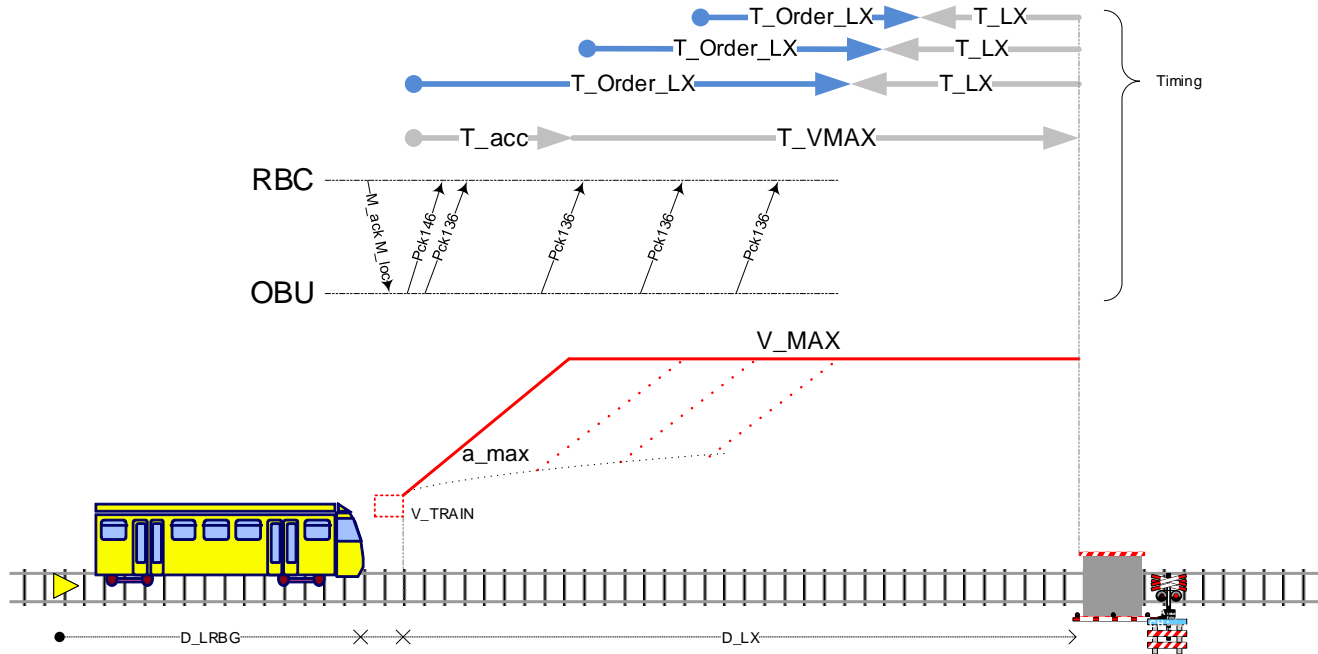


LX protection with ERTMS position rapport

Before authorizing the train across the LX:

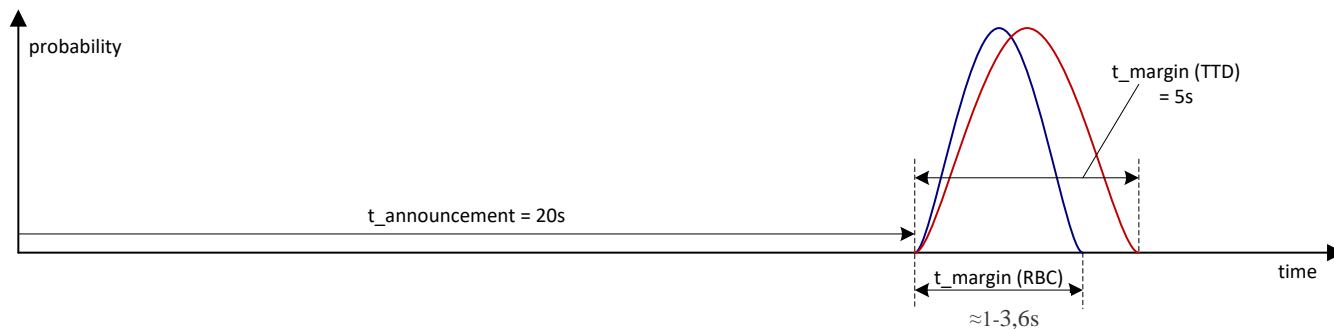
1. Calculate the earliest possible arrival time on reported position and speed.
2. Set LX closing timer (T_{order_LX}) based on the required announcement time (T_{LX}).
3. Repeat this calculation on new (train position) information.

Only issue the MA if the LX is closed safely before the train can be at the LX.

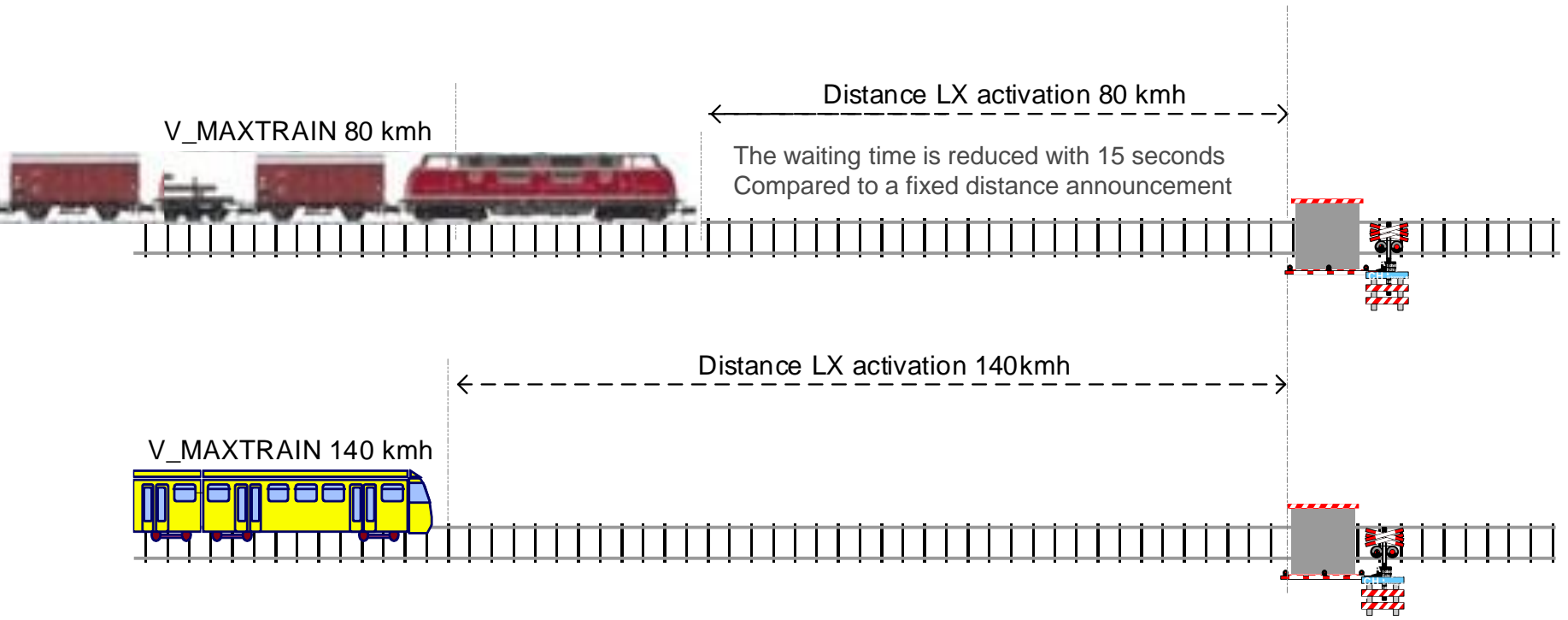


Margin / delay distribution

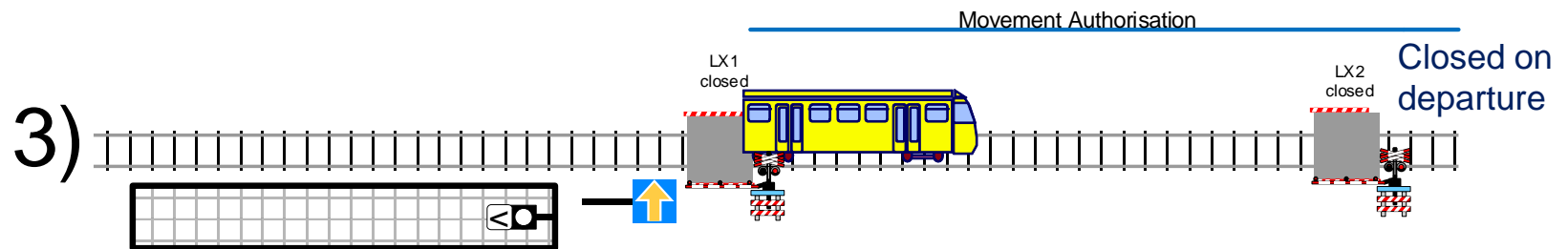
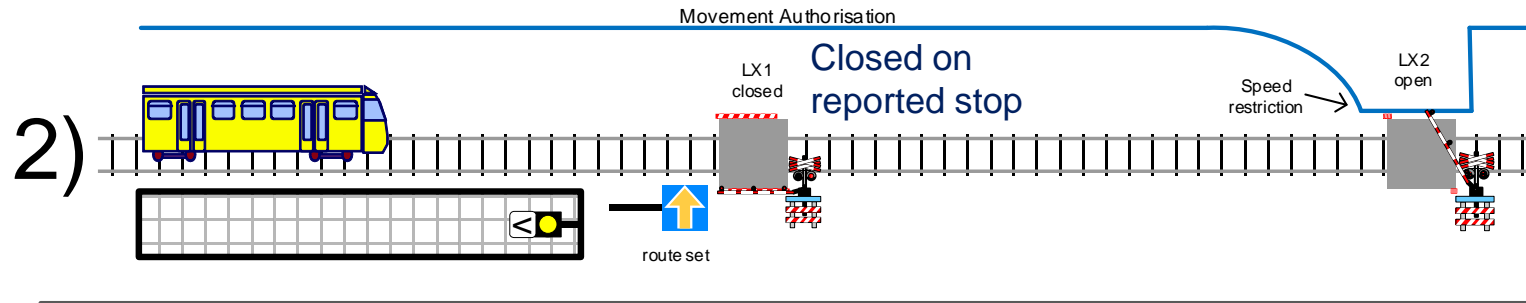
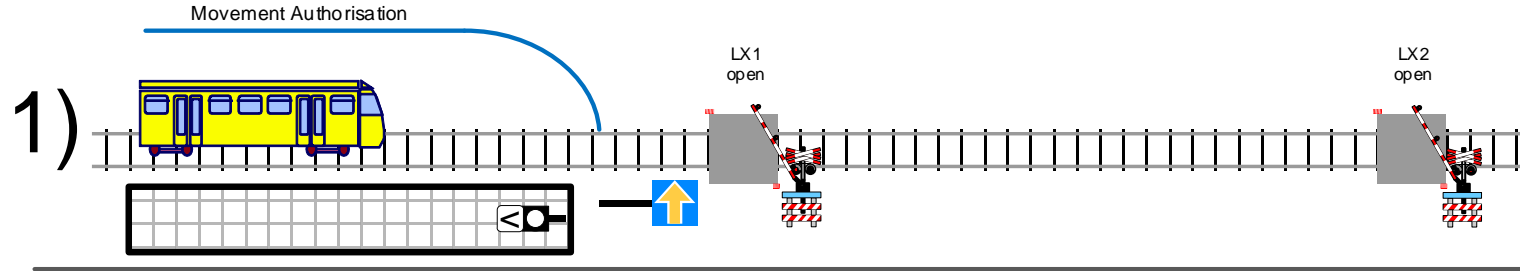
- Position/speed margin (2% - 5%): 0,2 - 1,6 sec
- Maximum age position report: 0,4 - 1 sec
- Communication sync delays: 0,4 - 1 sec +
- Total: 1 - 3,6 sec

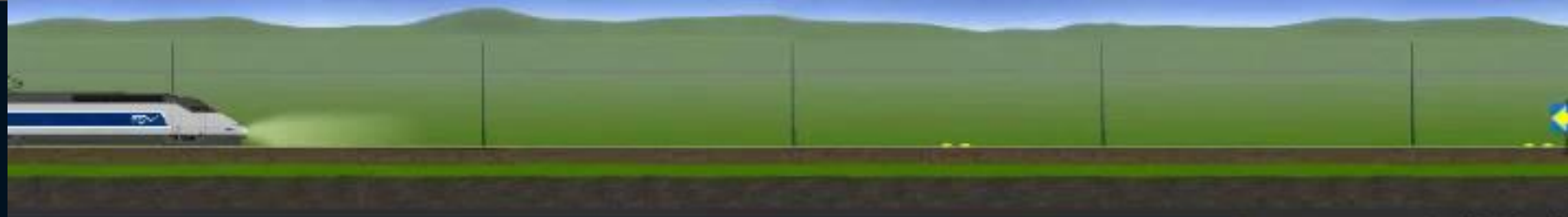


LX open line: train depended triggering



LX close to platform/stop





Main

Over-
ride

Data
View

Spec



A control panel featuring a vertical slider on the left with a black sphere at the top, ranging from 0% to 100%. To the right are several toggle switches and indicators: 'Power' and 'Cabin' (On/Off), 'Close' and 'Open' (Up/Down), 'Main switch' and 'Pantograph' (On/Off), 'B N F' (On/Off), 'Direction' and 'Auto Drive' (On/Off), a red 'Emergency Brake' indicator, and a 'Pipe pressure' gauge. A 'Mitre' indicator is also present at the bottom.

Scenario
Data
Controls
View

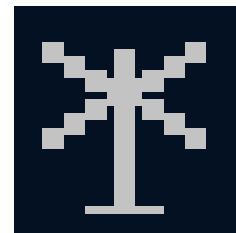
MA LX4

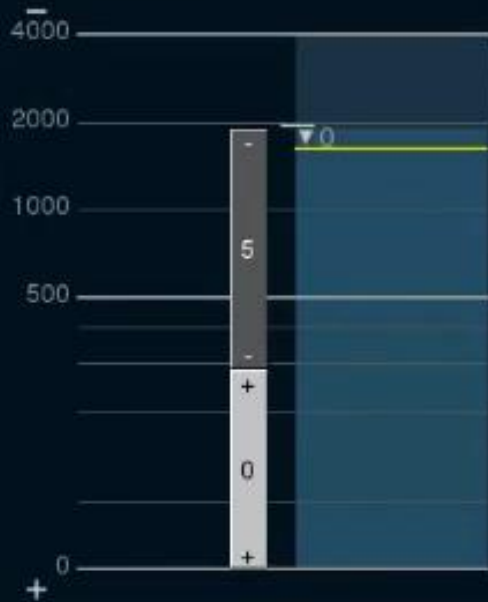
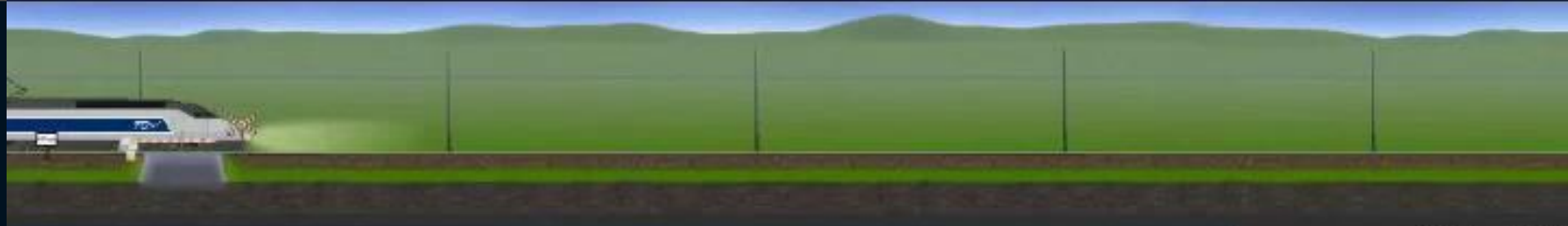
Level crossing assistance indication



Level crossing failure procedure

- Failsafe LX operation: close on failure
- Degraded procedure when closed to long (> 5minutes):
 - Currently vocal procedure (Aanwijzing AKI/ AHOB)
 - Most used procedure 20.000+
 - Risk's on missing/wrong location/wrong procedure
- ERTMS function: “not protected LX ” (packet 88)
 - LX icon shown on DMI
 - V_LX: allowed speed to pass LX
 - Panel at LX for passing without an MA





Main

Over-
ride

Data
View

Spec

A control panel with various indicators and switches. It includes a vertical slider on the left with '100%' at the top and '100%' at the bottom. To the right are several toggle switches labeled 'On' and 'Off'.

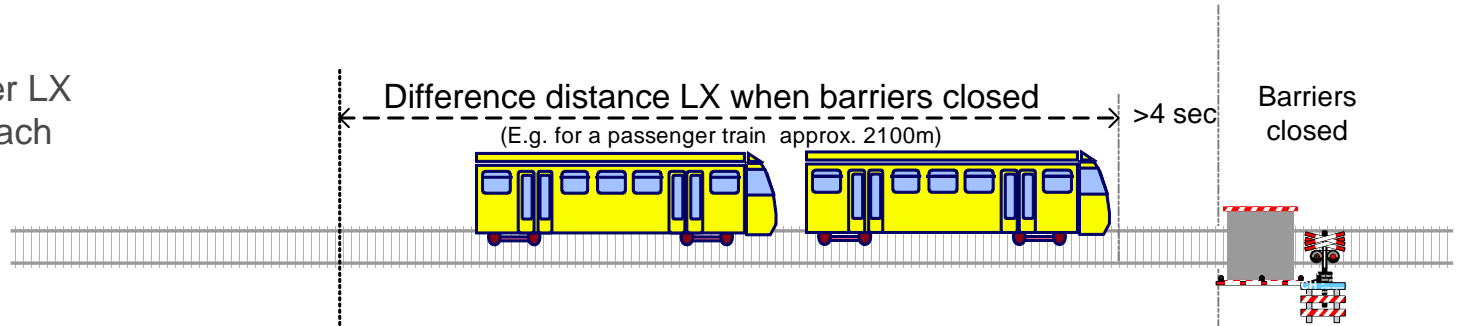
On	Off	On	Off	
Power	Cabin			
Close	Open	Up	Down	
Main switch	Pantograph			
B	N	F	On	Off
Direction	Auto Drive			

Below these are a red 'Emergency Brake' button, a 'Pipe pressure' gauge, and a 'Mitmetris' indicator.A settings menu with a vertical sidebar on the left containing 'View', 'Controls', 'Data', and 'Scenarios'. The main area is titled 'General' and 'Braking curves'.

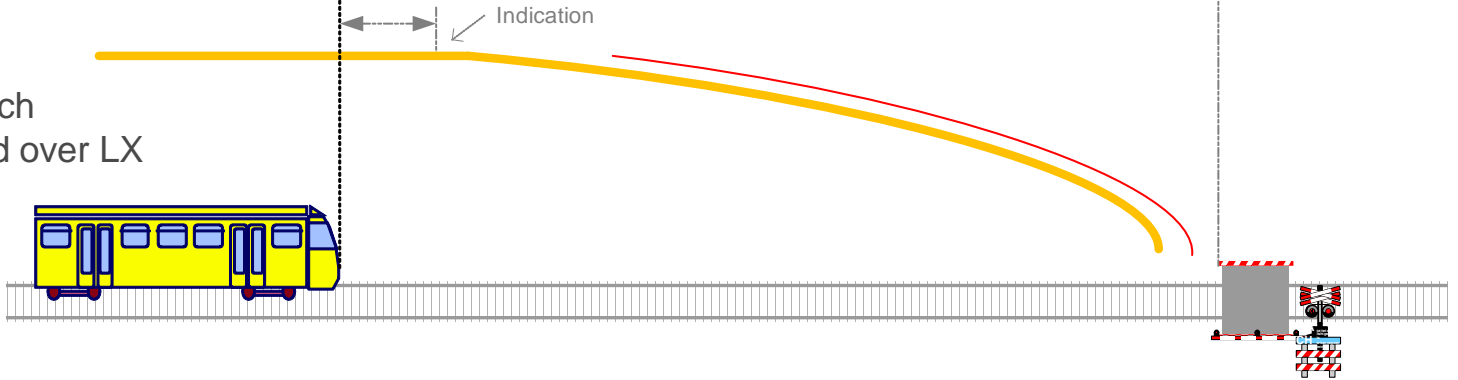
<input type="checkbox"/>	EVC log
<input type="checkbox"/>	Braking curves

Difference in LX-announcement ‘philosophy’

A) Train authorised over LX
LX closed on approach



B) LX closed on approach
Then train authorised over LX



Removed 'barriers' with LX-ERTMS

1. Speed depended LX-announcement (Constant Warning Time)
2. Optimal LX-closure time with short stops (*'Stop/Door'*)
3. No train train detection for LX announcement (cost, reliability)
4. Automatic handling degraded LX situations (no written orders)

Questions?

More info:

- ERTMS specification, ERA, TSI CCS, annex A, set #3. <https://www.era.europa.eu>
- Guideline: Handling of level crossings with Baseline 3, EEIG Engineering Support workgroup. https://ertms.be/workgroups/engineering_support, 2017
- Hybrid ERTMS/ETCS Level 3 Principles, EEIG User group.
<https://ertms.be/workgroups/level3>, 2017
- No barriers for level crossing with ERTMS, ILCAD LX conference 2019,
<https://UIC.org>
- Video: <https://youtu.be/N0Mg0QpSDhw>