

# INTERFACE BETWEEN RAIL AND ROAD AT LEVEL CROSSINGS IN SOUTH AFRICA

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## 1 SUMMARY

Level crossings in South Africa have been neglected for some time with respect to legislation both from the road and rail perspective. The extent to which level crossings are addressed in the National Road Traffic Act No 93 of 1996 is limited. The Railway Safety Regulator (RSR) has therefore developed a National Level Crossing Standard which was published by the South Africa Bureau of Standards (SABS) in 2011. The standard provides clarity in terms of the relative responsibilities of road authorities and railway operators regarding issues such as the level of protection, signage and the maintenance of lines of sight for road vehicle drivers through the clearing of vegetation and limiting the erection of structures that impede these lines of sight.

The RSR then requested the Minister of Transport to legalise the signage manual for the road side by means of a regulation to the abovementioned Act which currently has the status of an unenforceable guidance document.

This interface between rail and road at level crossings has for the first time in history of railways in South Africa, been properly addressed and is widely appreciated by all affected parties in the transport industry.

## 2 INTRODUCTION

The RSR started the level crossing project back in 2006, with the mandate determine and interrogate all the common concerns regarding level crossings. These common concerns were inadequate legislation and standards as well as ineffective policing. In the past each road authority and rail operator has considered their problems and possible resolutions in isolation. The fragmented approach has meant that the seriousness of the problems was not fully appreciated by the parties. Railway operators blamed the road authorities for poor policing and traffic management, whilst road authorities viewed level crossing as the sole responsibility of the railways.

Consideration then was given to possible alternatives for addressing these serious concerns and finally after many benchmarking exercises and workshops with the industry the final decision was to develop **a level crossing standard** together with updated **road signs manual** for level crossings plus a **risk assessment model and guide** to implement the standard.

The standard outlines a common approach to the management of the interfaces between road and rail and intrafaces within an operator's activities, which are crucial for ensuring safety at level crossings. The life cycle phase of any level crossing is also clearly described and started with a feasibility study up till operation and end with decommissioning.

This adopted approach recognizes that, whilst there is an ideal level of safety, the costs of achieving this might far outweigh the benefits and limit the viability of railway operations. However, it is recognised that both road authorities and railway operators address their commercial and social responsibilities by providing the appropriate level of protection to ensure safety at level crossings.

### 3 NOTATION

**Network operator:** person who has the ultimate accountability for one or more of the following:

- ensuring the safety of a network or part thereof including the proper design, construction, maintenance and integrity of the network;
- ensuring compliance of rolling stock with the applicable standards of the network; or
- authorizing and directing the safe movement of rolling stock on the network

**Railway reserve:** width of the land at level crossings between the proclaimed boundaries, usually demarcated by fences including railway lines, stations, yards, sidings, gates, fences and other related facilities

**Road reserve:** width of the road approaching level crossings between the proclaimed road boundaries, usually demarcated by fences including roads, signage, road markings, approaching roads, and other related facilities

### 4 SCOPE OF THE STANDARD

The standard supersedes and replaces existing agreements between network operators and the relevant road authorities (national, provincial and local, and private road owners). It describes the minimum requirements to which network operators, road authorities and private road owners shall comply. It also clarifies the role/s of local authorities in respect to their responsibilities in term of level crossing safety and applies to proposed new level crossing, modification of level crossings and the elimination or decommissioning of existing level crossings.

### 5 APPLICATION for approval of a level crossing

As part of the application for approval in principle for **public** level crossings the following are needed:

- An integrated development plan
- An environmental scoping report
- Public awareness communication plan
- General layout and locality plan

However for **private** level crossings only an environmental report and a general layout and locality plan are necessary.

### 6 CRITERIA WHEN AN APPLICATION WILL NOT BE CONSIDERED

If any of the following **exclusion criteria** exist, the application for a new level crossings or modification shall not be considered:

- The train speeds on the railway line shall not be greater than 100km/h
- The road is classified in the Geometric Design Guide or SADC-RTSM as a freeway
- The level crossing is within 1 km of another level crossing
- Where there is an existing accessible grade separated crossing facility within 10km or other agreed distance from the proposed level crossing
- The level crossing is within 500m from the end of a station platform
- A road approach gradient steeper than 1:50 within 8m of the nearest rail and 1:20 from 10m and beyond
- The line of sight along the railway line is less than 230m for a running line and 50m for a yard line
- When a level crossing or road intersection or property access on the road approach to a level crossing, is to be constructed, the location shall be such that no part of the travelled way of the intersecting road or entranceway, or the stop line or the position for a traffic control device, shall be closer than 50m to the nearest rail of the level crossing.

### 7 LIFE CYCLE PHASES

The life cycle process is applicable whether a public level crossing is upgraded/modified, eliminated/decommissioned or for the construction of a new one.

It comprises the following phases:

- Feasibility study
- Prioritising and funding
- Design
- Construction\inspection, testing and commissioning
- Operation
- Monitoring and maintenance
- Modification and
- Decommissioning

Network (rail) operators and road authorities shall establish, develop or adopt processes and procedures for validation and verification of the life cycle phases.

PS: Private road owners are not required to have such processes and procedures and the relevant network operator shall ensure that due processes and procedures are followed.

## 8 LEVEL CROSSING PHYSICAL ASSESSMENTS

Processes and procedures shall be established, developed or adopted, implemented and maintained by network operators and road authorities for the conducting of physical assessments of public and private level crossings in accordance with the **Level Crossing Physical Assessment Model**. The model is applicable:

- on existing level crossing if after two or more collisions at the level crossing in one calendar year,
- after a collision resulting in a fatality at the level crossing,
- significant changes in road traffic patterns, including a change in the road design vehicle passing over the level crossing,
- significant changes in railway traffic patterns, including the introduction of a new service,
- proposed changes in land use, including residential, recreational, commercial and industrial developments,
- an increase in the maximum operating speed of road traffic or line speed of the railway at the level crossing,
- the reclassification of the road,
- a proposed development that may impact on the line of sight of both train drivers and road users,
- if instructed by the relevant authorities,
- on proposed new level crossings
- at least once every 5 years, jointly between the railway network operators and road authority unless both parties agreed on an extended period with remained safe conditions.

The level crossing physical assessment methodology is developed to assist network operators and road authorities with the evaluation of the efficiency of new and existing public and private level crossings. The methodology enables the assessment team to perform the evaluation by undertaking site investigations and making use of data from existing management systems. It provides the assessment objectives and process, guidelines for selecting an assessment team, and the methodologies for conducting level crossing physical assessments.

The level crossing physical assessment methodology is intended to provide consistent and comprehensive guidelines for conducting assessments at public and private level crossings. Outputs of this process will be the inputs into the risk assessment model.

Level crossing physical assessment is a systematic process to evaluate the efficiency of new and existing public and private level crossings. It is a proactive strategy to:

- Identify the conditions that could increase the risk of level crossing accidents by considering the safety aspects of all level crossing users including trains, pedestrians, and motorised and non-motorised vehicles.
- Verify compliance to the requirements of national legislation, this standard, the South Africa Road Traffic Signage Manual (SARTSM) Volume 2 Chapter 7, other applicable regulations, guidelines and documents.

- Complementing existing safety programs at public and private level crossings, and routine level crossing maintenance programmes, as well as identifying high accident locations.

The level crossing physical assessment will include the following aspects:

- A physical level crossing assessment on site;
- Confirming and verifying design standards;
- Occurrence history (last five years)
- Train usage patterns;
- Road traffic usage patterns;
- Selection of design vehicles;
- Stopping sight distances (SSDs);
- Clearance distances;
- Road geometry;
- Line of sight;
- Signs and road markings; and
- Modes of control.

PS: a demonstration of the model will be covered in the presentation.

## 9 RISK MANGEMENT

Further to an operational risk management process that has to be followed according to the South African Standard, network operators and road authorities shall establish, develop/ or adopt and maintain policies and procedures to conduct level crossing risk assessments on existing or proposed public level crossings. This will include the **identification of hazards** associated with the level crossing and also those arising from railway traffic, road traffic, the railway network, road layout and condition, adjoining property and geographical considerations. Furthermore it will also address the **evaluation of the** abovementioned **hazards**, determination of the level of control required to mitigate the risks to acceptable levels and the implementation of the controls and monitoring of the effectiveness thereof.

The focus when managing risk shall be on preventive/proactive measures. Formal operational risk assessments shall be conducted by network operators and road authorities in accordance with this procedure.

## 10 SIGNAGE OF LEVEL CROSSINGS

Signage of level crossings is one of the control measures under the risk assessment and shall be done in accordance with the SARTSM. The level of protection described in this manual shall be as determined by the outcome of the risk assessment of the level crossing. The residual risk after applying the appropriate level of protection may necessitate the elimination of the level crossing by closure or the construction of a bridge or subway.

A significant number of changes were done to the level of signage at a level crossing. However the biggest signage change was the change from flashing red disks (flickering red lights) to a conventional traffic light. The different levels of protection is illustrated in the figure 1. (see below)

Road traffic signs provided at level crossings for the protection of road users fall in the following two categories:

- regulatory control signs, markings and signals for the control of road vehicles at level crossings,
- advance warning signs, warning signs or markings (or any combination of these) that comprise a range of signs, which will vary according to the specific site circumstances, together with various hazard marker warning signs, for the provision of advance warning to road users approaching the level crossing.

Although levels of protection are illustrated in figure1, the level of protection should be determined by the level of prevailing risk at the level crossing and in certain circumstances shall require a higher level of protection.

Most illustrations in figure 1 show minimum signage requirements. The use of optional additional signs is dependent on the outcome of the level crossing assessment and associated risk assessment.

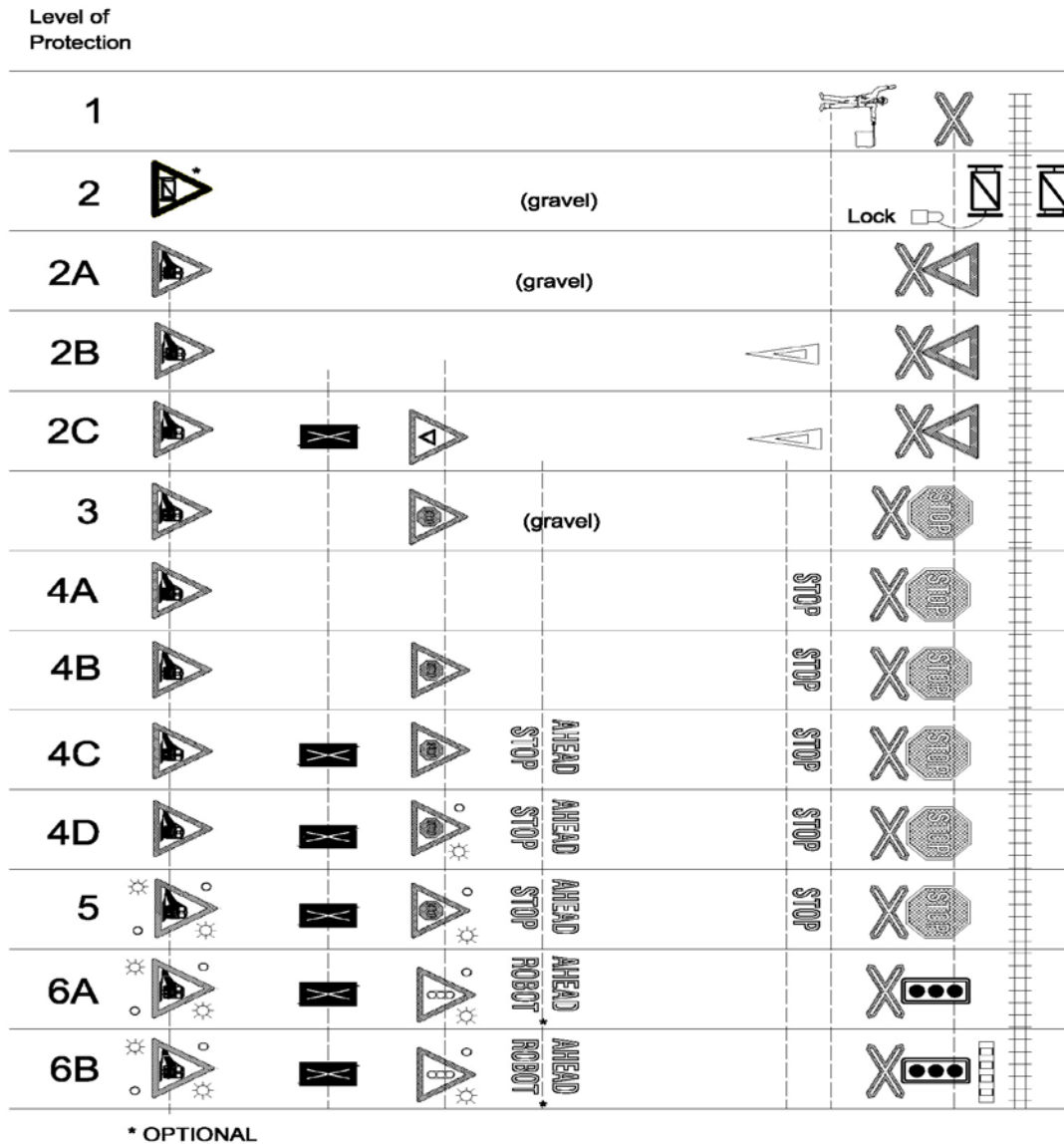


Figure 1: Levels of protection at level crossings

## 11 FEASIBILITY STUDIES/PRIORITISING AND FUND/ DESIGN AND CONSTRUCTION

All of the above shall incorporate the results of the risk assessment in order to mitigate the risks and reducing the impact of occurrences and shall be approved by the road authorities and the relevant network operators respectively.

## 12 INSPECTION, TESTING AND COMMISSIONING

Processes and procedures shall be established, developed or adopted and maintained for inspection, testing and commissioning of new or the modification of an existing level crossing and includes road signage, road surface geometry, track geometry and track signage, civil and electrical infrastructure and train control and authorisation systems where applicable. This includes systems, sub-systems and components which are essential elements in ensuring safety integrity.

## 13 OPERATIONS

Once operational readiness is confirmed and had followed due processes operations can start. Whilst in operation processes and procedures shall include:

- Physical and risk assessments,
- Road user and train operator education and awareness
- Enforcement of safe road usage and railway operations
- Monitoring of usage of level crossings
- Occurrence management and investigation
- Operating procedures

## 14 MONITORING AND MAINTENANCE

Monitoring of road and railway infrastructure and systems shall be undertaken. Preventative maintenance and corrective actions shall include, inter alia, process control, access control, procedures to ensure restoration of level crossings to the required standard, including maintenance of road surface, maintenance of the track geometry, erection and maintenance of the road signage and road markings, maintenance of line of sight along the railway line and along the road, installation and maintenance of integrated drainage systems, effective vegetation control, erection and maintenance of the overhead track equipment height gauges, including warning signs, as well as of track-side warning boards, whistle and speed boards, installation and maintenance of level crossing advance warning systems, provision of maintenance of fences, gates, cattle guards and cattle grids, and effective access control by private road owners.

## 15 MODIFICATION

Modification processes and procedures include design, implementation and commissioning as mentioned above, effects of the proposed modification on safety at the level crossing during the modification phase, communication of all these and recording of the modifications in a configuration management system.

## 16 DECOMMISSIONING

The decommissioning of an existing level crossing may result in the elimination of it by means of a structure, the closure of a road or a railway line. In cases where the residual risk at a level crossing is unacceptably high after applying the maximum level of protection described in the signage manual (also an annexure to the standard) the level crossing shall be listed for elimination by means of a structure, or where possible, shall be closed.

## 17 ROLES AND RESPONSIBILITIES

The roles and responsibilities of the network operator, road authorities and private road owners are clearly defined for implementation during the life cycle by means of the management of the interfaces between them, funding the management of occurrences and the investigation thereof and the management of level crossings that are not in use or redundant.

### 17.1 Public level crossing

The responsibilities of **the rail network operators** are limited within the rail reserve and are as follow:

- Principle approval of new and modification to existing level crossings
- The life cycle phases
- Scheduling and conducting of physical – and risk assessments together with relevant road authorities
- Compliance with the prescribed signage for level crossings
- Conducting of feasibility studies

- Prioritising and funding of new/modified level crossings
- Prescribed design requirements of new/modified level crossings
- Prescribed construction requirements of new/modified level crossings
- Prescribed inspection, testing and commissioning requirements of new/modified level crossings
- Prescribed requirements for the operation of new level crossings
- Prescribed requirements for the monitoring, maintenance and modification of level crossings
- Prescribed requirements for the decommissioning of level crossings
- Maintaining and updating the national level crossing database.

The responsibilities of **road authorities** are limited to the activities outside the rail reserve and are the same as the abovementioned for the rail network operator.

## 17.2 Private level crossings

The responsibilities for private level crossings are the same as for public level crossings and the network operators will take the necessary responsibility to ensure that due processes have been complied with.

## 18 OCCURRENCE MANAGEMENT

All occurrences at level crossings are to be managed and investigated by both the road authority and the rail network operator. This shall include the measures to be taken to minimize hazards at the scene and consequences of the occurrences.

Both parties shall establish, develop or adopt, communicate and maintain contingency plans, including emergency preparedness plans for safe operations linked with the interfaces/intrafaces of other operators including the various departments in the country responsible for disaster management. All occurrences shall be reported to the RSR and recorded in the national level crossing database.

## 19 CONCLUSION

A total of 181 level crossing occurrences were recorded from 1 April 2009 until 31 March 2010. This was a 6.5% increase on the 2008.2009 year. Taking into account the reduction in activity level of the biggest freight rail operator as well as the biggest commuter rail operator in South Africa, these two operators experienced an effective increase of 20.1% and 52.9% respectively. Therefore the incidence of level crossings collisions has increased significantly in a year.

Investigations by the RSR following level crossing collisions have revealed that in the majority of cases the primary cause is non-compliance to road signage by the road vehicle driver. A contributory factor to these occurrences has been the inadequate maintenance of the road surface across some level crossings. Another important consideration is the original design of the level crossings and the changing traffic patterns, which will require capital investment to improve the level of protection at these identified level crossings. Notwithstanding these physical deficiencies, non-adherence to traffic signage and rules by road vehicle drivers remains the major cause of the accidents, necessitating the need for increased and sustained education and traffic law enforcement.

From the above mentioned it is clear that a level crossing standard for all the stakeholders in South Africa was more than needed.

In conclusion we have succeeded in addressing the dual responsibility by the road authorities as well as the network operators. The relevant life cycle processes, the roles and responsibilities are now for the first time clearly defined.

After applying the physical and risk assessments to a level crossing in a suburban area in Cape Town, where 9 school kids were last year fatally injured, (see photo below), the outcome of these assessment were that the level crossing will be decommissioned by the Province by means of an underpass that will be constructed.

Therefore the implementation of the standard has for sure started!!

## REFERENCES

South African Development Community road Traffic Signs manual (SADC-RTSM)

National Roads Agency Limited Geometric Design Guideline

South African Road Traffic Signs Manual (volume 2 chapter 7) (as amended)

South African Road Traffic Signs Manual (volume 3) (as amended)

SANS 3000-1: 2009 General

SANS 3000-2-1: 2008 Technical Requirements for engineering and operational standards – General

SANS 3000-2-2: 2008 Technical Requirements for engineering and operational standards – track, civil and electrical infrastructure

SANS 3000-2-2-1: 2011 Level crossings