OFFICE OF RAIL AND ROAD

Principles for managing level crossing safety

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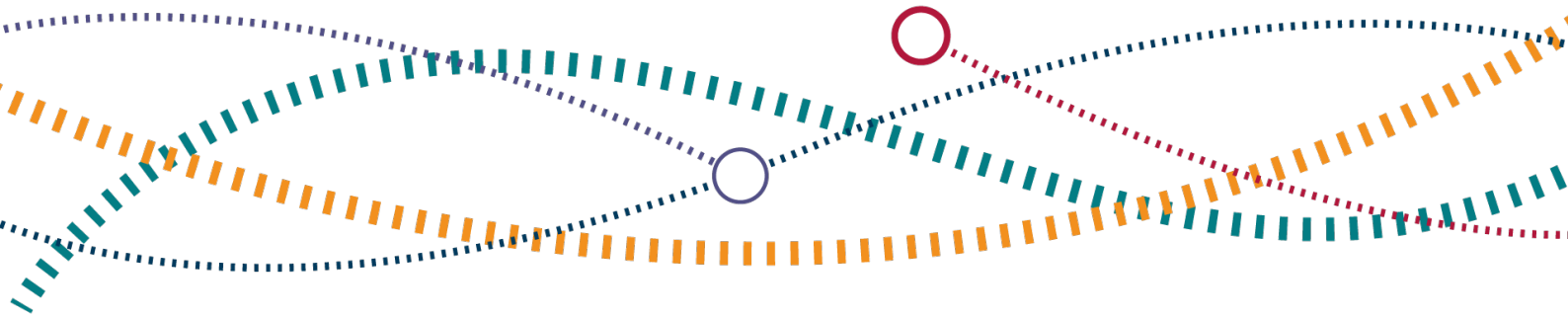

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Foreword

Level crossings provide access routes across our railways for the public and for private landowners, but they present a particular safety challenge which has increased as our railways and highways have become busier. Level crossings are a priority topic for the Office of Rail and Road (ORR) because of the potential for harm and injury to members of the public.

There are currently just under 5,800 level crossings on the mainline railway with another estimated 1,500 on heritage and minor railways. They range from rural footpath crossings where the user checks for themselves that it is safe to cross, to high-tech public road crossings with obstacle detection systems and automatic barriers. This guidance is for all types of level crossing and is aimed at a wide audience including level crossing operators and managers, users, landowners and local traffic authorities.

This guidance marks a change from our level crossing guidance published in 2011 - *Level Crossings: Guidance for Managers, Designers and Operators*, and known as RSP7. While RSP7 does not set mandatory standards, it does describe particular layouts and methods of operation, and as such is perceived as setting requirements for level crossing design. *Principles for Managing Level Crossing Safety* takes a risk based approach, in line with other ORR health and safety guidance, and sets out principles and factors which should be considered in a level crossing risk assessment. It emphasises that risk should be reduced through the design of a level crossing or through an alternative way of crossing the railway where this is reasonably practicable, and the importance of considering how level crossings are actually used. Overall, this guidance supports our strategy for regulating level crossings, which is focussed on continued improvement in risk management.

This guidance has been developed with the help of a stakeholder steering group who were invited by ORR to engage from early in the project. We would like to thank the members of the stakeholder steering group: Association of Directors of Environment, Economy, Planning and Transport (ADEPT), British Transport Police, Department for Transport, Heritage Railway Association, Hertfordshire County Council, Institute of Public Rights of Way, Network Rail, Rail Delivery Group and RSSB.

Ian Prosser CBE - Director, railway safety

1. Introduction

1. This guidance is intended to inform the assessment and control of risks at all types of level crossings, through a thorough understanding of the user. A number of principles are set out, describing ORR's expectations for identifying and controlling the risks, and a list of key factors to consider accompany each principle.

2. This guidance does not place additional burdens on duty holders, introduce new duties, or prescribe how a level crossing should be designed, operated or maintained. Further information about level crossings is available on our website.

ORR's role

3. ORR is the independent safety and economic regulator for Britain's railways. We strive for a railway that operates safely, reliably and provides value for taxpayers and customers. We protect the health and safety of people who work in the rail industry or those affected by its activities, by ensuring railway businesses have effective health and safety management systems in place. This includes identifying, assessing and controlling risks properly.

Who is this document for?

4. The principles contained in this guidance apply to the design, management and operation of level crossings on:

    - mainline railways (National Rail);
    - non-mainline railways (e.g. heritage railways, metro systems, rail freight sites);

5. This guidance is a resource for anyone involved in level crossing safety, those whose activities impact on level crossing safety, and users of level crossings. Specifically, for those in the railway industry, traffic authorities, local authorities and others associated with the railway, such as landowners who have rights over the railway.

6. This guidance is likely to be relevant to people in the following roles in these organisations:

    - designers, planners and engineers;
    - those dealing with planning applications, access and public rights of way matters;

- managers, staff and volunteers with responsibilities which affect safety at, or near, level crossings.

7. This guidance is not specifically aimed at tramways but may be useful reference material when designing tramway crossings. More information on tramways is available on ORR's website.

How to use this document

8. The main purpose of this guidance is to inform the assessment and control of risks at a level crossing, recognising that every level crossing is different and its individual circumstances need to be taken into account.

9. We encourage consideration of the 'whole-system' in which a level crossing operates, by this we mean understanding how people, processes and technology work together to deliver a safe level crossing. A level crossing is an interface between the highway and the railway and involves a wide range of users and different parties who each have an impact on safety. The principles reflect this by focusing on users, the railway and the highway. We also emphasise the importance of collaboration between the various parties who contribute to level crossing safety.

10. For the purpose of this guidance, when we use the term 'highway' we also include private roads. A highway is usually defined as any road (including byways), footpath or bridleway to which the public have access.

11. Each of the principles in this guidance describes an ORR expectation for identifying or controlling the risks at a level crossing. A list of factors for consideration accompany each principle. We encourage you to consider all the principles and factors in this guidance. Not all principles and factors will be relevant for all level crossings; you may also need to identify other factors for level crossings where there are unusual circumstances. This is because each level crossing should have its own site specific risk assessment.

12. We have case studies to illustrate how the principles may be applied available on our website. A glossary of key terms is provided at **Annex A**.

13. You will also need to take account of other health and safety guidance, legislation and standards relevant to the railways and public highways. Equally, you will need to comply with relevant equality legislation and consider other relevant standards and guidance. Further information is available on our website.

Collaboration

14. It is particularly important that all those involved in the process of level crossing risk assessment work together so that opportunities can be taken to eliminate and reduce risk. Early engagement and consideration of solutions from different perspectives will provide better opportunities for innovation in managing risk. For example, a local housing development scheme which could increase use of a footpath crossing may provide an opportunity to replace the level crossing with a bridge as part of the development scheme.

15. There should be a joined up, collaborative approach to managing and improving level crossing safety between the infrastructure manager, traffic authority, local authority, train operating companies (including freight), users (particularly for private user-worked crossings) and other organisations such as the British Transport Police.

16. Where level crossings on public highways are under review, it is vital that the relevant local traffic authority is engaged in early discussions. This allows local traffic factors to be taken into account when designing level crossing controls. This is increasingly important given the greater volumes of road and rail traffic, and the impact the length of time that a level crossing is closed can have on road traffic. Equally, when there are temporary or permanent changes to highways that affect a level crossing, the traffic authority needs to discuss these with the crossing operator.

17. We support the use of joint plans which help to provide a structured and long-term approach to collaboration. These can be used to identify relevant organisations and user groups, gather relevant information and data (such as traffic volumes), local knowledge and incident history and document the necessary policies and processes.

2. Level crossing risk assessment

Human factors in level crossing design

18. Good level crossing design should understand the needs and limitations of the user, taking into account normal use, reasonably foreseeable human error and unintended methods of use. It should also consider the needs of those operating and maintaining the level crossing.

19. Level crossing users are individuals and differ, for example, in their mode of transport, age, sensory and mobility capabilities, familiarity with using level crossings and perception of risk. They may use the crossing for one part of a journey and have other demands or distractions on their mind, particularly in relation to the rush and pressures of daily life.

20. Every user will develop their own understanding of how to use a level crossing from the information available to them and their experience of similar situations. This understanding may have to be built up very quickly if they are unfamiliar with a level crossing and using it for the first time. Or they may be very familiar with a level crossing and have already developed and refined their understanding of how to use it. The user's understanding may not match how the level crossing is intended to be used. This means it is preferable to adopt a level crossing design that minimises cognitive demands and places as little onus as possible on the user to take decisions about when it is safe to cross the railway. Designers should also be aware that because of their level of expertise and familiarity, they may overestimate the intuitiveness of their design and therefore likelihood of users behaving as expected.

21. The points below set out some considerations for level crossing design:

    - understand natural human tendencies, such as people's willingness to wait. People will look for a quicker and easier way of doing something, especially if they are regular users. They may build up assumptions about the timing of trains and when they consider it is safe to cross, however trains do not always run to time or freight trains may be time tabled when not expected.

    - take account of how people can react when required to make quick decisions that affect safety.

- recognise people's expectations from the world around them on how something should work can be utilised to develop effective control measures e.g. people know that a green light means go and a red light means stop. Equally, where control measures do not meet with people's expectations for how something should work, risk can be introduced e.g. if there is inconsistency between the two sides of the crossing.

- use engineering controls to remove the risk of human error e.g. ensuring that once a railway signal has been cleared to allow a train to proceed towards a crossing, there can be no change to the equipment protecting the crossing. Where there is the potential for errors when people are expected to communicate with the crossing controller, consider other more reliable technological means to let users know when it is safe to cross. For all crossings, think about how to simplify and reduce the number of tasks that people are expected to perform and the instructions they are expected to follow in order to minimise their cognitive load.

- make it clear to people what they are expected to do. Where user action is required, such as closing gates, it is beneficial to make this easy, reinforce the need for the action to be completed, and confirm that it has been completed by giving feedback to the user. This is particularly important where there is a known problem e.g. where gates are being left open, electronic signs can remind users to close the gate.

- consider use of natural and/or artificial constraints, e.g. fencing on the approach to a crossing, to guide the user to the next appropriate decision or action.

What a risk assessment involves

22. Health and safety law requires railway duty holders to reduce the level of risk from their operations so far as is reasonably practicable. Level crossings present a particular challenge because they are at the interface between the railway and the highway, so require a collaborative approach between those involved, particularly as level crossing risks are not all under the direct control of the railway duty holders.

23. It is essential that decisions and options for level crossing control measures are informed by a suitable and sufficient assessment of the risks. This should be site specific and completed by competent people with thorough knowledge of the risks and the application of controls associated with level crossings, as well as a good

understanding of user behaviour and their perception of risk. The key elements of a suitable and sufficient risk assessment are:

Identify the hazards - An essential part of this will be to understand how the level crossing is used, both in normal and abnormal operating conditions, and who the users are. The safe user principles and factors set out in this document will help you to do this.

Assess the risks - This is about deciding how likely it is that someone could be harmed by each of the hazards identified and how serious it could be. The consequence and likelihood of harm should be considered in combination when assessing the significance of risks.

Control the risks - First consider whether the risk can be eliminated and if this is not reasonably practicable to achieve then consider how the risk can be controlled to reduce the likelihood of harm, following the principles of prevention described later. The safe railway and safe highway principles and factors set out in this publication will help you do this.

Record your findings - This should include documenting the hazards you have identified and the controls you have put in place.

Review the controls - The controls should be reviewed to ensure that they are working as intended and risk assessments should be kept up to date so that any changes at the crossing are assessed and managed.

24. When a risk assessment is reviewed because the level of risk has changed at a level crossing, e.g. because the speed and/or frequency of rail services has increased on a route, you must ensure you continue to meet the legal duty to reduce risk so far as is reasonably practicable. There may be situations where an increase in risk is acceptable because it is not reasonably practicable to reduce that risk.

Principles of prevention

25. Arrangements for managing risk at level crossings should follow the principles of prevention which are found in The Management of Health and Safety at Work Regulations 1999[1]. The following paragraphs set out an ideal order to follow when deciding how to manage risk at a level crossing.

1.

[1] The Management of Health and Safety at Work Regulations 1999, schedule 1.

Elimination

26. The first consideration for all level crossings should be whether there are reasonably practicable alternatives to a level crossing, this is best considered at the design stage of a level crossing as part of a whole system approach.

27. Proposals for new level crossings are rare, but projects to reinstate old railways may include proposals to reinstate a level crossing which previously existed on the route. During the design of a new railway or reinstatement scheme, there are likely to be fewer constraints and greater flexibility for identifying alternatives. In principle, ORR does not support the creation of new level crossings where there is a reasonably practicable alternative, and we encourage alternatives such as diversions, bridges or tunnels to be fully explored and delivered where reasonably practicable. Each situation should be considered on a case-by-case basis, taking account of the nature of the railway operations, surrounding environment and foreseeable users

28. For an existing level crossing, the risk assessment should always consider whether closure is a reasonably practicable option. However, we recognise that there are many factors to be considered, including the legal arrangements for closing rights of way. The cost of alternatives has to be taken into account but also the feasibility of alternatives e.g. level crossings are often located in built up areas where it is simply not possible to construct a bridge without causing significant detriment to local people. There may be local opinions either for or against a level crossing and good communication between the railway, the local authority, and other affected parties such as users and landowners is vital in these situations.

29. Using a risk assessment approach enables the costs and benefits of level crossings to be compared with the costs and benefits of alternatives to a level crossing, such as a bridge. This should also take into account the wider implications, such as the possibility that risk may be transferred to another level crossing.

Engineering controls

30. Where it is not reasonably practicable to close a level crossing, engineering controls should be considered. There is now a range of technologies available for level crossings. In addition, the cost has been decreasing over time, as the technologies are refined and the efficiency with which they can be installed increases. This has increased the options available for installing engineering controls e.g. by providing an active warning system in preference to relying on the user to look out for trains and determine whether it is safe to cross the railway. Another example is the use of obstacle detection systems at road level crossings, which check that a level crossing is clear for trains to proceed and can reduce human error and signaller workload.

Administrative controls

31. Administrative controls such as signage and instructions should be used in conjunction with other control measures where this is reasonably practicable, as they place a heavy reliance on the user and do not actively manage the risks.

32. Administrative controls also include the safe system of work for operating the level crossing under normal and abnormal operating conditions. Engineering controls should be used where reasonably practicable, however administrative procedures and processes will be required at most level crossings.

Reasonable practicability and decision making

33. Reducing risk so far as is reasonably practicable involves a judgement as to whether the risk can be controlled if the duty holder takes certain measures. The level crossing operator has a duty to manage risks to those who use a level crossing, including rail employees, rail passengers and members of the public.

34. The Courts have decided that risk control measures should be deemed reasonable unless the cost of the measure is grossly disproportionate when compared to the risk. There is no authoritative guidance on what factors should be taken into account when deciding whether cost is grossly disproportionate and no single algorithm which can be used to determine gross disproportion; it is a case-by-case, site-by-site judgement. Although there is no authoritative case law on what constitutes gross disproportion, ORR supports the view of the Health and Safety Executive that where the risk is greater a more significant degree of disproportion is justified.

Applying the gross disproportion judgement

35. Duty holders have to judge the risks at a level crossing. The risks to individuals and the likelihood and severity of the consequences of an incident at a level crossing, should be taken into account along with the specific characteristics of each crossing. This should be weighed against the cost in money, time and trouble or effort of options to eliminate, reduce, or mitigate risk.

36. Gross disproportion is a matter of informed judgement on a case-by-case basis for the duty holder. ORR does not set out what an appropriate gross disproportion factor would be for a level crossing. This is for two key reasons. Firstly, a single factor cannot be used for such a variety of circumstances as those found at level crossings. Secondly, the choice of factor should take account of the degree of risk involved, the uncertainty of any analysis and the potential for significant harm, which can only be determined on a case-by-case basis.

37. Use of cost benefit analysis (CBA) and applying the gross disproportion test are useful ways of deciding whether you have reduced risk so far as is reasonably practicable, but they are only part of the overall decision making process. The judgement should not be based on numerical calculations alone and should take account of your knowledge about the particular location, including information on past incidents and near misses. RSSB provide a useful guide to decision making – *Taking Safe Decisions* – which sums up the key test of a good decision as whether you are confident that it is rational, equitable and defensible.

38. In many situations CBA may not be required and relevant established good practice can be used as a baseline for risk reduction measures. In more complex situations CBA can be used to aid decision making by giving a monetary value to costs and benefits and enabling a comparison between them. The CBA should consider the costs to the duty holder of implementing the safety measure. This would include, for example, installation, training, maintenance and operational costs for the whole life of the level crossing. The benefits to be included in the CBA are the benefits in terms of the reduction in risk to passengers, workers and members of the public. To enable a comparison between costs and benefits, the health and safety benefits need to be given a monetary value and this is done using the value of preventing a statistical fatality (VPF). RSSB recommend a VPF figure based on that published by the Department for Transport. At the time of publication it is £2.017million.

3. Safe for the user

This section is for the identification of hazards at a level crossing. It follows the user's journey, from approaching the crossing to travelling over it and exiting it. It also asks you to consider the different types and characteristics of users at a crossing, which will identify some as being more vulnerable than others. The overall aim being to ensure that all foreseeable hazards are identified.

There should be comprehensive identification and understanding of all foreseeable users *before* considering the railway and public highway principles.

User Principle 1: Understand all foreseeable level crossing users.

To help you achieve this outcome, you should consider, at least, these factors:

(a) use a variety of quantitative and qualitative methods to gather evidence in order to get a good understanding of who uses the level crossing, how they use it and the frequency and pattern of use e.g. daily, weekly, seasonal variations and times of peak usage;

(b) nearby local facilities, e.g. stations, schools, care homes, national leisure routes, seasonal attractions or event venues and their foreseeable users e.g. people with luggage, children and elderly people;

(c) users with protected characteristics under the Equality Act 2010. You should ensure the specific risks these users encounter are identified and have due regard to eliminating or reducing these risks to promote equality of opportunity for these users;

(d) users with particular characteristics that impact on their safe use of the level crossing, e.g. dog-walkers, users crossing in groups, horse-riders, cyclists, motorcyclists;

(e) users who may be unfamiliar with a level crossing or who may have difficulties understanding instructions, e.g. delivery or commercial vehicle drivers and seasonal agricultural workers;

(f) livestock driven on foot over the level crossing, when this is likely, and who is in charge of the livestock;

(g) types of vehicles using the level crossing and how their particular characteristics might impact on the safe use of the level crossing e.g. long slow vehicles or farm machinery;

(h) users of private crossings who operate crossing controls, including those who need to brief others on how to do so safely, to understand how and when they use the level crossing and review/identify safe systems of work.

User Principle 2: Understand foreseeable user behaviours or actions at, or near, the level crossing.

To help you achieve this outcome, you should consider, at least, these factors:

(a) gather data on how users behave at the level crossing, including when there are known problems, e.g. through the use of incident data and technology such as cameras;

(b) why some users may not follow the expected route over a level crossing, e.g. local factors including layouts, the proximity of structures such as signal boxes, nearby footpaths, behaviour when there is a station nearby, or pubs/clubs are nearby;

(c) people deliberately taking risks at a level crossing e.g. going onto a level crossing that has been closed for an approaching train;

(d) clothing and equipment e.g. hoods and headphones which may affect awareness and/or concentration;

(e) animals accompanying users over the level crossing e.g. dogs and horses and their potential impact on behaviour;

(f) how passengers access any nearby platforms, information notices, ticket sales points or car park machines and the effect of this on the number of times a user needs to cross the railway and their willingness to wait;

(g) routine users who may develop assumptions and practices that can underestimate risks, especially when the system is not operating as it should;

(h) foreseeable user behaviour when level crossing equipment does not operate as expected by the user e.g. if the barriers have malfunctioned.

User Principle 3: Understand how users become aware of the level crossing.

To help you achieve this, you should consider, at least, these factors:

(a) information and cues provided to warn users they are reaching a level crossing so they can modify their actions, e.g. signage, highway markings, fencing, changes in the approach surface;

(b) highway approach angles, gradients and approach speed and how this affects awareness of the level crossing, particularly where the highway approach offers limited visibility.

User Principle 4: Provide a safe and convenient waiting place for users at the level crossing and where necessary on the approaches to the level crossing.

To help you achieve this, you should consider, at least, these factors:

(a) drivers of long, large or slow vehicles, farmers with livestock, or horse riders who may need a place to wait on the approach to the level crossing so they can communicate with the crossing controller;

(b) a safe place at the level crossing where the user can wait whilst a train passes or identify when it is safe to use the level crossing;

(c) depending on the crossing controls, users will need to undertake different actions at the waiting place, and their needs should be accommodated. Some level crossings require users to have good visibility of the track, which can be affected by the height of the user e.g. those in tractors and wheelchairs, and their distance from the track;

(d) physical controls, e.g. gates, fencing, chicanes, vegetation, structures and their positive (but also negative) impact on the effectiveness of the waiting place.

User Principle 5: Provide information to enable users to safely cross at the level crossing.

To help you achieve this, you should consider, at least, these factors:

(a) how, when and where users need to receive information to make decisions about when it is safe to cross or whether they should wait;

(b) communicate information and cues in the correct sequence, so the user clearly understands what they need to do. The surrounding environment, mode of transport and the importance of physical controls such as barriers and gates should be taken into account;

(c) impact of time of day, seasons and weather conditions on the effectiveness of the control measures provided for the user, e.g. artificial lighting may be necessary and any seasonal or daytime variations in sun glare may need to be mitigated;

(d) make users aware of specific hazards such as the height of overhead line equipment (OLE).

User Principle 6: Provide a suitable warning for users that a train is approaching to enable them to be in a safe place before a train passes.

To help you achieve this, you should consider, at least, these factors:

(a) an active warning system in preference to relying on the user to determine whether or not a train is approaching the level crossing;

(b) user behaviours and actions in relation to the operation of the level crossing, e.g. to prevent them from being trapped within a closed crossing or starting to cross when it is unsafe to do so;

(c) foreseeable actions of different users in a 'another train coming' scenario, these trains may be coming in the same or different directions; one may be inaudible and hidden from view;

(d) adequate visibility along the railway where sighting distances are part of the intended control measures e.g. vegetation management, the identification of lineside equipment that limits visibility and the impact of curved track;

(e) number of users and their characteristics, traffic volumes and time it takes to cross the railway in determining the closure sequence in relation to the likelihood of a descending barrier, or moving gate, striking a user or a train arriving when a user is on the crossing;

(f) impact of long and/or variable waiting times on user behaviour, e.g. impatience and risk taking behaviour such as attempting to beat/weave-around a closing level crossing barrier, or disregarding miniature stop lights and audible warnings;

(g) where users require permission from a crossing controller to cross, the information required and how this is conveyed.

User Principle 7: Users should be able to cross safely without stopping.

To help you achieve this, you should consider, at least, these factors:

(a) actual user routes and the time taken to cross the railway, including eliminating/ reducing the impact of any level crossing skew;

(b) risk of traffic building up and blocking back over the level crossing and how this can be managed;

(c) how to keep users a sufficient distance away from OLE or conductor rails;

(d) segregating users at a level crossing e.g. pedestrians or horse-riders from vehicles. This could include physical separation, or suitable footways or highway markings;

(e) hazards created by the level crossing surface, e.g. from the rails, surface edges or flangeway gaps. The level crossing surface, including construction material, grip, colour and surface profile should be suitable for all foreseeable users.

User Principle 8: The level crossing should be left in a safe state for other users.

To help you achieve this, you should consider, at least, these factors:

(a) minimising reliance on the user to return to the level crossing to a safe state through the use of technology;

(b) encourage the desired behaviour after users have crossed, especially in relation to any further actions that are required, e.g. returning gates to a closed position;

(c) crossing equipment and method of operation should be consistent on both sides e.g. any barriers or gates;

(d) provision of information on how to report defects and misuse of level crossing equipment;

(e) users who have crossed the railway should be able to continue their journey without blocking the exit for other users.

User Principle 9: Understand how the level crossing is managed and operated by railway staff.

To help you achieve this, you should consider, at least, these factors:

(a) how the operating arrangements may create risks to those operating the level crossing, including in foreseeable abnormal conditions;

(b) the impact of any infrastructure or level crossing maintenance activity on the level crossing;

(c) foreseeable workload and fatigue issues and their potential impact on managing or operating level crossings, including when level crossing controls are changed;

(d) the design and operation of the level crossing should mitigate the likelihood and severity of errors by placing the least reliance on human intervention or responses.

4. Safe railway

This set of principles guides your risk control measures for a level crossing from the perspective of the railway. The primary safety consideration is to prevent a collision between a train and crossing user. Where this involves a large obstruction there is also the potential for a train to be derailed.

Railway Principle 1: A level crossing should be designed with protective measures so it is safe for users.

To help you achieve this, you should consider, at least, these factors:

(a) placing the least reliance on human intervention or responses from railway staff or users as possible. Risk control measures include:

- prevention of access to the railway by provision of barriers or gates activated or locked by the approach of a train;
- alerting users to an approaching train by visual and/or audible active warnings;
- gates or barriers, a suitable distance from the railway.

(b) appropriate monitoring of the level crossing asset to ensure it is functioning as intended, e.g. lights, barriers and emergency telephones. This needs to take into account how failures and other issues, such as a gate being left open, will be detected;

(c) minimise the likelihood of equipment failures that result in unsafe situations;

(d) displays, controls and mechanical components which provide the user with clear information on level crossing status, the approach of trains, and whether it is safe to cross;

(e) user behaviour if level crossing equipment fails, including the impact of frequent failure and how this can lead to unsafe assumptions;

(f) minimise the risk of a user being delayed or becoming trapped on a level crossing when a train is approaching, including consideration of the:

- width and surface profile of the highway throughout the level crossing;
- width and design of the gates/barriers on each side of the railway and their impact on entering and exiting the level crossing;
- crossing closure sequence, so it provides sufficient warning of an approaching train but also allows safe exit if a user is already on the level crossing. These elements need to be balanced because extended waiting times can encourage risk taking behaviour;
- height and position of any load gauges above the levelled highway surface;
- methods to prevent barriers or gates from unintentionally closing while the level crossing is being used;

(g) prevent users being injured as a result of being struck by descending barriers or moving gates;

(h) users should not be able to access any dangerous parts of machinery which are part of the level crossing equipment.

Railway Principle 2: Signalling controls at a level crossing should result in it being clear of users or obstructions before a train arrives.

To help you achieve this, you should consider, at least, these factors:

(a) an automatic system, of sufficient safety integrity, that detects people or obstructions on the level crossing before closing it and allowing a train to enter;

(b) prevent a train that has passed a protecting signal at danger or exceeded its movement authority from reaching the level crossing by providing a safety overlap (to the signal) reinforced by engineering controls (train protection systems that will bring the train to a stand);

(c) where it is not possible to provide an effective safety overlap or train protection system at a protecting signal, alternative protective measures should be provided. E.g. initiating the closure sequence before the protecting signal is reached, or providing an appropriate warning to users so that if a train passes a protecting signal at danger, they know to leave the level crossing if they are on it, or not to enter it.

Railway Principle 3: Take all foreseeable rail movements into account.

To help you achieve this, you should consider, at least, these factors:

(a) all foreseeable directions that trains and other rail vehicles, including road rail vehicles, might approach from, and their operating characteristics, including the frequency of trains and their speed;

(b) avoid train movements which would require a train to wait on a level crossing;

(c) specify any circumstances when a level crossing attendant will be required to operate the level crossing.

Railway Principle 4: It should not be possible to re-open railway controlled barriers or gates until the train has fully passed over the level crossing, or stopped in advance of the level crossing.

To help you achieve this, you should consider, at least, these factors:

(a) all foreseeable operating circumstances, including the speed, braking distance of trains and another train coming;

(b) the level crossing and signalling controls should place the least reliance on procedures and correct actions by the crossing controller;

(c) avoid trains stopping on a level crossing. It should not be possible to open the level crossing to pedestrian or road traffic if a train has stopped on it.

Railway Principle 5: People working on the level crossing should be able to do so safely.

To help you achieve this, you should consider, at least, these factors:

(a) facilitate safe access to the level crossing and its equipment for maintenance, e.g. minimising working at height or availability of parking areas for maintenance vehicles;

(b) how the level crossing will be safely operated by railway staff during normal and abnormal conditions e.g. manual operation of gates creating risks from road traffic;

(c) processes and procedures to manage the risk of injury from machinery and other equipment;

(d) lighting conditions, including light from nearby sources, which may impact on the visibility of the level crossing;

(e) avoid lighting that impairs the crossing controller being able to see approaching train headlights.

Railway Principle 6: Avoid road vehicles becoming stranded or grounded.

To help you achieve this, you should consider, at least, these factors:

(a) a suitable surface profile, which takes into account:

- foreseeable vehicle characteristics, e.g. vehicle length, wheel base or ground clearance;
- entry and exit gradients and their impact on any vehicle clearance from OLE.

(b) a means of communication with the level crossing controller where required;

(c) contingency plans for dealing with a stranded vehicle.

Railway Principle 7: Prevent livestock and other large animals such as horses straying onto the railway.

To help you achieve this, you should consider, at least, these factors:

(a) foreseeable use of the level crossing and the likelihood of livestock or other large animals being in the vicinity;

(b) measures to prevent access to the level crossing, e.g. gates, lick guards, cattle grids, holding pens and fencing;

(c) measures to prevent straying onto the line from the level crossing, such as cattle-cum-trespass guards.

Railway Principle 8: Discourage trespass onto the railway and vandalism.

To help you achieve this, you should consider, at least, these factors:

(a) provide the shortest route possible across the railway, with a defined route from entry to exit;

(b) the route over the level crossing should be obvious to the user, e.g. through the provision of well-maintained fenced approaches, distinct crossing surfaces and edge markings;

(c) anti-trespass guards to deter access onto the railway;

(d) design features for level crossing equipment to improve resilience against vandalism e.g. blocking public access to equipment and the use of protective meshes;

(e) monitoring equipment e.g. to act as a deterrent, provide information on activity at the level crossing;

(f) gates that are normally kept closed across the railway, where it is feasible and necessary to do so.

Railway Principle 9: Take account of foreseeable environmental conditions.

To help you achieve this, you should consider, at least, these factors:

(a) foreseeable weather conditions, e.g. fog, ice or wind noise;

(b) local environment e.g. ambient noise levels, geographical features;

(c) natural light conditions, e.g. sun glare (direct and reflected);

(d) where identified as necessary, sufficient lighting should be provided. This should not impair the ability of users to see approaching trains where the safe use of the level crossing relies on this.

5. Safe highway

This set of principles guides risk considerations for a level crossing from the perspective of the highway and is concerned with the approaches to the level crossing. The primary safety consideration is to prevent a collision between a level crossing user and a train. These principles also cover preventing road traffic incidents at, or near, the crossing.

Highway Principle 1: Warn users that they are nearing the level crossing by providing information.

To help you achieve this, you should consider, at least, these factors:

(a) signage and other measures should be provided at appropriate locations on the approaches to the crossing;

(b) maintain clear information by avoiding signage clutter;

(c) minimise demands and distractions on a user's attention as they approach a level crossing e.g. changes to the speed limit on the approach;

(d) signage and other measures should be maintained so they are visible, this may include vegetation management;

(e) warnings for specific hazards so users can take evasive action where necessary, e.g. the presence of OLE.

Highway Principle 2: Highway approach surfaces should enable users to cross safely.

To help you achieve this, you should consider, at least, these factors:

(a) approaches and profiles should be consistent with those at the level crossing, e.g. minimising slopes and acute angles to achieve an even passage over the level crossing;

(b) approach surfaces and profiles should be maintained so they continue to be suitable e.g. profile, colour, construction material and grip.

Highway Principle 3: Minimise the risk of road traffic blocking back over the level crossing.

To help you achieve this, you should consider, at least, these factors:

(a) road markings and/or signage, e.g. to prohibit overtaking, turning across the opposite carriageway or parking or waiting on the carriageway;

(b) linking road traffic light signals with the level crossing closure sequence;

(c) changes to road layout and features to improve traffic flows, e.g. providing waiting areas or addressing restrictive road layouts and gradients.

Highway Principle 4: Design highway approaches to avoid vehicles grounding on the level crossing.

To help you achieve this, you should consider, at least, these factors:

(a) the surface profile or other elements of the road layout;

(b) different road layouts e.g. provision of dedicated laybys for large, slow moving vehicles;

(c) advanced information signage to warn vehicles at risk of grounding.

Highway Principle 5: Take account of foreseeable environmental conditions on the level crossing approaches.

To help you achieve this, you should consider, at least, these factors:

(a) foreseeable weather conditions, e.g. fog or ice;

(b) natural light conditions, e.g. sun glare (direct and reflected);

(c) where identified as necessary, sufficient lighting should be provided;

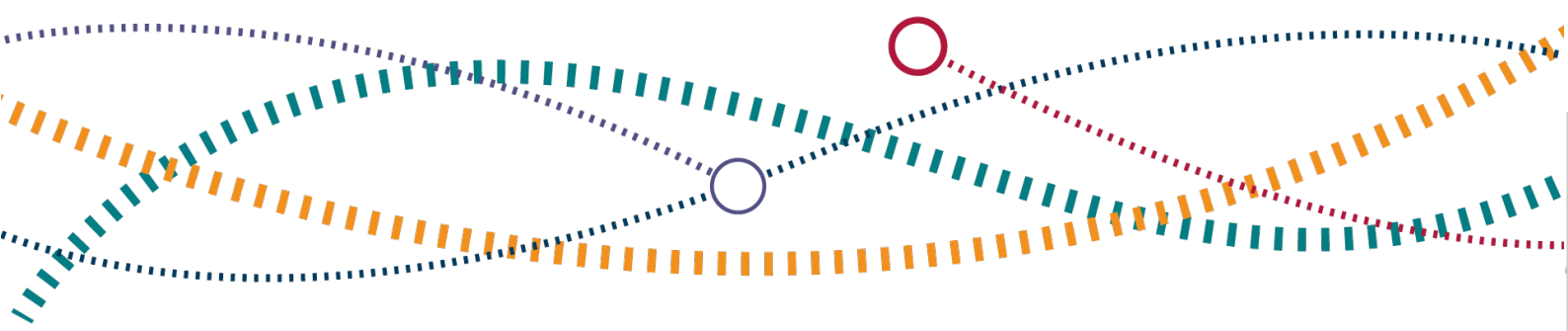
(d) maintain visibility of the level crossing and its equipment e.g. by vegetation management and maintenance of signage and road markings so that they remain visible and legible.

Annex A: Glossary

For the purpose of this document, the following definitions are used.

another train coming	Also known as ‘second train coming’ and ‘hidden trains’, this is when a train passes over a level crossing with another train approaching. The second train may be obscured by the first train.
blocking back	A situation where road vehicles enter a level crossing when they are unable to leave because the exit is blocked by other vehicles, so vehicles are stationary on the level crossing.
conductor rail	Also known as ‘third rail’, a conductor rail provides trains with up to 750 volts DC. The live rail is raised and mounted on insulators at the sleeper end.
crossing controller	A person who controls the operation of a level crossing either at the crossing or remotely from a control centre.
flangeway gap	The gap between rails and highway which allows rail vehicle wheels to pass through.
highway	A highway is any road (including byways), footpath or bridleway to which the public have access. For the purpose of this guidance the meaning of highway should be interpreted as including private roads.
level crossing	A level crossing is where a railway crosses a road on the level (i.e. without the use of a tunnel/underpass or bridge). NB A road would include footpaths, bridleways and cycle ways.
overhead line equipment (OLE)	Overhead line equipment refers to the overhead wires and supporting infrastructure that carry electricity at 25,000 volts (AC) or 750 to 1500 volts (DC) to power electric trains.
protected characteristics	There are nine groups of people with protected characteristics defined in the Equality Act 2010: age, disability (a physical or a mental condition which has a substantial and long-term impact on the ability to do normal day to day activities), gender reassignment, marriage and civil partnership, pregnancy and maternity, race (colour, or nationality, or ethnic or national origins), religion or belief, sex and sexual orientation.
skewed crossing/skew	A level crossing at which the angle measured from the public highway to the running rail is not at a right angle

whole system	A ‘whole-system’ approach of level crossing safety by setting out the needs of crossing users as well as risk assessment considerations from the railway, and highway perspectives.



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