ENGINEERS AUSTRALIA

Transport Australia society

Draft Standard AS 7531 Rolling Stock Lighting and Visibility

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Introduction

Engineers Australia appreciates the opportunity to provide a submission to the Rail Industry Standards and Safety Board on the draft Australian Standard AS7531 Rolling Stock Lighting and Visibility.

Improving safety on roads and railways is critical for Australian business and society. Engineers will continue to lead the development of new safety measures to improve transport safety for everyone affected. High level standards must be applied to provide the safest, most efficient and sustainable transport modes practicable.

Engineers Australia is very aware that no single part of any transport system can ensure safety in isolation. Road users, companies, governments, train drivers and others need to contribute to all stages of design, construction, operations and maintenance. Infrastructure, vehicles, operators, legislation, enforcement and other activities need to be practiced at the highest level. It is not acceptable that any Australian dies in a transport crash which is avoidable.

About Engineers Australia

Engineers Australia is the peak body for the engineering profession in Australia. With about 115,000 members across Australia, we represent individuals from a wide range of disciplines and branches of engineering. Engineers Australia is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community.

Engineers Australia's response is guided by our Charter and Code of Ethics which states that engineers act in the interest of the community, ahead of sectional or personal interests towards a sustainable future. Engineers are members of the community and share the community's aspirations for Australia's future prosperity.

This submission is developed by members of the Transport Australia Society and their working group on road safety. The Transport Australia Society is an Engineers Australia technical society for transport professionals in Australia. They focus on key transport decisions affecting the well-being, productivity and sustainability of our cities and regions. Through their work they seek to improve public debate on strategic transport issues, and to provide valuable expert advice to governments making decisions regarding transport policy, reform, and infrastructure investment.

Contact information

The Transport Australia Society is keen to contribute to the constructive dialogue on road safety. Several of the issues raised and their mitigations are complex and could be described in greater detail. To discuss the contents of this submission further, please contact policy@engineersaustralia.org.au

Background

Engineers Australia and the Transport Australia society (TAs) take a multimodal and multidisciplinary approach to transport issues. Level crossing safety can only be improved if both road and rail transport system factors are takin into account. It will require many specialist professional perspectives and contributions from a variety of organisations, companies and individuals. The Standard for Rolling Stock Lighting and Visibility is one specific, but important part of a comprehensive and holistic approach required to improve level crossing safety. While a wide range of other activities are required to maximise level crossing safety, only the draft Standard is considered in this submission.

TAs notes that the Office of the National Rail Safety Regulator (ONRSR) has identified regional level crossing safety as a national priority. It represents the greatest risk for death and injury for the public. Risk at level crossings has not improved over recent years, except as a result of reduced nighttime operations. More needs to be done to improve level crossing safety urgently. While there have been some major initiatives to improve level crossing infrastructure over the past few years, there has probably been no improvement to train lighting and visibility for more than 20 years. The current Standard is 17years old and needs to be updated. Updating the Standard to the highest level possible for train lighting and visibility is therefore crucial.

Research for ONRSR highlights human factors for road users are critical for level crossing safety. Road users need to go through a series of tasks to identify the type of level crossing and if a train is approaching, assess a safe gap and cross the tracks. Failure to successfully complete any of these tasks could result in a catastrophic crash.

Road users encounter trains in an infinite variety of situations and conditions. In regional areas drivers very commonly cross railways which have no lights or boom gates, are at acute angles, when lighting is hazy at dawn or dusk, when visibility is poor due to inclement weather and in variety of visual fields where a train may be hard to distinguish (such as agriculture or in towns). Drivers may encounter trains approaching at different speeds. In fact, a train in the distance which is stopped is indistinguishable from a train which is travelling at high speed because drivers can notice a train before they can determine its speed.

For many road users, trains are an unexpected hazard. Many railways are used only a few times a day while other operate only seasonally. To a casual observer, an operating line may look no different to a disused railway line that has level crossing warning signage. Tourists or people visiting family and friends may not expect a train or have much experience in responding to the hazard.

TAs notes the very good outline for investigating rail safety issues, the Contributing Factors Framework Manual (CFF Manual) provided by ONRSR, which is particularly relevant to level crossing safety. On human error the CFF Manual notes that:

> *"Active failures (errors and violations) are a natural product of the human condition. Modern approaches to the understanding of human error and violations accept that human error is inevitable. This approach accepts that errors and often violations are the product of latent failures in the organisational system such as poor systems design, inadequate procedures and operational practices."*

The CFF Manual has very good descriptions of a wide range of "local conditions and organisational factors" that apply to all the relevant participants and the whole life cycle of railways activities. The factors include Personal factors; Knowledge, skills and experience; Task demands; Physical environment; Social environment; Procedures; Training and assessment; Equipment, plant and

Infrastructure; People management; Organisational management and External organisational influences. These factors, summarised in the Attachment, are particularly important for level crossing safety.

Research by the US Transportation Research Board describes that drivers traverse several zones and complete a variety of activities to cross a railways safely, including:

- Advance Approach Zone - Presence of a crossing, crossing type (passive or actively protected)
- Approach Zone - Location, distances and number of tracks at crossing ahead, Sight limitations, train present or approaching crossing, train speed, distance and direction, appropriate approach speed
- Non-Recovery Zone - Train's speed and distance from the tracks, no train in vicinity of crossing, vehicle's speed and distance from the tracks, location of appropriate stop point
- Hazard Zone - Physical crossing difficulties, visibility distance up the tracks and clearance at the crossing, number of tracks, and existence of multiple trains.

Each of these activities requires specific visual information and an appropriate response which requires road users to have sufficient skills knowledge and experience. However, we know that drivers cannot and do not always accurately make these assessments and respond in the safest manner possible. Drivers' assessments of speed and distance to an approaching train are biased towards being safer than the actual situation they are in – they underestimate the safe gap available before a train arrives.

Merely blaming the road user for level crossing crashes is inconsistent with the CFF Manual's approach to responsibility and blame. The Standard must take account of any of the factors that contribute to crashes and reduce them wherever possible. It is universally recognised that crashes are almost never caused by single factors in a complex system. So, any part of the System that can contribute to improved safety should be maximised. It has been said that "Human error is a symptom of system failure, not a cause".

TAs has used the CFF Manual as a guide for reviewing the draft Standard AS7531 together with a risk analysis of the greatest hazards and which can be managed. This review reveals some important changes that can be made to the draft Standard which are reasonably practicable and therefore consistent with National Rail Safety Law (or perhaps required).

Ultimately, AS7531 must ensure that road users are given the best visual information possible to safely negotiate a level crossing. The recommendations below will help ensure that this occurs.

Recommendations

The following improvements are strongly recommended to improve the draft AS7531.

1. The Standard should include higher specifications for high risk operations.

At present AS7531 is not mandatory and is an absolute minimum, falling well behind the levels of safety if other comparable situations in transport and elsewhere. This may be acceptable for low risk operations, such as low volume rail lines or across low volume roads, or with wagons only used occasionally. Higher standards should be required for high risk rolling stock.

2. Flashing lights must be installed on the front of all regional passenger and freight trains.

Front flashing lights are required to alert a road users of an approaching train, particularly in daylight. At night, flashing lights will help distinguish a train from other competing lights in the background. Flashing lights are used universally in road transport and other areas to indicate unexpected or unusual hazards.

3. Side marker lights must be installed on all regional passenger and freight trains.

In additional to marker lights that outline the front of a train, side lights help drivers to gauge speed and distance of trains, particularly in poor light conditions. At night, side lights help alert a driver to an oncoming tarin and distinguish it from other background lights which may be confusing.

4. Section 12. Wagons need to be much more visible with either improved reflective delineators or side lighting.

Many wagons are very dark, the current reflector standard specified is not high reflectors and are not well maintained or cleaned. In certain circumstances, such as at night in inclement weather and at acute angles, wagons can be hard to see. The Standard can be improved by requiring either

a. Higher standard and more reflectors on wagons.

The specification of AS/NZS 1906.2 Class 400 reflective material is far too low. The current AS/NZS 1906.2 falls far behind current commercial products. Road vehicles are required to comply with the Commonwealth Government's current equivalent standard for road vehicles "Road Vehicle Standards: VSB 1 – Trailers with an Aggregate Trailer Mass of 4.5 Tonnes or less". These are based on international standards which far exceed the draft AS7531. For instance:

- reflective tape is not acceptable,
- reflectors must not be more than 3000mm apart, and
- dimension locations are more closely specified.

Class 1100 reflective material may be adequate for low-risk operations but is not suitable for high-risk operations. Higher standard reflective materials than Class 1100 are widely available commercially and should be used.

b. Wagons should have side lights when they are a high hazard

Wagons that are poorly maintained or carry dirty product, are in frequent use, regularly crossroads without flashing lights or boom gates and operate in poor light conditions or at night represent a greater risk and should have a higher standard of visibility.

5. Section 11 Livery. The fronts of trains should have starkly contrasting marking patterns and colours.

The changes to livery colours proposed for the front of trains is an improvement to the Standard. However, a single colour does not provide sufficient visibility against different backgrounds and in different lighting conditions. The areas of high visibility livery should be larger, consist of two high contrast colours and be arranged in a stark pattern. This arrangement is used in many other

situations, such as in traffic management, on emergency vehicles, and even on track maintenance machines. Some railways are to be commended for already implemented high visibility colour patterns on the front of their locomotives.

With respect to additional lighting, the draft Standard requires lighting for several purposes including couplers, work around trains, access and end of trains. If these can be provided there is no apparent impediment to implementing improved lighting according to the recommendations above.

The features recommended above are particularly valuable in a range of lighting conditions, locations with different backgrounds and approach angles. Importantly, speed. TAs notes that headlights are bright enough for a driver to see a train, often over a long distance. However, a single light source does not convey sufficient visual information to gauge the distance to a train or its speed. In fact, headlights which are too bright can mask other lighting, thereby making it harder for drivers to make good judgements.

All the recommendations above have been proven practicable in many other transport operations including, mining, remote areas, workplaces (occupational health and safety) and safety critical industries. Neither governments, ONRSR nor, the rail industry have provided information which describes that the recommendations are not reasonably practicable. Indeed, the recent research reports for ONRSR demonstrates that the recommendations above can be implemented, and railways have had sufficient time already to do so.

TAs recognises some of the improvements will be challenging for a range of reasons. Nevertheless, rail operators have had many years to undertake trials and designs to apply solutions which are practicable. Any number of further investigations could be undertaken which would only delay improving level crossing safety.

Furthermore, AS7531 is not mandatory which is in stark contrast to safety standards elsewhere in transport and other safety domains.

It is recommended AS7531 be mandatory.

Conclusion

The draft AS7531 is an improvement on the previous version which urgently needed to be improved. Nevertheless, several reasonable improvements are still achievable as recommended above.

The Transport Australia society has a strong independent membership with a wide range of knowledge and expertise applicable to railway standards. TAs would welcome the opportunity to contribute further to this standard and any others where our members can make a useful contribution.

Attachment

Contributing Factors Framework Manual (Office of the National Rail Safety Regulator)[1]

Summary of Local conditions and organisational factors

Local conditions and organisational factors	Keywords	
Personal factors	Alcohol/drugs Expectation Fatigue/alertness Health-related condition Motivation/attitude	Physical limitations Pre-occupation Stress/anxiety Other personal factors
Knowledge, skills and experience	Abnormal/emergency operations knowledge and skills Normal operations knowledge and skills	Task experience Communication skills Teamwork skills Other knowledge, skills and experience factors
Task demands	Distractions High workload Low workload	Time pressure Other task demand factors
Physical environment	Air quality Housekeeping Lack of environmental cues Lighting/visibility	Noise Temperature/humidity Vibration Weather-related factors Other environmental factors
Social environment	Diffusion of responsibility Peer pressure Norms and values	Team climate Other social environment factors
Procedures	Absent procedure Accuracy/adequacy Availability/access	Clarity Work-ability/relevance Other procedures factors
Training and assessment	Competency assessment Currency tracking Initial training	Ongoing training Training review Other training factors
Equipment, plant and infrastructure	Availability Absent equipment, plant and infrastructure Alarm design Control/input device design Display design	Infrastructure design Signage Functionality Reliability Other equipment, plant and infrastructure factors
People management	Job/task design Selection/recruitment Reward/discipline structures Roles and responsibilities Rostering/scheduling	Fitness for duty monitoring Staff support Supervision Other people management factors
Organisational management	Business planning and asset/resource management Communication and consultation process Competence of senior personnel Compliance Contractor/interface management Information management	Monitoring, review and validation Organisation design Policy Risk/change management Interface management Other organisational management factors
External organisational influences	Community expectations or behaviour Government influences Industry standards or guidance	Regulatory activities Regulatory standards and guidance Other external organisational influences

[1] Rail Safety Regulators' Panel, Office of the National Rail Safety Regulator (ONRSR, 2011) *Contributing Factors Framework, Manual.* https://nraspricms01.blob.core.windows.net/assets/documents/Resources/Contributing-Factors-Framework-Manual.pdf