Railway Safety Commission

Post Incident Inspection

Collision of train with a landslip at the 38 ¼ milepost on the Kilkenny to Waterford line

31st December 2013.

Issue	Prepared by	Checked by	Issue date
First draft	A. Byrne	C. Boland	11th March 2014
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Finalised	A. Byrne	G Beesley	1st April 2014

Executive Summary

1. At approximately 06:40 on Tuesday 31st December 2013, the 06:05 Waterford to Heuston train (Train ID A503, a 2x3 piece ICR), with unit 22219 leading hit a landslip near Legan Level Crossing (XW112) at the 38 ¼ mile post in the Ballyhale/Lavistown section of the Kilkenny-Waterford line. The first three carriages of the train passed through the debris resulting in extensive damage to the underside of these carriages. The train came to a stop with the rear third carriage over the bulk of the debris. The train did not derail and there were no injuries to either the driver, on-board staff, or the eight passengers who were on-board. The line was closed for circa 6 hours to facilitate clean-up operations and inspection.

2. While individuals within Iarnród Éireann – Infrastructure Manager's Chief Civil Engineering department were aware of a previous slip in the vicinity of this failure, no information was readily available within the Infrastructure Asset Management System. Thus Iarnród Éireann's cuttings and embankments management system that applied to cutting slopes had not identified the historic pond in the field adjacent to the railway and staff were thus not aware of the potential for saturation of the cutting.

3. The train departed Thomastown as usual and was travelling at 79 km/h as it approached the site of the collision. It is not possible to say at what exact speed the train was travelling when it collided with the landslip material, however, it is known that the train came to a stop 18 seconds after the brake handle was moved to the emergency position. (Permissible line-speed at this location is 80 mph or 128 km/h.)

4. The RSC has made a total of 10 "recommendations" to Iarnród Éireann – Infrastructure Manager relating to the management of earthworks and 1 "recommendation" to Iarnród Éireann – Railway Undertaking. Collectively these include:
    - an action to remedy a minor non-compliance in relation to the 'Weather Management Protocol'
    - an action required to identify, and then adequately maintain, drainage which is required for railway safety but is not necessarily located on railway property,
    - actions required to review the hazards and risks associated with cuttings and embankment structures,
    - an action required to review the practice of sending out first trains at line speed after adverse weather events.

    Further information on the recommendations made in this report are contained in section 5

5. While the purpose of this Post Incident inspection is to check IÉ's compliance with their Safety Management System (SMS) and associated technical standards the RSC are of the opinion that the landslip was most likely caused by saturation of the cutting owing to inadequate drainage in the field above the railway cutting.

Next steps

6. As is RSC protocol, following the identification of a non-compliance IÉ-IM are required to advise the RSC of the actions that they will take to address the minor non-compliance and the timescale within which it shall be completed. This notification from IÉ-IM will be in the form of an Improvement Plan in accordance with Section 76 of the Act. The RSC will review this Improvement Plan and, subject to it being acceptable, will monitor its execution.

7. In addition to the 1 minor non-compliance (miNC) that relates to the Weather Management protocol, 6 'Action Required' items have been identified and the RSC has assigned planned completion dates (PCD) to each of these, as follows:

Number	Area	PCD
13/14-PII-AR 1	Review of IAMS assets to ensure the correct 'asset identifiers' are assigned	1 Month
13/14-PII-AR 2	Review of Dublin Division Risk Register mitigations	1 Month
13/14-PII-AR 3	Brief technical staff on importance of thorough site inspections	1 Month
13/14-PII-AR 4	Completion of cutting & embankment inspection cards	3 Months
13/14-PII-AR 5	Remedial Work to improve drainage at this location	3 months
13/14-PII-AR 6	Review of the process of 'Route Proving'	1 Month

Table i: Actions required items

8. Iarnród Éireann – Infrastructure Manager and Iarnród Éireann – Railway Undertaking shall review the above and implement the necessary remedial measures, and the RSC will monitor actions taken to affect these 'recommendations'.

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1. Key Facts about the landslip and subsequent collision

9. At 06:40 on Tuesday 31st December 2013, the 06:05 Waterford to Heuston train (Train ID A503, a 2x3 piece ICR), with unit 22219 leading hit a landslip near Legan Level Crossing (XW112) at the 38 ¼ mile post in the Ballyhale/Lavistown section of the Kilkenny-Waterford line.

10. The first three carriages of the train passed through the debris resulting in damage to the underside of these carriage. The train came to a stop with the third carriage over the bulk of the debris. The train did not derail and there were no injuries to either the driver, ticket checker, the Rail Gourmet attendant, the Permanent Way staff member or the eight passengers who were on-board.

11. The train was the first train out of Waterford Station bound for Dublin Heuston on that day, and it departed on time. A weather alert had been advised circa 48 hours previous and the local Permanent Way Inspector (PWI) had arranged for a member of his team to be on the train with a chainsaw for the purpose of cutting any fallen trees. (A member of the permanent way team had been on-board on the morning of the 27th, 29th and 31st December following the issuance of a weather alert).

12. The train proceeded to Thomastown Station and stopped where one person boarded.

13. The train departed Thomastown Station and approximately ¾ mile north of the station, at the 38 ¼ milepost the train collided with the landslip. The train was travelling at no more than 49 mph (79 km/h) at the point of impact. The train did not derail and remained upright.

14. The consequences could have been more severe had the train struck the land-slip at the permissible line-speed of 80 mph (128 km/h).

15. The line was closed for circa 6 hours to facilitate clean-up operations and inspection.

2. Purpose of the Post Incident Inspection

16. The Railway Safety Commission (RSC) in complying with its statutory duty to regulate railway safety is concerned with any occurrence which could, in slightly different circumstances, result in a serious or catastrophic accident. It is not the role of the RSC to determine the cause of an accident or incident — that responsibility rests with the Railway Accident Investigation Unit (RAIU) — but to identify whether an occurrence resulted from a duty holder's failure to comply with its approved Safety Management System (SMS).

17. Any structural failure of an asset has the potential for serious consequences. In this instance the landslip was relatively small in size and the passenger train was not travelling at the permitted line-speed when the collision took place. Nonetheless, it is because of the serious potential for a derailment that the RSC decided to undertake a Post Incident Inspection in accordance with section 73 of the Railway Safety Act 2005, as amended.

3. The Incident

3.1. Parties Involved

18. Iarnród Éireann – Infrastructure Manager (IÉ-IM) owns and maintains the railway infrastructure at the accident site. The accident location is within the Dublin Division which broadly covers the railways radiating from Dublin stations.

19. The Chief Civil Engineer's (CCE) department is the responsible unit within IÉ-IM for the inspection and maintenance of track and structures that include cuttings and embankments.

20. Iarnród Éireann – Railway Undertaking (IÉ-RU) owned, maintained and operated the train involved in this incident.

21. Chief Mechanical Engineer (CME) department is the responsible unit within IÉ-RU for the inspection and maintenance of rolling stock (trains).

3.2. Location

22. The accident occurred just to the north of Legan Level Crossing (XW112) at the 38 ¼ mile post in the Ballyhale/Lavistown section on the Dublin to Waterford mainline. This location is rural being ¾ mile from Thomastown station, and is bounded on both sides by farm land.

3.3. The Train

23. The train involved in the accident was the 06:05 service from Waterford to Dublin Heuston. The train ID for the service was A503 and was formed of two 3 piece ICR sets, (6 carriages), with unit 22219 leading.

24. The train was travelling at 49mph (79 km/h) as it approached the site of the collision, well below the permissible line-speed of 80 mph (128 km/h). Analysis of the On Train Data Recorder (OTDR) confirms that the train was put into braking 199m from where it stopped.

25. It is not possible to say at what exact speed the train was travelling when it collided with the landslip material, however, it is known that the train came to a stop 18 seconds after the brake handle was moved to the emergency position.

26. The first three carriages of the train passed through the debris resulting in damage to the underside and piping of these carriage. The train came to a stop with the third carriage over the bulk of the debris. The train did not derail and there were no injuries to either the driver, on-board crew, or the eight passengers who were on-board.

3.4. The Infrastructure

27. The railway at this location was opened in 1848 by the Waterford & Kilkenny Railway Company and today remains as a single line railway comprised of flat-bottomed rail on concrete sleepers. The cutting that failed was at an angle of 55° from horizontal with typical

amounts of vegetation growing thereon. Such slopes would be common throughout the network.

28. A pond[1] was noted during an inspection undertaken by STSE personnel on the 9th January 2014. In addition a crest drain was noted and it was also advised that water flow through this was less than would have been expected given the volume of water in the pond.

3.5. Weather Conditions

29. Prior to the collision the weather conditions in the area had been poor with strong winds and reasonably significant levels of rainfall in the preceding 24-48 hours. On the morning of the occurrence the weather was again poor with rain falling.

30. A weather alert from Met Éireann was received by Central Traffic Control (CTC) on the morning of Sunday 29th December 2013. Then at 09:23 on Sunday 29th December 2013 a text and email was issued by the Duty Manager CTC to all applicable managers. The following text was circulated:

31. "Rainfall Warning for Iarnród Éireann issued by Met Eireann at 07:00 Sunday, 29-Dec-2013 Rain will become persistent and heavy at times especially this evening/early tonight with the risk of spot flooding in parts of Munster/South Leinster - Totals of 25 to 35mm - Valid from 12:00 29-Dec-2013 until 06:00 30-Dec-2013"

4. The Post Incident Inspection

4.1. Sources of evidence

32. Evidence reviewed as part of this PII included;

    - Detail of the rolling stock including OTDR information
    - Review of Forward Facing CCTV (FFCCTV)
    - Photographs taken of the collision and landslip involved in the incident
    - Cutting Inspection records by engineering personnel
    - Patrol Ganger Inspection records for the length in question
    - STSE Report (undated) following a similar landslip on 16th January 2010, which was within 150m of this occurrence.
    - STSE Dublin Division Risk register
    - Consultant's (Agec) report on the cutting (dated 10th February 2012)
    - LiDAR (aerial photographic imagery)

[1] This lagoon or 'Marl Hole/Pond' can be seen on historic Ordinance Survey maps and was also visible on LiDAR aerial images that would have been available to Inspection personnel.

4.2. Summary of evidence obtained during interview

33. A key source of evidence was interviews with various CCE & Railway Undertaking personnel. These included;

- The Train driver
- Patrol Ganger
- Class A Inspector
- Class B/C Inspector
- Structures Inspector
- Senior Track & Structures Engineer
- Regional Manager (South & East)
- Infrastructure Manager Dublin
- Asst. Principal Engineer Structures
- Principal Engineer Structures
- CCE Technical Manager
- Chief Civil Engineer

The salient facts in relation to this incident are now summarised.

4.2.1. Facts relating to the Train Driver

34. The train driver had 6 ½ years' experience driving locomotives and Diesel Multiple Unit (DMU) trains. His route knowledge permitted him to drive between Dublin Heuston and Waterford, Dublin Connolly and Rosslare and Waterford to Limerick Junction.
    - On the day of the occurrence the driver commenced his turn of duty at 05:00, as in previous days, and was scheduled to work the 06:05 passenger service to Dublin Heuston and return on the 10:15 service finishing his shift at 12:30.
    - Prior to departure of the 06:05 passenger service, whilst undertaking routine train preparation checks the driver was approached by a member of staff from the Permanent Way. The staff member advised the driver that he would accompany him as far as Kilkenny due to the poor weather conditions the previous day/night. The driver was not aware of any weather alert (drivers do not receive them) and received no instruction from his line manager. ***Finding 1***
    - The train departed Waterford on time with seven passengers on-board, a Ticket checker, an individual employed by Rail Gourmet and the Permanent Way staff member. The train proceeded to Thomastown Station and stopped were one person boarded.
    - The train departed Thomastown Station and approximately ¾ mile north of the station, at the 38 ¼ milepost the train collided with the landslip. The train was travelling at no more than 49mph (79 km/h) at the point of impact. The train did not derail and remained upright.
    - The train driver with the help of the Ticket checker moved the passengers forward to the front carriage. They were later escorted on foot to Legan Level Crossing (XW113), circa 5 minutes away.

4.2.2. Facts relating to the inspection of the cutting

35. The cutting slope was inspected by the STSE after a landslip on the 16th January 2010 and a report was completed. This report identified the cause of the land-slip to be as a result of
    - saturation of the embankment following heavy rain the night before,
    - the steepness of the embankment, and
    - the presence of badger sets.

    This slip occurred circa 150m away from the 31st December 2013 slip occurrence and it is believed that both landslips occurred along the same cutting. No recommendations were

made following the January 2010 slip and subsequent inspection, however, it was stated in the report that:

> *"The circumstances of this landslide are unusual and while there is likelihood of a reoccurrence, the risk may be something the railway has no choice but to carry."*

No remedial work other than clearing the site was undertaken on foot of this report.

36. The next inspection of the cutting slope by an Engineer took place on the 28th July 2011. This inspection was undertaken by an IÉ Engineer from the STSE Dublin team. A 'Design, Condition, Deterioration' (DCD) rating of 2-3-1 was assigned to the cutting, essentially meaning that the cutting was in a poor condition with significant structural defects but it not at risk of imminent failure. This cutting slope inspected is understood to be on the 'up side' but was recorded as being on the 'down side' against an incorrect Serial No. The average slope angle stated in the report differed to that shown in the sketch. ***Finding 2***

37. On foot of 2010 landslip and the poor condition rating (3) assigned to the cutting slope following the July 2011 inspection, an external consultancy (Agec) was contracted to carry out a geotechnical survey of the cut slope between 38 miles 0 yards to 38 miles 644 yards.

38. In the intervening period the location was routinely monitored by the Patrol Ganger who walked the track twice a week. The Patrol Ganger would complete a short inspection report and on this had routinely stated that the cutting slope (at the location) was unstable and that maintenance was required. In April 2013, the same Patrol Ganger noted on one of his inspection reports that there had been new movement in cutting. The Permanent Way Inspector (PWI) did not question the Patrol Ganger about this. The Patrol Ganger continued to report 'movement in cutting' on his inspection reports but no action was taken. Upon questioning it became apparent that the movement reported in April 2013 was very minor and nothing had fouled the railway line. Between April and December 2013 the Patrol Ganger continued to report movement in cutting, however, it was established that there had not been any actual movement but rather the Patrol Ganger wished to make it clear that he was checking the slope as there had been a landslip in years past (2010) and there was often small amounts of loose soil and stones at the toe of the cutting. ***Finding 3***

39. On the 31st December 2013, the day of the accident, the cutting was inspected by the STSE, Regional Manager and District Manager. Approximately two weeks later on the 9th January 2014 the cutting was structurally inspected by STSE personnel. This individual noted a large pond in the field adjacent to the cutting and a crest drain that ran parallel to the railway line along the top of the cutting. Another ditch was noted to connect the pond to the crest drain. This was considered to be somewhat ineffective in moving water from the pond into the crest drain possibly owing to cattle trampling across it.

40. The pond noted on the 9th January 2014 inspection was not noted by STSE personnel during the first embankment inspection undertaken on the 7th July 2011. Nor was it identified by Agec (the external consultancy engaged to inspect the cutting in 2012). ***Finding 4***

4.2.2.1. Track & Structures Risk Register

41. As required by CCE Safety Management System standard CCE-SMS-006, 'Hazards and Risk Assessments', (version 3.0), hazards are identified and risks are assessed and precautionary/mitigation measures are implemented to limit the probability of those risks occurring.

42. All hazards are risk assessed in terms of the likelihood of the event occurring and the severity of the outcome. For risks associated with track and structures it is the responsibility of the Senior Track & Structures Engineer (STSE) to ensure that all risks are mitigated to a tolerable level or controlled by effective measures (that cannot be bettered without disproportionate expenditure).

43. To discharge this responsibility the STSE maintains a register of all known risks. Risk number STR-DD-074 was added to the risk register on the 30th March 2012 with the following hazard identified, "Badger Sets in cuttings and embankments leading to slippage". Unfortunately, this hazard was not specific to the location of this incident, but rather, was grouped together with 10 other locations, some of which were on different railway lines. Additionally, the location was noted to be on the opposite (Down) side of the track. The risk of slippage as a result of badger sets in conjunction with a saturated cutting or embankment on the Up side, was not identified. ***Finding 5***

44. Risk number STR-DD-074 had a qualitative pre risk assessment score of 8, (Likelihood 2 x Severity 4 = Risk 8) meaning, the 11 locations to which it applied were already deemed to be in the tolerable region, and, no further mitigation was necessary. However, it was stated in interviews that following a weather alert, the mitigation implemented was that 'hot spots' (vulnerable cuttings and embankments) would be checked by a member of the permanent way team. While this might be a mitigation in this instance it did not prevent the train colliding with the landslide. ***Finding 6***

4.2.2.2. Consultant's Report

45. As stated in paragraph 37, on foot of a previous landslip and the poor condition rating assigned to the cutting slope following the July 2011 inspection, an external consultancy (Agec) was contracted to carry out a geotechnical survey of the cut slope between 38 miles 0 yards to 38 miles 644 yards.

46. The inspection by the external consultants was carried out on the 1st February 2012 but was limited to only a visual examination. It did not include any soil sampling or testing of the embankment. ***Finding 7***

47. The consultant's report was reviewed by the Principal Engineer for Structures who deemed there to be no action needed. This individual then sent the report, along with a number of others, to the STSE via email. Owing to the size of the email (with the numerous attachments) the file was saved on a local drive and was not reviewed or actioned by the STSE. In the email to the STSE it was stated that a "Register of Recommendations" would be prepared to capture the recommendations from the consultant's reports. There was no evidence to confirm that this was done. ***Finding 8***

48. The consultant's inspection report states that "the land behind the crest of the cut slope consisted of a green field/agricultural land". The report also states that "it was not possible to access the adjacent field to see if any drainage measures such as interceptor drains had been installed at the crest of the slope." However, the report states that "a badger set entrance was discovered at the top of the embankment". The consultants did not identify the pond (Marl Hole/Pond) in the adjacent field. ***Finding 9***

49. The consultant, using the same marking (rating) criteria as IÉ's Engineers scored the cutting with a 'DCD' rating of 2-1-1, essentially meaning the cutting was in a good condition. This differed significantly to the condition rating provided by the IÉ Engineer of 2-3-1 (paragraph 27). The consultant also identified on their inspection report that 'Additional Examination Measures' were necessary but it is not clearly stated in the report as to what these were to be.

50. A number of short and longer term measures were recommended these included;
    - Leaving the slope in its current condition but carrying out regular monitoring
    - Installing an interceptor drain at the crest of the cutting (if none existed)
    - Removal of the unstable/previously disturbed material and replace with a more suitable material
    - Consider installing a retaining structure if further movement was recorded.

51. No physical remediation measures were undertaken. However, the embankment was monitored by the local Patrol Ganger following an extreme rainfall event which was considered to be the most appropriate measure relative to the risk that was identified.

4.2.3. Facts relating to the operation of trains

52. To manage the railway and reduce the impact of poor weather on services IÉ-IM in conjunction with IÉ-RU have written and implemented a 'Weather Management Protocol'. The protocol assists local managers plan a response to a period of severe weather. The protocol sets down what actions will be taken and by whom when a Met Éireann weather alert is received.

53. Following a flooding alert a number of actions should be followed to assure the [train] service for the following morning. These include:
    - A group text and email is issued by the Duty Manager CTC to all relevant line managers
    - A conference call should take place between Operations and Chief Civil Engineers department personnel to decide on the appropriate course of action to take in response to the flood alert. Possible responses discussed will include;
        - The need for proving trains
        - Impose a TSR in the affected area
        - 'At Risk' embankments checked
        - CCE personnel travel on proving train or first service train
        - Caution first service

54. Through the interview process it has been determined that a group text was issued and, to an extent, acted upon by CCE personnel. This included the inspection of key cuttings and

embankments “hotspots” by Patrol Gangers or their equivalent. Additionally, on the morning of the 27th, 29th and 31st December a member of Permanent Way staff accompanied the driver of the 06:05 service.

55. No conference call between Operations and Chief Civil Engineers department personnel took place and personnel interviewed advised that no such call had ever taken place, to discuss any specific course of action. ***Finding 10***

4.2.4. Route proving

56. Appendix 2 of the ‘Weather Management Protocol’ details the arrangements in place to prove a route, i.e, obtain assurance that a route is clear of any obstruction, e.g., fallen trees, a failed structure, submerged lines, etc. Route proving is be means of DMU, ICR or Light Engine. No further guidance is provided in the Weather Management Protocol, i.e., should the DMU or ICR set be an out of service train driven at a reduced speed. ***Finding 11***

57. Interviewees advised there was no communication between Operations and the CCE department regarding route proving following the weather alerts issued in the preceding period. It was also advised by interviewees that it was usual for first trains (passenger services) to travel at line-speed. ***Finding 12***

5. Analysis, findings & outcomes

58. Based upon the above facts, evidence and analysis a number of findings are now presented. From the findings identified as part of this inspection a number of inspection outcomes have been decided. These outcomes are in accordance with the RSC's guidance on supervision and enforcement, RSC-G-023-B, but for convenience they are explained below. Where possible, they are made specific, measurable, achievable, realistic and time-bound (SMART). The supervision activity outcomes are classified as follows;

    Major Non Compliance (MaNC): an area of non-compliance with an IÉ internal, an applicable external standard, or legislation that is evidence of a system failure.

    Minor Non Compliance (miNC): an area of non compliance with IÉ internal standard, an applicable external standard, or legislation that is evidence of a sporadic lapse in implementation of a system or deviation from a system.

    Action Required (AR): an area where potential exists for a non compliance to occur unless remedial actions or improvements are made, or an isolated error that requires correction.

    Scope for improvement (SFI): an area highlighted where, in the opinion of the Inspector, system or business improvement can be achieved by the company. Typically this is phrased as a recommendation, the merits and implementation of which should be decided by organisation in question.

The format in which outcomes are made are shown thus;

13/14-PII-AR 1 - "unique supervision activity number for the year"/"year"-"supervision activity"-"counter with prefix MaNC, miNC, AR or SfI"
Title (High level descriptor of identified issue)
Detail as required
PCD: (Planned completion date only specified for an 'Action Required' item)

Table 1: Recommendation Format

5.1. Finding & Outcomes

5.1.1. Documentation

59. Previous inspections of the cutting site that failed on the 31st December 2013 appear to have been undertaken in accordance with CCE technical standards. However, confusion has been created by the fact that the unique 'Asset identifier' for the cutting appears to be have been mixed up on some inspection reports. The available records reviewed by the RSC include;
    - The STSE's report of a previous slip in the immediate vicinity, on the 16th January 2010, was noted to be on the Up Side.

- The July 2011 inspection by an IÉ-IM member of staff records the asset to be on the Down Side.
- The inspection report by Agec (external consultancy) identifies the asset as being on the Down side.
- The risk register identified a risk of "Badger Sets in cuttings and embankments leading to slippage" on the Down side.
- The failed asset, the Up side, was not identified on the risk register.
- The slip on the 31st December 2013 occurred on the Up side.

60. It is clear that documentation pertaining to the failed asset was weak insofar as the recording of the assets location was ambiguous. Therefore based on the above which summarises Finding 2, in section 4, the following outcome is made.

13/14-PII-AR 1: Review of IAMS assets to ensure the correct 'asset identifiers' are assigned
The CCE TM should, at a minimum, seek the necessary assurances that all assets identified (listed) in the Dublin Division Risk Register have been correctly identified.
PCD: 1 Month

Further to Findings 5, 6 and 8 the following outcome is made.

13/14-PII-AR 2: Review of the Dublin Division Risk Register
The CCE TM should critically review:
a. all cutting & embankment hazards listed in the Dublin Division Risk Register confirming that they have appropriate likelihood and severity ratings.
b. all cutting & embankment risks that require mitigation confirming they are being managed appropriately.
c. the benefit of additional inspections following a weather event as opposed to imposing time based emergency speed restrictions.
d. all Agec Reports and the recommendations contained therein ensuring there are mitigations in place. Additionally the 'Register of Recommendations' should be updated.
PCD: 1 Month

Following on from Finding 8, the following scope for improvement is made.

13/14-PII-SfI 1: Review of contract specifications when engaging consultants
Agec were engaged to undertake a geotechnical survey of the cutting. This did not involve any instrumental checks or laboratory analysis. The survey comprised of a visual inspection only. The CCE TM might consider reviewing future contract specifications and submissions so as to ensure they meet expectations.

61. In relation to Finding 4 above, inspections undertaken in 2010, 2011 and 2012 failed to identify the pond in the field above and adjacent to the railway. While access to the top of the cutting may have been difficult, it was possible following the 2013 slip. Had the IÉ Engineer and/or the consultants engaged to inspect the cutting checked the top of the cutting the crest ditch (drain) and pond may have been identified possibly resulting in different actions being recommended.

62. An aerial survey of the Carlow branch was undertaken on the 16th March 2011. It is understood that the LiDAR images and the associated aerial photography were not available

in advance of the February 2012 survey by Agec owing to the considerable volume of information that needed post processing. However, had this information been available, which clearly showed the marl pond, it is possible that it may have impacted upon their DCD rating, recommendations made, and the STSE's subsequent risk mitigations.

63. Through the course of this PII it has been determined that the pond was a long established feature predating the construction of the railway line. (Based on historic Ordinance Survey maps of the location).

13/14-PII-AR 3: Brief technical staff on importance of thorough site inspections
The CCE TM (or their nominated deputy) should brief all technical staff on the importance of systematically checking cuttings and embankments including checking the top of cuttings and land adjacent to the railway.
PCD: 1 Month

13/14-PII-SfI 2: Better utilisation of tools available such as LiDAR, Aerial Photographs & OSI Maps
In conjunction with AR2, the CCE TM (or their nominated deputy) could consider briefing technical personnel on the importance of undertaking desktop surveys prior to site inspections.

13/14-PII-AR 4: Completion of cutting & embankment inspection cards
The CCE TM (or their nominated deputy) could consider reviewing the cutting & embankment inspection card as records supplied suggest they are not being completed as per standard, e.g., individuals are entering 'Y's' and 'N's' as opposed to G (Good), R(Requires Repair) or E(Element requires further examination). Additionally it might be useful to have space on the form where 'Work Order' references are added aiding traceability.
PCD: 3 Months

5.1.2. Training and Competence

64. Training and competence of personnel involved in safety critical work is a key activity of any duty holder. Earthworks structures are particularly complex and require competent and diligent staff undertaking the inspections. Given the above the following outcome is made.

65. Technical staff have received some training in the area of cuttings and embankments, but there is no formal assessment of this competence.

13/14-PII-SfI 3: Review of staff training & competence in earthworks structures
The CCE TM could consider the training, competence and assessment of staff undertaking inspections of earthworks structures. Such training should include briefing on asset identification and recording systems used to manage cutting and embankment assets.

66. With regards to Finding 3, the Patrol Ganger reported, on a twice weekly basis, movement in the cutting even thought there was no actual movement. This possibly led to the PWI not reacting to any noted changes.

13/14-PII-SfI 4: Review of staff training & competence in earthworks structures for track patrolling staff
The IM Dublin (or their nominated deputy) could consider the re-briefing Patrol Gangers on the filling out of Patrol Ganger Reports. In particular this briefing could explain the importance of identifying 'changes' so as to assist the PWI in managing the assets for which they are responsible.

5.1.3. Water within the cutting

67. Uncontrolled water can have a significant destabilising effect on earthworks that can and do result in slips. While unconfirmed by this PII, water in the cutting is likely to have reduced its stability. This probably arose due to a combination of the following likely causal factors:

- water draining from the adjacent land, in which there was a sizeable pond, into the cutting affected its stability at its upper levels;
- the ditch running from the pond to the crest drain along the top of the embankment was not working as it should owing to being trampled by livestock that would use the field; and
- The crest drain running parallel to the railway line at the top of the embankment was also insufficient in draining water from the pond to a nearby culvert.

13/14-PII-AR 5: Remedial Work to improve drainage at this location
The CCE should take measures to prevent a reoccurrence at this location. This could include the clearing of blocked ditches and the crest drain that exists at the top of the cutting slope.[2]
PCD: 3 months

5.1.4. Weather Alerts and preparedness

68. The CCE's SMS is underpinned by many standards, guidance notes, bulletins and protocols. One such document is the 'Weather Management Protocol' which has been developed to assist local managers plan a response to a period of severe, possibly service affecting weather. The document states that:

> *"The protocols set down what actions will be taken and by whom when a Met Eireann weather alert is received."*

It is evident from Finding 10 above that the protocol was not followed and therefore the following non-compliance is raised.

03/14-PII-miNC 1: Non-compliance with the 'Weather Management Protocol'
The 'Weather Management Protocol' as written is not being implemented consistently insofar as the CCE department do not always consult with the Operations department (and vice versa) following a weather alert. Similarly, it is not clear if train drivers are advised of weather alerts or given any instructions as to how they should drive following a weather event.

69. Given Findings 1, 11 and 12 above, the following outcome is made.

13/14-PII-AR 6: Review of the process of 'Route Proving'
The Director RU should critically review the process for proving routes so as to avoid first passenger service trains operating at line speed following an extreme weather event (weather alert).
PCD: 1 month

[2] It is noted that some work which may be desirable to undertake might be on land not in the ownership of Iarnród Éireann. In such instances the RSC would expect the CCE to at least try to engage with third party land-owners to see if desirable works can be accommodated.

5.1.5. Summary of findings & outcomes

70. While unconfirmed by this PII it is likely that the landslip was caused by a combination of a number of factors including:
    a. saturation of the cutting,
    b. increased water loading in the pond in the field above the railway together with
    c. high winds that were recorded at the time of the landslip.

71. However, the purpose of this report is not to identify the cause but rather check Iarnród Éireann has complied with their SMS. The RSC, through this post incident inspection, have identified a number of weaknesses in IÉ's processes and as a consequence have made 11 inspection outcomes.

72. They include;
    - 1 minor non-compliance,
    - 6 'Acton Required' items and
    - 4 'Scope for Improvement' areas.

The tables below summarise the inspection outcomes.

Number	Area
13/14-PII-miNC 1	Non-compliance with the 'Weather Management protocol'

Table 2: Non-compliance summary

Number	Area	PCD
13/14-PII-AR 1	Review of IAMS assets to ensure the correct 'asset identifiers' are assigned	1 Month
13/14-PII-AR 2	Review of Dublin Division Risk Register mitigations	1 Month
13/14-PII-AR 3	Brief technical staff on importance of thorough site inspections	1 Month
13/14-PII-AR 4	Completion of cutting & embankment inspection cards	3 Months
13/14-PII-AR 5	Remedial Work to improve drainage at this location	3 months
13/14-PII-AR 6	Review of the process of 'Route Proving'	1 Month

Table 3: Inspection outcome summary

Number	Area
13/14-PII-SfI 1	Review of contract specifications when engaging consultants
13/14-PII-SfI 2	Better utilisation of tools available such as LiDAR, Aerial Photographs & OSi Maps
13/14-PII-SfI 3	Review of staff training & competence in earthworks structures
13/14-PII-SfI 4	Review of staff training & competence in earthworks structures for track patrolling staff

Table 4: Scope for Improvement outcome summary

73. It is also recommended that the CCE again review the RSC's audit of IÉ's Management of Cutting and Embankments undertaken in March 2011 as it would appear that some 'recommendations' made remain valid, e.g., in relation to asset condition ratings and staff training and competence.

6. Relevant actions already taken or in progress

74. On the 31st March 2014 Iarnród Éireann – Infrastructure Manager advised the RSC of the following;
    - A speed restriction of 25mph has been put in place. This will remain until completion of remediation works.
    - An internal investigation was carried out and is currently being finalised.
    - A technical review of the slip area was undertaken with a view to developing an appropriate design solution.
    - A remediation plan has been developed based on above design which involves improvements to the drainage and a re-grading of the cutting slope. This work will be undertaken in accordance with the plan following completion of some other current on-going Cutting & Embankment remediation works at another high risk location.

7. Next Steps

75. In accordance with section 76 of the Railway Safety Act, to ensure deficiencies in the process for controlling risks in relation to competency assessment, Iarnród Éireann – Infrastructure Manager shall submit an Improvement Plan (Plan) to the RSC by a prescribed date. This plan should clearly define how it intends to rectify the SMS deficiencies (non-compliance) identified and provide a timescale for doing so. The RSC will review this submission and subject to it being satisfactory will track its implementation.

76. Similarly, Iarnród Éireann – Infrastructure Manager should detail the actions taken /proposed to address the 'Action Required' items. Furthermore Iarnród Éireann – Infrastructure Manager should confirm its acceptance of the proposed planned completion dates for all 'Action Required' items.

77. As is stated in section 5, a 'Scope for improvement (SFI)' item is an area highlighted where, in the opinion of the Inspector, system or business improvement can be achieved by the company. Typically they are phrased as recommendations, the merits and implementation of which should be decided by inspected organisation.

Appendix A – List of Interviewees:

Name	Position
[redacted]	Chief Civil Engineer
[redacted]	Technical Manager – CCE
[redacted]	STSE Dublin Division
[redacted]	Structures Inspector Dublin Division
[redacted]	Infrastructure Manager Dublin
[redacted]	Regional Manager – Dublin Division
[redacted]	Principal Engineer Structures
[redacted]	Asst. Principal Engineer Structures
[redacted]	Train driver (Waterford District)
[redacted]	Class 'A' Permanent Way Inspector – Division 10
[redacted]	Patrol Ganger
[redacted]	Class 'B/C' Permanent Way Inspector - Division 10