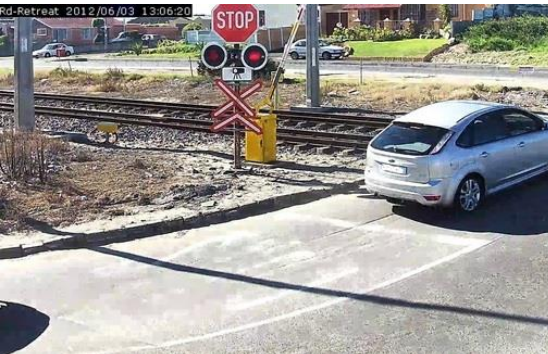




Level Crossings: A New Approach By Jonita Delaney





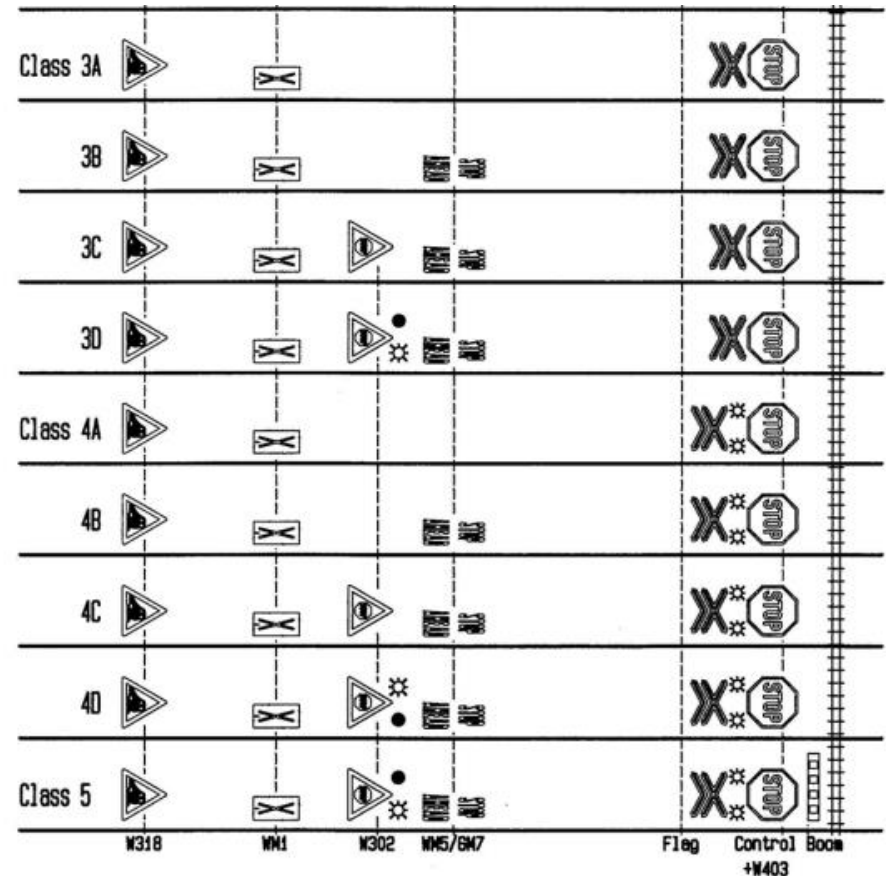
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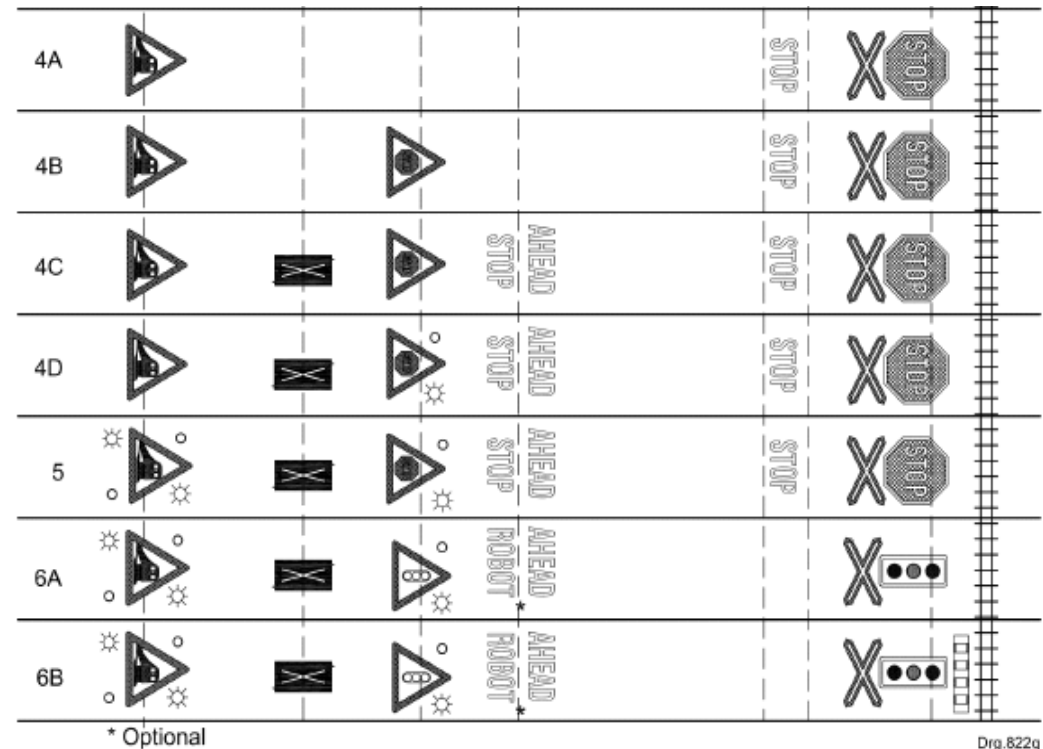
The History of Level Crossings in SA

- **SAFE** crossing of rail and road traffic
- Rail traffic has right of way
- Road user's responsibility to ensure it is safe to cross
- Non-fail safe systems, thus stop sign
- LX Driver lights to give train driver an indication of LX status



SANS 3000-2-2-1 (2012)

- Flash lights replaced with traffic lights
- Attempt to improve safety and standardize the interface to road users at road-rail interfaces
- Train no longer has right of way



The Journey

- TFR Pilot installations:
 - Leeupan
 - Boshhoek
 - Chavonnes
 - Muldersvlei
- Additional installations:
 - UMK Mine
 - BMW Rosslyn

TFR Pilot results

- Failed due to:
 - System safety levels
 - System functional specification not defined
 - Unsafe situations created during manual authorization
 - Impact on train service (train no longer has right of way)
 - Misalignment between Standard and SARTSM
 - Misalignment between Standard and the TWR
 - Legal risk to operators
 - System reliability

Operators vs RSR

The Fight

- TFR & PRASA decided to push back in a combined effort
- Meetings held on all levels with no resolution found
- TFR struggling with maintenance of pilot systems – Prohibition notice issued for Leeupan

RSR 1 – Operators 0

- Operators agreed to try and find a solution
- Workgroup formed to develop a solution
- RSR agreed to consider reintroducing flashlights
- Monthly progress meetings

A New Approach

- Aim: Reduce level crossing incidents
- Purpose of level crossing: **SAFE** and **EFFICIENT** crossing of rail and road traffic
- Manage traffic flows, without delaying trains unnecessary
- Manage human behavior by paying more attention to road user requirements
- Treat level crossings same as a railway crossing, interlocking the controller with the signaling system.
- Analyse and design each level crossing individually

New proposed standard

LEVEL 4C

- Flashlights without booms (Not interlocked)
- Lower risk level crossings with visibility problems
- No train driver and motorist limitations and/or discipline risk

LEVEL 4D

- Flashlights with half arm entry booms (Not interlocked)
- Higher risk level crossing
- No train driver and motorist limitations and/or discipline risk

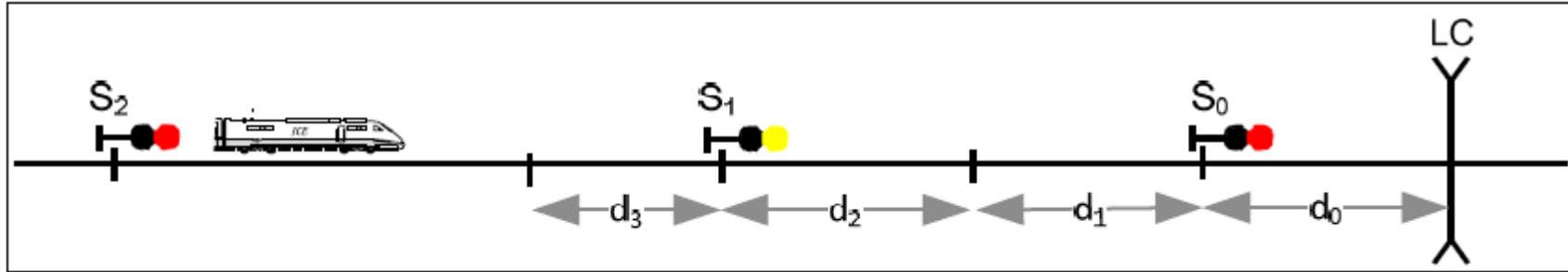
LEVEL 5

- Flashlights with half arm entry booms (Interlocked)
- Higher risk level crossing
- Low level of train driver and motorist limitations and/or discipline risk

LEVEL 6

- Traffic light with entry and exit booms (Interlocked)
- High risk level crossing
- High level of train driver and motorist limitations and/or discipline risk

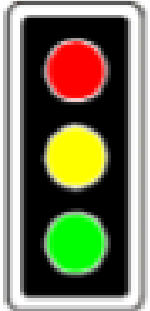
New LX interface concept



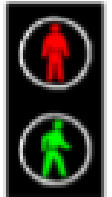
- LX protected by 2 signals:
 - LX protection signal (S_0)
 - Intermediate LX protection signal (S_1)
- Interlocking request protection to be put in place
- Interlocking request protection to be removed
- S_0 will only clear if level crossing is protected
- Warning time to motorists ≥ 30 seconds, but not *too long*
- 30 km/h speed restriction from S_1
- LX in overlap treated according to zero-overlap concept (Delay timer on S_1)

Level 6 LX controller concept

- SIL4 system
- Road traffic controlled by S1 traffic signal and half-arm entry and exit barriers
- Normal state: Green
- Interlocking requests protection:
 - Traffic signal change to amber, then red
 - Entry barrier closes
 - Confirm no vehicles on LX island
 - Exit barrier closes
 - Confirms “protected”
- Interlocking requests protection to be removed:
 - Entry and Exit barriers open
 - Traffic signal change to green



S1



S11P
(S11)

Failure modes

Controller failure

- Traffic signal: Flashing red / Dead
- Barriers: Open

When?

- Internal Controller failure
 - Traffic signal failure
 - Barrier failure
 - Vehicle detection system failure
 - Backup battery low
- Power failure
- Communication failure

Failure modes

How?

- No request for protection in place
 - Traffic signal changes from green to flashing red
 - Keep barriers open
- Request for protection in place
 - Traffic signal changes from red to flashing red
 - Keep barriers closed
 - Open barriers after request to remove protection is received
 - Request not received: Open after a configurable period of time
- Power failure
 - Traffic signal changes from red/green to dead
 - Keep barriers in current state (Open/Closed)
 - Barriers to be cranked open if closed

The Good

- Safer level crossings (Rail and Road traffic)
- Improved traffic flows (Level 6)
- Less frustration to motorists, thus less motorists taking changes
- Team work and agreement between all stakeholders (RSR, RTMC, TFR & PRASA)
- Single standard for implementation

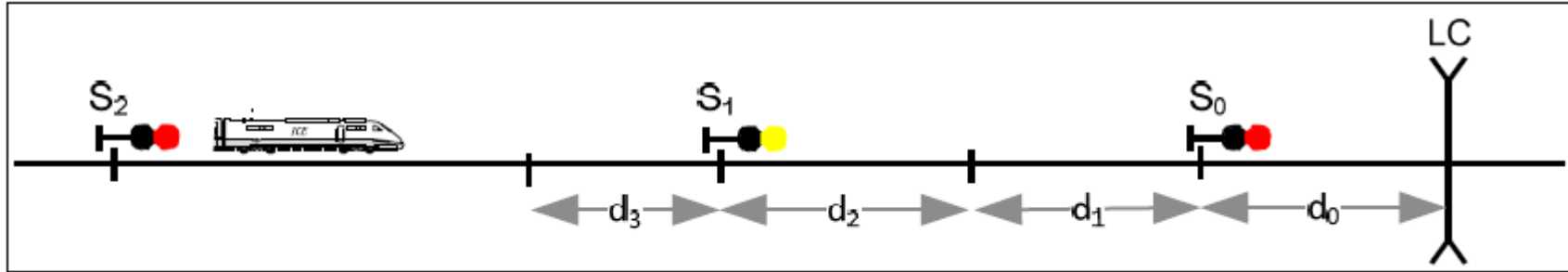
The Bad

- Negative impact on headways (Incorrect design)
- Costly
- SARTSM still not aligned
- Technical solution for Level 6 not yet available

The “Not so black-and-white”

- Warning time: What is *too* long?
- What if infrastructure layout does not allow for warning time to be reduced?
- Trains stopping at platforms
- Time before removing protection if no request received from interlocking
- Fall back – Putting protection in place during manual authorization
- LX in Dark territories
- LX within shunting limits

Responsibility of the Signal Engineer



- Liaising with Road Engineers to controller timers to comply with regulations and best practices
- Determine correct signal placement to ensure safety and headway
- Determining optimal length for d_1
- Determining S_0 and S_1 timers
- Determining safe time to open barriers (Failure mode)

