



**Railway Accident
Investigation Unit**

Ireland



INVESTIGATION REPORT

**Tractor struck train at level crossing XE020,
County Clare
20th June 2012**

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Reader guide

All dimensions and speeds in this report are given using the International System of Units (SI Units). Where the normal railway practice, in some railway organisations, is to use imperial dimensions; imperial dimensions are used and the SI Unit is also given.

All abbreviations and technical terms (which appear in *italics* the first time they appear in the report) are explained in the glossary.

Descriptions and figures may be simplified in order illustrate concepts to non technical readers.

Report preface

The RAIU is an independent investigation unit within the Railway Safety Commission (RSC) which conducts investigations into accidents and incidents on the national railway network, the DART network, the LUAS, heritage and industrial railways in Ireland. Investigations are carried out in accordance with the Railway Safety Directive 2004/49/EC and the Railway Safety Act 2005.

The RAIU investigate all serious accidents. A serious accident means any train collision or derailment of trains, resulting in the death of at least one person or *serious injuries* to five or more persons or *extensive damage* to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety.

The RAIU may investigate and report on accidents and incidents which under slightly different conditions might have led to a serious accident.

The purpose of RAIU investigations is to make safety recommendations, based on the findings of investigations, in order to prevent accidents and incidents in the future and improve railway safety. It is not the purpose of an RAIU investigation to attribute blame or liability.

Report summary

On the 20th June 2012 at 14:50 hours the 14:15 hours passenger train travelling from Limerick to Galway was involved in a collision with a tractor at level crossing number XE020 which is located close to Cratloe, County Clare on the R462. The driver of the train was initially unaware of the collision and continued to Sixmilebridge Station. The tractor driver although shocked was uninjured and the tractor sustained frontal damage. There was a substantial delay in alerting and communicating with the emergency services to assist their attendance at the scene.

The immediate cause of the accident was that that tractor entered the swept path of the train as the train was travelling through the level crossing.

The contributory factors identified were:

- The viewing distances failed to meet the requirements set out in of Iarnród Éireann's CCE-TMS-380, Technical Standard for the Management of User Worked Level Crossings;
- The Tractor Driver had to position the tractor within the swept path of the train in order to look for trains;
- The Tractor Driver had been using the railway signals to estimate train approaching times, a system which may have been adopted due to the poor viewing distances at the level crossing but contradicts the instructions given in the Safe Use of Level Crossings guidance booklet.

The underlying factors identified were:

- Having been unable to close the level crossing due to a lack of agreement between the relevant land owners, Iarnród Éireann did not introduce adequate safety measures as a result of the inadequate viewing distances at the level crossing;
- Iarnród Éireann may not have prioritised work at this level crossing as a result of the low risk rankings awarded by Iarnród Éireann's Level Crossing Risk Model.

The following additional observation, not relating to the cause of the accident, was made during the investigation:

- The signalman did not have the sufficient information immediately available to him to assist the Emergency Services to respond to the accident scene.

The RAIU made three new safety recommendations, related to the occurrence, as follows:

- Iarnród Éireann should close, move or alter the level crossing in order to meet the required viewing distances in Iarnród Éireann's technical standard CCE-TMS-380 Technical Standard for the Management of User Worked Level Crossings;
- Iarnród Éireann should review their systems of managing level crossings that fail to meet the viewing distances in Iarnród Éireann technical standard CCE-TMS 380 Technical Standard for the Management of User Worked Level Crossings to ensure that any mitigation measure that is introduced is effective at reducing the risk to level crossing users;
- Iarnród Éireann should audit their Level Crossing Risk Model, to ensure it correctly identifies high risk level crossings; and identifies appropriate risk mitigation measures for individual level crossings.

One new safety recommendation was made as a result of an additional observation made and one previous RAIU safety recommendation is re-iterated as a result of this investigation.

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The occurrence

Summary of the occurrence

- 1 At approximately 14:50 hours (hrs) on Wednesday 20th June 2012 the delayed 14:15 hrs passenger service from Limerick to Galway was involved in a collision with a tractor on a level crossing located next to the regional road R462 near Cratloe, County Clare, see Figure 1 for the location of the accident.

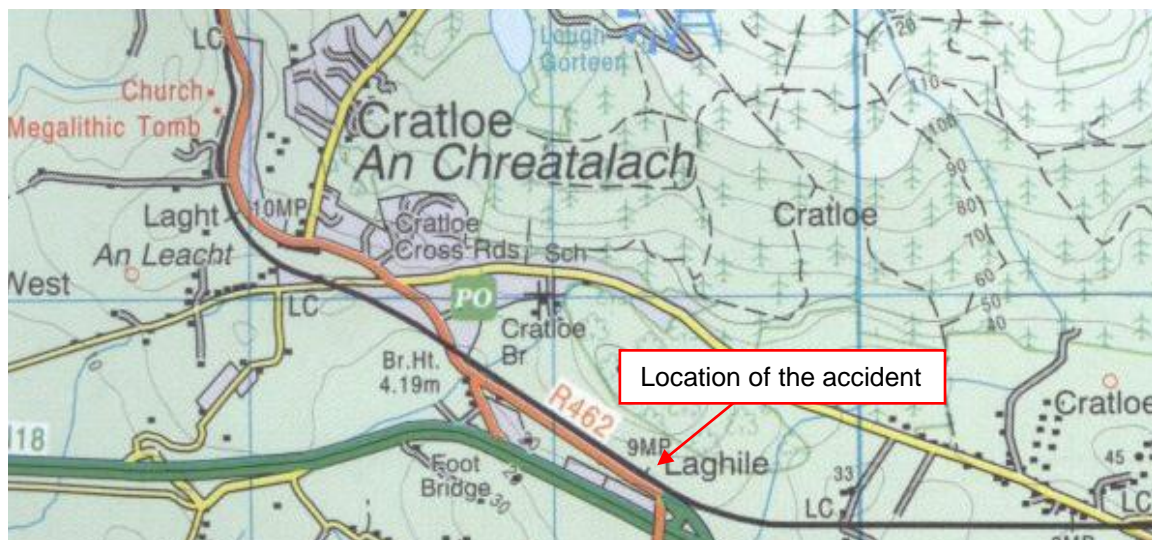


Figure 1 – Location of accident

- 2 The train was running twenty minutes late when it approached the level crossing. There was a *Temporary Speed Restriction* (TSR) imposed at the level crossing of 25 miles per hour (mph) (40 kilometres per hour (km/h)). As the train passed through the level crossing, the driver felt a slight movement which he thought was due to a track defect and the reason for the TSR.
- 3 A Revenue Protection Unit (RPU) Officer who was travelling on the train was knocked over by this movement. He then went to the driver's cab, as the train was approaching Sixmilebridge Station, and informed him that the train may have come into contact with a tractor which he had noticed close to the level crossing as the train passed through.
- 4 The train driver then contacted the signalman and reported a near miss, as he did not see the tractor.
- 5 When the train driver arrived at Sixmilebridge Station, he checked the train and observed slight damage on the right hand side of the train. The driver then informed the signalman that he checked the train and that there was a definite collision.

- 6 The signalman notified a number of Iarnród Éireann (IE) staff of the accident. However, he found it difficult to ascertain the location of the level crossing and contacted the Emergency Services twenty seven minutes after the accident had been confirmed by the train driver.
- 7 The train driver did not suffer any injuries, the RPU Officer suffered minor injuries as a result of being knocked over by the impact of the tractor and the tractor driver suffered from shock but was otherwise uninjured.

General description of the railway

Infrastructure

- 8 The line from Limerick to Athenry is a single track bidirectional line. The track is plain line with flat bottom *continuously welded rail* (CWR) mounted on concrete sleepers in ballast. No factors in relation to the condition of the track were found to have contributed to the accident.

Rolling stock

- 9 The train involved was the 14:15 hrs passenger service from Limerick to Galway, train identification A786. The service was operated by a two carriage Class 2700 *Diesel Multiple Unit* (DMU), consisting of carriages 2722 and 2719. Carriage 2722 was the leading carriage at the time of the accident. The two carriage unit is 43.18 metres (m) long. The maximum allowable speed of the DMU is 120 km/h. The type 2700 model train has a *kinematic envelope* of greater than 0.6 m from the outside rail edge to the edge of the carriage step boards. No factors in relation to the condition of the train were found to have contributed to the accident.
- 10 The train was fitted with an event recorder that records the status of predefined equipment on the train. The event recorder recorded that the train driver sounded the horn at the appropriate location and was travelling at 23 mph (36.8 km/h), under the TSR speed of 25 mph (40km/h) at the time of the accident.

Signalling and communications

- 11 The single track route from Limerick to Athenry is signalled using two and three aspect *colour light signals*, controlled by the Galway Line Signalman based in Athlone. *Track Circuit Block* regulations apply to this route. No factors in relation to the condition of the signalling and communications systems were found to have contributed to the accident.

- 12 The means of communication between train drivers and the Galway Line Signaller on this route is via train radio.

Operations

- 13 The Train Driver was a qualified driver. Train movements on this section of track are controlled by the Galway Line Signaller. The maximum permitted speed on the line is 50 mph (80 km/h) however there was a TSR in place at the time of the accident of 25 mph (40 km/h). The limits of the TSR are 8 miles 1400 yards to 9 miles 500 yards (*Up & Down directions*). The TSR was imposed in October 2011 following a *Sighting Survey* where substandard views from the level crossing were identified.

Fatalities, injuries and material damage

Fatalities and injuries

- 14 The RPU Officer, who was travelling on board, suffered minor injuries as a result of falling due to the movement of the train from the collision of the tractor with the train. The driver of the tractor was shocked but otherwise uninjured. The train driver was uninjured.

Material damage

- 15 There was superficial damage to the right side of the train, see Figure 2 for photographs of the damage.



Figure 2 – Damage to train

- 16 The tractor sustained damage to the lights and bodywork directly in front of the front axle; with the battery box and associated electrical equipment removed in the collision. See Figure 3 for photograph of the damage sustained by the tractor. The tractor was repaired and is back in daily use.



Figure 3 – Damage to the tractor

Parties and roles involved in the occurrence

Parties involved in the occurrence

- 17 IÉ is the *railway undertaking* (RU) that owns and operates mainline railway services in Ireland. IÉ is also the *railway infrastructure manager* (IM), managing the design, installation, testing, inspection, maintenance, renewal and operation of the railway's physical assets. The IÉ departments associated with this incident are the:

- Intercity and Commuter Network (ICCN) Department – responsible for the operation of trains on the mainline, excluding the DART network. This includes the supervision of train drivers; ICCN is also responsible for the control of train movements through Centralised Traffic Control (CTC) Dublin and the regional controlling cabins;
- Chief Civil Engineer's (CCE) Department – responsible for the design, inspection, maintenance and renewal of the railway's structural infrastructure, including level crossings, and the management of risks relating to the use of passive level crossings that are operated by the level crossing user.

Roles involved in the occurrence

18 The roles involved in the accident are as follows:

- Train Driver – An employee of IÉ who was trained and competent to drive trains;
- Signalman – Galway Line Signalman, located in Athlone, was the *controlling signalman* at the time of the accident;
- RPU Officer – was onboard the train to check passenger tickets;
- Tractor Driver – is a local resident who is familiar with the area and use of this level crossing.

External circumstances

19 The weather recorded at Shannon Airport at the time of the incident was 17°C with a 10 km/h east south easterly wind. It was dry with some light cloud cover.

RAIU Investigation

RAIU decision to investigate

- 20 In accordance with the Railway Safety Act 2005 the RAIU investigate all serious accidents. Under slightly different conditions, this occurrence may have lead to a serious accident where there would have been potential for fatalities, serious injuries and extensive damage. As a result of the collision between the train and tractor, there was some potential for fatalities and other possible consequences, therefore the RAIU have made the decision to investigate this accident.

Scope of investigation

- 21 The RAIU must establish the scope of the investigation to ensure that only pertinent information is recovered and reviewed. Therefore, for this occurrence, the RAIU have defined the following scope:

- Establish the sequence of events;
- Establish, where applicable, the *immediate cause*, *casual factors* (CF), *contributory factors* (CoF) and *underlying factors* (UF);
- Examine the relevant elements of the safety management system;
- Examine any other significant safety deficiencies identified as a result of this investigation.

Investigation and evidence

- 22 The RAIU was notified of the accident at 15:30 on the 20th June 2012 and immediately mobilised to the site of the accident to conduct an on-site investigation. During the on-site and off-site investigation the RAIU collated and logged the following evidence:

- Photographic record of accident site;
- In-situ surveys for positioning of infrastructure and rolling stock;
- Witness testimonies from parties involved in the occurrence;
- Other testimonies from members of the RU with information pertaining to the accident;
- Inspection and maintenance records for inspections carried out on the infrastructure;
- IM and RU standards, procedures and other documentation;
- Standards, procedures and documentation from other relevant bodies;
- Data from the event recorder;
- Reconstructions conducted by IÉ under the supervision of the RAIU.

Evidence

The Level Crossing

General description

- 23 Level crossing XE020 is located 9 miles 389 yards on the Limerick to Athenry railway line (within the Limerick to Ennis section), in a rural area. It is an 'F' type level crossing, which means it is a user worked unattended field crossing. The level crossing is fitted with a palisade gate which is padlocked and is part of a perimeter fence on the Down side which is adjacent to the R462 national road, see Figure 4.



Figure 4 – Down side level crossing approach

- 24 Field gates are fitted and padlocked on the Up side of the level crossing, see Figure 5. The signage in place complies with IE's Technical Management Standard CCE-TMS-380, 'Technical Standard for the Management of User Worked Unattended Level Crossings' (which will be referred to as CCE-TMS-380 for the remainder of the report), which was issued on the 9th May 2012 and replaced the previous level crossing standard, MW50.



Figure 5 – Up side level crossing approach

Viewing distances for approaching trains

- 25 The *viewing distances* on user worked level crossings are governed by CCE-TMS-380, which sets out the minimum viewing distances required to allow level crossing users to safely cross the railway. This gives the position of measurements, called the viewing position, to be at 3.66 m from the nearest rail and at a height of 1.22 m above ground to allow for the position of the driver of a crossing vehicle. It also takes into account a reaction time of 1.5 seconds (s), a crossing speed of 1.34 m/s, a crossing distance of 5.5 m and a standard vehicle length of 7.3 m based on an agricultural tractor and trailer.
- 26 With a line speed of 50 mph (80km/h), a viewing distance of 250 m is required to permit safe crossing. However, after a Sighting Survey carried out by IÉ on the 20th September 2011 where the viewing distances were found to be substandard, a TSR of 25 mph (40 km/h) was imposed allowing a new viewing distance of 125 m. A survey conducted post accident recorded the actual viewing distances at the level crossing, these are illustrated in Figure 6 below:

Viewing position	Required viewing distance	Actual viewing distance
Up Side – looking Up (towards Limerick)	125 m	34 m
Up Side – looking Down (towards Ennis)	125 m	10 m
Down Side – looking Up (towards Limerick)	125 m	68 m
Down Side – looking Down (towards Ennis)	125 m	461 m

Figure 6 – Viewing distances recorded at the level crossing

27 The views from the viewing positions are shown in Figure 7 and Figure 8 below:



Figure 7 – View on Up Side looking Up



Figure 8 – View on Up Side looking Down

- 28 The level crossing failed to achieve all but one of the viewing distance requirements. In particular, it was not achieved on the Up Side – looking Up (towards Limerick), Figure 7, which is the side from which the train approached the level crossing in relation to the tractor. The viewing distance was recorded at 34 m.
- 29 Whistle boards were erected at the level crossing as an audible warning to level crossing users as a risk mitigation measure due to the restricted views in accordance with CCE-TMS-380. The level crossing users, according to the LC guidance booklet, should open at least one window of their vehicle to listen for the train horn. The whistle boards were positioned at a distance of 250 m from the level crossing, which would have been correct for the original line speed of 50 mph (80 km/r); however, given the TSR the whistle boards should have been positioned at 150 m from the level crossing. However, the Tractor Driver did not hear the train horn.

Level crossing users

- 30 IÉ have two listed users of the level crossing (one of which is the Tractor Driver). Both have keys to the gates and both were issued with the IÉ's level crossing guidance booklet 'The Safe use of Unattended Railway Crossings' (which will be referred to as the 'LC guidance booklet' for the remainder of the report) in 2005.

- 31 The railway signals can be seen by users of the level crossing when at the level crossing. The LC guidance booklet advises users: “Do not rely on any railway signals, provided for the control of trains, to give you a guarantee that there is no train approaching” (IÉ, 2001). It should be noted that a previous RAIU investigation, 2011-R006, ‘Road vehicle struck at level crossing XM096, County Roscommon, 2nd September 2010’, where the user of a user operated level crossing was fatally injured, the RAIU found that the users had been incorrectly reading the signals before they would cross the level crossing.

Level crossing risk ranking

- 32 IÉ determines the risk ranking of each level crossing by using a computer programme known as the *Level Crossing Risk Model* (LCRM) which is a live ranking system that recalculates the ranking when new data is inputted. The order of risk is ranked from the highest (number 1) to the lowest, which at the time of the accident was 987. Speed at level crossings is one of the data inputs of the LCRM (i.e. a reduction in speed at a level crossing results in a drop in the risk ranking). Figure 9 illustrates the risk ratings generated for the level crossing as of the 22nd June 2012 as follows:

Risk type	Risk description	Risk for level crossing
Individual risk	The risk to a typical person exposed to one or more hazardous events.	818 out of 987
Collective risk	The totality of risk to all exposed groups from one or more hazardous events.	827 out of 987

Figure 9 – Risk ranking for the crossing (Sotera, 2008)

- 33 IÉ have made several attempts in the past to close XE020 due to the poor viewing distances. A nearby crossing XE021 was closed in 2004 for similar reasons and there is correspondence dating back to 2000 where the options of land purchase and alternative access for XE020 have been explored but to date there has been no agreement between the interested land users and CIE Group Property Department to allow a planning application.

Description of the tractor

- 34 The tractor was a 1984 model David Brown 1390 which was found to be in a road worthy condition. The vehicle is 3.42 m in length with a wheel base of 2.10 m and an unladen weight of 2494 kg.

Events before the occurrence

- 35 The Tractor Driver had used the level crossing earlier in the day to access farming land in the course of his daily business. The gates were secured and at approximately 14:40 hrs the Tractor Driver had to exit the property via the level crossing.
- 36 The Tractor Driver had received the LC guidance booklet in 2005, and was a regular user of the level crossing. The Tractor Driver approached the level crossing, see Figure 10, and stopped his vehicle short to allow him to open the gates. He opened both gates and checked the railway line in both directions for any trains, which is in accordance with the LC guidance booklet.
- 37 However, the RAIU found during the investigation that the users of this level crossing did check the railway signal lights to check that that they were not showing green as they walked across the track after opening the gates, before proceeding over the level crossing in their vehicle.
- 38 He returned to the tractor and edged forward slightly. At this point, a motor vehicle on the R462 pulled into the gateway blocking his exit, see Figure 10. The driver of the vehicle saw the tractor and then continued on his journey.



Figure 10 – Events at level crossing leading up the accident

- 39 The passenger train was scheduled to depart Limerick Station for Ennis at 14:15 hrs but did not leave until 14:35 hrs due to a delay. The train was crewed by a driver and a RPU Officer.

Events during the occurrence

- 40 The train approached level crossing XE020 at a speed of 23 mph (36.8 km/h). The Train Driver sounded the horn at the whistle board location (250 m before the level crossing). He did not see the tractor as he approached the level crossing.
- 41 The Train Driver felt a slight movement of the train as the train passed through the level crossing which he thought was a track defect (which he thought was the reason for the TSR).
- 42 The Tractor Driver after opening the gates and checking the signals then edged forward and collided with the train as it passed through the level crossing. The first point of contact with the train was at the step board on the second set of doors rear of the first carriage, see Figure 11, at a point 13 m from the front of the train, see Figure 12. The train continued through the level crossing with the tractor scraping along the train for a distance of 3 m before being pushed sideways off the train. The Tractor Driver did not hear the train horn at any point.

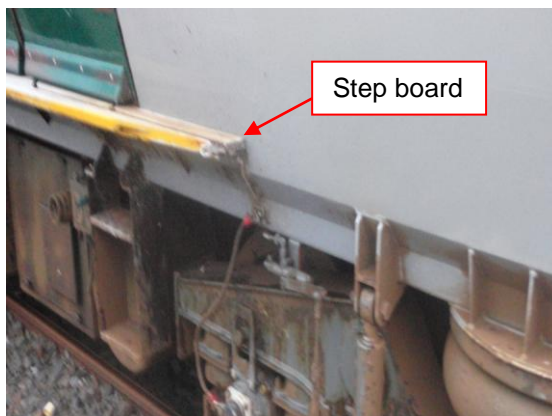


Figure 11 – Step board



Figure 12 – First impact of tractor with train

Events after the occurrence

- 43 As the train continued the RPU Officer on board made his way to the driver's cab and told the Train Driver that he saw a tractor close to the train as it passed the level crossing and at that time there was a bump and he was knocked off his feet and thought that may be the train had struck the tractor.
- 44 As the Train approached Sixmilebridge Station, at approximately 14:54 hrs, the Train Driver contacted the Signaller to report a near miss with a tractor at the level crossing.

- 45 At Sixmilebridge Station the Train Driver examined the train and noticed some scrape marks on the right side of the train. After departing Sixmilebridge Station he reported to the Signaller at approximately 15:00 hrs that there was damage to the train and there was a definite collision with the tractor at the level crossing. The Signaller instructed the Train Driver to stop the train at Ennis Station, which was the next scheduled stop.
- 46 The Signaller was not familiar with the area and attempted to ascertain where the level crossing was located and the road access point to the level crossing but the only information available to him was on a piece of paper, see Figure 13, which only included the MP location of the level crossing. MP locations are a railway term that are not commonly understood outside the railway industry.

Crossing information					
X-ING No.	Local Name	mls	yds	TYPE	Current Status
XE001	Bunnavalley LC.(U)	1	500	F	Closed
XE002	Singland L.C (CX).	1	850	CX	Open
XE006	Park L.C. (CX).	2	1060	CX	Open
XE007				F	Closed
XE008	Pedestrian Crsg.	3	760	O	Closed
XE009	Pedestrian Crsg.	3	1150	O	Closed
XE010	Longpavement LC.(CX)	3	1640	CX	Open
XE011	Pass L.C. (U).	5	660	F	Closed
XE012	Meelick L.C. (U).	6	700	O	Open
XE013	Declan Hodgins' Cg	7	45	F	Open
XE014	Cratloe wood LC. (U)	7	1060	O	Open
XE015	Cratloe Lower.(CX)	7	1720	CX	Open
XE016	Cratloe Lower.(CX)	8	280	F	Closed
XE017	Joe Whites' Crsg.	8	785	OP	Closed
XE018	John Arther's Crsg	8	1440	F	Closed
XE019	John Arther's Crsg	8	1560	F	Open
XE020	Carroll's Crossing	9	345	F	Open

Figure 13 – Information available to Signaller in relation to level crossings

- 47 The Signaller then contacted the *Permanent Way Inspector* to advise him and to ascertain when they would have a member of staff on site; and then contacted the Train Regulator in Centralised Traffic Control (CTC), Dublin and advised him that there was a reported collision. It was noted that a large number of calls were coming into the Signaller from other IÉ parties in relation to the accident, and the Signaller spent a long time giving unnecessary information to these parties.
- 48 The Crossing Control Centre (CCC) Supervisor who is located in another room within the same building as the Signaller offered his assistance to the Signaller and attempted to ascertain the location of the level crossing using IÉ's *Infrastructure Asset Management System* (IAMS), which was accessible in another room in the building. The location of level crossing and their access

points was included on IAMS after a previous recommendation made by the RAIU which stated “IÉ should review their procedure for the management of accidents to ensure that communication with the emergency services is clear and provides the necessary information to locate an accident site without undue delay and access it by the most appropriate point”. However, IAMS was located in a different room, the Signalman did not have access to the system and the CCC Supervisor was not trained in using the system and therefore IAMS was unable to assist the Signalman in locating the level crossing.

- 49 At 15:22 hrs, the brother of the Tractor Driver then contact the Signalman to inform him that a train had struck a tractor at level crossing XE020 and the Tractor Driver was still on site and in a state of shock.
- 50 The Signalman contacted the Emergency Services at approximately 15:27 hrs, twenty-seven minutes after the Train Driver had confirmed that he had struck the tractor. The Signalman was only able to provide the MP location to the Emergency Services, which is compliant with Section A 3.8 of the IÉ Rule Book, which requires that the Signalman gives his title and identifies the site of the occurrence by mile post (MP) and asset number but this was of little assistance to the Emergency Services in their response to the accident
- 51 The Garda and the Fire Service arrived on site at approximately 15:49 hrs and 15:51 hrs, respectively. Therefore the Emergency Services arrived at the accident site 49 – 51 minutes after the accident occurred and 22 – 24 minutes after the call was made by the Signalman to the Emergency Services.
- 52 A summary of the events after the accident are illustrated below in Figure 14:

Time (hrs)	Event
14:35	Limerick to Ennis passenger train, ID A786, departs from Limerick Station.
14:50	Tractor collides with the train as it passes over level crossing XE020.
14:54	Initial call from Train Driver to Signalman advising of near miss at level crossing.
15:00	Train Driver contacts Signalman to confirm collision between train and tractor.
15:22	Tractor driver's brother contacts Signalman to inform him of train collision with tractor and the Tractor Driver is still on site in a state of shock.
15:27	Signalman contacts the emergency services.
15:49	Garda arrive on site.
15:51	Fire Service arrive on site.

Figure 14 – Summary of post accident events

Accident reconstruction

- 53 A reconstruction was carried out at the level crossing with the tractor once it was repaired. It was found that in order for the Tractor Driver to obtain a view of an oncoming train exiting the field gate on the up side the tractor had to move forward to a point where the edge of its front body work was 0.6 m from the outside edge of the nearest rail, see Figure 15. On the day of the reconstruction, the train horn could be heard from a position of 250 m from the level crossing.



Figure 15 – Position the tractor requires to look for approaching trains

Similar occurrences

- 54 There was one near miss at this level crossing reported on 18th May 2005 involving a Landrover vehicle, who was not one of the known IÉ users.
- 55 There have been two accidents and 64 near misses at F type level crossings since 2007.

Analysis

The Level Crossing

- 56 The viewing distances at the level crossing did not meet those required by CCE-TMS-380 for the line speed of 50 mph (80 km/h) which would require a viewing distance of 250 m. IÉ recognised that there were poor viewing distances and imposed a TSR of 25 mph (40 km/h), however, these also failed to meet the new viewing distance of 125 m for three of the four views from the level crossing (paragraph 25 and 26).
- 57 Whistle boards were also erected at the level crossing to provide an audible warning to users of the level crossing, however, these were found to be erected at a distance of 250 m instead of the 150 m required for the TSR speed of 25 mph (40 km/h) (paragraph 29). The LC guidance booklet requires that users of the level crossing should lower at least one window of their vehicle to listen for the train horn, sounded at the whistle board location. On the day of the accident, the train horn was sounded at 250 m but the Tractor Driver did not hear it.
- 58 The reconstruction of the accident showed that the tractor would have to be positioned at a distance of 0.6 m from the track to allow the user look for trains. Considering the kinematic envelope of the train is greater than 0.6 m, this means that the tractor would encroach into the *swept path* of the train. Given that the tractor just scraped the side of the train, it is likely that the Tractor Driver positioned the tractor 0.6 m from the track to allow him to look for trains (paragraph 53).
- 59 IÉ have been actively trying to close the level crossing due to the poor viewing distances for some years. Options that have been explored to eliminate the level crossing include land purchase and alternative access arrangements, however, at the time of the accident this was still an ongoing issue with a lack of agreement by the interested parties (paragraph 33).
- 60 LCRM, the live ranking system for level crossings on the IÉ network, calculated the individual risk at the level crossing as 818 of 987 and the collective risk as 827 of 987, as of the 22nd June 2012. The low risk ranking at this level crossing was awarded as a result of the introduction of a TSR and whistle boards. The introduction of these mitigation measures do not resolve the issue of the poor viewing distances, resulting in the Tractor Driver having to position the Tractor into the swept path of the train to look for approaching trains (paragraph 58).

Actions of the Tractor Driver

- 61 The Tractor Driver was a regular user of this level crossing and had a copy of the LC guidance booklet which he received in 2005 and adhered to the instructions given in them for the opening and closing of gates and keeping the gates locked when not in use.
- 62 However, the Tractor Driver had also incorrectly adopted his own system of reading the railways signals to check for approaching trains. He would check the signals when he was opening the gates. It is likely he adopted this system due to the poor viewing distances at the level crossing (paragraph 37). On the day of the accident he saw the nearest signal was yellow and the next signal was green, he therefore assumed that it was safe to cross the level crossing. A previous RAIU report discovered others users of another user operated level crossing, were reading signals in assisting them in level crossing the level crossing (paragraph 31).
- 63 On returning to the tractor after opening the gates and checking the signals the Tractor Driver saw a vehicle blocking his exit onto the R264. The driver of the vehicle was stationary for a period of several seconds before realising that the exit path for the tractor was blocked before moving away from the exit.
- 64 Although the Tractor Driver was not adhering to the LC guidance booklet which states users should not rely on any railway signals he had assumed it was safe to cross the level crossing; and despite being delayed by the vehicle blocking his exit the Tractor Driver then edged forward to look again for oncoming trains. The Tractor Driver did not hear the train horn before edging forward.
- 65 The position the Tractor Driver would have to locate his tractor was 0.6 m from the track, and with the kinematic envelope greater than 0.6 m (paragraph 9) the tractor would have to breach the kinematic envelope to look for oncoming trains (paragraph 53).

Actions of the Signalman

- 66 The Signalman contacted the Emergency Services twenty seven minutes after the Train driver confirmed there was a collision with a tractor at the level crossing. From the logs of phone calls it can be seen that the Signalman was taking a large number of calls and attempting to get IÉ staff to the accident rather than contacting the Emergency Services immediately (paragraph 47).
- 67 A long time was spent by the Signalman trying to ascertain the location of the level crossing as the information available to him only included the MP location (paragraph 46). The CCC Supervisor attempted to retrieve the level crossing location from IAMS, which was updated with this information following a previous RAIU recommendation in relation to communication with the

Emergency Services; however, the CCC Supervisor was unable to immediately retrieve this information (paragraph 48).

68 When the Signaller did contact the Emergency Services, he fully complied with the IÉ Rule Book, in that he gave his title and identified the site of the occurrence by MP and asset number, however, this was of little assistance to the Emergency Services in their response to the accident (paragraph 50).

Conclusions

The Level Crossing

- 69 Viewing distances at the level crossing did not meet IE's 'Technical Standard for the Management of User Worked Level Crossings' for three of the four views from the level crossing. The viewing distances should have exceeded 125 m, however, the viewing distances recorded at the time of the accident were 10m, 34m, 68m and 461m. In relation to the accident the Tractor Driver had a viewing distance of 34m into the direction of the approaching train (paragraph 56).
- 70 Whistle boards erected at the level crossing as a result of the poor viewing distances did not meet IE's 'Technical Standard for the Management of User Worked Level Crossings' as they were erected at a 250 m from the level crossing instead of the required 150 m (paragraph 57). There is some doubt as to the effectiveness of the audible warning as the Tractor Driver did not hear the train horn. This may have been as a result of being distracted by the vehicle blocking his path or by environmental conditions on the day of the accident.
- 71 From the reconstruction, it can be established that the Tractor Driver had to position the tractor, 0.6m from the track to look for trains. As the train has a kinematic envelope of greater than 0.6 m, the tractor would have to encroach into the swept path of the train in order to look for approaching trains (paragraph 58).
- 72 Although several attempts were made by IE to close or move the level crossing, these were unsuccessful due to disagreements with the level crossing user over land purchasing (paragraph 59).
- 73 The LCRM system awarded a low risk ranking to the level crossing. This was in part due to the imposed lower speed at the level crossing as a result of the TSR and the erection of whistle boards. However, given that the level crossing failed to meet three of the four viewing distances, this required the Tractor Driver to position his vehicle in the swept path of the train to look for trains, there is some doubt as to the efficacy of the LCRM system (paragraph 60); as the system is based on generic risk factors and are not specific to the level crossing.

Actions of the Tractor Driver

- 74 The Tractor Driver was a daily user of this level crossing and had a copy of the LC guidance booklet which he received in 2005.

- 75 The Tractor Driver had also adopted his own system of using the railways signals to check for approaching trains, which is specifically set out in the LC guidance booklet as something that should not be done by users. Depending on the colour of the signals he makes an assumption on whether the train was approaching or not. He is likely to have adopted this approach as a result of the poor viewing distances at the level crossing. This reading of signals, has also been found by the RAIU at another level crossing, where a user was fatally injured (paragraph 62).
- 76 On the day of the accident, having assumed it was safe to cross he had been distracted by a vehicle blocking his exit, and when he edged forward to look for approaching trains he struck the train as he encroached into the swept path of the train (paragraph 62 and 63).

Actions of the Signalman

- 77 The Signalman contacted the Emergency Services twenty seven minutes after the Train driver confirmed there was a collision with a tractor at the level crossing as he had become distracted by the number of calls coming in and trying to ascertain the location of the level crossing (paragraph 66).
- 78 The input of level crossing locations into IAMS failed to help the Signalman locate the level crossing as it was located in a different room in the building, he had no access to the system and the CCC Supervisor who did have access to it was unable to use it as he had not been trained in its use. As a result, he was dependent on the information available to him, which was the MP location, which according to the IÉ Rule Book is the only information that the Signalman is required to give the Emergency Services despite it being a railway term and of little assistance to the Emergency Services in their response to the accident (paragraph 67 and 68).
- 79 The inputting of level crossing information into IAMS was done after a previous RAIU safety recommendation in relation to communications with Emergency Services. Although IAMS does provide information on the location of the level crossing, this information was not sufficient to direct the Emergency Services to the level crossing access points on the day of the accident. Sufficient and relevant information needs to be readily available to those persons who will need it, and such persons should be appropriately trained (paragraph 67).

Immediate cause, contributory factors and underlying factors

- 80 The immediate cause of the accident was that that tractor entered the swept path of the train as the train was travelling through the level crossing.

81 The contributory factors identified were:

- CoF-01 – The viewing distances failed to meet the requirements set out in of IÉ CCE-TMS-380, Technical Standard for the Management of User Worked Level Crossings;
- CoF-02 – The Tractor Driver had to position the tractor within the swept path of the train in order to look for trains;
- CoF-03 – The Tractor Driver had been using the railway signals to estimate train approaching times, a system which may have been adopted due to the poor viewing distances at the level crossing but contradicts the instructions given in the LC guidance booklet.

82 The underlying factors identified were:

- UF-01 – Having been unable to close the level crossing due to a lack of agreement between the relevant land owners, IÉ did not introduce adequate safety measures as a result of the inadequate viewing distances at the level crossing;
- UF-02 – IÉ may not have prioritised work at this level crossing as a result of the low risk rankings awarded by IÉ's LCRM system.

83 The following additional observation (AO), not relating to the cause of the accident, was made during the investigation:

- AO-01 – The signalman did not have the sufficient training and information immediately available to him to assist the Emergency Services to respond to the accident scene.

Relevant actions taken or in progress

Actions taken by IÉ

84 At the time of publication of the this report IÉ have:

- Relocated the whistle boards to 150 m before the level crossing;
- Fitted convex mirrors to assist vehicles exiting from the field side on to the level crossing;
- Engaged with the local authority in order to put warning notices on the public road;
- Reinitiated talks with the users of the level crossing in relation to closing or moving the level crossing.

Safety recommendations

General description

85 In accordance with the Railway Safety Act 2005 (Government of Ireland, 2005a) and the European railway safety directive (European Union, 2004), recommendations are addressed to the national safety authority, the RSC. The recommendation is directed to the party identified in each recommendation.

86 As a result of the RAIU investigation four new safety recommendations are made, three relating to the occurrence and one relating to an additional observation. One previous RAIU safety recommendation was also re-iterated.

New safety recommendations related to the occurrence

87 Viewing distances at the level crossing do not meet IÉ's 'Technical Standard for the Management of User Worked Level Crossings'. Given that viewing distances can still not be met by the introduction of a TSR (CoF-01) and that users have to position themselves within the swept path of the train in order to look for trains (CoF-02); and that the Tractor Driver did not hear the train horn sounded at the whistle boards location, the RAIU make the following safety recommendation:

IÉ should close, move or alter the level crossing in order to meet the required viewing distances in IÉ's technical standard CCE-TMS-380 Technical Standard for the Management of User Worked Level Crossings.

88 Having failed to close the crossing (UF-01), IÉ attempted to mitigate the poor viewing distances at the level crossing by the introduction of the TSR and whistle boards, which proved inadequate on the day of the accident resulting in the Tractor Driver adopting his own systems for using the level crossing (such as reading railway signals) (CoF-03) the RAIU make the following safety recommendation:

IÉ should review their systems of managing level crossings that fail to meet the viewing distances in IÉ technical standard CCE-TMS 380 Technical Standard for the Management of User Worked Level Crossings to ensure that any mitigation measure that is introduced is effective at reducing the risk to level crossing users.

- 89 IÉ's LCRM system failed to recognise the high risk associated with the viewing distances at the level crossing, which may have resulted in a lack of urgency for upgrade works at the level crossing (UF-02). The LCRM system also applies generic solutions (such as speed reduction) to level crossings which may not in fact mitigate the risk of striking vehicles (i.e. the Tractor still had to enter into the swept path of the train in order to look for trains). Therefore the RAIU make for following safety recommendation:

IÉ should audit their LCRM system, to ensure it correctly identifies high risk level crossings; and identifies appropriate risk mitigation measures for individual level crossings.

Reiterated safety recommendations related to the additional observations

- 90 The RAIU made a safety recommendation in Investigation Report 2011-R005 based on a fatal accident at XE039 on the 27th June 2010, as the Signaller was unable to give clear instructions to the Emergency Services (AO-01), the RAIU reiterate the following safety recommendation:

IÉ should review their procedures for the management of accidents to ensure that communication with the emergency services is clear and provides the necessary information to locate an accident without undue delay and access it by the most appropriate point.

New safety recommendations related to the additional observations

- 91 IÉ included information for the Signaller on IAMS based on the previous RAIU safety recommendation above. Given that IÉ consider this previous safety recommendation to be complete despite the Signaller being unable to communicate clearly with the emergency services and with the Signaller continuing to use railway terminology (AO-01) there is some doubt that this recommendation has been completed adequately. Therefore the RAIU reinforce their previous safety recommendation with the following new safety recommendation:

IÉ staff who may be required to contact the emergency services should have the appropriate information readily available to them in order to give clear instructions to the emergency services in order that they can attend accident sites in a prompt manner. This information should then be updated in IÉ's Rule Book.

Additional information

List of abbreviations

°C	Degrees Celcius
CF	Causal factor
CoF	Contributory factor
CWR	Continuous Welded Rail
DMU	Diesel Multiple Unit
IAMS	Infrastructure Asset Management System
IM	Infrastructure Manager
kg	Kilogram
km/h	Kilometres per hour
LCRM	Level Crossing Risk Model
m	Metre
MP	Mile Post
No.	Number
RAIU	Railway Accident Investigation Unit
RPU	Revenue Protection Unit
RSC	Railway Safety Commission
RU	Railway Undertaking
SI Units	International System of Units
TCB	Track Circuit Block
TSR	Temporary Speed Restriction
UF	Underlying factor

Glossary of terms

Accident	An unwanted or unintended sudden event or a specific chain of such events which have harmful consequences including collisions, derailments, level-crossing accidents, accidents to persons caused by rolling stock in motion, fires and others.
Causal factors	Any factor(s) necessary for an occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.
Colour light signals	Signals that convey movement authority to train drivers by means of coloured lights.
Continuous welded rail	Sections of rail that are welded together.
Contributory factor	Any factor(s) that affects, sustains or exacerbates the outcome of an

	occurrence. Eliminating one or more of these factor(s) would not have prevented the occurrence but their presence made it more likely, or changed the outcome.
Contributory factors	Any factor(s) that affects, sustains or exacerbates the outcome of an occurrence. Eliminating one or more of these factor(s) would not have prevented the occurrence but their presence made it more likely, or changed the outcome.
Controlling signalman	The signalman designated to control a specific section of track.
Down direction	The line on which trains normally travel away from Limerick.
Extensive damage	Damage that can be immediately assessed by the RAIU to cost at least €2,000,000 in total.
Field crossing	A user worked level crossing for accommodating agricultural use.
Immediate cause	The situation, event or behaviour that directly results in the occurrence.
Incident	Any occurrence, other than an accident or serious accident, associated with the operation of trains and affecting the safety of operation.
Infrastructure Asset Management System	Database in which details of IÉ assets (including level crossings) are recorded. It also encompasses a Condition Monitoring Module, a Fault Management System, Work Order Processing and a Geographical Information System.
Infrastructure Manager	Organisation that is responsible for the establishment and maintenance of railway infrastructure, including the management of infrastructure control and safety systems.
Kinematic Envelope	The maximum sectional outline that a rail vehicle occupies under various conditions.
Level Crossing Risk Model	The software package authorised by the Board of IÉ for the assessment of risks at level crossings on the IÉ network.
Mile Post	A post used to denote a location on a railway line using miles from a fixed point known as the 0 milepost.
National safety authority	The national body entrusted with the tasks regarding railway safety in accordance with European directive 2004/49/EC.
Permanent Way Inspector	Permanent Way Inspector is responsible for overseeing and guiding workplace activities in his CCE location.
Railway Undertaking	Organisation that operates trains.
Rolling stock	Railway vehicles.
Serious accident	Any train collision or derailment of trains, resulting in the death of at least one person or serious injuries to 5 or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety,

	where extensive damage means damage that can be immediately assessed by the RAIU to cost at least €2,000,000 in total.
Serious injury	Any injury requiring hospitalisation for over 24 hours.
Swept path	The plan area occupied by a rail vehicle as it moves along the track.
Track circuit block	A signalling system that uses track circuits to confirm the absence of trains in order to control the movement of trains.
Temporary speed restriction	A speed restriction imposed, generally for a short time, usually as a result of engineering work, to guarantee the safe passage of trains.
Underlying factor	Any factor(s) associated with the overall management systems, organisational arrangements or the regulatory structure.
Up direction	The line on which trains normally travel towards Limerick.
Viewing position	Position from where the viewing distance is measured.
Whistle board	A board positioned on the side of the track that indicates to train drivers that they are to sound the train horn.

References

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