RAIB

Rail Accident Investigation Branch

Rail Accident Report

Investigation into safety at user worked crossings

Department for Transport

Report 13/2009
June 2009

This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC;
- the Railways and Transport Safety Act 2003; and
- the Railways (Accident Investigation and Reporting) Regulations 2005.

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Email: enquiries@raib.gov.uk
Telephone: 01332 253300
Fax: 01332 253301
Website: www.raib.gov.uk

This report is published by the Rail Accident Investigation Branch, Department for Transport.

Investigation into safety at user worked crossings

Contents

This page is left intentionally blank

Preface

1 This report describes an investigation carried out by the Rail Accident Investigation Branch (RAIB) into the risk associated with user worked level crossings (UWCs). UWCs are level crossings where railways intersect with private roads, or minor public roads, where road users are responsible for operating gates or barriers when crossing the railway. In some cases there is no additional equipment to warn of approaching trains, and the user has to look, listen and decide for themselves whether it is safe to cross. In other cases there are telephones and/or warning lights provided to give information on the whereabouts of trains.

2 The investigation uses data from a series of accidents and incidents which occurred at UWCs between June 2006 and December 2008, and other evidence gathered by the RAIB from level crossing operators, train operators, and crossing users. The report makes recommendations about measures that the RAIB believes should be adopted to reduce the risk.

3 Safety at level crossings has been studied extensively by the railway industry and the Railway Inspectorate over many years. This report uses material from earlier studies, and adds to it the RAIB's own work on recent incidents. Some of the recommendations in this report have been put forward in the past. However, for a variety of reasons they have not been adopted fully and effectively. This report analyses the present situation and suggests a way forward.

4 The sole purpose of a RAIB investigation is to prevent future accidents and incidents and improve railway safety.

5 The RAIB does not establish blame, liability or carry out prosecutions.

6 Access was freely given by the Office of Rail Regulation (ORR), Network Rail and the Rail Safety and Standards Board (RSSB) to their staff, data and records in connection with the investigation.

7 The report focuses on the Network Rail system. Many of the issues that it covers will also be of interest to, and may need attention by, Northern Ireland Railways (NIR) and heritage railways throughout the UK.

8 Appendices at the rear of this report contain the following glossaries:

- acronyms and abbreviations are explained in Appendix A; and
- technical terms (shown in *italics* the first time they appear in the report) are explained in Appendix B.

Summary

9 At the end of 2007, there were 2814 user worked level crossings (UWCs) on the national rail network in Great Britain.

10 A collision between a road vehicle and a train at a UWC may result in derailment of a train and casualties among the train passengers and crew, as well as the vehicle occupants. The risk of such a collision, in terms of the number of times each crossing is used, is the highest of any type of level crossing. However, the relatively low usage of UWCs compared to most public level crossings means that such collisions are rare events.

11 This report is based on a study of incidents at UWCs. It is mainly concerned with incidents involving trains colliding with vehicles and large animals, which may result in derailment or damage to the train. While it is not the primary focus of this report, the RAIB has also looked at factors affecting pedestrians using footpaths which are part of, or adjacent to, UWCs.

12 The study carried out for this report showed that risk is likely to be concentrated at a few crossings, and there are many more near-miss and misuse incidents than actual collisions.

13 The investigation also found that:

- The immediate cause of most accidents at UWCs is an error or violation by the crossing user. Errors by railway staff contribute to risk at user worked crossings in about 4% of incidents.
- Contributory factors include:
  - expectation by the user that there will not be any trains in the area;
  - inconsistent or unreliable information available to the user on the whereabouts of trains;
  - absence of guidance on where the decision to cross should be taken; and
  - signs which give confusing instructions on how to use the crossing.
- The industry has undertaken research into improvements to crossings.
- Network Rail have policies and arrangements in place for managing the risks at UWCs.
- ORR have an ongoing strategy for securing the control of risks at UWCs.
- The legal framework relating to level crossings has not been updated for many years, but the Law Commission now has a project in progress to review and modernise law in this area.
- Involvement of the authorised user, or other appropriate persons, in the preparation of a risk assessment for a UWC takes place at higher risk crossings and can be very valuable in informing the crossing operator (Network Rail) of the control measures needed at the crossing.
- The signage in use at crossings does not highlight the presence of a railway, the nature of the risk, or the responsibilities of the user for their own safety. The signs are not always easy for all users to understand and the risks associated with individual crossings are not taken into account when signs are designed.

- The decision point at crossings is not always marked.
- New methods of providing improved protection at UWCs using 'predictor' technology and electronic treadles are available and are now being tested by Network Rail with a trial at ten crossings.
- If a crossing cannot be used safely in its existing form it should be upgraded or closed.
- Other methods of achieving safe use of UWCs, including the removal of gates or use of vehicle holding areas, combined with the use of road-type traffic signals, may be feasible and should be considered further, although changes to the law may be required before they can be implemented.

14 The Law Commission and the Scottish Law Commission are currently considering changes to the legal framework relating to level crossings. The RAIB's submission on appropriate objectives for change is at paragraph 198.

15 Safety recommendations can be found in paragraph 199. They relate to the following areas:

- involvement of the crossing user in the preparation of risk assessments;
- marking of the point from which a decision to cross should be made;
- improved protection at crossings where adequate sighting is not achievable;
- closure of crossings not adequately protected;
- assessment of alternative methods of crossing protection; and
- review of the requirements for signs at crossings.

Introduction

User Worked Crossings (UWCs)

16 UWCs are level crossings where railways intersect with private roads, or roads which were originally private but have acquired public status as a result of changes in land use over a long period, and where the road user is required to operate gates or barriers when crossing the railway. Where the road is private, use of the crossing is, in theory, restricted to specific people, who are usually referred to as 'authorised' users. Where the crossing is of the type known as an 'accommodation' crossing, connecting sections of land which were severed by the building of the railway, only the owner of the severed land and his tenants and licensees are authorised users. The other type, known as an 'occupation' crossing, carries a private occupation road which was in existence before the railway. It serves homes, farms or other businesses on that road. Occupiers of all these premises, whose lands do not necessarily adjoin the railway, may have acquired rights to use the occupation road. Only these people (and persons having permission from and/or business with them) have rights to use the crossing, and are therefore deemed to be authorised users. However, there is no legal sanction against other people using the crossing, other than the civil law of trespass. In many cases, the amount and nature of the traffic using a crossing has changed over the years. When developments take place, additional users may acquire rights over the crossing, or more people may need to use the crossing to reach businesses that are on the far side of the crossing from the public road network. In such cases any member of the public may find themselves needing to use the crossing. Network Rail considers that 162 of the UWCs on the national network have now acquired the status of public roads.

UWC with MWL	93
UWC with telephones	1661
UWC – no additional protection	1060
Sub-total (user worked)	**2814**
Public crossings – controlled	828
Public crossings – automatic	630
Public crossings – open	63
Footpath crossings	2586
Total	**6921**

(Source: RSSB)

Table 1: Level crossings on Network Rail - 2007

17 The number of active level crossings, both public and private, on Network Rail at the end of 2007 is shown in Table 1. Of the UWCs listed, 590 also incorporate a public footpath crossing.

18 In the period 1946 – 2005, the number of crossings on the national network was reduced from 27,000 to the figure shown above. In that period (60 years) there were 1066 fatal accidents at all types of level crossings, resulting in 1210 deaths. Of these casualties, 55% were pedestrians, 39% were occupants of road vehicles, 4% were railway staff (crossing keepers and train crew) and 2% were train passengers (21 deaths in three accidents, at Hixon (1968), Lockington (1986) and Ufton (2004). These three were all at public road crossings, not UWCs). For most of the period there are no separate statistics for incidents at public road crossings and UWCs. The last accident at a UWC which caused the death of train passengers was at Cross Drove (now called Pleasants), near Hilgay, Norfolk in 1939, when an express train derailed after colliding with a lorry, resulting in the death of four passengers. The last time that staff on trains died in a collision at a UWC was at Chivers No. 1, near Shippea Hill, Norfolk, in 1976, when a passenger train was in collision with a lorry carrying carrots, and the driver of the train was killed.

19 UWCs are usually equipped with swinging gates or lifting barriers. The road vehicle driver is required to open the gates or operate the barriers to use the crossing (Figure 1). In some cases red/green miniature 'stop' lights (also known as miniature warning lights, and generally referred to by the railway industry as miniature stop lights) are provided to give warning of approaching trains and indicate when it is permissible to cross (Figure 2). At some crossings telephones are provided, communicating with a signal box, and users are required to use the telephone to obtain information about the whereabouts of trains. At other UWCs there are no lights or telephones and the user must make a visual check for approaching trains before deciding if it is safe to cross. In addition to the number of crossings indicated in Table 1 for Network Rail, there are also a number of UWCs on heritage railways and in Northern Ireland, and similar arrangements apply to these.

Figure 1: Example of a user worked crossing without additional protection (Bratts Blackhouse, Suffolk)

Figure 2: Example of a user worked crossing with miniature stop lights and telephones (Black Horse Drove, Cambridgeshire)

20 The concept of the private level crossing equipped with gates or barriers is a particular characteristic of railways in the UK (and Ireland). Elsewhere in the world, railways in rural areas are generally unfenced and level crossings that give access to private land are protected only by notices warning users to look out for approaching trains.

Types of crossing protection

21 The types of crossing protection are summarised in Table 2. There are particular drawbacks and risks associated with each type.

Type of UWC	Gates (or barriers)	Signs	Telephones	Warning lights
Basic crossing	✓	✓		
With telephones	✓	✓	✓	
With MWL	✓	✓	✓	✓

Table 2: Types of user worked crossing

22 The basic crossing without lights or telephones relies on the user looking for an approaching train and making a decision on whether or not it is possible to cross safely. If the user cannot or does not see the train when it is a safe distance (known as the sighting distance) away, they will not be able to make a safe decision on whether to cross the line. If they do see the train, they may decide to cross even though the train may be close to the crossing. There are many factors that may influence the behaviour of both pedestrians and vehicle users, including:

- their familiarity with the crossing;
- the frequency with which they use it;
- their knowledge of train speeds;
- their expectation that no trains will be nearby;

- environmental factors, including darkness, ambient noise, and/or visibility limited by rain, fog or falling snow;
- the position of the crossing gates as they approach (an open gate may tempt a driver to proceed without stopping to look for trains); and
- personal factors such as readiness to take risks, pressure of time, and tolerance of delay.

23 The user may believe that they are safe if they cannot see a train approaching, and be unaware that growth of vegetation has restricted their view to a dangerous extent. If the user is driving a vehicle, the point at which they have to make a decision to cross may not be clearly identifiable to them, or may not give them sufficient visibility to make the right decision.

24 The user may (on a double track line) focus on a train coming from one direction, and be unaware that another train is coming the other way.

25 Telephones at UWCs can be used to provide protection in two ways, which are in practice not easily distinguishable by the user, but have fundamentally different risk profiles.

26 When telephoned by a crossing user, a signaller may, if he or she has sufficient information on the whereabouts of trains, tell the user either that they may cross, or to phone back in a few minutes, by which time the train (if it has in fact already passed the crossing) may have reached a point where its position becomes known to the signaller. On lightly used lines where there may be a very long distance between signalboxes, the signaller may not have any means of knowing exactly where a train is and may not be able to give the user any information on how long they may have to wait. This can reduce the potential benefit of providing a telephone, because users may become impatient or unwilling to wait for an unspecified period (up to 30 minutes in extreme cases) for a train to pass before they cross, and may choose to cross without permission.

27 The other protection method is used when a signaller receives a request to use a crossing with animals or a large, low or slow-moving vehicle. In this case the signaller must place and maintain signals at danger, give the user permission to cross, and ask to be told when the user is clear of the crossing, so that rail traffic can safely resume. This is straightforward where there are signals which can be controlled by the signaller and are in a suitable position to protect the crossing without causing appreciable delay to trains. If the train has already passed the signal that protects the crossing, the user may have to wait some time before permission to cross is given.

28 If the user, after traversing the crossing, does not call the signaller back to confirm that they are clear of the crossing, it is necessary for the signaller to contact the driver of the next train over the crossing and caution them to approach the crossing at a speed at which the train can stop short of the crossing if it is found to be obstructed. The train driver may be asked to stop and close the gates. This can result in significant delay to rail services.

29 If sighting to give the minimum warning of trains cannot be obtained, and the actual number of daily road vehicle users exceeds 100, or the provision of a telephone is impractical for the reasons discussed in paragraph 26[1], the relevant guidance (which is explained in more detail at paragraph 46) indicates that the crossing should be equipped with miniature stop lights (Figure 2). These are worked automatically by approaching trains. They display a green light to the user when there is no train in the vicinity, and a red light when an approaching train passes the *strike-in* point for the crossing. They are called 'miniature' because of their small size in relation to standard road and rail traffic signals.

30 Miniature stop lights provide the user with a clear indication of whether or not to begin to cross. The lights may be located on one or both sides of the line, and are normally incorporated into notices explaining how to use the crossing. They are intended to be read by pedestrians and drivers of stationary vehicles, and are not designed to be prominent enough to be suitable for moving traffic. Conventional wisdom says that it is important that the gates or barriers at crossings with miniature stop lights are kept closed, so that vehicles approaching the crossing are forced to obey the sign requiring them to stop, giving the driver a good chance to see and obey the message given by the lights.

31 Users are required to close the gates after crossing at a UWC, and there is a fixed penalty (currently £1000) for not doing so. As well as the need to stop animals straying onto the line, it is important for the gates to be closed because experience has shown that the next person to approach the crossing may not be familiar with it, and may assume that the crossing is under the control of the railway, and that an open gate indicates that it is safe to cross. Consequently, the unfamiliar user may drive onto the crossing without looking for trains.

32 At crossings which are remote from public roads, where normally the regular users are the only traffic, closing the gates may be seen by users as a pointless formality. It is very common for gates at remote farm crossings to be left open. Train drivers are required to report open gates to the signaller, who must then arrange for the gates to be closed, either by the driver of the next train or, if this would cause excessive delay, by a member of staff visiting the crossing. In this case, until the gates have been closed, the signaller is required to instruct drivers of trains to approach the crossing cautiously, and to be prepared to stop if a crossing user appears. This also causes delay to trains.

33 Opening and closing the gates on both sides of the line requires a lone vehicle driver to pass over the crossing five times (four times on foot, and once in their vehicle) each time the vehicle needs to use the crossing. Someone assisting a vehicle driver will still have to pass over the crossing at least twice on foot. These multiple traverses are time-consuming and expose the users to additional risk each time they cross the railway.

[1] RSPG para 133

34 In many cases, although the authorised users are the only people who have rights to take vehicles over the crossing, there may be a public footpath which passes over the same crossing. The footpath may be provided with *wicket gates* or stiles. The existence of this path has sometimes resulted in other members of the public becoming accustomed to using the crossing as a through route, possibly with bicycles, motorcycles or other vehicles. In such cases the authorised user may padlock the vehicle gates to try and prevent unauthorised vehicles from using the private road over the crossing. The unauthorised users, who may believe that they have a right to pass over the crossing, have been known to force the padlocks or damage the gates.

35 There may also be difficulties for people with pushchairs, wheelchair users and dog walkers, who may seek to use the vehicle gates rather than a stile. In some cases such usage has resulted in the authorised user giving up any attempt to restrict the use of the crossing. There is no specific law available which could be used to deter unauthorised use of a crossing. Civil remedies for trespass are cumbersome and not easy to pursue.

36 Even where there is no public footpath nearby, the authorised user may have little control over the actual users of the crossing. In addition to visitors and regular tradesmen and deliveries (e.g. mail, milk and coal), whom he might be in a position to provide with instructions and information on the safe use of the crossing, there may also be occasional delivery contractors, utility companies, government and local authority staff, and people who have mistaken their route. All of these rely on the information presented on the signs at the crossing.

37 The design of modern trains is intended to reduce the risk to passengers in collisions with obstructions, including vehicles at level crossings. Obstacle deflectors, intended to prevent small and medium sized obstructions getting under a train's wheels, have been effective, for example, in preventing derailment or minimising the consequences of collisions between trains and road vehicles in the accidents at Swainsthorpe, Norfolk on 13 November 2005 (RAIB report number 03/2006) and Copmanthorpe, York on 25 September 2006 (RAIB report number 33/2007)[2].

Statistical background – overview of risk

38 The level of risk from level crossings is analysed in the Risk Profile Bulletin published by the railway industry standard-setting body, the Rail Safety and Standards Board (RSSB) (issue 5.5, May 2008). The overall level of risk (passengers, train staff, road vehicle occupants and pedestrians) is estimated to be 11.84 *fatalities and weighted injuries* (FWI) per year. Level crossing risk is 8.6% of the overall railway risk. The majority of level crossing risk (86.1%) is attributable to pedestrian members of the public being struck and passenger train collisions with road vehicles. UWCs are not identified separately in these figures.

[2] RAIB reports can be viewed at www.raib.gov.uk

39 Train collisions with road vehicles at level crossings now contribute a high proportion (45%) of train accident risk, and 77.9% of the total risk from train collisions with vehicles on the line. These figures include the risk to road users, and the risk to train passengers related to level crossings is 16% of the total. In terms of annual risk, *automatic half barrier crossing*s (AHBs) contribute the greatest risk. *Automatic open locally monitored crossings* (AOCLs) have the highest risk per crossing location. However, the greatest risk per train-vehicle interaction (occasions on which the crossing is used by a road vehicle when a train is in the vicinity) is at user worked crossings. This takes into account the low number of vehicle crossings at UWCs (compared to public roads).

40 For all types of crossing, the greater part (69.4%) of level crossing risk is attributed by RSSB to misuse (errors) by users. Violations by users account for 23.6% of the risk and the remaining 7.0% of risk is from railway staff errors or equipment failures. Both 'error' and 'violation' have a specific meaning in the context of accident causation. 'Error' implies an action which was unintentionally incorrect, caused by a lapse, a slip or a lack of knowledge. 'Violations' are actions which are deliberate, contravening rules or instructions to gain a perceived advantage such as increased speed or reduced effort. In the use (or misuse) of level crossings, underestimating the time available, and consequently crossing closely in front of a train, would be an error. Leaving the gates open after driving over, having seen and read the instructions on the signs at the crossing, would be a violation.

41 The total number of fatalities at all types of level crossing per year has remained roughly constant over the past thirty years. Normalising for the reduction in the number of UWCs over the period, the rate of fatal accidents per 1000 UWCs per year, has remained between 0.6 and 0.8. However, the rate for accidents involving vehicles has reduced from 0.5 to less than 0.2, while the rate for pedestrian accidents has risen from 0.3 to 0.5 and is still rising.

42 UWCs have lower fatal accident rates per 1000 crossings per year than footpath crossings. However, the majority of recent fatalities at UWCs have been pedestrians.

43 In 2007, on the Network Rail system, trains struck road vehicles at level crossings on eleven occasions during the year, of which three were at UWCs (paragraph 76).

44 Network Rail uses the All Level Crossing Risk Model (ALCRM) to assess the risk at individual crossings. More details of the ALCRM are at paragraphs 63 to 66 and 117 to 134.

Review of literature and research

45 Current standards and guidance and recent research relating to UWCs are summarised below.

Standards and guidance

46 Guidance on the conditions for suitability and the levels of protection at UWCs are set out in the Office of Rail Regulation (HM Railway Inspectorate) (ORR (HMRI)) document 'Railway Safety Principles and Guidance, section 2E: Guidance on level crossings' (RSPG Section 2E), published in 1996. Following the guidance should provide a sufficient level of safety at new or upgraded crossings, and the guidance is used by ORR when considering the acceptability of the arrangements at existing crossings. The conditions for suitability for UWCs, as given in chapter 6 and summarised in table 1 of the guidance, are:

1. The speed of trains over the crossing should not exceed 160 km/h (100 mph) unless additional protection is provided.
2. There are no limitations on the frequency of rail traffic.
3. These crossings should only be used on private roads.
4. There should not normally be more than two lines over the crossing.
5. The time required by likely users to traverse the crossing length should be at least five seconds less than the warning time available, unless additional protection is provided. The warning time is the time that the user is aware of the approach of a train, whether by visual or audible warning.
6. Where miniature stop lights are provided, the warning period should be greater than the time required by likely users to traverse the crossing length by not less than five seconds.

'Additional protection' in the form of telephones is required on crossings where the line speed is greater than 160 km/h (100 mph), or where the minimum warning time of trains cannot be obtained, or there is known regular use by animals on the hoof, or the actual daily road vehicle use exceeds 50, or there are more than two running lines. Miniature stop lights must be provided where the daily road user exceeds 100 and the minimum warning time of trains cannot be obtained, or where the provision of a telephone is impractical because it is difficult to provide reliable information about the whereabouts of trains, or the information supplied would be so restrictive that it would be likely to cause the user to become unduly impatient and to cross without permission.

RSPG 2E is a relatively recent publication. If routes are being upgraded, line speeds increased, protection methods amended, or other changes being made to the crossing, then the guidance in RSPG 2E should be applied. However, it is not retrospective, and existing crossings may not necessarily comply with the guidance (although railway operators have a general duty under section 3 of the Health & Safety at Work etc Act 1974 to conduct their undertakings in a way that does not expose persons not in their employment to risk, *so far as is* reasonably practicable, and to fulfil this duty the operator must assess the risk at each crossing and implement reasonably practicable control measures).

47 RSSB controls standards (known as Railway Group Standards) which apply to the activities of Railway Group companies, where these activities affect more than one company[3].

48 The current Railway Group Standard GI/RT7012 'Requirements for Level Crossings' was issued in 2004 and includes requirements for UWCs, giving details of the dimensions and operational requirements for surfaces, gates, barriers, signs, telephones, lights, audible warnings and other equipment. These generally reflect, and expand on, the requirements in RSPG Section 2E.

49 Network Rail has a safety management system which is intended to ensure that the company fulfils its responsibilities for safety and compliance. Physical, managerial and operational requirements are set out in company standards. The relevant company standards relating to UWCs are NR/L2/SIG/19608 Issue 4 'Level Crossing Infrastructure: Inspection & Maintenance' and NR/SP/OPS/100 Issue 2 'Provision, Risk Assessment and Review of Level Crossings'. This describes Network Rail's regime for the risk assessment of level crossings. The history of the development of this process is described in detail in paragraphs 63 to 66.

Research

50 Since 1996 a large amount of research has been carried out by RSSB and its predecessors into the factors influencing safety at all types of level crossing. British published work with relevance to UWCs includes:

- Special topic report – road vehicle level crossings (2004).
- User worked and footpath level crossing research (2002, T000).
- Human factors risk at user worked crossings (2004, T269).
- Development of a universal level crossing risk tool (2006, T028).
- Developing enhanced consequence algorithms for level crossing risk models (2005, T521).
- Reducing the risk to motorists traversing UWCs on foot (Ongoing, T334).
- The cost of level crossings – an international benchmarking exercise (2006, T364).
- Attitudes to, process and funding for, crossing closures in other countries (2006, T528).
- Evaluating the safety benefits of installing new miniature warning lights at user worked crossings (2007, T561).
- Research into the safety benefits of train horns at level crossings (2006, T668).

51 The European Level Crossing Forum (http://www. levelcrossing.org/elcf/research.htm) lists only UK research on its website.

[3] RSSB defines the Railway Group as consisting of those infrastructure managers who hold a safety authorisation issued in respect of the GB mainline railway and those railway undertakings who hold a safety certificate issued in respect of the GB mainline railway: Network Rail, the Train Operating Companies, and maintenance and renewal contractors who operate trains on the national network.

52 The RAIB has also reviewed research from Finland[4]. Differences in the way crossings are managed in Finland mean that there is little in the Finnish study which can usefully be transferred to UK practice.

RSSB Research

Special Topic Report: Road Vehicle Level Crossings (2004)

53 The Special Topic Report on vehicular crossings was prepared to provide the industry with a detailed breakdown and analysis of the causes and consequences of accidents and incidents at road vehicle level crossings to assist in targeting further cost effective risk reduction strategies. It includes a detailed statistical analysis of level crossings and incidents in the period 1991 – 2003, and summarises the research that RSSB had in progress or planned in 2004. The total number of crossings on the network had been falling over the period of the study, but this reduction had almost stopped. The number of safety related incidents had remained fairly constant over the previous five years. A significant issue that was highlighted by this report was that AOCLs create the greatest risk per crossing on the network. In response to this, 'red light' CCTV cameras were introduced at a number of AOCLs in Scotland as a deterrent. However, accidents at AOCLs continue to occur. The RAIB is currently investigating the fatal collision at Wraysholme AOCL, Cumbria, on 3 November 2008, which was the second accident at this crossing in 2008.

RSSB research: T000: User Worked and Footpath Level Crossing Risk Review Study (2002)

54 The research making up T000 was designed to explore the hazards and risks at 'passive' level crossings (those without any devices giving warning of the approach of trains), both footpath and vehicular. Specifically, it examined the relationship between user perceptions of risk and other locational factors such as sighting times. The research was commissioned in 2000, and undertaken by A D Little. Work took place during that year to survey 308 crossings across all the Railtrack Zones. Site work involved assessment of the physical condition of the crossing and its surroundings, and collection of data on user behaviour based on observation and interviews. The result of the work provided evidence for the existence of certain 'risk factors', or crossing and user characteristics that influence risks at UWCs. These factors were:

- gates left open;
- poor sighting time (less than or only slightly greater than traverse time);
- high utilisation for type; and
- trains at long and/or irregular intervals.

55 These factors were found to increase risk, except for poor sighting (sighting time less than or only slightly greater than traverse time), which was considered to make users more vigilant and behave with caution. This result needs to be understood in the light of users of UWCs being mostly familiar with the crossing. Where sighting time is poor, the report found that users are aware of the fact and respond by traversing more rapidly with heightened vigilance.

[4] Safety Study on Level Crossing Accidents, Accident Investigation Board of Finland, 2006. See www.onnettomuustutkinta.fi.

56 This highlights the importance of the users' perception of the risk, and how this influences their behaviour. The study found that users generally perceive crossings to be 'dangerous' where there are fast trains and sighting is poor, and 'safe' where there is good sighting, and trains are slow and infrequent. Possibly as a result of this, less cautious behaviour was observed at crossings where trains are infrequent.

57 The report recommended the improvement of risk controls, and better incident reporting and data collection, to gain a better definition of the extent of risks. It also suggested that findings from this study should be synthesised with those of the recently completed review of Railtrack's automatic level crossing risk model to ensure that lessons learned were applied across the spectrum of crossings. RSSB proposed a number of recommendations and follow-up actions to this report. Some of these resulted in the development of the All Level Crossing Risk Model (ALCRM) (paragraph 63) while others were covered in the further research described below.

58 Before the development of the ALCRM, Network Rail developed simple risk ranking tools for UWCs and station crossings, making use of this research. These tools used the responses to up to 15 questions to give an estimate of the risk at a crossing, and an indication of the effect of proposed mitigations, so that cost-benefit analysis could be carried out. This was used as an interim method of managing the risk at these types of crossings until the delivery of the ALCRM.

T269: Human factors risk at user worked crossings (2004)

59 The study of human factors at user worked level crossings, T269, was intended to gain a better understanding of human behaviour at user worked crossings and identify contributory factors to risk at the crossings. It also included the evaluation of potential risk reduction measures. The research comprised three separate streams: determining when users make the final decision to cross; whether users notice and understand miniature warning lights; and user acceptance of novel warning devices. The results of the research were intended to help to reduce risk at UWCs by providing an improved understanding of the risk and the relative merits of practical risk reduction measures, such as sighting time optimisation and the introduction and positioning of new types of warning light.

60 Historically, the 'decision point' was a concept used in crossing management and was not supposed to be a predetermined point identifiable by the user. The study found that users' decision points were regularly determined by the physical characteristics and environmental surroundings of the individual crossing. Vegetation often partially obscured users' views down the track (due to lack of maintenance or position of the gate) until they were actually on or closely adjacent to the line. Only at this point was there sufficient sighting to enable them to make a decision either to cross or retreat. This point was not always in a *position of safety*. Users at crossings with a minimum sighting time of less than 20 seconds were almost twice as likely to make the final decision to cross from a point on or adjacent to the tracks as users at crossings with a minimum sighting time of greater than 20 seconds.

61 Maintaining a practicable minimum warning time reinforced by clearer crossing instructions to aid users' decision-making criteria was suggested as the best solution. The study concluded that the establishment of a 'final decision point' by providing a marker, where possible, for where the decision to cross should be made would also be of benefit. This should be in a position of safety, i.e, at least 1.25 m from the line for line speeds up to 100 mph, and at least 2 m from the line if train speeds above 100 mph are permitted. This would give a clear indication to users about how close they can get to the tracks for an unobstructed view, without putting them in harm's way. The position of such a crossing marker is likely to be crossing specific: at the safest point, clear of the line, where a decision to cross can be made. This recommendation was not accepted by Network Rail because of the practical difficulties associated with defining a decision point for drivers who may be well back from the front of the vehicle. The issues associated with defining a decision point for pedestrians were not explored, because this project was concerned with people in charge of vehicles.

62 Within the same project (T269), the study of users' understanding of miniature stop lights concluded that the primary source of risk at this type of crossing was found not to be related to visibility or comprehension of the lights and instructions, but instead to deliberate crossing violations. An underestimation of time taken to cross combined with an overestimation of the time between the onset of the warning system and the arrival of a train was identified as a major cause of these violations, but this was not linked to any evidence that accidents had resulted from this behaviour. This is discussed further in paragraphs 154 to 156.

T028 and T521: The development of the All Level Crossing Risk Model (1997 – 2007)

63 Railtrack's Automatic Level Crossing Risk Model (Auto LCRM) was developed from 1993 by A D Little for railway staff to use to assess the risk present at automatic half barrier crossings (AHBs), using a standardised methodology. The history of the Auto LCRM is described in RSSB report T737 'Documenting the ALCRM'. The initial model, presented to the British Railways Board in 1994, allowed estimation of level crossing risks for any particular site according to crossing type, levels and types of use, rail traffic density and line speed. The model worked within the bounds of quantified risk analysis conducted during its development. It was used in 1994 – 96 to support a number of risk assessments associated with lines of route, individual crossings and more generally in Railtrack Zones.

64 The model was developed steadily, and updated to V2.2 in 1997. This was the first version to be released for widespread use across Railtrack. This version included the ability to distinguish between trains with differing speeds and lengths, an improved user interface, and other refinements. At this stage the model was only regarded as robust for *automatic crossing*s, because 'the fundamental work on human safety performance in relation to sighting times and reasons for user distraction or indiscipline have not been sufficiently explained.'

65 Version V3 of the model was released in late 2002. Changes from V2.2 included (among others) remodelling of user misuse, revised weighting for *blocking back*, reviewing the pedestrian risk model, and the relationship between risk and train length. The changes required recalibration of the model, which involved running it for all automatic crossings, and this was completed late in 2003. Some changes were then made to the multipliers for 'deliberate abuse' and 'blocking back', and V3.1 of the model was then rolled out and used by Network Rail until 2006. In this form it allowed risk areas to be identified and mitigated, and was used as a tool to help understand where it would be sensible and cost effective to upgrade particular crossings.

66 Research projects T028 and T521 built on this foundation to develop the Auto LCRM model into the ALCRM which could be used to assess risk at all crossings, including UWCs. New risk assessment methodologies were incorporated into the model for passive crossings, based on the research in T269. Safety benefit calculations were included in the ALCRM in order to facilitate comparison of different level crossing upgrade options, and a number of other improvements were introduced into the existing risk assessment methodology. The first version of the model was available for trial in early 2006. It was subsequently verified against the functional specification (which had been defined in 2002/03 by a steering committee of industry experts and managers) and calibrated. This showed, among other things, that risk associated with passive crossing use is broadly in line with that predicted by RSSB's Safety Risk Model. Network Rail then designed and delivered training courses for the model for their various level crossing practitioners. The ALCRM is now being used by Network Rail across the network as a tool in its safety decision-making process. Further information on the ALCRM is at paragraphs 117 to 131.

T334: Reducing the risk to motorists traversing UWCs on foot

67 This research has been in progress since 2006. Its abstract states that: 'UWCs pose a particular risk for motorists, who must leave their vehicles and traverse the crossing on foot four times to open and close the crossing gates. This research will assess this risk, the human factors issues associated with the use of these crossings and the options for risk mitigation through engineering design solutions. It will examine the extent to which drivers are tempted to drive across without looking properly when gates or barriers are left open. It will examine the merits of employing different types of gates or raising barriers, including manually pumped or electrically driven options and automatically lowering or user lowered options, and the potential use of miniature warning lights. By adopting a cost benefit approach the research will help focus further work on the most worthwhile options.'

T335: Improving road user and pedestrian behaviour at level crossings

68 The results of this research were published in 2008. This was a comprehensive study into improving road user and pedestrian behaviour at level crossings. The project assessed, and reported on, the current knowledge of public behaviour after drawing up task and human error analyses, carrying out a literature review and reviewing actual accident and incident data. The project then prioritised the risk associated with the human factors issues underpinning the various behaviours and identified and evaluated current and new mitigation measures to influence human behaviour. Working very closely with Network Rail's practitioners in level crossings, the project designed a toolkit which gives details of the mitigations that are available to tackle human factors issues, enables the systematic evaluation of these issues, supplies practical guidance on the selection of appropriate risk mitigation measures and supports a cost benefit analysis process. The toolkit is already in use.

T364: The cost of level crossings – an international benchmarking exercise (2006)

69 The research into the costs of level crossings internationally (T364) was intended to discover how the costs of upgrading crossings in Britain compared with similar projects overseas. It was specifically designed to analyse the costs of the migration path from the British crossing type AOCL to a barrier crossing such as AHB, or their international equivalents. The research compared the situation in Britain with that in several other developed countries and looked at the transferability of improvements in risk or technical innovation. The report found, among other things, that there is significant variation in the technical scope and complexity of crossings between different countries, which is a key factor in determining their cost. The report was a benchmarking exercise and made no recommendations. However, the subsequent trial of predictor technology (described in paragraphs 110 to 112) by Network Rail recognises the opportunities for cost reduction that exist.

T528: Crossing closures in other countries (2006)

70 Another exercise in comparing costs in Britain with those overseas was project T528, which examined attitudes to, and the processes and funding for, crossing closures in other countries. The project investigated the difference between national approaches to closing level crossings, and identified lessons that may be learned that would make the closure of crossings in Great Britain less complicated. The report found that most of the countries studied permit decisions on crossing closure to be made at local level, in contrast to the UK, where the final decision must be made at central government level.

T561: The safety benefits of new miniature warning lights (2006)

71 One of the most significant barriers to upgrading crossings, as identified in T364, was the cost of the technical solutions involved. Network Rail initiated a project to develop a Novel Warning Device (NWD) to develop a relatively inexpensive system of train detection for level crossings. The findings from T269 contributed to the selection by Network Rail, with the support of ORR, of a type of light-emitting diode (LED) MWL for trial at three crossings which had not previously been equipped with warning lights. RSSB intended to use this exercise to evaluate the safety benefits of miniature stop lights from first principles for the first time (T561). However, in late 2005 Network Rail's Tactical Safety Group decided to close down the NWD project because the technology of level crossing predictors provided a more readily available alternative (paragraphs 109 to 112). To maintain momentum on research project T561, RSSB decided to investigate three crossings where trials of predictor technology (paragraph 110) would lead to miniature stop lights being installed. The first part of the project involved recording user behaviour before it could be influenced by the miniature stop lights. A feasibility study was carried out, but one of the chosen crossings was subsequently closed and funding for the upgrade at another was withdrawn. It was not considered viable to proceed with just one crossing, and so project T561 was closed down in December 2006. Predictor technology has subsequently been tested and approved for use on Network Rail and is being implemented.

T668: The safety benefits of train horns at level crossings (2006)

72 One factor in the protection of level crossing users (particularly pedestrians) is the sound provided by train horns. Where sighting from footpath crossings is insufficient, 'whistle' boards are provided to increase the warning time to what is required to cross safely. In recent years the perceived noise from train horns has increased as modern train fleets have been equipped with more efficient horns that comply with safety standards, and there have been many complaints about noise pollution and general disturbance. Research into the safety benefits provided by train horns at level crossings (T668) was carried out during 2006. An initial hazard and operability study was undertaken by RSSB, examining the influence of the use of the train horn at footpath crossings. RSSB also carried out a literature review on human factors issues related to the use of the train horns, their impact on safety risk and other related factors. As part of the consideration of risk, the study accepted that there are adverse health effects associated with the disturbance caused by train horns, and these must be taken into account in any calculation of the benefits of horn use. The report concluded that the best estimate of the national safety benefit of whistle boards is that it is of the order of 1 to 2 Fatalities and Weighted Injuries (FWI) per year. Whistle boards are an inexpensive (about £5,000 per whistle board) means of providing sufficient warning at crossings with restricted sight times. Therefore, although safety benefits at most crossings will not be high, whistle boards can be justified on cost-safety benefit grounds.

73 A further stage in the research evaluated the risk at crossings equipped with whistle boards, to determine what level of mitigation is reasonably practicable to implement. This was designed to lead to recommendations about what changes, if any, could be made to the current arrangements for the sounding of train horns at the approach to level crossings. Following this, the Rule Book was changed in 2006 and train drivers are no longer required to sound the horn at 'whistle' boards between 23:00 hrs and 07:00 hrs. A toolkit has been designed for use by railway staff assessing the need for whistle boards at specific locations, but this can only be partly effective because of the non-use of horns at night.

2006 – 08 Study

74 To establish the current nature and extent of incidents at UWCs, the RAIB collected data for events occurring between 1 June 2006 and 31 December 2008 from the industry's Safety Management Information System (SMIS), which is managed by RSSB, and from the Network Rail National Operations Centre (NOC) daily log. The NOC log records incidents in 'real time'. Incidents that are significant enough to come to the attention of the NOC should subsequently be recorded on SMIS by the train operator involved. This data was refined to focus on UWCs, where collisions or other incidents had occurred involving trains and road vehicles or large animals, i.e. where there was a risk to the train. There were 529 such incidents, occurring at 341 separate locations, as shown in Table 3.

Type of incident	Type of crossing			Total
	MWL	Phones	No Phones	
Collision – error by railway staff	0	4	0	4
Collision – error by crossing user	2	5	6	13
Near miss – error by railway staff	1	17	1	19
Near miss – error by crossing user	8	169	71	248
Misuse of crossing (not deemed to be near miss)	9	192	44	245
Total	20	387	122	529

Table 3: Incidents at UWCs and crossing type

Incidents were recorded as a 'near miss' if the train driver considered that a collision had been narrowly avoided. Staff error, representing 4% of incidents, involved incorrect information about location of trains being given by signallers over the telephone to users in 17 out of the 19 cases[5].

The crossing types concerned, and the distribution of incidents, are shown in Table 4. The figure for 'Number of incidents' refer to the total number of incidents which were recorded at each crossing during the period, so that, for example, one level crossing had twelve incidents, five had five incidents, sixteen had four incidents, and so on. There were no crossings with between eight and eleven incidents.

Type of crossing	Number of incidents								Total
	12	7	6	5	4	3	2	1	
Miniature warning lights, with telephone	0	0	0	0	0	0	4	13	17
User worked, with telephone	1	1	0	5	14	17	37	161	236
User worked, no telephone	0	0	1	0	2	4	14	67	88
Total	1	1	1	5	16	21	55	241	341

Table 4: UWCs and incident type

[5] Of the remaining two incidents, one occurred at very low speed and was caused by errors by an on-track machine driver and a shunter at the crossing at the entrance to Westerleigh training school, Somerset, and the other involved an allegation that the green light at a MWL crossing continued to show as the train approached. No fault was found with the equipment on investigation.

75 No-one was seriously injured in any of the collisions which occurred on Network Rail infrastructure during the period, although two of them involved cattle and several beasts were destroyed. Of the 17 crossings where collisions took place, two had miniature warning lights and telephones, nine had telephones only, and six had no telephones. Of these crossings (where collisions occurred), one was the site of four incidents (including the collision) during the period, one had three incidents, and two had two incidents.

76 Brief details of the collisions (except for the collision at Loover Barn Crossing, Sussex, on 13 June 2008, which is described in detail in paragraphs 93 to 102) are:

13 June 2006: 2E69 14:35 hrs Leicester to Lincoln struck a van at Skewbridge (Coulson Road) user worked level crossing, Lincoln. No damage to train and only minor damage to van. No injuries suffered. Crossing user had not used telephone to request to use crossing.

28 July 2006: At 09:49 hrs, 2R11 09:27hrs Lincoln to Adwick struck a cow on the Down line at River Bank user worked level crossing, Saxilby. The collision was at slow speed and there was no damage to unit 144010. The beast was knocked clear of the lines. The farmer had contacted the signaller at West Holmes and requested permission to use the crossing. Signaller advised farmer that it was in order to use the crossing but omitted to ask the farmer if the train had passed, hence the train struck the cow.

30 August 2006: Tractor driver at Smeafield Farm crossing reported his tractor being struck by a northbound express train. Train 1S13 11:00 hrs Kings Cross - Glasgow Central was damaged but had not derailed.

2 October 2006: 1S50 06:54 hrs Newcastle – Glasgow struck a herd of cows near Guillyhill UWC, Dumfries. Cattle had gained access via open gate of level crossing. Not clear whether attempt had been made to drive cattle over crossing, which is not fitted with telephones. Sixteen cows killed. Not recorded on NOC log.

24 February 2007: 2E29 19:05 hrs Pembroke Dock to Swansea collided with a car at Fynnongain MWL Crossing, Whitland. Car driver opened near gate, drove onto line, got out to open far gate, and car was struck by train. It was dark, raining and the car driver was unfamiliar with the area and had not previously encountered a user worked crossing.

30 August 2007: 2W21 17:46 hrs Bridlington - Hull reported that the back end of the train had been struck by a tractor as it went over Abbey Farm level crossing, Hutton Cranswick. Signaller had given the farmer permission to use the crossing but did not notice that 2W21 was still in section.

13 September 2007: At 16:46 hrs, 2H64, 15:52 hrs Wick – Inverness struck a glancing blow to a tractor on Sibster Burn UWC, on the single line just south of Georgemas Junction. No injuries occurred to traincrew or passengers, and no derailment occurred. The crossing is not fitted with telephones. The collision was reported as having taken place at 50 mph. The tractor driver drove straight onto the crossing without stopping to check if it was safe to do so, contrary to the instructions displayed at the level crossing. The tractor driver was unable to hear the train's warning horn from the tractor cab.

5 December 2007: At 12:55 hrs the signaller at Carmarthen Junction authorised a farmer to use Coed Farm No.1 UWC on the single line between Carmarthen Junction and Ferryside with 2E13, 11:05 hrs Pembroke Dock – Swansea, still in section. As a result the train struck three sheep.

15 April 2008: At 11:15 hrs, the 07:12 Nottingham – Nottingham railhead treatment train struck a forklift truck on Lower Portland UW LC, on the double line freight-only route between Langley Mill and Kirkby-in-Ashfield. There was only minor damage to the train and paint marks on the forklift. It was reported that the farmer had opened the first gate and edged onto to the crossing, and, although the vehicle was clear of the crossing, the raised forks were actually foul.

18 May 2008: At 14:10 hrs, the 14:00 Barton-on-Humber – Cleethorpes struck a boat on a trailer being towed by a car at a location known locally as Ski Club Crossing UWC. Witness evidence showed that the gates were already open as the car approached.

18 May 2008: At 23:52 hrs, the 22:26 Sheffield – Hull struck a van on the line at Lowfield UWC at 8 m 78 ch between Ferriby and Brough. The van was pushed approximately 200 yards and came to rest down an embankment. No derailment occurred and only minor damage was sustained. Of the 12 passengers on board the train, two suffered minor injuries and were treated at the scene. Police on site could find no trace of the vehicle occupants, and declared the incident a scene of crime.

3 June 2008: At 17:23 hrs, the 19:33 Carlisle - Newcastle train hit a parcel delivery van at Haugh Gardens UWC, between Haltwhistle and Bardon Mill. The van driver had not telephoned the signaller for permission before crossing. He was subsequently prosecuted and convicted of endangering the safety of passengers on the railway, and given a thirteen-week custodial sentence, suspended for twelve months.

2 July 2008: At about 22:10 hrs, the 20:00 Pwllheli – Machynlleth train struck a herd of cows which had gained access to the railway at Rhiwlas Hall UWC, between Dovey Junction and Machynlleth, after a gate had been left open. The train was not derailed, but 27 cows had to be destroyed.

31 July 2008: At 06:40 hrs, as the 06:00 Perth – Kirkcaldy train was passing over Anniesmuir UWC, between Newburgh and Ladybank, a road vehicle waiting at the crossing rolled forward causing the train to strike a glancing blow to the vehicle. The train only sustained superficial damage and the road vehicle user was uninjured. As the vehicle waited at the crossing the motorist's foot slipped off the clutch causing the vehicle to roll forward as the train approached. No request had been made to the signaller for permission to use the crossing.

10 September 2008: At 12:11 hrs, the 10:33 Birmingham New Street – Aberystwyth, struck a lorry on Smiths Lower Cefn UWC between Sutton Bridge and Welshpool. There were no reported injuries to the 114 passengers, staff or vehicle occupants. The vehicle driver admitted using the crossing without speaking to the signaller.

12 November 2008: At 09:20 hrs, the 08:50 hrs Bristol Temple Meads – Salisbury, struck a road vehicle on Glass' MWL UWC. There were no injuries.

Multiple incident locations

77 The crossing where there were twelve incidents during the period, near Edenbridge, Kent, has a long history of disputes between the authorised users and Network Rail about the safe use of the crossing. Two of the twelve incidents here were errors by signallers. There is a permanent speed restriction of 40 mph for trains passing over this crossing. It is equipped with CCTV to monitor misuse, and has been the subject of considerable attention by ORR over a number of years. The crossing where seven incidents occurred, near Aspley Guise, Bedfordshire, is on a line which has been equipped with new signalling recently. Telephones were provided as part of this project and users have been reluctant to use them correctly.

78 The 43 crossings where between three and six incidents occurred are widely separated geographically, and there is no discernible pattern to the incidents. At one of the crossings the authorised user is considered by local staff to be 'hostile' to the railway.

79 The 55 crossings where two incidents occurred include one crossing on a single line branch where, on 21 August 2006, three successive trains found the gates open on the outward journey and stopped to close them when returning from the terminus. On the third occasion the authorised user was seen to open the gates and walk away from the crossing while the train was still present. This sequence of events was considered to be a single incident for the purposes of this report. The crossing is not equipped with telephones. In 2002 a motorist was killed when his van was struck by a train at this crossing, on an occasion when the gates had been left open by a previous user.

High consequence locations

80 All 171 crossings where incidents occurred in the period between June 2006 and November 2007 were examined for proximity to infrastructure features which might increase the severity of the consequences of a collision. Five were identified as being on the immediate approach to *facing points*, and one to *trailing points*. If a train is derailed by collision with an obstruction on a level crossing, the consequences of the derailment may be made much worse if the derailed vehicles encounter points while the train is still travelling at speed. In the accidents which occurred at Great Heck in 2001 and Ufton crossing in 2004, trains travelling at high speed derailed after colliding with road vehicles on the line, and then passed over points, which had the effect of diverting the derailed vehicles away from the straight path that they would probably otherwise have followed. In one case the derailed train collided with a freight train approaching from the opposite direction. Casualties were heavy in both cases.

81 Of the five locations identified in the study as being close to points, four have a line speed of 90 mph or more over the crossing. Other local features that might increase the risks could include bridges close to the crossing, signal gantries and supports for overhead electrical equipment (OLE). These factors are taken into account as part of the risk assessment carried out using the ALCRM.

Categories of user

82 The usage of each crossing is difficult to categorise without visiting each site. However, using the information available from maps and from incident reports, preliminary categories have been allocated as shown in Table 5:

Principal access over crossing	%
Fields	35
Farm buildings	31
Minor roads (through routes)	9
Factories/industrial sites	6
Residential	5
Urban areas (use not obvious)	4
Foreshore	4
River banks	3
Forests	1
Golf courses	1
Campsites	1
Total	100

Table 5: Surroundings of crossings

83 There are no recent figures available for the usage of each crossing. The crossings described as 'minor road' are those which clearly give access to a number of properties or in some cases can be used as a through route between public roads. This is the type of crossing which is likely to have the highest number of occasional users and where the authorised user(s) are not likely to be controlling the use of the crossing. An example of this is the crossing at Martin's Lane, Burscough, Lancashire (paragraph 145).

Perceptions of users

84 The study highlighted that there is no definition of a near miss at a crossing. If the train driver declares that a near miss took place, it is entered on SMIS accordingly. There have been suggestions that some train operating companies encourage their drivers to record all crossing misuse events as near misses, but this is not apparent from the study. There is insufficient data to identify any regional or operating company trends in reporting.

85 The reason this is of importance is because the user of a crossing may be applying widely different standards for 'safe use' from those which would be expected by railway staff. A road vehicle driver will encounter many situations during the course of a day's driving when he or she will need to make a decision about crossing a carriageway or turning onto a major road. It is normal for a waiting driver to observe approaching traffic, judge its speed, and decide that there is sufficient time to cross or make a turn before the approaching vehicle arrives. There may be as little as three or four seconds margin, and this is accepted as normal by road users.

86 However, a number of incidents in the study suggest that train drivers often appear to be concerned about any crossing of the line in front of a train, almost regardless of how far ahead this takes place. On a 60 mph line, traffic may legitimately cross an AHB or AOCL as the amber light shows, 704 yards (24 seconds at 60 mph) in front of an approaching train. Any distance less than this, at an AHB, AOCL or any other sort of crossing, may be regarded by the train driver as dangerous misuse or a near-miss, although the crossing user may not see the incident in the same way.

87 The signage presented to the user at UWCs says 'Stop – Look – Listen'. It does not forbid the user to cross in sight of a train. Users who are accustomed to the trains on the line will have experience of how long it takes a train to reach the crossing after coming into view, and may make a judgement that they have time to cross before the train arrives, using the same decision-making criteria as they would at a road junction.

Other incidents at UWCs

88 On 19 October 2005 the 10:45 hrs passenger train from London Kings Cross to Kings Lynn collided with an agricultural tractor and trailer at Black Horse Drove MWL UWC, between Littleport and Downham Market. The driver of the tractor was killed. The RAIB's investigation[6] concluded that the tractor driver either failed to notice that the red minature stop light on the crossing was showing, or chose to ignore it, and drove the tractor onto the crossing immediately in front of the train. It is possible that the crossing gates had been left open by a previous user. The report recommended that the design and location of signs and warning lights at this type of crossing should be reviewed, to ensure that they provide adequate information to unfamiliar or occasional users on how to operate the crossing safely, and that the vegetation at the crossing should be better managed to optimise sighting of approaching trains.

89 On 22 May 2006 a freight train travelling from Willesden to Sizewell collided with a car on Bratts Blackhouse No.1 UWC, on the Sizewell branch in Suffolk. There were no injuries. The motorist did not stop at the 'stop' board, and drove straight onto the crossing into the side of the moving train. The RAIB's investigation[7] concluded that the crossing gates were habitually left open (and at the time of the accident were so overgrown they could not be closed). The railway is only used by one train a week in each direction, and trains pass over the crossing at about 20 mph. The RAIB recommended that Network Rail should remind authorised users of the correct method of operation, and check that they were adhering to it (e.g. that the users were closing the gates after use), and should improve the standard of maintenance at the crossing, and these are being implemented. In addition, the RAIB recommended that Network Rail should provide the name of the crossing and the telephone number of the signaller on signs at UWCs, so that users with mobile phones can contact the railway and accurately identify where they are speaking from. Network Rail has not yet accepted these latter recommendations.

90 Included within the events analysed in this report is the collision between the 11:00 hrs London Kings Cross – Glasgow Central train and a tractor and trailer at Smeafield (no.179) MWL UWC, Northumberland, on 30 August 2006. There were no injuries in this accident. Following the collision, ORR took enforcement action against the authorised user of the crossing, issuing an Improvement Notice requiring Hoo-Bee Agrics to formally develop and put into practice a safe system of work at Smeafield Farm UWC, and ensure their employees are briefed on and follow that system.

[6] Report 12/2006. All the RAIB's reports can be found at www.raib.gov.uk.

[7] Report 09/2007

91 On 2 August 2007 the 15:05 hrs Northern Ireland Railways passenger train from Londonderry to Belfast collided with a tractor on XL202 UWC, Limavady, killing the tractor driver. The RAIB carried out an investigation of this accident[8]. The tractor driver drove onto the crossing, which was not equipped with telephones, as the train approached. Provision of telephones at this location would not have been helpful because of the very long signal sections involved, and the consequent inability of a signaller to provide accurate information to the user on the position of trains. The RAIB made no recommendations relating to the cause of the accident, but observations made during the investigation led the report to recommend that Northern Ireland Railways should review its level crossing risk assessment model, the risk assessment for the crossing itself, and the signs used at the crossing. Since this accident Northern Ireland Railways has invited equipment suppliers to produce a mechanism that will enable gates at UWCs to be opened and closed from one side of the line, reducing the number of times that a user has to cross the line. Designs are still being evaluated.

92 On 25 August 2007 a train on the narrow-gauge Leighton Buzzard Railway collided with a tractor at Cavalry Horse UWC on the outskirts of Leighton Buzzard, Bedfordshire. One passenger was slightly injured. The RAIB's investigation[9] concluded that the tractor had been driven onto the crossing while a train was approaching, and that the tractor driver had inadequate visibility of trains because vegetation at the crossing had not been cut back. There were no signs at the crossing. The RAIB recommended that the railway should give guidance to the users of crossings on the requirements for operating over them, and carry out works to improve the signage, the condition of the crossings, and the management of vegetation.

93 On 13 June 2008 at about 15:15 hrs at Loover Barn crossing near Glynde in Sussex, a collision occurred between a train and an agricultural tractor. There are five UWCs between Berwick and Glynde. Only one of these is used regularly: the crossing at Loover Barn, about half a mile east of Glynde station.

94 Loover Barn accommodation crossing connects fields lying on opposite sides of the railway, and there is no public access to it. It is used only for agricultural purposes, for taking tractors, other vehicles and occasionally animals across the line. The crossing is provided with a timber surface, field-type gates that open away from the railway, and telephones on both approaches which communicate with Berwick signal box.

95 The method of working for the crossing requires the user to telephone the signaller for permission to use the crossing. The signaller checks that there are no trains in the section or signalled and places or maintains the protecting signals (BK 41 at Glynde station on the down line, and BK3 at Berwick station on the up line) at danger, and places reminder appliances on the switch and lever respectively which control these signals. The signaller then advises the user that it is safe to use the crossing. Once they have passed clear of the crossing, the user phones the signaller and confirms that the crossing is clear. The signaller then removes the reminder appliances from the lever and switch and resumes normal working. Each telephone call is recorded by the signaller.

[8] Report 10/2008

[9] Report 46/2007

96 During 2008 the crossing was not used at all during January and February, and less than once a day on average in March, April and May. From 10 June, however, cutting crops for silage began in the field beyond the crossing.

97 The register kept by the Berwick signaller records that Loover Barn crossing was used 35 times on 10 June, 48 times on 11 June, 32 times on 12 June and 31 times on 13 June up to 15:00 hrs.

98 The workload created by the heavy use of the crossing in this period caused one of the signallers at Berwick to vary the working method by leaving the reminder appliances on the signal controls all the time, and only removing them when he needed to clear the signals for a train.

99 At about 15:14 hrs, a tractor driver telephoned and asked to use the crossing. The signaller checked that the reminder appliances were on the signal controls and gave the user permission to cross. He overlooked the track circuit indication which showed that an up train, 1F37, the 14:58 hrs Eastbourne – Haywards Heath, was still occupying the section between Berwick and Glynde.

100 The tractor driver moved forward towards the crossing, looked both ways, and saw the train approaching as he moved onto the crossing. He stopped and began to reverse his vehicle, but the train struck the heavy cast counterweights on the front of the tractor at about 80 mph. There was no derailment and no-one was injured, but the train was disabled and received significant structural damage which caused it to be out of service for over six months.

101 The immediate cause of the accident was the error by the signaller at Berwick. A contributory factor was the heavy use of the crossing on that day. The condition of the crossing and the actions of the train driver and the tractor driver were neither causal nor contributory to the accident.

102 The underlying cause of this accident, as with the great majority of the collisions at UWCs, was the existence of the uncontrolled crossing, which relies on people to ensure safe operation.

Analysis

Current policies and initiatives

Network Rail

Strategy

103 Network Rail's approach to managing level crossing safety is set out on its web site at http://www.networkrail.co.uk/documents/4424_Level%20Crossing%20Policy.pdf. It includes closure of crossings, education of users, implementation of risk reduction options, enforcement of the law on crossing use, engineering changes to enhance protection at crossings, and evaluation of new initiatives and technologies to improve safety in the future. Network Rail also has a national UWC closure programme and a ten-point plan for improving UWC safety, which includes contacts with corporate users (such as Royal Mail and utility companies) who may not be targeted by local campaigns.

104 Education of users has recently involved a national marketing campaign, which used a variety of media to reach potential users. The campaign initially focused on crossings on public roads, but the most recent material has been designed to target users of UWCs, and alert them to the risks and the correct method of crossing use.

105 Network Rail has also issued information packs to authorised users, distributed leaflets to households in areas where there is a high level of misuse, and conducted local awareness events with stands at stations, in town centres and at exhibitions.

106 Enforcement of the law is an ongoing process, but the need to collect evidence (particularly of identity) to a standard which can be used in court means that successful prosecutions usually only take place following collisions (an example of a prosecution is described in paragraph 76 in relation to the collision at Haugh Gardens UWC on 3 June 2008).

Crossing protection systems

107 Conventional level crossing train detection is expensive (between £250,000 and £400,000 for minature stop lights per crossing) and does not give users a consistent message about the time they will have to wait, because it is based on the maximum permissible speed on the section of line and takes no account of the actual speed of an approaching train.

108 Level crossing protection systems are designed in all cases to fail safe. Much of the complexity of the systems is necessary to achieve the levels of reliability and safety which are considered to be necessary for the equipment to give the best possible protection to users of the crossing.

Predictor systems

109 Predictor technology is likely to cost less than the conventional protection systems used at AHB, AOCL, ABCL and miniature stop light crossings in the UK. It can be used to power miniature stop lights, provided a suitable power supply exists.

110 The WESTeX[10] level crossing predictor uses the rails to transmit audio frequencies from the predictor unit, located close to the crossing. The unit uses the electromagnetic characteristics of the track, and the short-circuiting effect of a train's wheels, to produce a signal which can be used to predict the time remaining before the arrival of a train. This requires no remote location cases, power supplies, treadles or cabling.

111 As a train travels towards the level crossing, the predictor unit measures the rate that it is moving at and uses it to initiate the level crossing protection sequence. By comparison with a pre-configured minimum warning time, the predictor is able to calculate the optimum point at which to initiate the sequence. This leads to a consistent crossing closure time regardless of the type or speed of the approaching train. To avoid the risk than an accelerating train may arrive before the predictor estimates that it will, a back-up 'virtual treadle' is used to ensure that the crossing is activated at a defined minimum time before the train arrives.

112 Network Rail has nominated ten sites for the installation of miniature stop lights before the end of 2009 to be operated using predictor technology or electronic controllers (treadles). All are already equipped with telephones.

Other initiatives

113 A local initiative on the Sussex route has fitted counters to UWC gates to record the number of times a gate is opened (which can then be compared with the number of times permission to use the crossing has been sought from the signaller). This information can then be used in discussions with crossing users, as an enforcement tool, and input into calculations of risk using the ALCRM.

114 One UWC (Shevock, Scotland) has been fitted with motorised gates at the user's expense.

115 Network Rail has continuing dialogue with the National Farmer's Union (NFU). Over recent years, changes have take place in both the railway and in the agriculture industry which may affect the way crossings are used, eg migrant workers, greater use of agricultural contractors, and larger agricultural machinery. A 'Business Guide to the Safe Use and Operation of User Worked Rail Crossings' has been prepared and is available to NFU members on the internet. Network Rail, in conjunction with ORR, BTP and local train operators, hold seminars in rural areas to which local farmers are invited, to explain the issues relating to crossings and how they can be used safely. Farmers are encouraged to do their own risk assessments, using data on train speeds and other information provided by Network Rail.

116 The results of these discussions and seminars have been used in the preparation of information packs for authorised users of UWCs, to remind them of the correct way of using the crossings, which have been sent out by Network Rail during 2007.

[10] Manufactured by Westinghouse Rail Systems Ltd, Chippenham.

Network Rail's use of the ALCRM

117 The ALCRM was launched on Network Rail on 12 January 2007. Its use is mandated by Network Rail company standard NR/SP/OPS/100 Issue 2 'Provision, Risk Assessment and Review of Level Crossings'. Its purpose is to inform decision making on level crossings. It is intended to provide Network Rail with a common means of assessing risk at each of nearly 7000 level crossings and evaluating mitigation options to reduce risk so far as is reasonably practicable. The model used in the ALCRM has limitations when considering individual situations. It is good at comparing relative risks between crossings of similar type. The model is admitted by its developers to over-predict risk for small numbers of events. This means that, where a crossing has only a low usage, the overall level of risk predicted at that location will be higher than experience indicates is actually the case. Therefore outputs for UWCs must be treated with some caution because of their low level of usage compared with most public road crossings.

118 The RAIB has found that data for sighting times that is input to the ALCRM should also be treated with caution, because the methods and equipment used to measure the distance at which approaching trains can be seen are left to individual assessors and are therefore not consistent. The results may also vary according to the time of year that the assessment is made. These inconsistencies do not appear to be addressed by the checks and audits which are carried out on the ALCRM. The RAIB's investigation into the fatal accident at Tackley station level crossing, Oxfordshire, on 31 March 2008 (report 09/2009) found that there were inconsistencies in the assessment of the sighting distances at that crossing, and that these were not identified when assessment reports were reviewed.

119 Since launch, Network Rail has chosen and trained 100 of its mobile operations managers (MOMs), who are the front-line staff dealing with operational incidents in each area, to do the site surveys, which provide the data for the ALCRM, as part of their normal duties. If MOMs are not available, the operations risk control co-ordinators, who are office-based staff who oversee the management of level crossings and train the MOMs, can also carry out these surveys.

120 The ALCRM takes the data provided from site surveys (there can be up to 200 input variables for each crossing) and calculates values for individual and collective risk[11]. These are output as a letter (A-M, where A is high risk) for individual risk, and a number (1-13, where 1 is high risk) for collective risk. Individual risk is expressed as 1 in xxxx per year, while collective risk is in terms of FWI[12] per year. Incident data from SMIS is not part of the data input to the ALCRM. However, weighting is given in the ALCRM to an assessment by the person surveying the crossing of any history of accidents, near misses and misuse incidents that they are aware of.

[11] These are concepts used in statistical analysis. In the railway industry, individual risk is the probability (per year) of fatality to which an individual is exposed from the operation of the railway. Collective risk is the average number of fatalities, or fatalities and weighted injuries (FWI) per year that would be expected to occur from a hazardous event (or group of hazardous events).

[12] For statistical and planning purposes, the numbers of major and minor injuries are weighted in recognition of their relatively less serious outcome in comparison to a fatality. The current weighting is 0.1 of a fatality for each major injury and 0.005 for each minor injury. The combined measure is designated 'fatalities and weighted injuries'(FWI). Source: RSSB, 'Risk Profile Bulletin'.

121 The output from the ALCRM estimates the safety risk to crossing users, train staff and passengers and the operational risk associated with level crossing accidents and failures. It considers collisions between trains and crossing users, collisions between crossing users and crossing equipment such as barriers, and also other incidents such as slips, trips and falls of pedestrians on the level crossing. The estimation of train passenger risk considers the potential for derailment following collisions with road vehicles, and the possible outcomes that can result from derailment including collisions with lineside objects and other trains.

122 The ALCRM does not include calculation of the risk to crossing operators (for example the risk to train drivers at train crew operated gate crossings, and to keepers at crossings with manually operated gates). The estimation of risk to train passengers does not take into account train passenger loading or rolling stock type. The risk to animals and the accompanying humans (e.g. the horse rider or cattle herder) is not considered by the model. Modelling of the risk associated with signals passed at danger protecting level crossings is not specifically included in the model (although such errors are included in fault tree base events such as “user does not expect train at level crossing”).

123 The safety benefits associated with the placement and use of ‘whistle’ boards are not considered by the model, and so may over-predict levels of risk at footpath crossings where such boards are provided. This is being addressed in the current development of the ALCRM.

124 The ALCRM includes an estimate of the indicative level of individual risk of fatality to a ‘typical’ regular user, assumed to use the crossing 250 times per year (500 traverses). It is not practicable to determine the level of individual risk to those who may use a crossing more or less frequently than this ‘typical’ regular user.

125 The ALCRM does not include risk associated with deliberate acts at level crossings such as suicide and terrorism.

126 Up to the end of 2008, all public crossings and station foot crossings have been surveyed and input to the ALCRM, and about 90% of the total number crossings on Network Rail have now been surveyed, including about 66% of UWCs. Non-public crossings are required to be assessed every three years, so all UWCs should have been surveyed by 11 January 2010.

127 The output from the ALCRM is seen by Network Rail as part of its broader risk management of level crossings. It suggests and informs decisions regarding risk, and selection of risk control measures, and the ALCRM results must be used alongside sound engineering judgement and local knowledge.

128 Where the output from the ALCRM is a risk ranking of 1, 2 or 3 (collective risk), or if the contribution of train accident risk is more than 50%, then the action required by Network Rail, at these higher risk crossings, is for the operations risk control co-ordinator for the area to arrange a site visit by a team of experienced staff representing the signal engineering and operations functions, to consider crossing-specific options for mitigating the risk. Authorised user(s) are also invited to attend. Once those present have used their experience and other aids such as the level crossing toolkit (paragraph 68) to identify the options, a cost-benefit analysis is done to give a value for each fatality prevented (VPF), to produce a score which can be compared with the current global VPF[13]. The best risk mitigation option which reduces risk so far as is reasonably practicable is then selected. Any history of incidents at the crossing is taken into account at this stage, and will add weight to the arguments for risk reduction measures. The local management presents a business case to the Network Rail investment panel. If this is approved, the protection is implemented. The ALCRM risk score is then recalculated.

129 Where the output from the ALCRM shows a lower level of risk, in the range individual risk A to C and collective risk ranking of 4 or 5, the operations risk control co-ordinator is required to review the crossing and decide if a site visit is required.

130 Network Rail has little information on actual crossing usage. Leaflets sent to authorised users now include a questionnaire to give Network Rail some data on use. Some of these have been returned to Network Rail, but the actual level of response has not been measured.

131 The results of the first year's data entry to the ALCRM have shown that higher-risk crossings with more than 0.05 predicted FWI per year make up 1.7% of the total population.

132 The development of the ALCRM is an ongoing process. Network Rail has had the functional specification and software implementation of the model reviewed by external consultants, and refinement and enhancement of the model is continuing.

133 A report on Network Rail's procedures for managing level crossing risk, carried out by ORR between April 2007 and September 2008 (paragraph 139), recommended that the company should:

- review the appropriateness of the combined generic models for two types of foot crossings at stations;
- use the observations in ORR's expert review and combine actions in response to these with those arising from the Sotera review in developing the model; and
- monitor the assessment of level crossing risk to ensure appropriate use is being made of all available tools to produce suitable and sufficient risk assessments.

134 The ALCRM is intended to be calibrated against RSSB's safety risk model (SRM). The calibration of automatically-protected crossings is good and users can have confidence in the results. The calibration of manually-protected and passive crossings is not as good as they need to be recalibrated when a significant proportion of these crossing types have been input. This work is still outstanding.

[13] The global value of a prevented fatality (global VPF) represents the expenditure which is considered acceptable to avoid an event which results in one fatality. It is calculated by RSSB for the rail industry and currently stands at £1.65 M.

ORR

135 ORR has a strategy for securing adequate control of risk at level crossings, which is published at http://www.rail-reg.gov.uk/upload/pdf/RPT_levxings.pdf.

136 During 2007-08, as part of this strategy, ORR carried out a project on 'Tackling User Worked Crossing Misuse'. This project included detailed inspection of a number of UWCs, discussions with many authorised users, review of Network Rail's management of crossings, investigation of incidents, provision of advice and guidance, and formal enforcement.

137 At one crossing, Network Rail had worked closely with the authorised user to produce a comprehensive risk assessment for the use of the crossing, including a defined method of working. Although this was precipitated by a near miss at the location, ORR felt that it demonstrated the benefits of co-operation between the parties, and that it should generally form part of the routine approach to assessing and managing private crossing risk. It concluded that Network Rail should proactively approach selected users with a view to jointly drawing up site specific risk assessments for crossings.

138 The project also included consideration of the possibilities for closure of crossings. This is discussed further at paragraph 182.

139 The ALCRM and its operation was reviewed in detail by an ORR project carried out between April 2007 and September 2008. The project consisted of an expert review of the mathematics of the ALCRM model by the Health & Safety Laboratory (HSL), and inspection of the implementation of the model within Network Rail's overall risk management processes.

140 The review found that the approach to modelling risk used in the ALCRM was 'reasonable and not fundamentally flawed'. It emphasised, however, that the ALCRM in itself was not capable of producing a suitable and sufficient risk assessment, and is one of a number of tools to be used in managing crossing risk.

141 Limitations to the model were identified reflecting current data availability and the approach used in modelling certain crossing types. The limitations will reduce after a period of calibration and field use refines the ALCRM. While this is taking place, ORR believes that it is important that the limitations of the model, and its role in the crossing risk management process, is recognised by users and by ORR inspectors.

142 The review made four recommendations, three of which related to Network Rail's use and development of the ALCRM (paragraph 133). The fourth recommended that ORR use the findings of the project to ensure that its inspectors carrying out level crossing work fully understand the role and limitations of the ALCRM and the Network Rail crossing risk management process.

Train operators

143 Train operating companies (TOCs) have almost no input to the management of UWCs. National Express expressed interest in becoming involved in the assessment of risk at individual crossings, because they feel that local driver managers could provide a view on the sighting of the crossing by train drivers, and experience of local conditions and crossing misuse in greater depth than can be gained from SMIS data.

144 There is scope for the use of forward facing CCTV on trains, to provide information on crossing misuse, and evidence for investigations into collisions and other events. Trains recently delivered to several train operating companies are already fitted, and at least one TOC has a franchise commitment to fit forward facing CCTV to its fleet within 12 months. RSSB is carrying out a study to establish how many trains are currently fitted with forward facing CCTV.

Police

145 The BTP assist Network Rail with local initiatives on education at UWCs. An example of this took place near Southport, Lancashire, in October 2007 when BTP officers and Network Rail staff attended the crossing at Martin's Lane, Burscough for two hours in the morning peak on two successive days, to explain the correct operation of the crossing to users. This was one of the crossings where three incidents occurred during the period covered by the RAIB study (paragraphs 78, 83).

146 The police also react to reported incidents and gather evidence for prosecutions where possible. Unless a collision has occurred it is difficult to obtain evidence sufficient to secure a conviction, mainly because of issues of identification. Where there has been a collision, a successful prosecution may result (paragraph 76). Red light cameras have been used to provide evidence of violations at some public crossings in Scotland, but not yet at UWCs, although CCTV cameras have been used at a few crossings to monitor user behaviour.

Other railways

147 UWCs exist on other railways in the UK, in addition to the national network. Accidents on Northern Ireland Railways and the narrow-gauge Leighton Buzzard Railway have been described in paragraphs 91 and 92.

148 In general, crossings on standard gauge heritage railways are similar to those on the national network, and in most cases the same types of warning sign and other methods of protection (such as telephones and miniature stop lights) are in use. The risks to rail users and staff are generally lower because of the 25 mph (40 km/h) maximum speed on most heritage railways, which means that any collision is unlikely to result in a derailment causing injury to people on the train. However, the risks to the crossing user are still significant, and a fatal collision between a steam locomotive and a road vehicle occurred at Irwell Vale UWC on the East Lancs Railway on 14 May 2003.

149 On narrow-gauge railways, where trains are smaller and may lack the protection for those on board that is associated with standard gauge rolling stock, there is a significant risk to train crew in the event of a collision with a road vehicle. There have been three fatal accidents on the fifteen-inch (380 mm) gauge Romney, Hythe and Dymchurch Railway, Kent, in which train drivers were killed in collisions with road vehicles, in 1972, 2003 and 2005. All of these occurred at public road crossings. The railway has since upgraded the standard of protection at its public road crossings. On larger narrow-gauge lines, with gauges between two feet (610 mm) and three feet (915 mm) the consequences of a collision are more likely to be similar to those on a standard gauge line, with significant risk to the road vehicle occupants.

Review of legal and enforcement issues

150 The law relating to level crossings, as described in Appendix C, has developed in piecemeal fashion over the years and has generally not kept up with the development of road use by motor vehicles in the last century. There is no specific offence of misusing a crossing, and unauthorised use is a civil rather than criminal matter. A modernisation of the law in this area could enable the possibility of enforcement action to be a more effective deterrent to dangerous behaviour than it is at present.

151 The Law Commission and the Scottish Law Commission are currently undertaking a joint project to review the law relating to level crossings. Many organisations, including Network Rail, have made submissions to this project. The ORR has suggested to the Law Commissions that this project should:

- consolidate and modernise the law;
- align with the principles of general health and safety law;
- ensure the same, or better, levels of safety;
- identify the most efficient and economic solution for dealing with level crossings issues;
- ensure appropriate balance between the interests of the railways and those of level crossing users;
- recognise and deal with the impact of land-use planning on level crossing usage and consequent risk;
- aim to reduce the regulatory burdens associated with the present legislative structure, including considering the role of Level Crossing Orders;
- aim to help the efficient and timely closure of level crossings wherever possible; and
- enable decisions about level crossings to take account of all the relevant issues – safety, economic, convenience and capacity – in relation to both road and rail users.

Use of crossings

Network Rail's relationship with users

152 Network Rail maintains information on authorised users of crossings, as occupiers of premises and owners of land, not individuals. Prior to 2005, it was Network Rail's policy to write to the authorised users of all UWCs, other than those fitted with miniature stop lights, to remind them of their responsibilities and the correct way of using the crossing. Typically, this took place once every two years (unless there were particular local issues requiring more frequent contact). Since the accident at Black Horse Drove (paragraph 88), this policy has been extended to include the authorised users of those UWCs fitted with miniature stop lights.

153 Recent mailshots (as part of the "Don't Run the Risk" campaign (paragraph 104)) have included leaflets, information packs and questionnaires intended to improve the data Network Rail holds on the amount the crossing is used and the number of different people likely to use it.

Behaviour at MWL crossings

154 The RSSB research into human factors risk at user worked crossings (T269, paragraph 62), found that users underestimated the time required to cross and overestimated the time they would have to wait when the red light showed. It is likely that users' tendency to overestimate the time between the appearance of the red light and the arrival of the train stems from the inconsistency of this period in practice. This is because the existing system for activating the miniature stop lights requires the approaching train to 'strike in' at a treadle or track circuit which is a fixed distance from the crossing. The red light sequence will then begin, regardless of the speed that the train is travelling at. The warning time provided by the equipment is calculated on the speed of the fastest train that can approach the crossing. In most cases this will be simply derived from the permitted speed ('line speed') on that section of line.

155 The time between the red light appearing and the arrival of the train may vary greatly between the slowest and fastest trains. For example, if the fastest train on the line travels at 100 mph and arrives in 40 seconds after the red light appears, a freight train at 40 mph will take one minute and 40 seconds to appear. The pattern of train services may mean that fast trains are very rare (perhaps only empty trains going to a depot will not stop at the nearby station, for instance), and users may become accustomed to an extended warning time.

156 Predictor technology (described in paragraphs 109 to 112) exists for systems that will provide a warning based on a more accurate prediction of the arrival time of an approaching train. These have been used extensively in the USA, where they are said to have contributed to a 60% reduction in level crossing fatality rates between 1990 and 2005[14], although other factors including line closures and user education campaigns also influenced the fatality rate during this period. It has not been possible to quantify the benefit of the use of predictors, but it is likely that the more consistent warning time provided by a predictor system may influence users to take more heed of the lights. However, it is also possible that very frequent users may continue to make their own assessment of when it is safe to cross.

The Decision Point

157 The RSSB research report T269 recommended that a marked decision point should be provided at vehicular crossings which were not provided with additional protection (paragraph 61). This was rejected by Network Rail because of practical difficulties involved in defining a safe decision point for vehicles, for the reasons discussed in paragraphs 161 to 163.

158 Research relating to the decision point is discussed in paragraphs 60 and 61. The decision point is important because it provides a defined position at which a safe decision to cross can be made. A user who is too far from the crossing may not be able to see far enough to obtain adequate sighting of an approaching train, and one who comes too close to the line before looking to see if it is safe to cross is at risk of being struck by a train. A marked point, from which adequate sighting is obtainable, will assist with consistent and safe decision making.

[14] FRA Railroad Safety Statistics – Annual Reports 2000 - 2005 (Federal Railroad Administration, Washington)

159 RSPG Section 2E defines the decision point:

'A point where guidance on crossing safely is visible and at which a decision to cross or wait can be made in safety. For footpath crossings this should be not less than 2 m from the nearest running rails or 3 m where the line speeds are higher than 160 km/h. For bridleway crossings and user-worked crossings this should not be less than 3 m from the nearest running rail.'

160 A poorly defined decision point was noted in the RAIB's investigation into the accident at Bratts Blackhouse UWC on 22 May 2006. The sightlines at the closest point where the crossing signage could be read by a motorist were too short to provide sufficient warning time to enable the user to cross in safety, even though train speeds were very low.

161 There are practical difficulties associated with the use of a decision point at a vehicle crossing. The main one is that the driver, particularly of agricultural machinery, may be a considerable distance from the front of the vehicle. If the marked point takes this into account, it may be so far back from the crossing as to require very extensive clearance of vegetation, at least some of which is likely to be outside the railway boundary. In this situation, it is likely to be appropriate to provide additional protection (such as telephones) at the crossing.

162 For an approaching vehicle there may, in practice, be two places to stop: the first is to allow the gates to be swung open in front of the vehicle; the second, closer to the railway, is the decision point, where a view along the line is obtainable. Any signs and markings provided for the decision point must make this distinction clear.

163 If it is possible to clear vegetation obstructing sighting from the decision point, then consideration of a practicable means of marking the point is the next step. In road traffic practice, a "stop" sign and solid white line across the carriageway are used. If the crossing approaches are not surfaced, it is not possible to apply a white line, but a suitably worded "stop" sign can be used in most situations (Figure 3). In every case an assessment of both the need for a marked decision point and the practicability of providing one would be needed.

Figure 3: 'Stop' sign at UWC

Additional protection measures

164 Reliance on sighting of approaching trains, whether or not a marked decision point is provided, limits the safe use of the crossing to periods of clear weather, and in some cases effectively to daylight (at locations where it may not be possible to pick out train headlights from other lights after dark). If this is the case, the result of a risk assessment, supported by use of the ALCRM, should be to identify the need for additional protection such as telephones to be provided.

165 If the nature of the railway and the signalling system is such that telephones cannot be relied on to give the user suitable information on the position of trains (paragraph 26), and it is not reasonably practicable to provide additional protection measures such as miniature stop lights, then the only way to ensure safety is closure of the crossing.

Signage and crossing users

166 The concept of the authorised user is not appropriate in the present day. When it was originally introduced, there was normally a clear-cut distinction between landowners or tenants who had rights to use the crossing, and other people who did not have permission to enter the land. Now, there are many organisations and groups of people which have rights and duties which may lead them to use private level crossings. These include statutory undertakings such as utility companies, delivery companies, central and local government employees, and members of the public using rights of way.

167 For crossing users in these groups, the legal difference between public and private crossings is not significant in practice. At UWCs they may be confronted with signs which are not easy to understand and provide confusing information on the nature of the crossing, the hazards that exist, and the way to use it.

168 Operators of railways or tramways that are crossed by a private road or path are authorised by section 52(1) of the Transport and Works Act 1992 to place near the crossing signs that are prescribed in Regulations made by the Secretary of State for Transport. These signs are prescribed by The Private Crossings (Signs and Barriers) Regulations 1996 (SI 1996 no 1786).

169 None of the signs prescribed by these Regulations actually inform the user that they are approaching a railway crossing, or what hazards they should be aware of. The message ‘Beware of Trains’ appears only at the bottom of a sign whose main message is ‘Stop - Look – Listen’. Signs are sometimes located some distance from the track, near the railway boundary, despite the requirement of RSPG that signs should be placed at the decision point (on footpath crossings). Because of this the sighting distance from the position of the sign can be very limited, and the user is left to judge for themselves the point from which to look for approaching trains (paragraph 60).

170 The signs warn people not to trespass on the railway. They place requirements on the users of large or slow vehicles, without defining what these are. They use railway terminology which is in some cases obsolete. They create confusion about what horse riders and dog walkers are supposed to do by referring to people crossing ‘with animals’. They rely entirely on written text to convey their message, rather than pictograms or diagrams, and do not emphasise the private nature of the crossing (Figure 4).

Figure 4: Signs and telephone at a UWC with a public footpath alongside it

171 There is considerable scope for review of the current law on signs, to make them more effective, coherent, comprehensible and accessible.

Options for improvement

172 Table 6 summarises some of the possible options for enhancement of safety at UWCs identified during the investigation. The cost figures are from RSSB's research[15]. In this context 'high' cost means greater than £100,000 per crossing, 'medium' is £10,000 – 100,000, and 'low' is less than £10,000.

[15] T335 Development of a Level Crossing Risk Management Toolkit, RSSB, 2008.

Enhancement option	For	Against	Comments
Provision of whistle boards	Gives user warning of approach of trains Low cost.	Relies on driver compliance. Environmental impact (noise). Audibility limited if user is inside motor vehicle or has hearing impairment. Inconsistent warning time as train speeds vary.	Not suitable as a protection measure for vehicle crossings.
Provision of telephones	Gives user information on approach of trains. Low to medium cost.	Increases signaller workload. Relies on user compliance Problems providing accurate information on whereabouts of trains. Relies on user compliance.	May be suitable in some cases.
Provision of telephone number for signal box	Low cost. Gives user information on approach of trains. Most users likely to have mobile phones.	Security concerns. Increases signaller workload. Possible problems providing accurate information on whereabouts of trains.	
Upgrade to MWL (conventional)	Gives user information on approach of trains.	High cost. Inconsistent information to user if train speeds vary.	Superseded by predictor technology where practicable.
Upgrade to MWL (using predictor)	Gives user consistent information on approach of trains.	Cannot be used on electrified lines at present. High cost (but less than conventional).	Now being trialled.
Provision of holding area inside gates on each side of line	Medium cost. Reduces number of times vehicle users need to traverse crossing.	May require land purchase. May mislead drivers about protection and decision point if not correctly signed.	See Figure 5. Should be combined with telephone or MWL protection.
Removal of gates	Medium cost. Reduces number of times vehicle users have to traverse crossing.	May increase risk to occasional users. Not suitable where animals are present and cattle grids are not practicable.	Requires some form of signal to road users to achieve sufficient conspicuity.
Marking of final decision point	Low cost.	Requires adequate standard of vegetation management. Needs to allow for position of driver in road vehicle.	May be suitable where adequate sighting can be obtained at specified point. Recommended in RSSB report.
Provision of power operated barriers or gates	Reduces number of times vehicle users need to traverse crossing Improves likelihood of gates being closed	High cost. Ongoing maintenance liability.	May be provided in partnership with user.
Monitoring by CCTV	Influence on user behaviour. Provides information on crossing usage.	High cost of installation and operation.	Installation costs reducing as technology develops. Does not provide protection.
Monitoring by gate counters	Provides low cost information on crossing usage. Can be used to drive reminder to user to close gates.	May not reflect crossing usage if gates are not used correctly.	Provides information but does not immediately improve safety.
Closure	Eliminates risk.	One-off cost.	Should be done wherever possible.
Speed restriction for trains	Improves warning time for crossing users.	Effect on rail journey time and line capacity – continuing cost.	Used where rail traffic is infrequent.

Table 6: potential enhancements for UWCs

Notes on technical aspects of enhancements

173 Where a crossing is approached by a fenced road on both sides, it may be possible to move the gates back to form a holding area for vehicles clear of the track, as shown in Figure 5. This avoids the need for the user to cross more than once in each traverse of the crossing, because the gate on the far side does not need to be opened until after the vehicle has crossed the line. The gate is no longer close to the decision point, so it is important that the instructions to users make it clear that the user must stop after passing the gate. This is so that they can first close the gate and then make the decision to cross, from a clearly marked decision point. Correct use of this arrangement will require lone users to walk the full length of their vehicle twice more and get out of the vehicle twice more than with the normal arrangements. This may be unattractive to some users. In some cases the use of very long agricultural vehicles may make the arrangement impractical.

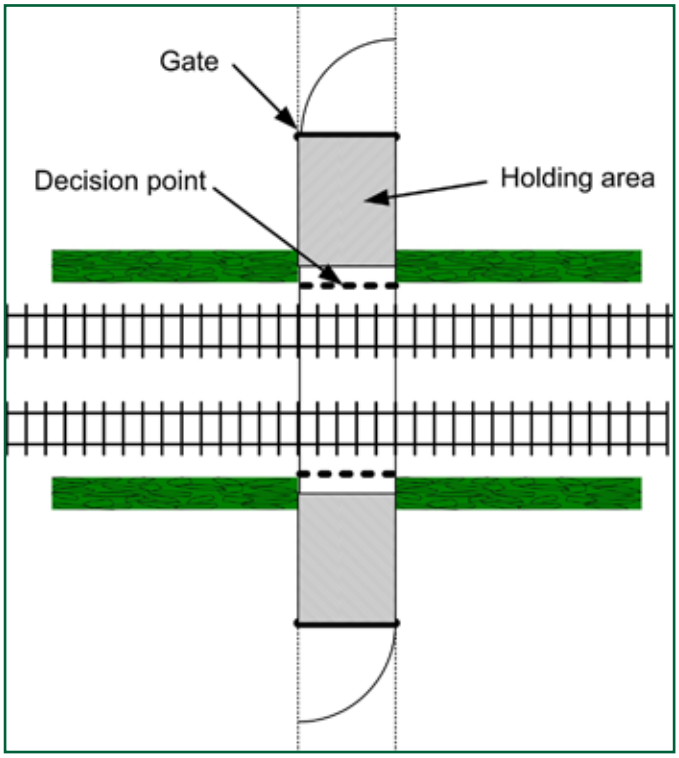

Figure 5: Sketch of possible layout of UWC with holding area inside gates

174 Power operated barriers, controlled by the crossing user, can reduce the number of times users have to traverse the crossing from five to one. They have been installed at a UWC in Scotland (Moulinearn). There are issues associated with user behaviour if the barriers can be raised with a train approaching, but if used with a key switch or swipe card, this system can restrict use of the crossing to authorised persons.

175 Removal of the gates at crossings fitted with miniature stop lights has taken place at one crossing in Cumbria (Figure 6). This was at a location where the crossing was heavily used to gain access to industrial premises and farm buildings over the crossing. It was felt that there was no prospect of gates being used correctly, and that it would be safer to remove them and brief all the authorised users to pay attention to the miniature stop lights. However, the signage was not altered and this raises questions about the message given to an unfamiliar user.

Figure 6: UWC with miniature stop lights, with gates removed (Network Rail)

176 This change was made in 1990, and there have been no significant incidents at this crossing subsequently.

177 Removal of gates might be combined with upgrading of miniature stop lights to road traffic lights. There is no legal basis for doing this at present and it remains a theoretical possibility, but could be considered as part of future strategy for the improvement of UWCs.

Closure of crossings

178 Rights to use a private crossing are usually enshrined in the Act of Parliament which authorised the construction of the section of railway. To close the crossing normally involves the user surrendering those rights in return for a payment by the railway. Alternative means of access to land may have to be provided or negotiated with other landowners.

179 If the crossing is of the accommodation type (i.e. giving access between two areas of land divided by the construction of the railway), the right to use it disappears if the owner of the land on one side of the line changes, so that the two areas are no longer in the same ownership. Many crossings have been closed for this reason.

180 Where the closure process is straightforward, it has often been done already. The number of crossings on the national network has been reduced from 27,000 to under 7,000 over the last 60 years, although many of the closed crossings were on railways which have been closed completely during this period. Network Rail has a national level crossing closure programme, which has a budget allocated to it. However, the closure process has slowed in recent years, mainly because of the increased cost associated with closure where alternative access routes have to be provided, and 47 crossings were closed in 2007.

181 It was alleged by some of those interviewed during the investigation that there is provision in law in the Republic of Ireland for private crossings to be summarily closed if repeated misuse takes place. Examination of the Irish statute book and literature issued by Iarnród Eireann (Irish Rail) has not discovered anything to support this belief.

182 The work done by the ORR (paragraphs 135 to 139) found that there was scope for discussion with users about crossing closure in about 20% of the cases examined, and there appeared to be opportunities for rationalising crossing use at locations where multiple crossings were being used by a single business. In most cases the user would require some additional access roads and/or modifications to an existing crossing before they could agree to closure of a crossing. Negotiations would be required to achieve closure in such cases, but successful closure would remove the source of risk, and reduce costs, and might enable better control of risk at the remaining crossings.

Reporting of incidents

183 There was not enough data in this study to establish whether or not there is substantial under-reporting of incidents at level crossings. If near-miss incidents are not reported by train drivers, it is possible that insufficient weight may be given to the risks at an individual crossing when the ALCRM is being used, or later when the practicability of mitigation measures is being considered.

Conclusions

184 The immediate cause of most accidents at UWCs is an error or violation by the crossing user. Errors by railway staff contribute to risk at user worked crossings in about 4% of incidents (paragraph 74).

185 Contributory factors include:

- expectation by the user that there will not be any trains in the area (paragraph 56);
- inconsistent or unreliable information available to the user on the whereabouts of trains (paragraph 154);
- absence of guidance on where the decision to cross should be taken (paragraph 60); and
- signs which give confusing instructions on how to use the crossing (paragraph 170).

186 The industry has undertaken research into improvements to crossings, which is summarised in this report. Network Rail have policies and arrangements in place for managing the risks at UWCs. ORR have an ongoing strategy for securing the control of risk at UWCs, as outlined in paragraphs 135 to 139.

187 The law relating to user worked crossings is dominated by nineteenth century provisions which are not appropriate for modern conditions. Changes in the nature of traffic using a crossing may take place without the knowledge or consent of the crossing operator, and there is no balance between the obligations of the railway and the user in such cases. There may be an opportunity in the near future for changes in the law relating to level crossings (paragraph 151).

188 Involvement of the authorised user (or other appropriate persons) in the preparation of a risk assessment for a UWC can be very valuable in informing Network Rail of the control measures needed at the crossing, but only takes place at present at crossings which have been assessed by Network Rail as higher risk (paragraphs 128, 137, **Recommendation 1**).

189 The signage in use at crossings does not highlight the presence of a railway, the nature of the risk, or the responsibilities of the user for their own safety. The signs are not always easy for all users to understand and the risks associated with individual crossings are not taken into account when signs are designed (paragraph 170, **Recommendation 8**).

190 The study carried out for this report showed that risk is likely to be concentrated at a few crossings, and there are many more near-miss and misuse incidents than actual collisions. However, defining an incident as a near-miss is often the result of a subjective judgement by a train driver, and the crossing user may not believe that they have done anything that endangers themselves or the train (paragraph 85).

191 The decision point at level crossings is not always marked. The RAIB's investigation into the fatal accident at Tackley station level crossing, Oxfordshire on 31 March 2008 (report 09/2009) found that the use of an unmarked decision point for assessment and inspection purposes, which did not reflect the behaviour of crossing users, was a possible contributory factor (paragraph 61, **Recommendations 2, 3**).

192 New methods of providing improved protection at UWCs using 'predictor' technology and electronic treadles are available and are now being tested by Network Rail with a trial at ten crossings (paragraphs 109 to 112, **Recommendation 4**).

193 If a crossing cannot be used safely in its existing form it should be upgraded or closed (paragraphs 165, 182, **Recommendations 2, 3**).

194 Suitable methods for estimating sighting distance are not defined by Network Rail in the guidance given to its staff who assess risk at UWCs, leading to inconsistency in the sighting times which are part of the data input to the ALCRM (paragraph 118).

195 Other methods of achieving safe use of UWCs, including the removal of gates or use of vehicle holding areas, combined with the use of road-type traffic signals, may be feasible and should be considered further (paragraph 172, **Recommendation 5**).

196 Northern Ireland Railways is currently in the process of responding to recommendations made by the RAIB to reduce risks at the UWCs on its network (paragraph 91, **Recommendation 6**).

197 The risks at crossings on heritage railways are lower because of the lower speeds involved, but the railways should ensure that they are aware of good practice in level crossing safety and take appropriate action to control risk (paragraph 148, **Recommendation 7**).

Changes to the law

198 The RAIB proposes that, when considering changes to the law relating to level crossings, the Law Commission should, in addition to taking into account the principles set out by ORR, consider the following specific objectives:

- The crossing operator should be made a statutory consultee in respect of planning applications which may affect the nature and volume of road traffic using the crossing (the RAIB has already made a recommendation in similar terms to this, in its investigation into a derailment near Moy, Inverness-shire, on 26 November 2005 (report 22/2006, recommendation 4)).
- The concept of the 'authorised user' should be replaced. The law should clarify the nature of private rights of way over crossings, recognising that all persons having business with the occupiers of lands served by UWCs may legitimately need to use the crossing. The intention of this submission is to improve safety by clarifying the duties and responsibilities of the various parties involved (paragraphs 166, 187).
- The operator of a crossing should be able to adopt and maintain appropriate measures for the safety of crossing users and others who may be affected by the operation of the crossing. The intention of this submission is to enable appropriate protection measures to be chosen, which may include alternatives to the gates which the present law prescribes (paragraph 177).
- The law should impose a duty on crossing users to comply with instructions displayed at a crossing, with appropriate offences and penalties for failing to comply (paragraph 150).
- The law should provide a simple and rational mechanism for the permanent closure of private crossings, with or without replacement, in cases where there is a reasonable alternative means of access to land (paragraph 182).

Recommendations

199 The following safety recommendations are made[16]:

1. Network Rail should invite the authorised user or other invitees (such as persons having business on the land) to participate in the preparation of comprehensive site specific risk assessments for UWCs in all cases The intention of this recommendation is that all factors affecting the use of the crossing should be considered when risk assessments are carried out, and that this should be done at all crossings, instead of just at those which have been assessed as higher risk (paragraph 188).

2. Network Rail should include in the risk assessments that it carries out for UWCs that are not equipped with telephones or lights an evaluation of whether there is sufficient information for users on where they should make a decision on whether it is safe to cross, based on the best sighting of approaching trains. Where deficiencies are identified consideration should be given to:

   - enhancement of sighting by the removal of obstructions (including improved management of vegetation), so removing the need for additional guidance to users;
   - the moving and/or adaptation of existing signs, gates or barriers;
   - the provision of an additional sign or visual feature to mark a point where users can wait in safety, clear of the line, and have sufficient sighting of approaching trains (ie at the final decision point); or
   - the upgrading of the crossing to an enhanced level of protection, using telephones or warning lights as appropriate to the location.

   The intention of this recommendation is that, as a result of risk assessment, users should be given sufficient information or protection to enable them to use the crossing safely (paragraphs 191, 193).

continued

[16] Those identified in the recommendations, have a general and ongoing obligation to comply with health and safety legislation and need to take these recommendations into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the Office of Rail Regulation (Recommendations 1 – 5 and 7), the Department for Regional Development (Northern Ireland) (Recommendation 6), and the Department for Transport (Recommendation 8) to enable them to carry out their duties under regulation 12(2) to:

(a) ensure that recommendations are duly considered and where appropriate acted upon; and

(b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 167 to 171) can be found on RAIB's web site at www.RAIB.gov.uk.

3. Network Rail should initiate research into reasonably practicable methods of marking the final decision point at those UWCs where such a solution is assessed as being appropriate. This scope of this research should include:
   - the requirement to reconcile the needs of various types of user (eg drivers of vehicles, pedestrians, cyclists and equestrians);
   - the various categories of UWC (including those which also include public footpaths and bridleways);
   - an analysis of where to locate such signs or visual features in relation to the track; and
   - the need to protect the railway from vehicle incursions.

   (paragraphs 191, 193).

4. Network Rail should, taking into account the results of the current trials with new technology, consider how the protection of UWCs which at present are without telephones or lights, can be improved to give the user reliable, consistent and timely warning of the approach of trains, and implement a programme to upgrade the crossings which would benefit from this protection (paragraph 192).

5. Network Rail should carry out an assessment of the risks and benefits of removing the need for the crossing user to open gates or barriers, in conjunction with the protection of the crossing by road traffic signs or lights of an appropriate type. The results of this assessment should be used to inform Network Rail's policy on the upgrading of user worked crossings (paragraph 195).

6. Northern Ireland Railways should take note of the findings of this report and review their risk assessment and crossing management arrangements accordingly (paragraph 196).

7. The Heritage Railway Association should draw its members' attention to this report so that individual heritage railways can note the findings and review their risk assessment and crossing management arrangements (paragraph 197).

8. The Department for Transport, in consultation with the Office of Rail Regulation, should review the requirements for signs prescribed by law for use at private crossings, and revise them as necessary, taking into account the need to convey information and instructions clearly and unambiguously to diverse users (paragraph 189).

Appendices

Appendix A - Glossary of abbreviations and acronyms

ABCL	Automatic half-barrier crossing locally monitored
AHB	Automatic half-barrier crossing
ALARP	As low as reasonably practicable
ALCRM	All level crossing risk model
AOCL	Automatic open crossing locally monitored
Auto LCRM	Automatic level crossing risk model
BTP	British Transport Police
CCTV	Closed circuit television
FWI	Fatalities and weighted injuries
HMRI	Her Majesty's Railway Inspectorate (post -1990)
LED	Light emitting diode
MOM	Mobile operations manager
MoP	Member of the public
MSL	Miniature stop lights
MWL	Miniature warning lights
NFU	National Farmers' Union
NOC	National Operations Centre
NWD	Novel warning device
ORR	Office of Rail Regulation
RAIB	Rail Accident Investigation Branch
RI	Railway Inspectorate (pre-1990)
RSPG	Railway Safety Principles and Guidance
RSSB	Rail Safety and Standards Board
SMIS	Safety management information system
UWC	User worked crossing

Appendix B - Glossary of terms

All definitions marked with an asterisk, thus (*), have been taken from Ellis' British Railway Engineering Encyclopaedia © Iain Ellis. www.iainellis.com

Automatic crossing	Any level crossing where the warning to highway users is given automatically, triggered by the approach of a train. This Includes Automatic Half Barrier (AHB), Automatic Barrier Locally Monitored (ABCL), Automatic Open Locally Monitored (AOCL), Automatic Open Remotely Monitored (AOCR) and Miniature Stop Light (MSL) Crossings.*
Automatic half barrier crossing	An automatic level crossing fitted with half barriers, traffic lights on the highway and a telephone to the relevant Signal Box.*
Automatic open crossing, locally monitored	A level crossing without barriers, that is equipped with a flashing white light which is observed by the train driver to confirm that the road lights are functioning before the train proceeds over the crossing.
Blocking back	The outcome of a queue of highway traffic extending across a level crossing following some upset on the highway.*
Facing points	A set of points installed so that two or more routes diverge in the direction of travel.*
Fatalities and Weighted Injuries	A measure used by RSSB to indicate the relative values of risks. For a set of events resulting in harm, the numbers of major and minor injuries are weighted in recognition of their relatively less serious outcome in relation to a fatality. The current weighting is 0.1 of a fatality for each major injury and 0.005 for each minor injury. The weighted values are added together to produce the FWI figure.
Position of safety	A place far enough from the track to allow a person to safely avoid being struck by passing trains. On Network Rail infrastructure this is 1.2m (4 feet) at speeds up to and including 100 mph, 2m (6 feet 6 inches) at speeds up to 125 mph, and 2.75m (9 feet) at speeds over 125 mph.*
So far as is reasonably practicable	Reduction of risk to a level of residual safety risk at which the cost of any further reduction in risk becomes grossly disproportionate to the benefit achieved.
Strike-in point	The location on the approach to an automatic level crossing at which an approaching train triggers the operating sequence of the crossing.*
Trailing points	A set of points installed so that two or more routes converge in the direction of travel.*
Wicket gates	A small gate sometimes provided to allow pedestrians to cross at their own risk after level crossing barriers have descended, or the gates are closed.*

Appendix C - Outline of legislation relating to UWCs

1 Each UWC is subject to the general legislation governing level crossings and to the arrangements laid down in the Act under which the railway was built (with any subsequent modifications, either statutory or by agreement between railway and landowner). Closure of the crossing will generally require provision of a grade separated alternative or a payment by the railway to the authorised user in exchange for giving up the right to use the crossing.

2 The Railways Clauses Consolidation Act 1845, section 68, requires the railway to make and maintain works for the accommodation of owners and occupiers of lands adjoining the railway, and to make 'sufficient post, rails, hedges, ditches, mounds or other fences for separating the…railway from the adjoining lands, and protecting such lands from trespass, or the cattle of the owners or occupiers thereof from straying thereout, by reason of the railway, together with all necessary gates made to open towards such adjoining lands, and not towards the railway'.

3 Where a private road is crossed by the railway, section 61 of the 1845 Act requires that the railway company shall 'if such highway be a bridleway, erect and at all times maintain good and sufficient gates, and if…a footway…gates or stiles, on each side of the railway where the highway shall communicate therewith'.

4 Section 75 of the 1845 Act created the offence of failing to shut the gates at accommodation crossings as soon as a user had passed through. The penalty for this offence now stands at £1000.

5 It is usual for the locations of public and private road crossings, and occupation crossings, to be specified in the enabling Act for each section of line. The persons for whom the crossing is provided are specified in the Act, and they and their successors are the only people who are considered to be authorised to use the crossing. The authorised user may permit other people, such as visitors and others having business on the land, to use the crossing. He has a common-law duty of care to people passing onto or across his land, but (if the authorised user is not carrying out a work activity, ie is a private individual using the crossing for domestic purposes) there is no specific obligation for him to provide briefing or instruction on the correct use of the crossing to such occasional users.

6 When a crossing user behaves in a way which endangers safety on the railway, the prosecuting authorities often invoke section 34 of the Offences Against the Person Act 1861, which states: 'Whosoever, by any unlawful act, or by any wilful omission or neglect, shall endanger or cause to be endangered the safety of any person conveyed or being in or upon a railway, or shall aid or assist therein, shall be guilty of a misdemeanor, and being convicted thereof shall be liable, at the discretion of the court, to be imprisoned for any term not exceeding two years.'

7 Where the authorised user of a crossing is a company, or is using the crossing in connection with a business (such as a farm), they have duties under the Health & Safety at Work etc Act 1974 to conduct their undertaking in a way which does not expose themselves, their employees or others (such as railway staff and passengers) to risk.

8 As noted in paragraph 35, unauthorised use of crossings can be difficult to prevent in practice, and may be unenforceable in law. The need for changes in the law to remedy this and other deficiencies relating to crossings was examined in detail in the report on the Cross Drove collision of 1939[17].

9 Where land-use changes may affect land adjacent to a railway, British Railways used to be a statutory consultee in the process of obtaining planning consent for the development. However, this obligation was not transferred to Railtrack (and later to Network Rail) as part of the privatisation process. Where the development is not immediately adjacent to the railway, but it may affect the volume and nature of traffic using a level crossing, there is also no such obligation to consult the railway. In its report on a derailment at Moy, Inverness-shire, on 26 November 2005 (report 22/2006) the RAIB made a recommendation to the appropriate authorities to make Network Rail a statutory consultee for planning applications in the vicinity of the railway. RAIB has been told that the Scottish Executive has accepted the recommendation, and the work initiated in relation to it will now form part of the Scottish Executive's general review of statutory consultees for the purposes of the modernisation of the planning system. In England, the Department for Communities and Local Government has accepted the recommendation and are in contact with Network Rail about amending the requirements as a statutory consultee for planning applications.

10 The Level Crossings Act 1983, as amended by the Level Crossings Regulations 1997 and the Railways Act 2005, gives ORR the power to require that Network Rail seeks a level crossing order for a crossing to which the public has access. This has the effect of compelling the upgrading of protection arrangements in cases where UWCs have effectively become public crossings because of changes in usage. However, only a very small number of crossings have come within the scope of this provision.

11 The Private Crossings (Signs & Barriers) Regulations 1996 prescribe the signs that may be erected at UWCs. The regulations give the crossing operator (normally Network Rail) the power to place signs of the prescribed type on the approaches to UWCs. They do not prohibit the erection of any other signs, but any variation from the prescribed patterns would require the agreement of the landowner on whose property the signs were placed. The deficiencies of the prescribed signs are discussed in paragraphs 168 to 171.

12 No other changes to the general law affecting UWCs have been made since 1939.

[17] http://www.railwaysarchive.co.uk/documents/MoT_CrossDrove1939.pdf

This page is left intentionally blank

This report is published by the Rail Accident Investigation Branch,
Department for Transport.

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Telephone: 01332 253300
Fax: 01332 253301
Email: enquiries@raib.gov.uk
Website: www.raib.gov.uk