Railway Accident Investigation Unit Ireland

INVESTIGATION REPORT

Derailment of DART passenger service, at Points DL115, Dun Laoghaire, 13th September 2017

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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

On the 13th September 2017, the DART passenger service from Howth to Bray (Train E222) was delayed due to a loss of *points detection* at Points DL115, resulting in Signal DL31 being at danger.

Arrangements were made to have a Dun Laoghaire Station operative act as a Points Operator and clip and scotch Points DL115 in the *normal position*. The Points Operator did not carry out the instructions set out in the IÉ Rule Book, in full, leaving a gap between the *switch rail toe* and the *stock rail*. The Points Operator advised the Controlling Signalman that the route was set and the Controlling Signalman gave the driver of Train E222 (Driver E222) permission to pass Signal DL31 at danger, over Points DL115.

At approximately 18:04 hours (hrs) the leading bogie of Train E222 derailed while crossing over Points DL115 before coming to a stop approximately 109 metres (m) from Dun Laoghaire Platform 2. The driver of Train E222 immediately reported the accident to the Controlling Signalman who arranged signal protection to both the *up* and *down lines*.

Approximately sixty to seventy passengers carried out an uncontrolled impromptu evacuation from the train on to the *permanent way* before a controlled evacuation of the passengers was arranged by Iarnród Éireann (IÉ).

The immediate cause of the derailment was as a result of Train E222 travelling over failed Points DL115 which had been incorrectly secured by the Points Operator by leaving a gap between the stock and switch rails.

Contributory factors associated with the accident are:

- The Points Operator did not carry out the instructions set out in the IÉ Rule Book (Section B, Part 2, 10.0) and the General Appendix (Section E, 3), in full, for the hand operation of power operated points;
- The Points Operator and the Controlling Signalman did not adhere to the strict requirements for safety critical communications, in particular the repeating of messages, resulting in the Points Operator and Controlling Signalman not coming to a clear understanding of the situation.

The underlying causes associated with the accident were:

- Deficiencies in the training records, continuous assessment and performance records of points operators resulted in the Points Operator not having sufficient knowledge, competency or practical experience in order to carry out his duties;
- The derogation to extend workplace development events for the assessment of points operators from six months to twelve months resulted in the Points Operator not being re-assessed after being passed competent at the time of the accident.

A root cause associated with this accident is:

- Standard, IM-SMS-027, 'Derogation from Safety Management System' was drafted without following the principles of IM-SMS-014, 'Safety approval of changes in Plant, Equipment, Infrastructure and Operations (PEIO)' resulting in a derogation to standard IMO-SMS-031, 'Competence Management – Person required to conduct IM operating duties' being authorised without carrying out a risk assessment or involving all of the stakeholders to assess the effects of any changes.

The RAIU have made seven new safety recommendations, as follows:

- IÉ Infrastructure Manager (IM) should conduct a full review of IMO-SMS-031, 'Competence Management – Persons required to conduct IM operating duties' and associated documentation, to identify deficiencies in training, continuous assessment and the recording of performance of duties to ensure that persons carrying out these duties are competent to do so;
- IÉ IM and IÉ Railway Undertaking (RU) should evaluate the current training, assessment and monitoring of Safety Critical Communications to ensure that communications are carried out to the requirements set out in IÉ Rule Book, and safety critical communications standards IMO-SMS-033 and OPS-SMS-8.1;
- IÉ RU should review their suite of documents which reference major customer disruptions and emergencies, and address any deficiencies in relation to the management of passengers on trains and uncontrolled impromptu evacuations. These documents should then be briefed to staff who have roles in relation to customer disruptions and emergencies to ensure they are aware of their responsibilities;
- IÉ IM should update the relevant sections of the General Appendix and other associated documentation to specify where the points clip should be fitted;
- IÉ should agree and implement a consistent wording in the Rule Book, General Appendix, training material and oral instructions in relation to the points operator's instructions; and ensure that the importance of the task order is highlighted in the training for points operators;
- IÉ IM should review the drawing and specification requirements for points scotches and ensure only scotches manufactured to the required drawing and specification are made available to points operators;
- IÉ RU should brief the relevant staff on the requirements of the IÉ Rule Book (Section M 3.1.2) which states that where emergency detonator protection is not needed, drivers must place a Track Circuit Operating Device on the line(s) concerned to supplement the signal protection.

Contents

The Accident

Summary of the accident

1 On the 13th September 2017, the 16:45 DART passenger service E222 from Howth to Bray (Train E222), a six car 8100 Electrical Multiple Unit (EMU), was delayed at Salthill Station for thirty minutes as a result of the Signal DL31 being at danger, due to the failure of Points DL115 going to reverse.

2 Arrangements were made to have a Dun Laoghaire Station operative act as a Points Operator and clip and scotch Points DL115 in the normal position. The Points Operator did not carry out the task correctly and advised the Controlling Signalman that the route was set and the Controlling Signalman gave the driver of Train E222 (Driver E222) permission to pass Signal DL31 at danger.

3 At approximately 18:04 hours (hrs) the leading bogie of Train E222 derailed while crossing over Points DL115 before coming to a stop approximately 109 metres (m) from Dun Laoghaire Platform 2 (Figure 1). Driver E222 immediately reported the accident to the Controlling Signalman who arranged signal protection to both the *up* and *down lines*.

Figure 1 – DART passenger service derailed at Points DL115, Dun Laoghaire

4 Between 18:25 and 18:40 hrs approximately sixty to seventy passengers carried out uncontrolled impromptus evacuations on to the permanent way after activation of the emergency door opening devices.

5 The line reopened to traffic at 03:30 hrs the on 14th September 2017.

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

Parties involved in the accident

Iarnród Éireann

6 IÉ is the railway undertaking (RU) who owns and operates mainline and suburban railway including DART services in Ireland and operates under a safety certificate issued by the Commission for Railway Regulation (CRR). The RU Safety Certification is issued in conformity with Commission Regulation (EU) 1158/2010; the certification was renewed in March 2018 for a period of five years. The RU Licence is issued in conformity with European Directive 2012/34/EU and S.I. 249 of 2015; the licence was renewed in 24th September 2015 for a period of five years.

7 IÉ is also the infrastructure manager (IM), who owns and operates their railway infrastructure in Ireland and operates under a Safety Authorisation certificate issued by the CRR. The IM Safety Authorisation is issued in conformity with Commission Regulation (EU) 1169/2010; the authorisation was renewed in 24th March 2018 for a period of four years.

8 The IÉ IM and RU departments involved in the accident include:

- IM Signalling, Electrical and Telecommunications (SET) Department - responsible for the design, installation and maintenance of signalling equipment;
- IM Chief Civil Engineer's (CCE) Department – responsible for the design, inspection, maintenance and renewal of the railway's structural infrastructure and the management of risks associated with these assets;
- RU Operations – responsible for the operation of trains on the network. This includes the supervision of train drivers. The RU Operations also supply staff to the IM under special working arrangements for emergency operational duties;
- The Infrastructure Manager Operations (IMO) Department – responsible for the safe and efficient control of operations on the rail network for the IM team. The department is responsible for the management, control, supervision, delivery and recovery of train control operations activities on the IÉ Network. The activities of the department are allocated between the Train Control Manager and Manager CTC & Train Performance and can be categorised as follows; Central Traffic Control (CTC), Signalling Control, Level Crossing Control, Emergency Response (Degraded Working), IÉ Network Capacity Allocation and Train Performance Reporting;
- CTC – responsible for the efficient management of track use across most of the IÉ network, in particular over lines that are directly supervised through signalling control;
- RU Chief Mechanical Engineer's (CME) Department – responsible for the specification, purchasing, commissioning and maintenance of rolling stock, including management of the maintenance depots, associated personnel and procedures. The CME department are also responsible for the re-railing of vehicles.

Roles involved in the accident

9 The IÉ staff directly involved in the accident were the:

- Driver E222 – a competent driver since 1994 who was driving Train E222 (a driver only service);
- Points Operator – Station operative, working in Dun Laoghaire, certified as competent to manually operate power operated points at the time of the accident;
- Controlling Signalman – a competent signalman located at Centralised Traffic Control (CTC) in Connolly Station; who instructed the Points Operator to scotch and clip Points DL115.

Roles not directly involved in the accident

10 The roles not directly involved in this accident:

- Competency Assessor for Points Operator – Responsible for ensuring the competency of staff in his control, by providing training and competency assessment of the staff;
- IÉ Incident Officer (IÉIO) – Responsible for taking charge of the railway interests at the site.

General description of the railway

Infrastructure

11 The line between Howth Station and Bray Station, see Figure 2, is a *double line track* with flat bottom continuously welded rail (CWR) mounted on concrete sleepers set in ballast. There is a permanent speed restriction of 50 kilometre per hour (km/h) (31 miles per hour) between Salthill through Dun Laoghaire to Glenageary from the 5 ¾ to the 6 $^{1}/_{8}$ mile posts (MP) as set out in the working time table effective from 20th January 2013.

Figure 2 – Location of the accident

12 *Overhead line equipment* (OHLE) is installed along the line to supply traction power at 1,500 volts direct current to electric trains. The OHLE is supported by a mixture of portal, headspan and cantilever structures. The electrification on the route is controlled by the Electrical Control Operator located in CTC, Connolly Station Dublin.

13 Railway points are mechanical installations enabling trains to be guided from one track to another such as at a junction or where a *siding* branches off. Points DL115 will be further discussed in the Evidence Section (paragraph 38 - 41).

Rolling stock

14 Train E222 was made up of a six car 8100 EMUs comprising of 8308-8108, 8332-8132, 8306-8106 with 8308 leading, see Figure 3.

Figure 3 – EMU involved in derailment

15 The total length of the train was approximately 126 metres (m) (413 feet), Tare weighing 198.36 tonnes and 277.05 tonnes crush laden. The maximum allowable speed of the 8100 EMU fleet is 100 km/h (62 mph).

16 The 8100 EMU fleet comprise of two car sets which can be operated in multiple units up to a maximum of eight cars. There are no through gangways between each coupled two car sets.

17 The *wheel profile* of the leading wheelset on EMU 8308 was measured post-accident and was found to be within specification.

18 The maximum speed of the train after being given permission to pass Signal DL31 at danger was 22 km/h.

19 No factors related to performance, or speed, of the rolling stock were found to have contributed to the accident.

Signalling and Communications

20 The line between Howth Station and Bray Station is controlled by the Controlling Signalman.

21 The route is fitted with two, three, and four aspect colour light signals. Trains are signalled under *Track Circuit Block* regulations and train detection is achieved by a combination of *track circuits* and *axle counters*. Train detection is exclusively by track circuit south of Sandymount Station.

22 Train protection is provided over the route by *Continuous Automatic Warning System* (CAWS) and *Automatic Train Protection* (ATP) for DART trains. Train radio coverage with the Controlling Signalman is also provided over the entire route.

23 The means of communication between the Controlling Signalman and Points Operator is via telephone (including mobile telephone and signal post telephone).

Operations

24 Under normal operation conditions Points DL115 are controlled by the Controlling Signalman.

25 In the event of a failure of points, the RU contract staff to the IM to provide emergency response. The procedure to manually operate power operated points including clip, lock and scotching the points in a requested position to allow the safe passage of trains over the points is covered with the agreement.

Fatalities, injuries, emergency response & material damage

Fatalities, injuries & emergency response

26 There were no fatalities, serious or minor injuries as a result of this accident.

27 Dublin Fire Brigade and Ambulance Service attended the site as there was a report of a pregnant lady and a girl suffering from a panic attack on board the train.

28 Staff from IÉ (SET, CCE, CME, and IMO) and the re-railing team along with the staff from the RAIU and the CRR attended the scene.

Material damage

29 Only minor damage occurred to IÉ rolling stock and infrastructure Points DL115 as a result of the accident.

External circumstances

Weather

30 The weather recorded by Met Éireann at the Phoenix Park weather station was; temperature high of 15.6˚C and a low of 6.3˚C with broken cloud, wind speed of 22 km/h.

31 External circumstances, including weather conditions, did not contribute to the accident.

RAIU Investigation

Decision to investigate

32 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.

33 Given that under slightly different circumstances, this accident may have led to a serious accident with potential for fatalities and serious injuries, due to a passenger train derailing; the RAIU made the decision to conduct a full investigation.

34 The RAIU may conduct investigations into occurrences leading to the closure of a railway line for more than six hours, which was the case with this accident as the lines was closed for a period of nine hours and twenty-six minutes (from 18:04 hrs – 03:30 hrs).

35 In addition, the RAIU, as part of this investigation, reviewed the events surrounding the uncontrolled impromptu evacuation of passengers onto the railway line, as under different circumstances, this may have led to injuries or fatalities.

Scope of the investigation

36 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 accident;
- 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 Points Operator;
- Examine the actions of the Points Operator on the day of the accident;
- Examine the safety history of the Points Operator;
- Examine the events surrounding the evacuation of passengers.

Investigation and Evidence

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

- Formal interview and witness testimonies from the relevant IÉ personnel
- On Train Data Recorder (OTDR) download and analysis;
- On-board CCTV from the train;
- Voice communication recordings between the Points Operator and Controlling Signalman;
- IÉ Rule Book and General Appendix;
- IÉ SMS related to competency management of manual operation of power operated points;
- Training and competency records of the relevant staff;
- Post-accident examination report of Points DL115;
- IÉ internal investigation report, report number R0601-2018-12, published the 24th May 2018, 'Report of Investigation: Train E222 derailed at 115 pts at Dun Laoghaire 13th of September 2017';
- Review the documentation in relation to evacuation of passengers.

Evidence

Points DL115

General Description

38 At Dun Laoghaire, Points DL115 are situated on the down road on the Dublin side of Dun Laoghaire Station, see Figure 4; and allow movement of trains from the main line in the *normal* position or into the Bay Platform 3 in the *reverse* position. The points can be requested (normal or reverse) by the Controlling Signalman under regular conditions or manually by a Points Operator as a result of a failure.

39 DL115A points are located at the five mile 1591 yards at Dun Laoghaire on the Pearse to Shanganagh Junction, see Figure 4. The points are constructed from 113 pound flat bottom rail and are approximately twenty-one years old.

Figure 4 – Location of Points DL115 (DL115A facing, DL115B trailing)
(Figure taken from IÉ Report)

40 Points DL115 are classified as *Clamp Lock Points* which use a hydraulic system for the movement of the switch rail. The points operate by guiding one track to another by the movement of the switch rails items 7 and 8, in Figure 5.

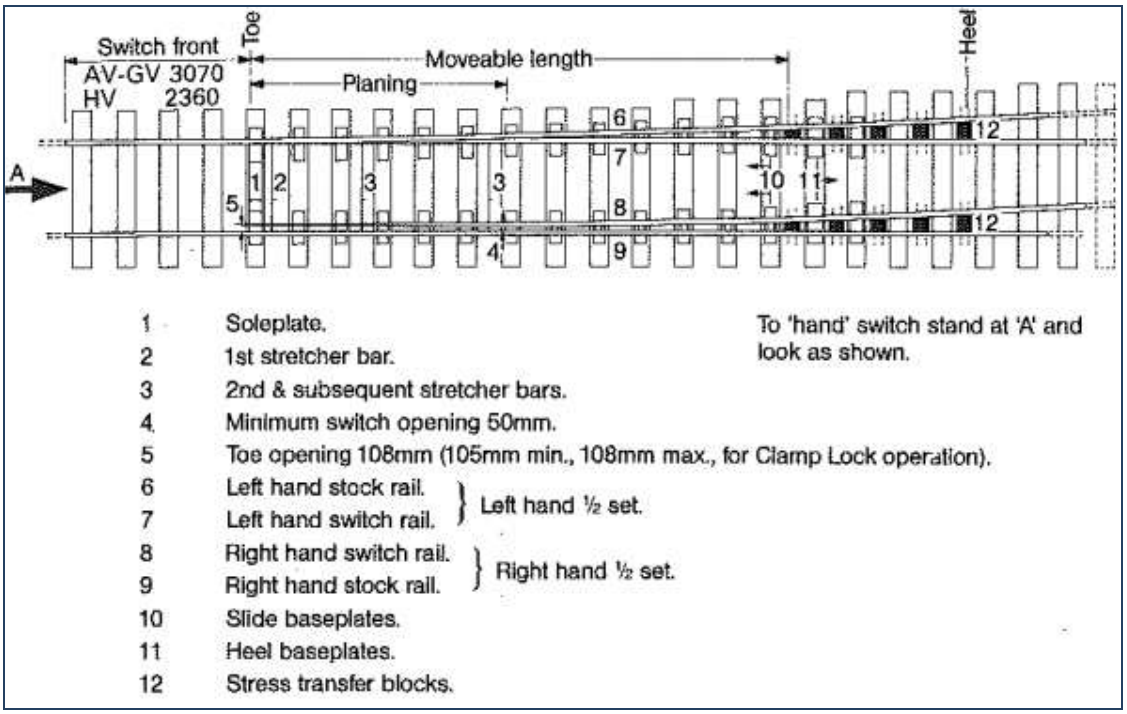

Figure 5 – Points components

41 The planned scheduled maintenance work for points DL115 was up to date, with no outstanding items from the maintenance requiring attention despite a fault of “Fail to go to reverse” being reported on the day of the accident.

IÉ Rule Book[1] & General Appendix for Operation of Clamp Lock Points

General description

42 This section of the RAIU report outlines instructions for the Points Operators and the hand operation of power operated points. References to the IÉ Rule Book are from Section B Part Two 10.0, 'Instructions to Points Operators' (with the relevant paragraphs being identified) and references to the General Appendix are from Section E – Signalling and Station Working, 'Instructions for Hand Operation of Power Operated Points' (with the relevant paragraphs being identified).

Instructions to Points Operators

43 IÉ Rule Book – Paragraph 10.0 'Instructions to Points Operators' details the procedures and instructions for the manual operation of power operation points. Paragraph 10.1 'When you may act as Points Operator' states that you may act as a points operators "only if you are currently certified as competent to manually operate power operated points of the type(s) at the location concerned and only on the instruction of the Signalman[2]".

Equipment

44 IÉ Rule Book – Paragraph 10.2 'What equipment you must have with you' states that points operators must have their current certification of competence and "clips, locks and scotches and the necessary keys and points handles".

45 General Appendix – Paragraph 2.4 states that "the Handsignalman[3] must be given possession of any emergency keys, scotches, clips, detonators, crank/pump handle(s), hammer and/or crowbar necessary to operate the affected points manually". Paragraph 2.5 states that "Where it is necessary at certain locations for the crank handle to be released by the Signalman, he must arrange with the Handsignalman as to the location from which this will be done".

[1] The IÉ Rule Book is a joint document with Northern Ireland Railways (NIR), but will be referred to as the IÉ Rule Book in this document.

[2] The IÉ Rule Book and General Appendix refer to the Controlling Signalman as the Signalman.

[3] The General Appendix refers to the Points Operator as a Handsignalman.

On arrival at the points

46 IÉ Rule Book – Paragraph 10.3 'What you must do when acting as points operator', states that on arrival to site (10.3.1), the points operator must: "report your arrival to the Controlling Signalman; check for any damage, or obstruction in, the points; and, tell the Signalman if any point motor is running continuously, cut off the power supply if possible and not to insert the point handle while the motor is running". IÉ General Appendix – Paragraph 2.6 re-iterates the above.

47 The IÉ Rule Book continues, that the points operator must observe the Controlling Signalman's instructions (10.3.2), and "not operate any points unless expressly instructed by the Signalman". In the case where the points are to be operated, the Controlling Signalman will tell the Points Operator: "which points to operate; to which position to move them; and, whether they must be secured by clip, lock and scotch or scotch only".

Operation of the Points

48 IÉ General Appendix – Paragraph 2.7 states that "the Handsignalman must then hand operate the points, in accordance with the instructions relative to the particular type of machine involved to set the route in the direction in which he has been instructed by the Signalman. The Handsignalman must wind or pump the points until he can verify by observation that the points have completed their travel and that the lock(s) is (are) home i.e. continue winding/pumping until no further handle movement is possible". Paragraph 2.8 then states that "the points must be clipped and, where practicable, scotched".

49 IÉ Rule Book states that after operation of the points, the points operator must:

- "Walk through the route;
- Check that each point end is lying in the required position;
- Check that the necessary clips, locks and scotches are applied;
- Give the Signalman the details of the route now set, quoting point numbers, positions and whether secured;
- Do not operate or release the points until further instructed by the Signalman".

50 General Appendix – Paragraph 2.9 also states that the Handsignalman must walk through the route, checking that the points are lying as instructed and report this to the controlling signalman.

51 Section 10.3.3, 'Manual Operation of Points', in Section B Part Two of the IÉ Rule Book sets out the procedures for the manual operation of points, stating that the points operator must:

- Ensure that the power supply is cut off before moving or securing any points;
- Not restore the power until authorised by the Controlling Signalman;
- When moving the points, turn the handle in the required direction until the points complete their travel; continue cranking until resistance is met, proving the lock is home;
- Secure the points by clip, lock and scotch or by scotch only as instructed by the Signalman.

52 IÉ General Appendix – Paragraph 3.6 sets out the instructions for the operation of Clamp Lock Points (only sections relevant are included) stating:

- Access to the hand controls is by unlocking the cover of the points machine and lifting it back. The hand controls of the machine consist of (see Figure 6 for illustration from General Appendix & Figure 7 for a photograph of the mechanism):
  - Rotary switch;
  - Directional Control Level;
  - Socket for hand pump handle.
- Method of hand operation:
  - Turn the rotary switch from power to manual;
  - Insert the handle in the pump socket;
  - Move directional control lever to the required poisition (normal or reverse) and hold in position. This switch is spring loaded and will return to the neutral position if not held;
  - Operate the pump handle backwards and forwards, holding the directional control lever in the required position, over its full length of stroke until exceedingly hard pressure is required. The points will move and lock to the selected position;
  - When the switch has closed tight against the stock rail, a further three or four strokes of the handle are required to engage the working mechanism. (The points should be clipped and scotched as required by these instructions);
  - When normal working of the points is to resumed and the relevant lever or switch in the signal box is in correspondence with the position of the points, the controlling signalman may authorise the re-setting of the rotary switch from manual to power.

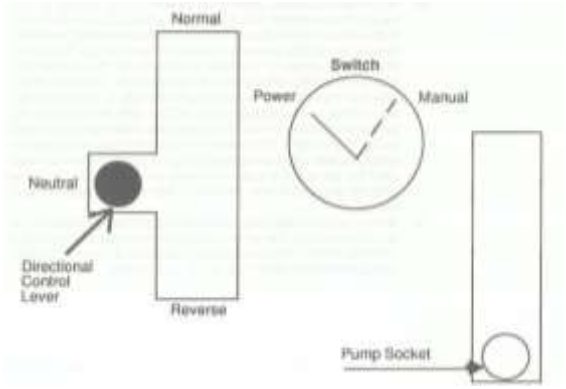

Figure 6 – Clamp Lock Mechanism (from General Appendix)

Figure 7 – Photograph of Clamp Lock Mechanism

53 The Points Operator involved in the accident was also issued with a a prompt card 'Scotching and Clipping Points Checklist' which summarises the instructions in the IÉ Rule Book and the General Appendix.

Application of the clip

54 The IÉ Rule Book or the General Appendix does not identify where the points clip should be applied.

55 However, in the United Kingdom (UK), Section 7.3, 'How to apply a points clip and scotch' of the UK Rule Book, GE/RT8000/HB4 (published in June 2010), states that "The clip must be placed under the rail as near to the tip of the tongue[4] as possible. Always try to get it in the first or second *bed*".

Video illustrating the Operation of Points

56 IÉ have developed a video illustrating how the duties of a Points Operator for the hand operation of power operated points as per the IÉ Rule Book and General Appendix could be carried out. It is a concise video, with the except that the terminology used in the video is not consistent with the wording of the Rule Book and General Appendix; as the IÉ Rule Book and General Appendix refers to "clip, lock and scotch" of the points, while the terminology in the video is "scotching and clipping" the points, inferring that the scotch should be applied before clipping the points.

[4] Toe

Post derailment inspection of Points DL115

57 The post derailment inspection of Points DL115 identified that the power supply had not been taken from the points before fitting the clip and scotch.

58 There was a gap between the toe of the switch rail toe and the stock rail, see Figure 8.

Figure 8 – Gap between the toe of the switch rail toe and the stock rail

59 The points clip was applied in the third bed back from the toe of the switch rail. The points clip collar, which restricts the loosening of the clip, had not been applied; and the points clip had not been locked with a padlock, see Figure 9.

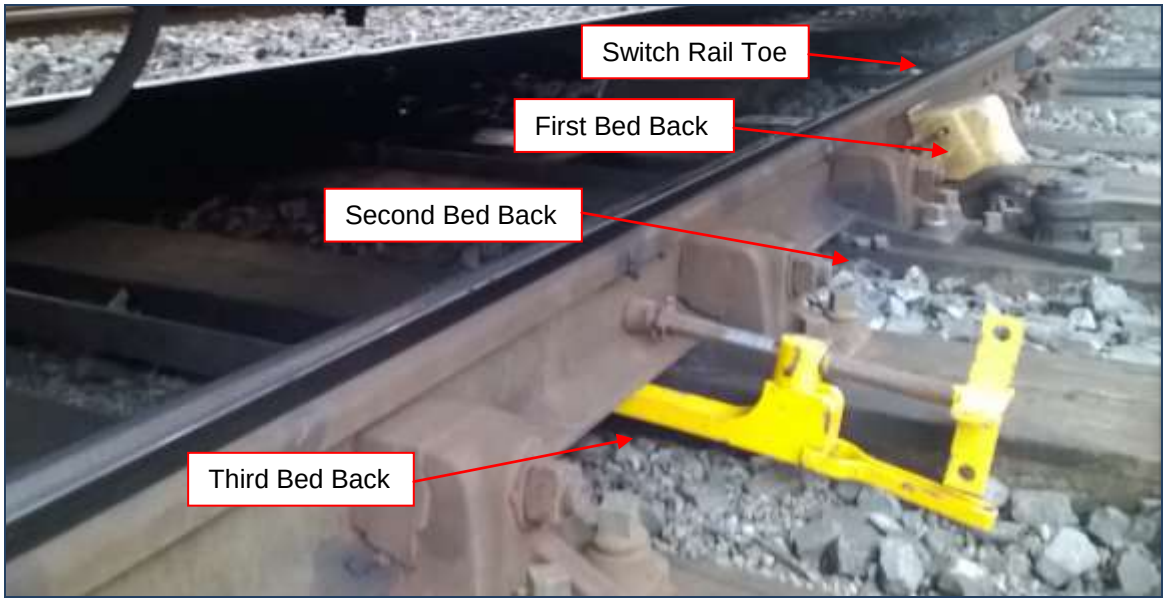

Figure 9 – Placement of the Points Clip

60 The scotch was not manufactured to the dimensions set out in IÉ Drawing No. W487 / 29, 'Timber Scotch for Points – Oak'. Figure 10 illustrates the required dimensions (in black) of the timber scotch under drawings number W487/29 in comparison with the actual dimensions of the timber scotch used on the day of the accident (in red). It should be noted, that the incorrect dimensions did not contribute to the accident.

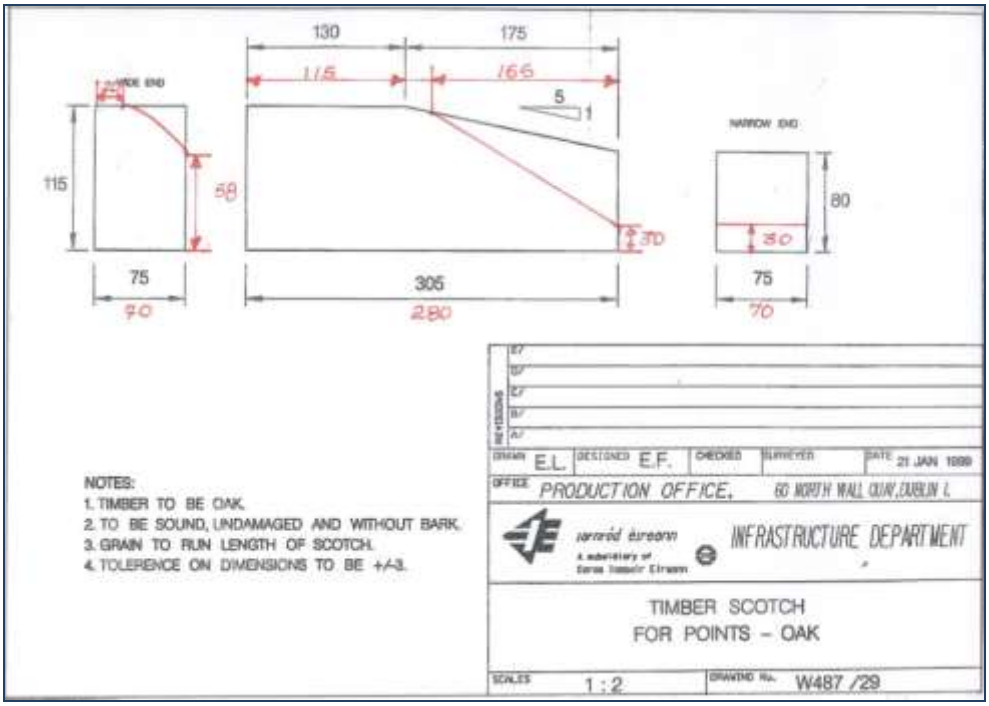

Figure 10 – Required (black) versus actual (red) dimensions of Timber Scotch

Training, Monitoring & Competency Assessment of Points Operators

Standards & Procedures

61 Training, Certification and Competency Assessment of Points Operators is carried out by District Traffic Executives (DTEs). IÉ's standard IMO-SMS-031, 'Competence Management-Persons Required to Conduct IM Operating Duties' (Issue 1, operative date 24/10/2016) details the process of managing the selection, training, certification, monitoring and competency assessment of five operational duties including operation of points in an emergency that RU contracted staff may be requested to carry out in the event of a failure of a system. The standard specifies the frequency of assessment over a 24 month cycle with the following structure:

- Four workplace development events – one every six months;
- Interim assessment within the 11th or 12th month to review progress;
- Summary assessment within the 23rd or 24th month.

62 In relation to the four workplace development events, a derogation to extend the six monthly workplace development events for points operators to twelve monthly was applied for on 15th December 2016 and was authorised on 12th January 2017. The application for the derogation complied with the requirements of IM-SMS-27 'Derogation from Safety Management System' but IM-SMS-27 does not comply with the principles of IM-SMS-014 'Safety approval of changes in Plant, Equipment Infrastructure and Operations (PEIO)' with regards to mandating a risk assessment and involving all stakeholders.

63 Some staff involved in the competency assessment of points operators advised that they were not consulted when the derogation was being processed and had raised concerns over the twelve month period of assessment when they were made aware of the derogation being granted.

Training, Monitoring & Assessment of the Points Operator involved in the accident

64 IÉ were unable to find any records to show when or if the Points Operator received any formal training for the duties associated with Points Operator.

65 However, the Points Operator received a briefing (including demonstation) on the hand operation of power operated points on the 15th September 2016, which was followed by an assessment directly afterwards, after which the Points Operator was passed competent.

66 As the workplace development events were scheduled to be undertaken annually, the Points Operator had not undergone any practical elements of the hand operation of power operated points at the time of the accident (had the workplace development events been scheduled for the original six monthly intervals, the Points Operator would have had one assessment).

67 The day of the accident, was the first day that the Points Operator had been required to carry out the duties of points operator, where a train was required to travel over them.

Voice communications between the CTC Signalman and the Points Operator

Voice Communications Training Document

68 Voice communications in relation to a failure on the rail system are classified as safety critical communications. All staff that may be required to communicate safety critical messages are trained in safety critical communications and must carry out the communication as required in the IÉ Rule Book Section A, 3.0, 'Communications'. Paragraph 3.3, 'What you must do to ensure your message is properly understood' includes:

- First, say who you are and where you are;
- If you are a Signalman, give the name of the signal box where you are located;
- Give your radio call number or telephone number as appropriate;
- Check you are speaking with the correct person at the right place;
- Give your message clearly, slowly and concisely;
- Ask the person receiving the message to repeat it to you;
- Do this at the end of the message, or as necessary during the message if it is complicated;
- Do not assume anything to have been understood until correctly repeated to you.

69 As outlined in paragraph 47 of this report, the IÉ Rule Book states when observing the controlling signalman's instructions, the controlling signalman will tell the points operator whether the points must be secured by clip, lock and scotch, or by scotch only; the IÉ Rule Book does not require the controlling signalman to give a full instruction to the points operator on how to take the power off the points and pump the points in the case of Clamp Lock Point.

Voice communications between the CTC Signalman and the Points Operator

70 The recordings of the voice communication between the Controlling Signalman and the Points Operator were assessed by IÉ Safety Critical Communications Review Group to determine an overall call grade; grading is from A – E, with A being the highest grade (26-28) and E being the lowest grade (0-10). One of the call grades for the communications between the Points Operator and the Controlling Signalman was a score of D (20-11); which is described as "some attempt to use the protocols but with significant variations which may lead to an increased risk of misunderstanding occurring and a high risk of error", and as the score was less than 21 the staff involved must get immediate feedback from the DTE.

71 The Controlling Signalman made a number of requests/statements to the Points Operator which were misinterpreted by the Points Operator, which resulted in the Points Operator incorrectly assuming he was to clip and scotch the points as they were in-situ; and, incorrectly assuming that no trains were going to travel over the points.

Evacuation of passengers

General description

72 IÉ have three publications in relation to emergency responses and train evacuations:

- Emergency Response Handbook, IM-SMS-012-OP1, published in August 2014;
- 'A guide for any staff who could be involved in a Train Evacuation Briefing Notes'; to be referred to as 'Train Evacuation Briefing Notes' for the remainder of this report. The document was produced by the IÉ Training Centre in conjunction with the Operations Safety Department;
- Major Customer Disruption Response Handbook, Version 1, published in 2014.

Emergency Response Handbook

73 The Emergency Response Handbook sets out the IM requirements and guidance for the handling of emergencies; the document is relevant for the cases when major emergencies have been declared; and therefore not relevant to this accident.

Train Evacuation Briefing Notes

74 The Train Evacuation Briefing Notes outline key topics, such as: fires on trains; types of evacuations; special considerations; emergency equipment; and, using others to assist. The document outlines three different types of evacuation:

- Controlled Train Evacuation – "Evacuating customers from a train so that they can complete their journey by another train or other transport. There is no immediate threat to life";
- Emergency Evacuation – "Evacuating customers from a train when immediate danger makes it absolutely necessary. The driver/train crew will invariably lead the process";
- Impromptu Evacuation – "Situations can arise where trains may be stopped for a period of time and passengers can decide to disembark themselves from the train. Should such a situation arise train protection should be immediately requested form the controlling signalman via driver/train crew".

Major Customer Disruption Handbook

75 A Major Customer Disruption (MCD) can be triggered and declared by the CTC Duty Manager, in *Zone 1* (anywhere between Portlaoise and Heuston, Connolly and Drogheda, Connolly and Bray, and Connolly and Maynooth), based on their likely timescales, by a number of severe events, including mainline derailment.

76 On making the decision the CTC Duty Manager will alert the relevant staff members; and activate an Information Incident Room (IIR), where required. The MCD Response Handbook identifies concise actions to be taken by numerous departments; however, it does not identify how the passengers should be detained on the train, evacuated in a controlled manner, or, what to do if passengers begin impromptu uncontrolled evacuations.

Actions taken by IÉ on the day of the accident

77 Train E222 was delayed for thirty minutes, derailing approximately four minutes after departing Salthill Station. There was close to 600 passengers on board the train; and, after the derailment they were advised of a further delay by Driver E222 over the public address system.

78 Train E222 was located approximately 109 m from Dun Laoghaire Platform 2.

79 Approximately twenty minutes after the derailment one passenger in the leading carriage (who did not adhere to the signage on the train to stay on the train) activated the emergency passenger door opening device and left the train. Driver E222 entered the saloon and closed the door. Approximately fifteen minutes later a passenger (again not adhering to the signage on the train) in the rear carriage opened the passenger door by means of the emergency opening device and exited the train, he was followed by a large number of passengers (approximately sixty to seventy) who made their way away from the train in many different directions on the up and down lines towards Dun Laoghaire Station and the sidings.

80 During this time, Driver E222 made two further announcements, using the public address system, at approximately twenty-five minute intervals stating that there had been a derailment and gave estimated times for a controlled evacuation of the train.

81 The 8100 EMU fleet are two car sets and when coupled in multiple unit formation there is no through gangway between each additional two car set; as a result Driver E222 could not travel through the entire train without disembarking the train, from the cab, and re-entering at the next cab, for every two car set.

82 An MCD was declared at 18:13 hrs by the CTC Duty Manager, and the relevant staff informed. However, none of the three IÉ publications in relation to emergency responses and train evacuations, addressed situations related to the prevention of uncontrolled impromptu evacuation of passengers. However, a controlled evacuation of the train was carried out at 18:49 hrs and completed by 19:15 hrs.

Events before, during and after the accident

Events before the accident

83 Train E222, the 16:45 hrs Howth to Bray passenger service departed Howth, on time.

84 At 17:22 hrs detection was lost on Points DL115 in reverse. The Controlling Signalman operated the points a number of times to test if detection could be regained but then detection was lost in both the reverse and normal directions on Points DL115. SET maintenance staff were advised and made arrangements to travel to site by road; but due to heavy traffic made instructions for an RU station staff member to act as Points Operator.

85 At approximately 17:30 hrs the RU station staff, who was to act as Points Operator, was contacted by the Traffic Regulator CTC requesting him to contact the Controlling Signalman.

86 At 17:32 hrs, Train E222 arrived at Salthill Station, one minute late. While Train E222 was detained on the platform at Salthill the platform side passenger doors were in the opened position and updates on the delay were relayed by Driver E222 and over the station public address system.

87 At 17:33 hrs the Controlling Signalman contacted the Points Operator, and the Points Operator stated he would go to Points DL115 and visually check the points. The Controlling Signalman instructed the Points Operator to make contact when he was at Points DL115.

88 The Points Operator went to Points DL115, bringing only the scotch and clip (and not bringing the key, lock or points handle as required by the Rule Book).

89 At 17:39 hrs the Points Operator contacted the Controlling Signalman from the Signal Post Telephone at Signal DL40 and gave the Controlling Signalman his mobile number.

90 At 17:40 hrs the Controlling Signalman phoned the Points Operator and requested that the Points Operator check Points DL115 for blockages at the points. The Points Operator reported no blockages were found, the Controlling Signalman asked the Points Operator to stand clear that he was going to test the points again. The Points Operator observed and informed the Controlling Signalman that there was a gap between the toe of the switch rail and the stock rail.

91 The Controlling Signalman then instructed the Points Operator to scotch and clip Points DL115 in the normal position, and reminded him to take the power off the points before pumping them across. He also informed the Points Operator that no trains would be operating over Points DL115 (the Controlling Signalman was referring to the train movements during the time the Points Operator was fitting the scotch and clip; however, the Points Operator thought that no trains would be travelling over the points, until inspected by SET maintenance staff).

92 The Points Operator while manually operating Points DL115:

- Did not turn off the power to the points to take local control;
- Did not pump the points until the points were fully closed;
- Applied the clip in the third bed back from the toe of the switch rail (paragraph 59), without applying the padlock;
- Inserted the scotch;
- Did not re-iterate to the Controlling Signalman that there was a gap between the stock and the switch rails.

93 At 17:57 hrs the Points Operator contacted the Controlling Signalman to confirm that Points DL115 were "scotched and clipped" in the normal position.

94 At 18:02 hrs the Controlling Signalman contacted Driver E222 and advised him that Points DL115 were scotched and clipped and advised Driver E222 he could depart Salthill and proceed as far as Signal DL31 which would be at danger and to contact him. Train E222 departed Salthill, after a delay of thirty minutes. Driver E222 stopped short of Signal DL31 and contacted the Controlling Signalman; and filled out the 'Authority to pass signal a danger' form and was given permission to pass Signal DL31 at danger and to proceed as far as Signal DL45 and obey.

Events during the accident

95 Driver E222 checked Points DL115 as he approached at caution and did not notice anything unusual.

96 As Train E222 travelled over Points DL115, the leading bogie of EMU 8308 derailed.

97 Driver E222 brought the train to a stop and at 18:04 hrs made an emergency call to the Controlling Signalman; advising him that the train had derailed, was upright and not fouling the opposite line.

Events after the accident

98 The Controlling Signalman gave signal protection to both the up and down lines.

99 Driver E222 did not fit the *Track Circuit Operating Device* (TCOD) to the adjacent line after the derailment, as Driver E222 could see there was a train stopped, with a red signal, on the Up Line.

100 Driver E222 advised the passengers, by the public address system, of a further delay.

101 At approximately 18:24 hrs one passenger in the leading carriage activated the emergency passenger door opening device and left the train, Driver E222 entered the saloon and closed the door. Approximately fifteen minutes later a passenger in the rear carriage opened a passenger door by means of the emergency opening device and exited the train, he was followed by a large number of passengers (approximately sixty to seventy) who made their way away from the train in

many different directions on the up and down lines towards Dun Laoghaire Station and the sidings.

102 At approximately 18:39 hrs, a District Traction Executive arrived on site and declared himself IÉ Incident Officer (IÉIO). As the IÉIO made his way to Train E222 he saw the passengers making an uncontrolled evacuation.

103 At 18:43 hrs the IÉIO was joined by the District Manager DART and they assessed how best to evacuate the remaining 500 passengers; the IÉIO was also informed that a pregnant woman and a woman having a panic attack were on the train and an ambulance was called.

104 At 18:49 hrs, following further confirmation that full protection was in place, IÉ staff arranged a controlled evacuation of the train was carried out and completed by 19:15 hrs.

105 The Points Operator was tested for drugs and alcohol in line with IÉ's post-accident policy. All tests were returned Negative.

Similar occurrences

Points Run Through, Cobh, on the 8th August 2017

106 A similar incident at a set of points which did not result in a derailment occurred on the 8th of August 2017 during degraded working at Cobh, County Cork, was reviewed by the RAIU.

107 On the 8th August 2017, the Controlling Signalman at Cobh (to be referred to as the CSC for the remainder of this report) could not get detection for Points 964 in the reverse position. The station controller contacted the station operative at Cobh and advised him of the fault and that he was required to act as a point's operator (to be referred to as the POC of the remainder of this report).

108 The CSC contacted POC and requested Points 964 (see Figure 11) to be scotched and clipped in the reverse position; POC carried out the instruction.

109 POC then proceeded to Points 964A where he observed the points were in the reverse position. POC did not take control of the Points 964B but placed a scotch in the points in the reverse position and advised CSC. CSC authorised the movement of Train P238 (09:00 hrs Cobh to Cork).

Figure 11 – Points 964 set to the normal position

110 The CSC requested the POC to remove the scotches and clips from Points 964 as the next movement required Points 964 to be set in the normal position. On completing the task the POC gave control of Points 964 back to CSC. CSC moved Points 964 to the normal position and as he had detections, advised POC that once the train standing on the down line at the signal outside the station had arrived on to the Platform (Train D240, 09:00 hrs Cobh to Cork), to reverse Points 964 again and phone him back.

111 When Train D240 had passed the POC contacted CSC and was requested to scotch and clip Points 964 in the reverse position. POC took control of Points 964 from CSC and wound back the Points at the B-end to the reverse position before scotching and clipping the points. POC then

went to the A-end of Points 964 where he applied the scotch not realising that the A-end of Points 964 were in the normal position.

112 POC contacted CSC and confirmed to him that Points 964 were scotched and clipped in the reverse position. CSC then authorised Train P239 (09:00 Cobh to Cork) to depart Cobh. The driver of Train P239 departed Cobh and observed Points 964B were correct but heard an unusual noise coming from underneath the train and brought the train to a stop. On examination the driver identified that Points 964A (trailing end) were not correctly set for the direction of travel.

113 As a result of the incident the following recommendation was issued by IÉ: The Head of Health and Safety IM should conduct a review of the assessment documentation used for Points Operators. The review should focus, but not be confined to, include a more robust practical / operationally realistic element to the assessment process.

Analysis

Actions of the Points Operator & Controlling Signalman

Actions of the Points Operator

114 The IÉ Rule Book, Section B Part Two and the General Appendix Section E – Signalling and Station Working, "Instructions for Hand Operation of Power Operated Points" details the instructions for Points Operators on how to operate power operated points (paragraphs 42 to 53).

115 The Points Operator did not follow the instructions outlined, in full, as he did not:

- Bring all the required equipment, such as the locks, necessary keys and points handles (IÉ Rule Book Section B, 10.2; General Appendix, Section E, 2.4) to Points 115 despite the equipment being available to him (paragraphs 44, 45, 88);
- Turn off power to Points 115 (IÉ Rule Book, Section B 10.3.1 & 10.3.3; General Appendix, Section E, 2.6) to take local control (paragraphs 46, 92);
- Manually pump the points with the pump handle until they had completed their travel and that the lock(s) is(are) home i.e. continue winding/pumping until no further handle movement is possible (IÉ Rule Book, Section B, 10.3.3 & General Appendix – Paragraph 2.7), (paragraphs 48, 51, 92);
- Ensure that the clip fully clamped the points, this was as a result of the Points Operator placing the clip too far away from the toe of the points (paragraph 92), although it should be noted that the IÉ Rule Book or General Appendix does not identify where the clip should be placed (paragraph 54);
- Apply the padlock to the clip (paragraphs 49, 51, 89); meaning that there was potential for interference by a third party if left unattended, or, loosening of the clip from vibration in the event of movement of trains over the points;
- Report to the Controlling Signalman that the points were not fully closed i.e. there was a gap between the toe of the switch rail and the stock rail (General Appendix – Paragraph 2.9) after he had applied the clips, locks and scotches (paragraph 50, 92).

Actions of the Controlling Signalman

116 The actions of the Controlling Signalman, in terms of safety critical communications, are discussed in paragraphs 122 - 125 of this report.

Training, Certification, Monitoring & Competency Assessment of Points Operators

IÉ Standards & Procedures

117 Included in IÉ's standard IMO-SMS-031, 'Competence Management-Persons Required to Conduct IM Operating Duties' is the process of managing the selection, training, certification, monitoring and competency assessment of points operators duties in the event of a failure of a system. The standard sets of the frequency of assessment over a twenty-four month cycle (paragraph 61).

118 The requirement for four workplace development events over a two-year period had been halved to two workplace development events, meaning that a points operator would be assessed annually. This procedure did not comply with the principles of IM-SMS-014 Safety approval of changes in Plant, Equipment Infrastructure and Operations (PEIO) with regards to mandating a risk assessment and involving all stakeholders (associated with points opertors competency assessment) with concerns (paragraphs 62 - 63).

119 In addition to the formal standards above, the training video outlining the duties of a Points Operator, illustrates clearly how to perform the duties. However, the terminology used in the video is not consistent with the wording of the Rule Book and General Appendix; in that the video refers to "scotching and clipping the points", rather that the correct terminology of "clip, lock and scotch the points" (paragraph 56).

Training, Monitoring & Assessment of the Points Operator involved in the accident

120 IÉ were unable to locate any records to show when or if the Points Operator received any formal training for the duties associated with Points Operator. However, it has been established by the RAIU that the Points Operator had only carried out the physical activity of points operator on one occasion prior to the accident, which was during his assessment. The lack of practical experience was as a result of the reduced frequency of workplace development events and as a result of there being no requirement to undertake the duties at regular intervals (paragraphs 64 - 67).

121 In terms of the efficacy of the training, monitoring and assessment processes for points operators, it is clear that, in the case of this accident, the training of the Points Operator to perform his duties was not adequate; as the Points Operators did not perform his duties in full by omitting to carry out six key duties (paragraph 115).

Voice communications between the CTC Signalman and the Points Operator

122 The IÉ Rule Book, Section A, 3.0, 'Communications' is robust in its requirements for safety critical communications, which outlines how messages should be properly understood (paragraphs 68 – 69). Sections 10.3.1 – 10.3.3 of the IÉ Rule Book is also clear in how the Points Operator should observe the Controlling Signalman's Instructions (paragraphs 46, 47, 51).

123 However, on the day of the accident, one of the safety critical communications between the Points Operator and the Controlling Signalman was graded D, meaning there is some attempt to use the protocols but with significant variations which may lead to an increased risk of misunderstanding occurring and a high risk of error (paragraph 70).

124 These poor communications resulted in the Points Operator, incorrectly assuming he was to clip and scotch the points as they were in-situ i.e. without the need to take the power off the points or use the pump to move switch rail tight against the stock rail (paragraph 71); and, incorrectly assuming that no trains were going to travel over the points (paragraph 71).

125 Had the communications requirements been adhered to, in particular, the repeating of messages for the Points Operator to gain a full understanding as to his requirements, the above misunderstandings may have been avoided; however, the accident is still likely to have occurred due to the insufficient training and competency of the Points Operator.

Evacuation of passengers

126 IÉ have a number of documents in relation to emergency, major customer disruption responses and evacuations (paragraphs 72 - 76).

127 This accident did not warrant the activation of a major emergency response. An MCD was declared (paragraph 75). However, the existing IÉ publications in relation to emergency responses and train evacuations, did not address the prevention of uncontrolled impromptu evacuations (paragraph 82).

128 As a result, a significant number of passengers, carried out an number of uncontrolled impromptu evacuations, without the guidance of IÉ staff; this is likely due to the fact that the:

- Location of the derailed train was close to Platform 2 at Dun Laoghaire Station (paragraph 78);
- Train E222 was already running thirty minutes late (paragraph 77);
- Absence of information from Driver E222 of an estimated controlled evacuation time (paragraphs 77 and 80).

129 The controlled evacuation commenced at 18:49 hrs (forty-five minutes after the derailment, with an overall delay of one hour and fifteen minutes) and was completed at 19:15 hrs (paragraphs 82 and 104).

Conclusions

Summary of conclusions

IÉ Rule Book & General Appendix

130 The IÉ Rule Book and General Appendix sets out the detailed instructions for Points Operators on how to operate power operated points (paragraphs 42 - 56); with the exception of these documents identifying where the clip should be placed (paragraph 54); and, reversing the correct terminology of "clip, lock and scotch" to "scotching and clipping" of the points (paragraph 119).

Actions of the Points Operator

131 In terms of competency of the Points Operator, the Points Operator had only physically performed the duties of points operator on one occasion, during his assessment (paragraph 120).

132 The Points Operator had not undertaken an annual workplace development event at the time of the accident, as these workplace development events had been reduced in frequency from every six months to annually (paragraph 120).

133 Partly, as a result of the deficiency in training, the Points Operator did not follow the instructions set out in the IÉ Rule Book and General Appendix, in full, in that he did not: bring all the appropriate equipment; turn off the power to the points; pump the points with the pump handle until they had completed their travel; clip the points correctly; apply a padlock to the clip; or, report to the Controlling Signalman that the points were not fully closed (paragraph 115); which lead to the derailment of Train E222.

Voice communications

134 The IÉ Rule Book is robust in its requirements for safety critical communications, which outlines how messages should be properly understood; and, is also clear in how the Points Operator should observe the Controlling Signalman's Instructions (paragraph 122). However, on the day of the accident, one of the safety critical communications between the Points Operator and the Controlling Signalman were poor which lead to further misunderstandings and errors (paragraph 123 - 125).

Evacuation of passengers

135 Existing IÉ publications did not address the prevention of uncontrolled impromptu evacuations (paragraph 127). This absence of controlled response, coupled with the frustration of the delayed passengers on board a train which was situated close to a platform, may have resulted in a significant number of passengers carrying out impromptu evacuations without the supervision of IÉ staff (paragraph 128).

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

Immediate cause, contributory factors, underlying causes & root causes

136 The immediate cause of Train E222 derailing was as a result of Train E222 travelling over failed Points DL115 which had been incorrectly secured by the Points Operator by leaving a gap between the stock and switch rails.

137 Contributory factors associated with the accident are:

- CF-01 – The Points Operator did not carry out the instructions set out in the IÉ Rule Book (Section B, Part 2, 10.0) and the General Appendix (Section E, 3), in full, for the hand operation of power operated points;
- CF-02 – The Points Operator and the Controlling Signalman did not adhere to the strict requirements for safety critical communications, in particular the repeating of messages, resulting in the Points Operator and Controlling Signalman not coming to a clear understanding of the situation.

138 The underlying causes associated with the accident were:

- UC-01 – Deficiencies in the training records, continuous assessment and performance records of the Points Operator resulted in the Points Operator not having sufficient knowledge, competency or practical experience in order to carry out his duties;
- UC-02 – The derogation to extend workplace development events for the assessment of points operators, from six months to twelve months, resulted in the Points Operator not being re-assessed after being passed competent at the time of the accident.

139 A root cause associated with this accident is:

- RC – 01 – Standard, IM-SMS-027, 'Derogation from Safety Management System' was drafted without following the principles of IM-SMS-014, 'Safety approval of changes in Plant, Equipment, Infrastructure and Operations (PEIO)' resulting in a derogation to standard IMO-SMS-031, 'Competence Management – Person required to conduct IM operating duties' being authorised without carrying out a risk assessment or involving all of the stakeholders to assess the effects of any changes.

Additional observations

140 The following additional observations have been made by the RAIU:

- AO-01 – The IÉ suite of documents in terms of management of passengers during a major customer disruption event, does not adequately address the issues associated with uncontrolled impromptu evacuations, or, how these can be avoided (paragraphs 72 - 82, 126 - 129, 135) which resulted in the uncontrolled impromptu evacuation of approximately sixty to seventy passengers on the day of the accident;
- AO-02 – The IÉ Rule Book and the General Appendix does not specify where the points clip should be fitted (paragraph 54), as opposed to the UK Rule Book, which does (paragraph 55);
- AO-03 – IÉ Rule Book and the General Appendix require the points operators to "clip, lock and scotch the points"; however, IÉ appear to have adopted "scotched and clipped" when used in voice communication; which may lead to confusion in terms of the chronology of performing the duties (paragraphs 56, 119, 130).
- AO-04 – The scotch used at points DL115 was not manufactured to Infrastructure Department drawing W487/29 (paragraph 60);
- AO-05 – A TCOD was not fitted to the adjacent line, by Driver E222, after the derailment (paragraph 99).

Relevant actions taken or in progress

Actions taken by IÉ

141 IÉ have advised the RAIU that the following actions have taken in relation to this accident:

- IM/SA4/2017 Safety Alert "Operational incidents during manual operation of power operated points" was issued by the IÉ IM Safety Department on the 19th September 2017;
- IÉ have reverted to four workplace development events over a twenty four month period (i.e. one every six months) for points operators, for the operation of points in an emergency, as specified in IMO-SMS-031, 'Competence Management Person required to conduct IM operating duties';
- Derogation to IMO-SMS-031, 'Competence Management – Persons Required to Conduct IM operating duties' expired and a request for renewal was not made;
- IM-SMS-027, 'Derogation from Safety Management System', Version 2, has been issued with the following amendments:
    - Section 4.3.5 – Each application for a derogation must be accompanied by a Risk Assessment, detailing the risks and associated mitigations arising from the derogation;
    - Section 4.3.8 – Confirm all relevant stakeholders have been identified and consulted.
- The Points Operator is no longer on the panel for manual operation of power operated points;
- A recruitment process for Mobile Emergency Response Team staff has commenced.

Safety recommendations

General description

142 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.

Actions taken by IÉ that do not warrant a safety recommendation

143 In relation to the derogation to extend the six monthly workplace development events for points operators under IM-SMS-27, 'Derogation from Safety Management System' not complying with the principles of IM-SMS-014,' Safety approval of changes in Plant, Equipment Infrastructure and Operations (PEIO)' with regards to requirements of conducting a risk assessment and involving all stakeholders (UC-02). This has been addressed by IÉ and does not warrant a further safety recommendation.

Safety recommendations associated with the accident

144 As the Points Operator did not appear to have a clear understanding of how to perform his duties in terms of the hand operation of power operated points as a result of deficiencies in training, continuous assessment (CF-01, UC-01), performance records. As a result the RAIU make the following safety recommendation:

IÉ IM should conduct a full review of IMO-SMS-031, 'Competence Management – Persons required to conduct IM operating duties' and associated documentation, to identify deficiencies in training, continuous assessment and the recording of performance of duties to ensure that persons carrying out these duties are competent to do so.

145 The Points Operator and the Controlling Signalman did not adhere to the strict requirements for safety critical communications, resulting in misinterpretation of directions by the Points Operator which lead to further errors.

IÉ IM and IÉ RU should evaluate the current training, assessment and monitoring of Safety Critical Communications to ensure that communications are carried out to the requirements set out in IÉ Rule Book, and safety critical communications standards IMO-SMS-033 and OPS-SMS-8.1.

Safety recommendations associated with additional observations

146 The IÉ suite of documents related the management of passengers during a major customer disruption, does not adequately address the issues associated with uncontrolled impromptu evacuations, or, how these can be avoided (AO-01); as a result the RAIU make the following safety recommendation:

IÉ RU should review their suite of documents which reference major customer disruptions and emergencies, and address any deficiencies in relation to the management of passengers on trains and uncontrolled impromptu evacuations. These documents should then be briefed to staff who have roles in relation to customer disruptions and emergencies to ensure they are aware of their responsibilities.

147 The IÉ Rule Book and the General Appendix does not specify where the points clip should be fitted (AO-02); as a result the RAIU make the following safety recommendation:

IÉ IM should update the relevant sections of the General Appendix and other associated documentation to specify where the points clip should be fitted.

148 IÉ Rule Book and the General Appendices require the points operator to “clip, lock and scotch the points”; however, IÉ appear to have adopted “scotched and clipped” when used in voice communication; which may lead to confusion in terms of the chronology of performing the duties (AO-03); as a result the RAIU make the following safety recommendation:

IÉ should agree and implement a consistent wording in the Rule Book, General Appendix, training material and oral instructions in relation to the points operator’s instructions; and ensure that the importance of the task order is highlighted in the training for points operators.

149 The scotch used at points DL115 was not manufactured to Infrastructure department drawing W487/29 (AO-04); as a result the RAIU make the following safety recommendation:

IÉ IM should review the drawing and specification requirements for points scotches and ensure only scotches manufactured to the required drawing and specification are made available to points operators.

150 A TCOD was not fitted to the adjacent line, by Driver E222, after the derailment (AO-05); as a result the RAIU make the following safety recommendation:

IÉ RU should brief the relevant staff on the requirements of the IÉ Rule Book (Section M 3.1.2) which states that where emergency detonator protection is not needed, drivers must place a TCOD on the line(s) concerned to supplement the signal protection.

Additional Information

List of abbreviations

AO	Additional Observation
ATP	Automatic Train Protection
CAWS	Continuous Automatic Warning System
CCE	Chief Civil Engineer
CCTV	Closed Circuit Television
CF	Contributory Factor
CME	Chief Mechanical Engineer
CRR	Commission for Railway Regulation
CTC	Centralised Traffic Control
CTE	Chief Traffic Executive
DTE	District Traffic Executive
DTTAS	Department of Transport, Tourism and Sport
EMU	Electric Multiple Unit
hrs	Hours
IÉ	Iarnród Éireann
IIR	Information Incident Room
IM	Infrastructure Manager
IMO	Infrastructure Manager Operations
km/h	Kilometres per hour
m	Metre
MCD	Major Customer Disruption
MP	Mile Post
mph	Miles per hour
No.	Number
OHLE	Overhead Line Equipment
OTDR	On Train Data Recorder
RAIU	Railway Accident Investigation Unit
RC	Root Cause
RU	Railway Undertaking
SET	Signalling, Electrical and Telecommunications
SMS	Safety Management System
SI Units	International System of Units
TCOD	Track Circuit Operating Device
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.
Automatic train protection	A communication and control system which utilises lineside equipment (Balises) to transmit permissible speed and signal aspect information to the train.
Axle counter	A track mounted device that accurately counts passing axles. By using the axle counter evaluator to compare the number of axles entering and leaving a block section, the signalling system can determine whether the section is clear or occupied.
Bed	The space between adjacent sleepers normally filled with ballast.
Bi-directional	A track on which trains may be worked in either direction under normal signalling arrangements.
Clamp Lock	A hydraulic ram arrangement that operates and positively clamps the closed Switch rail to the Stock rail. The Ram is actuated by a small electrically operated hydraulic pump.
Clip	A device resembling a G-clamp fitted to a rail to retain a switch rail in place.
Coloured light signals	Signals which convey movement authorities to drivers by means of coloured lights
Continuous automatic warning system (CAWS)	CAWS a form of cab signalling and train protection system. The coded track circuits transmit information about the signal aspect to the on-board equipment via two pick-up coils mounted on the front of the train, one over each rail.
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.
Competent person	A person who is passes as being qualified and has the required knowledge and skills to carry out a particular rule, regulation, instruction or procedure.
Detection	The proof that points are correctly locked in the NORMAL or REVERSE position. Detection must be achieved before the protecting signal will clear.
Double line track	A route with two tracks.
Down Line	Trains travelling from Connolly to Bray.
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.
Normal	The direction that trains run under normal circumstances.
Overhead Line Equipment (OHLE)	The equipment suspended over the railway line for supplying electricity to electric trains and includes the overhead wires, insulators and any associated equipment.

Permanent way	The track complete with ancillary installations such as rails, sleepers, ballast, formation and track drains, as well as lineside fencing and lineside signals.
Permissible speed	The maximum permitted speed as shown in the working Timetable.
Points	A mechanical installation enabling trains to be guided from one track to another, such as at a junction or where a spur or siding branches off.
Points Detection	An arrangement of electrical switches that detect the position of a set of points. This information is used within the interlocking to determine whether a route may be safely set over the points.
Protection	Ways of making sure that a line is protected. This includes keeping signals at danger, placing detonators on the line using a track circuit operating device and showing a hand danger signal.
Railway Undertaking	Organisation responsible for the supervision and operates trains.
Reverse	The direction trains do not normally run.
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.
Scotch	A wedge shaped piece of timber that is placed between the Switch rail and Stock rail to ensure on open Switch remains open.
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.
Siding	Track which are not part of any running line, used for loading and unloading of goods and also to store rolling stock.
Signal protection	The signal preventing train movement towards a particular point.
Standard	A document that mandates technical, operational or managerial requirements.
Stock rail	The fixed rail in a point's assembly.
Switch rail	The thinner moveable machined rail section that registers with the Stock rail and forms part of the point's assembly.
Toe	The moveable end of a Switch rail.
Track Circuit	An electric device installed in running rails which detects the presence of a train.
Track Circuit Block	A signalling system that uses track circuits to confirm the absence of trains in order to control the movement of trains.
Track Circuit Operating Device	An adjustable bar that can be locked in position between the rails to short out the track circuit in an emergency.
Underlying cause	Causes related to skills, procedures and maintenance.
Up Line	The line on which trains travel from Bray to Connolly Station.
Weekly Circular	A document published on a weekly basis, providing information about engineering works, possessions requested, changes to services and speed restrictions.
Wheel Profile	The shape of a section of a rail wheel taken through the axis of rotation.
Worked points	Points which are operated from a signal box or ground frame.
Zone 1	Anywhere between Portlaoise and Heuston, Connolly and Drogheda, Connolly and Bray, and Connolly and Maynooth.

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