Road-Rail Interface Safety

A guide to RSSB research in Road-Rail Interface Safety

April 2011
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**What is RSSB?**

RSSB facilitates the resolution of difficult cross-industry issues and builds consensus.

RSSB delivers a unique mix of products and services to the industry – supplying knowledge, analysis, a substantial level of technical expertise and powerful information and risk management tools.

RSSB is a not-for-profit company owned by major industry stakeholders, working together to:

- **Continuously improve the level of safety in the rail industry**
- **Drive out unnecessary cost**
- **Improve business performance**

The company is limited by guarantee and is governed by its members, a board and an advisory committee. It is independent of any single railway company and of their commercial interests.
A key part of RSSB’s product range is the research and development (R&D) programme that it manages on behalf of the railway industry. The programme is funded by the Department for Transport (DfT) and aims to assist the industry and its stakeholders in achieving key objectives:

- **Improving performance in terms of health and safety, reliability, and punctuality**
- **Increasing capacity and availability**
- **Reducing cost**
- **Integrating all of these to compete effectively with other transport modes (or complement them as appropriate) and deliver a sustainable future for the railway**

The RSSB-managed rail industry research programme focuses on industry wide and strategic research that no individual company or sector of the industry can address on its own. The programme is also instrumental in supporting the development of a future vision that can be best delivered. In addition, RSSB manages the rail industry strategic research programme which has been specifically developed to support industry and its stakeholders in the delivery of ‘step changes’ in industry strategy in 10, 20 and 30 years time – as outlined in the Rail Technical Strategy.

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Operations and Management Research

Operations and management research covers seven major research topics, which are:

- Health
- Road-Rail interface
- Operations
- Public behaviour
- Workforce development and competence
- Sustainable development
- Safety policy and risk management

This booklet focuses on the area of RSSB research covering Road-Rail interface safety:

- Informing you about research that has been done
- Showing you where to find the results of the research
- Encouraging you to find out more, including registering to receive the RSSB R&D e-newsletter

The R&D programme has generated substantial knowledge, information and resources – all specifically designed to support the rail industry’s day-to-day operations, at senior level and on the front line.

This booklet provides only a brief insight into the projects – the best way to find out more information about each project is to go to the Research and Development section of the RSSB website – www.rssb.co.uk – where you can find more details including links to the reports and outputs.
The Road-Rail interface topic covers R&D into the causes of misuse, the effectiveness of existing and new technologies in reducing risk, and ways of improving the management of level crossings, including improved risk profiling. The scope of this topic covers both footpath and station crossings, as well as road vehicle crossings. It includes technical, human factors and economic issues that affect the railway (and roads) at level crossings, of which there are almost 6700 on the national rail network. It also covers the causes and incidence of bridge strikes and other vehicle incursions onto the railways.

At the broadest level, the topic considers the impact of external and societal changes on level crossings and other places where the road network impinges on the railway, including bridges. The scope extends beyond the rail industry and the British context to understand and learn from best practice elsewhere.

Road-Rail interface research is conducted in nine main areas, which are:

**Area 1 - Understanding the risk at level crossings to enable prioritisation of remedial actions**

Research in this area looks at the societal and attitudinal changes to risk taking and to authority in general, and how changes may lead to positive or negative effects in terms of safety at level crossings. Different social groups may behave, and change their patterns of behaviour, in different ways. Practical application of knowledge in this area would include improving the design of safety communications.
Area 2 – Identifying and sharing good practice in Britain and overseas to facilitate the adoption of appropriate solutions

Research in this area has investigated:

- International practices on Road-Rail issues that help deliver safety improvements, which are reasonably practicable and fundable within the current industry arrangements
- Experience gained within Canada regarding ‘second train coming’ signs
- The use of risk models world-wide
- Good practice in the education of the risks associated with level crossings

Area 3 - Identifying new technical and operational solutions to prevent errors and misuse of crossings

Research in this area aims to assist the industry by investigating possible solutions such as:

- Alternative technologies, such as signage, cameras, road markings, vehicle-activated signs and traffic calming to understand what works best
Road-Rail interface safety

Area 4 - Understanding the costs of level crossings and the benefits of adopting alternatives to optimise societal benefits

Research in this area reviews how the costs associated with maintaining, operating, upgrading, and renewing level crossings may be reduced. A comprehensive model has been created to aggregate the various whole-life costs of a public road crossing, allowing the industry to decide, using cost benefit analysis, whether it is economical in the long term to replace any particular crossing by a bridge or by diverting traffic to other routes. This model will assist in the development of business cases for crossing closures or conversions to bridges. Research can also assist in improving safety at public level crossings by understanding why current upgrade techniques can be expensive, and identifying how less expensive, yet effective, upgrades can be implemented.

Area 5 - Working in collaboration with highway and planning authorities to design out safety risk and reduce the overall cost to society

Research can contribute to the development of better relationships with external agencies representing public authorities and stakeholder groups. In particular, a better appreciation of highway issues and working together with planning authorities may help address the overall residual safety risk, design risk out of new schemes at source, reduce road congestion / delay issues and save money through integrated planning.
Issues that have already been identified as requiring research support under this area include:

- The use of level crossing signs on public and private roads
- The timing of amber lights and whether it is sufficient
- The impact on the road network with the introduction of extra and faster trains
- The impact of smart rerouting to help high vehicles avoid bridges on the road network
- The potential use of cheap bridge crossings and footpaths at level crossings
- The lower overall weight of modern trains (especially their leading vehicles) against the increased size and weight of heavy goods vehicles

Area 6 - Understanding the needs of vulnerable users at level crossings to facilitate social inclusion

Research has been undertaken to inform future developments of new crossing types (or modifications to existing designs) to take account of the need of vulnerable users, particularly pedestrians and other non-motorised users at level crossings.

This research should also look at how to reduce the impact of any potential ‘vulnerable-user’ solutions on ‘able-bodied’ users.
Area 7 - Review and overhaul of the legislative framework for level crossings to identify legal requirements and consolidate disparate regulations

Members of R-RISG identified the need for a review and overhaul of the legislative framework for level crossings, consolidating disparate laws/regulations into a single act covering road, rail and planning issues. Government has invited a review by the Law Commissions of England and Wales, and Scotland and inputs have been made to the process. Research could also assist in defining the needs and areas for change, and help secure a legislative, consultative and standards framework that engages all parties and facilitates adequate risk control by duty holders.

Area 8 – Research into bridge strikes and vehicle incursions

Members of the Bridge Strike Group have identified various research questions which need to be explored and, if appropriate, turned into research projects. Research is in progress to:

- The need to understand, from a human factors perspective, why some truck and bus drivers fail to realise that their vehicles are too high to go under the bridges they are approaching and, what training would ensure motorists would know the height of their vehicles
- Developing a specification for roadside cameras to be located at low bridges to prevent and, if that fails, record accidents
- Evaluating the effectiveness of interactive road signs and which bridges should have them installed
- Reducing the already relatively low level of vehicle incursions on the railway away from level crossings and bridges

Area 9 – Research to support inquiry recommendations, government and regulatory policies, proposed and new legislation

Research is from time to time required to ensure recommendations relating to the management of relevant risks from investigations of recent major incidents, from Rail Accident Investigation Branch (RAIB) investigations as well as other ORR and industry investigations, are satisfactorily addressed. The impact on the railways from changes to Traffic Management Acts and future increases in the use of congestion charging may also need to be investigated.
# Road-Rail interface projects - published

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### T000 User worked and footpath level crossing research

**Description**
Understanding risk relating to user-worked and footpath level crossings by surveying 300 crossings, interviewing users and analysing accident data. Proposing improved risk control measures, incident reporting and data collection.

**Abstract**
Residual risk associated with user-worked and footpath ‘passive’ crossings has remained constant over recent years, while that relating to automatic crossings has been substantially reduced through industry efforts. This study explored the hazards and risks at passive crossings, focusing in particular on user (driver and pedestrian) perception of risk. By surveying over 300 passive crossings, interviewing users, analysing accident data and working with industry experts, A D Little concluded that certain crossing and user characteristics constituted key risk influencing factors - gates being left open; high crossing utilisation; and trains running infrequently. Poor sight time and frequent and fast trains were associated with lower risk, as they seemed to increase user vigilance. A higher than expected proportion of accidents was found to involve road vehicles. Recommendations on risk control included technical enhancements to counter gate abuse, better road markings, consistent use of train whistles, and user education, as well as improved data collection.

**Published**
August 2001

**Current Position**
This was the first piece of research undertaken just as the research programme was beginning. It helped define the problems and led to a sequence of implementation activities.
T028 Development of a universal level crossing risk tool

Description
Developing a risk tool to encompass all level crossings and locating the tool in a web browser environment in line with Network Rail Information Management strategy.

Abstract
This project was carried out by Arthur D Little and Strategic Thought for RSSB and Network Rail. It extended the application and functionality of an existing risk model for automatic level crossings to all level crossings. The new model, the All Level Crossings Risk Model (ALCRM), improves Network Rail’s ability to manage the risk to crossing users, passengers and rail staff by targeting those crossings with the highest risk for remedial measures. Complex algorithms created by Arthur D Little were transferred by Strategic Thought to a web-browser software environment. This allows local Network Rail level crossing practitioners to enter data for their crossings and establish the risk for each. A key feature of the project, requiring the closest co-operation between the two suppliers, under the management of Network Rail Information Management, was to ensure that in the transfer the model’s integrity was not corrupted.

Published
July 2007

Current Position
The project won the 2007 Award for the Advancement of Railway System Safety. The level crossing tool that was developed, the ‘All Level Crossing Risk Model’ (ALCRM), is being used by Network Rail to assess the risk at their crossings and is a key plank in its level crossing strategy. It led directly to some further research T737 Documenting the All Level Crossing Risk Model to provide a description of the development of ALCRM and to an enhanced specification for the ALCRM so that future developers would be able to see the structure and functionality of the model easily and quickly thus facilitating future upgrades to the model. T936 Enhancing the accuracy and functionality of the All Level Crossing Risk Model, which will further update the model, is just beginning.
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<tr>
<td><strong>Description</strong></td>
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### T105 Wayside horns at level crossings

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<tr>
<th><strong>Description</strong></th>
<th>Establishing the best way to deliver audible warnings to crossing users should noise bans make it impossible to rely on horns operated by train drivers.</th>
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<tbody>
<tr>
<td><strong>Abstract</strong></td>
<td>This research, conducted for RSSB by A D Little, was an initial report addressing the potential of road-side directional horns, which are triggered by the approach of a train and can target specific road users (pedestrians and motorists), to reduce complaints about noise pollution generated by driver-operated train horns. The research reviewed synergies with Network Rail research on novel warning devices, the issues that wayside horns could help resolve at passive level crossings and the additional benefits, costs and environmental noise impacts arising from the replacement of the traditional ‘yodel’ alarm at automatic level crossings by wayside horns or other audible warning devices. Changes to the Rule Book requirements on the use of horns at level crossings and the downward revision of the noise volume specified in the Standard applying to train horns, both made since this research was undertaken, have resulted in further research in this area being curtailed.</td>
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<tr>
<td><strong>Current Position</strong></td>
<td>Since this research was carried out, there has been a review of the Rule Book requirements for the use of horns at level crossings, and changes have been made.</td>
</tr>
</tbody>
</table>

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**RSSB**

19
### T232  Improving level crossing information systems

**Description**

Improving Network Rail’s national level crossing information database - ALRMS. Assessing user and stakeholder requirements, the strengths, weaknesses, and opportunities to upgrade the system, to manage level crossing risk better.

**Abstract**

The 8000 level crossings on Britain’s national rail network represent a major area of risk in terms of accidents. Maintaining accurate and up to date information on crossings has a key role to play in reducing this risk. Data is currently held by Network Rail within the Access Level Crossing Risk Management System (ALRMS). This research project, conducted for RSSB by Halcrow, aimed to identify opportunities to improve ALRMS through such measures as links with other industry systems, integration of regional data to allow exploration of national trends and improvements to data integrity. The research scoped the then current situation, industry’s requirements, and how the gap between these could be closed. It examined how comprehensive information about asset, risk and accident data could be provided for all crossings on a national basis. Subsequent to the production of Halcrow’s interim report it was decided to incorporate much of the functionality required in the all level crossing risk model (research project T028) which itself will have links to the various Network Rail databases.

**Published**

February 2006

**Current Position**

It was decided to incorporate much of the functionality required in the ‘All Level Crossing Risk Model’ (ALCRM). See research project T028 Development of a universal level crossing risk tool which itself has links to the various Network Rail databases.
## T269 Human factors risk at user worked crossings

### Description
Gaining a better understanding of human behaviour at user worked crossings and identifying contributory factors to risk at the crossings. Evaluating potential risk reduction measures.

### Abstract
This research assessed aspects of risk arising from human behaviour at user worked crossings, which comprise half the 8,000 crossings on the Network Rail infrastructure. Conducted for RSSB by Human Engineering, it also evaluated a range of measures to mitigate this risk. 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 are helping to reduce risk at user worked crossings 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.

### Published
June 2004

### Current Position
The project led to a number of initiatives and follow-on research. Using the results of this project, the industry was able to overcome a view that vehicle users at user worked crossings would not look again for oncoming trains once they had returned to their vehicles after going through the gate opening procedures. The project also highlighted that users did not understand well the differences in warble tone that signified another train was coming very close after the passage of a first train. This led to another research project that focused on this issue and produced guidance on the way forward, see T652 Examining the benefits of ‘another train coming’ warnings at level crossings.
<table>
<thead>
<tr>
<th><strong>T332  Understanding the risk at station and barrow crossings</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Examining the requirements for the use of station and barrow crossings to traverse the track. Assessing current safety controls, and the scope of procedural or technical innovation to reduce risk.</td>
</tr>
<tr>
<td><strong>Abstract</strong></td>
</tr>
<tr>
<td>Station and barrow crossings represent an area of risk, principally in the individual rather than catastrophic category. This risk had not previously been quantified, yet there is a concern that a serious accident could happen. This research examined the requirements for the use of station and barrow crossings to traverse the track. It assessed the current safety controls, the level of risk and the scope of procedural or technical innovation to reduce that risk. In particular, it also investigated the extent to which current usage is essential or could be more limited, whether existing controls are understood and obeyed, and what would be needed to make users behave appropriately. The study found that there is a lack of clarity as to the number, usage and designation of station and barrow crossings, and it would appear that in general, past upgrades of level crossings to provide lights have been made at crossings with higher line speeds and train frequencies; in other words focused at potentially higher risk crossings. However, the risk assessments currently being undertaken by Network Rail will provide a much better means of focusing risk mitigation.</td>
</tr>
<tr>
<td><strong>Published</strong></td>
</tr>
<tr>
<td>November 2005</td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
</tr>
<tr>
<td>Findings from this project have led to further research being undertaken, T730 Understanding human factors and developing risk reduction solutions for pedestrian crossings at railway stations and also T652 Examining the benefits of ‘another train coming’ warnings at level crossings.</td>
</tr>
</tbody>
</table>
Description
Understanding the cost-effectiveness of, and issues surrounding, red light cameras and investigating alternative deterrent and enforcement strategies used in Great Britain and overseas.

Abstract
This research reviewed experience of red light enforcement equipment (RLEE) at level crossings in Great Britain. RLEE includes cameras, data capture and vehicle sensing apparatus. The research identified and examined technical, commercial, and legal issues associated with the use of this equipment. It reviewed changes in safety brought about by the introduction of cameras at eight Scottish and seven English crossings in 2000 and 2003 respectively. The review included the effect of prosecutions by the British Transport Police of motorists photographed passing the stop line. The research focused on the cost effectiveness of the equipment installed and concluded that potential advances in technology, coupled with legal acceptance of securely transmitted digital evidence from the crossing site, may make this a cost-effective deterrent. Complementary research was undertaken to look at other deterrent and enforcement strategies used by other industries and by overseas administrations, including vehicle activated signs, median barriers, etc.

Published
May 2007

Current Position
The project highlighted the need for a research-led examination of red light enforcement with a trial at a number of crossings focusing on clearly defined ‘before installation’ and ‘after installation’ phases to elucidate the costs and benefits of the current generation of red light enforcement equipment. This is now being taken forward by Network Rail, and both fixed and mobile camera units began to appear across Britain early in 2011.
## T334 Reducing the risk to motorists traversing user worked crossings on foot

<table>
<thead>
<tr>
<th>Description</th>
<th>Examining technical solutions to risk reduction at user worked crossings where users are currently required to traverse the crossing four times on foot to open and close gates.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>There were approximately 2,700 user worked crossings on Britain’s national rail network when this research was started. They 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. The 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.</td>
</tr>
<tr>
<td>Published</td>
<td>August 2009</td>
</tr>
<tr>
<td>Current Position</td>
<td>A site specific risk assessment will be needed for each crossing where co-acting gates could be installed. Network Rail is now working towards a trial of these gates at two sites. The opportunity to consider wider adoption at more level crossings may be then considered.</td>
</tr>
</tbody>
</table>
T335 Improving road user and pedestrian behaviour at level crossings

Description
Evaluating existing research into human behaviour at level crossings to understand and prioritise the risk associated with these behaviours, and to construct a practical guidance tool for practitioners to apply appropriate mitigations.

Abstract
This research has undertaken 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.

Published
July 2008

Current Position
The Level Crossing Risk Management Toolkit (LXRMTK) produced by this project is widely used by Network Rail level crossing practitioners. The toolkit allows them to choose appropriate risk mitigations and gives salient details of each, such as the cost (range). The toolkit works well in tandem with the All Level Crossing Risk Model; the latter assesses the risk, the former suggests ways of managing it. A technical update for the toolkit has been completed: T863 Updating the level crossing risk management toolkit.
<table>
<thead>
<tr>
<th><strong>T336 Modelling the economics of level crossing closures and conversions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Abstract</strong></td>
</tr>
<tr>
<td><strong>Published</strong></td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
</tr>
</tbody>
</table>
**T364  The cost of level crossings - an international benchmarking exercise**

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>This research benchmarked the costs of upgrading level crossings in Britain and overseas. It aimed to discover how to achieve increased safety at crossings for lower cost.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abstract</strong></td>
<td>This research aimed to improve safety at public level crossings. A study of the current cost structure of various upgrade options was carried out by A D Little for RSSB to identify how inexpensive, yet effective, upgrades can be implemented. It identified some causes of high upgrade costs and the options available to reduce them, focusing on the supply chain, contractual arrangements, project management, approvals and technical innovation. This research was specifically designed to analyse the costs of the migration path from the British crossing type called AOCL to another called ABCL or another called AHB, or their international equivalents. (AOCL is an automatic open crossing locally managed by train crew; ABCL an automatic barrier crossing locally monitored by train crew; and AHB an automatic half barrier crossing.) The desired output was to understand how such changes could be effected less expensively. 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. Safety and economic benefits are expected to arise from reduced upgrade costs, reduced accident costs, and reduced risk at particular level crossings.</td>
</tr>
<tr>
<td><strong>Published</strong></td>
<td>September 2006</td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
<td>The findings were shared with a large number of infrastructure managers, operating level and grade crossings throughout Europe and overseas. Many of them, including the infrastructure manager responsible for such crossings in Great Britain, Network Rail, were able to assess where they found themselves in the 'league tables' which should help drive down costs and promote the adoption of smarter solutions.</td>
</tr>
</tbody>
</table>
## T521 Developing enhanced consequence algorithms for level crossing risk models

### Description
Developing enhancements to the automatic level crossing risk model and the specification of the all crossing risk model.

### Abstract
Following the accident at Ufton Nervet on 6 November 2004, further work was commissioned from A D Little to enhance the consequence algorithms for the existing automatic level crossing risk model and the all level crossing risk model currently under development. This factored in the potential risk from infrastructure, such as (but not exclusively) facing points, which are situated beyond level crossings in the direction of travel. The analysis found that relatively few crossings have obstacles that lie immediately after the level crossing, and in most of these cases the likely train speed will be low, and/or there are low train frequencies. This meant that the additional risk resulting from the presence of obstacles is a small component of the total risk at level crossings. Network Rail has incorporated the algorithms created by this research into the remit for the all level crossing risk model, which is expected to be in use by the end of 2006.

### Published
February 2006

### Current Position
This was a very specialised research project which concentrated on low frequency, high consequence accidents following the accident of Ufton Nervet. The results were fed directly into T028 Development of a universal level crossing risk tool.
T522  Research into obstacle detection at level crossings

**Description**
Understanding the potential opportunities and challenges posed by installing obstacle detectors at level crossings in Great Britain by examining the technicalities, logistics, cost and safety benefits of

**Abstract**
Obstacle detectors at level crossings are used to detect obstructions capable of causing significant damage to a train, or to assist the signaller in charge of a closed-circuit television (CCTV)-controlled crossing to know that the crossing is clear before the gates are closed. In order to avoid unacceptably high levels of safe-side (false) trips, the system has to be sensitive enough to distinguish a significant threat to a train such as a car from an insignificant threat like a shopping basket or a fox. Obstacle detectors are used on several overseas railway administrations. The opportunities and challenges posed by these detectors need to be understood if they are to be used successfully in a cost effective way in Britain. The project investigated the technicalities, logistics, cost and safety benefits of the most promising potential solutions for automatic half barrier crossings and for crossings manually controlled with the aid of CCTV and made several recommendations, which are being assessed for implementation by Network Rail.

**Published**
November 2006

**Current Position**
The findings from this research project have been actively pursued by Network Rail. The first trial of a crossing fitted with obstacle detection is in progress at Filey. Further research work has been undertaken to understand some of the detailed implications; see T729 Further work on obstacle detection at level crossings.
# T524 Use by other railways of risk models and risk assessments for level crossings

## Description
Assessing the benefits of various risk models and risk assessments for level crossings used by railway administrations in Great Britain, Ireland and overseas. Many countries have risk models for the level crossings on their railways. This project compared some of these models with the All Level Crossing Risk Model (ALCRM) and assessed their benefits to see if any could be applied to the ALCRM.

## Abstract
The risk model for level crossings on Network Rail-owned infrastructure was developed in the early 1990s by AD Little and has been working satisfactorily for some ten years for automatic level crossings. Other level crossings were encompassed in a major upgrade, known as the All Level Crossing Risk Model (ALCRM), which is being rolled out. Other risk models are being used within the British Isles. The research sought to compare other British, and overseas, models to establish whether they can augment or improve the ALCRM. The research showed that the ALCRM is a sophisticated model and is fit for purpose for the environment within which it is used. It also produced seven ideas for developing the ALCRM further and these are being considered by Rail Safety and Standards Board (RSSB) and Network Rail as appropriate.

## Published
May 2007

## Current Position
This research project provided useful guidance to those involved in risk modelling in Great Britain as it showed that the ‘All Level Crossing Risk Model' (ALCRM) was one of the more sophisticated level crossings models in the world. It was decided that one of the ideas from the project - to promulgate good practice in level crossing management - would be included in the update of the Level Crossing Risk Management Toolkit. See T863 Updating the level crossing risk management toolkit.
# T527 Analysis of research ideas from recent international level crossing conferences

<table>
<thead>
<tr>
<th>Description</th>
<th>The research captured research ideas raised at recent level crossing conferences and ranked them in order of priority.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>This research project focuses on the outputs from a number of international meetings at which level crossing research practitioners met to discuss their projects and plans. The aim of this project is to ensure that the findings from these meetings - International Level Crossing Symposium, the meetings of the European Level Crossing Research Forum, and other industry conferences on level crossings - are understood, classified, and used to inform the research that RSSB undertakes in the short and longer term. The work was supported by the National Level Crossing Group who are considering future research ideas which have been identified in this piece of research.</td>
</tr>
<tr>
<td>Published</td>
<td>June 2007</td>
</tr>
<tr>
<td>Current Position</td>
<td>This work was supported by the National Level Crossing Safety Group (now the Road-Rail Interface Safety Group), which considered the potential research ideas identified by the project as part of the development of its topic research plan. It helped benchmark existing research against other ideas being investigated elsewhere.</td>
</tr>
</tbody>
</table>
## T528 Attitudes to, processes and funding for, crossing closures in other countries

### Description
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.

### Abstract
Level crossings bring no benefits to railways. They bring several disadvantages, for example they are hazardous to train-borne passengers and operating performance. In many cases they are expensive to operate, maintain, and upgrade. For this reason, the first and best solution to the problems posed by level crossings is to close them. The process to close a crossing will vary with the type of level crossing under consideration. A public road crossing will demand a great deal more effort with a great many more stakeholders than an accommodation crossing that is only used by one farmer. The present view in Britain of level crossing closures is that as the railway originally caused the crossing to come into being, the railway should pay for its closure. Many overseas administrations take a different view. In order to inform the debate in this country about what the processes and protocols should be for closure, this research examined how other countries deal with closures. The work also recorded what funding mechanisms are used to support ongoing operation and upgrades of crossings in the countries studied.

### Published
June 2007

### Current Position
The information produced by this project was fed into the review of level crossing legislation being led by the Law Commissions of England and Wales, and of Scotland. The Commissions produced a consultation paper in 2010, and a draft Bill is planned to follow, probably in 2012.
### Description
Evaluating the safety benefit to the railway industry brought about by installing new miniature warning lights at user worked crossings previously not protected by warning lights.

### Abstract
There are some 4,000 user worked level crossings (UWC) in Great Britain. Some 150 are protected by miniature warning lights (MWL). The cost of installing MWLs is considerable (about £300,000) and it has always been difficult to assess the safety benefit of installation as we do not have safety data before and after installation. A separate project - the Novel Warning Device project - is independently installing MWLs at three UWCs. There is an opportunity to film the crossings in shadow mode for three months and then for three months when the MWLs are visible to the public. With careful measurements and analysis, it might well be possible to assess the safety benefit of MWLs which will underpin future investment decisions on their installation. These decisions will be especially important in the next few years as new technology promises to reduce installation costs.

### Published
June 2007

### Current Position
See notes under T821 Further work on miniature warning lights at user worked crossings.
Network Rail is currently planning for the next generation of level crossing designs. This research proposes a number of generic solutions that could be considered at renewal or upgrade of level crossings in order to improve accessibility and reduce risk.

This research was carried out on behalf of the Road-Rail Interface Safety Group and in conjunction with the Disabled Persons Transport Advisory Committee (Rail) (DPTAC), to help inform the upgrade and/or renewal of public road level crossings so as to take account of the accessibility issues facing disabled pedestrians. It has identified, reviewed and ranked current facilities which disabled pedestrians may find difficult to use at level crossings on public roads in Great Britain (GB) in order to present solutions that aim to improve accessibility for all users.

Drawing on an initial list provided by disabled representatives from DPTAC and JCMPS (Joint Committee on Mobility of Blind and Partially Sighted People) and a workshop including representatives from the rail industry, site visits were made to determine the accessibility issues that disabled pedestrians face. Additionally, the level crossing task process was defined and a task analysis conducted. Workshops with disabilities groups and industry representatives were held to investigate problems and solutions.

In general it was found that level crossings achieve a moderate level of accessibility in their current state and that the Railway Safety Principles and Guidance (RSPG2E) already provides a wealth of guidance on accessible features that, if applied consistently across the network and maintained to the required standard, would bring a marked improvement in accessibility for pedestrians with disabilities. Nevertheless, several access problems exist at level crossings, falling into three specific categories: identification of the crossing, decision-making, and navigation and physical access.

The research identified 77 potential solutions in these areas which were scored and ranked; 12 of these were selected to address the key deficits in accessibility that are a priority for the rail industry. As was the intention with this research, the recommendations proposed are generic and have
been developed in order to support the duty holder in understanding the various generic issues and solutions to level crossing accessibility issues.

In light of the findings, Network Rail as the duty holder has considered the recommendations and has undertaken to take all of the findings into account when crossings are renewed or upgraded. It has also proposed that some of the findings should go into the Level Crossing Risk Management Toolkit when it is next updated so that additional measures at a specific crossing can be considered should it become apparent that a large number of people with accessibility problems are using it. The main benefits from the implementation of this research will not be realised immediately but as each crossing is renewed or upgraded. On a localised basis, crossing by crossing, a combination of some or all of the 12 recommended solutions will improve accessibility not only for people with one or more disabilities, but for pedestrian users generally.

Published February 2011

Current Position Network Rail has accepted the recommendations contained in this report and will incorporate the appropriate measures (as determined by site-specific circumstances) as crossings are upgraded in the future.
### T652 Examining the benefits of ‘another train coming’ warnings at level crossings

<table>
<thead>
<tr>
<th>Description</th>
<th>Examining the benefits that special warnings that ‘another train is coming’ can give to users of level crossings, and how these warnings may best be delivered to the user.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>There have been a number of accidents at level crossings that might be attributed to users not appreciating that another train is coming after a train has passed over the crossing. It is also possible that users can be distracted by a stationary train or one advancing slowly in the vicinity of the level crossing, only for the user(s) to be struck by a train coming from the opposite direction. Various types of warning have been tried in the past such as special illuminated ‘another train coming’ signs, a change in the warning tone, etc. The project studied the various solutions presently available, considered overseas administrations’ experiences and, following an industry workshop, came up with a short list of promising solutions. The preferred options were then tested on 624 members of the public (via video simulation) to gain an understanding of their potential effectiveness. These levels of effectiveness were factored into cost benefit analyses. The overall results indicated that fitting another train coming warnings at user worked crossings protected by miniature warning lights at stations is supported by cost benefit analysis. Network Rail is presently considering how it should take forward the research findings.</td>
</tr>
<tr>
<td>Published</td>
<td>December 2008</td>
</tr>
<tr>
<td>Current Position</td>
<td>Network Rail is currently considering how it should take forward the findings in the report. The research was also fed into project T730 Understanding human factors and developing risk reduction solutions for pedestrian crossings at railway stations.</td>
</tr>
</tbody>
</table>
**T653  Safer European level crossing assessments and technology (SELCAT)**

<table>
<thead>
<tr>
<th>Description</th>
<th>To provide an overview of existing and planned level crossing research and a standard method of reporting level crossing accidents in European countries.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>SELCAT (Safer European level crossing assessments and technology) was a project funded by the European Commission (EC) under the sixth framework programme. The principal client group for the Rail Safety and Standards Board (RSSB) input to the project was the Road Rail Interface Safety Group. The project aimed to provide an overview of existing and planned level crossing research and a standard method of reporting level crossing accidents in European countries. The SELCAT consortium comprised 19 partners from the rail and road sectors, and academic and scientific organisations, with three of the members coming from Great Britain: RSSB, Network Rail, and the University of Birmingham. There were also partners from China, India, Morocco and Russia. The research was designed to codify and analyse the current state of knowledge and to help all partners to understand good practice and to inform and influence future policy developments by the European Rail Agency. The involvement of the British partners gave international visibility of existing good practice in risk modelling, level crossing management, technological developments, data collection and application, and research and development, whilst helping the railways in Great Britain to see if changes to existing approaches would be beneficial. The deliverables from SELCAT, in the form of several reports and appendices, were delivered to the EC in September 2008 and will be disseminated more widely once the Commission has concluded its review of them.</td>
</tr>
<tr>
<td>Published</td>
<td>March 2009</td>
</tr>
<tr>
<td>Current Position</td>
<td>The work was split into three work packages plus a ‘dissemination activity’. A crucial prerequisite for the collection of relevant information in the form of documents or statistics was the design and development of a level crossing web portal: <a href="http://www.levelcrossing.net/">http://www.levelcrossing.net/</a>. Its ontology based implementation features provided for an effective and easily accessible knowledge management system. Its functionality provides for the direct use of a tool for international level crossing safety performance monitoring in accordance with the Railway Safety Directive.</td>
</tr>
<tr>
<td>Description</td>
<td>To evaluate the risk at whistle board crossings and determine what level of mitigation is reasonably practicable to implement.</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Abstract</td>
<td>One of the principal forms of protection for level crossing users at the many ‘passive’ crossings in Great Britain is the sound provided by train horns. In recent years the noise from train horns has increased as modern train fleets have been designed to meet higher required standards, and there have been many complaints about noise pollution and general disturbance. An initial hazard and operability study has been undertaken by the Rail Safety and Standards Board (RSSB), examining the influence of the use of the train horn at footpath crossings. RSSB has 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. 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. A toolkit has been designed for use by railway staff assessing the need for whistle boards at specific locations. This research is one of a suite of three related projects designed to provide background information for decision makers.</td>
</tr>
<tr>
<td>Published</td>
<td>December 2006</td>
</tr>
<tr>
<td>Current Position</td>
<td>The introduction of a night time quiet period and the use of the low tone has removed many of the concerns of the public and established a better balance between the safety of crossing users and the health of neighbours of the railway. This is evidenced by the considerable drop in the number of public complaints and media queries about train horn nuisance, since this change was implemented. The industry is keeping the actual level of risk at level crossings and the impact of horn noise on members of the public under review. This project supported an innovative industry decision to remove a control (and thereby increase the level of risk) in favour of reducing harm, caused by noise nuisance, to the health of neighbours of the railway. Further work on some specific localised issues has also been completed.</td>
</tr>
</tbody>
</table>
### T680  Mapping the extent of the train horn noise problem

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>This project was designed to understand the geographical extent of properties and residents affected by the sounding of train horns at whistle boards protecting level crossings.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abstract</strong></td>
<td>One of the principal forms of protection for level crossing users at the many ‘passive’ crossings in Great Britain is the sound provided by train horns. In recent years the noise from train horns has increased as modern train fleets have been designed to meet higher required standards, and there have been many complaints about noise pollution and general disturbance. Before considering making any changes to the train horns or their use, it was necessary to fully understand the problem by collecting noise data in the residential areas surrounding whistle boards. RSSB has undertaken a study to assess the impact on local residents of noise relating to the use of whistle boards at footpath and level crossings. This research is one of a suite of three related projects designed to provide background information for decision makers.</td>
</tr>
<tr>
<td><strong>Published</strong></td>
<td>November 2006</td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
<td>Please see current position under <a href="http://www.rssb.co.uk/community_relations/index.asp">T668 Research into the safety benefits provided by train horns at level crossings</a>. For further information, please visit: <a href="http://www.rssb.co.uk/community_relations/index.asp">http://www.rssb.co.uk/community_relations/index.asp</a>. See also <a href="http://www.rssb.co.uk/community_relations/index.asp">T681 Understanding the problems that train horn noise causes to neighbours</a>.</td>
</tr>
</tbody>
</table>
T681 Understanding the problems that train horn noise causes to neighbours

Description
This project was designed to gain an understanding of the effect train horns have on residents who live in the vicinity of whistle boards that are sited to protect pedestrians on level crossings.

Abstract
One of the principal forms of protection for level crossing users at the many ‘passive’ crossings in Great Britain is the sound provided by train horns. In recent years the noise from train horns has increased as modern train fleets have been designed to meet higher required standards, and there have been many complaints about noise pollution and general disturbance. Before considering making any changes to the train horns or their use, it was necessary to fully understand the problem, including how to value the increase in noise to trackside residents. RSSB has undertaken a study to assess the impact of train horn noise on trackside residents on behalf of the railway industry. This research is one of a suite of three related projects designed to provide background information for decision makers.

Published
November 2006

Current Position
Please refer to current position under T668 Research into the safety benefits provided by train horns at level crossings and T680 Mapping the extent of the train horn noise problem. For further information, please visit: www.rssb.co.uk/Pages/Train_Horns.aspx
This project analysed CCTV recordings of driver behaviour at three level crossings, where road median strips, also known as lane separators, were due to be installed to prevent accidents.

Following the completion of RSSB research project T032 ‘Trials of median strips / lane separators at level crossings’ the next stage of the project was to install median strips at Downham Market and Beccles Bypass level crossings. A further phase could have involved installation at Littleport Bypass crossing. As this required Network Rail to install fixed equipment in the highways, plus associated signage work, RSSB provided collection and analysis of CCTV footage from Beccles, Littleport and Downham Market level crossing sites, on Network Rail’s behalf, and also for other stakeholders in the Road-Rail Interface Safety Group. Previous film of motorists’ behaviour at these crossings allowed stakeholders and the industry to understand more about motorists’ use of automatic half barrier crossings. While the filming was continuing a number of factors that reduced the likely coverage of crossings to be fitted with median strips became clear and the cost of fitment continued to increase. In the circumstances, it has now been confirmed that Network Rail’s updated strategy no longer supports the continuance of the filming, or the development of the planned trials. The Road-Rail Interface Safety Group consequently decided that the research should be terminated.

The safety benefits available from the installation of median strips would, in the very few locations where they could be installed, be very low and the costs and indemnities expected would be expensive. Network Rail decided that continuing with these trials, and future installations, would not be reasonably practicable and it was therefore decided to stop work on this research.
### T729  Further work on obstacle detection at level crossings

**Description**  
The risk from using obstacle detection systems to check that level crossings are clear of people and objects was compared to the risk of using a signaller to do the same task.

**Abstract**  
At many level crossings on public roads in Great Britain, a signaller checks visually to see whether it is safe to allow trains over the crossing. The signaller checks, either locally or remotely via CCTV, for vehicles, pedestrians and objects that might become trapped between the gates/barriers. Obstacle detection systems are now used for this task in some European countries. This project, sponsored by the Road Rail Interface Safety Group, explored the benefits and likely risk profiles of using obstacle detection systems on the GB network building on the previous study, T522 Obstacle detection at level crossings, which was published in 2006. Obstacle detection systems were found to be broadly neutral in terms of risk compared to conventional checks by a signaller, with one exception. The study found that a significant risk would be introduced if the current design of obstacle detector were to be introduced because the design does not detect users who are prostrate on the level crossing, perhaps as the result of a trip, a fall, or a medical condition. As a result of this research, Network Rail is now basing its safety case on mitigating the additional risk by the use of a second, complementary, obstacle detection system. Trials of the revised approach are in progress.

**Published**  
October 2010

**Current Position**  
The information made available in this research has been incorporated by Network Rail in its continuing trials of obstacle detection systems at level crossings.
### Description
Undertaking a comprehensive review of existing guidance related to the design of station pedestrian crossings as recommended by the Rail Accident Investigation Branch’s inquiry into the fatal accident at Elsenham.

### Abstract
The project addressed the recommendations regarding station pedestrian crossings arising from the Rail Accident Investigation Branch (RAIB) report into the fatal accident at Elsenham Station Crossing in December 2005. The project, which was sponsored by the Road Rail Interface Safety Group, undertook a comprehensive review of existing guidance relating to the design of station pedestrian crossings. This covered the existing and potential roles of current technology; current human factors practice; fencing to direct passengers to the route that gives optimum sighting of trains and signs; additional stop lights on the far side of the crossing from an approaching user and ‘another train coming’ warnings. A number of other options were considered, some in use already, and some of a ‘novel’ character. The report concluded that there were a number of remedial measures which can be considered for implementation at station crossings on a site-specific basis but that there is no single solution which could be widely installed. Action being taken by Network Rail to bridge the four busiest (and therefore the highest risk) locations has also reduced the applicability of some of the options. The research is being studied by Department for Transport, Network Rail and the Office of Rail Regulation in order to inform their responses to the RAIB recommendations.

### Published
March 2009

### Current Position
The research showed that if it were possible to close a small number of the highest risk crossings (as is being planned by Network Rail), the total overall risk at station pedestrian crossings could be reduced significantly (for example replacing the top five crossings with footbridges could in theory reduce total risk by around 50%). In this case, the total benefits available from the options presented in the report would be reduced, and in many cases this would mean that they could not be justified on a cost-safety benefit basis. The findings from the research were used by DfT, Network Rail and ORR to inform their responses to the RAIB recommendations.
T737 Documenting the All Level Crossing Risk Model

Description

Supplying a history of the All Level Crossing Risk Model, and a detailed, referenced explanation of its construction and functionality, and the main parameters used in its formulation.

Abstract

The All Level Crossing Risk Model (ALCRM) is being rolled out across Network Rail and populated with data. The current version of the model can be seen as the culmination of nearly fifteen years’ work of modelling, calibration, upgrades, and related activities. A need was identified to capture the history of the development of the model since the first level crossing risk model was designed by Arthur D Little in the mid-1990s. It is desirable to capture and reference key decisions made over the years; and the need for this work was approved by the National Level Crossing Safety Group. An independent review of the model by another consultancy, Sotera Risk Solutions, in 2006 highlighted a lack of readily available documentation regarding the structure and functioning of the model. The second part of the project was to describe the model via an ‘Enhanced Specification’ which provides references for all variables and algorithms, with narrative sections that provide explanations of the main steps in the algorithms. The ‘history’ document is published on the Rail Safety and Standards Board (RSSB) website. The Enhanced Specification is available only to the ALCRM configuration management team.

Published

March 2008

Current Position

The Enhanced Specification and History documents have now been brought up to date. Both documents help to spread knowledge about the model to facilitate the competition amongst suppliers or to enable Network Rail to maintain the model in-house.
T738 Trialling the national roll out of the level crossing cost model

Description
Trialling the national roll out of the level crossing cost model (AXIAT) using road rail partnership groups and increasing the functionality of the model.

Abstract
The research project T336, ‘Modelling the economics of level crossing closures and conversions’, produced a tool, ‘AXIAT’ (this acronym approximates to the ‘Assessment of Crossing Alternatives Tool’.) This brings together all of the significant rail and road costs associated with keeping a level crossing in use and gives costs for alternatives such as bridges, underpasses etc so that a business case for an alternative can be made. Feedback on the tool from both local authorities and Network Rail alike was positive and suggestions for improvements to be incorporated into an upgrade were made. Following various meetings between Network Rail, ADEPT (formerly known as the CSS and prior to that as the County Surveyors Society) and other bodies, Road Rail Partnership Groups (RRPGs) were launched. They are central to Network Rail’s strategy of management of the risk at level crossings. Network Rail wanted to establish whether passing the model to RRPGs would lead to timely population of the model. Four RRPGs were trialled. In parallel, a number of improvements were considered and designed into an upgrade. A project encompassing the population of the model and the upgrade was sponsored by the Road Rail Interface Safety Group. The results from the population exercise were promising with all four RRPGs finishing the work of collection of the data within approximately fifteen months. Following various presentations to Network Rail, DfT, ORR and the Law Commissions, Network Rail is now considering the best way forward for using AXIAT to facilitate the closure process of public road level crossings.

Published
December 2010

Current Position
Network Rail is now planning the roll out of AXIAT nationwide via Road Rail Partnership Groups so that business cases for closure of promising public road level crossings can be examined.
T818 Optimising public communication with signallers in emergencies at level crossings

Description
Investigating how best to highlight the presence of emergency level crossing phones for use in emergency situations and understanding the communication links between calls made to 999 and their subsequent connection to the railway signal room.

Abstract
Recent accidents involving fatalities at level crossings, such as Ufton Nervet and Marston-on-Dove, have been the result of train/vehicle collisions caused by vehicles stopped on the tracks at the crossing. Investigations into the circumstances surrounding each incident revealed that members of the public attempted to alert the authorities in both cases. At Ufton, a witness attempted to use the Public Emergency Telephone System (PETS) at the crossing but was unable to operate it correctly. At Marston-on-Dove, a mobile call was placed to 999. Both instances resulted in significant delays to the emergency response; had PETS been used successfully, the collision at Marston-on-Dove might have been averted. This project, sponsored by the Road Rail Interface Safety Group, used human factors techniques and a risk-based approach to establish the best methods for highlighting the presence of the level crossing phone for use by the public, and investigated how the current process for routeing 999 calls to the railway signalling control room in emergency situations could be improved. Level crossing emergency phones have a dual purpose on the GB railway; not only are they for use by members of the public in the event of emergencies but also by drivers of exceptional loads to communicate with the signaller. This second purpose was not included within the project scope, but borne in mind when considering the impact of the recommendations which have been accepted in principle by Network Rail and may result in improvements to phone conspicuity and emergency call handling.

Published
December 2009

Current Position
Network Rail has adopted the recommendations contained in this research concerning the proposed changes to telephone cabinet designs but has decided that the suggested changes to 999 call protocols would not be reasonably practicable to undertake.
## T821 Further work on miniature warning lights at user worked crossings

<table>
<thead>
<tr>
<th>Description</th>
<th>The research investigated detailed usage data and train traffic data for all three types of user worked crossings to establish the efficacy of miniature warning lights.</th>
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<tbody>
<tr>
<td>Abstract</td>
<td>There are three types of user-worked crossings (UWCs) on British railways. All three rely on the user opening and closing gates or lifting and lowering barriers before and after traversing the crossing respectively. Only one type of UWC has lights to advise the user of an oncoming train. These lights are referred to as miniature warning lights (MWLs). The second type of UWC has a telephone, for the user to contact the signaler for advice on the positions of trains; and the third has neither telephone nor lights. In the past, due to their high cost, MWLs have only been installed at UWCs which were thought to present higher than average risk; eg because of a high amount of use, or regular use by animals on the hoof. Risk investigations into different types of UWCs consistently show that a higher risk per crossing is attached to UWCs with MWLs than the other two types. This seems counter intuitive and makes it difficult to justify further installation of MWLs. The project analysed a large set of usage data at the three types of UWCs, which has recently been collected by Network Rail. It established that the risk per traffic moment (trains multiplied by user traverses), considered to be the best measure of exposure to risk for user worked crossings, is significantly lower at crossings with MWLs than those without them. This confirmation of a significant safety benefit from MWLs will be useful not only in formulating business cases for their installation but also as a catalyst for efforts to reduce their cost by adopting appropriate new technology.</td>
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<tr>
<td>Published</td>
<td>December 2010</td>
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<tr>
<td>Current Position</td>
<td>The research has demonstrated that there is a clear safety benefit available when user worked crossings are upgraded by the addition of miniature warning lights and Network Rail can now plan accordingly. As a separate initiative, Network Rail is working on reducing the cost of such upgrades.</td>
</tr>
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### In Progress Road-Rail interface safety projects

<table>
<thead>
<tr>
<th>T707 Analysing the potential of vehicle activated signs at public road level crossings</th>
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<tbody>
<tr>
<td><strong>Description</strong></td>
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<td><strong>Abstract</strong></td>
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<td><strong>Published</strong></td>
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<td><strong>Current Position</strong></td>
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T756  Research into traffic signs and signals at level crossings

Description  Evaluating the effectiveness and comprehensibility of traffic signs and signals on the approach to level crossings.

Abstract  Since the advent of the railways, signage for road users has evolved to keep pace with various types of level crossings. However there are now a plethora of signs with the road user often being confronted with many signs on the approach to a single level crossing. This project gives the industry the opportunity to reflect from first principles, without the constraints of money, background or existing practice, on the type(s) of sign(s) that should be presented to the road user. The project will produce a study which will explore which signs and signals best convey the particular points of information that road users need when approaching various crossings. The project will first draw up a guidance document that will gather together good practice in signing in general and in the railway environment in particular. Existing signs and signals at level crossings will then be compared with this guide and where it is judged that they are not the best solutions, other signs and signals will be considered. Attention will be given to exactly when, where and how a road user needs to be alerted to the presence of a level crossing and what is the optimal number and types of signs that should be presented to road users. If it is found that improvements can be made, this project will identify those improvements and give broad advice on the type of information that the signs and signals should proffer and outline how they might appear to road users. A follow-on project will then establish whether it is reasonably practicable to design and install those signs in a campaign change or as the old signs come up for renewal or whether the (extra) cost of the preferred signs cannot be justified. The key benefit of the project is to allow a root and branch review of all level crossing signs without preconceptions to establish whether the present regime is fit for purpose in all respects or whether improvements can be made.

Published  Due for publication in 2011

Current Position  In progress
**T854 Reducing the number and impact of vehicle strikes on railway bridges**

**Description**
To determine the effectiveness of interactive road signs, and to identify bridges that are suitable for such installations; with recommendations for improvements where necessary.

**Abstract**
There are nearly 1700 bridge strikes a year recorded by Network Rail. The consequences of these strikes are wide-ranging and include disruption to road and rail transport systems, damage to infrastructure and risk to railway and road users. Despite a number of initiatives to reduce bridge strikes, the number of incidents has remained at a consistent level, indicating that either the current reduction methods are not having the desired effect, or the underlying causes have not been fully identified and understood. Through improved understanding of why bridge strikes occur and integration of human factors principles into the design of measures to reduce bridge strikes, numbers and severity of bridge strikes could be reduced.

This project will deliver a comprehensive study of bridge strikes through a detailed review of research projects, incidents, current legislation, surveys with key stakeholders and review of measures for mitigating bridge strikes. Improved guidance for reducing bridge strikes will then be produced. All work will be undertaken by subject matter experts with input from human factors specialists as necessary.

Improvements to the understanding of the causes of bridge strikes and of methods aimed at preventing them offer the opportunity to significantly reduce the numbers and severity of bridge strikes reducing costly service delays, infrastructure damage and the risk to railway and road users.

**Published**
Due for publication in 2011

**Current Position**
In progress
T936 Enhancing the accuracy and functionality of the All Level Crossing Risk Model

Description
A detailed review and research of assumptions and data identified in the ALCRM causing concern to users and reviewers. Modifications and development of new algorithms based on the review of the system.

Abstract
The ALCRM has been used to assess the risk at Level Crossings since January 2007. Whilst Network Rail is the custodian of the model, detailed information from the model is made available to bona fide railway enquirers. A number of reports and reviews have been undertaken by ORR, Network Rail and RAIB into the system and algorithms and these as well as the comments from users have identified a number of areas where further development of the ALCRM would enhance the model and its outputs for the industry. Undertaken in three phases the project would deliver the findings of the research including assumptions made and data used with a clear rationale for the findings of the research and any data points changed or added. The project would also reference and supply the data used to underpin the research; supporting documents that would contain algorithms and supporting information for the new crossing types modelled and modified algorithms. Implementation of the findings would be undertaken by Network Rail as the custodians of ALCRM. It is envisaged that the project would supply a number of benefits such as maintaining the credibility of the industry’s sole national risk model for level crossings, improve the identification of risk at crossings, support and inform detailed documentation that would allow the industry to explain and answer any questions on the rationale and data used in the ALCRM in a timely and effective manner.

Published
Due for publication in 2012

Current Position
In progress
Bells suspended over the road at a railway crossing to give an audible warning to drivers of vehicles that exceed the safe height beneath electrified overhead cables

Level crossing with a gate or barrier

Miniature warning lights at level crossings

Automatic open level crossings have flashing signals and audible warnings. The lights will flash and the warnings will sound until it is safe to cross

Plate used with level crossing warning signs: advance warning of light signals at a level crossing with or without a gate or barrier

Open level crossings without gates, barriers or road traffic light signals have “give way” signs over a symbol of a locomotive

All images above are from the Department for Transport ‘The Official Highway code’ revised 2007 edition and are Crown Copyright 2007
Where can I find research?

The Road-Rail Interface Topic Research Plan is published on the RSSB website.

All the research outputs that have been published since RSSB began its programme can be found at ‘Research Topics and Projects’:

www.rssb.co.uk/research/pages/researchanddevelopmenttool.aspx

If you know the reference number for the project – eg TXXX – you can use the Search field at the top of the projects list to find it. Alternatively enter a keyword in the Search field to find all the projects with that word in their title.

The previous pages contain listings of the published and current Operations – Road-Rail Interface Safety – correct at the time of publication.

We hope this helps you find the information that is most relevant to you.

If you can’t find what you’re looking for, please contact us – enquirydesk@rssb.co.uk
Each project has a research brief that provides a concise summary.

Research Brief
Improving safety and accessibility at level crossings for disabled pedestrians
T650 - February 2011

Overview
For pedestrians with a disability, using a level crossing can be a challenge. Level crossings present pedestrians with a variety of visual and audible messages, and require users to cross a surface that may pose physical challenges due to its structure, gradient and exposure to the track. Pedestrians with sensory, physical or cognitive impairments may be less able to cross safely because of these factors. Level crossings account for 8.2% of the overall rail network risk (Safety Risk Model v6.1) and pedestrians are involved in approximately three-quarters of all incidents at level crossings, placing them at greater risk than road vehicle users (Risk Profile Bulletin v6.1, June 2009).

This research was carried out on behalf of the Road-Rail Interface Safety Group (RRISG), and in conjunction with the Disabled Transport Advisory Committee (Rai) (DPTAC Rai) to help inform the upgrade and/or renewal of public road level crossings in terms of the accessibility issues facing disabled pedestrians. It has identified, reviewed and ranked current facilities which disabled pedestrians may find difficult to use at level crossings on public roads in Great Britain (GB) in order to present solutions that aim to improve accessibility for all users.

Aims
The aim of the research was to investigate what specific facilities for pedestrians with disabilities should be included in the next generation of level crossing designs in order to improve accessibility and reduce risk. Specifically, the objectives were to:

- Identify, review and rank the existing facilities that pedestrians with disabilities find difficult to use at level crossings.
- Explore and evaluate ways of improving level crossing facilities for disabled pedestrians in future designs for crossing replacements.
- Develop practicable and accessible solutions, indicating which potential solutions are most appropriate for further evaluation and which are not, based on the level of accessibility and practicability they offer. A ‘practicable’
More Information

The RSSB R&D e-newsletter is an email bulletin that keeps the industry updated on the latest research projects to be started or published.

To view the most recent edition and to sign up for your own copy, visit:

www.rssb.co.uk/research/pages/randde- enewsletter.aspx

If you have enquiries about research – contact research@rssb.co.uk or the RSSB Enquiry Desk – enquirydesk@rssb.co.uk, tel 020 3142 5400

You can also access more information - including research - from Opsweb, the website of the Operations Focus Group, facilitated by RSSB. It’s easy to sign up for access on-line and from there you can obtain a wealth of information and good practice from across the industry. Go to: www.opsweb.co.uk. For further information about the Road-Rail Interface Safety Group (R-RISG), select industry groups and download a copy of the group’s remit.

The Community Safety Resource Centre website was launched in March 2009, it is a one-stop-shop for industry resources and information. The site will only be accessible to industry – users can apply for a login username and password via the main home page at: www.railcommunitysafety.com. For more information about the Road-Rail Interface Safety Group and the European Level Crossing Forum, sign up for an account today!
The Road-Rail Interface Safety Group (R-RISG) works under the general direction of the Community Safety Steering Group (CSSG) and seeks to steer the work of the rail industry - together with road authorities - in increasing awareness of the hazards and risk at level crossings arising from inappropriate behaviour by those who use the crossings.

The group also considers bridge strikes and other incursions by motor vehicles onto the railway, working closely with Network Rail’s Bridge Strike Prevention Group.

R-RISG is a member of the European Level Crossing Forum, which exchanges good practice, education campaigns and outcomes of research on level crossings.

The European Level Crossing Forum (ELCF) is an informal group that brings together key rail and highway professionals from European countries, to exchange information and provide experiences and lessons for improving safety management of level crossings.

Engaging with highway authorities, who see level crossings as a small component of road safety risks, will support a greater understanding of the high risk to rail of road user (mis)behaviour and develop shared risk control activity as a bi-modal issue. The following are examples of ELCF’s core subject areas:

- Evaluating the risk at level crossings
- Economics of level crossings
- Engineering (road and rail)
- Co-operation and partnership
- Education and human factors
- Enforcement

For further information about the ELCF, please visit: **www.levelcrossing.net**