RAIU

Railway Accident Investigation Unit

Investigation Report 2011-R001

Laois Traincare Depot Derailment

20th January 2010

Document History

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Function of the Railway Accident Investigation Unit

The Railway Accident Investigation Unit (RAIU) is a functionally independent investigation unit within the Railway Safety Commission (RSC). The purpose of an investigation by the RAIU is to improve railway safety by establishing, in so far as possible, the cause or causes of an accident or incident with a view to making recommendations for the avoidance of accidents in the future, or otherwise for the improvement of railway safety. It is not the purpose of an investigation to attribute blame or liability.

The RAIU's investigations are carried out in accordance with the Railway Safety Act 2005 and European railway safety directive 2004/49/EC.

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Executive Summary

At 15.25 hours on the 20th January 2010 a Class 22000 six carriage train was scheduled to leave Laois Traincare Depot after routine servicing. The intended destination of the train was Heuston Station. The Train Driver performed his pre-departure checks and the Shunter authorised the train to proceed out of Laois Traincare Depot as far as signal PL278, which controls the exit from the depot onto the down loop adjacent to the main line. The Shunter set the number 2A points for the train to leave the depot.

The Train Driver stopped at signal PL278 as he was unable to read it due to sunlight shining on the signal and requested that the Shunter walk forward to check the signal aspect. The Shunter had been waiting at the number 2A points for the train to exit the depot in order to reset the points for the headshunt, protecting the down loop. He walked forward until he had a clear view of signal PL278 and advised the driver he had a proceed aspect. The Train Driver moved the train forward checking the aspect displayed when the signal was shaded by the train. The Shunter then walked back towards the depot and as he passed the points handle for the number 2A points, he operated the points. The train was still travelling over the points and derailed.

The immediate cause of the accident was the movement of the number 2A points as the train was passing over them causing the carriages to take diverging routes and carriages three and four to derail.

Contributory factors in this accident were:

- The Shunter was taken away from normal task to check the aspect of Signal PL278 for the Train Driver due to the effects of sunlight on visibility of the signal;
- It was standard practice in Laois Traincare Depot to leave the points handle for the number 2A points engaged when not in use;
- The points mechanism at the number 2A points required little effort to operate;
- The remedial action taken to improve the visibility of signal PL278 was ineffective resulting in the occasional practice of shunters assisting train drivers with reading of the signal.

Underlying factors in this accident were:

- The operating procedure for Laois Traincare Depot did not control the risk of accidental operation of the number 2A points;
- A Signal Sighting Committee was not convened to investigate concerns raised by train drivers with signal visibility.

As a result of this investigation the Railway Accident Investigation Unit has made the following two recommendations:

- Iarnród Éireann should ensure that the risks relating to use of spring assisted manual points are identified and that appropriate control measures are implemented based on the risks identified;
- Iarnród Éireann should ensure that the Signal Sighting Committee is informed when train drivers report difficulties viewing a signal and the Signal Sighting Committee should verify that the reported difficulties are addressed effectively.

Contents

1 Factual information

1.1 Parties involved

Iarnród Éireann[1] (IÉ)[2] is the *Railway Undertaking* that operates mainline railway services in Ireland. IÉ is also the railway *Infrastructure Manager*, managing the design, installation, testing, inspection, maintenance and renewal of the railway's physical assets.

The departments associated with this accident are:

- Operations Department – responsible for the operation of trains, except in depots, and the supervision of train drivers;
- Signalling, Electrical and Telecommunications (SET) Department – responsible for the design, installation and maintenance of signalling equipment;
- Chief Mechanical Engineer's (CME) Department – responsible for the maintenance of rolling stock, including activities within the depots.

A *Signal Sighting Committee* is made up of representatives from the various departments with competence in the engineering and train driver requirements for signal sighting.

Laois Traincare Depot (the Depot) is the primary maintenance and storage facility for the Class 22000 rolling stock.

The Depot Manager has overall responsibility for safety management in the Depot.

The Duty Manager is responsible for the day-to-day management of the Depot.

A Shunter and a Train Driver were directly involved in the accident. The Shunter is responsible for the safe movement of trains both within and in and out of the depot. The Train Driver was operating the train under the control of the Shunter.

[1] Terms which appear in italics, the first time they appear in the report, are explained in the 'Glossary of Terms' section of this report.

[2] Abbreviations are defined in the 'List of Abbreviations' section of this report.

1.2 The accident

On Wednesday the 20th January 2010 a six carriage train (Unit 22037) was departing the Depot at 15.25 hours (hrs) after routine servicing, destined for Dublin Heuston Station.

The Depot is located adjacent to the *down loop* which leads onto the *down line* of the Heuston to Cork line, one mile south of Portlaoise, see Figure 1. All trains entering or leaving the Depot use the down loop, there is one exit from the Depot, which is controlled by *position light shunt signal* PL278. The Depot layout is shown in Figure 2. Movements within the Depot are controlled by CME staff.

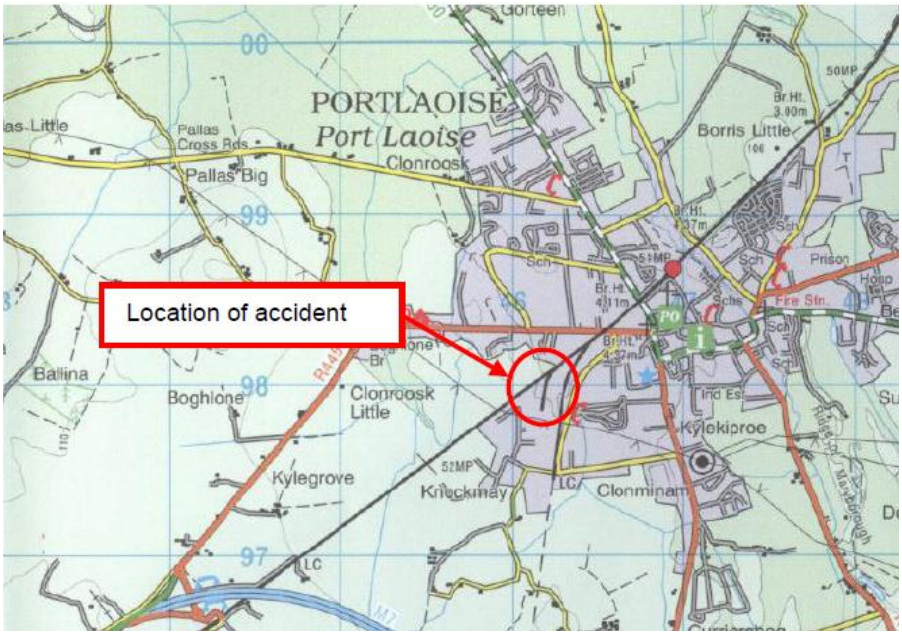

Figure 1 – Location map
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The Train Driver performed his pre-departure checks and carried out a brake test with the assistance of the Shunter. The Shunter then gave permission for the train to proceed from the service area towards exit signal PL278.

On approaching the number (no.) 2A points the Shunter moved the *points handle* setting the no. 2A points for travel in the direction of the down loop. The train then moved forward to signal PL278, see Photograph 1. The Train Driver was unable to read the *signal aspect* due to sunlight shining on it.

The Train Driver asked the Shunter to check the signal. The Shunter walked forward from no. 2A points, checked the signal aspect and advised the Train Driver that it was clear for him to proceed onto the down loop. This was not normal procedure but did occasionally take place at this signal. The Train Driver moved the train forward checking the aspect displayed when the signal was shaded by the train.

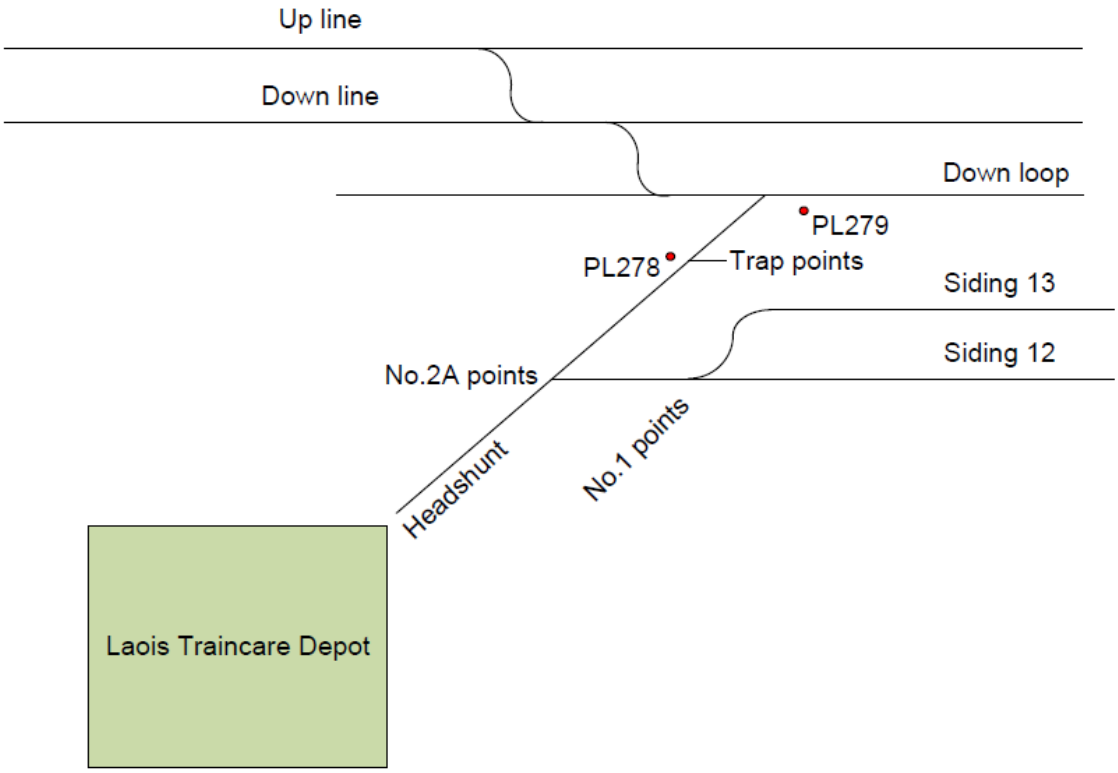
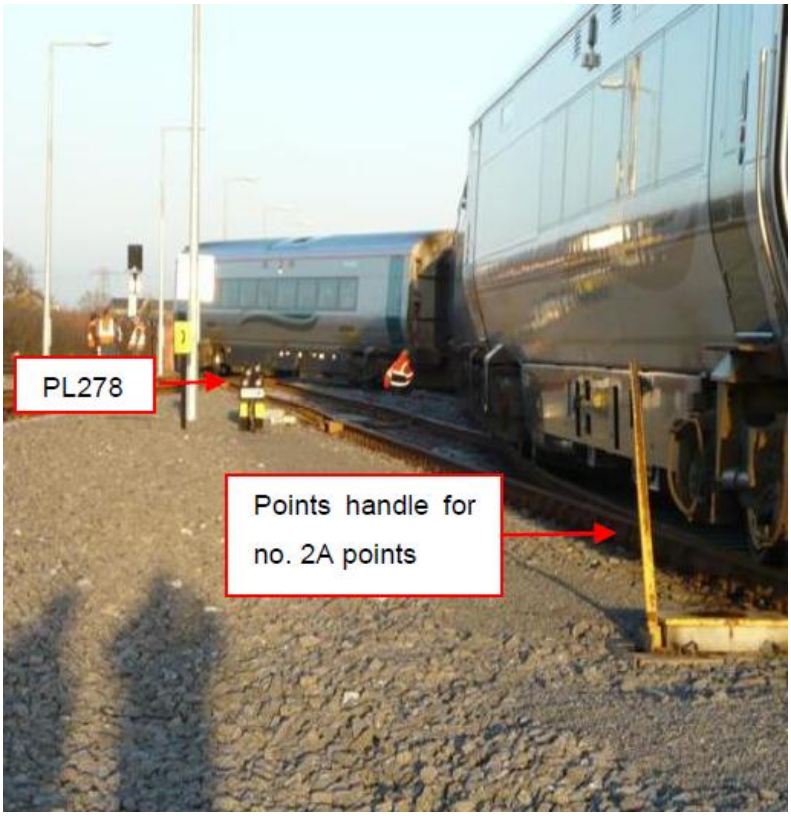


Figure 2 - Depot layout

The Shunter then walked back alongside the train to the no. 2A points, a distance of approximately 30 metres (m), in order to return them to their normal position, for movements on the *headshunt*. He operated the points handle changing the direction of the points as the train was still moving over them. The Shunter realised his mistake immediately but was unable to rectify the situation. This led to the train taking divergent paths resulting in the derailment of the third and fourth carriages. See Photograph 1.



Photograph 1- Signal PL278 with 2A points in the foreground

The weather at the time of the accident was dry and sunny.

1.3 Laois Traincare Depot

The Depot was constructed to cater for the servicing and maintenance requirements of the Class 22000 *Diesel Multiple Unit* (DMU) trains. It was brought into use in July 2008.

1.4 Signalling and communications

1.4.1 General description

Central Traffic Control (CTC) at Connolly Station controls train movements on the Heuston to Cork line.

Train drivers communicate with CTC via on board *train radios*. Shunters communicate with CTC via *line side telephones*, which can also be used by train drivers if necessary. Communication between shunters and train drivers is by hand signals and verbally.

1.4.2 Depot signalling

The signalling within the Depot consists of *colour light signals* and *position light shunt signals*. It was designed in accordance with IÉ standard I-SIG-2043 'Lineside Signal Sighting and Spacing' (IÉ SET, May 2006).

Signals PL278 and PL279 authorise movement between the Depot and the down loop, these are controlled by CTC. Signal PL279 controls entry to the Depot and signal PL278 controls exit from the Depot onto the down loop, see Figure 2. When leaving the Depot trains remain stationary at signal PL278 until a proceed aspect is given to join the down loop.

1.4.3 Signal PL278

At the time of the accident signal PL278 was illuminated by filament lamps, see Photograph 2. Train drivers had voiced concerns over visibility of this signal through the Operations Department prior to the accident. Initially these concerns were raised verbally, however, on the 9th Sept 2009 a written request was made to the SET Department to upgrade the signal from a filament lamp to a brighter LED signal. The Depot Manager was unaware of the train drivers concerns with the signal.

Section 2.1.5 of standard I-SIG-2043 states in relation to reported sighting problems:

'Signal sighting committees are also convened to consider problems (or alleged problems) arising from the position or sighting of an existing lineside signal, indicator or notice board.'

Signal Sighting Committees are convened, as required, to determine the most suitable and safest positions for all new and altered signals. Their remit also includes convening to consider problems or alleged problems with an existing signal. The SET Department did not inform the Signal Sighting Committee of the reported issue with signal PL278. The SET Department adjusted the orientation of the signal head. There was no evidence to show that the SET Department checked the effectiveness of this change.

Photograph 2 - Signal PL278 illuminated by filament lamps

1.5 The points

There are two types of point mechanism within the Depot, mechanical hand points and spring assisted hand points.

All of the point mechanisms in the Depot apart from the no. 2A points are mechanical hand points. These are single action mechanisms that are operated by moving the points handle and require a substantial force on the points handle to operate.

The points mechanism installed at no. 2A points are spring assisted and require minimal force to operate them. They require two actions to operate the points, these are:

- Engaging the points handle by lifting the points handle from its stored position, laid horizontally on the ground, and connecting it to the points gearing, see Photograph 3;
- Moving the points by moving the points handle.

When not in use the points handle is to be stored in the disengaged position, see Photograph 3. There are only two sets of this type of points mechanism on the IÉ network.

The no. 2A points facilitate trains moving out to signal PL278. The points are not interlocked to the signalling system and are operated manually.

Photograph 3 – No. 2A points with points handle disengaged

1.6 Movement of Trains

Operations within the Depot are governed by CME instruction IE/SSOW/PL/001'Laois Traincare Depot Safe System of Work and Operating Instruction' (IÉ CME, July 2009). All train movements within the Depot are controlled by shunters who report directly to the Duty Manager.

The movement of trains exiting the Depot is carried out in accordance with section 4.3, points 1-7:

1. The duty manager will inform the shunter that all work on the train is complete and it can be handed over to operations to enter service.

2. On arrival at the depot the train driver will contact the shunter to establish location of the train.

3. Once the driver has completed train preparation duties, the driver will advise the shunter that he is ready to depart.

4. The shunter will contact the duty manager and CTC to advise them that a train is ready to depart and to establish that there is no incoming service.

5. Once CTC have confirmed that no trains are arriving, and the shunter is satisfied that it is safe to do so, the shunter will instruct the driver to proceed towards signal PL278.

6. On arrival at PL278 the driver will contact the signalman that the train is ready to depart.

7. Once the train has left the depot the shunter will reset the no. 2A points to the *headshunt.*

The no. 2A points are normally positioned for movements on the headshunt to prevent unauthorised access to the down loop.

The requirement to disengage the points handle is not covered in the instruction and was not strictly enforced in the Depot.

When the no. 2A points are not in use shunters are instructed to disengage the points handle to prevent accidental activation of the points. This instruction is not documented as part of the operating procedure and implementation of this verbal instruction was found not to be strictly enforced.

Section 1.8 of the CME instruction identifies the requirement to maintain all risk assessments relating to operation of the depot. No risk assessments were found to have been produced in relation to the operation of the no. 2A points.

Shunters are trained in the use of the operating procedure and the importance of resetting the no. 2A points to the headshunt is highlighted as part of this training. The Shunter involved in the accident was trained and deemed competent by IÉ on the 10/02/2009.

The Train Driver was experienced in carrying out train movements within the depot and his competency was last assessed on the 19/12/2009.

1.7 Traction and rolling stock

The Train involved was a six carriage Class 22000 DMU, identified as Unit 22037, consisting of carriages 22137, 22437, 22537, 22637, 22737 and 22337. Carriage 22137 was the leading carriage at the time of the accident. The six carriage unit is 139m long, 2.84m high and 3.9m wide and has a mass of 299 tonnes.

The train is fitted with an event recorder which logs train speed and other information. The information that was downloaded was found to be corrupted, therefore the speed of the train at the time of the accident could not be established.

1.8 Fatalities, injuries and material damage

1.8.1 Fatalities and injuries

There were no fatalities or injuries.

1.8.2 Infrastructure damage

The track sustained the damage identified in Table 1.

Table 1 – Infrastructure damage

No. 1 points	*Screws* and *clips* leading towards the no. 1 points were damaged. The *heel* at sidings 12 and 13 buckled. The points clip leading to siding 13 was bent.
No. 863B trap points	The trap points buckled. A *side plate* near the toe sheared. *Stretcher bars* were bent.
Siding 13	All four fish bolts sheared on a *fish plate.* A number of clips and screws were damaged.

1.8.3 Rolling stock damage

Damage was caused to three of the six carriages as identified in Table 2.

Table 2 – Rolling stock damage

Carriage 22437	*Coupler* equipment was damaged at the connection with carriage 22537. The *gangway* bellows were damaged between carriages 22437 and 22537.
Carriage 22537	The gangway was heavily damaged and internal panelling in the area of the gangway suffered minor damage at the end connected to carriage 22637. There was damage to the electrical and mechanical coupler and ancillary equipment at the end connected to carriage 22637. The underframe and fixings suffered some damage. The suspension system suffered damage to various components. The retention brackets for the propulsion system were damaged. The effluent tank suffered damage.
Carriage 22637	The gangway connected to carriage 22537 was heavily damaged. There was coupler damage. The exhaust system and propulsion drive system suffered some damage.

1.9 History of similar occurrences

There is no history of similar occurrences in the Depot or elsewhere on the railway involving this type of points mechanism.

2 Analysis

2.1 Operation of the no. 2A points

The Shunter was awaiting the departure of the train from the Depot at the no. 2A points in order to reset the points for the headshunt once the train had left, protecting against unauthorised movements onto the down loop. He was focused on this task when the Train Driver called him forward to check the signal aspect. This interruption appears to have caused a momentary lapse in attention, resulting in the Shunter omitting to await the departure of the train before resetting the points thus allowing the carriages to take divergent routes.

No risk assessment was found to exist in relation to the no. 2A points. In addition, the CME instruction 'Laois Traincare Depot Safe System of Work and Operating Instruction' (IÉ CME, July 2009) did not identify the requirement to disengage the points handle when not in use, which mitigates the risk of accidental operation of the points. The requirement to disengage the points handle was found to be covered as part of the training of shunters but there was no enforcement of this verbal instruction. This led to the points handle being left in the engaged position on the day of the accident. Once this occurred the minimal effort required to move the points handle allowed the Shunter to operate the points inadvertently whilst walking past.

2.2 Signal PL278

Visibility of signal PL278 was found to be creating difficulties for train drivers in sunlight leading to the need for a shunter to assist on occasion with the reading of the signal. When a train driver was unable to read the signal the shunter would be called forward to communicate the aspect to the train driver. A shunter checking the signal aspect is not normal procedure within the Depot however it had become an occasional practice at this signal.

Concerns had been raised in relation to visibility of the filament lamps in signal PL278. This did not prompt the SET Department to inform the Signal Sighting Committee in accordance with section 2.1.5 of I-SIG-2043, instead the positioning of the signal head was adjusted by the SET Department. The effectiveness of the change was not verified and as a result of this the need for shunters to assist train drivers with the reading of the signal continued.

3 Conclusions

The Shunter was called forward to read the aspect of signal PL278 whilst he was waiting to reset the no. 2A points to the headshunt. This led to a momentary lapse in attention resulting in the Shunter omitting to let the train pass clear of the points before resetting them.

The immediate cause of the accident was the movement of the no. 2A points as the train was passing over them causing the carriages to take diverging routes and carriages three and four to derail.

Contributory factors in this accident were:

- The Shunter was taken away from normal task to check the aspect of Signal PL278 for the Train Driver due to the effects of sunlight on visibility of the signal;
- It was standard practice in the Depot to leave the points handle for the no. 2A points engaged when not in use;
- The points mechanism at the no. 2A points required little effort to operate;
- The remedial action taken to improve the visibility of signal PL278 was ineffective resulting in the occasional practice of shunters assisting train drivers with reading of the signal.

Underlying factors in this accident were:

- The operating procedure for the Depot did not control the risk of accidental operation of the no. 2A points;
- A Signal Sighting Committee was not convened to investigate concerns raised by train drivers with signal visibility.

4 Relevant actions already taken or in progress

As of the 9th of December 2010 IÉ have confirmed that the following remedial actions have been taken:

- Signal PL278 has been upgraded to an Light Emitting Diode (LED) display;
- Shunters have been briefed regarding this accident and of the need to remain focused on their task.

5 Recommendations

As a result of this investigation RAIU have made two safety recommendations[3].

The necessity to disengage the points handle for the no. 2A points when not in use was not addressed in the operating instructions for the Depot and the verbal instruction to disengage the points handle was not enforced. As a result, the risk of accidental operation of the points due to their ease of use was not adequately controlled. Hence, it is recommended that:

- IÉ should ensure that the risks relating to use of spring assisted manual points are identified and that appropriate control measures are implemented based on the risks identified.

The filament lamps in signal PL278 were difficult to read in sunlight. A Signal Sighting Committee was not convened to consider the problem and the measures taken by the SET Department to resolve this issue were found to be ineffective. The change was not verified for effectiveness, allowing the problem to remain. This has led to the recommendation:

- IÉ should ensure that the Signal Sighting Committee is informed when train drivers report difficulties viewing a signal and the Signal Sighting Committee should verify that the reported difficulties are addressed effectively.

[3] Recommendations shall be addressed to the safety authority and, where needed by reason of the character of the recommendation, to other bodies or authorities in the Member State or to other Member States. Member States and their safety authorities shall take the necessary measures to ensure that the safety recommendations issued by the investigating bodies are duly taken into consideration, and, where appropriate, acted upon. (Railway Safety Directive, 2004/49/EC)

6 Additional information

6.1 Abbreviations

CME	Chief Mechanical Engineer.
CTC	Central Traffic Control.
DMU	Diesel Multiple Unit.
hrs	Hours.
LED	Light Emitting Diode.
m	Metre.
No.	Number.
RAIU	Railway Accident Investigation Unit
SET	Signalling, Electrical and Telecommunications.
The Depot	Laois Traincare Depot

6.2 Glossary of terms

Colour light signal	Signals controlling the movement of trains by coloured lights.
Coupler	A device used to connect railway vehicles.
Diesel Multiple Unit	A train powered by diesel with the engines distributed along its length under the carriages.
Down Line	The line on which the normal direction of travel is usually away from Dublin.
Down Loop	A loop off the main line to minimise the impact of train movement on the operation of the main line, positioned beside the down line.
Fishplates	Cast forged steel plates used to join track.
Gangway	A covered walkway connecting two carriages.
Heel Block	A metal block fitted between a switch rail and a stock rail.
Headshunt	A piece of track allowing shunting movements in sidings without fouling the main line.
Lineside Telephone	A telephone positioned adjacent to the track that allows communication with the controlling signalman.
Points Handle	Manual actuating device used to operate a set of points.
Position light shunt signal	A signal controlling the movement of trains through the position of lights that are located near the ground.
Shunter	A person whose duties include directing and controlling train movements.
Signal Aspect	Indication displayed by a signal.
Signal Sighting Committee	A committee normally made up of representatives from the signalling installers, signalling maintainers, train drivers and local operations management tasked with the assessment of signal sighting.

Trap Points	An assembly intended to derail vehicles in the event of an unauthorised movement.
Up Line	The line on which the normal direction of travel is usually towards Dublin.

6.3 References

IÉ CME (July 2009), Portlaoise Traincare Depot Safe System of Work & Operating Instruction, IE/SSOW/PL/001 version 1.

IÉ SET (May 2006), Infrastructure Signalling Standard, I-SIG-2043, Lineside Signalling Sighting and Spacing.