



Investigation Report 2010 – R005



Irregular operation of Automatic Half Barriers at Ferns Lock,
County Kildare, on the Dublin to Sligo Line,
2nd September 2009

Document History

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Function of the Railway Accident Investigation Unit

The Railway Accident Investigation Unit (RAIU) is an 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

On Wednesday the 2nd September 2009 scheduled upgrading work was being undertaken at the Ferns Lock Automatic Half Barrier. During these works an Iarnród Éireann power cable was inadvertently severed disabling the external power supply to the level crossing, this caused the crossing to fail and the barriers to automatically lower to the failsafe position.

An Emergency Operator from Maynooth took control of the crossing while repairs were being undertaken to the cables. The Emergency Operators function is to ensure that a train can only use the level crossing when the barriers are down, preventing road traffic from accessing the rail line, this is done in conjunction with the controlling signalman and train driver.

However, the signalman signalled the train through the crossing without advising the Emergency Operator of the approach of a passenger service, which resulted in the passenger service travelling through Ferns Lock Automatic Half Barrier while the barriers were in the raised position – open to road traffic.

It was found during the course of the investigation that the controlling signalman, at the time of the incident, normally operates the Suburban Network which has no Automatic Half Barrier type crossings and only occasionally performs relief duties on the Sligo & Northern Line. This meant that the signalman was not familiar with his requirements in relation to the emergency operation of the Automatic Half Barrier and therefore he did not react to the indications displaying on the Sligo & Northern Line console which showed a fault at the Automatic Half Barrier and the fact that an Emergency Operator had put the Automatic Half Barrier into local operation and raised the barriers of the Automatic Half Barrier to road traffic.

Immediate cause of the incident:

The controlling signalman did not follow the requirements for the ‘General Instructions to Signalmen’ during degraded operations at an Automatic Half Barrier.

Contributory factors:

The controlling signalman was unfamiliar with the ‘General Instruction to Signalmen’ when an Emergency Operator is on duty at an Automatic Half Barrier as he had never experienced an AHB in a degraded mode either in training, operationally or through the current competency management system.

Underlying cause:

The competency management system did not ensure that relief signalmen were adequately trained to deal with degraded operations at an Automatic Half Barrier crossing.

Recommendations:

The RAIU have made the following safety recommendation:

- Iarnród Éireann should review the competencies of all signalmen to ensure that when signalmen are assigned relief duties they have the required training and experience to perform these duties appropriately.

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1 Factual information

1.1 Parties involved

The parties involved in the incident, from Iarnród Éireann (IÉ) are as follows:

| | |
|--------------------------------|---|
| <i>Emergency Operator (EO)</i> | The Maynooth <i>Station Manager</i> who elected to perform the duties of an EO when the defect was reported. |
| <i>Lookout</i> | On site lookout, watching for and giving appropriate warning of approaching trains to the worksite gang. |
| Signalman A | Sligo & Northern Line <i>controlling signalman</i> who took the initial request from the EO, based at Connolly. Signalman A performed duty on the Sligo & Northern Line on a full time basis. |
| Signalman B | Sligo & Northern Line controlling signalman who took over the duties of Signalman A, and was acting as the controlling signalman at the time of the incident. Signalman B normally performs duty on the Suburban Line and on this occasion was providing relief on the Sligo & Northern Line. |
| Maynooth Signalman | Operates the <i>fringe signal box</i> at Maynooth. |
| Driver A | Scheduled driver for the A907 service from Sligo to Maynooth. |
| Driver B | Accompanied Driver A on the A907 service to gain route knowledge. |

1.2 The incident

1.2.1 General information

On Wednesday 2nd September, 2009, the 11:00 hours (hrs) passenger service from Sligo to Connolly (train identification number A907) passed through Ferns Lock Automatic Half Barriers (AHB), at 13:33 hrs while the barriers were in the raised position, see Figure 1.

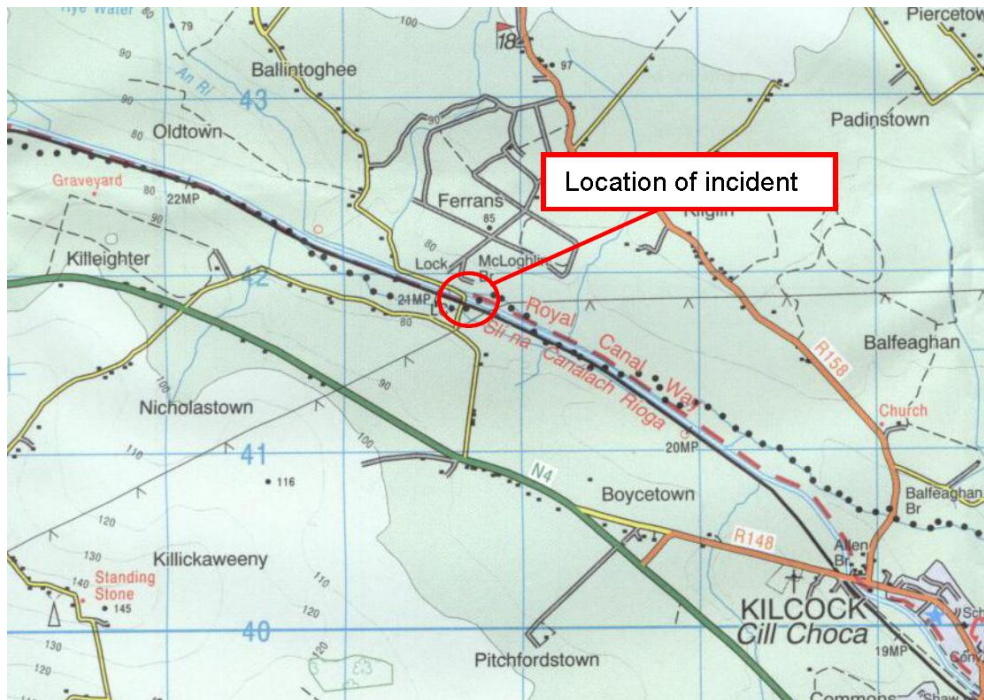
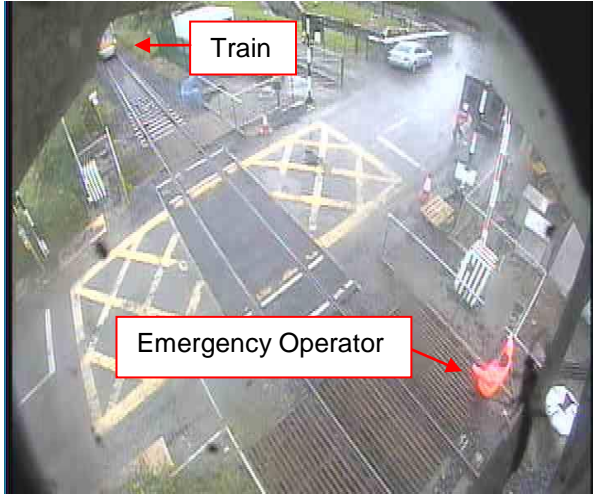


Figure 1 – Location Map

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At the time of the incident Ferns Lock AHB was being locally controlled by an Emergency Operator (EO). The incident was recorded on closed-circuit television (CCTV) of which the following photographs are taken at half second intervals, (see Photographs 1 – 4):



Photograph 1 – EO signalling to A907 train



Photograph 2 – A907 approaching crossing



Photograph 3 – A907 entering crossing



Photograph 4 – A907 on crossing

1.2.2 Events leading to the incident

Scheduled upgrading work was being undertaken at the Ferns Lock Automatic Half Barrier, railway infrastructure designation XG019, on the 2nd September 2009, for the installation of a new Close Circuit Television (CCTV) type level crossing at this location. This work included excavation works adjacent to the track to install the new cabling, but despite a survey for underground cables being carried out prior to excavation works, an underground power cable was severed.

This resulted in the following events occurring at Ferns Lock AHB with the following consequences:

- 12.04.36 hrs An IÉ underground power cable was accidentally severed;
- 12.04.44 hrs The severed cable correctly caused the barriers to automatically close to prevent road traffic from crossing which is the default safety position when a fault is detected in the crossing.
- 12.05 hrs At approximately 12.05 hrs, the lookout contacted his supervisor to report the problem, who in turn requested the Maynooth Station Manager to designate an EO to attend XG019. The Maynooth Station Manager decided to attend and perform the role of the EO as he was both available and was adequately trained to perform this role.
- 12.08 hrs An empty train travelling from Boyle to Connolly passed through XG019 with the barriers in the lowered position.
- 12.38.18 hrs The EO used the *crossing phone* to contact Signalman A to inform him that he was going to try and raise the barriers using the controls located on the pedestal of the XG019. The EO advised Signalman A that he would inform the Maynooth Signalman that XG019 was in *local control*. The EO instructed Signalman A to contact him on his mobile phone if the barriers were to be lowered for a train entering the section.
- 12.39.52 hrs The EO switched XG019 into local control.
- 12.40.06 hrs The EO raised the barriers at XG019 to road traffic.
- 12.42.50 hrs The EO phoned the Maynooth Signalman, and asked him to turn the *key switch* to facilitate him manually operating XG019.
- 12.44 hrs The signalman did as requested and made an entry in his register that the EO was in attendance at Ferns Lock and XG019 was under local control.
- 13.00 hrs Signalman A signed off duty and Signalman B took up duty on the console.
- 13.29.09 hrs The 11.00 hrs passenger service from Sligo to Connolly (A907) departed Enfield for Maynooth.
- 13.33 hrs The train passed through XG019 at approximately 65 kph while the barriers were in the raised position.
- 13.34.02 hrs The EO phoned the Sligo & Northern Line Signalling console and asked Signalman B why and who had let the train through the crossing from Enfield as the barriers were not lowered. Signalman B advised the EO that he had signalled the train from Enfield because he was advised by Signalman A that the EO was switching XG019 into local control to lower the barriers.
- 13.35.55 hrs Driver B onboard the train contacted the Sligo & Northern Line signalling console and advised Signalman B that the train was signalled to emergency stop by the EO at XG019 and that Driver A had gone back to XG019 to ascertain what went wrong. Signalman B advised Driver B that XG019 was in local control.

1.3 Infrastructure

1.3.1 General description

The Ferns Lock level crossing is an AHB type level crossing and is situated in the townland of Ferrans, County Kildare, 20 miles and 1,660 yards from Broadstone on the Dublin to Sligo Line, see Photograph 5. The railway line runs in a south easterly direction from Enfield to Maynooth and at the crossing is a single line track with a maximum permitted line side speed of 110km/h through the section of line concerned. The public road over the crossing runs north/south between Kilcock and Rathmolyon.



Photograph 5 – Approach to Ferns Lock AHB

1.3.2 Ferns Lock Automatic Half Barrier

At an AHB access for road users is prevented by means of two half-barriers that block the flow of road traffic approaching the crossing. The crossing is protected by a combination of road traffic light signals, audible warning devices and the physical half-barriers with road markings and signage on approach, see Photograph 5.

The operation of the barriers is initiated automatically as the train approaches, which activates lights and sirens at a set time before the barriers are lowered to road traffic. The barriers then raise automatically when the train has passed.

When a fault is detected at this type of crossing an EO is deployed in order to operate the crossing manually, the EO does this in conjunction with the signallers responsible for the train movements, this is referred to as a degraded operation.

At the time of the incident, Ferns Lock AHB was the only AHB crossing on the Dublin to Sligo Line.

1.4 Signalling at Ferns Lock Automatic Half Barrier

1.4.1 General information

The signalling is *coloured light aspect signalling*, trains are detected on the track by both *track circuits* and *axle counters*. Trains running between Sligo and Maynooth are controlled by CTC (including Sligo & Northern Line) whilst trains running between Maynooth and Enfield are controlled by a fringe signal box in Maynooth.

XG019 is not interlocked to the signalling system and therefore the controlling signalman has to control the movement of trains in conjunction with the EO at the crossing. The signalman must set protecting signals to danger and caution the drivers of approaching trains to stop short of the crossing and take direction from the EO at XG019.

1.4.2 Emergency operation of Ferns Lock Automatic Half Barrier – Emergency Operator

In the case of emergency operation of Ferns Lock AHB, the Station Manager/Supervisor at Maynooth Station is responsible for the control of the *crossing control key* (key) which is kept in a secure *key switch box* at Maynooth Signal Cabin. When issuing the key the Station Manager/Supervisor should consult with the Sligo & Northern Line controlling signalman, making the appropriate entry into the key switch register before unlocking the key switch box and turning the key to 'Local' and then removing the key.

The Station Manager/Supervisor should then appoint a competent EO and hand over the key along with any emergency equipment to the EO. As the Station Master at Maynooth was a trained EO, he elected to perform the duties of the EO in this instance.

On arriving at XG019, the EO must contact the Sligo & Northern Line Signalman using one of the two SPTs and insert the crossing control key into the pedestal and turn the key into the 'Local' position, which the EO did, XG019 was now under the control of the EO (until such time as the key is returned).

1.4.3 Emergency operation of Ferns Lock Automatic Half Barrier – Signalmen

The Sligo & Northern Line Console is operated on a 24/7 basis with six signalmen covering the shift rota, rest days and shift pattern are compliant with EU Working Time Regulations. The shift patterns are as follows:

| | |
|-------------|---------------|
| Early duty | 06.00 – 14.00 |
| Middle duty | 11.00 – 19.00 |
| Late duty | 14.00 – 22.00 |
| Night duty | 22.00 – 07.00 |

It is normal procedure within CTC that the personnel working on the middle shift act as relief for the early and late turn signallers and facilitate comfort breaks as required. Signalsman A commenced early duty at 06.00 hrs operating the console. Signalsman B was scheduled to work the middle duty roster but was in work early that day, and assisted Signalsman A.

XG019 is displayed on the Sligo & Northern Line Console (console), see Figure 2, which includes XG019 illustrated as a vertical line intersecting the track, and letters giving indications to the controlling signalman.

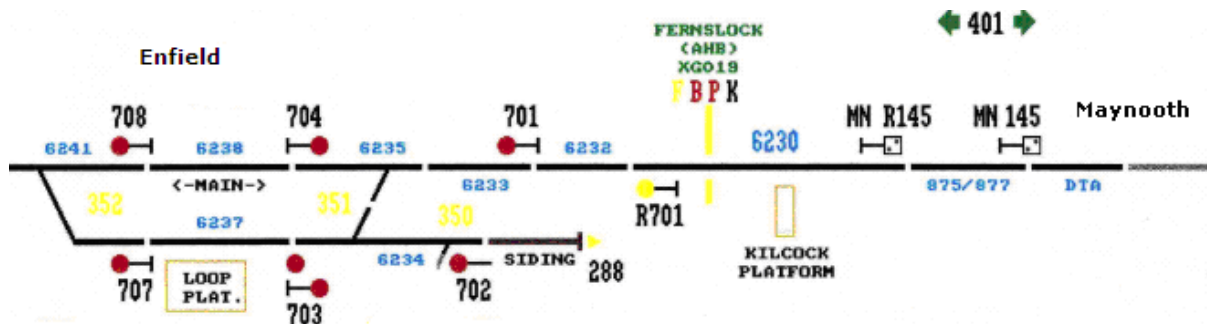


Figure 2 – Sligo & Northern Line Console with Ferns Lock AHB

The vertical line, XG019, displays different colours which indicate the following:

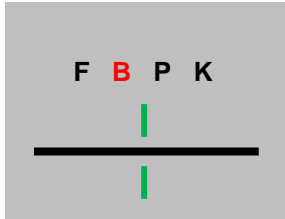
| | |
|--------|--|
| Red | XG019 open to road traffic and closed to rail traffic. |
| Yellow | XG019 is in an intermediate state on initiation by an approaching train. |
| Green | XG019 closed to road traffic and open to rail traffic |

The letters give indications on the following:

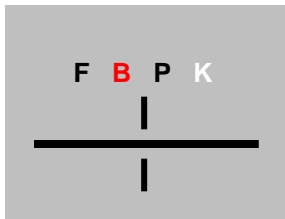
| | |
|---|---------|
| B | Barrier |
| K | Key |
| P | Power |
| F | Fault |

During the course of the following events, Signaller A was in communication with the EO forwarding all information to Signaller B who was monitoring the console, until Signaller A finished his duty.

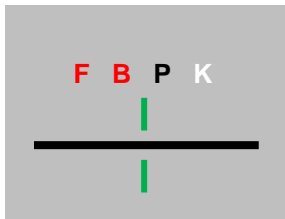
The following table illustrates the indications on the console to Signaller A and Signaller B:



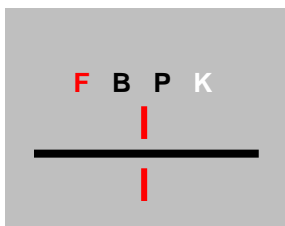
The barriers stayed in the lowered position against road traffic after the passage of the empty train through the crossing, with the red B displaying on the console.



The EO contacted Signaller A, requesting local control from the Maynooth signalbox. When Signaller A switched the key in the key switch box a flashing white K appeared on the console, when the Signaller A acknowledged this, the K became steady.



The EO then informed Signaller A that he was going to try and raise the barriers by the local control panel at the crossing. When the EO switched XG019 into local control, a red F displayed on the console indicating a fault. Signaller A informed Signaller B of this fault, and that XG019 was being controlled locally by an EO.



The EO raised the barriers at XG019 to road traffic. This resulted in the vertical line of the AHB turning red to indicate to Signaller A that the barriers were raised, the red B symbol then extinguished.

Signaller A finished his duty at 13.00 hrs, with this display on the console. Signaller B was now operating the console alone. This indication remained on the console when the train passed through XG019 while the barriers were in the raised position. Signaller B confirmed that he had signalled this train through XG019.

1.5 Traction and rolling stock

The train involved in this incident was a three piece Diesel Multiple Unit (DMU) class 22000. The train consisted of the leading car 22205, followed by 22405 & 22305. The maximum speed of the train was 160km/h.

1.6 Signalmen

1.6.1 General information

Signalman A performed duty on this console on a full time basis and was both familiar with the degraded operation of an AHB crossing and had previously experienced a fault at XG019.

Signalman B normally performs duty on the Suburban Line and on this occasion was providing relief on the Sligo & Northern Line. The Suburban Line has no AHB crossings. All crossings on the Suburban Line are full four barrier crossings with CCTV that require no intervention by the controlling signalman when a fault occurs.

1.6.2 Competencies for Signalmen

Signalman A and Signalman B were deemed competent by IÉ and had been annually assessed in operating the Sligo & Northern Line console.

The annual rules examination for Signalman B show that Signalman B was last assessed in relation to XG019 on the 6th February 2007. The assessment did not include questions on the understanding of all aspects of the symbols on the console nor was Signalman B monitored on the Sligo & Northern Line. The next assessment of Signalman B on 15th October 2008 only tested Suburban signalling procedures.

1.6.3 Rules and regulations

IÉ 'Train Signalling Regulations & General Instructions to Signalmen', issued in November 2007, states that where crossing control keys and emergency equipment are issued locally to an EO the controlling signalman must observe the special instructions issued to them in relation to the issue of keys and emergency equipment. The signalman must:

- Advise the EO when to take local control, (before doing so protecting signals should be at danger and any approaching train that has not been cautioned should be passed clear);
- Advise the EO of any approaching trains in sufficient time to enable the crossing to be closed to road traffic;

- Instruct train drivers to approach the crossing cautiously, stopping short of it and only proceeding when authorised by the EO;
- Advise other signalman concerned if the signalman does not control both sides that the EO is on duty and to caution drivers as necessary;
- Inform the EO when normal operation can resume.

1.7 Emergency operator

The EO was familiar with this type of crossing and had a current certification to perform this role having been last assessed on the 12th of June 2009. Additionally, he had been assessed at XG019 by a District Traffic Executive on 24th July 2008 for emergency operation of the AHB.

1.8 Fatalities, injuries and material damage

There were no injuries as a result of this incident. There was no damage to any infrastructure or rolling stock as a result of this incident.

1.9 History of accidents or incidents at Ferns Lock

There have been six similar accidents or incidents over the past nine years, as outlined below:

- On the 24th July 2004 as the 10.30 hrs Pearse to Enfield service approached the crossing the driver noticed that the barriers were up on sounding the horn an EO appeared at the crossing and the barriers were lowered;
- On Wednesday 4th July 2007 the 08.20 hrs passenger train from Dublin Heuston to Westport passed through Ballacagher AHB with the barriers in the raised position while they were in local operation. The barriers were in local operation to facilitate a tamping operation being carried out by the Permanent Way under a possession;
- On Saturday the 14th June, 2008 at 08.50hrs an empty DMU exited Manulla Junction en route to Dublin passed through Ballymurray AHB while the barriers were in the raised the position while staff were testing track circuits. The RAIU conducted an investigation, finding that the incident was a result of poor communications between staff involved in the maintenance of the AHB as staff had worked together regularly in the past which lead to a familiarity and an informal approach to communications. The lack of a formal maintenance process, that should include a safe system of work, would also have contributed to the incident;
- On Tuesday 2nd September 2008 during single line working, the 12.00hrs passenger service from Heuston to Cork passed through Emly, AHB at 14:29hrs while the barriers were in the raised position.

2 Analysis

2.1 Emergency operation at Ferns Lock Automatic Half Barrier

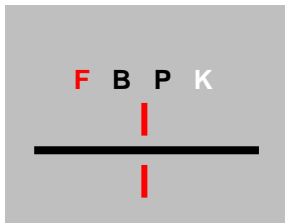
The correct procedures for the appointment of an EO were carried out and the EO and Signalman A were carrying out the instructions in 'Train Signalling Regulations & General Instructions to Signalmen' correctly.

However, Signalman B did not follow these instructions correctly in that he:

- Did not advise in EO of the approaching train;
- Did not instruct the train driver to approach the crossing cautiously, stopping short of it and only proceeding when authorised by the EO.

This resulted in the train travelling through Ferns Lock AHB while the barriers were in the raised position.

Signalman A had verbally communicated to Signalman B that there was a fault and that it was being controlled locally by an EO. Signalman B acknowledged this. However, Signalman A, normally works on the Suburban Line which has no AHB crossings, all crossings are full four barrier crossings with CCTV that require no intervention by the controlling signalman when a fault occurs. And therefore Signalman B incorrectly assumed that no intervention was required on his part.



Signalman B, would have seen the display with the red F, again, assuming that no intervention was required on his part. In addition, a red vertical line was displayed, indicating that the barriers were raised to road traffic. However, this did not prompt any action for Signalman B, as again he incorrectly assumed that no intervention was required on his part.

On listening to the post incident recordings between the EO and Signalman B it is evident that even after the incident Signalman B did not understand his role in relation to the emergency operation of XG019.

2.2 Staff competencies

Signalman A, who received the call from the EO, was a designated controlling signalman on the Sligo & Northern Line Console and understood the complexity involved in a degraded operation at XG019 as he performed duties on this console on a full time basis and was both familiar with the degraded operation of an AHB crossing and had previously experienced a fault at XG019.

While Signalman B normally operates the Suburban network which has no AHB type crossings and occasionally performs relief duties on the Sligo & Northern Line. Signalman B had been assessed in relation to XG019, however, the assessment did not include questions on the understanding of all aspects of the symbols on the console nor was Signalman B monitored in carrying out duties on the Sligo & Northern Line.

3 Conclusion

Signalman B was not familiar with the requirements of the controlling signalman in relation to the emergency operation of XG019 and as a result did not ensure that the protecting signals were at danger after receiving the message, through the EO, via Signalman A.

It was found during the course of the investigation that Signalman B normally operates the Suburban network which has no AHB type crossings and only occasionally performs relief duties on the Sligo & Northern Line. This meant that Signalman B was not familiar with the requirements of the controlling signalman in relation to the emergency operation of XG019 and as a result did not ensure that the protecting signals were at danger after receiving the message, through the EO, via Signalman A. Signalman B did not advise the EO of the approach of the A907 service, which resulted in the train travelling through Ferns Lock AHB while the barriers were in the raised position.

Immediate cause of the incident:

- Signalman B did not follow the requirements for the 'General Instructions to Signalmen' during degraded operations at an Automatic Half Barrier.

Contributory factors:

- Signalman B was unfamiliar with the 'General Instruction to Signalmen' when an Emergency Operator is on duty at an Automatic Half Barrier as he had never experienced an AHB in a degraded mode either in training, operationally or through the current competency management system.

Underlying cause:

- The competency management system did not ensure that relief signalmen were adequately trained to deal with degraded operations at an Automatic Half Barrier crossing.

4 Relevant actions already taken or in progress

IEÉ have advised that the following actions had been taken in relation to the accident:

- Ferns Lock level crossing was commissioned as a four-barrier CCTV into Athlone Crossing Control Centre at 14.30 hrs on 22nd January 2010. A weekly circular notice which was published in conjunction with this to notify relevant staff in regarding the upgrade;
- Of the original nineteen AHB type crossings on the IEÉ network, eight have now been converted to CCTV four barrier crossings (with protecting interlocked stop signals) with two AHB crossings have been closed to date. Of the remaining nine AHBs, four crossings are on target for conversion to four barrier CCTV by year end (2010) with five AHB crossings to be converted to four barrier CCTV next year (2011);
- IEÉ have reviewed the training and competency management for relief signalman and are developing a standard specifically for the training and competency management of relief signalmen.

5 Previous RAIU Recommendations

It was found during the course of the investigation that Signalman B normally operates the Suburban network which has no AHB type crossings and only occasionally performs relief duties on the Sligo & Northern Line.

Signalmen providing relief duties were also found to be contributory to a previous RAIU investigation, 'Collision of a Locomotive with passenger carriages Plunkett Station, Waterford' (RAIU Investigation Report No. 2010-R001). Therefore the RAIU, re-iterate a safety recommendation made in this investigation:

IEÉ should review their systems for training and competency management of signalmen ensuring working as a relief is taken into account.

6 Recommendations

Based on the conclusions above it has been determined that two new safety recommendations¹ were warranted as identified below:

As the above recommendation requires IÉ to review their systems for training and competency management of relief signalmen, in the interim while this recommendation is outstanding, to ensure that all signalmen allocated to perform the duties of relief signalmen are fully competent to perform their duties correctly. The RAIU make the following safety recommendation:

IÉ should review the competencies of all signalmen to ensure that when signalmen are assigned relief duties they have the required training and experience to perform these duties appropriately.

¹ 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)

7 Additional information

7.1 List of abbreviations

| | |
|-----|-------------------------|
| AHB | Automatic Half Barrier |
| CTC | Central Traffic Control |
| EO | Emergency Operator |

7.2 Glossary of terms

| | |
|-------------------------|---|
| Axle Counters | A track mounted device that accurately counts passing axles on trains. |
| Controlling signalman | A person employed by IÉ to supervise and operate a signalling system for a particular section of line. |
| Crossing control key | Key stored in a key switch box in signal cabins which facilitates the Emergency Operator in the local control of the Automatic Half Barriers. |
| Crossing Telephone | Permanently mounted telephones either side of the crossing giving a direct line of communication to the Signalman controlling the crossing. |
| Double Track | A route with two tracks |
| Emergency Operator | Member of railway staff trained and certified to operate Automatic Half Barriers manually when necessary. |
| Fringe Signal Box | A signal box that interfaces with Central Traffic Control |
| Key Switch Box | A secure box which controls the issue and subsequent handing back of the crossing control key, located in the key switch box, during emergency operation of the crossing. |
| Permanent Way Inspector | Person responsible for maintaining or renewal of the track and associated items. |
| Passing Loops | A track onto which rail traffic may be diverted or held to allow other rail traffic to pass |
| Local control | The manual operation of a level crossing from a point adjacent to the level crossing. |
| Lookout | A competent person whose duties are to watch for and give appropriate warning of approaching trains. |
| Intercity | Long distance routes, generally travelling from Dublin. |
| Tapper Key | Manual limited communication method between Signal Cabins |
| Track Circuits | An electrical train detection system based on proving the presence of a train. |