

Enhancing Third Party Awareness of Railway Risk

Risks that are imported to railways by third parties are more difficult to control than intrinsic railway risk; the latter being more formally controlled by the railway company's safety management system and the regulatory regime, in particular the Railway Safety Act 2005.

This paper looks at some of those risks imported by third parties and explores methods of getting the message across that these activities can at worst cause a catastrophic rail accident with multiple fatalities as well as being expensive and disruptive to both the railway company and the third party. The following activities will be looked at:

1. Bridge strikes by road vehicles.
2. Road user behaviour at level crossings.
3. The Luas system; actions by pedestrians and road users.
4. Farmers.
5. Developers.

Railways are open vulnerable systems, not entirely amenable to the control of their operators. In a variety of ways homo sapiens intervenes and because the railway forms and has formed part of his environment, his thinking about it is on auto pilot, if at all.

1.1 Bridge strikes by road vehicles

Slide

This is the most eloquent expression of third party indifference to railway safety.

5 people killed.

Slide

This was not the truck that caused that accident where five people died (I hesitate from calling it an accident; that would suggest some rational activity on the part of the driver), but it could have been. He tried to dislodge the tracks carrying the Dublin-Cork train, but failed.

Iarnrod Eireann respond promptly to bridge strike reports; closing traffic until inspection and then carrying out repairs. They are vigilant, but with 513 road under railway bridges to keep an eye on, it is not difficult to imagine the odds.

In that first incident referred to, in December 1975 an excavator on the back of a lorry struck a railway under-bridge (UB), Cain Bridge in Wexford. Extensive damage was caused to the bridge; the two wrought iron girders were dislodged leaving the actual rails unsupported and out of alignment. Approximately two minutes later a passenger train derailed on the bridge. Five people were killed and forty three were injured.

In 1974 a passenger train was derailed in Longford but fortunately there were no serious injuries because the vehicles that derailed had been locked off to passengers.

The same incident clearly demonstrates the consequence of a bridge strike in distorting the railway track.

If a train operator demonstrated an indifference to track maintenance which had the same or similar results, they would be socially pilloried and rightly so; so why the social and political indifference to the activities of road users?

Slide

This incident serves to illustrate social attitudes; this was treated on the evening news as a confused mixture of humour, vigorous free market endeavour being thwarted by an 18th century relic like a railway and a display of machismo. If there were such a thing as a normal social response this driver would have been ridiculed to distraction.

Why the heat? Is it really such a serious issue?

The number of railway UB's which are being struck by road vehicles is on the increase in Ireland; a cause of concern for both Iarnrod Eireann and the Railway Safety Commission. The number of UB strikes since 2001 are detailed in the table 1 below. Table 2 shows the number of strikes for the last twenty years.

2001	2002	2003	2004	2005	2006 to 11Sept
78	99	136	123	203	143*

Table 1

* Projected to end of 2006 = 205

86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
60	67	76	93	72	67	54	52	63	82	73	79	88	101	106	78	99	136	123	203

Table 2

Sure most of them are minor incidences. Yes, but it is the mind set of indifference that we must engage with.

Research has demonstrated that there are statistical links between minor incidents and major accidents. There have been many studies, however, the overall implications are the same. One of the earliest studies was carried out by Frank Bird in 1969 which is known as the loss triangle.

The question must be asked 'How many strikes can a bridge actually take? One particular bridge on East Wall Road was struck 71 times over a 7 year period. This resulted in the bridge having to be renewed at a cost of €2 million.

Today the two most frequently struck bridges are Custom House Quay in Dublin City Centre and UB 145, Dublin Cork line, on the N80 (National Primary route 80) at Portlaoise.

	Height	'01	'02	'03	'04	'05	'06 *
Custom House Quay	4.73m	5	8	1	9	16	8
UB 145 Cork Line	4.10m	5	9	14	17	22	22

* '06 to 11th September.

Table 3

1.2 Efforts by Iarnrod Eireann to mitigate this risk

Once a bridge strike is reported rail traffic is stopped until the bridge is inspected. This is essential to ensure that there is no risk to trains. All reported strikes are investigated.

Bridge Design: All new railway under-bridges are designed for impact loading in accordance with UIC Code 777-1. The best clearance possible is achieved; this can be up to 5.7m. The national construction clearance requirement for new bridges over a public road is 5.3m, maintained to a clearance of 5.03m. Every bridge that is renewed is designed for impact loading and an improvement in clearance is also achieved. In some instances strengthening of existing bridges can be a viable mitigating measure against bridge bashing; strengthening is not suitable for short span bridges as the bridge may still lift out of its position.

The erection of shock absorbing beams on the existing abutment in front of the superstructure, or the erection of a protective portal on the approach to the bridge to absorb the impact offers a high level of protection to the bridge. Shock absorbing beams have been erected at a number of high risk bridges. The preferred option is to erect them away from the bridge so that if they get damaged trains do not have to be stopped. These beams are designed to UIC Code 777-1 for impact loading.

Regulatory Height Signs: Iarnrod Eireann place regulatory height signs on bridges where the 'headroom' is less than 5.03m (16' 6"). Headroom is defined as the highest 12.2m (40 ft.) long vehicle that can safely pass under a bridge.

It is an offence to pass such a sign if the height of your vehicle is greater than the headroom indicated on the sign.

So if a vehicle is stuck under a bridge the driver is prima facie guilty of an offence.

Publicity/Information: A TV advertisement was run earlier this year on the national television station and another one is planned before the end of the year in conjunction with advertising in the national print media. Publicity leaflets have been distributed to the registered owners of commercial vehicles, and maps showing bridges and their heights are published and distributed to hauliers and ferry companies. Bridge headroom information is published on the IE web site and is also detailed on ordnance survey maps.

Advertising signs: Advertising signs are being removed from railway bridges to improve the visibility of regulatory height signs.

1.3 Efforts by Iarnrod Eireann together with the Road Authorities

Iarnrod Eireann work together with the road authorities in relation to:

- ❖ the placing of regulatory height signs on bridges,
- ❖ provision of updated lists of headroom restricted bridges,
- ❖ provision of accident data on bridge strikes,
- ❖ correct road re-surfacing procedures when working under railway bridges so as not to interfere with the clearance,
- ❖ provision of variable message signs (VMS) at particular bad actors e.g. UB 146 at Portlaoise
- ❖ progress is being made towards the erection of infra-red detection equipment at two bridges on a trial basis.

1.4 The Road Rail Safety Working Group (RRSWG)

The Road Rail Safety Working Group is an advisory working group with representations from the road authorities, the Irish Road Hauliers Association, An Garda Síochána, the Department of Transport, the railway undertakings and the Railway Safety Commission. The Working Group is central to raising the awareness of railway risk for third parties.

They work to terms of reference as follows:

- ❖ provide advice/encouragement to each body represented and to raise their awareness of safety at road rail interfaces.
- ❖ provide exchange of information regarding safety at road rail interfaces both at home and abroad. This will include sharing new ideas or methods.
- ❖ inform the above process by discussing the main risk factors which lead to accidents at road rail interfaces.
- ❖ facilitate good communication and co-operation between the Agencies on the Working Group.

Over the past two years the group has particularly focussed in increasing the awareness nationally of the seriousness of the issue of bridge bashing. The Irish Road Hauliers Association participate on the working group. The group is managed by the Railway Safety Commission.

1.5 The Department of Transport

The Department of Transport participate on the RRSWG.

Under the Railway Safety Act 2005, s138, it is an offence to drive a mechanically propelled road vehicle under a railway bridge if the height of the road vehicle is greater than the height displayed on the bridge. It is also an offence under the same section not to report striking a railway bridge. So far this year there have been at least four prosecutions under the 2005 Act for striking a bridge

The Road Traffic Act 2006 came into force in July. Under that Act striking a railway bridge has been added to the list of penalty point offences; three points being allocated for such an offence.

The regulatory signs which are placed on railway bridges and the advance warning signs are included in the Rules of the Road Booklet; a written test on this booklet is part of the driving test programme.

1.6 Use of Overheight Vehicle Detection – Infra Red Beams.

Another protective method that can be used is an infra red beam, which when broken causes the vehicle driver to see an LED variable message display (VMS) telling him to divert.

Such beams are used at the entrances to the Jack Lynch Tunnel in Cork. The beam consists of a transmitter and receiver and an inductive loop in the ground. If a vehicle traverses the loop, the beam is broken in the direction of traffic and an LED sign will flash 'Overheight Vehicle – Divert'. Site layout for such beams is very important as the truck driver must have time and a route to divert safely. The distance between the beam and the VMS is determined by the road speed. It is questionable how practicable this is for a railway bridge as the diversion route may be many miles away. These issues must be borne in mind when selecting a site.

The number of alarms triggered at the Jack Lynch Tunnel over a four month period this year were:

April	68
May	87
June	77
July	84

Table 4

When speaking with the tunnel management they informed me that only a small percentage of such vehicles would divert. There is a 100mm difference between the height of the beam (4.75m) and the actual height of the tunnel (4.85m). The design height of the tunnel is 4.6m. Perhaps drivers know what they can get through with. On a positive note the beam being broken and the VMS will more than likely cause drivers to slow down and will thus there will be less damage to the tunnel. The tunnel is provided with a sacrificial beam at the entrance; one bad strike in 2004 caused €500, 000 worth of damage to the tunnel.

Dublin Port Tunnel which will open later this year will also use an infra red beam detection system. There will be three sets of beams on each approach to the tunnel; the first two beams will be followed by a VMS telling the truck driver he is too high and to divert. If the third beam is broken, traffic lights ahead will be initiated to danger where the truck will be stopped and told to divert by the tunnel management.

1.7 Applying Available Technology

Iarnrod Eireann in conjunction with the road authority are in the process of installing a similar infra red beam warning system at two bridges in Portlaoise, one being UB 145, referred to earlier. If the beam is broken in the direction of traffic towards the bridge, a VMS will flash telling the driver to divert or go back depending on the site. Agreement has not yet been reached with the road authority on how much of a margin there will be between the bridge height and the infra red beam height. Road surface geometry will play an important part. As I mentioned earlier site layout is very important; so also is road speed. Another important issue is what happens if the system malfunctions. The system designed for Portlaoise is such that there will always be a diamond shaped warning system on display. If the power supply fails there is a back up battery. If any of the sensors fail there will be an automatic display in addition to the diamond indicating that the system is not functioning.

1.8 Cultural Variable

A key issue in relation to an infra red beam warning system is road user behaviour. The Irish attitude as regards compliance with the rules of the road, speed restrictions, low bridge warning signs etc is not as good as our nearest neighbours in the UK. At one of these bridges in Portlaoise, UB 146, security was put in place between 3rd and 23rd December 2005. Drivers were asked the height of their vehicles; several of those who had vehicles higher than the bridge were willing to try and get under the bridge. These were all Irish drivers. Variable Message Signs were placed on UB 146 on 5th December 2005 and are still in place. The bridge has been hit 9 times since that date. Similarly, Variable Message Signs were placed on UB 145 on 1st March 2006 and the bridge has been hit 17 times since that date.

The Road Traffic Act and the Railway Safety Act, if applied with rigour, will have a very important role to play as regards this issue. There have been 4 prosecutions so far under the Railway Safety Act 2005, which was enacted on 1st January 2006, for striking a railway bridge.

2.0 Road User Behaviour at Level Crossings

Table 5 lists four categories of accidents involving road users at level crossings. The first row lists the incidents where the barriers, both full barriers or half barriers were hit by a road vehicle after the crossing was initiated by a train; the second row lists the number of those incidents which occurred at half barrier crossings (AHB's) only. The risk at an AHB crossing is much higher as there are no protecting signals for the train; once the crossing is initiated and the barriers lowered the train can arrive in 16 seconds. In both those type of crossings there is very clear road signage and flashing red lights to warn road users. At all of the incidents in row 1 the red lights would have been flashing. Row 3 lists those incidents where gates were being manually closed to allow a train to cross; these gates are very visible and there is currently a level crossing warning sign. There is a proposal to improve signage at this type of crossing which will be rolled out in early 2007. Row 4 lists gates that were struck; these gates would have been open to road traffic.

In all cases the incidents occurred because of the road users failure to obey a red light or a warning sign.

		2001	2002	2003	2004	2005	'06, to 31 Aug
1	Barrier (full + AHB) struck after initiation by train	16	17	13	39	18	8
2	AHB only being struck after initiation by train	1	4	2	8	6	3
3	Gate strike, train in section	2	0	1	3	1	12
4	Gate strike only, no train in section	5	5	4	10	2	

Table 5

The Luas system is also vulnerable to indifference and ignorance by road users. So far this year there have been six prosecutions for red light infringements an road junctions including a taxi driver been fined €1,200

3.1 LUAS – Dublin's Light Rail System

In 2004 trams ran again on the streets of Dublin after an absence of 45 years. Veolia, the operator of LUAS, has had a very good accident record in comparison with start-up systems in other cities. Operating since June 2004, there have been no passenger fatalities and a very small number of serious injuries, up to June 2006. Reducing the number of tram emergency brake applications has been one of the areas identified by Veolia for continuous improvement; a passenger on the tram could get injured as a result of such an application. Pedestrians wandering in the path of the tram is usually what causes the emergency brake to be applied.

Enhancing the awareness of pedestrians or other road users of the risk they import to the LUAS or their own personal risk is challenging; this group is difficult to get to because of their diversity. Veolia's public awareness campaigns include both the distribution of leaflets and media advertising. General do's and don'ts are highlighted e.g.

Motorists should:

- ❖ Not '*amber gamble*' – always stop at a red light.
- ❖ Look both ways before crossing.
- ❖ Make sure you can go without stopping on the tramway.
- ❖ Never drive along tram lanes.
- ❖ Never obstruct trams.
- ❖ Watch out for trams at junctions.
- ❖ Keep junction boxes fully clear.

Pedestrians should:

- ❖ Cross only where you see the '*Look Both Ways*' sign
- ❖ Stand well back from the platform edge.
- ❖ Wait for the tram to leave the stop before crossing the tracks.
- ❖ Never walk along tramways.

Cyclists should:

- ❖ Not let cycle wheels get caught in the rail groove.
- ❖ Be aware that tram tracks may be slippery.
- ❖ Never ride on '*tram only*' streets or tram lanes.

3.2 Efforts by Veolia

Veolia concentrate on driver training, defensive driving techniques and route knowledge regarding emergency brake black spots. Signalling changes have been made at one junction, Blackhall Place. The tram does not now get priority through the junction which means the tram will not approach the junction at speed. Meetings are on-going with the road authorities and Veolia to identify any new high risk areas and agree mitigating measures.

Awareness of changing circumstances along a railway route is essential to the safe management of a railway. Veolia have been keeping a close look at two of Dublin's night clubs which are situated adjacent to the LUAS track. The entrance to one of these night-clubs, D2, is right beside the tram track. Normally there is no problem as the last tram passes the area at 00.30hrs and there are no great crowds. However, at Christmas the last tram passes at 03.00hrs while the night club closes at 02.30hrs. Great care needs to be

taken by tram drivers as large crowds of high spirited and inebriated patrons file on to the tracks from 02.30hrs onwards. Veolia work in co-operation with the Gardai to ensure no injuries.

Another night-club poses a danger on just one night each year; the night following the results of the ‘junior cert.’, a state examination taken around the age of fifteen. The night-club has a special promotion for students on that night. Large crowds of fifteen year olds, excited from their examination results and who are not used to alcohol or late night entertainment have no awareness of the danger they pose to themselves or LUAS passengers. Again Veolia work in conjunction with the Gardai to prevent injury.

Efforts to mitigate risk imported by such diverse groups requires constant vigilance by the railway undertaking. The co-operation of the Gardai is crucial.

Other Third Parties that can have significant impact on railway risk.

Two other groups can impose a considerable risk to the railway if they are not made aware of the impact of their activities. These are farmers and developers.

4.0 Farmers

The interface between the farmer and the railway can be more problematical than with any other user group. It is not unusual for a farmer to have to cross the railway (either over, under or through) to move from one part of his farm to the other. He may view the railway as an impediment to the management of his business, or he may become so complacent that the basic dos and don'ts of good practice are discarded.

Farming activities such as:

- ❖ herding animals across the railway,
- ❖ crossing the railway with tractors, lorries and trailers,
- ❖ crossing the railway with heavy, low-slung or cumbersome vehicles
- ❖ change in the established usage of a level crossing e.g. provision of a milking parlour in the vicinity

can all pose a danger to trains. Generally this group of persons can be identified. Iarnrod Eireann have produced a booklet ‘The SAFE use of Unattended Railway Level Crossings’ which is given to all users of such crossings giving guidance on how to carry out these activities in a safe way.

Other farming activities which can impose a risk to the railway are:

- ❖ changing field drainage arrangements,
- ❖ changing the use of a field,
- ❖ burning off,
- ❖ felling trees, and
- ❖ adding or removing trees/vegetation.

These are currently managed by Iarnrod Eireann through track patrolling and follow up whenever a change is observed. The Railway Safety Commission is in the process of drawing up guidance for a number of Third Party Groups which will include farming activities.

5.0 Developers

Developers interfere with water, electricity and telecommunications in the course of their activities, so railway people should not be surprised that they don't discriminate against railways. Apart from the inept use of heavy equipment, developers can disturb the system at a more prosaic level.

Developments can sometimes lead to an increase in traffic flow across the railway without the railway having been considered. Issues to be considered where traffic flow is increased are:

- ❖ A level crossing type; this may be inadequate so an upgrade to the level crossing or grade separation may be required.
- ❖ The increase in traffic flow may be temporary during construction works. This could apply to both a level crossing or a bridge; an underbridge may be too low or an overbridge may not be suitable for construction type traffic.

Planners and Developers need to consider such bridges and level crossings at an early stage. It is important that the railway company is consulted during the planning process. These issues will also be included in the guidance which is being prepared by the Railway Safety Commission for Third Parties.

There will also be particular requirements for the design of structures over, under or adjacent to the railway:

- ❖ bridge design must comply with the requirements of the road authorities, the railway company and the Railway Safety Commission.
- ❖ safety barriers must similarly comply.
- ❖ special structures such as a football stadium will have particular requirements e.g. imperforate barriers or glazing type.
- ❖ design of temporary works must be approved by the railway company.
- ❖ lighting, temporary or permanent could interfere with the train driver's view of signals.

The approval of the railway company is required for such works. Currently this is done through the Third Party Co-ordinator for Iarnrod Eireann.

Other issues that need to be considered by developers are:

- ❖ the erection of cranes near the railway.
- ❖ works that could destabilise the track formation.

AND FINALLY

The following activities have been examined:

1. Bridge strikes by road vehicles.
2. Road user behaviour at level crossings.
3. The LUAS system; actions by pedestrians and road users.
4. Farmers
5. Developers.

In my view there is a recurring theme in each of the five areas which impact negatively and sometimes fatally on the railway system and that is indifference and ignorance. Both of these conditions can be

cured but it requires active and enthusiastic evangelisation by those committed to railway safety and like any process of education it is best applied at a young age.

But that is long term, the guy who steps into his truck to-day and doesn't know the height of his vehicle or finds himself embedded into the side of a tram, he has to be got urgently and changed, or removed from the road.

Acknowledgements

Improving third party awareness of railway risk cannot be done by one person in isolation and neither was this paper. I would like to thank the following for their input:

Bruno Fualdes, Veolia
Dan Quill, Veolia
John Haughey, Iarnrod Eireann
Kieran O'Donnell, Iarnrod Eireann
Nicholas West, Iarnrod Eireann
Peter Cuffe, Iarnrod Eireann
Peter Muldoon, Iarnrod Eireann
Con O'Donoghue, An Garda Siochana
Paul Moran, National Roads Authority
Noel Brett, Road Safety Authority
Peter O'Brien, Dublin Port Tunnel
Dermot Woods, Cork Tunnel Management