Railway Accident Investigation Unit

Ireland

INVESTIGATION REPORT

Near miss at Knockcroghery Level Crossing, XM065, Co. Roscommon

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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 to illustrate concepts to non-technical readers.

Report preface

The RAIU is an independent investigation unit within the Department of Transport, Tourism and Sport (DTTAS) which conducts investigations into accidents and incidents on the national railway network, the Dublin Area Rapid Transit (DART) network, the LUAS, heritage and industrial railways in Ireland. Investigations are carried out in accordance with the Railway Safety Directive 2004/49/EC enshrined in the European Union (Railway Safety) (Reporting and Investigation of Serious Accidents, Accidents and Incidents) Regulations 2014.

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

At approximately 11:10:56 hrs, the 09:45 hrs passenger service from Westport to Heuston (Train A805) triggered the initiation for Level Crossing XM065 (a CCTV level crossing with lights and full barriers), which resulted in the road traffic lights flashing to indicate to road users that rail traffic was approaching. Two cars approached the level crossing from the Athlone direction, after this initiation had commenced, with one car stopping on the yellow box area (Car 1), within the confines of the level crossing and one stopping close to the level crossing barriers. When the Level Crossing Control Operator attended to the level crossing, the view of the car on the level crossing was obscured, but the Level Crossing Control Operator froze the barriers for the second car which is positioned near the level crossing. When the Level Crossing Control Operator (LCCO) saw the second car (Car 2) clear the level crossing, he began the closing sequence again and cleared the level crossing (the car on the level crossing could not drive off the level crossing); which resulted in the barriers fully lowering with the first car trapped in the confines of the level crossing.

The immediate cause of Train A805 passing through LC XM065 with a car inside the lowered barriers, was as a result of the LCCO clearing the level crossing while the car was within the confines of the level crossing. Contributory factors associated with the incident are:

- Car Driver 1 did not adhere to the road traffic legislation related to this type of crossing, in that, the driver did not stop clear of the level crossing; and drove past the red warning lghts.
- When the LCCO attended to the LC XM065, fifteen seconds after the initiation alarm, Car 1 was partially obscured by the barriers, the road flashing red signals and a street light resulting in the LCCO not seeing Car 1;
- As the barriers were not fully raised, and remained frozen in a midway position, until the LCCO cleared the level crossing, Car 1 could not clear the level crossing; as another car had driven on to the crossing preventing Car 1 from exiting.
- The obstruction of Car 1 was enabled by the poor positioning of the level crossing cameras at Level Crossing XM065, resulting in poor views on the LCCO's display monitors;
- The LCCO did not utilise the appropriate non-technical skills to fully assess Level Crossing XM065 before clearing the level crossing.

The underlying cause associated with this incident:

- There was no adequate risk assessment process for the position of Closed Circuit Television (CCTV) level crossing cameras;
- There is no adequate 'non-technical skills' training or documentation to assist LCCOs in their duties.

The following additional observation is made by the RAIU:

- The Level Crossing Control Centre Instructions is a document of intense text which is difficult to read, and reads as more of a technical document than a guide for LCCO's.

The RAIU have made the following five safety recommendations as a result of this investigation:

- The Signalling, Electrical and Telecommunications (SET) Department should review the camera position at Level Crossing XM065, and other similar CCTV level crossings, to ensure that the LCCOs have optimum, unobstructed, views of level crossings;
- The SET Department should develop a formalised risk assessment process for the positioning of CCTV cameras and associated design works.
- IÉ- Infrastructure Manager (IM) should identify CCTV level crossings with obstructed views and issue interim instructions to LCCOs to fully raise the barriers where there is a possibility of any obstructions on level crossings.
- IÉ-IM should review the human factors and non-technical skills training for LCCOs, and introduce further training, where applicable. In addition, IÉ- IM should finalise the Professional Support Handbook for Level Crossing Control Operators; to provide guidance for LCCOs in the areas of human factors and non-technical skills.
- IÉ-IM should review and update the LCCC Instructions, to make them more user friendly for LCCOs.

Contents

The Incident

Summary of the incident

1 At approximately 11:10:56 hrs on the 31st January 2017, the 09:45 hrs passenger service from Westport to Heuston (Train A805) triggered the initiation for Level Crossing XM065 which resulted in the road *Flashing Red Signals* beginning to flash at 11:11:03 hrs to indicate to road users that rail traffic was due to approach. A number of events occurred in the following two and a half minutes, namely:

- Five seconds after the warning signals begin flashing a car is driven onto the level crossing (from the Athlone direction) and stops on the '*yellow box area'* (the car is within the entry and exit barriers which are raised);
- Another car, travelling behind the first car, travels over the *transverse vehicle stop line* (referred to as 'stop line' for remainder of report);
- The barriers start to lower (with one car within the confines of the level crossing and one car under the lowering barrier);
- The barriers freeze (due to the actions of the Level Crossing Control Operative (LCCO) based in Athlone) and both cars start reversing;
- The barriers start lowering again (due to the actions of the LCCO) with one car within the confines of the level crossing and the other car clear of the level crossing;
- The train passed through the level crossing with the car on the yellow box area of the level crossing (see red circle in Figure 1) trapped by the lowered barriers;
- The barriers start to raise and the trapped car exits off the level crossing.

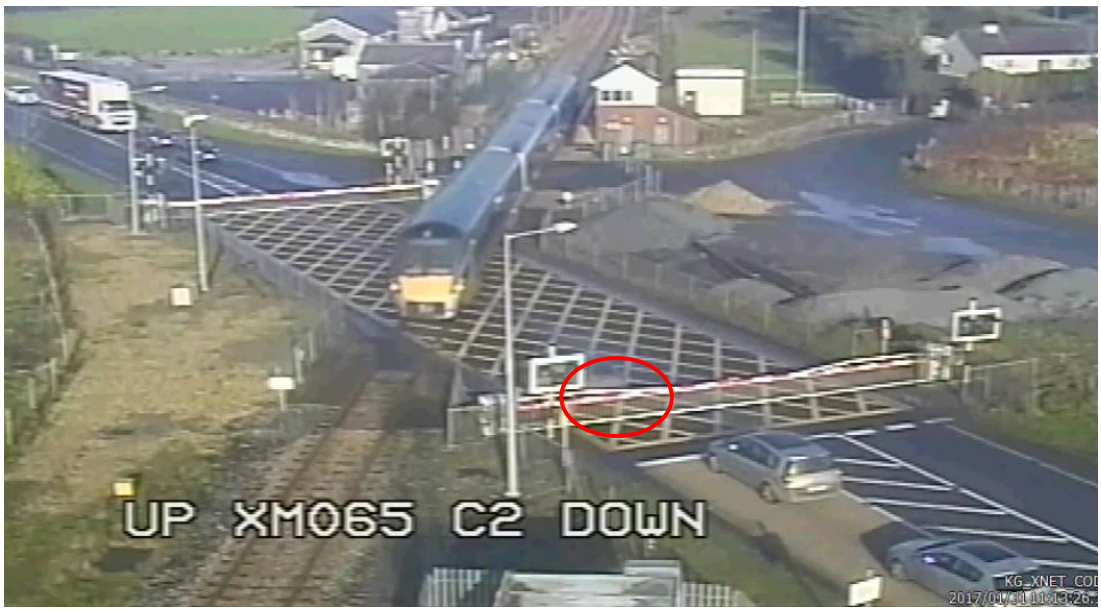


Figure 1 – Train travels through level crossing, with car (circled) trapped on level crossing

2 The driver of the train reported the incident at approximately 11:15 hrs and the LCCO was removed from operational duties.

Parties and roles involved, directly and indirectly, in the incident

Parties involved in the incident

Iarnród Éireann

3 IÉ is the *railway undertaking* (RU) who owns and operates mainline and suburban railway services in Ireland and operates under a *safety certificate* issued by the Commission for Railway Regulation (CRR). The RU Licence is issued in conformity with European Directive 2012/34/EU and S.I. 249 of 2015; the licence was renewed on 24th September 2015 for a period of five years.

4 IÉ is also the *infrastructure manager* (IM), who owns and operates the railway infrastructure in Ireland and operates under a safety certificate issued by the CRR. The IM Safety Authorisation is issued in conformity with European Directive 2012/34/EU, the authorisation was renewed on 25th March 2013 for a period of five years.

5 The IÉ-IM department involved in the investigation include the Signalling, Electrical and Telecommunications (SET) Department who are responsible for the design, installation and maintenance of signalling equipment, including Closed Circuit Television (CCTV) cameras. The Infrastructure Manager Operations controls the operation of CCTV Level Crossings.

Roles involved in the incident

6 The IÉ staff directly involved in the incident were the:

- Driver A805 – A competent driver who was driving the 09:45 hrs passenger service from Westport to Heuston;
- LCCO – The LCCO, based at the Level Crossing Control Centre (LCCC) in the Athlone Local Control Centre (ALCC), who was involved in the incident;
- LCCO Supervisor – Supervisor in the LCCC, in charge of four rostered LCCOs at the time of the incident.

7 The other parties involved in the incident, were the car drivers:

- Car Driver 1 – Car Driver 1 was driving a small blue hatchback (Car 1); this driver was trapped in the level crossing; no other details about this driver are known to the RAIU;
- Car Driver 2 – Car Driver 2 was driving a silver people carrier (Car 2); this driver was at the level crossing when the barriers were lowered; no other details about this driver are known to the RAIU.

Roles not directly involved in the incident

8 The roles not directly involved in this incident, but responsible in some aspects of the LCCOs role are as follows:

- Chief Traffic Executive (CTE) – Responsible for preparation, maintenance, development, compliance and efficiency of relevant LCCO standards;
- District Traffic Executives (DTE): Responsible for recruitment, training and assessment of LCCOs; ensuring a competency management system is established and maintained for LCCOs; and, completion and maintenance of LCCOs records;
- Operations Control Manager (District Manager/LCCC Manager) – Responsible for selection, recruitment, training, certification, monitoring and management of LCCOs; and provision of their safety equipment and information.

General description of the railway

Infrastructure

9 The line involved is the Athlone to Westport line (on the Mayo Line). The track from Athlone to Westport is a *bi-directional, single line* with flat bottom *continuously welded rail* (CWR) mounted on concrete sleepers set in ballast. Trains traveling from Athlone to Westport are travelling in the *Down* direction. The maximum line speed is 70 mph (113 km/h).

10 No factors related to the condition of the track were found to have contributed to the incident.

11 The level crossing involved in the incident, is Level Crossing XM065 (to be referred to as LC XM065 for the remainder of this report), located at Knockcroghery, see Figure 2. LC XM065 is a CCTV level crossing, operated on the Roscommon national secondary road, the N61, which links Athlone, Roscommon, Tulsk and Boyle. Details on the level crossing will be outlined further in the Evidence section of this report.

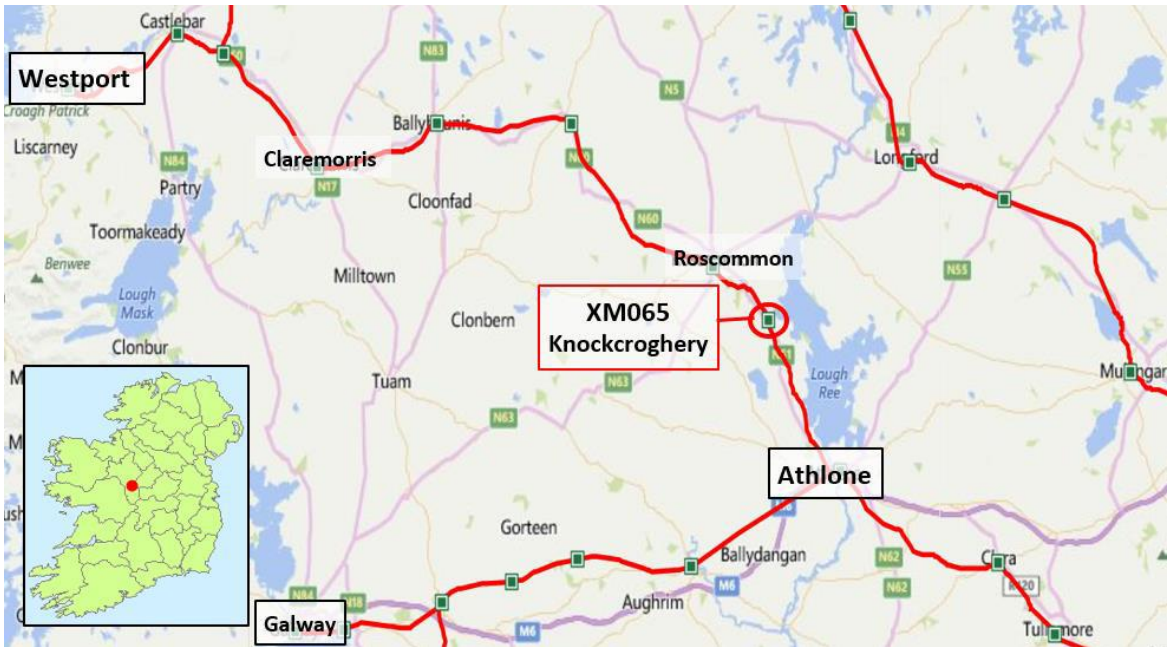


Figure 2 – Location of the incident

Map taken from IÉ investigation report

Rolling stock

12 The train involved in the incident was the 09:45 hrs service from Westport to Heuston (Train Identification A805). Train A805 was a three car Intercity Railcar (ICR) consisting of units 22361 (leading), 22461 and 22261. The total length was approximately 70 m, and the mass was 147 tonnes. The maximum allowable speed of the ICR is 100 mph (160 km/h).

13 No factors related to performance of the rolling stock were found to have contributed to the incident.

Signalling and Communications

14 The line from Athlone to Westport is operated under the rules and regulations for signalling by *track circuit block* with two and three aspect *coloured light signals* (see Figure 3). The line is controlled by the *Mayo Line Signalman* (which will be referred to as the Signalman for the remainder of this report) at ALCC.

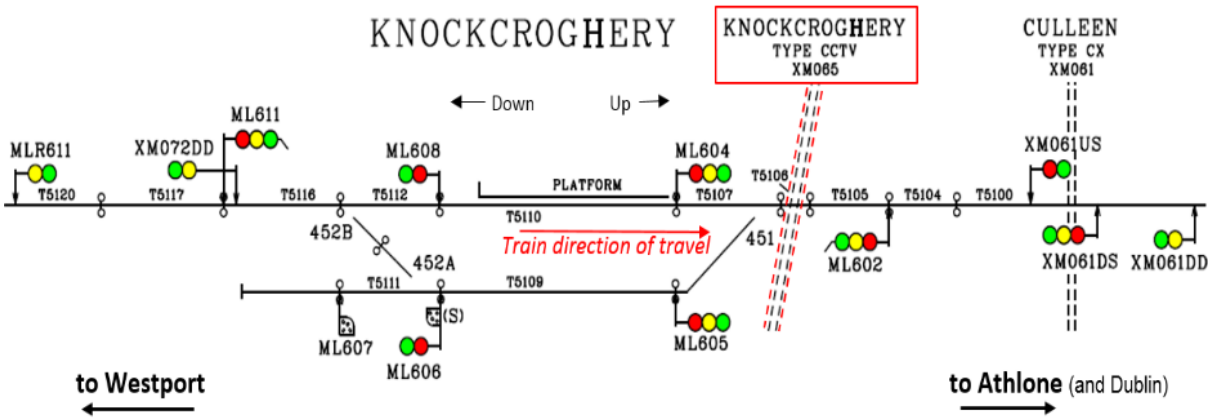


Figure 3 – Signalling layout

15 Train detection is achieved by means of axle counters (mid-section) and track circuits (stations).

16 The means of communication between the Signalman and protection staff on the IÉ network is via telephone (including mobile telephone and signal post telephone). The means of communication between road users and the LCCO is through yellow box telephones (six present).

17 No factors related to the signalling and communication system were found to have contributed to this incident.

Operations

18 The operation of LC XM065 is provided from the LCCC Room, in ALCC, for the controlling of: Closed Circuit Television (CCTV) automated level crossing; line signalling; and security monitoring.

19 The ALCC and LCCC will be further outlined in the Evidence section of this report.

Fatalities, injuries and material damage

Fatalities and injuries

20 There were no fatalities, major or minor injuries as a result of this incident.

Material damage

21 No material damage occurred to IÉ rolling stock or infrastructure as a result of this incident.

External circumstances

22 The weather recorded in the location of the incident, by Met Éireann, was recorded as having a maximum temperature of 11.4 Deg C with 1mm of rainfall having fallen. The mean wind speed was 5 knots (9.2 km/h).

23 There were no external circumstances (e.g. weather conditions) identified that contributed to this incident from the perspective of the LCCC or LCCO.

24 It is unknown whether any external circumstances (e.g. weather conditions) contributed to Car Driver 1 arriving at the level crossing and becoming entrapped in the barriers, as the Car Driver 1 and 2 remains unknown to the RAIU.

RAIU Investigation

RAIU decision to investigate

25 In accordance with the Railway European Union (Railway Safety) (Reporting and Investigation of Serious Accidents, Accidents and Incidents) Regulations 2014, the RAIU investigates incidents and accidents on the national railway.

26 Given that under slightly different circumstances, this incident may have led to a serious accident where there could have been potential for fatalities or serious injuries, due to a train collision with a car, the RAIU have made the decision to conduct a full investigation.

Scope of investigation

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

- Establish the sequence of events leading up to the incident;
- Establish, where applicable, the immediate cause, contributory factors, underlying factors and *root causes*;
- Examine the relevant elements of the safety management system (SMS);
- Examine the competency management system in place for LCCOs;
- Examine the actions of the LCCO on the day of the incident;
- Examine the safety history of the LCCO.

Investigation and evidence

28 During this investigation the RAIU collated and logged the following evidence:

- Witness testimonies from IÉ personnel;
- CCTV footage of the incident;
- Level Crossing Control Centre Instructions;
- IÉ standards, procedures and other documentation related to competency management of LCCOs in general and the LCCO involved in the incident;
- Site examination of the LCCC in terms of working conditions.

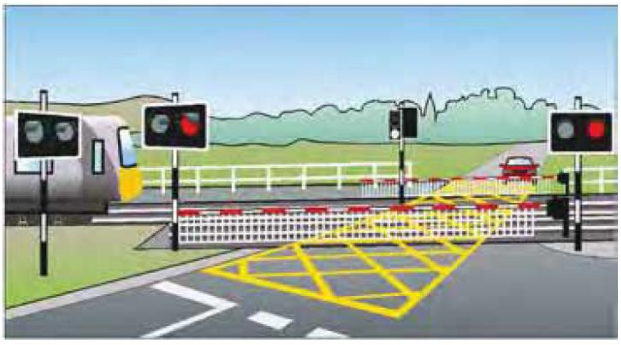
Evidence

Rules of the Road

29 Section 6, Traffic Signs and Road Markings, of the Rules of the Road includes a section on 'Railway Level Crossings'; Part 4 of this section relates to 'Automated railway level crossings with barriers and flashing red lights'; which states that drivers should: stop safely when the amber and red lights shows, see Figure 4; and obey the rules for traffic lights. The infrastructure associated with level crossings will be discussed in the next section of this report.

4. Automated railway level crossings with barriers and flashing red lights

These level crossings have barriers which automatically come down when a train is approaching. The amber light is the same as an amber traffic light – stop safely when the amber light shows. Flashing red lights have the same meaning as a steady red traffic light – stop safely when they show.



Level crossing ahead with lights and barriers. Crossing may also have audible warning alarms.

Drivers – what you must do:

- Obey the rules for traffic lights.
- If you have already entered the crossing, move clear as quickly as possible.
- Wait for all lights to go out and barriers to be raised before moving on.

REMEMBER

A flashing red light always means stop

You should never zigzag around the barriers of a level crossing

Figure 4 – Extract from Rules of the Road

Level Crossing Roadside Infrastructure

General description

30 As mentioned previously, LC XM065 is a CCTV level crossing located at Knockcroghery. LC XM065 was commissioned in April 2007; and operates on the N61, which links Athlone, Roscommon, Tulsk and Boyle. The speed limit on the road, in the location of the level crossing, is 60 km/h in both directions.

Road signs, markings, signals & alarms

Road signs, markings & signals set out in the Road Signs Manual (2010)

31 In accordance with the Road Signs Manual (Department of Transport, 2010), there are a series of regulatory signs, warning signs and road markings required at level crossings; the series required on the road approaches depends on the type of crossing.

32 In terms of regulatory and warning signs for a level crossing with full barriers with Flashing Red Signals (which is the case for LC XM065), three sets of signs and a light signal are required on each road approach, see Figure 5 (in red box).

Sign Position	Level Crossing Type				
	Full Barrier or Half Barrier	No Barrier	Full Barrier	Gates Which Close Railway or With Signal Interlock	Gates Without Signal Interlock (User or Attendant Operated)
	Flashing Red Signals		Without Flashing Red Signals		
A	Sign W 120 with Plate P 001 or Marker W 122.3L		Sign W 121 with Plate P 001 or Marker W 122.3L		
B	Sign W 120 with Plate P 001 or Marker W 122.2L		Sign W 121 with Plate P 001 or Marker W 122.2L		
C	Sign W 120 with Plate P 001 or Marker W 122.1L		Sign W 121 with Plate P 001 or Marker W 122.1L		
D	Signal RTS 005[1]		Sign RUS 027 on Barrier	Sign RUS 027 on Gate	Signs RUS 027 on Gate and on Post[2]

Figure 5 – Warning signs for level crossings, Chapter 6, Road Signs Manual

33 The illustrations of the signs and signal used are as follows: WL120 Level Crossing with Flashing Red Lights (Figure 6); WL122 Countdown Marker (Figure 7); and RTS 005 Level Crossing Signals (Figure 8).

Figure 6 – WL120 LC with Flashing Red Signals

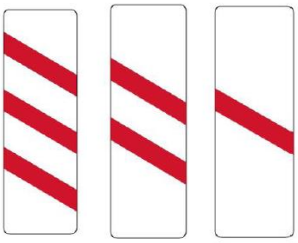


Figure 7 – WL122 Countdown Markers

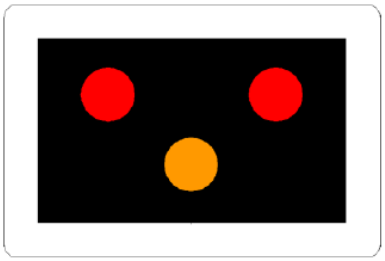


Figure 8 – RTS 005 Flashing Red Signals (Level Crossing Signals)

34 The signs and signal are designated 'Sign Positions' A to D in the order in which an approaching road driver encounters them, as set out in Figure 9.

35 These three sets of signs and one light signal are then positioned according to the speed limit. So for a speed limit of 60 km/h, as is the case on the N61 at Knockcroghery, the signs should be positioned at 90 metre (m) intervals, see Figure 9.

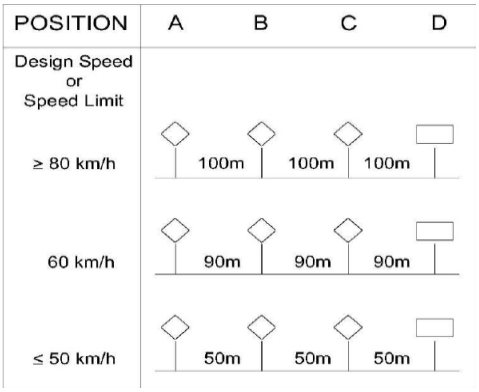


Figure 9 – Positioning of signs

36 In terms of road markings, the markings associated with a railway level crossing (Chapter 7, Road Signs Manual (2010)), comprise of a series of markings (it should be noted, that special thicknesses and lengths are required for level crossings, which are included in Chapters 7 & 10):

- Yellow Box Marking (Area), RRM 020 (Figure 10), indicating the area to be kept clear of stationary traffic;
- Transverse Vehicle Stop Line, RRM 017 (Figure 10);
- Transverse Exit Boundary Line, M 122 (Figure 10), indicating the extent of the crossing on the exit side;
- Approach carriageway continuous Centre Line, RRM 001 (Figure 10), extending back at least 20m from the Stop Line,
- Internal carriageway centre Warning Line, RRM 002D extending between the two vehicle Stop Lines;
- Edge of Carriageway Markings, RRM 025 (Figure 10), shall be laid between the two vehicle Stop Lines, to define the edge of the vehicle running lanes through the level crossing.

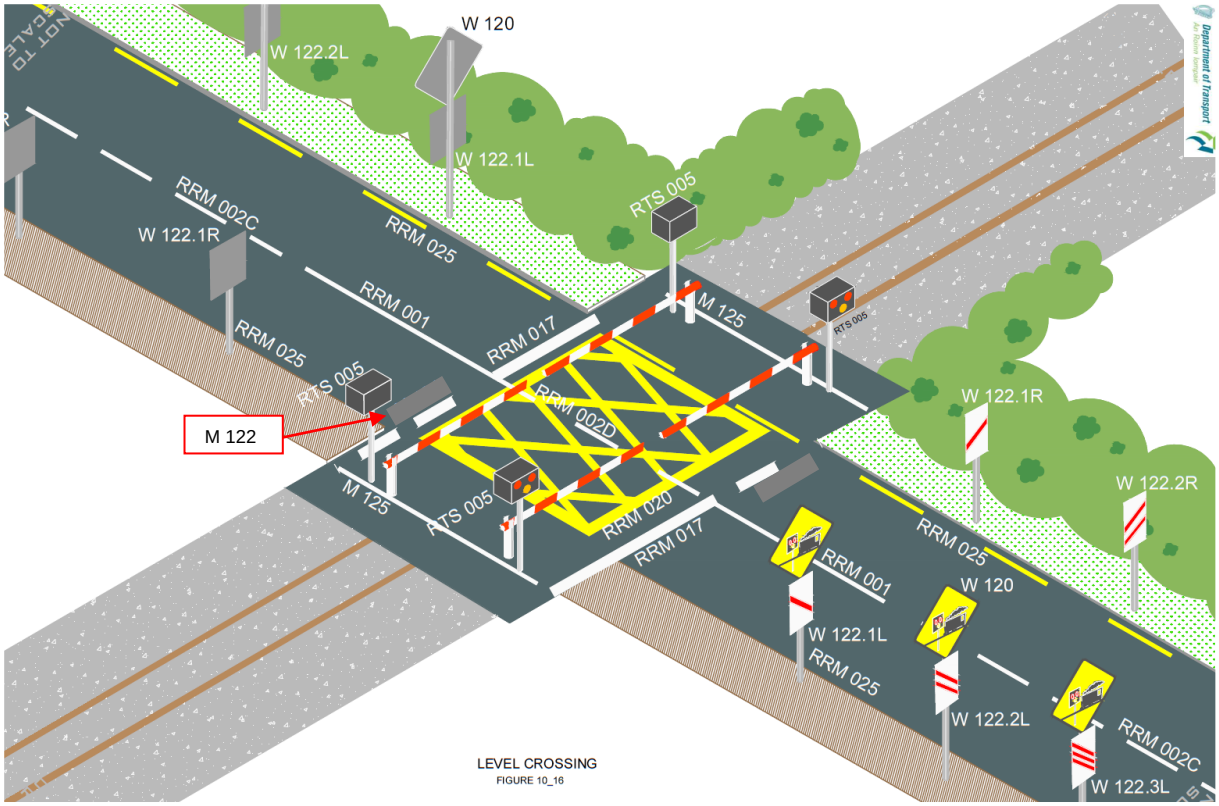


Figure 10 – Layout for a level crossing with barriers & flashing signals

Figure taken from Chapter 10 of the Road Signs Manual (edited).

Road signs, markings & signals at Knockcroghery Level Crossing

37 At LC XM065, the appropriate warning signage has been erected on the approach roads to the level crossing. The Countdown Markers for road users are located on the Roscommon and Athlone approaches, at approximately 300 m, 200 m and 100 m from the nearest barrier at the level crossing; and, are accompanied by the associated Level Crossing signage, WL120; see Figure 11 for an example of the countdown markers.

Figure 11 – Signage and signal at Knockcroghery Level Crossing

38 In addition, there are road traffic lights at the level crossing, the Advanced Flashing Yellow Signals (see road traffic light in Figure 11), and the Flashing Red Signals; and an audible alarm to warn road users of the presence of a train.

Roadside Equipment for Four Barrier CCTV Controlled Level Crossing

39 Illustrated in Figure 12 is the typical roadside equipment associated with a four barrier CCTV Controlled Level Crossing for a double line (the arrangement is similar for a single line). This roadside equipment corresponds with the road signs, markings & signals set out in the Road Signs Manual (2010) as discussed in paragraphs 31 - 41, and illustrated in Figure 10.

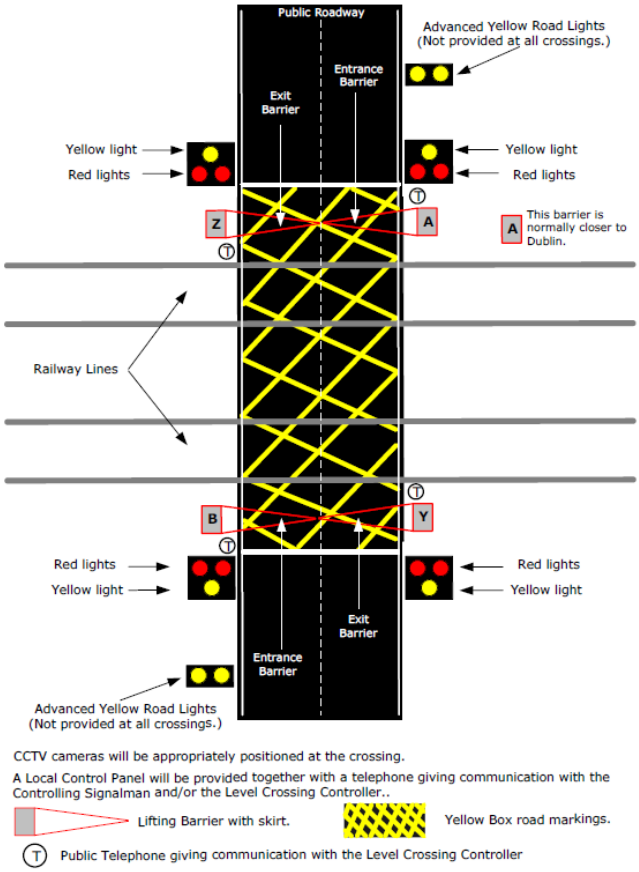


Figure 12 – Level Crossing Roadside Equipment

40 There are also four mounted halogen street lights immediately at the level crossing, which illuminate the entire CCTV level crossing area in the hours of darkness.

41 IÉ have placed six yellow box telephones at the crossing so users can contact the Signalman.

CCTV Cameras

42 For level crossings with one monitor display, there are two cameras in approximately the same position, which alternate on a daily basis (the additional camera is for back-up in the case of one camera failing). In relation to the positioning of the CCTV cameras, there are a number of factors for consideration before determining the optimum positioning of CCTV cameras. For example, depending on the orientation of the crossing to the public road and the surrounding environment, along with other conditions, it is normally preferable to have CCTV cameras positioned:

- North facing – To minimise sun reflection from wet road surfaces;
- Perpendicular to road traffic – To avoid glare from traffic headlights;
- At a sufficient distance from the line – To provide good access for maintenance;
- At an optimum position – To be able to capture all four barrier machines and booms.

43 In the case of LC XM065, the cameras were originally positioned at a different location in 2007; and relocated to a location opposite in January 2013, as a result of issues raised by the LCCOs in relation to glare on the cameras caused by road traffic during the hours of darkness.

44 This relocation of cameras, as carried out by the SET Department, on a trial basis, in conjunction with the ALCC Manager and LCCO Supervisors at the time; the trial found that the new location was a better location in terms of reducing the glare. However, none of the parties considered any other risks associated with the relocation of the cameras i.e. the introduction of a new risk due to the relocation; and, no formal risk assessment was conducted.

45 It is noted by the RAIU, that a technical standard for design requirements of CCTV level crossings, exists in draft format, since April 2011, which required risk assessments for the positioning of cameras; the draft is entitled, 'Design Requirements for Level Crossing CCTV System'. Section 3.1.1 of this draft states that "A detailed site survey shall be carried out to determine the optimum location of the CCTV cameras considering the orientation of the crossing and the required viewable area. The objective of the survey is to select the best location, height and lens focal length for the CCTV cameras considering any physical or environmental constraints that may be present in order to achieve an optimal image of the required area. A site survey report shall be completed. Refer to Appendix 1 for required details". 3.1.2.5 states that "The lens selection for the camera shall maximise the required viewable area on the Operators monitor. Preferably this area should occupy at least two thirds of the monitor area". While Section 3.1.2.6 continues, "When the optimum position of the cameras is determined and the required viewable area identified, any obstruction that appears within the field of view shall be subject to risk assessment to determine if it materially impacts on the use of the image for its design intent. It is envisaged that it may be unavoidable that lampposts, floodlights, fencing, road traffic lights, etc., may be present in the field of view but that these may have no material impact".

CCTV Level Crossing Control Centre

General

46 This section of the report gives an overview of the LCCC in the ALCCC, describing the room, with defined areas and the equipment which the LCCO interfaces with, namely, the touchscreens and monitors.

LCCC Work Area – General Description of the LCCC Work Area

47 The LCCC is designed to accommodate the control of CCTV level crossings. The CCTV live feed from each level crossing is provided on a dedicated monitor situated on a fixed rack directly above the touchscreen controlling the level crossing, see Figure 13.

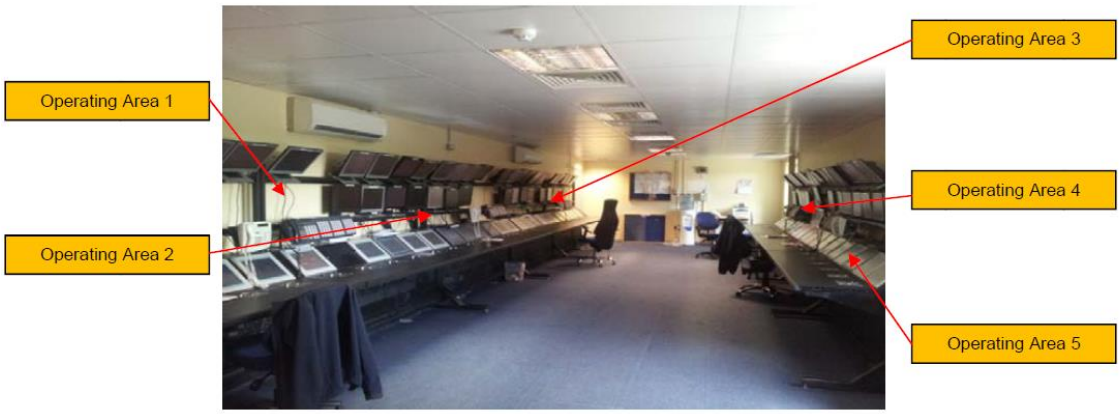


Figure 13 – LCCC with monitors and touchscreens

48 There are currently seventy-eight CCTV automated level crossings controlled from the LCCC, with the control of the level crossings being divided into five areas (Area 1 – Area 5), which each area having thirteen to seventeen level crossings assigned to the area. Area 1 and 2 are assigned the Mayo Line level crossings; Area 3 is assigned the Galway Line level crossings, Area 4 is assigned the Waterford Line level crossings and Area 5 is assigned the Sligo Line level crossings.

49 There are four LCCOs rostered for duty for each shift with one supervisor, and they normally sit at Area 1, Area 3, Area 4 and Area 5; which leaves Area 2 to be managed by the other LCCOs; Area 2 is normally the responsibility of the LCCO responsible for Area 1, as both areas (Areas 1 & 2) include the level crossings associated with the Mayo Line. Knockcroghery Level Crossing is situated in Area 2. The LCCOs estimate that they each manage approximately 160 – 200 level crossing operations daily.

LCCC Equipment – General Description of Touchscreens, Monitors & Other Equipment

General

50 The LCCOs' equipment for CCTV level crossings comprises of a touchscreen unit and a colour TV monitor (or in some instances two monitors) for each of the level crossings. Each touchscreen unit normally displays information for two level crossings i.e. the touchscreen unit is divided into two portions, with two monitors for the corresponding touchscreens. For example, the equipment for LC XM065, comprised of the top portion of the touchscreen and the corresponding top monitor (see Figure 14). A built-in trackerball (see Figure 14), with one button, is also associated with each complete touchscreen.

Figure 14 – Knockcroghery Level Crossing Touchscreen & Monitor

Touchscreen

51 Figure 15 shows the touchscreen for Knockcroghery Level Crossing under normal operating conditions, with no trains in the section; it is displaying information in relation to the Up Distant, Up Signal, Down Signal and Down Distant. At crossings (such as Knockcroghery Level Crossing) are protected by signals controlled by the Signalman, no signal indications are displayed on the touchscreen. The touchscreen is a control panel with controls, i.e. buttons and indications as shown in Figure 15.

52 The touchscreen can be operated directly by touching the screen or by using the tracker ball or mouse. The controls on this touch panel, must be operated one by one, they cannot be operated simultaneously. When inactive, the touchscreen display dims, this is an energy saving feature. The Level Crossing Logger records all buttons activated by the LCCOs.

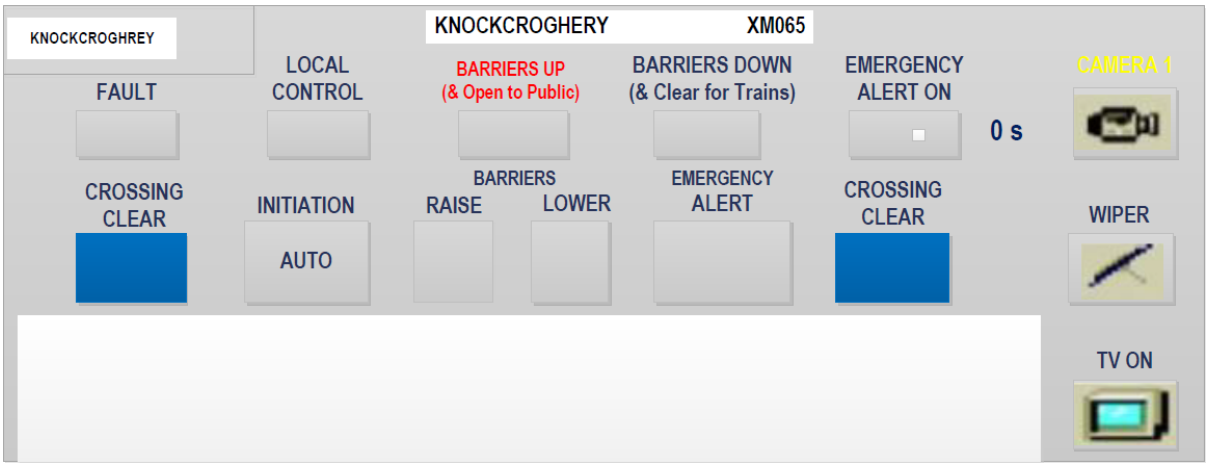


Figure 15 – Knockcroghery Touchscreen

Monitors

Knockcroghery Level Crossing Monitor

53 Each level crossing normally has a dedicated monitor associated with it (in some instances two monitors). Figure 16 illustrates the view of Knockcroghery Level Crossing on the monitor, the level crossing is at an approximate 30° angle to the screen orientation, and the full level crossing is taking up less than half of the monitor display.

Figure 16 – View of Knockcroghery Level Crossing on monitor

54 A view of the monitor display shows that some of the views of the Yellow Box Area are obscured by the Level Crossing Signal, street light and entry barriers, see Figure 17.

Figure 17 – View of monitor display

Examples of other monitor displays

55 Paragraphs 53 to 54 show the monitor display for Knockcroghery Level Crossing; Figure 18 and Figure 19 provides examples of other views from other monitor displays in the LCCC at ALCC. Some of the displays are in parallel view with the train line (XW143 – Knockmoylan), while some are in parallel view with the road (XM255 – Derrycoosh). Some of the views of the Yellow Box Area or pedestrian crossing area are obscured by the Level Crossing Signals (XM120 – Adragoole, XG125 – Ballinsloe); and the view of XW069 – Gowran has a low definition picture.

Figure 18 – Examples of views from display monitors

Figure 19 – Examples of monitor displays

56 In addition, some level crossings have two monitor displays, e.g. XW098 - Dunbell, see Figure 20.

Figure 20 – Level crossing with two monitor displays

Operation of Level Crossing XM065

LCCCs – General

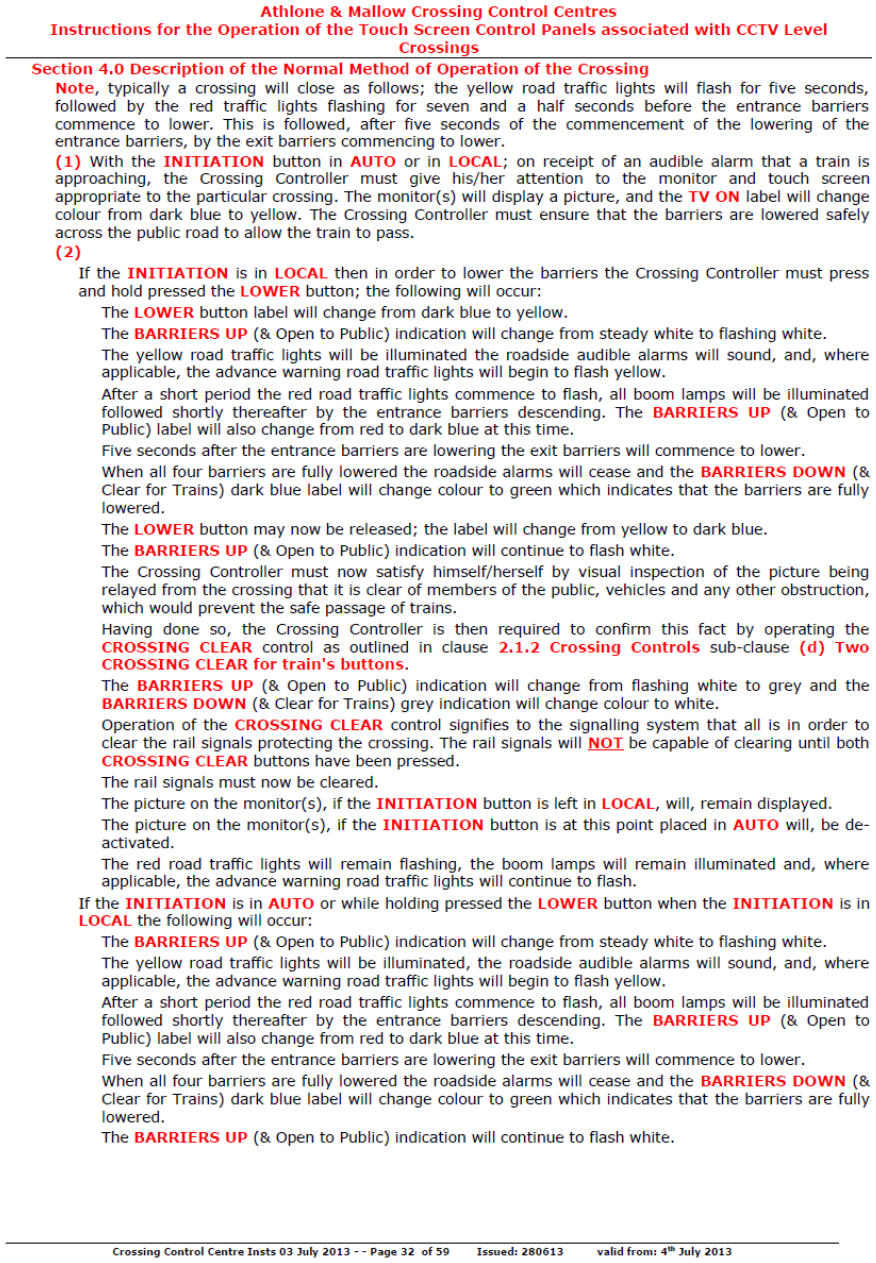
57 Athlone LCCOS are required to operate under the IÉ Rule Book and the 'Athlone & Mallow Crossing Control Centres, Instructions for the Operation of Touch Screen Control Panels associated with CCTV Level Crossings' (referred to as LCCC Instructions for the remainder of the report) issued on the 3rd July 2013 by the IM Safety Manager. This section of the report will outline the details specifically related to this incident, and not refer to other content (e.g. emergency operation of barriers, etc).

58 The LCCC instructions are a fifty-nine page document consisting of eleven sections[1] and five appendices, namely:

- Section 1 – Touch Screen Control Panels;
- Section 2 – Detailed description of Crossing Equipment provided in Crossing Control Centre;
- Section 3 – Summary of the Normal and other labels, buttons and indications on the touchscreen;
- Section 4 – Description of the normal method of operation of the crossing;
- Section 5 – Emergencies;
- Section 6 – Fault/ Failure Situations / Remedial Procedures;
- Section 7 – Procedures to be followed upon a relieving crossing controller assuming duty;
- Section 8 – Appointment of an Emergency Operator;
- Section 9 – Appointment of an Attendant;
- Section 10 – Manual Operation of the Barriers;
- Section 11 – Power;
- Appendix 01 – Emly CCTV Level Crossing – Special Instructions;
- Appendix 02 – List of places allocated to the Athlone Crossing Control Centre;
- Appendix 03 – List of places allocated to the Mallow Crossing Control Centre;
- Appendix 04 – Carrontubber XM234 CCTV Level Crossing & Smuttanagh XM235 'C' Type Level Crossing – Passing Signals at Danger Special Instructions to the Crossing Controller for Carrontubber in Athlone;
- Appendix 05 – Dunbell XW098 CCTV Level Crossing additional Instructions to the Crossing Controller due to the use of Two TV Monitors in the Crossing Control Centre.

[1] It should be noted that the document does refer to Section 12, however, there is no Section 12 in the document.

59 There is no index or table of contents provided at the beginning of the document and the pages are primarily made up of dense black and red text, with a limited number of illustrations; see Figure 21 for a typical page from the LCCC instructions.



Athlone & Mallow Crossing Control Centres
Instructions for the Operation of the Touch Screen Control Panels associated with CCTV Level Crossings

Section 4.0 Description of the Normal Method of Operation of the Crossing

Note, typically a crossing will close as follows; the yellow road traffic lights will flash for five seconds, followed by the red traffic lights flashing for seven and a half seconds before the entrance barriers commence to lower. This is followed, after five seconds of the commencement of the lowering of the entrance barriers, by the exit barriers commencing to lower.

(1) With the **INITIATION** button in **AUTO** or in **LOCAL**; on receipt of an audible alarm that a train is approaching, the Crossing Controller must give his/her attention to the monitor and touch screen appropriate to the particular crossing. The monitor(s) will display a picture, and the **TV ON** label will change colour from dark blue to yellow. The Crossing Controller must ensure that the barriers are lowered safely across the public road to allow the train to pass.

(2)

If the **INITIATION** is in **LOCAL** then in order to lower the barriers the Crossing Controller must press and hold pressed the **LOWER** button; the following will occur:

The **LOWER** button label will change from dark blue to yellow.

The **BARRIERS UP** (& Open to Public) indication will change from steady white to flashing white.

The yellow road traffic lights will be illuminated the roadside audible alarms will sound, and, where applicable, the advance warning road traffic lights will begin to flash yellow.

After a short period the red road traffic lights commence to flash, all boom lamps will be illuminated followed shortly thereafter by the entrance barriers descending. The **BARRIERS UP** (& Open to Public) label will also change from red to dark blue at this time.

Five seconds after the entrance barriers are lowering the exit barriers will commence to lower.

When all four barriers are fully lowered the roadside alarms will cease and the **BARRIERS DOWN** (& Clear for Trains) dark blue label will change colour to green which indicates that the barriers are fully lowered.

The **LOWER** button may now be released; the label will change from yellow to dark blue.

The **BARRIERS UP** (& Open to Public) indication will continue to flash white.

The Crossing Controller must now satisfy himself/herself by visual inspection of the picture being relayed from the crossing that it is clear of members of the public, vehicles and any other obstruction, which would prevent the safe passage of trains.

Having done so, the Crossing Controller is then required to confirm this fact by operating the **CROSSING CLEAR** control as outlined in clause **2.1.2 Crossing Controls** sub-clause **(d) Two CROSSING CLEAR for train's buttons**.

The **BARRIERS UP** (& Open to Public) indication will change from flashing white to grey and the **BARRIERS DOWN** (& Clear for Trains) grey indication will change colour to white.

Operation of the **CROSSING CLEAR** control signifies to the signalling system that all is in order to clear the rail signals protecting the crossing. The rail signals will **NOT** be capable of clearing until both **CROSSING CLEAR** buttons have been pressed.

The rail signals must now be cleared.

The picture on the monitor(s), if the **INITIATION** button is left in **LOCAL**, will, remain displayed.

The picture on the monitor(s), if the **INITIATION** button is at this point placed in **AUTO** will, be de-activated.

The red road traffic lights will remain flashing, the boom lamps will remain illuminated and, where applicable, the advance warning road traffic lights will continue to flash.

If the **INITIATION** is in **AUTO** or while holding pressed the **LOWER** button when the **INITIATION** is in **LOCAL** the following will occur:

The **BARRIERS UP** (& Open to Public) indication will change from steady white to flashing white.

The yellow road traffic lights will be illuminated, the roadside audible alarms will sound, and, where applicable, the advance warning road traffic lights will begin to flash yellow.

After a short period the red road traffic lights commence to flash, all boom lamps will be illuminated followed shortly thereafter by the entrance barriers descending. The **BARRIERS UP** (& Open to Public) label will also change from red to dark blue at this time.

Five seconds after the entrance barriers are lowering the exit barriers will commence to lower.

When all four barriers are fully lowered the roadside alarms will cease and the **BARRIERS DOWN** (& Clear for Trains) dark blue label will change colour to green which indicates that the barriers are fully lowered.

The **BARRIERS UP** (& Open to Public) indication will continue to flash white.

Figure 21 – Typical page from LCCC Instructions

LCCC Train Initiation

60 As a station level crossing (those crossings where the signals are controlled by the Signalman), as is the case of LC XM065, the initiation is through 'automatic initiation', and as such the LCCO is alerted to the approach of a train towards the CCTV level crossing by 'auto-initiation' where the passage of the train at a certain point activates an audible sound on the panel at the LCCC.

LCCC – Normal Operation of the Crossing

No obstruction of road or pedestrian traffic

61 On receipt of an audible alarm for a level crossing, indicating that a train is approaching, the LCCO must give his/her attention to the monitor (which will automatically display a picture) and touchscreen appropriate to the particular level crossing.

62 Typically a level crossing will close as follows: when the train has initiated the level crossing, firstly the road Advanced Flashing Yellow Signals will flash for five seconds, then the Flashing Red Signals flash for seven and a half seconds, and then the entrance barriers commence to lower first, followed by the exit barriers five seconds later.

63 The LCCO must observe the movement of road traffic on the monitor; and, if the road traffic is clear of the level crossing, the LCCO can allow the barriers to fully lower and when all four barriers are in the fully lowered position (an audible alarm will sound to indicate the status of the barriers) the LCCO can press the two CROSSING CLEAR buttons.

64 These CROSSING CLEAR buttons must only be pressed one at a time. The first button must be pressed and held pressed until its label begins to flash yellow and then released. Then the second button must be held pressed until its label also begins to flash yellow and then released. Both buttons must be operated within ten seconds. On pressing the two buttons the 'crossing clear control operated' has been achieved, signifying to the signalling system that all is in order to clear the rail signals protecting the level crossing. The view of the crossing on the LCCO's monitor will then deactivate.

65 The Crossing Controller must now be satisfied by visual inspection of the picture being relayed from the crossing that it is clear of members of the public, vehicles and any other obstruction which would prevent the safe passage of trains. Having done so the Crossing Controller is required to confirm this fact by operating the CROSSING CLEAR control.

Level Crossing Obstruction

66 Section 4.0, Description of the Normal Method of Operation of the Crossing, Part (3) of the LCCO Instructions outlines the actions the LCCO must take where there is an obstruction on the level crossing. The LCCO Instructions states that if upon activation of the monitor, the LCCO observes that a crossing is obstructed by vehicles or other obstruction he/she must place the INITIATION button from AUTO to LOCAL (or if the INITIATION button is already in LOCAL, the LCCO should immediately release the (barriers) LOWER button.

67 This action "freezes" the barriers in whatever position they lie, effectively preventing the level crossing close sequence from proceeding any further; and the two CROSSING CLEAR buttons will be removed from the touchscreen. The LCCO can wait for the obstruction to clear, and, if required the (barriers) RAISE button can be pressed to raise the barriers to assist the clearing of the level crossing. It is not obligatory to raise the barriers fully, only, if the LCCO considers it will assist the clearing of the level crossing.

68 When the obstruction has been observed to clear the crossing, the LCCO can place the INITIATION button back to AUTO (or if INITIATION button is in LOCAL then the LOWER button must again be pressed and held pressed). This action will result in resumption of the crossing close sequence, as in paragraphs 63 and 64.

Inspection & Maintenance of Level Crossing XM065

69 Inspection and maintenance of LC XM065 occurs in line with relevant standards. There were no issues, related to the condition or functionality of the Level Crossing asset, which contributed to the incident, with the:

- 'Manager DART Signalling & National Telecoms, SE&T' confirming that the Level Crossing CCTV monitor functioned correctly at the time of the incident;
- 'Regional Manager, Signalling' confirming that level crossing lights and barriers at LC XM065 was fault free and functioned as expected, at the time of the operational incident.

Selection, Training, Certification, Monitoring & Competence Management of LCCOs

General description

70 This section of the report outlines, in general terms, the training, assessment, certification, competence management and monitoring of LCCOs from mid-2013 to early 2017; as this is the timeframe in which the LCCO involved in this incident was passed competent, to the time of the incident. Paragraphs 82 - 93 then outline how these were applied to the LCCO. In terms of selection, training, certification, monitoring, assessment and competence management for LCCOs, the standards applicable were/are:

- IM/RU-OPS-4.1: Selection, Training, Monitoring & Assessment of Non-CTC Signallers: Introduced on the 25th March 2013; the LCCO was selected, trained, monitored, assessed, certified and subject to Post Qualification Assessment (PQA) requirements under this standard, for a period of eight months;
- IMO-SMS-035: Selection, Training, Monitoring & Assessment of Gatekeepers and Level Crossing Control Operators and the Inspection of Level Crossings introduced on the 15th December 2015;
- IMO-SMS-030: Competence Management – Signallers, Level Crossing Controllers and Gatekeepers (both iterations). Introduced on the 15th December 2013 (to be referred to as IMO-SMS-030 (2013) for the remainder of this report) and re-issued as Issue 1.0 on the 24th October 2016 (to be referred to as IMO-SMS-030 (2016) for the remainder of this report) and active to the date of publication of this report; the LCCO was monitored, assessed and subject to PQA requirements and re-certified under these standards.

71 In relation to development and support of LCCOs after an incident, IMO-SMS-040: Development and Support – Signallers, Level Crossing Controllers and Gatekeepers; Issue 1.0 was introduced on the 24/10/2016.

72 In addition to the normal workplace assessments/monitoring, additional inspection checks are undertaken every six months in terms of Safety Tours (OPS-SMS-1.3, Operational Standard for Safety Monitoring and IMO-SMS-008, Safety Tours & Monitoring); and safety critical communications should be monitored every six months (in accordance OPS-SMS-8.1, IM/RU-SMS-4.1 and IMO-SMS-033, Safety Critical Communications).

73 In addition to the competence management of LCCOs, this section of the report will also outline IMO-SMS-032, Selection, Training, Monitoring and Assessment of District Traffic Executives and CTC Traffic Executives (to be referred to as IMO-SMS-032 for the remainder of this report), Issue

1.0, issued on the 15th December 2013, in terms of the competence requirements for the assessors to assess LCCOs.

Selection, Training, Monitoring & Assessment of LCCOs

Selection & Training

74 In 2013, the selection requirements for LCCOs included fitness requirements (such as medical fitness) and selection procedures (such as aptitude testing and safety record); and, the initial training included three modules: foundation training, core rules, operating procedures, signalling regulations and basic practical workplace experience, workplace practical experience and training and competence assessment.

Initial assessment & certification

75 In terms of initial assessment and certification, the District Traffic Executive (DTE) was required to review all records of training, to ensure the LCCO had gained "sufficient depth and breadth" of experience. The DTE was then required to assess all performance criteria and knowledge requirements specific to the trainee LCCO's work location. attentio. If satisfied, a 'Certificate of Competence' was issued. Post initial qualification, the trainee LCCO carried out scheduled unsupervised shifts.

Ongoing assessment & monitoring

76 The PQA requirements, included additional monitoring and assessment for the first twelve month period post qualification, with a minimum of four assessments being required during the 1st, 3rd, 7th and 12th month timescale. The objective of this process was to: minimise the risk of inexperience; assess the candidate in the role; and, ensure that knowledge was being retained. A summary assessment was then required to be carried out within the 11th or 12th month; to determine the suitability of the candidate's progression to the two year continuous assessment process. If suitable, the continuous assessment cycle was put in place over a 24 month period once the next certificate of competence was issued and the LCCO assessed/ monitored over 24 months, which included: Four workplace monitoring and assessments – one every 6 months; Interim assessment within the 11th or 12th month to review progress; Summary Assessment within the 23rd or 24th month.

Assessment Methods

Formal Assessments

77 Formal assessments/monitoring were undertaken every six months to ensure LCCO's compliance to the standards and all applicable rules and regulations. The assessor would ensure competence

in the application of procedures for emergencies, degraded operations or other out-of-course situations; and, assess safety critical communications protocols.

78 The assessor was required to record all assessments using the Record of Assessment Form, which included general and specific assessments of the LCCO; as well as any identified deficiencies and associated corrective coaching plans or feedback.

Summary Assessments

79 Summary Assessments were conducted to verify competence over the assessment cycle through oral and written questions. The DTE would use this assessment as an opportunity to re-brief on rules, instructions and procedures, and where satisfied issue as new certificate of competence.

Review items & feedback

80 All significant review items must be recorded and supported by written feedback. There are three types of feedback for minor issues, serious problems and major problems. Feedback requires advice and coaching, additional assessment, and relief and re-training, for each of the issues, respectively. The details should be recorded on the Formal Assessment Evidence Form.

Retention of competence and refresher training

81 The local managers must ensure that competence is retained, and refresher training is provided where required.

Selection, Training, Certification, Monitoring & Competence Management of the LCCO

General description

82 The previous section of this report, paragraphs 74 - 81 outlines the selection, training, certification, monitoring and competence management for LCCOs in general. This section of the report outlines these in terms specific to the LCCO involved in the incident.

Selection, Training, Assessment & Certification

83 The LCCO was selected and commenced training under IM/RU-OPS-4.1: Selection, Training, Monitoring & Assessment of Non-CTC Signallers. The LCCO was trained and passed competent on the 27th May 2013 by the DTE using the 'Assessment Document for Level Crossing Control Centre Operator' document; and, appointed to the grade in the Athlone LCCC on 7th October 2013.

84 The LCCO was re-certified on a biennial basis on the 22/05/2014 under IMO-SMS-030 (2013) and again on the 19th to the 21st May 2016 under IMO-SMS-030 (2016).

Ongoing assessment, monitoring & safety tours

85 The LCCO was subject to the competence management requirements set out in IMO-SMS-030 (2013) from 15/12/2013 to the 23/10/2016 until the issuance of IMO-SMS-030 (2016) on the 24/10/2016. These assessments were routinely undertaken on a six monthly basis, and for the LCCO were undertaken on the 29/10/14, 13/05/15, 28/10/15, 19/05/2016, 11/11/2016 under IMO-SMS-030 (2013), the LCCO was then transferred to the requirements of IMO-SMS-030 (2016), however, was not due to be assessed under these requirements until after the incident in January 2017.

86 In addition to the above, the LCCO was subject to six month assessments under for: safety tours and monitoring, under requirements of OPS-SMS-1.3 on the 06/11/2013 and under IMO-SMS-008 on the 22/05/2014, 29/10/2014, 13/05/2015, 28/10/2015, 19/05/2016 and 11/11/2016; and, safety critical communications protocols under requirements of IMO-SMS-033 on the 22/05/2014, 29/10/2014, 13/05/2015, 28/10/2015, 19/05/2016 and 11/11/2016.

Development & Support

87 The LCCO was involved in a similar incident at LC XM065 on the 17th January 2014 (to be discussed in paragraphs 142 - 150). As a result of the incident, the LCCO received corrective coaching, re-assessment and additional monitoring. The 'Corrective Coaching/Additional Monitoring Record Form', completed on the 21st February 2014, required the LCCO to receive corrective coaching on Part 2.1.2 (d) of the "Instructions for the Operation of Touch Screen Control Panels associated with the CCTV level crossings". Part 2.1.2 (d) states "Crossing Clear – The Crossing Clear button operation must take place when all four barriers are in the fully lowered position, i.e. the Barriers Down (& Clear for Trains) label has changed colour from dark blue to green, and the crossing is seen to be clear of members of the public, vehicles and any other obstructions which would prevent the safe passage of trains".

88 There was a departmental development and support system in place at the time of the incident, while awaiting the issue of Standard TCM - 001.

Non-technical skills

89 There is no specific documentation that directly refers to non-technical skills associated with the role of LCCO; to provide guidance for LCCOs in the areas of human factors and application of non-technical skills.

90 The main method LCCOs are taught to look for obstructions is by checking each of the four level crossing corners and then into the middle of the level crossing, see Figure 22.

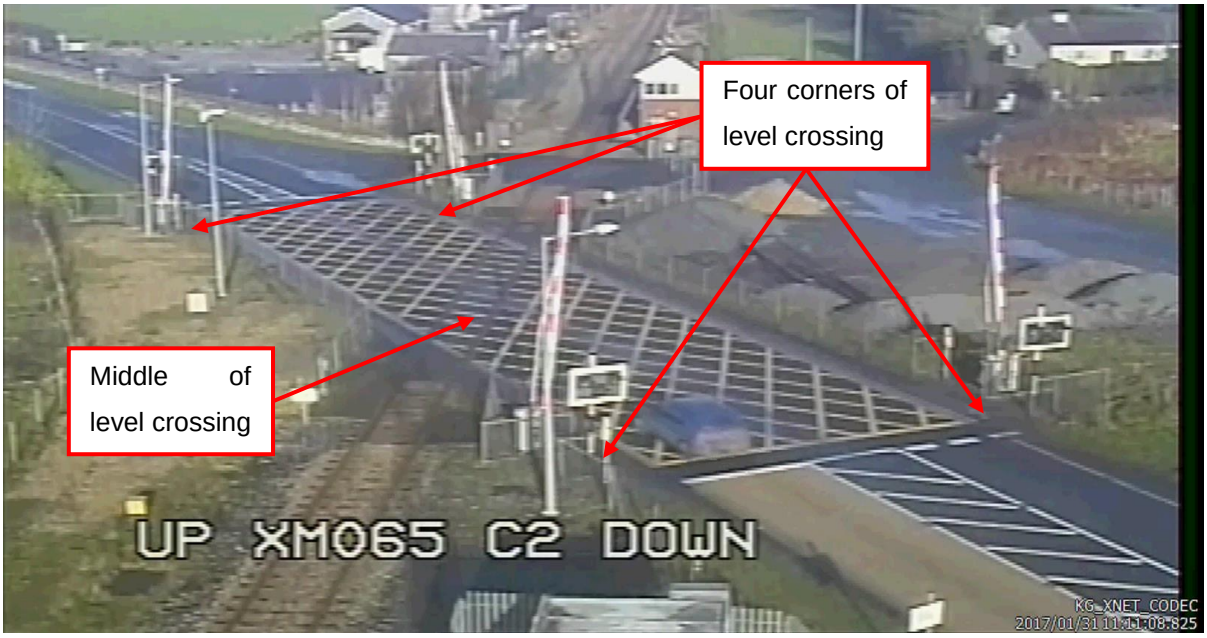


Figure 22 – LCCO checks for obstructions

Competence of the Assessors

91 As mentioned previously, IMO-SMS-032 is the standard which applies to all District Traffic Executives and Acting District Traffic Executives and CTC Traffic Executives who assess and manage the competence of safety critical staff, in relation to their own selection, training and competence.

92 The DTE/ CTC Traffic Executives who assess safety critical work must:

- Be competent in the role they are to assess, for example, competent to operate level crossing control centre equipment; and have at least three years' experience within the role/activity which they are to assess;
- Be working towards achieving the Training & Development Lead Body (TDLB) Units D32/D33 or Learning and Development (L&D) Unit A1;
- Have a clean safety record;
- Hold a number of personal competencies, such as ability to communicate effectively and demonstrate independence and fairness.

93 The DTE/ CTC Traffic Executives who assess safety critical work must undergo: training; assessment and certification; and, ongoing assessment and monitoring, in accordance with IMO-SMS-032, in order to perform the role; with retention of competence and refresher training also required under the standard to maintain competence.

94 The DTE/ CTC Traffic Executives involved in this incident, were all in compliance with IMO-SMS-032.

Events before, during and after the occurrence

Events before the incident

95 The LCCO signed on duty, fully rested, at 07:00 hrs at ALCC for his scheduled turn of duty (07:00 hrs – 15:00 hrs) where he was responsible for the level crossings in Area 1 and Area 2 (both the Mayo Line).

96 At 11:10:56 hrs[2], Train A805 approached LC XM065 in the Up direction, and initiated the level crossing, which sounded the alarm in the LCCC. At the time of the alarm sounding, the LCCO's attention was on a level crossing in Area 1, which also needed to be cleared.

97 At 11:11:03 hrs the Level Crossing Signals (RTS 005 Flashing Red Signals) began flashing and the roadside audible alarm began to sound.

98 At 11:11:08 hrs Car 1 drove over the Stop Line, past the Flashing Red Signals, through the raised level crossing barriers, and onto the Yellow Box Area, see Figure 23.

Figure 23 – Car 1 driving onto the level crossing

[2] The timings on the level crossing CCTV and the logger for the level crossing control system where not in sync. There is a discrepancy of approximately 45 seconds. The RAIU have adjusted the times of the logger to sync with the level crossing CCTV for the purposes of clarity for the reader.

99 Two seconds later, at 11:11:10 hrs, Car 1 stopped on the Yellow Box Area (it was not fouling the running rails). The view of the LCCO's monitor (Figure 24) shows that the view of Car 1 is partially obscured by the Level Crossing Signals, the street light and the raised Entry Barriers. At the same time, Car 2 drives over the Stop Line.

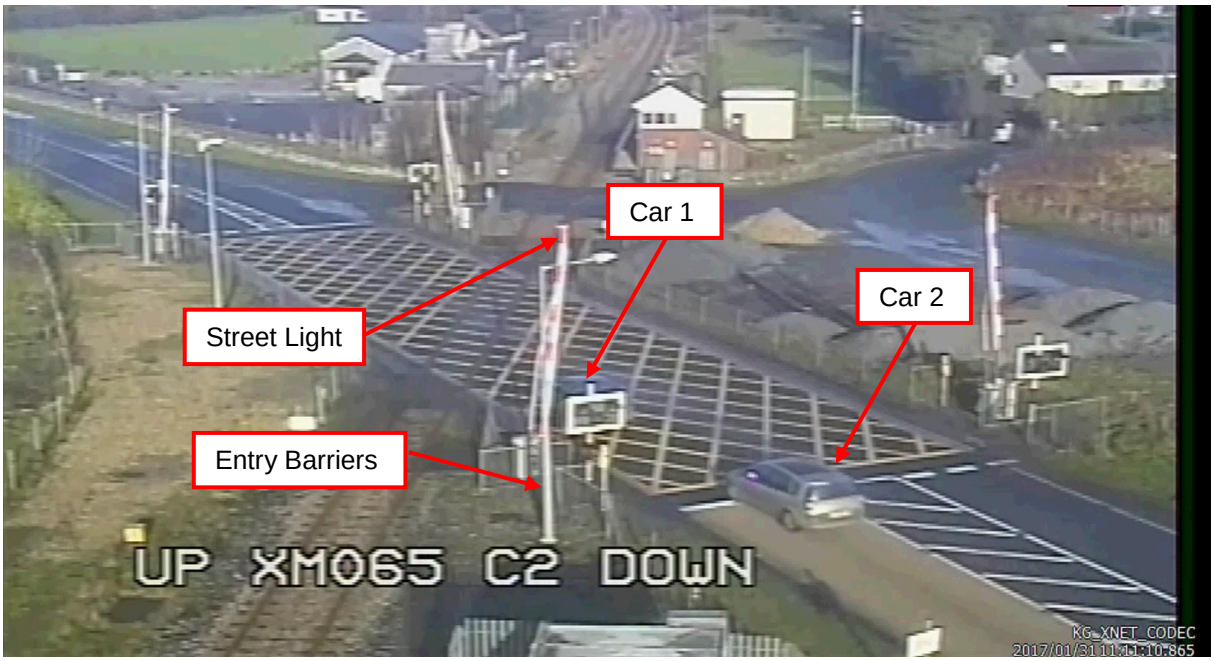


Figure 24 – Car 1 positioned behind the Level Crossing Signals

100 At 11:11:11 hrs, the Level Crossing Logger records the "barriers starting to lower" and the Entry Barriers begin to lower. Simultaneously, the LCCO moves from Area 1 to LC XM065 in Area 2 and sees Car 2 approaching the level crossing and switches the 'Initiation' button to 'Local'. As the level crossing Entry Barriers had already initiated and were lowering (11:11:11 hrs), they stopped lowering in a mid-way position at 11:11:14 hrs, see Figure 25.

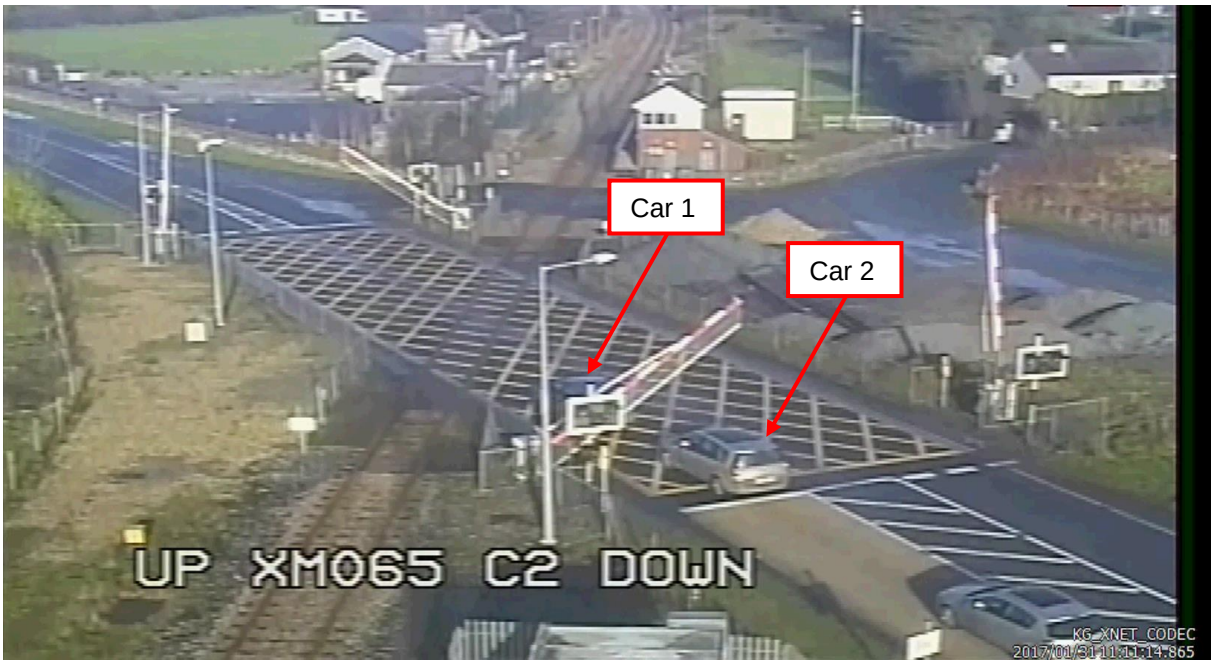


Figure 25 – Entry barriers stopped in a mid-way position

101 At 11:11:15 hrs, after travelling past the Flashing Red Signals and onto the Yellow Box Area, Car 2 came to a stop, outside the Entry Barriers, see Figure 25.

102 At 11:11:19 hrs, Car 1 started to reverse; one second later Car 2 started to reverse.

Events during the incident

103 The LCCO saw that Car 2 was reversing and clearing the level crossing and switched the 'Initiation Switch' back to the 'Auto' position (11:11:20 hrs).

104 At 11:11:21 hrs Car 1 stopped reversing, and started reversing again three seconds later, stopping again one second later (11:11:25 hrs). Six seconds after commencing reversing, Car 2 also stopped reversing at 11:11:25 hrs. At 11:11:26 hrs, both Entry Barriers are in the fully lowered position and the Exit Barriers begin to lower. See Figure 26 for Car 1 and Car 2 in the stopped positions with the Entry Barriers fully lowered.

Figure 26 – Car 1 & Car 2 in stopped positions with the Entry Barriers lowered

105 Car 2 started to reverse 11:11:30 hrs. All four barriers are fully lowered at 11:11:31 hrs (as recorded by the Level Crossing Logger and the Level Crossing CCTV footage). Car 2 stopped reversing for the second time at 11:11:34 hrs; Car 2 is positioned behind the Stop Line and the Flashing Red Signals, see Figure 27.

Figure 27 – All four barriers lowered & Car 2 has stopped reversing for the second time

106 At 11:11:36, the Level Crossing Logger recorded the LCCO pressing and releasing the 'Crossing Clear' buttons. The LCCO's monitor deactivates (i.e. goes blank) as designed, and the LCCO can no longer see the view of the LC XM065. The LCCO takes no further action in relation to LC XM065.

107 One second later (11:11:37 hrs), the Level Crossing Logger recorded that "Barriers Down & Clear for Trains".

108 Also at 11:11:37 hrs, Car 2 reversed again for two seconds (stopped reversing at 11:11:39 hrs). At 11:11:39 hrs Car 1 started reversing towards the Entry Barriers.

109 At 11:11:40, the Level Crossing Logger recorded that the "Crossing locked down and initiation reset – Crossing not free to raise", meaning that the signals had been cleared for Train A805.

110 At 11:11:44 hrs, Car 1 stopped reversing for the final time, see Figure 28.

Figure 28 – Car 1 and Car 2's final stationary position prior to arrival of Train A805

111 Train A805 arrived on the Level Crossing at 11:13:25 hrs and passed Car 1, which was trapped in the Level Crossing, at 11:13:26 hrs (see Figure 29), before exiting off the Level Crossing at 11:13:28 hrs.

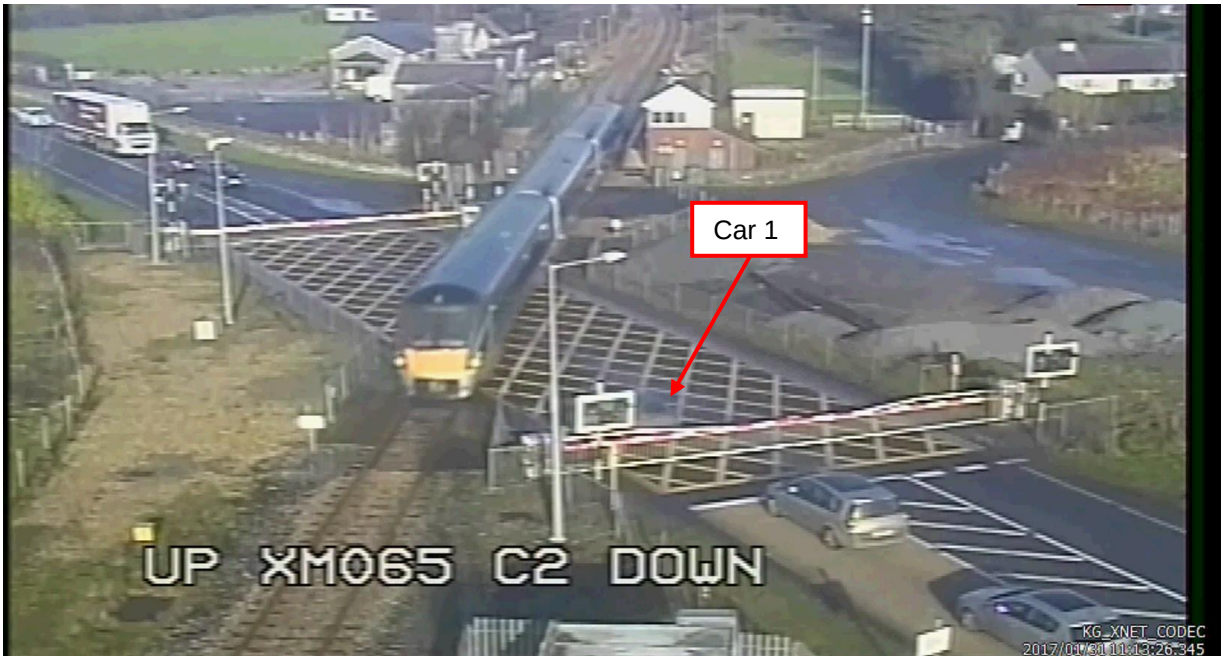


Figure 29 – Train A805 passing Car 1 which is trapped in the Level Crossing

112 After the train passes, Car 1 started to drive slowly towards the track (11:13:31 hrs).

113 At 11:13:34 hrs, the Level Crossing Logger, recorded "Crossing not locked down – Crossing free to raise". Car 1 stopped again on the level crossing (11:13:34 hrs).

114 The Level Crossing Logger recorded "Barriers starting to rise" at 11:13:35 hrs, which is also shown on the CCTV.

115 Car 1 then started to accelerated off the Level Crossing (11:13:37 hrs) towards Roscommon.

116 The Level Crossing Logger recorded "All 4 barriers in upright position" and "Barriers Up & Open to the Public" at 11:13:41 hrs.

Events after the incident

117 The Driver A805 immediately reported the incident to the Signalman, who in turn contacted the LCCO (and other relevant parties), who informed the LCCO Supervisor. At this time, the LCCO informed the LCCO Supervisor of Car 2, still unaware of presence of Car 1.

118 The LCCO was temporarily relieved of his duties, by the LCCO Supervisor, and subject to drugs and alcohol testing which were clear. The LCCO Supervisor consulted with the Signalman in relation to the incident and reported the incident to the relevant parties.

Similar occurrences

General information

119 There were four similar incidents to the incident at Knockcroghery on the 31st January 2017 where a cyclist, a car and two pedestrians were trapped in the confines of level crossings when the barriers were lowered. These incidents included:

- Level Crossing XT121, 21/02/15 (a level crossing controlled at Mallow LCCC);
- Level Crossing XG151, 20/07/14 (a level crossing controlled at Athlone ALCCC);
- Level Crossing XM080, 14/04/14 (a level crossing controlled at Athlone LCCC);
- Level Crossing XM065, 17/01/14 (a level crossing controlled at Athlone LCCC).

120 The LCCO involved in the incident at LC XM065 in 2014 was the same LCCO as this investigation at LC XM065 in 2017).

Cyclist inside the lowered barriers of Level Crossing XT121 (Ballybrack), 21/02/15

121 On Sunday, 21st February 2015, when the 17:05 hrs passenger service from Tralee to Mallow train approached Level Crossing XT121, it triggered the initiation for the crossing and the warning light signals and bells flashed and sounded, respectively, to warn any road traffic of the approaching train.

122 Two cyclists approached the level crossing at this time, Cyclist 1 (white top, Figure 30) did not obey the Flashing Red Signals and warning bells and continued over the level crossing while the barriers were lowering; while Cyclist 2 (red top, Figure 30) stopped and remained outside the barriers. Cyclist 1 became trapped inside the barriers when they were fully lowered and took refuge at the corner of the level crossing beside the level crossing barrier machine equipment housing, Figure 30.

123 The operation of XT121 is controlled from the Mallow LCCC. During the initiation, the LCCO responded to the audible tone on the panel for Level Crossing XT121 by checking the crossing monitor. The LCCO did not observe Cyclist 1, who was stationary within the confines of the level crossing, see Figure 30. The LCCO then, assuming that the level crossing was clear for the passage of train, pressed the two CROSSING CLEAR buttons on the touchscreen for Level Crossing XT121 and went about his duties without realising his error.

124 As the train passed over the level crossing, the train driver saw Cyclist 1 inside Level Crossing XT121 while the barriers were in the lowered position and reported the incident.

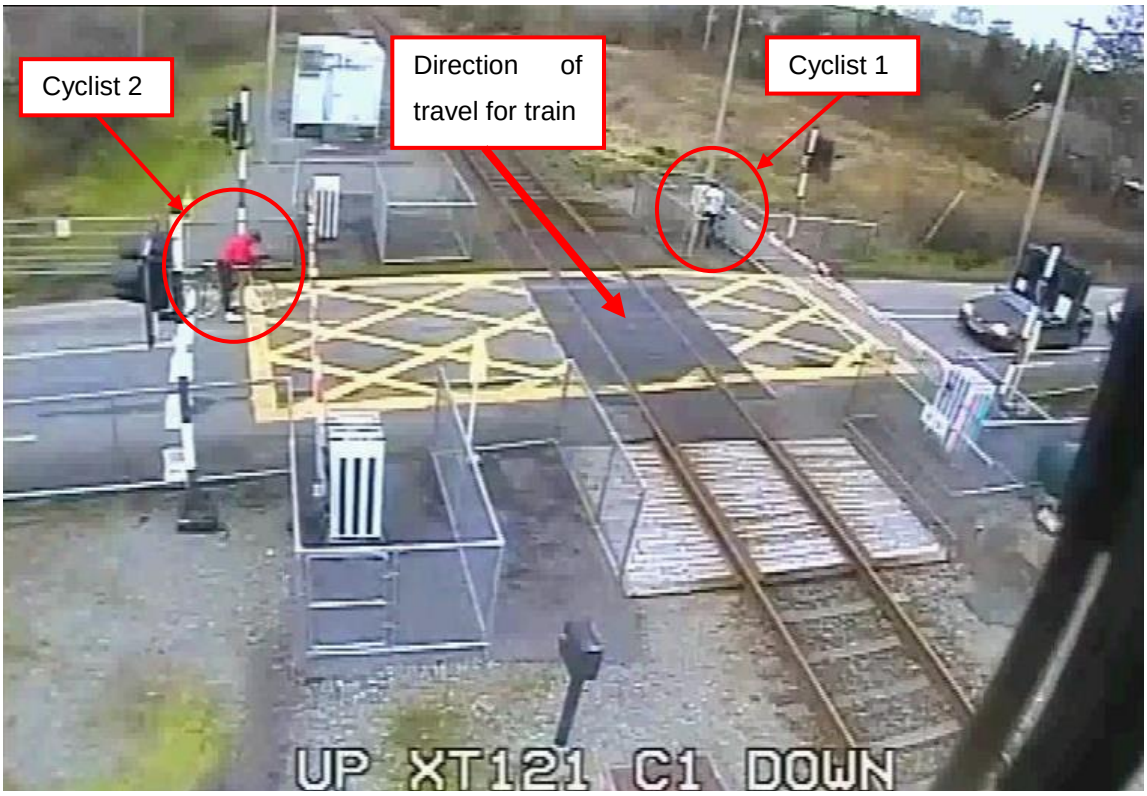


Figure 30 – Cyclist 2 within the confines of the Level Crossing

125 IÉ conducted an investigation, with the report of investigation 'Cyclist inside the lowered barriers of Level Crossing XT121 (Ballybrack) during the passage of a train, 21st February 2015' being published on the 25th June 2015. The report noted that the LCCO stated that when he arrived at the console when all four barriers were in the lowered position and "did not observe Cyclist 1 enter and walk over the crossing"; and that the "view provided at the crossing was not a factor in the occurrence". The report identified the immediate cause was that the LCCO "pressed the CROSSING CLEAR buttons when all four barriers were in the fully lowered position while a cyclist was still within the confines of the crossing". Other factors were identified as:

- Cyclist 1 "entered the crossing while the warning lights and bells were activated to indicate that the barriers were about to lower and after the barriers had lowered was trapped within the confines of the level crossing";
- The LCCO did not correctly carry out the crossing clear instructions contained within the Athlone and Mallow LCCO Instructions;
- The LCCO "did not observe the crossing long enough or with sufficient diligence to determine that the cyclist was still within the confines of the crossing".

126 As a result of the incident, the LCCO was placed on a development plan. No other observations or recommendations were made as a result of the incident.

Pedestrian inside the lowered barriers of Level Crossing XG151 (Athenry), 20/07/14

127 On Sunday the 20th July 2014, as the 08:30 hrs passenger service from Galway to Limerick, approached Level Crossing XG151 it triggered the initiation for the level crossing and the warning signal lights and bells flashed and sounded, respectively, to warn any road traffic and pedestrians of the approaching train.

128 During this time a pedestrian approached the level crossing. The pedestrian did not obey the Flashing Red Signals and warning bells and continued over the level crossing during the warning sequence and the barriers began to lower. The pedestrian had not exited the level crossing when the four barriers were fully lowered and was trapped in the confines of the level crossing.

Figure 31 – LCCO's view of Level Crossing XG151 with stationary pedestrian

129 The operation of Level Crossing XG151 is controlled from the Athlone LCCC; and by the time the LCCO responded to the audible tone, by checking the crossing monitor, the pedestrian remained stationary; and the LCCO did not see the pedestrian in the confines of the level crossing. The LCCO then, assuming that the level crossing was clear for the passage of the train, pressed the two CROSSING CLEAR buttons on the touchscreen for Level Crossing XG151 and went about his duties without realising his error.

130 When the train arrived at Athenry, the train driver saw a pedestrian inside the level crossing while the barriers were in the lowered position and the signals were cleared for the route. The train driver reported this to the Galway Line Signalman and the route was cancelled. The barriers were raised and the pedestrian left the crossing without injury.

131 IÉ conducted an investigation into the incident, and published the report of investigation 'Pedestrian inside the lowered barriers of LC XG151 (Athenry), 20th July 2014', published on the 20th February 2015. The report notes that the view of the camera on the day of incident "was clear with no external factors obscuring the view" of the LCCO and the LCCO stated "that he did not observe the pedestrian enter and walk over the crossing".

132 The report found the immediate cause was that the LCCO "pressed the CROSSING CLEAR buttons when all four barriers were in the fully lowered position while a pedestrian was still within the confines of the crossing". The causal factors were identified as:

- The pedestrian entered the crossing while the warning lights and bells were activated to indicate that the barriers were about to lower and after the barriers had lowered was trapped within the confines of the level crossing;
- The LCCO did not correctly carry out the CROSSING CLEAR instructions contained within the LCCO Instructions;
- The LCCO did not observe the crossing long enough or with sufficient diligence to determine that the pedestrian was still within the confines of the crossing.

133 As a result of the incident: the LCCO was placed on a development plan; and, all LCCOs operating in Athlone were re-briefed on Section 2.1.2 (d) relating to CROSSING CLEAR instructions by the Athlone DTEs.

134 The report made one recommendation, namely, that the Safety Manager, IM Operations/ New Works should consider introducing a Professional Support Handbook to Level Crossing Control Operators; to provide guidance for LCCOs in the areas of human factors and non-technical skills identified in the causal factors. At the time of publication of this report, this recommendation remains open and the handbook in draft.

Pedestrian inside the lowered barriers of Level Crossing XM080 (Roscommon), 14/04/14

135 On Monday, 14th April 2014, when the 12:45 hrs passenger service from Heuston to Westport was approaching Roscommon Station, it triggered the initiation for Level Crossing XM080 and the warning lights and bells flashed and sounded to warn any traffic/ pedestrians of the approaching train. During this time a pedestrian approached Level Crossing XM080. The pedestrian did not

obey the Flashing Red Signals and warning bells and continued over the level crossing during the warning sequence and the barriers began to lower. The pedestrian had not exited the level crossing when the four barriers were fully lowered and was trapped in the confines of the crossing and took refuge near the corner of the level crossing by the barrier machine equipment housing.

Figure 32 – Pedestrian within the confines of LC XM080 while the barriers are lowered

136 The operation of Level Crossing XM080 is controlled from the Athlone LCCC; and the LCCO at Athlone responded to the audible tone for Level Crossing XM080 by checking the level crossing monitor. The LCCO observed the stationary pedestrian at the corner of the level crossing and mistakenly believed the person to be standing at the end of the platform and not within the confines of the level crossing, see Figure 32. The LCCO then, assuming that the level crossing was clear for the passage of the train, pressed the two CROSSING CLEAR buttons on the touchscreen and went about his duties without realising his error.

137 The Person In Charge of Platform (PIC) at Roscommon reported the incident and an investigation was carried out by IÉ, and a report of investigation 'Pedestrian inside the lowered barriers of XM080 Roscommon LC, 14th April 2014' was published on the 21st November 2014.

138 The report noted that LCCO stated that he "did not observe the pedestrian enter and walk over the crossing but only observed the person in a stationary position".

139 The report identified the immediate cause was due to the fact that the LCCO "pressed the CROSSING CLEAR buttons when all four barriers were in the fully lowered position while a pedestrian was still within the confines of the crossing"; and identified other factors as the:

- Pedestrian entered the crossing while the warning lights and bells were activated to indicate that the barriers were about to lower and after the barriers had lowered was trapped within the confines of the level crossing;
- LCCO did not correctly carry out the CROSSING CLEAR instructions contained within the Athlone and Mallow Crossing Control Centres instructions for the operation of touchscreen control panels associated with CCTV level crossings;
- LCCO did not observe the crossing long enough or with sufficient diligence to determine that the pedestrian was still within the confines of the crossing. The LCCO observed the person in a stationary position and believed that person to be standing at the end of the platform and not within the confines of the crossing.

140 As a result of the incident:

- The LCCO was placed on a development plan;
- All LCCOs operating in Athlone were re-briefed on Section 2.1.2 (d) relating to CROSSING CLEAR instructions by the Athlone DTEs;
- The PIC was briefed by his DTE on Rule Book Section A on the procedure for relating to incidents which may endanger trains or people (as the PIC should have immediately advised the controlling signalman of the incident).

141 The report made one recommendation as a result of an observation, namely, that the Chief Engineer SET "should arrange a review of the position of the CCTV cameras mounted at XM080 (Roscommon) to address the potential risk observed during this investigation". The reason given was that "On viewing the level crossing CCTV footage it was observed that signal ML621 at the end of the Up platform at Roscommon Station partially obscures a section of XM080. Although this had no bearing on the occurrence there is a potential risk that the LCCOs view may be hindered from seeing a pedestrian (or other obstruction) on the crossing".

Car inside the lowered barriers of LC XM065 (Knockcroghery), 17/01/14

142 On Friday 17th January 2014, when the 07:35 hrs passenger service from Heuston to Westport was approaching Knockcroghery, it triggered the initiation for LC XM065 and the warning lights signals flashed and sounded to warn any traffic and pedestrians of the approaching train.

143 During this time a car approached LC XM065. The driver of the car did not obey the Flashing Red Signals and warning bells and continued over the level crossing during the warning sequence and the barriers began to lower. The car had not exited the level crossing when the four barriers were fully lowered and was trapped in the confines of the level crossing (see Figure 33).

Figure 33 – Car (circled) inside the lowered barriers of XM065

144 The LCCO at Athlone LCCC responded to the audible tone on the panel for LC XM065 by checking the crossing monitor. The LCCO did not see the car and assumed that the level crossing was clear for the passage of the train, and as a result pressed the two CROSSING CLEAR buttons on the touchscreen for LC XM065 (Figure 33 shows the screen at the time the LCCO pressed the CROSSING CLEAR buttons) and went about his duties without realising his error. After the passage of the train, the barriers raised automatically and the vehicle exited the level crossing.

145 A SET Technician received a report from a member of the public that a road vehicle was trapped inside the barriers at XM065; who in turn advised the LCCC Supervisor, and a report of investigation carried out, with the report 'Operational Occurrence at Knockcroghery LC XM065, 17th January 2014', published on the 18th June 2014. The report noted that the LCCO was required to wear prescriptive lenses while on duty, which he was not wearing; and the Acting LCCC Supervisor was unaware that the LCCO had arranged a mutual change of duty and in turn had insufficient rest to start duty.

146 The report identified the immediate cause, of the incident as LCCO Athlone lowering the barriers at XM065 with a car inside the level crossing and the signals were cleared for the passage of the train. The causal factors associated with the incident were:

- The Instructions, section 2.1.2(d), for clearing signals at a CCTV level crossing state: "The CROSSING CLEAR button operation must take place when all four barriers are in fully lowered position, i.e. the BARRIERS DOWN (& Clear for Trains) label has changed colour from dark blue to green, and the crossing is seen to be clear of members of the public, vehicles and any other obstructions which would prevent the safe passage of trains. The LCCO Athlone, did not determine that the crossing was "clear of vehicles" as per Instructions for the operation of the touchscreen control panels associated with CCTV level crossings section 2.1.2(d) and gave "crossing clear";
- The driver of the road vehicle did not adhere to the correct procedure for use of the level crossing as set out in the Road Safety Authority "Rules of the Road" booklet.

147 Underlying causes associated with the incident were that the:

- LCCO did not have sufficient rest before the commencement of the turn of duty on the day of the occurrence. There was an inadequate process in place to ensure LCCOs have sufficient rest prior to taking up duty;
- There was an inadequate system in place to ensure medical restrictions, such as the requirement to wear prescriptive lenses, are advised to the LCC Supervisor Athlone;
- There is no requirement for the LCCO to undergo a refresher of the instructions for the operation of level crossing control centres as part of a cycle under the safety standards;
- The instructions for operation of level crossing control centres are technical in nature and are difficult for an operator to navigate or refer to when required.

148 As a result of the incident, IÉ IM Operations has:

- Reviewed, produced and implemented an enhanced development plan for the LCCO which addresses the additional concerns raised within this report;
- Reviewed the process for authorising a mutual change of duty and implemented a new system for requests;
- Reviewed the supervision of LCCOs booking on duty and rostering arrangements;
- Implemented a process to review the rostering arrangements for LCCOs and supervision at Athlone LCCC.

149 As a result of the investigation, the report made five recommendations, as follows:

- The Operations Control Manager, West should arrange for relevant information referring to medical restrictions affecting safety critical staff to be advised to LCC Supervisors;
- The Operations Control Manager, West should review the process for mutual changes of duty to ensure compliance with working time rest periods;
- The Head of IM Safety should arrange a comprehensive review of the "Instructions for the Operation of Level Crossing Control Centres Mallow & Athlone" (LCCO Instructions);
- The Operations Control Manager, West should consider a review of workload allocation and assignment for level crossing operators at Athlone;
- The Head of IM Safety should arrange for the development of a specific safety standard for the development and support of all IM Staff.

150 At the time of publication of this report, all the recommendations were completed and closed out, with the exception of the recommendation in relation to the comprehensive review of the LCCO Instructions, which remain under review.

Analysis

Rules of the Road

151 The Rules of the Road were not adhered to by the drivers of Car 1 or Car 2 in that they did not stop for the amber or red flashing light signals (paragraph 29). As the drivers remain unknown to the RAIU, the RAIU cannot establish why the drivers drove as they did on the day of the incident.

Level Crossing Infrastructure (Roadside & LCCC)

Roadside Infrastructure – Road signs, markings & signals

152 The road signs, marking & signals are in accordance with the Road Signs Manual (Department of Transport, 2010); the manual is clear as to what the requirements are for level crossings in terms of the series of regulatory signs, warning signs and road markings to be placed at level crossings (paragraphs 31 - 36).

153 At LC XM065, the signs, markings and signals clearly indicate that road users are approaching a level crossing, as they: first approach Advanced Flashing Yellow Signals (which are additional to the requirements); then the Countdown Markers, WL122, with the level crossing sign, WL120; before arriving at the level crossing where there are the Flashing Red Signals and the painted Yellow Markings Area (paragraphs 37 - 38).

154 In addition, the presence of barriers, railway line, level crossing equipment and lighting and bells would alert a driver to the fact that they were approaching a level crossing; as a result, it is unlikely that the road users (Car 1 and Car 2) were not aware that they were approaching a level crossing as there is sufficient signage which complies with the Road Signs Manual.

LCCC Infrastructure – CCTV Cameras & Monitor Displays

155 In relation to the positioning of the CCTV cameras, the cameras were initially placed in a location to address the normal preferences for camera position e.g. north facing (paragraph 42). However, when LCCOs raised issues associated with glare during the hours of darkness (paragraph 43), the SET Department moved the cameras, after a trial period, without carrying out any form of risk assessment to identify future potential risks, such as the obstructions at the Athlone entry barriers where the view is obstructed by the Flashing Light Signals, street lighting and barriers.

156 In addition, had an SET design requirements document for level crossings, which was in draft (since 2011) at the time of the relocation, been in place, the new risks due to obstruction may have been identified in 2013 (paragraph 44) as the document required a risk assessment to be conducted.

157 LC XM065 has one dedicated monitor associated with it displaying imagines from one camera at a given time. The view from this sole camera shows the level crossing at an approximate 30° angle, and the full level crossing is taking up less than half of the monitor display (paragraph 53). The SET Department have already recognised, in their draft design document, that the level crossing should occupy at least two thirds of the monitor area (paragraph 45).

158 The views of the level crossing, on the Up Side (Roscommon), are relatively good, with no obstructions of the view of the Yellow Box Area or entry/exit barriers i.e. all cars trapped at this side should be seen by the LCCO, even when the barriers are lowered. However, the views of the Yellow Box Area for the entry barriers on the Down Side (Athlone) are obstructed by the Flashing Red Signals, the barriers and the street lighting, see Figure 34.

Figure 34 – Views of Level Crossing XM065

Operation of Level Crossing XM065

General

159 The level crossing was operating, as designed, at the time of the incident, with no faults detected (paragraph 59). There were no issues identified with inspection and maintenance of the level crossing (paragraph 69).

Selection, training, certification, monitoring & competence management of LCCOs

160 In terms of the selection, training, certification, monitoring and competency management of LCCOs, there is a large suite of documents associated with the competence management process, which appears to be regularly updated with improvements and effective at reviewing the competency of LCCOs at regular time intervals i.e. the DTE assesses the LCCOs approximately every six months, either through summary or formal assessments (paragraphs 70 - 81).

161 The RAIU have reviewed all documentation associated with the LCCO, which is reflective of the requirements and the assessments are carried out by competent assessors (paragraphs 82 - 94).

162 There appears to be little documentation which directly refers to non-technical skills (paragraph 89). IÉ have previously identified this in a report of investigation into 'Pedestrian inside the lowered barriers of Level Crossing XG151 (Athenry), 20/07/14' where it was recommended that a Professional Support Handbook to Level Crossing Control Operators be introduced to provide guidance for LCCOs in the areas of human factors and non-technical skills (paragraph 134). However, this recommendation remains open, with the handbook in draft format.

LCCC Instructions

163 The LCCC Instructions is a document of dense text which is difficult to read, and reads more of a technical document, than an instruction guide for LCCOs (paragraphs 57 - 59).

Actions of the LCCO on the day of the incident (31/01/2017)

164 Firstly, LCCOs generally have to manage a number of level crossings at a given time; this means that LCCOs, in general, may have a higher workloads for short periods of time i.e. the work load is not spread evenly through their shifts. This was the case for the LCCO on the day of the incident, where he was busy attending to a level crossing in Area 1 when the alarm sounded for LC XM065 (Area 2), indicating the beginning of the closing sequence for LC XM065 (paragraphs 96 and 100).

165 When the LCCO did attend to LC XM065, fifteen seconds after the initial initiation, the closing sequence was underway and Car 1 had already driven past the Flashing Red Signal and onto the Yellow Box Area of the level crossing and stopped in a position where it was partially obscured by the Flashing Red Signal, the street light and the raised entry barriers (paragraphs 98 - 99); and Car 2 was driving over the Stop Line as the barriers began to lower (paragraph 100).

166 The LCCO did not see Car 1, only Car 2. The LCCO then placed the Initiation Button to LOCAL which resulted in the barriers stopping in a midway position (paragraph 100). As the LCCO did not see Car 1 he did not raise the barriers and they remained in the midway position as Car 2 reversed clear of the level crossing. Car 1 could not clear the level crossing in time as the barriers were not fully raised; it should be noted that the LCCO is not required to raise the barriers fully (paragraph 68).

167 When Car 2 cleared the level crossing, the LCCO switched the Initiation Button to back to AUTO and the barriers begin to lower again, effectively trapping Car 1. The LCCO can see Car 2 reversing further away from the level crossing, but is still unaware of obscured Car 1, who is also attempting to clear the level crossing.

168 When the barriers were completely lowered and the LCCO saw that Car 2 had cleared the level crossing, the LCCO did one final check of the level crossing (by looking at each of the level crossing corners and then into the middle of the level crossing), and still did not see Car 1. Thinking the level crossing was clear of road traffic, the LCCO pressed the crossing clear buttons and the monitor went blank (see Figure 35 for the final view the LCCO had prior to pressing the crossing clear buttons (at 11:11:34 hrs) where Car 1 is in a stationary position at this stage, and the LCCO's view shows that the car is obstructed by the Red Light Signals, the level crossing barriers and the street light). The LCCO then went to attend to the next level crossing, not knowing Car 1 was still on the level crossing.

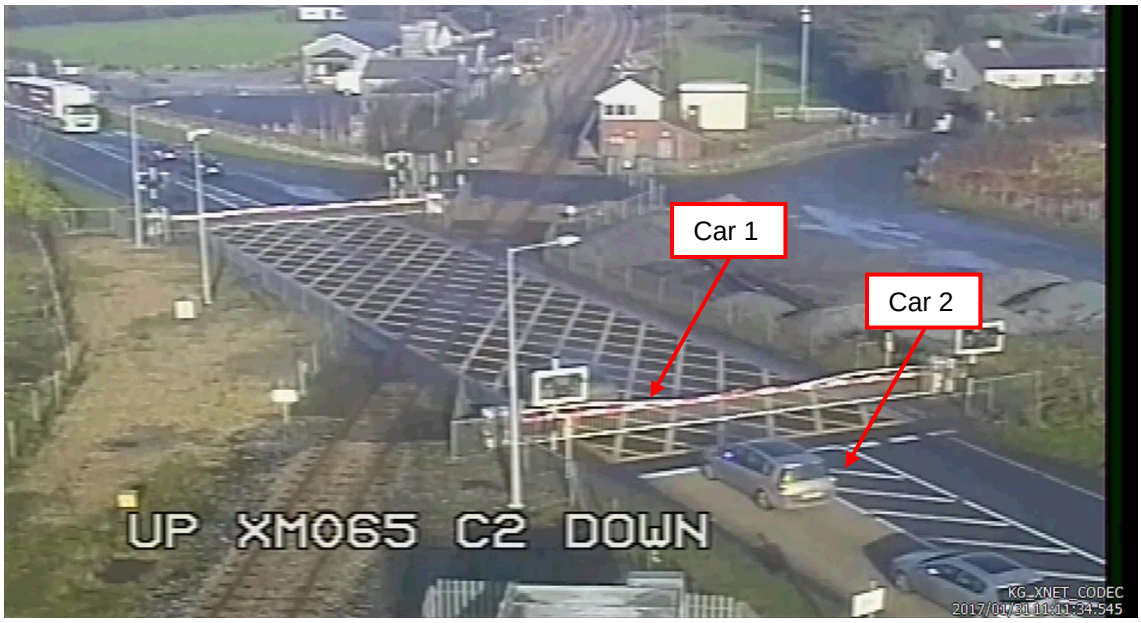


Figure 35 – All four barriers lowered & Car 2 has stopped reversing for the second time

169 The sequence of events indicates that the LCCO was focused on the presence of Car 2, and he stopped the closing sequence to allow Car 2 to clear, as set out in the LCCO Instructions. The focus on Car 2, coupled with the obstructions in front of stationary Car 1, meant that the LCCO did not see Car 1 trapped in the confines of the Level Crossing. The fact that the LCCO did not raise the barriers fully, although not required to, also meant that Car 1 was unable to clear the level crossing.

Actions of LCCOs involved in similar occurrences

170 Excluding the previous incident at LC XM065 in 2014, the IÉ reports of investigation from the similar occurrences at: Ballybrack LC XT121 on the 21/02/15; Athenry LC XG151 on the 20/07/14; and, Roscommon LC XM080 on the 14/04/14, all note that the LCCOs did not see the pedestrians or cyclist in motion at the time of LCCO checking the level crossing (paragraphs 125, 131, 138, respectively).

171 From the RAIU investigation, it was determined that the cyclists and pedestrians were stationary, and in a place of refuge when the LCCO did attend to the level crossing. This is similar to the incident at LC XM065 on the 31/01/2017, where the LCCO attended to the level crossing, when Car 1 was stationary behind the barriers, flashing light signal and street lighting (paragraph 168).

172 The main method used by LCCOs to check that the level crossing is clear is through checking the four corners and the middle of the crossing for obstructions (paragraph 90), which appears to be ineffective; as it appears that LCCOs are depending on motion on the display monitor to identify obstructions on the level crossing.

Conclusions

Summary of conclusions

173 The drivers of Car 1 and Car 2 did not adhere to the Rules of the Road as they did not stop for the regulatory signage and warning signals (paragraph 151) which were in line with the Road Signs Manual (paragraphs 152 - 154).

174 The level crossing equipment operated correctly on the day of the incident (paragraph 159); however, the location of the camera at LC XM065 has been identified as issue by the RAIU, in that, the view on the LCCOs monitor is small (paragraph 157) and obstructed at the Athlone side by the level crossing barriers, flashing light signals and street light (paragraph 158).

175 In terms of the competency management system for LCCOs, it appears to be relatively robust, in that the LCCOs are frequently assessed by competent staff (paragraphs 160 - 161). However, an area of concern has been identified in relation to the areas of human factors and non-technical skills (paragraph 162). This is highlighted by the fact that the LCCO in this incident where the LCCOs attention was focussed so heavily on Car 2, that the LCCO could not see Car 1 trapped in the confines of the level crossing (paragraphs 164 - 169) as Car 1 was stationary at the time that the LCCO attended to LC XM065. The fact that the obstruction (Car 1) was stationary at the time the LCCO attended to the level crossing has also been identified as causal in previous similar occurrences, where LCCOs have not identified stationary pedestrians or a cyclist (paragraphs 170 - 172).

176 The LCCC Instructions have also been identified to be unfit for purpose (paragraph 163) as it is difficult to read and understand. Another issue with the LCCC Instructions, which contributed to this incident, was the fact that the LCCC Instructions do not require that the barriers be fully raised when an obstructions has been identified near the level crossing (paragraph 166). Had the barriers been raised fully Car 1 would have likely been able to clear the level crossing.

Immediate cause, contributory factors, underlying causes, root causes and additional observations

177 The immediate cause of Train A805 passing through LC XM065 with a car inside the lowered barriers, was as a result of the LCCO clearing the level crossing while the car was within the confines of the level crossing.

178 Contributory factors associated with the incident are:

- CF-01 – Car 1 did not adhere to the road traffic legislation related to this type of crossing, in that, the driver did not stop clear of the level crossing;
- CF-02 – When the LCCO attended to the LC XM065, fifteen seconds after the initiation alarm, Car 1 was partially obscured by the barriers, the road flashing red signals and a street light resulting in the LCCO not seeing Car 1;
- CF-03 – As the barriers were not fully raised, and remained frozen in a midway position, until the LCCO cleared the level crossing, Car 1 could not clear the level crossing;
- CF-04 – The obstruction of Car 1 was enabled by the poor positioning of the level crossing cameras at LC XM065, resulting in poor views on the LCCO's display monitors;
- CF-05 – The LCCO did not have the appropriate non-technical skills to fully assess LC XM065 before clearing the level crossing.

179 The underlying cause associated with this incident:

- UC-01 – There was no adequate risk assessment process for the position of CCTV level crossing cameras;
- UC-02 – There is no adequate non-technical skills training or documentation to assist LCCOs in their duties.

Additional observations

180 The following additional observation is made by the RAIU:

- AO-01 – The LCCC Instructions have also been identified to be unfit for purpose as it is difficult to read and understand.

Relevant actions taken or in progress

Actions taken by IÉ

181 IÉ have advised the RAIU that the following actions have taken in relation to this incident:

- An operational occurrence review was chaired by the OCM (West) in Athlone on the 7th of February 2017 to review the evidence to date and establish the facts with an emphasis placed on the lessons learned from the occurrence. The review was attended by members of staff on duty at the time of the occurrence and other relevant staff members of the IM Operations Department;
- The LCCO was placed on a medium term development plan in accordance with IMO-SMS-040. The plan was designed to include:
    - Human Factors Training;
    - A return to work assessment taking in Risk Triggered Commentary and non-technical skills;
    - Four formal assessments with focus on non-technical skills;
    - Additional unannounced DTE monitoring;
    - Additional unannounced Supervisor monitoring.
- A review of the location of the Flashing Red Signals at the crossing was conducted by the SET Department on the 19th of April 2017 to explore the possibilities of relocating it to prevent it from partially obstructing the line of view of the CCTV cameras (and that of the LCCO). The review established the following:
    - The Flashing Red Signals would have to be moved five to six metres on the roadway and the change, if implemented, would be a significant deviation from the CRR guidelines (RSC-G-006-B);
    - The relocation of the Flashing Red Signals may introduce new risks for the crossing and road traffic.
- The SET Department conducted a survey of crossing image screen shots of all 138 CCTV crossings during February 2017 (Athlone, Mallow, & CTC). This was to identify where Flashing Light Signals partially obscured an area within the crossing where a vehicle could be present and go undetected by the LCCO during the 'Crossing Clear' process giving rise to a similar occurrence. The survey identified four CCTV level crossings where a Flashing Light Signal partially obscured an area on the crossing. However, only one of the crossings had a similar layout as that of XM065 (Knockcroghery) and under the same circumstances could partially obscure an area on the crossing, clear of the running line, where a vehicle could stop and potentially go undetected.

182 In addition, IÉ published a Report of Investigation into the incident, 'Vehicle inside the barriers of LC XM065 (Knockcroghery) during the passage of train A805, 31st January 2017', published on the 14th July 2017, which made the following safety recommendations:

- The Chief Engineer SET should arrange for a risk assessment to include the re-positioning of the Road Traffic Lights and the CCTV cameras at XM065 (Knockcroghery) and ensure that all appropriate actions arising are implemented. Additionally, the same process should be applied for the crossings identified in the CCTV crossing survey conducted by the SET Department during February 2017;
- The Chief Engineer SET should review, update and issue the current draft technical standard for the design requirements for level crossing CCTV systems. The review should include, but not be confined to, details on managing the risks associated with the positioning and/or relocating of cameras at CCTV crossings. It should also provide for that crossing surveys include input from operations (IM) in relation to the optimum positioning (or relocating) of CCTV cameras and the view provided to the Level Crossing Control Centre Operator.

Safety recommendations

General description

183 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 CRR. The recommendation is directed to the party identified in each recommendation.

184 As the view of LC XM065 is partially obscured by the barriers, the road flashing red signals and a street light, which resulted in the LCCO not seeing Car 1 (CF-02, CF-03); the RAIU make the following safety recommendation:

The SET Department should review the camera position at LC XM065, and other similar CCTV level crossings, to ensure that the LCCOs have optimum, unobstructed, views of level crossings.

185 As no formal risk assessment process was in place at the time of the re-positioning of the cameras, which effectively resulted in obstructed views at the level crossing (UC-01); the RAIU make the following safety recommendation:

The SET Department should develop a formalised risk assessment process for the positioning of CCTV cameras and associated design works.

186 As Car 1 was effectively trapped in the confines with the level crossing, without enough opportunity to clear the level crossing as a result of the barriers not being fully raised, the RAIU make the following interim safety recommendation, which may be removed when the views of the level crossings are unobstructed (CF-03):

IÉ IM should identify CCTV level crossings with obstructed views and issue interim instructions to LCCOs to fully raise the barriers where there is a possibility of any obstructions on level crossings.

187 As the LCCO did not apply adequate non-technical skills, when clearing the level crossing, and given that the RAIU have identified that there is a trend in LCCOs not identifying stationary obstructions at level crossings (CF-05, UC-02); and, that the LCCOs do not have adequate documentation to support this training, the RAIU make the following safety recommendation:

IÉ IM should review the human factors and non-technical skills training for LCCOs, and introduce further training, where applicable. In addition, IÉ RU should finalise the Professional Support Handbook for Level Crossing Control Operators; to provide guidance for LCCOs in the areas of human factors and non-technical skills.

188 Finally, the RAIU have identified that the LCCC Instructions are difficult to read and are unfit for purpose (AO-01); and as a result, the RAIU make the following safety recommendation:

IÉ IM should review and update the LCCC Instructions, to make them more user friendly for LCCOs.

Additional information

List of abbreviations

ALCC	Athlone Local Control Centre
CCE	Chief Civil Engineer
CCTV	Closed Circuit Television
CRR	Commission for Railway Regulation
CTE	Chief Traffic Executive
CWR	Continuous Welded Rail
DTE	District Traffic Executive
DTTAS	Department of Transport, Tourism and Sport
ICR	Intercity Railcar
IÉ	Iarnród Éireann
IM	Infrastructure Manager
LCCC	Level Crossing Control Centre
LCCO	Level Crossing Control Operative
m	Metre
MLCCC	Mallow Level Crossing Control Centre
No.	Number
RAIU	Railway Accident Investigation Unit
RU	Railway Undertaking
SET	Signalling, Electrical and Telecommunications
SMS	Safety Management System
SI Units	International System of Units
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.
Bi-directional	A track on which trains may be worked in either direction under normal signalling arrangements.
Cess	The part of the track outside the ballast shoulder that is deliberately maintained lower that the sleeper bottom to aid drainage.
Coloured light signals	Signals which convey movement authorities to drivers by means of coloured lights
Continuous welded rail	Sections of rail that are welded together.
Contributory Factor	Factors relating to actions taken by persons involved or the condition of rolling stock or technical installations.
Controlling Signalman	The Signalman designated to control a specific section of track.
Competence	IÉ IM Operations define competence as the ability to perform activities to the standard expected within employment, it includes practical and theoretical knowledge, experience and skill required to carry out duties to ensure the safety of any person who may be affected (by their duties).
Competence Management System	IÉ IM Operations define a competence management system as a documented system by which an employer ensures, as far as reasonably practicable, that its employees consistently achieve the standards of competence required for their work.
Control Room Process	Meeting that incorporates a visualisation room where the local supervisory/management team make prioritized decisions related to Maintenance production plans, progress reporting of different measures of performance, reviews of plans and revising actions to meet those plans, Occupational safety risks and asset safety risks and the appropriate risk mitigation actions, initiating practical problem solving for specific problems and controlling the extent of 5S workplace improvement action plans.
Division	Made up of a number of regions and several CCE Locations.
Double line track	A route with two tracks
Down Line	Trains travelling from Athlone to Westport.
Engineering train	A train used in connection with engineering works, e.g. carrying spoil.
Engineering Supervisor	The person nominated to manage the safe execution of works within an engineering worksite. This includes arranging the marker boards and authorising the movements of train in and out of the work site.

Extensive damage	Damage that can be immediately assessed by the RAIU to cost at least €2,000,000 in total.
Immediate cause	Direct and immediate causes of the occurrence including contributory factors relating to actions taken by persons involved or the condition of rolling stock or technical installations.
Incident	Any incident, other than an accident or serious accident, associated with the operation of trains and affecting the safety of operation.
Infrastructure Manager	Organisation that is responsible for the establishment and maintenance of railway infrastructure, including the management of infrastructure control and safety systems.
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.
Incident	An accident, serious accident or incident.
Railway Undertaking	Organisation that operates trains.
Region	Sub-division Consisting of a number of CCE Locations
Root cause	Causes related to framework conditions and application of the SMS.
Safety certificate	The purpose of the safety certificate is to provide evidence that the RU and IM: - Has established its Safety Management System (SMS) in accordance with Article Nine and Annex III of the Railway Safety Directive (RSD), and; - Can meet the requirements laid down in the Technical Specifications for Interoperability (TSI) and other relevant European Community legislation, and in National Safety Rules, in order to control risks and provide rail transport services safely on the network. The CRR issue the RU and IM safety certificate The RU Licence is issued in conformity with European Directive 2012/34/EU and S.I. 249 of 2015
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.
Standard	A document that mandates technical, operational or managerial requirements.
Stop Line	Transverse Vehicle Stop Line
Track Circuit Block	A signalling system that uses track circuits to confirm the absence of trains in order to control the movement of trains.

Transverse Vehicle Stop Line	Transverse road surface marking that inform drivers where they should stop or yield when approaching an intersection.
Underlying cause	Causes related to skills, procedures and maintenance.
Up Line	The line on which trains travel from Westport to Athlone.
Weekly Circular	A document published on a weekly basis, providing information about engineering works, possessions requested, changes to services and speed restrictions.
Yellow Box Area (Marking)	Provided to aid traffic flow, at road junctions (including roundabouts), junctions with tram tracks, railway level crossings, exits to bus lanes, or other locations as deemed appropriate by the road authority, where blocking back affecting a cross flow is a significant problem.

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