SHERIFFDOM OF GRAMPIAN, HIGHLAND AND ISLANDS AT ABERDEEN

[2026] FAI 59

ABE-B965-24

DETERMINATION

BY

SHERIFF LESLEY JOHNSTON

UNDER THE INQUIRIES INTO FATAL ACCIDENTS AND SUDDEN DEATHS ETC (SCOTLAND) ACT 2016

into the death of

CHRISTOPHER STUCHBURY, DONALD DIGBY DINNIE and BRETT GEORGE MCCULLOUGH

Aberdeen on 30 October 2026

DETERMINATION

The sheriff, having resumed consideration of the evidence and information presented at the Fatal Accident Inquiry into the deaths of Christopher Stuchbury, Donald Digby Dinnie and Brett George McCullough, determines in terms of section 26 of the Inquiries into Fatal Accidents and Sudden Deaths etc (Scotland) Act 2016 ("the 2016 Act") that:

When and where the deaths occurred (s26(2)(a))

Christopher Stuchbury

1. Christopher Stuchbury was born on 21 July 1958 and was aged 62 years at the time of his death.

2. Mr Stuchbury died on 12 August 2020, immediately after the derailment of train 1T08 at around 9.37am. His place of death was the East Coast Main Line between Aberdeen and Dundee, between Stonehaven and Carmont Signal Boxes.

Donald Dinnie

3. Donald Digby Dinnie was born on 15 August 1961 and was aged 58 at the time of his death.

4. Mr Dinnie died on 12 August 2020, immediately after the derailment of train 1T08 at around 9.37am. His place of death was the East Coast Main Line between Aberdeen and Dundee, between the Stonehaven and Carmont Signal Boxes.

Brett McCullough

5. Brett George McCullough was born on 4 July 1975 and was aged 45 years at the time of his death.

6. Mr McCullough died on 12 August 2020, immediately after the derailment of train 1T08 at around 9.37am. His place of death was the East Coast Main Line between Aberdeen and Dundee, between Stonehaven and Carmont Signal Boxes.

When and where any accident resulting in the death occurred (section 26(2)(b))

7. The accident resulting in the deaths of Christopher Stuchbury, Donald Dinnie, and Brett McCullough occurred at approximately 9.37am on 12 August 2020 on the East Coast Main Line between Stonehaven and Carmont Signal boxes (down line), close to milepost 221.

The cause or causes of death (section 26(2)(c))

8. The deaths of Christopher Stuchbury, Donald Dinnie and Brett McCullough were caused by multiple non-survivable blunt force injuries sustained in the derailment of train 1T08 on 12 August 2020.

The cause or causes of any accident resulting in the death (s26(2)(d))

9. The accident resulting in the deaths of Christopher Stuchbury, Donald Dinnie, and Brett McCullough was caused by train 1T08 striking debris washed on to the railway track from a drain following a period of very heavy rainfall, whilst the train was travelling at 73mph.

Any precautions which could reasonably have been taken, and had they been taken, might realistically have resulted in the death or any accident resulting in the death, being avoided (section 26(2)(e):

10. In terms of section 26(2)(e) of the 2016 Act, the following precautions could reasonably have been taken, and had they been taken, might realistically have avoided

the accident which resulted in the deaths of Christopher Stuchbury, Donald Dinnie, and Brett McCullough:

a. For Carillion Construction Limited ("Carillion") to have constructed the drain in the area of the derailment (the "2011/12 drain") in accordance with the design prepared by Ove Arup and Partners, thereby omitting the construction of a bund at the drain site which formed no part of the design and which was the significant cause of the washout of the drain on 12 August 2020.

b. For Carillion to have prepared "as built drawings" of the 2011/12 drain and provided same to Network Rail Infrastructure Limited ("Network Rail").

c. For Network Rail to have complied with its own standards in place at the time of the conclusion of the 2011/12 drain construction that required it to be in receipt of "as built drawings" and a health and safety file.

Any defects in any system of working which contributed to the death or any accident resulting in the death (section 26(2)(f)):

11. In terms of section 26(2)(f) of the 2016 Act, the following was a defect in a system of working which contributed to the deaths or any accident resulting in the deaths:

a. Network Rail's failure to ensure that the 2011/12 drain was constructed properly and in accordance with the design drawings.

Any other facts which are relevant to the circumstances of the death (section 26(2)(g)):

12. In terms of section 26(2)(g) of the 2016 Act, the following are facts relevant to the circumstances of the death:

a. Carillion failed to construct the 2011/12 drain in accordance with the design in a number of respects, including the following:

i. Catchpit 18 was not installed in the correct position, and an existing field pipe was not connected to catchpit 18;

ii. At catchpit 18 the pre-cut hole on the downslope side was significantly bigger than required;

iii. The section of drain trench immediately upslope of the washout between catchpits 16 and 19, was not fully lined with geotextile material;

iv. The material used to "backfill" the trench for a short distance upslope of catchpit 19 was locally dug material, rather than the gravel specified by the design;

v. A section of pipe between catchpits 18 and 19 had been installed at an angle so that its perforations were on the side rather than the upper part of the pipe.

vi. Proposed catchpit 17 was not installed

vii. A length of carrier pipe was installed instead of filter pipe between catchpits 18 and 19.

b. That between March 2013 and the accident, no routine inspection was carried out by Network Rail on the section of 2011/12 drain upslope of catchpit 18.

c. That at the time of the derailment, route control staff in Scotland were not adequately trained in relation to the national standard for managing extreme weather (NR/L2/OPS/21), including route coding per those standards;

d. That at the time of the derailment, the National Rail Weather Service ("NRWS") was not configured in the control room in Scotland to provide alerts in response to real-time weather data. In any event, at the time of the derailment, control room staff had not been trained on how to use the NRWS in response to real-time weather data to assist decision making;

e. That at the time of the derailment, Network Rail competency assessments and audits did not detect that staff in Scotland's control room were not adequately trained in relation to the national standard for managing extreme weather (NR/L2/OPS/21), including route coding per those standards or in the use of the NRWS.

f. That at the time of the derailment, there was no basis for the control room to put in place mitigations, such as speed restrictions, based on an extreme rainfall alone, regardless of levels of flooding and regardless of the categorisation of certain sites being "at risk".

g. Train 1T08 was a high-speed train comprising a leading power car, four passenger coaches all being British Rail mark 3 coaches, followed by a trailing power car. Having been introduced into main line service in the mid-1970s, it

was designed and manufactured before the Railway Group Standard GM/RT2100, issue 1 July 1994 and later. Accordingly, train 1T08 did not and was not required to, comply with the modern structural and crashworthiness standards required by GM/RT2100.

h. No guard or gathering rails were installed on the approach to and over bridge 325. The standards in place at the time of the derailment did not require there to be guard or gathering rails installed at that location.

Such recommendations (if any) as to any of the matters mentioned in subsection (4) as the sheriff considers appropriate (section 26(1)(b) and section 26(2)(4):

13. No recommendations.

NOTE

1. Introduction and contents

[1] On 12 August 2020 at approximately 9.37am, the 0638 hours passenger train service from Aberdeen to Glasgow (reporting number 1T08) a high-speed train comprising a front "leading" power car, followed by four passenger coaches (D to A) and a rear or "trailing" power car, was travelling north towards Stonehaven (the "down line") when it collided with debris washed from a drain onto the track ("washout") near to Carmont, Aberdeenshire. Nine people were on board, namely six passengers and three railway employees, one of which was travelling as a passenger.

[2] The location of the washout from the drain was between 220 miles and 1610 yards, and 220 miles and 1621 yards on the down line (line heading north) before a bridge situated over the Carron water, known as "bridge 325". When the train collided with the washout it was travelling at around 73mph, just below the normal speed for the line concerned as instructed by the signaller and in accordance with the railway rulebook.

[3] The collision caused the train to derail and deviate to the left, before striking the parapet of bridge 325 causing the train vehicles to scatter.

[4] Donald Dinnie died while acting in the course of his employment as a conductor on the train. Brett McCullough died while acting in the course of his employment as the driver of the train. Christopher Stuchbury died while travelling as a passenger on the train. The other six passengers were injured.

Christopher Stuchbury

[5] Christopher Stuchbury, known as Chris, was a beloved son, husband, father and stepfather, brother and friend. On the date of the accident, he was travelling south to commence work as a Tug Master on the Firth of Forth. Tragically, it was also the date of his tenth wedding anniversary and only a few weeks before the start of his retirement. His family continue to be deeply affected by his sudden and tragic death.

Donald Digby Dinnie

[6] Donald Dinnie was a much-loved son, partner, father, stepbrother, colleague and friend. It was clear from the evidence that he was a dedicated employee who enjoyed his role as a train conductor. On 12 August 2020, he carried out his duties diligently, attending to the welfare of his passengers with professionalism and kindness to the very end. His family continue to be devastated by his tragic and untimely death.

Brett McCullough

[7] Brett McCullough was a cherished son, husband, father, brother, colleague and friend. From the evidence and information before the inquiry, it was clear that Mr McCullough was totally focussed on the execution of his duties as train driver on 12 August 2020 in challenging and unprecedented weather conditions. He responded to the signals and instructions provided to him appropriately. His actions as train driver on 12 August 2020 cannot be faulted and in no way caused or contributed to the accident. He is forever missed by his family.

[8] This determination follows an inquiry into the circumstances of those deaths. The note to the determination is structured as follows:

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2. The legal framework

[9] The law and procedure relating to fatal accident inquiries in Scotland is set out in the 2016 Act and the associated procedural rules in the Act of Sederunt (Fatal Accident Inquiry Rules) 2017 ("the rules").

[10] This inquiry was arranged by the procurator fiscal pursuant to section 1 of the Act, to investigate the circumstances of the deaths (sections 1(1)(a) and (b)). The purpose of the inquiry is to (a) establish the circumstances of the deaths and (b) consider what steps (if any) might be taken to prevent other deaths in similar circumstances (section 1(3)(a) and (b)). The purpose is not to establish civil or criminal liability (section 1(4)). An inquiry is an inquisitorial, not adversarial process (rule 2.2) in which the procurator fiscal represents the public interest.

[11] This inquiry is both a mandatory and a discretionary inquiry. In relation to the deaths of Donald Dinnie and Brett McCullough it is a mandatory inquiry owing to their deaths having occurred in Scotland and as a result of an accident which occurred while they were acting in the course of their employment (section 2 of the 2016 Act). In relation to the death of Christopher Stuchbury, it is a discretionary inquiry owing to his death having taken place in Scotland, and in circumstances which the Lord Advocate has considered gives rise to serious public concern, such that it is in the public interest for an inquiry to be held into the circumstances of his death (section 4 of the 2016 Act).

Section 26 of the Act

[12] The matters to be determined by the sheriff are set out in section 26 of the 2016 Act, which is in the following terms:

> **"26. The sheriff's determination**
>
> (1) As soon as possible after the conclusion of the evidence and submissions in an inquiry, the sheriff must make a determination setting out –
> (a) in relation to the death to which the inquiry relates, the sheriff's findings as to the circumstances mentioned in subsection (2), and
> (b) such recommendations (if any) as to any of the matters mentioned in subsection (4) as the sheriff considers appropriate.
>
> (2) The circumstances referred to in subsection (1)(a) are –
> (a) when and where the death occurred,
> (b) when and where any accident resulting in the death occurred,
> (c) the cause or causes of the death,
> (d) the cause or causes of any accident resulting in the death,
> (e) any precautions which –
> (i) could reasonably have been taken, and
> (ii) had they been taken, might realistically have resulted in the death, or any accident resulting in the death, being avoided,
> (f) any defects in any system of working which contributed to the death or any accident resulting in the death ,
> (g) any other facts which are relevant to the circumstances of the death.
>
> (3) For the purposes of subsection (2)(e) and (f), it does not matter whether it was foreseeable before the death or accident that the death or accident might occur-
> (a) if the precautions were not taken, or
> (b) as the case may be, as a result of the defects.
>
> (4) The matters referred to in subsection (1)(b) are-
> (a) the taking of reasonable precautions,
> (b) the making of improvements to any system of working,

(c) the introduction of a system of working,
(d) the taking of any other steps,
which might realistically prevent other deaths in similar circumstances.

(5) A recommendation under subsection (1)(b) may (but need not) be addressed to –
(a) a participant in the inquiry,
(b) a body or officer-holder appearing to the sheriff to have an interest in the prevention of deaths in similar circumstances.

(6) A determination is not admissible in evidence, and may not be founded on, in any judicial proceedings of any nature."

Section 26(2)(a) to (d)

[13] In considering the circumstances set out at section 26(2)(a) to (d), the court simply exercises its traditional fact-finding functions. The standard of proof is on the balance of probabilities.

Section 26(2)(e)

[14] In order to make a finding under section 26(2)(e), namely the identification of any precautions, the court requires to be satisfied of two matters, namely (i) that a precaution existed that could reasonably have been taken and (ii) that, had the precaution been taken, it might realistically have resulted in the death being avoided. Both parts (i) and (ii) require to be satisfied on the evidence before a finding under section 26(2)(e) can be made.

[15] "Precaution" is given its ordinary and natural meaning, namely a measure, action or step taken beforehand against a possible danger, risk or inconvenience. In

relation to section 26(2)(e)(i), the court is considering whether there was a precaution which could reasonably have been taken. The court is not concerned with whether the precaution *should* or *ought* to have been taken (see *Duncan* v *Lord Advocate*, 2026 SC 30 per Lord President (Pentland) at paragraphs 51 and 52).

[16] A precaution might realistically have avoided a death if there is a real or lively possibility, as opposed to a remote chance, that it might have done so. The possibility requires to be one of substance and genuine potential, rather than a mere fanciful possibility (see Explanatory Notes to the 2016 Act, at paragraph 72; and *Inquiry re Death of James McAlpine* (Glasgow, 17 January 1986) and referred to in Carmichael, *Sudden Deaths and Fatal Accident Inquiries*, 3rd ed (Edinburgh 2005) at, paragraph 8.99 and see also paragraph 5.75). It does not matter whether it was foreseeable before the death or accident that the death or accident might occur if the precaution was not taken (section 26(3)).

[17] If the evidence presented at an inquiry shows that a precaution could reasonably have been taken and that had it been taken it might realistically have resulted in the death or the accident resulting in the death being avoided, such a precaution must be set out in the determination. The sheriff has no discretion not to make such a finding if the evidence satisfies the criteria in section 26(2)(e) (*Duncan* v *Lord Advocate*, paragraph 51).

Section 26(2)(f)

[18] Section 26(2)(f) of the Act, namely whether any defects in any system of working contributed to the death or any accident resulting in the death, is a question of fact to be

decided on the balance of probabilities. Before any finding can be made in terms of section 26(2)(f) the court requires to be satisfied on the evidence that there was a defect in a system of working and that the defect contributed in a causal sense to the accident resulting in the deaths. Again, it does not matter whether it was foreseeable before the death or accident that the death or accident might occur as a result of the defects.

Section 26(2)(g)

[19] In terms of section 26(2)(g) the sheriff can make findings in relation to "any other facts which are relevant to the circumstances of the death." In comparison with what is required before findings can be made under sections 26(2)(e) and (f), section 26(2)(g) is much wider in scope. There was no dispute among the participants that causation does not require to be established for a finding to be made under section 26(2)(g). All that is necessary is that the fact recorded under section 26(2)(g) is relevant to the circumstances of the death. Put another way and giving the words of section 26(2)(g) their ordinary meaning, what is required before a finding can be made under section 26(2)(g) is that the fact is connected to the circumstances of the deaths. In the context of the now repealed Fatal Accidents and Sudden Deaths Inquiry (Scotland) Act 1976 and the identical provision in section 6(1)(e), a fact relevant to the circumstances of the death was taken to mean the circumstances of the death as they may affect the public interest (see Carmichael, *Sudden Deaths and Fatal Accident Inquiries* (3rd ed, 2005) at paragraph 5.77).

[20] It follows that section 26(2)(g) allows the court to record matters which might, but for the absence of the required causal connection, have been recorded as findings

under sections 26(2)(e) and/or (f). In other words, section 26(2)(g) allows the court to make findings as to precautions which could reasonably have been taken but in respect of which it cannot be said might realistically have avoided the deaths. Similarly, it would allow for any defect in a system of work to be recorded even if it cannot be established on the balance of probabilities that the defect contributed to the death. All that is required in terms of section 26(2)(g) is that the fact is relevant to the circumstances of the death. Although I was not referred to it as an authority in this inquiry, I am confirmed in that view by the observations of Sheriff Collins at paragraph 32 of his determination following the Fatal Accident Inquiry into the deaths of Katie Allan and William Brown, who having made similar observations, noted that section 26(2)(g) "provides another way in which the inquiry can enable lessons for the future to be learned from the circumstances of the death." (*FAI into the deaths of Katie Allan and William Brown* [2025] FAI 6 per Sheriff Collins at paragraph 32).

3. Procedural history

[21] The Crown initiated the fatal accident inquiry by first notice lodged on 28 November 2024. Preliminary hearings took place on 29 January, 23 April, 23 June, 28 August, 24 and 29 September, 10 November and 22 December 2025 and 12 January 2026.

[22] At the hearing on 24 September 2025, I heard legal arguments in relation to a lengthy written submission lodged by the Rail Accident Investigation Branch (RAIB) relating to the application of certain principles derived from a number of English

authorities, together termed "the Norfolk principle". After hearing detailed legal arguments, I continued the hearing to 29 September to consider same. I gave my decision to parties at that hearing and issued a copy of my decision in writing on the same day. A copy of that note is published alongside this determination.

[23] At the last preliminary hearing on 12 January 2026, I was informed that the evidence relating to the response of the emergency services to the derailment was agreed in principle. Their actions did not cause or contribute to any of the deaths. On that basis, all parties indicated that subject to a joint minute being signed, it was agreed that the British Transport Police, Scottish Fire and Rescue Service, Scottish Ambulance Service and Maritime and Coastguard Agency could withdraw participation from the inquiry. Following a signed joint minute lodged on 20 January 2026 setting out the agreed facts about the involvement of these emergency services, and by agreement of all the parties, I allowed them to withdraw from the inquiry by interlocutor dated 22 January 2026.

4. The inquiry

Participants and representation

[24] The fatal accident inquiry took place (in person) at Aberdeen Sheriff Court between 26 January and 4 February 2026. A hearing on submissions took place by Webex on 30 and 31 March 2026.

[25] The procurator fiscal represents the public interest in a fatal accident inquiry. In this inquiry, the procurator fiscal was represented by Mr Prentice KC. Sixteen

participants took part in the inquiry, each with a different interest in the inquiry. They were as follows.

Network Rail

[26] Mr Gray KC, and Mr Scullion, advocate appeared for Network Rail. Network Rail owns, operates and maintains Great Britain's railway infrastructure.

ScotRail Trains Limited

[27] Mr Brodie KC appeared for ScotRail Trains Limited ("ScotRail"). ScotRail is the current operator of trains providing passenger rail services in Scotland (branded "ScotRail" services).

The RAIB

[28] Mr Webster KC appeared for the RAIB. The RAIB carried out an investigation into the accident in terms of the Railways (Accident Investigations and Reporting) Regulations 2005. Its investigation report was published in March 2022 and updated in January 2024 and made 20 recommendations aimed at improving railway safety.

Office of Rail and Road

[29] Ms Fraser, advocate appeared for the Office of Rail and Road ("ORR"). The ORR is, amongst other things, the independent safety regulator for the rail industry in the

UK. It is responsible for monitoring the rail industry's implementation of the RAIB's recommendations.

Ove Arup & Partners

[30] Mr Stewart KC appeared for Ove Arup & Partners ("Ove Arup"). Ove Arup was the engineering design organisation commissioned by Carillion plc (an approved contractor for Network Rail) to design the drain ("the 2011/12 drain") at the accident site.

Angel Trains Ltd

[31] Ms Bone, solicitor appeared on behalf of Angel Trains Ltd. Angel Trains Ltd is a rolling stock leasing company. At the time of the accident, it leased the vehicles comprising train 1T08 to Abellio ScotRail Limited.

Amey OWR Ltd

[32] Ms Metcalfe, solicitor, appeared on behalf of Amey OWR Limited ("Amey"). Amey was contracted by Network Rail to carry out routine inspection and examination of earthworks and structures (including the examination of mixed cuttings such as that at the accident site) on Network Rail's behalf.

Associated Society of Locomotive Engineers and Firemen ("ASLEF") and the National Union of Rail, Maritime and Transport Workers ("RMT")

[33] Mr Rodgers, solicitor appeared on behalf of ASLEF and RMT. ASLEF and RMT are trade unions. Brett McCullough was a member of ASLEF. Donald Dinnie was a member of RMT.

James Scullion

[34] Ms Toner KC appeared on behalf of James Scullion. At the time of the accident, Mr Scullion was employed by Network Rail as a route control manager based at the West of Scotland Signalling Centre.

Brian Mitchell

[35] Mr Smith, solicitor appeared on behalf of Brian Mitchell. At the time of the accident, Mr Mitchell was a relief signaller at Carmont Signal Box.

William (Billy) McKay, Alasdair McIver and Owen Ferry

[36] Ms Railton, solicitor appeared on behalf of Billy McKay and Alasdair McIver. Mr McKay was employed by Network Rail as a programme manager at the time of the accident. He was a project manager in respect of works carried out near to Carmont for rockfall protection and the installation of a new drain (the "2011/12 drain"). Also employed by Network Rail in respect of those works were, Mr McIver as a construction

manager and Owen Ferry, as scheme project manager. Mr Ferry was represented at the inquiry by Mr Hall, solicitor.

Karl Grewar

[37] Mr Hall, solicitor also appeared on behalf of Karl Grewar. Mr Grewar was employed by Network Rail as Head of Integrated Control at the time of the accident.

Alastair MacFarlane

[38] Ms Morgan, solicitor appeared on behalf of Alastair MacFarlane. At the time of the accident, Mr MacFarlane was employed by Network Rail as a Regional Asset Manager for Geotechnical, Drainage and Off-track.

[39] I am grateful to all of those who appeared in the inquiry during both the preliminary stages and at the substantive inquiry. Owing to the diligence and good cooperation of all parties, the substantial agreement of uncontroversial evidence and the efficient timetabling and management of witnesses, the evidence in this inquiry concluded in a significantly shorter timescale than was originally estimated. The detailed and carefully prepared written submissions also helpfully focused the issues for this determination and allowed the hearing on submissions to proceed expeditiously.

The evidence presented to the inquiry

[40] Following an order under rule 4.2(b), information was presented to the inquiry by way of written statements, affidavits, productions and joint minutes as well as witnesses giving evidence in person.

[41] The parties entered into two joint minutes of agreement in terms of rule 4.10. They were read to the inquiry. As a result, it was not necessary for evidence to be led at the inquiry in relation to the matters contained within those joint minutes.

[42] The inquiry heard from the following witnesses. Overall, all of the witnesses did their best to assist the inquiry, and were generally credible and reliable.

RAIB witnesses

[43] A number of individuals from the RAIB gave evidence to the inquiry. Nick Bucknell , Dominique Louis, Mark Hamilton and Ash Gardner are inspectors at the RAIB. Simon French is now an independent safety consultant but was previously a chief inspector at the RAIB. Their evidence related to the investigation carried out by the RAIB into the derailment and the report prepared by the RAIB, including the conclusions of that investigation and the recommendations made to the ORR. The witnesses from the RAIB presented their evidence by way of PowerPoint slides outlining the various chapters of the RAIB report. Their evidence was clear and detailed. They were credible and reliable witnesses and did their utmost to assist the inquiry.

Network rail

[44] A number of current and former Network rail employees gave evidence to the inquiry as follows.

Paul Ashton

[45] Paul Ashton is 53 years of age and the Head of Operational Safety and Assurance at Network Rail. At the time of the accident, he was Head of Operations, Principles and Standards. At that time, his key responsibilities were to look at the suite of operational standards and controls in place, covering multiple operating roles from signalling, mobile operating managers, response teams, electrical controls and route control activities and the competence arrangements for each of those operating roles across Network Rail. His evidence related to the written instructions, guidance and procedures as a means of risk control in the railway industry; the standards and guidance in relation to calling Extreme Weather Action Team/Teleconference ("EWAT"); the way in which the system of governance within Network Rail has changed since the derailment and the responsibilities of each team within the new governance structure. Mr Ashton gave detailed evidence to the inquiry. He was entirely credible and reliable.

Ross Moran

[46] Ross Moran is 49 years old and is Route Director in Network Rail. At the time of the accident he was Head of Operations Delivery in Network Rail. In that role he managed the signallers, and the hierarchy of management in signalling, namely the

mobile operations managers, local operations managers, operations managers, and regional operations manager, as well as the managed stations, electrical control and resourcing function. Mr Moran gave evidence on his responsibilities at the time of the accident; how he became aware of the derailment on 12 August 2020; his actions on that day; the nature of the railway rulebook and compliance with the rulebook on the date of the derailment; EWATS; the changes made to control following the derailment as regards weather management. Mr Moran gave clear and straightforward evidence to the inquiry. He was entirely credible and reliable.

Mona Sihota

[47] Mona Sihota is 54 years of age. She is Technical Head of Drainage and Lineside at Network Rail. Ms Sihota is a chartered civil engineer, with around 36 years of experience working on the railway in the UK and USA. She joined Network Rail in 2001 and held a number of roles within the organisation. At the time of the derailment she held the position of Professional Head of Drainage for Off-track and Asset Protection. Ms Sihota gave evidence about the history and nature of her role including at the time of the derailment; the effect of an improvement notice issued by the ORR in 2012/2013 following severe flooding and the response by Network Rail; the Network Rail standards and competencies for drainage and the drainage systems manual; the system and process of inspection of drainage assets including training given in relation to inspection; the design elements of the new system of drainage at Carmont following the derailment, including the Network Rail system for the recording drainage assets

("Ellipse") and the retention of health and safety files for construction projects; an explanation of the national catchment assessment tool; and how reports are made to Network Rail from members of the public in relation to problems with drainage assets.

[48] Ms Sihota was an impressive witness, who gave clear and detailed evidence on a number of highly technical matters. She was entirely credible and reliable.

William (Billy) McKay

[49] William McKay is 57 years old. He is a civil engineer. At the time of the derailment he was Programme Manager within Network Rail. His role was to oversee projects across the Network Rail estate. In 2010/2011 Mr McKay was the Project Manager for the rockfall protection work/drainage improvement works at Carmont. Mr McKay gave evidence about his role as project manager on that project; the nature of those works including the design and build contractual arrangements; his role in relation to the works and project including site visits; the system of handover of the project from the contractor; there being no health and safety file for the project and why that was the case. Mr McKay clearly took the experience of giving evidence to the inquiry very seriously. He was open and honest and I considered him to be a credible and reliable witness.

Stuart White

[50] Stuart White is 59 years old and is retired. Prior to his retirement in March 2024, he was Head of Programme Management at Network Rail, a post he had held

since 2014. In that role he oversaw project management within Network Rail. Mr White gave evidence about the construction design management regulations; the handover of construction projects including the submission of a health and safety file; the issue of non-compliance within Network Rail in relation to obtaining health and safety files on completion of projects generally and what was done to remedy that both before and after the derailment. Mr White's evidence was in short compass, however, he gave clear and straightforward evidence, and I found him to be entirely credible and reliable.

Russell Shanley

[51] Russell Shanley is 44 years old. He is Head of Programme Management with Network Rail. At the time of the derailment he was a Programme Manager working on an electrical safety programme focussing on workforce safety. He gave evidence about the Mair and Slingo reports (see further below) including why they were commissioned, what they recommended and how the recommendations were implemented; the creation of the Weather Risk Task Force in 2021 and improvements to Network Rail's processes and systems in managing weather-related risks including EWATs and the use of the convective altering tool system; and the inspection of "at risk" earthworks and drainage assets. He was entirely credible and reliable.

Karl Grewar

[52] Karl Grewar is 45 years old. He is a Programme Manager for Network Rail. At the time of the derailment, he was the Head of Integrated Control. Mr Grewar gave

evidence about the nature of that role; his actions on 12 August 2020, the weather on that day; the EWAT procedure; the gold command structure and how procedures have changed post-Carmont. Overall, I consider that Mr Grewar was doing his best to tell the truth. However, his evidence regarding the informal discussion that took place on 12 August 2020 and how that compared to a formal EWAT was vague. While that did not affect my overall assessment of his credibility and reliability, it did affect my assessment of that chapter of his evidence, on which I placed limited weight.

Alastair Macfarlane

[53] Alistair McFarlane is 49 years of age and is the Head of Engineering and Asset Management for Civil Engineering in Scotland's Railway, in Network Rail. At the time of the derailment, he was the Regional Asset Manager for Geotechnics Drainage and Offtrack. Mr McFarlane gave evidence about the improvement works carried out at the site of the derailment since the accident, including the topography of the site, the drainage works and installation of gathering rails and guard rails; the system of risk assessment of earthworks; the Slope Safety Review Group and the use of helicopters and drones for aerial survey of assets and as a route proving mechanism; the use of operational route sections and processes for imposing speed restrictions; changes to the EWAT process; and earthwork failure detection systems. Mr McFarlane presented as a knowledgeable and straightforward witness who gave clear and detailed evidence to the inquiry. He was credible and reliable.

David Harkin.

[54] Mr Harkin is 36 years old and is the Weather Resilience and Climate Change Adaption Strategy Manager for Network Rail. His role is to prepare the railway in Scotland for future climate changes. His evidence related to climate change, its impact on railway operations and how risks posed to the railway by our changing climate might be mitigated. Mr Harkin's evidence comprised a detailed PowerPoint presentation on these matters. He was credible and reliable.

The ORR

[55] Anna O'Connor of the ORR gave evidence to the inquiry regarding the investigation carried out by the ORR, the recommendations made to it by the RAIB and the extent of implementation of the recommendations. Ms O'Connor presented as an experienced and impressive witness. She gave evidence by way of a sworn affidavit and oral evidence to the inquiry. Her evidence was detailed and considered. For the avoidance of doubt, I placed no weight on any evidence given in relation to her instructions to the ORR's legal team, nor did I consider it to detract from her otherwise impressive evidence on the relevant matters before this inquiry.

5. Background to rail operations in Scotland

[56] The evidence relating to the way in which the railway is operated in Scotland, and the ownership and leasing arrangements pertaining to train 1T08, was a matter of

agreement (paragraphs 20 to 24 of the first joint minute). In order to understand the matters discussed in this determination, the position can be summarised as follows.

[57] Network Rail Infrastructure Limited ("Network Rail") owns and operates Great Britain's railway infrastructure. Maintenance work on Scotland's rail network is carried out by Network Rail, and by Network Rail's approved contractors, with contracts awarded through a formal procurement process.

[58] At the time of the derailment, the franchise for the operation of passenger rail services in Scotland (branded "ScotRail" services) was held by Abellio ScotRail Limited. On 1 April 2022, the operation of ScotRail services was transferred into the public sector to ScotRail Trains Limited and Abellio ScotRail Limited stopped operating rail services. In this determination, I shall refer to "ScotRail" and when I do so, those references should be read in the context of these relevant dates.

[59] The Route Control room at the West of Scotland Signalling Centre is located at Cowlairs Depot, Springburn, Glasgow. It is a shared complex and at the time of the derailment, staff within were employed by Abellio ScotRail Limited and by Network Rail. Route Control delivers a 24-hour service, seven days a week.

[60] Train 1T08 was owned by The Great Rolling Stock Company plc, a member of the Angel Trains group of companies, and leased to Angel Trains Limited. Angel Trains Limited leased train 1T08 to Abellio ScotRail Limited. Abellio ScotRail Limited operated train 1T08. It was an InterCity High-Speed Train ("HST").

[61] In addition, while there was no dispute about the location of the accident site, in order to understand references to it and other locations on the railway in this

determination, the following is helpful context provided by the RAIB report and the evidence of Mr Bucknell.

[62] The railway line on which the accident took place is part of the Edinburgh to Aberdeen line, known as the East Coast (Northern) Line ("ECN"). The section of the line at which the accident took place is known as "ECN5". ECN5 extends between a point just south of the village of Craigo near Montrose and north to Aberdeen Railway Station.

[63] The "down line" is the railway line carrying northbound trains (trains travelling north towards Aberdeen). The "up line" is the railway line carrying southbound trains (trains travelling south from Aberdeen towards Dundee). Locations on this section of the railway are described by reference to the distance of the location from Carlisle and referred to as "mileposts" or "ECN5 [number] miles". To give a more exacting description of a particular location on the railway, locations are sometimes described by reference to the milepost/miles followed by yards. The distance in yards is sometimes described by reference to "chains". A chain is equal to the distance of 22 yards. There are 80 chains in one mile. By way of an example, Laurencekirk railway station is located at 210 miles and 44 chains. Stonehaven railway station is located at 224 miles and 74 chains. The washout struck by train 1T08 on 12 August 2020 was located between 220 miles and 1610 yards, and 220 miles and 1621 yards.

6. The RAIB investigation

[64] The RAIB was established by the Railways and Transport Safety Act 2003 (as amended) to investigate, amongst other things, any serious railway accident and to try to determine what caused it. The purpose of the investigation is to improve RAIB safety by preventing future railway accidents, or by mitigating their consequences. The RAIB does not consider or determine blame or liability. The investigation is carried out in accordance with the Railways Accident Investigation and Reporting Regulations 2005 (as amended).

[65] The RAIB's investigation into this derailment was carried out in parallel to a Joint Investigation carried out by the Police Service of Scotland, British Transport Police and the ORR under the direction of the Crown Office and Procurator Fiscal Service. Owing to the overlap between those investigations, a Memorandum of Understanding between the RAIB, Crown Office and Procurator Fiscal Service, British Transport Police, Police Scotland, and the ORR dictates how evidence is shared among those different parties.

[66] The RAIB was notified of the accident at Carmont at around 10.10am on 12 August 2020. The RAIB's "accredited agent" arrived on site and was appointed at 12.52pm. An "accredited agent" is a member of railway staff that the RAIB has trained to act in specific circumstances on behalf of the RAIB. They take legal powers from the RAIB for a short period of time in order to act on site on the RAIB's behalf while the RAIB are travelling to site.

[67] RAIB inspectors arrived at the site at 6pm on 12 August 2020, with a team of five staff deployed on that date. Further RAIB staff and resources attended over the following days and weeks. The RAIB inspectors worked in difficult conditions with a number of hazards for example, sharp metal edges, unstable vehicles, diesel leakage and damaged batteries.

[68] The last rail vehicle was uplifted from site on 15 September 2020. The line reopened for rail traffic on 3 November 2020 after the installation of new drainage and improvement works at the site.

[69] The train was taken to a secure site for further detailed examination. As part of that examination, samples were taken from the train and tested against samples taken from the site in order to establish what happened during the accident.

[70] Following its investigation, the RAIB published its report in March 2022 (updated in January 2024). It is a detailed, comprehensive and impressive document. The investigators involved in that investigation gave evidence to the inquiry on the investigation and the conclusions reached in their report.

[71] At an early stage of the inquiry, parties were asked to confirm to the court any parts of the RAIB report that they disputed. That was in line with established practice in FAIs of this kind (see further below). All participants to the inquiry accepted the terms of the RAIB report. Its content was undisputed.

[72] There were matters considered by the RAIB in its investigation in respect of which the Crown sought to lead evidence over and above the conclusions of the RAIB. One such matter was evidence regarding the likelihood of Network Rail taking the

actions needed to avoid the accident had it convened an EWAT on the morning of 12 August 2020. That was the sole "disputed issue" identified by the Crown arising from the RAIB report. For the reasons already outlined in my previous decision (particularly, paragraphs 53 to 55) I allowed additional evidence to be led on this issue. However, in leading that evidence, the Crown in no way sought to challenge the terms of the RAIB report. The evidence led in respect of that issue was relevant both to sections 26(2)(e),(f),(g) as well as sections 26(1)(b) and (4).

[73] In addition and in any event, the RAIB report obviously only dealt with information available to it up to the point of its publication. The inquiry heard evidence regarding the implementation of the RAIB recommendations as well as other work carried out by the rail industry in response to the derailment.

[74] As I identified in my decision following the hearing on 24 September 2025, the matters addressed by the RAIB in its investigation and report, and the matters which I am obliged by statute to address in my determination are not identical. I am obliged to consider all the evidence presented to the inquiry and to make a determination on the matters set out in section 26 of the Act.

The RAIB report

[75] The RAIB report and the evidence from the RAIB inspectors formed a significant portion of the evidence at the inquiry and given the specialist and technical nature of the report, I do not seek to do a disservice to the careful and detailed work of the inspectors by repeating its terms at length. However, given the importance of the report, the fact

that no party has sought to dispute its terms and the significant weight I have placed upon it, I have referred to relevant findings of the RAIB investigation and conclusions reached throughout this determination. The full report and synopsis (version 2, January 2024) were lodged in this inquiry as production 1661. However, they are also publicly available here: *Report 02/2022: Derailment of a passenger train at Carmont - GOV.UK*.

[76] A summary of the conclusions reached by the RAIB in relation to the cause of the derailment (including the immediate cause, other causal factors, other issues considered in relation to causation and underlying factors) is set out at in the synopsis of the report at S82 to S87. The detailed analysis and conclusions in respect of those matters is set out at pages 67 to 175 of the substantive report. The RAIB also examined the consequences of the derailment, including amongst other matters, analysis of the crashworthiness performance of vehicles, comparison with modern rolling stock, the fire that took hold in the leading power car and coach B, and the emergency response (see S88 to S89, and pages 176 to 208 of the substantive report). It made certain additional observations arising from its investigation, including railway industry processes for route proving; the use of GSM-R radio system by ScotRail staff; and Network Rail's standard relating to the examination of "mixed cuttings" (see S90 and pages 209 to 214 of the substantive report). It had regard to the actions the railway industry had taken to the point of publication of the report (see S91 to 93 and pages 222 to 224 of the substantive report). It made 20 safety recommendations for the improvement of railway safety (see S94 and pages 225 to 234 the substantive report) and identified one learning point regarding the use of GSM-R radio (S96 and page 235 of the substantive report).

The RAIB's approach to causation

[77] As set out in the preface to the report, and as confirmed by Nick Bucknell in his evidence to the inquiry, the RAIB report requires to be read in the context of its approach to causation.

[78] Where the report describes a factor as being linked to cause and the term is unqualified, the RAIB has satisfied itself that the evidence supports both the presence of the factor and its direct relevance to the causation of the accident or incident that is being investigated. Where the RAIB was less confident about the existence of a factor, or its role in the causation of the accident or incident, the RAIB has qualified its findings by use of words such as "probable" or "possible" as appropriate. Where the RAIB considered there was more one than potential explanation, one factor may be described as being "more" or "less" likely than the other.

[79] Where a factor is described as "underlying", those factors are also relevant to the causation of the accident or incident but are associated with the underlying management arrangements or organisational issues (such as working culture). The words "probable" or "possible" can also be used to qualify "underlying factor".

[80] "Probable" means that although it is considered highly likely that the factor applied, some small element of uncertainty remains. "Possible" means that although there is some evidence that supports this factor, there remains a more significant degree of uncertainty.

[81] An "observation" is a safety issue discovered as part of the investigation that is not considered to be causal or underlying to the accident or incident being investigated, but does deserve scrutiny because of a perceived potential for safety learning.

The causes of the accident

Immediate cause

[82] The RAIB's investigation concluded that the immediate cause of the accident was that train 1T08 derailed because it struck washout debris (S72 and paragraph 72 of the substantive report).

Other causal factors

[83] The RAIB identified other causal factors as follows:

1. Had the drainage system been installed in accordance with the design it is highly likely to have safely accommodated the flow of surface water on 12 August 2020. However, as installed, the drainage system was unable to do so. This was because:
    (a) The gravel in the drainage trench was vulnerable to washout if large flows of surface water concentrated onto a short length of drain.
    (b) Carillion did not construct the drain in accordance with the designer's requirements. (See RAIB report, S83 and paragraphs 91 to 114 of the substantive report).

[84] RAIB also identified the following possible causal factors:

(a) Network Rail's project team were probably unaware that the 2011/12 drain was significantly different from that intended by the designer and therefore did not take action. Had the team been aware of this, it is possible the consequent risk would have been recognised and remedial actions taken.

(b) Network Rail's processes that were intended to ensure a managed transfer of safety-related information from constructor to infrastructure manager were ineffective. Had this managed transfer taken place in accordance with Network Rail's processes, it is possible that the divergence between the design intent and the asset that had been delivered would have been noted and remedial action taken.

(c) No action was taken by Network Rail or Carillion when water flow in a gully (known as "gully 1"- described below at paragraph 166 below) caused slight erosion to the gravel surface of the new drainage trench before the works were completed. This was a missed opportunity to recognise the effect of the bund on water flows, and is therefore considered to be a possible causal factor in this accident. (See RAIB report, S84 and paragraphs 160 to 185.)

[85] With regard to railway operations, RAIB identified the following causal factors:

(a) Network Rail did not have suitable arrangements in place to allow timely and effective adoption of additional operational mitigations in case of extreme rainfall which could not accurately forecast.

(b) Although aware of multiple safety-related events caused by heavy rain, route control staff were not required to, and did not, restrict the speed of train 1T08 northwards from Carmont to Stonehaven.

(c) The signaller and driver were not required to, and consequently did not, restrict the speed of train 1T08 to below that normally permitted. (See RAIB report, S85 and paragraphs 189 to 246).

Other issues

[86] The RAIB also identified the following as being issues that cannot be completely discounted as factors in the Carmont accident. However, the evidence available to the RAIB was insufficient to consider them to be causal. In other circumstances, they could have been a factor in an accident:

(a) the HST lifeguards (the metal brackets fitted to the front of the train intended to disperse debris and other objects on the track) were less robust than those on more modern trains. Although a stronger modern lifeguard may have been better able to move sufficient washout debris out of the path of the leading wheelset to prevent the derailment, the RAIB had insufficient evidence to determine the likelihood of that happening.

(b) Network Rail's process for initiating the inspection and maintenance of new drainage works had not been correctly applied. Consequently, it is likely that the upper section of the 2011/2012 drainage system had never been inspected. The RAIB found no evidence to suggest that an inspection

would have changed the outcome but that cannot be entirely discounted. Regardless, RAIB found that the absence of proper inspection of a safety critical asset is of great concern.

(c) Neither RAIB or Network Rail could find any trace of the health and safety file for the Carmont drainage works. The RAIB found evidence that Network Rail's processes relating to the creation and management of H&S files were not being correctly applied in Scotland and elsewhere in the UK.

(d) Custom and practice in Scotland's route control meant that extreme weather action team meetings were not always convened when required by Network Rail's processes and no such meeting was called on 11 or 12 August 2020 despite forecasts of severe weather. However, even if an EWAT had been convened the RAIB considered it unlikely that Network Rail would have taken the actions needed to avoid the accident. (See RAIB report S86 and paragraphs 267 to 298).

Underlying factors

[87] RAIB identified the following underlying factors:

1. Network Rail's management processes had not addressed weaknesses in the way it mitigated the consequences of extreme rainfall events for the following underlying reasons:

   (i) Despite an increasing awareness of the threat, Network Rail had not sufficiently recognised that its existing measures did not fully address

the risk from extreme rainfall events such as summer convective storms. Consequently, areas of significant weakness had not been addressed;

(ii) Network Rail's management assurance processes did not highlight the extent of any areas of weakness in the implementation of extreme weather processes in route controls or that controllers lacked the necessary skills and resources to effectively manage complex weather-related situations like those experienced on 12 August 2020. Consequently, significant areas of weakness in the railway's risk mitigation measures were not fully addressed;

(iii) The railway industry's risk assessments had clearly signalled that earthwork/drainage failure due to extreme rainfall was a significant threat to the safety of the railway. However, they had not clearly identified potential areas of weakness in the existing operational mitigation measures.

2. Despite an awareness of the risk, Network Rail had not completed the implementation of additional control measures following previous extreme weather events. It was possible that better delivery of change in response to safety learning would have resulted in actions that would have prevented or mitigated the consequences of the accident at Carmont. (See RAIB report S87 and paragraphs 318 to 397).

Examination of consequences

[88] The RAIB considered in detail the consequences of the accident which informed a number of its recommendations (see RAIB report S88 and 89, and paragraphs 451 to 565). The factors examined were as follows: the circumstances of the derailment, including the train speed, local topography and proximity to a bridge; the structural damage to the train vehicles; the unusually low number of passengers on the train; the crashworthiness of the vehicles including the severity and cause of injuries suffered by those on the train and a comparison with modern rolling stock; guidance of derailed vehicles; fire causation and effect; and evacuation of survivors and emergency egress.

[89] A significant portion of the evidence before this inquiry related to the RAIB's findings in relation to the consequences of the derailment. The parts relevant to this inquiry are considered and referenced in detail in this determination. I do not consider it necessary to summarise this part of the RAIB's report as it is referenced extensively in this determination.

Additional observations

[90] The RAIB made the following additional observations:

(a) Railway industry processes for the operation of route proving trains were poorly defined and inconsistent.

(b) Use of the GSM-R radio system by ScotRail staff would have broadcast emergency information to other railway staff more quickly.

(c) Network Rail's standard relating to the examination of mixed cuttings was open to differing interpretations, and so left a potential gap in the management of risk from soil components of mixed slopes. Although it was generally understood by local examiners that it was desirable to traverse the slope of a mixed cutting to view it from the bottom and top, the inability to do so was not always reported to Network Rail. (See RAIB report, S90 and paragraphs 566 to 584).

RAIB's Recommendations

[91] As a result of its investigation, the RAIB made 20 recommendations for the improvement of railway safety addressed to the ORR. The recommendations are detailed and comprehensive (see RAIB report S94; and paragraph 638). For each recommendation, the RAIB identified the party or parties it considered required to take action if the intent of the recommendation was to be met, known as "end implementers". In his evidence, Nick Bucknell summarised the general nature of each recommendation, how it related to the findings in the report and the end-implementer. In brief summary, the recommendations were as follows:

Recommendation 1

[92] The RAIB found that the drain (the 2011/12 drain) was not installed as designed, and the RAIB recommended that Network Rail improve the management of civil engineering construction activities

Recommendation 2

[93] The RAIB found that "as built" information relating to the drain was not handed over to the "maintainer". The RAIB recommended that Network Rail should ensure that all new works are incorporated into inspection and maintenance regimes.

Recommendation 3

[94] The RAIB found that the gravel in the drainage trench was washed out when subjected to concentrated flows on a short length. The RAIB recommended that Network Rail should enhance design processes for new drainage schemes to ensure that the risk of such washouts is minimised

Recommendation 4

[95] The RAIB found that the upper parts of the earthworks at Carmont were not examined prior to the derailment, and recommended that Amey who was the contractor undertaking the examinations, and Network Rail who contracted the work to Amey, should undertake a review of how earthwork examination processes for mixed cuttings are being implemented.

Recommendation 5

[96] The RAIB found that incomplete earthwork examinations were not being notified to Network Rail and recommended that Network Rail should evaluate the adequacy and

ways of improving the clarity of the relevant standard relating to earthworks examinations.

Recommendation 6

[97] The RAIB found that Network Rail's operational procedures did not adequately address extreme and volatile rainfall events, such as summer convective storms. The RAIB recommended that Network Rail should improve processes for implementing mitigations for weather-related risks.

Recommendation 7

[98] The RAIB found that the route control room was unable to effectively manage the situation in Scotland on the morning of 12 August 2020. The RAIB recommended that Network Rail should improve the capability of route control rooms to effectively manage complex, widespread and unusual incidents.

Recommendation 8

[99] The RAIB found that Scotland's integrated control room had not been subject to adequate audit, monitoring or review. The RAIB recommended that Network Rail improve management assurance of route control functions.

Recommendation 9

[100] The RAIB found that the learning from previous events had not been applied effectively, and recommended that Network Rail identify and address the obstacles to effective implementation of lessons learned from accidents and incidents.

Recommendation 10

[101] The RAIB found that Network Rail's engineering risk analysis assessed operational risk mitigation measures as being optimal. The investigation revealed this not to be the case and the RAIB recommended that Network Rail should consider risk assessment of the mitigating control measures that relate to the failures of earthworks and drainage.

Recommendation 11

[102] The RAIB found a lack of clear and consistent rules about the operation of "route proving" trains (trains used to establish the condition of a rail route, often utilised after, amongst other things, adverse weather). The RAIB recommended that Network Rail, assisted by the Rail Safety and Standards Board and by the Rail Delivery Group, should clarify the arrangements to be applied for the route proving of trains.

Recommendation 12

[103] In relation to the way in which a train runs after derailment (known in the rail industry as "guidance of derailed vehicles"), the RAIB found that the derailed train 1T08

did not stay close to the track after it derailed. The RAIB recommended that the Rail Delivery Group and Network Rail, in conjunction with the Rail Safety and Standards Board, should undertake an assessment of measures to provide improved guidance to derailed trains.

Recommendation 13

[104] Related to recommendation 12, the RAIB also recommended that Network Rail should review standards applying to the installation of guardrails and containment kerbs at high-risk locations.

Recommendation 14

[105] The RAIB found that the leading wheels of train 1T08 lifted clear of the rail when running in a relatively shallow debris field. The RAIB recommended that owners of high-speed train power cars should investigate the feasibility of strengthening the lifeguards on high-speed train power cars to better protect the wheels from obstacles.

Recommendation 15

[106] The RAIB found that glass in the windows of train 1T08's passenger coaches broke into long and potentially dangerous shards. The RAIB recommended that the Rail Safety and Standards Board ("RSSB") should undertake a review of current train glazing standards to minimise the risk of lacerations.

Recommendation 16

[107] The RAIB found that the bodyside mounted folding tables had sharp edges when folded down (in a collapsed position). The RAIB recommended that Angel Trains, in conjunction with ScotRail, should modify bodyside mounted folding tables to reduce the risk of injury to passengers in case of accidents.

Recommendation 17

[108] The RAIB found that the protection of train drivers remains a safety concern. The RAIB recommended that the RSSB should undertake a review of previous research on fitting secondary impact protection for train drivers, for example seat belts and airbags.

Recommendation 18

[109] The RAIB found no clear criteria for the extent of corrosion that is permissible in safety critical areas of rolling stock. The RAIB recommended that owners of mark 3 passenger coaches and other rolling stock susceptible to significant levels of corrosion should establish criteria for the allowable extent of corrosion in safety critical areas of rolling stock.

Recommendation 19

[110] The RAIB found that the damage to train 1T08 was very extensive. A significantly higher casualty toll would have been likely if the train had been heavily

loaded with passengers. The RAIB recommended that operators of high-speed trains, in consultation with rolling stock owners, should undertake an assessment of the additional risk to the vehicle occupants associated with the lack of certain modern crashworthiness features on high-speed trains, and the development of industry guidance for assessing and mitigating the risk associated with continued operation of high-speed trains, which were designed before the introduction of modern crashworthiness standards in 1994.

Recommendation 20

[111] The RAIB found that the fire in coach B was associated with the train's batteries. The RAIB recommended that the RSSB should undertake an investigation of alternative designs of batteries and their casings, which offer improved fire properties.

7. Criminal proceedings

[112] It was a matter of agreement that after the derailment, a joint investigation was carried out by the Police Service of Scotland, British Transport Police and the ORR under the direction of the Crown Office and Procurator Fiscal Service. Following that investigation, Network Rail was the subject of a criminal prosecution. On 7 September 2023 at the High Court in Aberdeen, Network Rail pled guilty to a contravention of the

Health and Safety at Work etc Act 1974, sections 3(1) and 33(1)(a). The charge was as follows:

> "between 1 May 2011 and 12 August 2020, both dates inclusive, on the railway line between Dundee and Aberdeen, near Carmont, Aberdeenshire, the West of Scotland Rail Operating Centre, 90 Cowlairs Road, Glasgow and elsewhere in Scotland, you NETWORK RAIL INFRASTRUCTURE LIMITED, being an employer within the meaning of the aftermentioned Act, did fail to conduct your undertaking in such a way as to ensure, so far as was reasonably practicable, that persons not in your employment who may have been affected thereby were not exposed to risks to their health and safety in that you did fail to ensure, so far as was reasonably practicable, that railway workers not in your employment and members of the public travelling by train were not exposed to the risk of serious injury and death from train derailment as a result of failures in the construction, inspection and maintenance of drainage assets and in adverse and extreme weather planning, and in particular you:
>
> (a) did fail to ensure, so far as was reasonably practicable, that a drainage asset located off-track of the Dundee to Aberdeen railway line between Montrose and Stonehaven, near Carmont, Aberdeenshire [hereinafter referred to as "said drainage asset"] constructed between 1 May 2011 and 31 December 2012, both dates inclusive, by your appointed contractor Carillion plc was constructed properly and was constructed in accordance with the design drawings and approved deviations thereto whereby:
>
> (i) inlet and outlet holes in catchpits were not pre-formed and joints between pipes and catchpits were not sealed and made secure whereby there were gaps around the inlet and outlet pipes of catchpit 16 and catchpit 18;
> (ii) proposed catchpit 17 was not installed;
> (iii) catchpit 18 was not installed in the correct position;
> (iv) an existing field pipe was not connected to catchpit 18;
> (v) the trench between catchpit 16 and catchpit 19 was not fully lined with geotextile;
> (vi) perforations in the filter pipes included perforations around the entire circumference of the pipe and on the sides and bottom whereas they should have been facing upwards;
> (vii) between catchpit 18 and catchpit 19 a length of carrier pipe was installed instead of filter pipe;
> (viii) between catchpit 18 and catchpit 19 site won excavated material was used instead of filter aggregate of the dimensions specified by the design;

(ix) a bund of material was constructed which caused surface water flows to concentrate into a short length of the drainage trench which caused gravel to be washed out of the area of land immediately surrounding the said trench and down onto the railway track;

(b) did fail upon the completion of the construction of said drainage asset to obtain as-built drawings and to conduct a hand-over meeting with the contractors instructed by you in order to check that the drainage asset had been properly constructed and had been constructed in accordance with the design drawings and approved deviations thereto;

(c) did fail to take all reasonable steps to ensure that upon completion of said construction a health and safety file for said drainage asset was kept available for inspection and further, did fail to add all parts of the asset to the Network Rail asset register and to the Network Rail asset inspection and maintenance systems whereby the asset was not suitably and sufficiently inspected, maintained or assessed for risk of failure in adverse and extreme weather;

(d) did fail to have in place an adequate system of training and quality assurance in relation to the analysis of weather forecasts and the use of available weather forecasting tools by Route Control Management staff employed by you and based in the West of Scotland Rail Operating Centre, 90 Cowlairs Road, Glasgow, and thereby fail to ensure that the Network Rail standards and procedures for managing the risk posed by extreme and adverse weather events were complied with by said Route Control Management staff, with the result that no emergency Extreme Weather Action Teleconference was held on the morning of 12 August;

and

(e) on 12 August 2020, following a forecast of extreme rainfall and reports of severe weather, intense rainfall, landslips and flooding in Aberdeenshire and the surrounding area and in the absence of current information about the integrity of the railway line and drainage assets between Montrose and Stonehaven, you did fail to impose an emergency speed restriction on the passenger train with reporting number 1T08 being operated by Abellio ScotRail or otherwise warn the driver of the said train that it was unsafe to drive the train on a section of track between Montrose and Stonehaven with restricted visibility due to a blind bend at the line speed of 75 miles per hour and caution him to reduce his speed;

> And in consequence of (a)(i) and (ix), (b), (d) and (e) hereof, on 12 August 2020 immediately after a period of severe weather and intense rainfall, said drainage asset which had not been properly constructed failed, gravel was washed out of the drainage trench and stones and other material was eroded from the surrounding area, and washed onto the railway track whereby the said passenger train struck said washed out gravel, stones and other material causing the train to derail, decouple and strike a bridge parapet whereby the train was extensively damaged and [six passengers] were injured and Brett McCullough, employed by Abellio ScotRail as the driver of said train, Donald Dinnie, employed by Abellio ScotRail as the conductor on said train and Christopher Stuchbury, a passenger on said train were so severely injured that they died:
>
> CONTRARY to Sections 3(1) and Section 33(1)(a) of the Health and Safety at Work etc Act 1974."

[113] Network Rail was sentenced to a fine of £6.7 million. The copy narrative and plea in mitigation formed part of the evidence to this inquiry. I do not consider it necessary to set out the terms of those documents in this determination.

8. Findings in fact

[114] It is now well-established practice that a determination following a fatal accident inquiry does not require to set out findings in fact, particularly in inquiries that have followed a detailed investigation by a specialist accident investigation branch such as the RAIB (see the *Fatal Accident Inquiry into the deaths of John Barkley and others* ("the Super Puma FAI") [2014] FAI 5 per Sheriff Principal Pyle at paragraph 7; the *Fatal Accident Inquiry into the deaths of Gary Arthur and others* ("the Clutha FAI") [2019] FAI per Sheriff Principal Turnbull at paragraphs 139 to 142; and followed in a number of other inquiries such as the *Fatal Accident Inquiry into the deaths of George Thomas Allison and others* ("the Sumburgh FAI") [2020] FAI 34; *the Fatal Accident Inquiry into the deaths of*

Paul Alliston, Martin Johnstone and Christopher Morrison ("the Louisa FAI") [2022] FAI 8 and *the Fatal Accident Inquiry into the death of Carlos Hernan Correa Palacio* ("the Edinburgh Tram Inquiry") [2025] FAI 22).

[115] The Crown and the RAIB invited me to follow the same approach. No other participant sought to argue the contrary. Accordingly, in line with the above authorities, I have declined to set out findings in fact on the evidence presented to the inquiry. Rather, I have outlined each of my findings on the matters required by section 26 of the Act and have set out my reasons on the evidence and information presented at the inquiry for making those findings, and for declining to make certain findings asked of me by the Crown.

9. Reasons for findings

When and where the deaths occurred (section 26(2)(a))

[116] The date and place of the deaths of Christopher Stuchbury, Donald Dinnie and Brett McCullough was a matter of agreement. That explains my finding in relation to section 26(2)(a). While the exact time of each death is unknown, all of the evidence available to the inquiry, and in particular the post-mortem reports, confirmed that on the train derailing, death would have been immediate upon impact. Accordingly, I have concluded that each victim died immediately after the derailment of train 1T08 which occurred at 9.37am

When and where any accident resulting in the death occurred (section 26(2)(b))

[117] The date and time of the accident was uncontroversial. There was no dispute as to the place of the accident. Finding 7 above is based upon the RAIB report and the evidence of Nick Bucknall summarising the RAIB's findings in that regard. However, in light of the public interest in this inquiry, the evidence as to the sequence of events upon which this finding is made can be summarised as follows.

When the accident occurred – train 1T08 and the sequence of events

[118] Train 1T08 left Aberdeen Railway Station on 12 August 2020 on time at 6.38am. It called at Stonehaven at 6.53am hours. At 7.00am it passed the Carmont signal box when shortly afterwards it was stopped by a railway emergency call made by the Carmont Signaller in response to a report by another train (train 2B13) of a landslip on the up line at Black Bridge. On receiving the emergency call from the Carmont signaller, Mr McCullough immediately brought train 1T08 to a stop. The landslip was subsequently found to be on the up line close to Ironies Bridge, around 1 mile south of the Carmont Signal Box. Train 1T08 stopped around 570 metres before the landslip.

[119] Unable to proceed south due to the landslip, and route control being concerned about passengers being stranded in a remote location, at 7.18am route control instructed the Carmont signaller to return train 1T08 to Stonehaven. To do so, the train required to cross from the up line to the down line over the crossover at Carmont. That required a mobile operations manager (MOM) to attend to fit equipment (temporary clamps and scotches) to the points, there being no permanent clamps and scotches at the crossover

point and there being no requirement for the Carmont signal box to hold them or indeed to have the personnel trained to apply them. The MOM was based in Aberdeen and was tasked to attend at 7.40am. However, due to the adverse weather and significant flooding in the area, he arrived at around 8.55am. The temporary clamps and scotches were fitted at around 9.17am. At 9.28am the signaller instructed Mr McCullough to return train 1T08 to Stonehaven. Mr McCullough asked the signaller whether any speed restrictions were in place. He was instructed to return at line speed (75mph).

[120] Train 1T08 moved off. It passed the Carmont signal box at around 0934 hours. The train's speed increased towards 75mph. At 9.37am the train struck debris washed over the train tracks on the down line. The driver's view was obstructed until it was less than 120 metres from the debris, which the train covered in 3.5 seconds. The emergency brake was applied about one second before the train struck the debris.

Where the accident occurred

[121] The railway line on which the derailment occurred is part of the East Coast Main Line running between Edinburgh and Aberdeen. The derailment site lies within section ECN5 (described above). The Carmont signal box is the nearest signal box to the derailment site, located at ECN5, 219 miles and 39 chains. The location of the derailment was close to ECN5, 221 miles (also known as milepost 221). Further detail in relation to the nature of the location of the derailment is discussed below in relation to the cause of the accident.

The cause or causes of the deaths (section 26(2)(c))

[122] The cause of death in respect of Christopher Stuchbury, Donald Dinnie and Brett McCullough was a matter of agreement among the parties to the inquiry (paragraphs 4; 7 and 10 of the joint minute). All three victims suffered multiple non-survivable blunt force injuries owing to the train derailment.

The cause or causes of any accident resulting in the deaths (section 26(2)(d))

"Accident"

[123] The Crown made submissions as to the interpretation of "accident" in section 26 of the 2016 Act referring me to the judicial interpretation of accident in the context of road traffic legislation. The RAIB referred me to the definition of a "railway accident" in the context of the Railways and Transport Safety Act 2003 (section 2(1)) and a "serious accident" in the context of the Railways (Accident Investigation and Reporting) Regulations 2005 (regulation 2(3)).

[124] I do not consider it necessary in the context of this inquiry, to consider the definition of "accident" in any detail. A train derailment is manifestly an "accident", giving that word its plain and ordinary meaning. In any event, there was no dispute that the derailment was an "accident" in the context of the 2016 Act, no dispute as to the cause of that accident and no dispute that the accident resulted in the deaths of Christopher Stuchbury, Donald Dinnie and Brett McCullough.

Cause of the accident

[125] The cause of the accident was train 1T08 striking debris washed from a drain onto the track following a period of very heavy rainfall whilst travelling at 73mph.

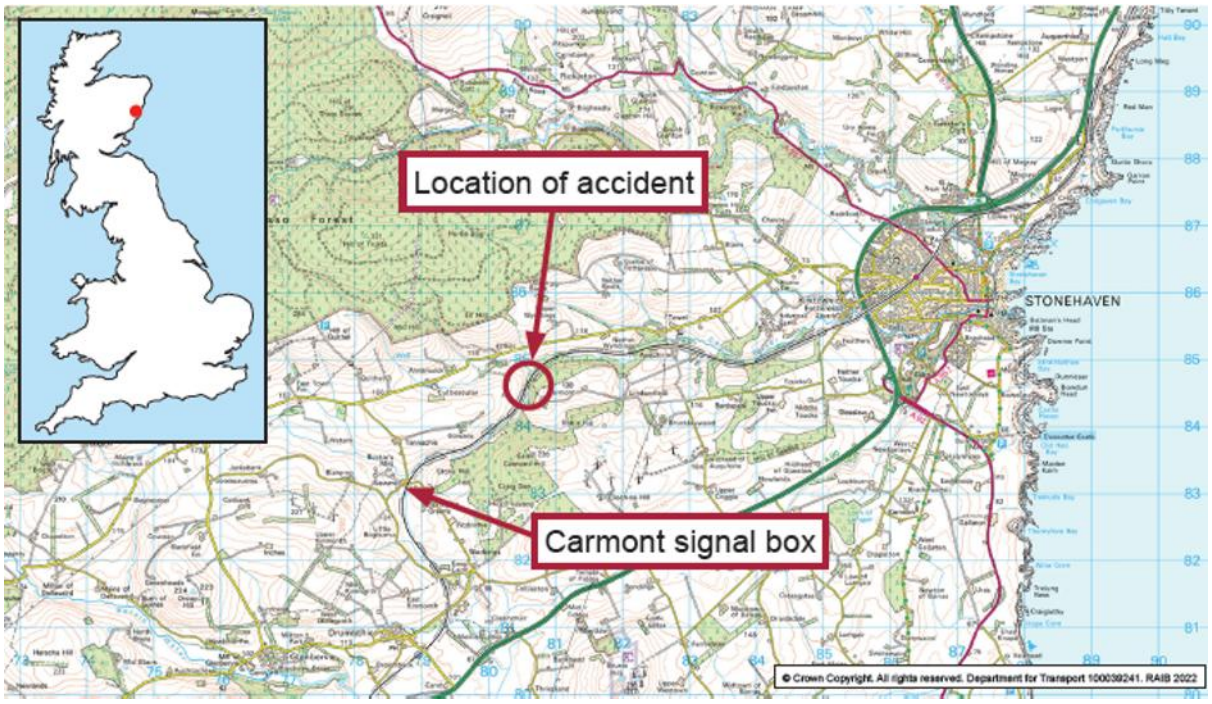
[126] I have reached that conclusion on the basis of the evidence from the RAIB. The cause of the accident was thoroughly investigated by the RAIB and set out in their detailed report. The report's conclusions as to causation were spoken to, principally by Nick Bucknall, as well as Dominique Louis. As outlined above, none of their evidence on these matters was challenged in any way, and I accepted their evidence in full. In essence, the cause of the accident was not disputed.

<u>The area of the washout</u>

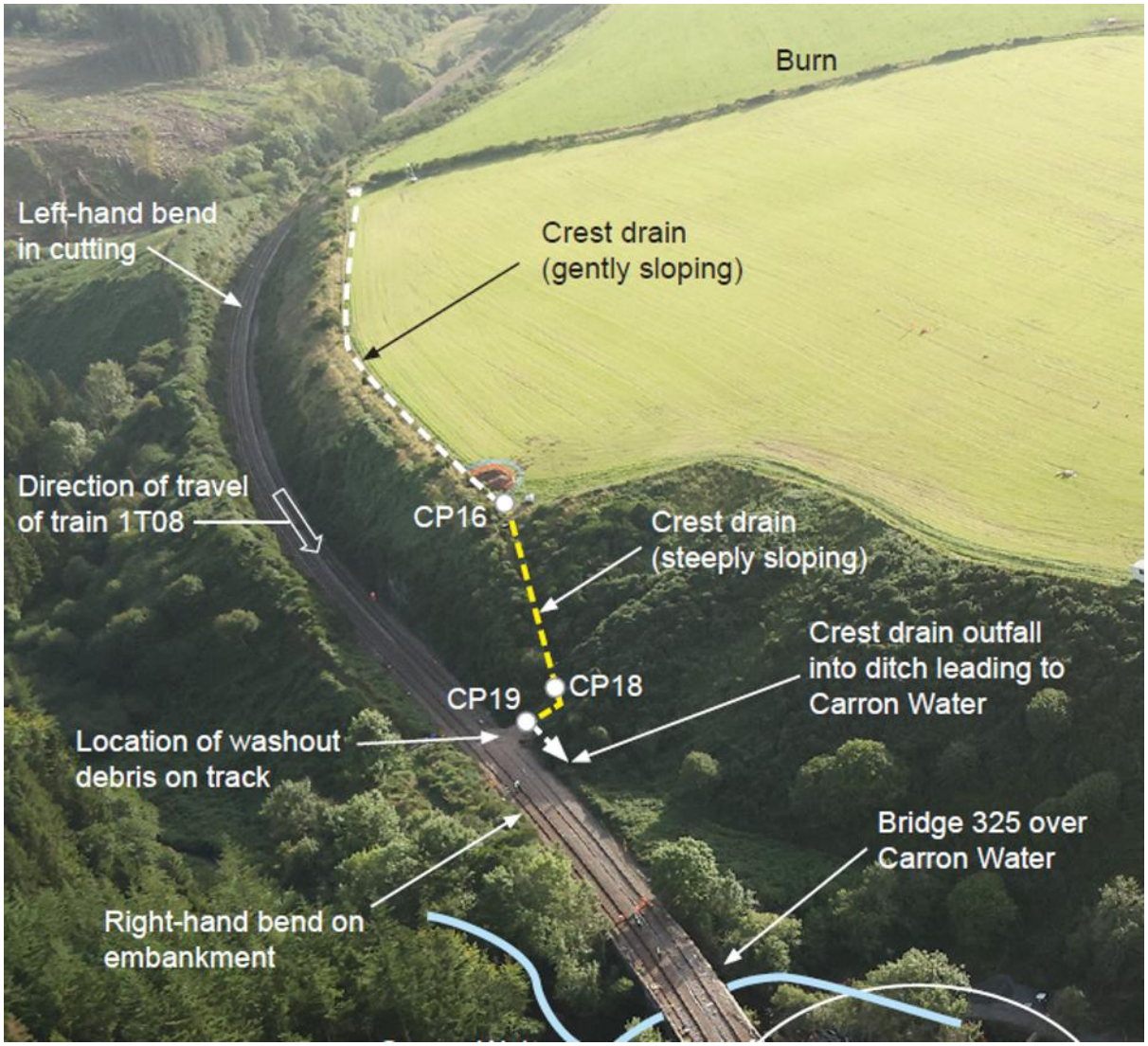
[127] At the time of the derailment, train 1T08 was travelling north on the down line towards Stonehaven, having been instructed to return there by the Carmont signaller.

[128] Heading north from the Carmont signal box, the railway runs east-north-east on a curving alignment to follow the Carron Water valley towards the coast at Stonehaven. About 2.4km north-east of the Carmont signal box, the railway is carried over the Carron Water by a bridge ("bridge 325"). Approaching bridge 325 from the south, the line runs along the west side of the river valley before entering a left-hand curve of 700m radius. This is followed immediately by a right-hand curve beginning about 100m before the bridge and becoming progressively tighter until it reaches a radius of about 700m a short distance beyond the bridge (see paragraph 7 of the RAIB report).

The location of the accident, and the area of the washout are shown in the following images:



Ref: RAIB report, figure 1 (at para 7) entitled "Extract from Ordnance Survey map showing location of accident"



Ref: RAIB report, figure 3 (para 11) entitled "Aerial image of the site (Network Rail)"

The surrounding area: the cutting

[129] Travelling north on the down line, at around 570 metres before bridge 325, the railway enters an area of deep "cutting" with steep rock faces on both side of the track. A "cutting" is a channel cut through an area of high ground during construction of the railway to allow the railway line to pass through at a shallow gradient. The cutting has man-made slopes on either side of the railway. In this case, the cutting before bridge 325

was a "mixed" cutting, comprising a mixture of rock and soil. The slope adjacent to the down line on which train 1T08 was travelling is up to 21 metres high. The cutting ends about 50 metres before bridge 325, close to the position at which the train 1T08 derailed.

The surrounding area: farmland

[130] From the top (the "crest") of the cutting adjacent to the down line, the surrounding farmland continues to rise away from the railway. Water gathered in that area (known as a "catchment") naturally flows towards the crest of the cutting. The sloping ground is vulnerable to saturation and therefore landslip. For that reason, as was the case in Carmont, the crest of the cutting will commonly have a drainage system to safely take the water away from the catchment without compromising the cutting. The drainage system at Carmont is considered in more detail below.

The weather on 11 and 12 August 2020

[131] On 11 August 2020 bands of heavy, locally intense rainfall moved northwest across Southern Scotland, the central belt and the Grampian Mountains. The rainfall reached Carmont at around 5.50am on 12 August 2020 and fell near-continuously until around 9.00am. Approximately 51.5mm of rain fell at the accident site in this period, comprising almost 90% of the average rainfall for the whole month of August (57.6mm) at Inverbervie (the nearest location in respect of which long-term data was available). There was significant flooding in and around that area.

[132] The intensity and duration of the rainfall was exceptional and was a rare weather event. The "return period" for this rainfall event (the likelihood of this rainfall event occurring) is 1 in 100 years, or 1 in 144 years depending on the methodology used. The weather on 11 and 12 August 2020 caused severe disruption and significant flooding in central and eastern Scotland.

[133] As outlined above, train 1T08 was held by the signaller at Carmont from 7.00am owing to a landslip in the Ironies Bridge area, until it was instructed to head north to Stonehaven at around 9.28 am. The last train to have passed the area of the derailment prior to the accident was train 2B13, which passed the area of the derailment at 7.07am without incident. The driver of train 2B13 saw nothing unusual between Carmont and Stonehaven.

[134] By the time train 1T08 approached the site of the derailment, the weather was dry and sunny with broken cloud.

The washout of the drain

[135] From the timing of the observations of train 2B13 on 12 August 2020, it can be concluded that the washout took place at some point between 7.07am and 9.37am (the time at which train 1T08 derailed).

[136] As train 1T08 approached the area of the washout at a speed of around 73mph, Mr McCullough's view of the washout was obstructed by the left-hand curve on the approach until it was less than 120 metres from the debris, which the train covered in 3.5 seconds. Data recovered from the train showed that the emergency brake was

applied about one second before the train struck the washout (paragraph 60 of the report). My assessment of the evidence from the RAIB witnesses and from the report was that owing to the obstructed view, Mr McCullough could not have applied the emergency brake any sooner.

[137] The location of the washout was on the down line between 220 miles 1610 yard and 220 miles 1621 yards, close to bridge 325. It comprised gravel, stone and soil covering around 10 metres of track.

[138] In his evidence, Mr Louis referred the inquiry to the evidence on which the RAIB was able to conclude that the immediate cause of the accident was train 1T08 striking the washout debris, causing it to derail. The evidence in that regard was as follows. CCTV images from both the front and rear end of the train were examined by the RAIB (the footage and still images from same were labels and productions in this inquiry). The images from the front and rear of the train showed the washout debris over the track. In addition, observations at the derailment site also supported that conclusion, namely (i) that there were no derailment marks on the track/surrounding area on the approach to the washout, suggesting that the train remained on the tracks up to the point of the washout; (ii) groove marks were observed cutting through the washout debris consistent with the passage of the train after hitting the washout; (iii) marks on the rails indicating that the leading wheelset had derailed immediately after the washout; (iv) sleeper damage was consistent with impact from several derailed wheelsets between the washout and bridge 325. No track faults were identified by the RAIB that could have initiated the derailment. Similarly, examination of the maintenance records of the

power cars and four coaches showed no outstanding defects or maintenance issues relevant to the accident.

[139] RAIB's conclusion as to the immediate cause of the accident being train 1T08 striking the washout was not challenged by any participant and I accepted the evidence comprising the report and the evidence of the inspectors in full.

[140] Evidence was also led as to what happened to train 1T08 when it struck the washout. Mr Bucknall gave an overview of the sequence of events on train 1T08 striking the washout. Mr Louis also gave evidence as to the detailed analysis undertaken by the RAIB at the site of the derailment and how the RAIB's conclusions regarding the derailment sequence were arrived at, as well as detailed evidence as to the way in which train 1T08 derailed. Again, none of that evidence as challenged and I accepted it, as well as the RAIB report on these matters in full. The way in which train 1T08 behaved on striking the washout informs not only what happened to train 1T08 on 12 August 2020 and the cause of the accident, but is also relevant to the performance of the train vehicles and their "crashworthiness" (considered in more detail below in the chapter headed "the train").

Sequence of events on striking the washout

[141] In summary, on striking the washout, the leading power car derailed to the left, deviating further as the track curved to the right. It continued running derailed for about 60 metres until it struck the south end of bridge 325's parapet. It destroyed part of the parapet and then fell off the bridge and down on to the wooded embankment below.

The driver's cab detached from the leading power car on impact with the ground, and the power car caught fire.

[142] Coaches D, C and B travelled in different directions beyond bridge 325. Coach D came to rest on its roof, almost at a right angle to the track. Coach C came to rest overturned on its roof with its trailing end facing the direction of travel. Coach B ran down the steep embankment, and came to rest on its right-hand side, subsequently catching fire. Coach A and the trailing power car remained coupled and upright.

[143] The evidence overwhelmingly pointed to train 1T08 striking the washout as being the cause of the accident. That explains finding 9 above.

Any precautions which could reasonably have been taken and had they been taken, might realistically have resulted in the deaths, or any accident resulting in the deaths being avoided (section 26(2)(e))

[144] The following sets out my reasons for making finding 10 above and for declining to make certain findings invited by the Crown, all under section 26(2)(e).

(i) The drain

[145] My findings in relation to section 26(2)(e) all broadly relate to the drain from which the debris was washed out on to the tracks and struck by train 1T08. Before detailing the reasons for my findings in relation to each of the precautions relating to the drain, it is necessary to give some background and context, all of which is based on the

terms of the RAIB report and evidence from the RAIB inspectors (Nick Bucknall). None of that evidence was disputed by any participant to the inquiry.

Background to the drain at the derailment site

[146] Prior to the derailment of train 1T08, landslips had affected the railway cuttings between Carmont and Stonehaven. One such landslip occurred in the 474 metre-long cutting slope (cutting ECN5/YD051 between 220 miles 1089 yards and 220 miles 1607 yards) near to the site of the derailment, and which blocked both lines on 21 August 2008.

[147] As a result, in 2009 Network Rail instructed Carillion Construction Limited ("Carillion") to design and construct cutting slope remedial works, including a drainage system, for the deep cutting adjacent to the site at which train 1T08 derailed.

[148] Carillion in turn instructed their sub-contractor, Ove Arup, to prepare a design for these works which included rockfall netting on both sides of the railway and a new drain running along the top of the west side (left-hand side if travelling north on the down line) of the cutting, intended to intercept water flowing over the surface and through the ground of the catchment. The new drain (referred to as "the 2011/12 drain") was to replace an old "crest drain" which was not functioning effectively and was part of an overall scheme designed to mitigate the risk of earthwork failure in an area of known risk. In December 2010, following work to remove vegetation from the cutting slope, Network Rail instructed Carillion to construct the works. It was constructed in two phases, in 2011 and 2012.

Design of the drain

[149] The 2011/12 drain designed by Ove Arup comprised, in summary, a gravel-filled trench containing a perforated pipe (sometimes referred to a "filter drain"), with the drain passing through a number of catchpits (manholes). It was designed to accommodate a water flow with a "1 in 100 year" return period.

[150] The design assumed that water reaching the surface of the drain would be distributed along substantial lengths of the drain (the normal way a drain of this kind should operate) rather than water reaching the drain as a large flow concentrated at one location. In addition, the design allowed for water to reach the new pipework through pipes from an existing burn running perpendicular to the railway at the southern and highest part of the crest cutting and from an existing drainage ditch.

[151] Following a thorough investigation by RAIB, including the joint commissioning of a series of technical and scientific testing with the ORR, the RAIB concluded that as designed, the 2011/12 drain could have accommodated the flow of water experienced on 12 August 2020. That was also the conclusion of the ORR investigation. No evidence was led during the inquiry indicating the design of the drain was defective in any way or that the design caused or contributed to the accident. I was not invited to make any finding in relation to the design of the drain. In any event, I was satisfied on the evidence that I did not require to make any findings under section 26 of the Act in relation to the design of the drain.

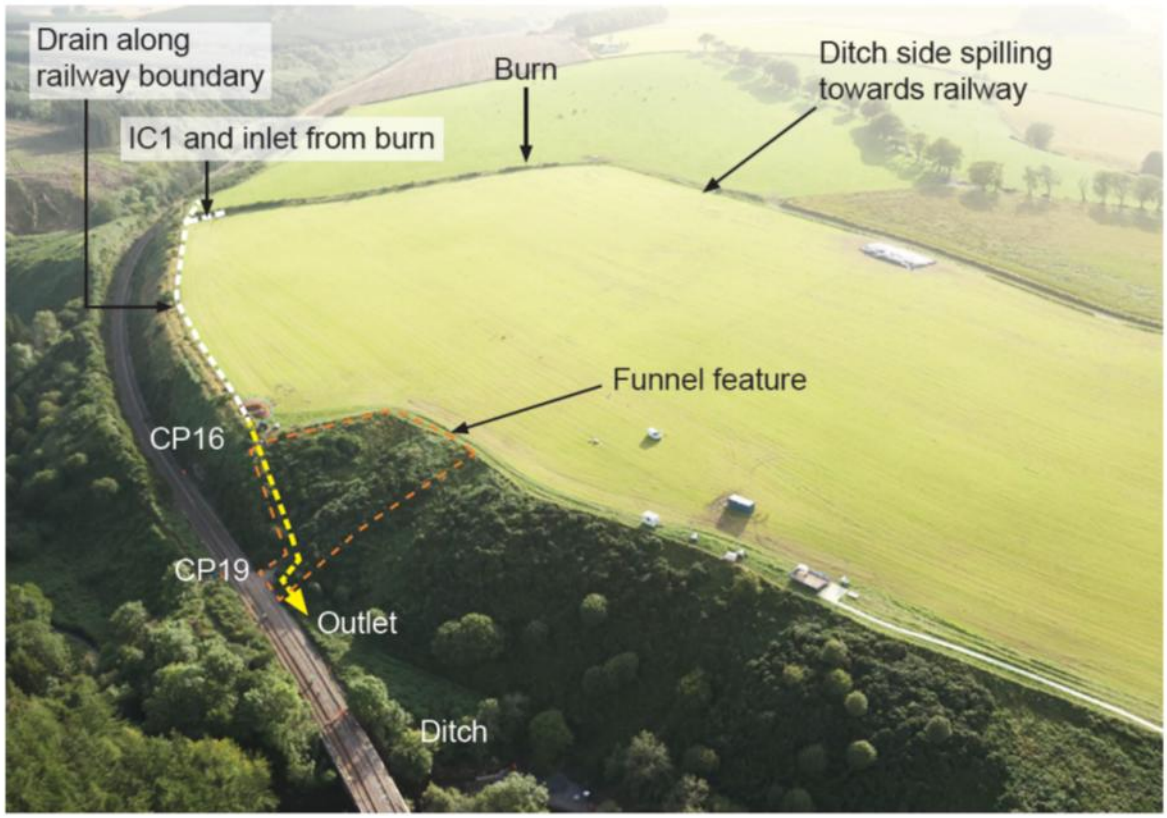
Construction of the drain

[152] The drain was not constructed/installed in accordance with the design. As a result, the drain was unable to accommodate the flow of surface water during the intense rainfall in the area on 12 August 2020.

[153] To understand the issues in relation to the construction of the 2011/2012 drain, and in turn my findings in terms of section 26(2)(e), it is necessary to briefly outline the route and features of the drain and the surrounding topography. This was information presented to the inquiry in the form of the RAIB report and the evidence of Nick Bucknall, none of which was challenged. I accepted all of that evidence.

The path of the drain

[154] As installed, the drain ran northwards from the highest part of the cutting for 372 metres to its outlet. The pipe started near an inlet which captured water from the small burn running perpendicular to the railway along a hedge line. The drain sloped gently for 306 metres along the edge of a field. It then sloped relatively steeply for 53 metres at an average gradient of 1 in 3 to track level. The final 13 metre section ran parallel to the track to an outlet into an open ditch running alongside the railway to reach Carron Water downstream of bridge 325. The path of the drain can be seen on the following image.



Ref: RAIB report, figure 25 (para 93) entitled "Post-accident aerial image of 2011/12 drainage system's catchment area (Network Rail)"

Catchpits ("CPs")

[155] Catchpits were situated at intervals along the pipe to allow for inspection and maintenance. The catchpits were assigned numbers. On the section of drain relevant to this inquiry, they were numbered 10 to 19, although catchpit 17 was not ultimately constructed.

[156] As installed, catchpit 10 was located at the southern end of the drainage works, shortly before the location of the burn running through the farmland perpendicular to the railway. Water from approximately 3.08 hectares of land drained into the burn, before entering the drain at an inlet structure close to the southern end of the drain. A

short pipe connected the inlet structure to a chamber (IC1) situated between catchpits 10 and 11.

[157] Between catchpits 10 and 16, the drain ran north and gently downhill towards catchpit 16 (catchpit 16 being situated at the top of a steeply sloping section). In total, approximately 7.43 hectares of land sloped towards the length of the drain between catchpit 10 and 16. Surface runoff was distributed along the entire length of this section of the drain due to the topography.

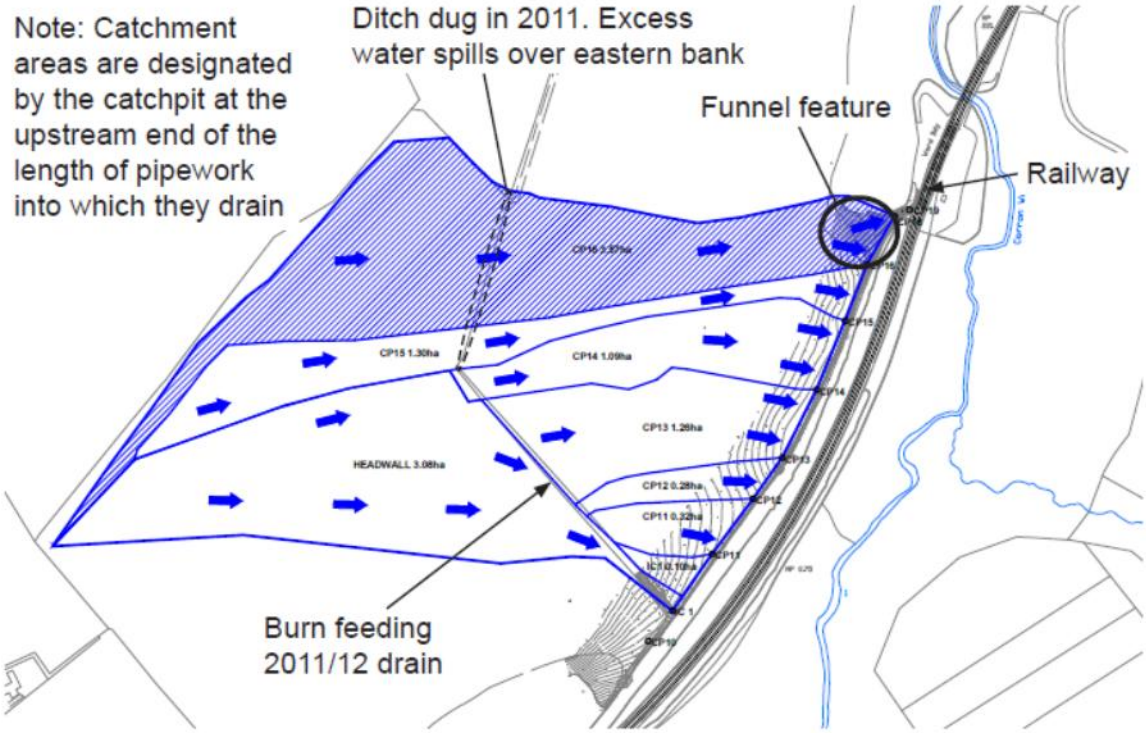
[158] From catchpit 16, the drain continued downslope for a distance of around 40 metres to catchpit 18, following the natural slope. After catchpit 18, the pipe continued in the same direction for around 1 metre, before reaching a natural channel created by a funnel feature (see further below), where it changed direction, turning sharply and on a steepening gradient towards the railway for around 12 metres to catchpit 19, situated about 5 metres from the railway. Beyond catchpit 19, the drain ran parallel to the railway to its outfall.

Funnel

[159] Catchpit 16 was located at the top edge of a natural "funnel section". The funnel was created because a large area of farmland did not slope directly towards the railway (as it did between catchpits 10 and 16). The bottom of the funnel feature formed a channel running perpendicular to the railway. That channel sloped downwards to reach the railway at the north end of the cutting.

[160] Approximately 3.57 hectares of the farmland, a relatively large area, sloped towards the top of the funnel section (referred to as the "funnel catchment"). The funnel section is shown in figure 29 of the RAIB report (below). The area shaded blue shows the area of farmland flowing towards the funnel ("the funnel catchment") the section hatched in black within that blue area shows the funnel section.

[161] The upper part of the funnel catchment was remote from the railway and upslope of a ditch running along a field boundary, approximately parallel to, and around 230 metres from the crest drain. The ditch is shown in figure 29 in black dashed lines within the blue shaded funnel catchment area.



(figure 29 from the RAIB report at para 95, entitled "Drain Catchment areas based on 2020 LiDAR data (AECOM)).

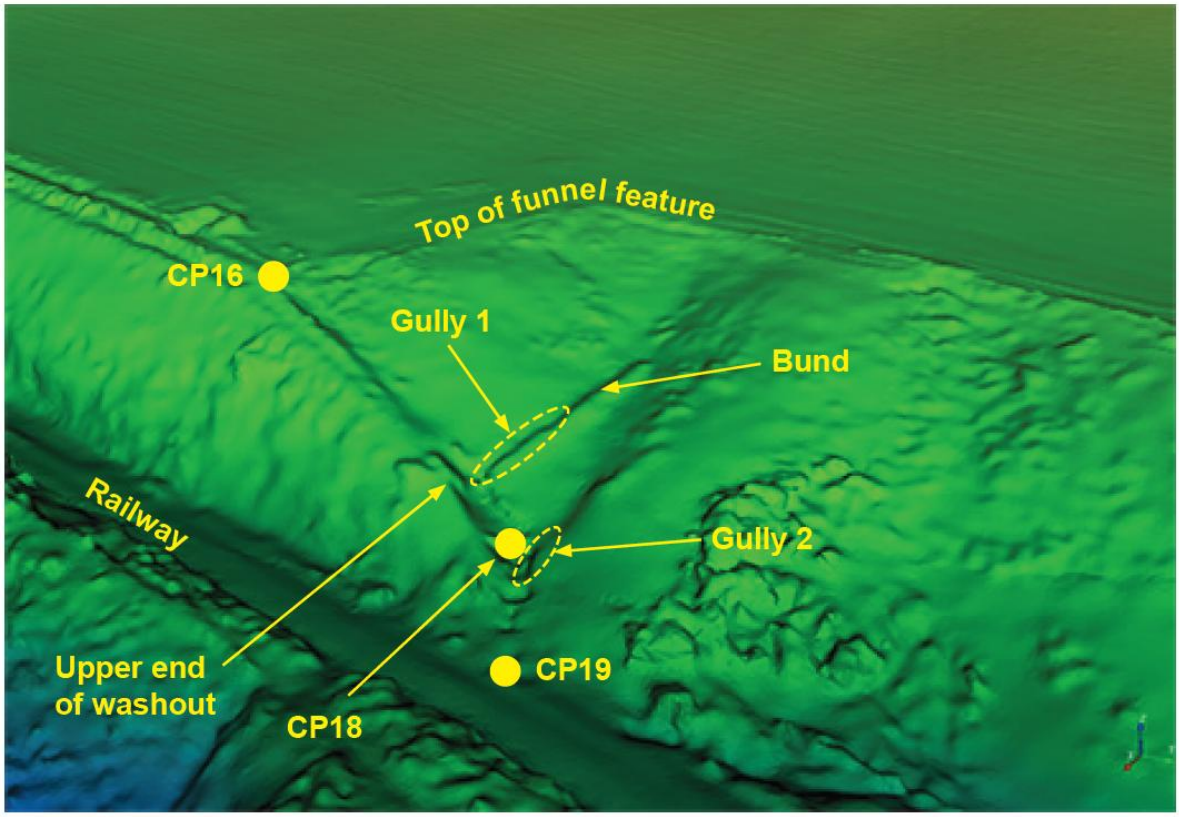
[162] The RAIB concluded that this ditch was dug in around 2011 by Carillion alongside a stone track built to provide access for the cutting stabilisation and drainage works. On the basis of post-accident surveys, the RAIB concluded that the presence and nature of the ditch meant that, if water inflow exceeded the rate of percolation into the underlying ground, water accumulating in that ditch would spill over its eastern bank onto the area of the agricultural land sloping towards the funnel, a similar route followed by water before excavation of the ditch.

[163] Before construction of the drain in 2011/12, most surface water reaching the funnel would flow into a ditch running along the lower part of the funnel (called the "pre-2010 ditch" in the RAIB report). It was connected through clay pipes into the railway drainage system alongside the track. However, the pre-2010 ditch and pipe leading from it were absent at the time of the accident (see further below).

Construction not in accordance with design

The bund

[164] In the investigations carried out after the accident, gorse covering the funnel surface was removed and a "bund" (artificial ridge) was discovered at the funnel surface. The presence of and location of the bund is best shown on the following image.



Ref: RAIB report, figure 35 (para 97) entitled "Post-accident funnel details shown on 2020 LiDAR data"

[165] I accepted the evidence of Nick Bucknall and the RAIB report that there was nothing to suggest that the bund was a natural feature of the land. The bund had a relatively uniform cross-section, linear alignment over a length of about 20 metres, and construction debris was found embedded in the bund – all pointing to it being an artificial, rather than a natural, feature. On the evidence available, including maps, surveys and aerial photographs before and after construction of the new drain, the RAIB concluded that the bund was constructed at about the time the 2011/12 drain was completed. I accepted that evidence.

The effect of the bund

[166] The presence of the bund had the following effect. The bund intercepted most of the water flowing into the funnel and guided it to a point about 7 metres upslope of catchpit 18. A gully, caused by water erosion, formed on the upslope side of the bund ("gully 1"). Another gully formed in the lowest part of the funnel, on the line of the pre-2010 ditch, passing close to catchpit 18 ("gully 2"). It intersected the drain immediately downslope of catchpit 18. After the accident, on 25 August 2020 the effect of the bund was observed during wet weather, namely that water flowed along gully 1, without a corresponding flow in gully 2.

[167] The practical effect of the bund was to "constrain most water entering the funnel, so that it flowed along gully 1 and reached the 2011/12 drain about 7 metres upslope of catchpit 18" (RAIB report, paragraph 132). In other words, a large amount of water was diverted from the funnel section into gully 1 with the effect that it all reached the drain at the same location, thus initiating the washout 7 metres upslope of catchpit 18. Analysis of the material washed out on to the track was consistent with it having come from the drain at this location (see paragraph 99 of the RAIB report for the detailed conclusions in this regard).

[168] The RAIB concluded that the washout on 12 August 2020 occurred because of the bund concentrating flows into gully 1 to the extent that the capacity of the drain was exceeded, washing out the gravel in the steeply sloped section of drainage trench on to the track below.

[169] Construction of a bund was not part of the Ove Arup design. There was no reason for the designer to expect that water would reach the drain as a concentrated flow, such as that from gully 1. There was no evidence available to the RAIB and no evidence presented to the inquiry, to explain why the bund was built, no records approving its construction; no record of any technical query being referred by Carillion to Ove Arup in relation to the construction of a bund or any records referring even to the possibility of construction to the bund to the designer.

[170] I accepted all the RAIB evidence regarding the design and construction of the drain. I therefore also accepted the evidence that the bund was constructed by Carillion at some point near the end of the 2011/2012 works, that the construction of a bund was not in accordance with the Ove Arup design, and that the presence of the bund caused the washout on to the track on 12 August 2020 – the washout that was ultimately struck by train 1T08.

[171] Standing the complete absence of any explanation as to why the bund was constructed, including no record of any technical queries having been made by Carillion to Ove Arup regarding the construction of the bund, a precaution which could reasonably have been taken was for Carillion to construct the drain in accordance with the design, which included not constructing a bund that formed no part of the design. Had Carillion constructed the drain in accordance with the design and in particular, omitted the bund, the washout was unlikely to have occurred, or at the very least, not occurred to an extent that would have seen the train derail and therefore, the accident

and the deaths of Christopher Stuchbury, Donald Dinnie and Brett McCullough might have been avoided. That analysis explains finding 10(a) above.

Other features of construction that did not accord with the design

[172] There were a number of other ways in which the drain as constructed did not accord with the design. Those features were all examined in detail by the RAIB including the consideration of detailed analysis carried out by AECOM of the way in which the non-conformities may have affected events on 12 August 2020 including if the bund had not been constructed. In short, my assessment of all of that evidence is that the most significant cause of the washout was the presence of the bund. Save for one feature discussed further below (site-cut holes), no participant sought to argue that these other areas of non-conformity caused the washout. In other words, no participant sought to argue (save for site cut holes) that these elements of the construction should give rise to a finding in terms of section 26(2)(e). However, the Crown did invite me to record these areas of non-conformity with design as facts relevant to the circumstances of the deaths in terms of section 26(2)(g). The following outlines the evidence led in this regard, why I have declined to identify further precautions under section 26(2)(e) in relation to these matters and instead recorded findings in terms of section 26(2)(g).

Catchpit 18

[173] Catchpit 18 was constructed around 7 metres from the location on the Ove Arup design (paragraphs 141 to 144 of the RAIB report). In addition, a sharp bend was

installed about one metre downslope of catchpit 18 (a consequence of moving the catchpit from its intended location)(see paragraph 153 of the RAIB report). This was not good practice because pipes are normally installed in straight runs between catchpits. However, analysis by AECOM showed that the bend had little effect on drain capacity and so did not affect the accident.

[174] In addition, existing pipes taking water from the pre-2010 ditch were not connected to catchpit 18 (paragraphs 134 to 140 of the RAIB report). In respect of the latter, the RAIB's investigation concluded that the designer's intention was to capture whatever water flowed down the pre-2010 ditch and the associated pipe system and feed it into the new drainage system at catchpit 18. That was reflected in the designer's drawings relating to catchpit 18 (see paragraphs 134 to 136 of the RAIB report). The RAIB did not find any records of formal or informal approval to omit the pipe connections.

[175] The RAIB concluded that connection of the pre-2010 ditch to the 2011/2012 drain via catchpit 18 was very unlikely to have prevented the accident on 12 August 2020 because the bund diverted most of the surface water away from this area towards the 2011/2012 drain. However, the RAIB nevertheless considered the hypothetical scenario of what would have happened if the bund had not been constructed, and the pre-2010 ditch connected to catchpit 18. In that scenario, the RAIB concluded that it was likely that all of the flow reaching the bottom of the funnel section would have passed through the pipe into catchpit 18 and there would have been no washout. In the absence of a connection to catchpit 18, water from of the funnel section would have flowed over the

ground surface reaching the 2011/2012 drain just downslope of catchpit 18 at the location of gully 2. That would have washed out the section of drain downslope of catchpit 18.

[176] Having regard to the amount of material that was washed out upslope of catchpit 18 ($10m^3$) and from around catchpit 18 and downslope of it ($13m^3$), in the hypothetical scenario of no bund and no connection from the pre-2010 ditch into catchpit 18, the RAIB concluded that the washout volume (and therefore the depth of debris over the rails) would have been "significantly reduced". That in turn "would have reduced the likelihood of derailment".

[177] The reality however, was that because of the presence of the bund, it cannot be said that this particular aspect of the construction failing to conform to the design was a precaution that might have realistically resulted in the accident having been avoided. However, it is indicative of the overall failure of Carillion to construct the drain as designed by Ove Arup.

[178] In addition, the analysis carried out by the RAIB in relation to the hypothetical scenarios of how surface water would have flowed if there had been no bund and no connection to the pre-2010 ditch to the 2011/2012 serves to demonstrate that it was the construction of the bund that was the substantial cause of the washout. Put another way, if no bund had been present, despite the construction at catchpit 18 not according with the design as I have highlighted, while there would have been some washout downslope of catchpit 18, the volume of washout would have been less and might not have resulted in derailment.

Site cut holes in catchpits

[179] The inlet and outlet holes to some catchpits were not in accordance with the Ove Arup design (paragraphs 149 to 151). In summary, the pre-cut holes in catchpits 16 and 18 were enlarged due to having been cut on site, leaving a gap through which water could potentially escape. At catchpit 18 the enlarged hole on the downslope side of the catchpit was significantly bigger than was required. However, following analysis by AECOM, the RAIB concluded that this would not have caused a washout. While it had the potential to trigger a washout if surface water flows over the drain were just less than needed to cause a washout, the washout upslope of catchpit 18 demonstrated that the surface flows were sufficient to cause washout without the assistance of water escaping from around the drainage pipe (in other words, through the gap between the pipe and the enlarged hole).

[180] The RAIB further concluded that after gravel had washed out from the downslope side of catchpit 18, leaving no gravel to restrict the rate at which water was escaping through the gap between the pipe and enlarged hole, it was likely that the amount of water then escaping would have influenced the distribution of debris downslope of catchpit 18. However, "it was not practical to model the effect on debris distribution with the confidence needed to determine the likelihood of this affecting the accident" (see RAIB report paragraph 151). For that reason, although the Crown invited me to make a finding in respect of a precaution relating to site-cut holes on the downslope of catchpit 18, given the unknown effect of this aspect of non-conformity with the design on the washout, I have declined to make such a finding. I accept the

RAIB's submissions that it cannot be said on the evidence that the use of a pre-formed hole on the downslope side of catchpit 18 is a precaution that might realistically avoided the accident.

Geotextile lining

[181] In its design, Ove Arup had specified that a geotextile lining should be placed on the upslope (field) side of the drain trench and near the top of the gravel. After the accident, site investigations disclosed that in a section of the drain trench immediately upslope of the washout, there was no geotextile (see paragraphs 145 to 148 of the RAIB report).

[182] The geotextile lining was a sheet with very small holes to allow water, but not fine soil particles, to pass through it. The geotextile lining was intended to prevent fine particles in surface runoff water from being washed into the spaces between the gravel as that would impede water flow to the pipe. An impermeable membrane was specified on the downslope (railway) side and lower part of the trench. That was to prevent water seeping out of the drain and into the adjacent cutting slope where it could cause instability. The way in which these linings ought to have been installed is best demonstrated in the following image.



(ref: RAIB report, figure 50 (at para 148), entitled "Figure 50: drain under construction in late 2012 showing section between CP11 and CP16 looking north")

[183] As outlined above, in the section of drain immediately upslope of the washout there was no geotextile.

[184] The RAIB considered the effect of the absence of geotextile in this area and whether that would have significantly affected the washout of gravel. Ultimately, the RAIB concluded that it was likely that the geotextile would have impeded the washout of gravel, however, the effect could not be quantified, and it was therefore uncertain whether it would have had a significant effect on the amount or distribution of debris washed onto the track.

[185] The RAIB concluded that the absence of geotextile would have allowed fine soil particles to enter the gravel during the years between construction and the accident,

thereby impeding the flow of water from the ground surface to the pipe and thereby increasing the amount of water flowing over the surface of the drain and increasing the likelihood of a washout. However, even if water flow had not been impeded in that way, the RAIB concluded that it was very likely that the washout would still have occurred on 12 August 2020 owing to the amount of water arriving at the drain from gully 1.

[186] Given the uncertainty as to the way in which a lack of geotextile affected the washout, and the RAIB's ultimate conclusion that notwithstanding the effect of a lack of geotextile, that the washout would still have occurred, I have declined to make a finding under section 26(2)(e) in respect of this aspect of the construction failing to conform with the design.

Locally dug fill upslope of catchpit 19

[187] The material used to "backfill" the trench for a short distance upslope of catchpit 19 was not in accordance with the Ove Arup design. The design required gravel to be used for this. Instead, what was used was locally dug material, with the effect that it was less permeable than the gravel and formed a dam. However, analysis by AECOM showed that the "dam effect" alone was insufficient to cause a washout. The RAIB concluded that the washout upslope of catchpit 18, in an area where the dam had little effect on water flows, demonstrated that the washout downslope of catchpit 18 was likely to have happened without the damming effect.

[188] Again, on the evidence I was therefore unable to conclude that had a precaution been taken in relation to this aspect of the construction, that the accident might have been avoided.

As-built condition of the drainage pipe

[189] A section of pipe between catchpits 18 and 19 had been installed at an angle, so that its perforations were on the side rather than the upper part of the pipe (RAIB report paragraph 154). The effect of this would have been to allow water to escape from the pipe into the surrounding gravel when the pipe was only 20% full, rather than 50% full if the pipe had been installed with its perforations in the correct alignment. The AECOM analysis concluded that the misalignment had minimal impact on the performance of the pipework.

[190] Again, on the evidence, in respect of this particular aspect of construction not conforming with the design, I was unable to conclude that had a precaution been taken in relation to it (constructing the pipe correctly) that the accident might have been avoided.

Catchpit 17 and section of carrier pipe

[191] During its investigation, the RAIB discovered that catchpit 17 was not constructed and that between catchpit 18 and 19 a length of carrier pipe was installed rather than filter pipe.

[192] As part of the planning for the work, Carillion's site engineer submitted technical queries (TQs) to the designer. By TQ19 Carillion asked the designer to omit catchpit 17, located on the design part-way down the steep slope between catchpits 16 and 18 on the basis that it would be particularly difficult to install on the slope. The designer accepted that proposal on 2 May 2011, but noted that the pipe would require a deeper excavation as a result. By a further technical query (TQ20) Carillion asked the designer if a carrier pipe rather than a filter drain could be used, essentially between catchpits 16 and 18. The designer instructed Carillion to retain the filter drain at that location. That decision was further queried by Carillion. The design team considered it again and responded to advise, amongst other things, that Carillion should carry out a simple level survey. RAIB found no evidence that the survey was ever carried out. On 5 May 2011, Carillion proposed an alternative arrangement involving the reinstatement of catchpit 17, and a combination of carrier and filter drains. This proposal was reviewed by the designer and accepted on 9 May 2011. However, it was not raised or recorded by Carillion through the TQ process and was not constructed. By the time of the construction of that section of the drain, the new site engineer had asked the designer for copies of the technical queries. Those were provided to him, including TQ19 seeking to omit catchpit 17, as well as the request for the additional survey. It appeared from the information discovered in the RAIB investigation, that the acceptance by the designer dated 9 May 2011 to reinstate catchpit 17 and the use of a mix of carrier and filter drain was not therefore known to the team at Carillion who ultimately constructed that section of the drain. For the avoidance of doubt, Carillion ought to have had the records

relating to technical queries and related correspondence without recourse to the designer.

[193] As with the other aspects of the construction which did not accord with design, there was no suggestion that the omission of catchpit 17 or the length of carrier pipe between catchpits 18 and 19 were the substantial cause of the washout, but they were other aspects of the construction that did not accord with design.

Conclusion re aspects of construction not conforming to the design

[194] While the other elements of construction failing to confirm with the design do not give rise to findings under section 26(2)(e), the failure by Carillion generally to construct the drainage system in accordance with the design in these various respects, and the absence of any explanation for that failure is a fact relevant to the circumstances of the deaths. Accordingly, I have made a finding under section 26(2)(g) in relation to these matters, referred to further at paragraphs 374 to 376 below.

Management of the construction process

[195] Having established the construction of a bund, not in accordance with design, at the time of construction of the drainage asset and that bund having caused the drain to washout on to the tracks on 12 August 2020, I have next considered why the defects in construction went undetected until the investigation into the derailment of train 1T08. In order to understand why the defects in construction went undetected until after the derailment, it is necessary to consider (i) the contractual arrangement between Network

Rail and Carillion for delivery of the project; (ii) the roles and responsibilities within Network Rail in relation to the project; and (iii) the arrangements for handover of the project from Carillion to Network Rail. In respect of those matters, I had regard to the unchallenged evidence from the RAIB (the RAIB report and evidence from Nick Bucknell) as well as the evidence to the inquiry from William McKay and Stuart White.

The contractual arrangements

[196] It was a matter of agreement that prior to its liquidation in 2018, Carillion was one of Network Rail's approved contractors. Carillion was Network Rail's principal contractor for the project to install rockfall protection and the 2011/12 drain (see paragraph 20 of the joint minute).

[197] In addition, as part of its investigation and report, the RAIB considered and set out contractual arrangements between Network Rail and Carillion, as well as the Network Rail standards and processes in overseeing delivery of the construction project for the drain. I accepted all of that evidence. It generally accorded with the evidence from the Network Rail witnesses, William McKay and Stuart White. From that evidence, I was satisfied of the following.

Design and build contract

[198] The construction of the 2011/2012 drain was undertaken as a "design-and-build" contract in terms of a framework agreement between Network Rail and Carillion. In

terms of that arrangement, Carillion was responsible for both the design and the safe delivery of site works, including ensuring the works were delivered in accordance with the designer's requirements. Carillion sub-contracted the design to Ove Arup.

Roles and responsibilities within Network Rail

[199] A Network Rail project team, led by a project manager (Mr McKay) oversaw delivery of the work at Carmont, as well as many other projects ongoing in Scotland at that time. On the evidence of the RAIB report, and witnesses Nick Bucknell and William McKay, I accepted that the project team were unaware of the fact the drain had not been constructed in accordance with the design. Mr McKay was candid in his evidence that had he or his team been aware of deviations from design during the construction, the project would have been halted and the matter investigated with Carillion and Ove Arup.

[200] The RAIB investigation and report sets out in detail why Network Rail were unaware of the non-conformity with design. None of those conclusions were challenged by any participant. They can be summarised as follows.

Oversight

[201] Network Rail had standards which provided for the way in which these projects would be managed on the Network Rail side, namely NR/L2/INI/02009 entitled "Engineering management for projects", NR/L2/MTC/088, "Maintenance of new and changed assets", and NR/L3/MTC/089, "Asset management plan".

[202] A number of forms required to be completed by the project manager during the construction and, in particular, on completion. Only one such form was located by Network Rail following the derailment (form AMP010, relating to a pre-work dilapidation survey recording existing site conditions). In particular, a number of steps required to be taken on completion of all core work, including: the project manager issuing a construction completion certificate (form AMP014); arranging a joint site walkout with the asset engineer to complete a "taking over certificate" (form AMP015); and, following rectification of any defects found during that process, a "final certificate" was to be issued to the interface coordinator. None of those forms were located following the derailment (see RAIB report paragraphs 161 to 167).

[203] Standard NR/L2/INI/02009 required the designated project engineer to formally accept the construction on behalf of Network Rail. There was no requirement for the designated project engineer to personally inspect the works during construction. The standard allowed for acceptance to be based on a sample review of a submission made by the construction team and confirmation that proper quality assurance processes were in place. No such submission, or evidence of formal acceptance of design changes were found by RAIB.

[204] In its submissions, Network Rail invited me to take account of the evidence of Mr McKay in relation to difficulties locating documents. I have had regard to that evidence, namely Mr McKay's search for documents (the health and safety file) following the derailment. In summary, Mr McKay went to Carillion's old premises to ascertain if paper copies had been left behind. Despite a thorough search, he was unable

to locate them. Network Rail invited me to consider that, while it accepted the RAIB's finding that no submission or formal acceptance of design changes were found, it was possible that these documents may actually have been completed, even though it was accepted they have not been produced. I accept that it is possible that Carillion did prepare these documents, but never produced them to Network Rail. In the context of Network Rail's responsibilities, that is beside the point. There was no evidence before the inquiry that anyone at Network Rail received these documents. Network Rail had the responsibility of ensuring that these documents were received and retained.
Mr McKay gave candid evidence to the inquiry that Network Rail never received the health and safety file from Carillion. The health and safety file, if prepared, should have contained the design drawings, reports, technical queries, and the "as built drawings." I comment upon this in more detail at paragraphs 215 to 218 below.

[205] There were a number of visits to the site carried out by members of the project team, in particular, by the construction manager Alisdair McIver as well as Mr McKay. While Mr McIver's main responsibility was monitoring site safety, he also checked the general standard of work, but not the detail of every item. The nature of Mr McKay's site visits correlated with his overseeing role as project manager. I accepted that he was dealing with more high-level matters such as access to site (there were difficulties with access to the site during the construction) and ensuring progress according to the programme for works. In general, I accepted that on the evidence, the project team would not see the majority of the completed parts of the project for the obvious reason that the majority of the installation was underground. For example, as RAIB identify in

their report, a lack of geotextile would not have been apparent after gravel was placed above its intended position (paragraph 172). They could, as Mr McKay accepted in his evidence, have opened catchpits to view the parts of the construction under the catchpit. However, they were otherwise unaware of differences as between construction and design. RAIB found no surviving records of the work undertaken, including site meetings or discussions held during the second phase of drain construction in October/November 2012 – the period when the connections to catchpit 18 were omitted and importantly, when the bund was formed. There was no evidence to suggest that the Network Rail team were aware of these changes.

[206] The Network Rail construction assurance processes and the level of oversight undertaken by Network Rail, require to be viewed in the context of the status Carillion held under the framework agreement as a "self-assured" contractor.

Carillion as a self-assured contractor

[207] The framework agreement between Network Rail and Carillion required Carillion to be responsible for self-certifying construction work. As outlined in the RAIB report, and in his evidence to the inquiry, Nick Bucknell explained that Network Rail operated a Principal Contactor Licensing Scheme ("PCLS") governed (at the time of the construction of the 2011/2012 drain) by Network Rail standard NR/L3/INI/CP/0071 which set out the management system requirements for suppliers applying for a Network Rail Principal Contractor's Licence. On application for a licence to deliver capital works for Network Rail, an initial audit of their systems and processes was

undertaken as part of a licensing scheme (known as "link up") before being granted a provisional licence. After completion of several projects successfully, Network Rail carried out a further audit to assess the quality of its work and ensure that the systems and processes reviewed as part of the first audit were actually being implemented. Provided all findings of the audit were satisfactory, a full licence was issued. Thereafter, all PCLS licence holders were audited on a regular basis.

[208] Carillion held a PCLS licence between March 2008 and April 2018. Seven audits were undertaken between 2010 and 2015. Bearing in mind that the construction of the new drain at the site of the derailment took place in 2011 and 2012, the RAIB's investigation found that before February 2012 the principal contractor audits were not carried out at site level. They were management system audits only which would not detect design modifications implemented on site without proper change control.

[209] That evidence (from Nick Bucknell and the RAIB report) was not challenged. In any event, it also accorded with the evidence of Mr McKay who spoke to Carillion being a self-assured contractor meaning that Carillion was viewed as a competent contractor; that inspections carried out at the site during construction ("walkouts" as they were described in evidence) would not detect non-conformity with design, because the installed drain was underground and that in general, Network Rail was relying upon Carillion performing their duties as contractor and carrying out the construction in accordance with design. I accepted the evidence of Mr McKay that if the project team had been aware of deviations from design, that would have been treated seriously, the project stopped and the matter investigated with Carillion and the designer.

Handover of the drainage asset

[210] On completion of the project, handover from Carillion to Network Rail did not take place as it ought to have done. In particular, key documents were not provided to Network Rail on completion. In the result, no one at Network Rail realised that the new drainage system "as built" differed in a number of respects to the design prepared by Ove Arup.

As-built drawings

[211] "As built" drawings were not prepared at the end of the project. On the unchallenged evidence of Mr Bucknall and the RAIB report, the "as built" drawings are an essential part of construction activities. They provide information for the future maintenance, modification and removal of assets.

[212] As a "design and build" contract, Carillion were responsible for providing the "as built" drawings to Network Rail. As the name suggests, the drawings required to show the drain as actually constructed – "as built". From the information available to the inquiry, it was clear that there was an expectation on the part of Ove Arup that they would be instructed by Carillion to prepare the as-built drawings. Had they been instructed to do so, there was an opportunity for Ove Arup to recognise that the drain had not been constructed in accordance with the design and in particular, to note the presence of the bund. That opportunity was lost owing to the fact that Carillion did not instruct Ove Arup to prepare the drawings, despite prompts from Ove Arup in late 2011

to do so (see RAIB report paragraph 180). The RAIB found no evidence that the "as built" drawings were prepared by anyone else (including Carillion) (see paragraph 183 of the RAIB report). The failure to obtain these drawings was a significant missed opportunity.

[213] The preparation of "as built" drawings was a precaution that could reasonably have been taken by Carillion. Had it been taken, I consider there is a real possibility that the discrepancies as between construction and design, in particular the presence of a bund at the site, would have been observed and rectified and therefore, a real possibility that the accident might have been avoided.

[214] In addition, Network Rail's own standards recognised the importance of the "as built" drawings. Standard NR/L2/INI/02009 specified that the project manager was not to "close out" any project without the "as-built" records, health and safety and other documents being provided to and accepted by Network Rail. Network Rail accepts that it did not obtain the "as built drawings" from Carillion. That acceptance reflected its plea of guilty in the criminal proceedings to a charge which libelled, amongst other things, that Network Rail had failed to ensure, so far as reasonably practicable, that the drainage asset was constructed properly and in accordance with the design drawings; including a failure upon the completion of construction to obtain as-built drawings and to conduct a hand-over meeting with the contractors to check that the drainage asset had been properly constructed and constructed in accordance with design.

[215] In addition, the Construction (Design and Management) Regulations 2007 required that a health and safety file be prepared containing all of the information that

might be needed for future construction activities. The conclusion of the RAIB, as well as the evidence of Mr McKay, is that the health and safety file would usually contain the "as built drawings". Network Rail accepts that it failed to take all reasonable steps to ensure that the information required for a health and safety file for the drain assets was received and retained. That acceptance again reflected the guilty plea tendered in the criminal case (see in particular paragraph (c) of the charge). Had Network Rail ensured receipt of a health and safety file from Carillion, the absence of "as built" drawings may well have been identified and rectified.

[216] In his evidence, Stuart White confirmed that the absence of health and safety files for completed construction projects was a known problem before the derailment at Carmont. That became known following a review within Network Rail, after which steps were taken to remedy the situation by either locating the health and safety files and lodging them with the National Records Group within Network Rail (where the project team ought to have passed every health and safety file following completion of a project) or in the case of missing files, creating the correct asset information for the projects. Unfortunately, while the general issue of non-compliance was known before Carmont, the absence of a health and safety file having been obtained and logged in respect of the 2011/12 drain was not known and not discovered until after the accident.

[217] Network Rail did not follow its own processes to ensure the safety related information (including the "as built drawings") for the project were handed over at the conclusion of the project. That was a precaution that could reasonably have been taken. Had Network rail insisted upon Carillion providing those documents to it, I consider

that there is a real possibility that the drawings would have been prepared, the divergence between the construction and design might have been detected, and the problems with construction remedied such that the accident might have been avoided.

[218] All of that has led me to conclude that the following are precautions that could reasonably have been taken and had they been taken, might realistically resulted in the accident being avoided, namely:

- for Carillion to have prepared "as built drawings" and to have provided same to Network Rail;
- for Network Rail to have complied with its own standards in place at the time of the conclusion of the 2011/12 drain construction that required it to be in receipt of "as built drawings" and a health and safety file.

[219] That explains finding 10(b) and 10(c) above. I have made a related finding under section 26(2)(f), namely that Network Rail's failure to ensure that the drain was constructed in accordance with the design was a defect in a system of working which contributed to the accident resulting in the deaths. In that regard, see paragraphs 367 to 372 below.

The drain: record keeping and inspection

[220] The failure to obtain and file the health and safety record had wider implications. Mona Sihota told the inquiry that the information from the health and safety files should be transferred into the Network Rail's maintenance database, known as Ellipse. In relation to the 2011/2012 drain, it was discovered after the derailment that only part of

the drainage system had been added to Ellipse, namely the lowest section of drain that was completed in the first phase of work in 2011. The RAIB concluded that when construction was completed, the remainder of the drainage system should have been, but was not, entered into Ellipse, as a consequence of Network Rail's failure to fully implement its procedures for introducing new assets onto its infrastructure. That in turn had consequences in relation to the inspection and maintenance of the drainage system after completion. No inspections were carried out upslope of catchpit 18 (the area not on ellipse) between March 2013 and the accident in August 2020. Ultimately, the RAIB concluded that it was unlikely that an inspection would have identified the bund, because it lay outside the railway boundary and became covered with dense gorse in the years following its completion in 2012. The RAIB also concluded that there may have been no obvious indication that the defect could suddenly become a significant washout and that it was not evident that an inspection would have led to remedial action, or that any remedial works would have been sufficient to prevent the washout on 12 August 2020 (see RAIB report paragraphs 275 to 286). On that basis, while entering the information on to ellipse is a precaution which could have been taken, there is insufficient evidence on which I could properly conclude that had it been taken it might realistically have resulted in the accident having been avoided. However, I have made a finding in terms of the lack of inspection upslope of catchpit 18 in terms of section 26(2)(g). See further at paragraphs 377 to 378 below.

Missed opportunity – December 2012

[221] The inquiry heard evidence from Nick Bucknell relating to paragraphs 185 to 188 of the RAIB report that in December 2012, shortly after the drain was completed but before the associated fencing work was finished, the landowner visited the sloping section of drain following heavy rain. He photographed the steeply sloping section of drain upslope of catchpit 18 showing water flowing in gully 1 and slight erosion to gravel surface of the 2011/12 drain. The landowner's position was that he had passed this evidence to Carillion or Network Rail. However, no evidence was found relating to receipt of the image or action being taken in response to it. In addition, during inspection of completed works by Carillion and Network Rail in March 2013, a further photo was taken, which although of poor quality indicated that the flow of surface water into the drain was established by the time of this visit, and the RAIB concluded that even on account of this poor quality photo, the limited areas shown suggested that no remedial work had been carried out in response to the 2012 photo.

[222] The RAIB concluded that no action was taken by Network Rail or Carillion when water flow in gully 1 caused slight erosion to the gravel surface of the new drainage trench before the works were completed, which therefore presented a missed opportunity to recognise the effect of the bund on water flows. This was identified as being a "possible causal factor" in the accident. The Crown invited me to make a finding that a precaution that could reasonably have been taken was for further investigation to have been made in relation to the 2012 photograph which might realistically have resulted in the accident being avoided. I have declined to make such a

finding. That is on the basis that although the landowner's position is that he provided the photograph to either Carillion or Network Rail, there was insufficient information before the inquiry as to who exactly the photograph was passed, or that either Carillion or Network Rail received any such photograph. For the same reason, I have declined to note this as a fact relevant to the circumstances of the deaths. In addition and in any event, I had regard to the RAIB's conclusion that it was very unlikely that the slight erosion of the gravel surface would have been immediately recognised as a precursor to sudden washout affecting railway safety (see paragraph 188). I accept that finding was made in the context of the RAIB's overall conclusion that the photographs evidenced a problem requiring investigation/repair and that it was therefore possible that such actions may have resulted in an effective drainage system avoiding the washout on 12 August 2020. However, I did not consider that there was sufficient evidence before me to conclude that there was a real or lively possibility that, even if these photographs had been received by Carillion/Network Rail, that the accident might have been avoided.

(ii) Management of adverse weather

[223] To understand the findings in relation to management of adverse weather, it is necessary to understand the management structure of the railway at the time of the derailment generally, and the background to the standards and procedures in place at the time to manage adverse weather. The following derives from the evidence of Nick Bucknall, Ash Gardner, Karl Grewar and the unchallenged RAIB report.

Management of the rail network

[224] At the time of the derailment, the overall management of train services throughout Scotland was provided from Scotland's route control room ("route control") located at the West of Scotland Signalling Centre in Cowlairs, Glasgow. The control room was staffed by both Network Rail and ScotRail employees, an arrangement known as "integrated control". It was responsible for providing operational control for all trains operating on the Network Rail infrastructure in Scotland, with ultimate control resting with Network Rail. The response to severe weather was the responsibility of the route control room. Although Network Rail and ScotRail control staff were located together, each party remained responsible for the safety obligations relating to its own activities. Network Rail retained oversight of track management, including the safety of railway infrastructure, including management of adverse weather. ScotRail had overall responsibility for the continued operation of passenger rail services including deployment of train crew and adequate resources to deliver the service.

[225] The roles within the control room at the time of the derailment can be summarised as follows. On the Network Rail side, there was a route control manager (RCM) responsible for the real-time management of the integrated control. Reporting to the route control manager were incident controllers, directly responsible for the management of reported defects and problems on their respective areas of the railway network. On the ScotRail side, there was a duty operations manager (DOM) who was

supported by a team of train service delivery managers. The RCM and DOM reported to the Head of Integrated control.

How were weather events managed as at 12 August 2020?

[226] The way in which adverse weather events were managed by Network Rail at the time of the derailment was less than straightforward. It is set out in the RAIB report at paragraphs 195 onwards. In summary, the position was as follows.

Arrangements at a national level

[227] At the time of the derailment, Network Rail's national arrangements for managing operational risk from extreme weather were set out in standard NR/L2/OPS/21, "Weather – managing the operational risks" (issue 8, June 2019). This standard required the creation of Integrated Weather Management Plans (IWMPs) giving planned, location-specific responses to adverse and extreme weather. That standard also described the processes to be adopted when extreme weather was forecast, when it arrived and during recovery from weather-related disruption.

[228] The content of IWMPs was provided in a number of documents giving detailed requirements for mitigating the risk of earthwork failure and drainage management in flooding. Module 8 of NR/L3/OPS/021 included a guidance note (clause 5.4) as follows:

> At times of significantly heightened rainfall intensity (ie levels well above asset thresholds) increased proportions of the network will become susceptible to failure. Therefore consideration needs to be given to dynamically assessing the risks, regardless of whether there are any cutting slopes or embankments in the documented IWMP for the geographical area under threat.

[229] National operating procedure NR/L3/OPS/045/3.17 (dated 6 June 2020) defined maintenance, asset management and control responsibilities for taking action in response to weather thresholds being reached. This document also set the particular thresholds. At the time of the accident, Network Rail had instructed its weather forecast provider to use a revised set of national alert thresholds, however the standard NR/L3/OPS/045/3.17 had not been amended to include those revised thresholds. It was accepted by the RAIB that there was no evidence to suggest this inconsistency was a factor in the accident.

[230] In any event, the thresholds on both versions used a colour-coded system, defined in NR/L2/OPS/21 as follows:

- "green – normal": the range in which the "Rail Industry operates effectively and reliably."
- "yellow- aware": "conditions which have breached the normal threshold however the Rail Industry continues to operate effectively and reliably.
- "amber- adverse": conditions which, "whilst not extreme, are known to be challenging to reliable operations".
- "red-extreme": conditions which are "so severe that consideration has to be given as to the level of service which can be safely operated"

[231] The thresholds (the revised thresholds in use by the forecast provider at the time of the accident) are shown in the following table:

National Table				
				Wind
Category	**Normal**	**Aware / Level 1**	**Adverse / Level 2**	**Extreme / Level 3**
Mean wind speed (mph)	29 or less	30 to 39.9	40 to 49.9	50 mph or more
Hourly Gusts (mph)	39 or less	40 to 49.9	50 to 59.9	60 mph or more
				Rain
Category	**Normal**	**Aware / Level 1**	**Adverse / Level 2**	**Extreme / Level 3**
24 Hour Unsaturated (mm)	Less than 20mm	20 to 29.9	30 to 39.9	40 or more
24 Hour Saturated (SMI >1) (mm)	Less than 10mm	10 to 14.9 mm	15 to 19.9 mm	20mm or more
				Convective Rainfall Intensity - Available 1st May to 30t
Category	**Normal**	**Aware / Level 1**	**Adverse / Level 2**	**Extreme / Level 3**
Precipitation in an hour (mm)	Less than 10	10 - 15	15 - 20	20 or more
				Temperature
Category	**Normal**	**Aware / Level 1**	**Adverse / Level 2**	**Extreme / Level 3**
Heat (°C)	Less than 20 C	20 to 24.9	25 to 28.9	29 or more
Cold (°C)	Warmer than -0	0 to -2.9	-3 to -7	-7 or colder
Frost (°C) (Minimum air temperature - wind >12 mph)	Warmer than -0	-0 to -0.9	-1 to -2.9	-3 or colder
1 Day Diurnal Cycle (°C)	Less than 13 C	13 to 15.9	16 to 17.9	18 or more
				Snow
Category	**Normal**	**Aware / Level 1**	**Adverse / Level 2**	**Extreme / Level 3**
Daily Snowfall (cm)	1.9 or less	2 to 4.9	5 to 14.9	15 or more
Drifting Risk	None	Low	Medium	High
				Lightning
Category	**Normal**	**Aware / Level 1**	**Adverse / Level 2**	**Extreme / Level 3**
Strike Risk	None	Low	Medium	High

Ref: Figure 55 from RAIB report (para 199) entitled "Weather thresholds in use by forecast provider at the time of the accident".

[232] Network Rail had a national contract for a specialist organisation (MetDesk) to provide bespoke forecasts structured around the specified weather thresholds, including a statement of their level of confidence in the forecast. Each morning, around 3.00am, the provider sent forecasts for the next 5 days, starting at 6.00am on the day of the forecast. Among those receiving the forecast were route control managers, maintenance delivery units and asset management teams.

Scotland's railway

[233] Scotland's railway developed an Adverse & Extreme Weather Plan (AEWP) as its equivalent of the IWMP. Issue 8 of the plan (18 January 2020) included elements of NR/L2/OPS/21 and NR/L3/OPS/045/3.17 outlined above as well as listings of locations for which action was required, and the type of action required if weather thresholds were exceeded. That "at risk list" included earthworks at particular risk of failure due to heavy rain.

[234] The guidance note in NR/L3/OPS/021 module 8 (outlined above) was not mentioned in the AEWP. National standards did not require it to be. Therefore, the AEWP was focussed upon "at risk" locations. The Network Rail geotechnical asset management teams were responsible for identifying locations at which earthwork failure due to extreme weather poses a high risk to the railway, and for identifying the associated mitigation required to achieve acceptable levels of safety during and after such weather. Prior to Carmont, mitigations included observing slopes for signs of movement (deploying "watchmen" to do so), stopping trains or reducing their speeds.

[235] The 2011/2012 drainage system at the site of the derailment was not on the "at risk" list. The locations nearest to the site of the derailment that were listed as "at risk" were 1.6 miles (2.6km) and 2.1 miles (3.4km) from the washout. At the time of the accident, Network Rail had no reason to believe that the 2011/2012 drain was at risk of a washout. At that time, Network Rail did not know that the construction of the drain did not accord with the design.

How was the weather managed in the days leading up to 12 August 2020?

Overview

[236] The RAIB found that the response by the route control staff in the days and hours leading up to the derailment was broadly consistent with the process described in the AEWP but at "significant variance" with Network Rail national standards for managing extreme weather.

[237] According to Network Rail's national standards, weather forecasts in the days leading up to the accident, and actual rainfall on the day of the accident, should have resulted in route control staff declaring a "red" route alert on the day of the accident. This would have led to one or more extreme weather action teleconferences (EWATs) at which weather-related responses from various parts of the rail industry should have been coordinated (see further below).

The weather forecast

[238] The forecast received on 11 August 2020 gave an "extreme" rating for heavy rainfall on 11 August 2020 for the "Perth area" (encompassing the accident site), but with a low confidence level. Extreme ratings were given for other areas on that date also. The 11 August 2020 forecast predicted no extreme events for 12 August 2020. However, the forecast received on 12 August 2020, predicted "extreme" for heavy rainfall in the Perth area.

Should a red day have been declared?

[239] National standards (NR/L2/OPS/021) required Scotland's route control to declare a red route alert status if a breach of an extreme weather threshold was included in a weather forecast and/or actually occurred. The route control manager did not declare a red route alert status as a result of the weather forecasts on either 11 August or 12 August because, applying his own judgement, he concluded that the forecast weather was not sufficiently adverse to require this. In respect of the 11 August forecast, the RCM declared 11 August to be an "adverse" (amber) day and 12 August an "aware" (yellow) day. In respect of the 12 August forecast, 12 August was declared an "aware" (yellow) day. As a result of not declaring a red route alert (a red day), no EWAT was arranged (see further below).

[240] During its investigation, the RAIB considered the intent of the national standard (NR/L2/OPS/021) and how it was applied by other route control centres. The outcome of that investigation was that the intent of the standard and the way in which it was applied by other route controls was that a red day would be declared if a forecast included a single "extreme" element within it. By contrast, in Scotland, a "majority of areas" approach was taken, so that a red day would be declared by the route control manager only if extreme weather was forecast in three or more of the five forecast areas for Scotland (Edinburgh, Glasgow, Motherwell, Perth and Highland).

[241] Even then, the forecast on 11 August demonstrates that the "majority of areas" approach was not consistently applied, as the forecast on that day did show a forecast of extreme weather in three of the five areas for Scotland and no red day was declared.

[242] The RCM applying his own judgement on 11 and 12 August to decide whether a red day should be declared was consistent with older versions of the national standard NR/L2/OPS/021 (June 2011), in terms of which the RCM was to interpret the weather information and assign the status of alert. However, that approach changed when an updated version of the national standard was published in March 2016, with a compliance date of June 2016. The application of RCM judgement was not therefore in accordance with the national standard in force at the time.

[243] The actual amount of rainfall at the accident site on 12 August 2020 was well in excess of the threshold for declaring a "red day". Accordingly, per the national standard NR/L2/OPS/021, a red day should also have been declared based on the actual extreme weather threshold having been breached, regardless of the forecast.

[244] Therefore, both the weather forecast on 11 and 12 August 2020 as well as the actual weather event that took place on 12 August 2020 ought to have triggered a red route day, and therefore an EWAT (see further below).

Real-time weather and the Network Rail Weather Service

[245] The RAIB investigation uncovered that route control staff did not consider they were expected to respond to real-time weather observations and were heavily reliant on the daily forecasts rather than any subsequent short-term forecasts.

[246] However, from 31 August 2015 a system was available, if appropriately configured, of providing staff with information in an appropriate format, namely, short-notice forecasts and actual rainfall data available through the internet-based, Network

Rail Weather Service. That service included: route-specific, five-day forecasts; hour-by-hour, location-specific forecasts; real-time weather observation data from 44 locations within Scotland, including from Inverbervie (only 8.5 miles away from the accident site); and alerts that could be set up by users to provide warnings if real-time observation data reached specific values. However, the NRWS installed in the control room had not been configured to provide this information and route control staff had not been trained on how to use it to assist decision making. In fact, no route control staff in Scotland or elsewhere had been trained to use NRWS to identify when real-time weather data had reached the thresholds at which they were required to implement extreme weather management process for events which had not been forecast.

[247] The route control managers on 11 and 12 August 2020 had been assessed as competent in managing adverse weather. However, the competency assessments did not detect that Scotland's control staff were allocating route alert codes that were not compliant with Network Rail national standards. In addition, the competency management system did not include a requirement for route control staff to have the detailed knowledge required to use NRWS, despite that being the source of information needed for them to comply with the national standards and the application of a red day (and therefore an EWAT) for weather events that had not been forecast.

[248] The RAIB considered why such a drift away from corporate expectations in respect of extreme weather management had not been detected by Network Rail's corporate assurance process. In the case of core safety management processes, that would be detected through an audit process known as a "level 2 audit." The RAIB found

no evidence of any level 2 audit that covered the activities of controllers in Scotland. As a result, senior management in Network Rail were unaware that in Scotland, the NRWS was not being fully utilised and that the nationally mandated process for the management of extreme weather events was being implemented differently.

The consequence of failing to declare a "red day"

[249] As already outlined, a "red day" was not declared and therefore, no Extreme Weather Action Teleconference was held ("EWAT") on 11 or 12 August 2020.

EWATs

[250] An EWAT is a multidisciplinary meeting to assess the impact of forecast extreme weather on the infrastructure, to determine the appropriate mitigation, monitoring and contingency plans and to communicate actions and decisions.

[251] It was not disputed by any participant to the inquiry that, in accordance with national standards, an EWAT should have taken place on 11 and 12 August 2020. That did not happen, because route control did not assign a red day on either 11 or 12 August 2020, working as they were to an old standard that allowed RCM judgment to be applied to the forecast to decide whether to declare a red day. That no EWAT was held on 11 and 12 August 2020 also generally accorded with the low numbers of EWATs held in Scotland around that time. The RAIB found that the number of EWATs convened by Scotland's route control in the years before the accident at Carmont was "fewer than would have been expected had the national operations standard governing the response to extreme weather events (NR/L2/OPS/021) been implemented in the way intended by

Network Rail" (RAIB report, paragraph 310). For example, RAIB found almost no records of EWATs having been declared in 2014 and 2015.

[252] That no EWAT was called was inextricably linked to route control not applying the national standard in relation to the thresholds that would trigger a "red day". It was the declaration of a red day that triggered the holding of an EWAT. Thus, the lack of training of route control staff in the management of adverse weather had a direct bearing on the failure to hold an EWAT on 11 and 12 August 2020. Put another way, not holding an EWAT was in keeping with the way in which adverse weather was responded to in Scotland at that time, which did not conform to national standards.

[253] For the avoidance of doubt, I did not accept Mr Grewar's evidence to the effect that, although no EWAT took place on 11 or 12 August 2020, the informal discussions that took place within the control rooms on those days were akin to what would be discussed during an EWAT. His evidence in relation to exactly what was said during these informal discussions was vague and lacked detail as to how they compared to what would be discussed at an EWAT. I did not accept that part of his evidence for those reasons.

Might an EWAT realistically have resulted in the deaths being avoided?

[254] The RAIB's conclusion was that, while an EWAT should have been held, there was "strong evidence that doing so would have had no practical effect on events at Carmont" (paragraph 209), because mitigations would have been implemented in accordance with the AEWP, namely at sites on the "at risk list" only. Since the

derailment site was not included on the "at risk" list, no mitigations could have been applied there, even if an EWAT had been called.

[255] There was evidence before the inquiry (namely the RAIB report) that in the days leading to the derailment, the Network Rail geotechnical teams and route control were aware of the risk of severe localised rainfall events to all earthworks, even if not on the "at risk list". That was expressly referred to in an email from the geotechnical team to route control on 10 August 2020 (see RAIB report paragraph 210). The geotechnical team undertook to identify earthworks not on the at risk list in the AEPW but possibly affected by the rainfall, if route control provided information about concerns in particular locations. Route control expressed concern about their ability to do that, particularly given the resources available to them at the time (see RAIB report paragraph 211 and 212).

[256] However, all of that said, in the hypothetical situation of an EWAT having been called, the fact remains that the 2011/2012 drainage system/derailment site was not on the "at risk" list within the AEWP, and therefore, would not have been subject to any mitigations being put in place as a result of the EWAT. Despite the geotechnical team making route control aware that any earthwork could be at risk during severe rainfall, the ability of route control to identify other sites not on the "at risk" list was hampered by (i) the fact that route control had not been trained in and was not using the NRWS to allow it to respond to real-time weather events (see above) and (ii) the resources available to route control at the time. The evidence from Mr Grewar and Mr Moran, none of which was challenged by any participant to the inquiry, was that route control

was under significant pressure on 12 August 2020 owing to the extreme weather affecting multiple sites across Scotland. That was in keeping with route control's concern on 10 August 2020 in response to the geotechnical team.

[257] The Crown relied upon Anna O'Connor's evidence to support the submission that the holding of an EWAT was a precaution that could reasonably have been taken and that had it been taken might have resulted in the accident/deaths being avoided. Ms O'Connor's evidence was that an EWAT "could have made a difference" because it would have allowed for a "time out" and for an objective view of train 1T08's situation – namely that it had been standing for 2.5 hours in unprecedented weather. However, she prefaced that evidence by telling the court that it was speculation and also told the inquiry that the RAIB's conclusion that an EWAT would have made no difference had "quite a lot of validity". I therefore considered her evidence to be neutral on the matter, and did not consider it to be a basis on which I could make the finding invited by the Crown.

[258] Viewed in the context of the whole evidence to the inquiry, and in particular the detailed investigation and conclusions reached by the RAIB in their investigation, the picture that emerges is that there was nothing within the national rail standards at the time that required, in the event of an EWAT having been called, mitigations to be applied in respect of train 1T08 or the site of the derailment. Therefore, I have concluded that while a precaution that could reasonably have been taken was the holding of an EWAT, it was not a precaution that might realistically have resulted in the avoidance of the accident/deaths.

[259] Related to the issue of weather monitoring and EWATs, the Crown invited me to make a finding that a precaution that could reasonably have been taken and might realistically have avoided the deaths, was an adequate system of training and quality assurance in relation to the analysis of weather forecasts by route control staff and the full use of existing weather tools (the NRWS) by appropriately trained route control staff to ensure compliance with Network Rail standards (namely, NR/L2/OPS/021). My findings on the evidence in relation to the lack of training and overall oversight of competence in relation to monitoring weather and complying with national rail standards is set out above. Had the staff been competently trained, working to the standards in place at the time and making full use of the weather forecasting and monitoring resources available to them, the route codes might have been applied correctly in relation to both the forecast and real-time weather in the lead up to and on 12 August 2020. Ensuring an adequate system of training and quality assurance in relation to route control's response to and management of forecast and real-time weather was therefore a precaution that could reasonably have taken. However, compliance with all of those standards, would all have amounted to the same result, namely the declaring of a "red day" and the holding of an EWAT. For the same reasons already outlined, the site of the derailment not being on the "at risk" list under the AEWP meant that no mitigations would have been put in place at the site of the derailment, and in light of my findings below in relation to speed restrictions, there was nothing provided for in the rule book to allow a speed restriction to be imposed on the basis of rainfall alone. In the result, even with adequate training and compliance in

relation to route control's response to forecast and real-time weather, it cannot be said that precaution might realistically have resulted in the accident/deaths being avoided.

[260] Given the changing and challenging weather conditions of 12 August 2020, I have considered whether any other precautions that could reasonably have been taken by route control on 12 August 2020, as events unfolded prior to the derailment, might have avoided the accident.

Speed restrictions; gold command and stranded train assessment

The situation in the control room on 12 August 2020

[261] Route control staff were dealing with a very challenging situation on 12 August 2020, with cancellations and a number of difficulties on the network as a result of the weather. Several witnesses, including those from the RAIB, described the weather as rare and unprecedented. In his evidence, Mr Moran described the day of the derailment as being possibly the busiest day he could recall in terms of the volume of rail incidents requiring to be managed. That accorded with Alastair Macfarlane's evidence that there were more "earthwork incidents" in the 24-hour period on 11/12 August 2020 than in a typical year.

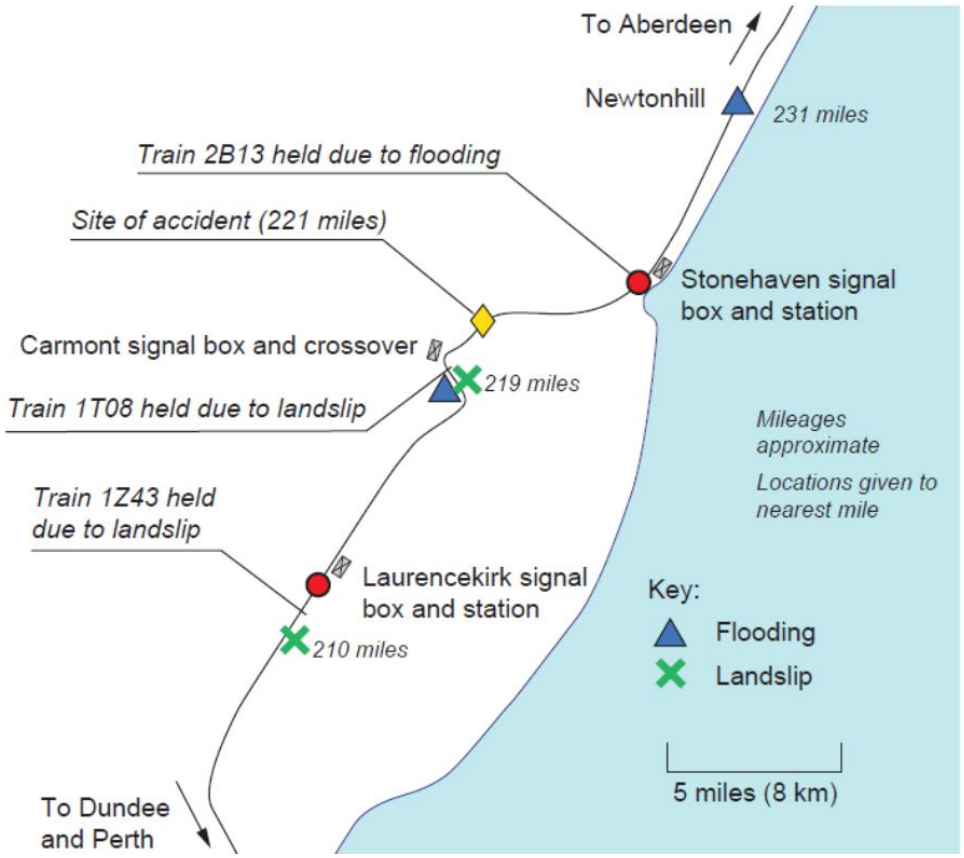
[262] The picture on the morning of 12 August 2020 can be summarised as follows (see RAIB report at paragraphs 44 to 53):

- By 6.55am on 12 August 2020 the only major route in the central and eastern parts of the country which remained unaffected was Inverness -Aberdeen- Dundee.

- The area south of Perth was affected by multiple instances of flooding, landslips and signal failures.
- A canal had burst its banks and closed the main Edinburgh to Glasgow line at Polmont.
- By 6.57am on 12 August 2020 there was flooding at Newtonhill (about 9km north of Stonehaven and 18km north of Carmont). The railway was closed at Newtonhill shortly thereafter.
- By 7.00am on 12 August 2020, a landslip had taken place on the upline just north of Ironies Bridge (around 1.6km south of Carmont signal box). This was the landslip reported by train 2B13 and which resulted in train 1T08 being instructed to stop by the Carmont signaller via an emergency call.
- By around 8.19am flooding was also affecting the down line in the vicinity of Ironies Bridge. This was discovered as a result of a Network Rail member of staff investigating the landslip reported by train 2B13.
- By around 8.50am, a landslip had taken place just south of Laurencekirk (around 210 miles and 154 yards). This landslip was reported by the driver of the 0600hrs service from Perth to Inverurie (1A43). That train was held at Laurencekirk due to the flooding at Newtonhill. At 8.28am it was instructed by route control, via the signaller at Laurencekirk, to terminate at Laurencekirk and to return south, as redesignated 1Z43. After travelling about 730 metres, it stopped on seeing a landslip ahead and reported same to the Laurencekirk signaller.

- By 8.50am route control were aware of two landslips and two flooding events in the 34 km section of line from just south of Laurencekirk to Newtonhill.

[263] The proximity of the flooding and landslips to the site of the derailment is best demonstrated by the following image.



Ref: figure 16 from the RAIB report (para 54) entitled "Train positions and known infrastructure failures around Carmont at 09:00hrs on 12 August 2020"

Speed restriction

[264] The Crown invited me to make a finding that precautions that could reasonably have been taken and which had they been taken might realistically have resulted in the deaths being avoided were (i) a restriction (by route control) on the speed at which train

1T08 required to travel on the return journey from Carmont to Stonehaven; and (ii) a requirement for train 1T08 to return from Carmont to Stonehaven "at caution".

[265] It was clear from the evidence that there was nothing within the rule book requiring the signaller to instruct train 1T08 to proceed at anything below "line speed" (the usual speed of 75mph) on its return to Stonehaven. Firstly, as outlined in Ash Gardner's evidence summarising the conclusions of the RAIB report, the rule book provided the circumstances in which a signaller should instruct a train driver to proceed "at caution" (a speed that would allow the driver to stop the train short of any obstruction). While the Carmont signaller was aware of a number of issues caused by adverse weather on 12 August 2020, none of those issues were between his signal box and the next one on the down line at Stonehaven. No issues were reported by train 2B13 when it safely passed the area of the washout around 7.07am and the signaller had no other information to suggest any obstruction on the line when he authorised train 1T08 to return to Stonehaven at around 9.28am. Indeed, by that point, the weather had significantly improved.

[266] The circumstances in which speed restrictions might be applied by route control was a matter of agreement in terms of the supplementary joint minute of agreement. In particular, it was agreed that at the time of derailment, Scotland's AEWP did not include (i) an option for the imposition of reduced running speeds at locations not identified as being at risk; or (ii) implementation of a blanket speed restriction in response to forecast heavy rain. As already outlined above, the section of line between Carmont and

Stonehaven, and in particular the area of the 2011/12 drain, was not an area identified as being at risk.

[267] By 9.00am on 12 August 2020 there were four obstructions of the railway within 11 miles of train 1T08 – two landslips and two reports of flooding. However, there was no process requiring route control to assess risks to specific trains such as 1T08 (with the exception of stranded train assessment – see further below) beyond the individual route controllers' general situational awareness, and nothing requiring or indeed allowing route control even in the circumstances surrounding train 1T08 to instruct it to proceed at anything below line speed. My conclusion therefore, is that route control as well as the signallers, acted in accordance with the operating procedures in place at the time in returning train 1T08 to Stonehaven at line speed. Mr McCullough, in following those instructions, also acted entirely appropriately.

[268] In addition, although the Crown invited me to make the findings referred to at paragraph 264 above in terms of section 26(2)(e), the Crown also accepted in its submissions that there was nothing in the Scotland's AEWP that allowed for reduced running speeds at locations not identified as being at risk or for blanket speed restrictions in response to forecast heavy rain. The Crown also accepted that the rule book did not cater for the imposition of a speed restriction as a result of forecast rain or rain falling. It required actual flood conditions before speed restrictions could be applied. Accordingly, on the evidence, imposing a speed restriction on train 1T08 was not a step or action that could reasonably have been taken at the time.

[269] In reaching that conclusion, I have had regard to the evidence about the instruction given to train 1A43 (redesignated 1Z43) to return to Dundee at "reduced speed" and how that stood in contrast to the instruction given to train 1T08 to proceed to Stonehaven at line speed. Train 1A43 was held at Laurencekirk station from around 7.16am until 8.28am, when route control staff instructed the Laurencekirk signaller to return the train to Dundee as redesignated train 1Z43. An informal exchange took place between route control and the signaller which identified that the train had been held for over an hour and led to control instructing the signaller that he should advise the driver of 1Z43 to run at a "reduced speed".

[270] I accepted the evidence of Ash Gardener that the instruction given to train 1Z43 did not fall into any of the categories of speed restriction recognised by the rule book, and appeared to be the application of common sense on the part of the route controller. As it transpired, that common sense was well-placed, as train 1Z43 encountered a further landslip on its journey south shortly after moving off and before it could even fully implement the instruction given to it. That instruction by route control was a deviation from the rule book, occasioned in my view by the fact that the rule book did not cater for a speed restriction to be applied in response to a rainfall event alone. I can sympathise with the position that route controller found himself in, and understand why he chose to apply his common sense to the events that were unfolding. The way in which speed restrictions are applied in response to rainfall events has changed since this accident, as I have explained below in relation to the chapter of this determination dealing with recommendations. There should be no need for a route controller to be

placed in such a position again, standing the substantial improvements made by Network rail in this area following the accident. All of that said, in the context of deciding what precautions could reasonably have been taken, I have placed limited weight on the evidence relating to the different instruction given to train 1Z43. The instruction given to that train did not accord with the rules relating to speed restrictions at the time of the derailment and for that reason, I do not consider that giving a similar instruction to train 1T08 was a precaution that could *reasonably* have been taken.

[271] Had the standards and rules in place at the time allowed for a speed restriction to have been applied in locations not identified as being at risk, such as the area of the 2011/12 drain or allowed for blanket speed restrictions in response to forecast heavy rain, the outcome for train 1T08 might have been different. For that reason, I have decided that these are matters relevant to the circumstances of the deaths and have included them as findings under section 26(2)(g).

Gold command structure

[272] On the morning of 12 August 2020 between around 7.00am to 7.30am (ie before the derailment occurred) route control decided to establish a gold command structure to manage the weather-related issues on the rail network. That decision did not take effect until 10.12am, after the derailment of train 1T08. The inquiry heard evidence about the possibility of route control establishing a "gold command" before that time, on either 11 August or earlier in the day on 12 August 2020.

[273] The gold command was an additional resource available to route control, in which senior managers are deployed to manage a specific problem, incident or event (see paragraph 238 of the RAIB report). The benefits of a gold command were explored with Ash Gardener and Karl Grewar in their evidence, which I accepted. In essence, it provided a strategic and high-level oversight, removing the management of the particular event, in this case the severe weather and disruption to the rail service caused by the weather, from the day-to-day running of the control room.

[274] The RAIB's investigation disclosed that during the night on 11/12 August 2020, the night shift RCM considered implementing a gold command, however did not do so because he decided that by the time the structure was put in place, the need for the additional support provided by the structure would have passed. On 12 August 2020, the day shift route controller, in conjunction with the head of integrated control (Karl Grewar) decided to implement the gold command, although that command structure became operational shortly after the derailment.

[275] On the evidence of both Karl Grewar, Ash Gardner and the overall conclusions in the RAIB report in this regard, establishing a gold command structure earlier in the day on 12 August 2020 was a precaution that could reasonably have been taken. The weather and overall circumstances on 12 August 2020 met the criteria for that command structure, and as a matter of fact, a gold command was put in place later in the morning on 12 August 2020. The question then, is if a gold command structure had been put in place earlier on 12 August 2020, might it realistically have avoided the deaths?

[276] The Crown invited me to make such a finding, namely that establishing the gold command before 6.38am (the departure time of train 1T08 from Aberdeen on 12 August 2020) was a precaution that could reasonably have been taken and which, had it been taken, might realistically have resulted in the deaths being avoided. In that regard, they relied principally upon the evidence of Ash Gardener speaking to the RAIB's conclusions in its report.

[277] The RAIB concluded that it was possible that had additional resources been available to route control earlier on 12 August, the threat to train 1T08 from the extreme weather in the vicinity of the train would have been realised, with the possibility of actions being taken to mitigate that threat (see paragraph 241). In his evidence, Ash Gardener was asked whether the type of actions that could have been taken would include a restriction on speed or cessation of travel. His evidence was that it would have been within the scope of gold command to "talk about" cessation of travel. He was less clear about speed restrictions, although speed restrictions are discussed in the RAIB report, none of which was challenged (see further below).

[278] Karl Grewar accepted that the events of 12 August 2020 justified a gold command structure, however explained that at the time, there was nothing in the rule book requiring any speed restrictions to be imposed unless, in circumstances such as flooding, flood water reached a particular level on the railhead.

[279] For Network Rail, James Scullion and Karl Grewar, it was submitted, in essence, that even if a gold command structure had been put in place earlier on 12 August 2020, it would not realistically have resulted in the deaths being avoided, because at the time

there was nothing in the rule book requiring or allowing for the imposition of a speed restriction on the basis of rainfall alone. I have accepted those submissions. They accord with the evidence led at the inquiry in relation to speed restrictions and my conclusions (above) in that regard. Even if a gold command had been put in place earlier in the day on 12 August 2020, a speed restriction could not have been applied to train 1T08 on its return journey to Stonehaven. As a result, while a gold command earlier in the day was a precaution that could reasonably have been taken, my view of the evidence is that it would not realistically have resulted in the deaths being avoided.

[280] The conclusions of the RAIB report in relation to gold command, and the possibility that "actions" might have been taken that might have realised and mitigated the potential threat posed to train 1T08 were not challenged in any way and I accepted those conclusions. However, that conclusion was reached in the context of an acceptance by the RAIB in its investigation that route control staff were not required to restrict the speed of train 1T08. In addition, the RAIB in reaching its conclusions is not applying the same test as I require to apply in terms of section 26(2)(e) of the Act.

[281] The only other evidence on which the Crown invited me to make a finding that a gold command might realistically have avoided the deaths by taking some other form of action came from Ash Gardner, and the possibility of a decision being made as part of gold command to cease all travel. Ash Gardener did not give evidence about cessation of travel in any detail other than to confirm to the Advocate Depute that he thought it would have been within the scope of the gold command to "talk about" cessation of travel. A decision to stop all travel as part of gold command decision-making was not a

conclusion set out in the RAIB report, and was not explored in any detail with other witnesses to the inquiry. Accordingly, I did not consider that there was a sufficient evidential basis for me to conclude that had the gold command been established earlier in the day, before train 1T08 departed, that an instruction might have been given as part of that gold command for the cessation of travel.

[282] Accordingly, for all of these reasons, while establishing a gold command earlier in the day on 12 August 2020 was a precaution that could reasonably have been taken, I do not consider that it might realistically have resulted in the deaths being avoided.

Conclusion on weather management

[283] While I have concluded that the statutory test in terms of section 26(2)(e) is not met in relation to this chapter of the evidence relating to weather-management by route control staff (including their training, competence and quality assurance re same; route coding (ie not declaring a red day), the absence of an EWAT and the inability to impose speed restrictions), when the factors I have examined are viewed together, I consider them to be facts relevant to the circumstances of the deaths.

[284] In combination, adequate training of the route control staff in Scotland in relation to the national standards and the application of route coding per those standards would have resulted in a "red day" being declared. The correct configuration of the NRWS in the control room and adequate training of staff in the use of the NRWS would also have resulted in a "red day" being declared. In either event, an EWAT would have been held. Had the standards and rule book in place at the time provided for mitigations to be put

in place, such as speed restrictions, based on an extreme rainfall event alone regardless of levels of flooding and regardless of the categorisation of certain sites being "at risk", the holding of the EWAT might have resulted in a mitigation such as a speed restriction being put in place which might have resulted in there being a different and perhaps, better outcome for train 1T08. I have therefore made findings in relation to these matters in terms of section 26(2)(g) of the Act, as being facts relevant to the circumstances of the deaths (see paragraph 379 below).

Stranded train risk assessment

[285] The inquiry heard evidence that no "stranded train risk assessment" was carried out by the control room in respect of train 1T08. According to the unchallenged evidence of the RAIB report, and the evidence from Ash Gardener about the report, a stranded risk assessment ought to have been carried out in terms of Network rail procedure (NR/L3/OPS/045/4.15) within 30 minutes of the train becoming stranded and with further assessments at intervals appropriate to the circumstances. The purpose of stranded risk assessments is to assess passenger welfare and to determine whether passengers should be evacuated from the train. The failure to carry out the stranded risk assessment was oversight due to the high workload in the route control room. Despite no risk assessment being carried out, the RAIB concluded and I have accepted that during the period that train 1T08 was held between 7.00am and 9.30am, there were no immediate welfare issues that would have required route control to take action specifically relating to passenger welfare. For example, the train had working toilets, air

conditioning etc. In addition, given the weather conditions and rural nature of train 1T08's position, evacuation of the train would have been hazardous. I have also had regard to the statements of the surviving passengers on the train. It was very clear to me that Mr McCullough, and in particular, Mr Dinnie, did their utmost to attend to the welfare of the passengers on the train during the period of the "stranding".

[286] The RAIB concluded that, although not part of the documented process for a stranded train risk assessment, it was "possible, but unlikely that an assessment in the knowledge of surrounding infrastructure problems would have triggered a decision by route control staff to require movement of train 1T08 at a reduced speed" (see paragraph 235 of the RAIB report). The RAIB reached that particular conclusion in the context of looking at the actions of route control in response to events on 11 into 12 August 2020, including its consideration of the informal exchange between route control and the Laurencekirk signaller in relation to train 1A43/1Z43. However, looking at the purpose of, and what might have been achieved by, a stranded train risk assessment, and applying my mind to the statutory test in terms of section 26(2), I do not consider that a stranded train risk assessment was a precaution that if taken, might realistically have avoided the accident, nor do I consider it to be a fact relevant to the circumstances of the deaths. That is because there were no welfare issues during the period the train was stranded that might have led to an evacuation of the train, and in any event, evacuation would have been extremely difficult given the location at which the train was being held. It was not an assessment that could give rise to a restriction on

the speed of the train on onward travel following stranding. I have therefore declined to make the findings proposed by the Crown in relation to a stranded risk assessment.

Implementation of Safety Recommendation 3 of the Landslip Class investigation in 2014

[287] The Crown invited me to find that full implementation of Safety Recommendation 3 of the Landslips class investigation in 2014 is a precaution which could reasonably have been taken and which, had it been taken, might realistically have resulted in the deaths being avoided.

[288] This chapter of evidence was spoken to by Simon French of the RAIB in his summary of this part of the RAIB report, namely paragraphs 397 to 437. None of those report conclusions were challenged in any way.

[289] For Network Rail it was submitted that I should not make the finding sought by the Crown. First, Network Rail submitted that there was limited evidence on which I could make such a finding, the Crown only having briefly explored the issue with Simon French in his evidence, and in particular, not having raised it with any witness from Network Rail. Secondly, Network Rail submitted that the RAIB did not conclude that the effective implementation of recommendation 3 of the 2014 investigation would have prevented the derailment, only that it is possible that more effective implementation would have "at least mitigated, if not prevented", and in any event, that that conclusion related to Network Rail implementing three previous recommendations, not only recommendation 3.

Implementation of previous recommendations

[290] The potential for railway incidents to be caused by failure of earthwork drainage was well-known prior to Carmont. In its report, the RAIB set out the incidents relating to earthwork drainage failure in the years preceding the Carmont derailment. The data demonstrated a correlation between earthwork failures and periods of heavy rainfall, and that failure could and did result at locations not previously considered to be "high risk" (see paragraphs 399 to 406 of the RAIB report).

[291] The RAIB had previously examined the risk posed by rainfall to the safety of the railway in its Landslips class investigation (RAIB report 08/2014), recommendation 3 of which stated, "Network Rail should implement a process for real-time collection (and appropriate use of) intelligence about very unusual rainfall or flooding conditions…". In demonstrating to the ORR that Network Rail had implemented that recommendation, Network Rail advised the ORR that it had procured as of 1 October 2015 a more advanced weather system with the ability to utilise actual rainfall data. In particular, Network Rail told the ORR that, "the current technology now allows Network Rail to better predict areas of concern for individual hazards but also act on hazards which may have occurred which were not predicted." Network Rail advised the ORR that it was in a far better position in terms of risk management for unusual and weather conditions which were not forecast. The "advanced weather system" referred to was the NRWS, which, as outlined above, was installed in the control room in Scotland, but had not been configured and staff had not been trained on how to manage the risk of intense rainfall

using that system (see above at paragraph 246 onwards and also RAIB report paragraphs 409 to 412). In his evidence to the inquiry, Simon French made clear that the ability of the controllers to take precautionary action in extreme rainfall using this technology, very much required adequate training and knowledge of the system. On its own, the technology had very limited value. Not only did individuals need to know how to use the technology, but they also needed to know what was expected of them in particular scenarios.

[292] The RAIB's Landslips class investigation also recognised that enhanced earthwork mitigation was required for very extreme weather conditions. In terms of recommendation 5 of that investigation Network Rail was to

> "formalise the process for implementing additional mitigation if very extreme rainfall conditions mean that the mitigation normally provided in response to a red warning is inadequate for earthworks on the 'at risk' register and/or there is a significant likelihood of landslips at locations not included on this register."

[293] Network Rail informed the ORR in July 2016 that the recommendation had been implemented by the introduction of a dynamic risk assessment process introduced to cover unpredicted changes to weather conditions as part of the operational weather management standard (NR/L2/OCS/021). The RAIB investigation into Carmont uncovered that reference to dynamic risk assessment for earthworks not on the "at risk list" was not provided for in Network Rail's suite of documents relating to weather management until module 8 of NR/L3/OPS/021 (June 2019), some 3 years after Network Rail justified closure of the recommendation to the ORR. In any event, by the time of the Carmont derailment, although the risk to earthworks not on the "at risk" list had been

recognised, no actions would be taken to mitigate the risk when it was triggered by rainfall alone. As Simon French set out in his evidence, what was required by module 8 was a very general process that there should be a dynamic risk assessment, but it was not tied in any way to the weather-related technology or to the specific circumstances that should trigger particular types of action, such as restricting the speed of trains or cessation of service.

[294] A further recommendation from the RAIB relating to processes needed to trigger appropriate mitigation following extreme weather was addressed in the RAIB's investigation into an incident at Lamington viaduct on 31 December 2015 in which high flows in the river Clyde (following exceptionally wet weather) caused scour at the base of a viaduct pier resulting in serious track deformation as a train travelled over it. In its report following that investigation (RAIB report 22/2016) the RAIB recommended that Network Rail should review and improve the management and assurance systems for all control centre processes relating to the safety of railway infrastructure used by Scotland Route. The review was to encompass both documented processes and the way they are implemented and was to include procedures directly relevant to control room staff and inputs required from external organisations. In implementing that recommendation, Network Rail told the ORR that it had updated its national standards for weather management. However, as the RAIB pointed out in its investigation following the Carmont derailment, and referred to above, there was evidently a gap between national standards and the way in which Scotland operated as regards weather

management. The RAIB could find no evidence that Network Rail had assured itself as to the adequacy of Scotland's weather-management processes.

[295] The RAIB concluded in the investigation into the Carmont derailment that it was possible that more effective implementation of these three RAIB recommendations addressed to Network Rail, would have at least mitigated, if not prevented the accident at Carmont.

[296] Even before the derailment at Carmont, Network Rail appeared to recognise the need to review the way in which it was implementing recommendations made to it. In July 2020 it commenced an audit of its business processes linked to the closure of RAIB recommendations and Network Rail's own formal investigations. In September 2020, that audit concluded that the process of verifying the closure of recommendations was unsatisfactory and could lead to risks not being effectively mitigated. The audit also identified a number of necessary improvements to the process for reviewing the actions taken in response to recommendations and the provision of guidance on the criteria to be used when assessing whether to close a recommendation. It also identified the need to confirm the implementation of recommendations by auditing the effective implementation of critical and high-risk controls that had been modified in response to recommendations. In other words, as Simon French described in his evidence, rather than simply saying a process had been changed in response to a recommendation, actually looking at how effectively it had been implemented.

[297] On all these matters, Mr French was speaking to the RAIB report's conclusions, none of which was challenged by any participant. While I accept that changes were

made by Network Rail in response to the earlier RAIB recommendations referred to above, Network Rail failed to recognise problems in the way those changes were being implemented and whether they were being given effect to. For example, Network Rail failed to recognise that route controllers had not been trained in how to use the new NRWS technology effectively and that dynamic risk assessment of weather-related risk to earthworks not on the "at risk" list was not tied to any action to mitigate the risk, for example by imposing speed restrictions or stopping all travel completely. There was also a failure to understand the gap between the expectation of national standards relating to weather management and the practice of route control in Scotland. I considered all of that to be tied to a failure by Network Rail to carry out sufficient quality assurance of its own processes, including training of staff.

[298] While implementation of previous recommendations of the RAIB, in particular more effective implementation of Safety Recommendation 3 of the Landslips class investigation in 2014, is a precaution that could reasonably have been taken, I did not consider there was sufficient evidence on which I could conclude that if it had been taken, the deaths might realistically have been avoided. In addition, and in any event, in concluding that it was possible that more effective implementation would have "at least mitigated, if not prevented" the accident, the RAIB was not applying its mind to the statutory test I require to apply when deciding whether or not to make a finding under section 26(2)(e).

[299] In any event, I have already recorded the matters which gave rise to RAIB's conclusion that Network Rail had not more effectively implemented these three earlier

recommendations from separate RAIB investigations, as facts relevant to the circumstances of the deaths, namely my findings 12(c) to 12(f) above and explained at paragraph 379 below.

(iii) The train

[300] The inquiry heard evidence about the design and physical features of train 1T08, how those physical features performed during the derailment, how the train protected its occupants during the accident (its "crashworthiness") and how train 1T08's features compared with modern structural and crashworthiness standards.

[301] In this context, "crashworthiness" relates to the ability of a train/vehicle to protect its occupants in the event of an accident. Crashworthiness does not therefore prevent an accident. However, it can mitigate the consequences of an accident for the occupants of the train.

[302] The court heard evidence from Dominque Louis about the conclusions of the RAIB report and from Anna O'Connor of the ORR in relation to the implementation of recommendations made by the RAIB following the accident, including the report prepared by Angel Trains relating to implementation of recommendation 19 (Crown production 1691). The particular features of the train to which the evidence about crashworthiness related were: the driver's cab; the vehicle structure of the mark 3 coaches and corrosion in coach D; the couplers; bogie retention; lifeguards; the vehicle interiors including folding tables, seat belts; and window breakage.

[303] In its written submissions, the Crown invited me to make a finding that forming train 1T08 of stock designed and manufactured to modern standards and fitted with bogies, couplers, lifeguards, anti-climb features and energy absorbing vehicle ends all conform to modern standards is a precaution which could reasonably have been taken and which, had it been taken, might realistically have resulted in the deaths being avoided. However, in his oral submissions to the inquiry the Advocate Depute referred to a "softening of approach" in relation to the Crown's position as to whether updating HSTs to comply with modern crashworthiness standards was a precaution that could reasonably have been taken. In addition, he accepted that given the severity of the collision, compliance with modern crashworthiness standards might not have made a difference, but referred me to the evidence (principally the RAIB report) that suggested that had the various modern features been in place on train 1T08, the "nature of the event" would have been different.

[304] In his supplementary oral submissions the Advocate Depute conceded that, with the exception of lifeguards, a "retro fit" of HST rolling stock or even a substantial modification in line with modern standards, given the enormous cost involved and limited lifespan of the HST stock, was not a precaution that could reasonably have been taken.

[305] Scotrail Trains Limited, the ORR and Angel Trains each gave detailed submissions to the inquiry on this chapter. In summary, their position was that I should decline to make the finding invited by the Crown because the evidence before the inquiry did not support that conclusion, in respect that (i) updating train 1T08 to

conform with modern crashworthiness standards (with the exception of lifeguards) was not a precaution that could *reasonably* have been taken, standing the costs involved in achieving that; and (ii) while the RAIB concluded that if train 1T08 had complied with modern crashworthiness standards it was more likely than not that the "outcome" would have been better, there was no evidence before the inquiry that would allow a finding that the deaths might have been avoided if the precaution had been taken.

[306] The RAIB made no submission in relation to whether updating HSTs to comply with modern crashworthiness was a precaution that could reasonably have been taken. However, in relation to the second part of the statutory test required by section 26(2)(e), in summary the RAIB submitted that the evidence, namely the RAIB report and the evidence of Dominque Louis, did allow for a finding that if the precaution had been taken that the deaths might have been avoided. In that regard, the RAIB referred me to the evidence of Mr Louis and the salient parts of the RAIB report, and made detailed oral submissions as to why the submissions made by Angel Trains Limited were flawed and should be rejected.

[307] Against that summary of parties' respective positions on this chapter of the evidence, the following explains why I have declined to make the finding invited by the Crown.

Background to the HST

[308] Mr Louis provided the background to the HST, and in doing so, was speaking to the RAIB report at paragraphs 481 to 483. Anna O'Connor also gave evidence

regarding the context of HSTs including their operation and known characteristics as well as the Angel Trains Report. In relation to the history and background of the HST, none of that evidence was controversial.

[309] Train 1T08 was a high-speed train, comprising a leading power car, four passenger coaches, all being British Rail mark 3 coaches, followed by a trailing power car. The HST was first introduced into the main line service in the mid-1970s. It was therefore designed and manufactured before the Railway Group Standard GM/RT2100 issue 1, July 1994 (and later), namely the modern structural and crashworthiness standards with which trains designed and manufactured since that date must comply. To be clear, the fact that HSTs were designed and manufactured before modern crashworthiness standards does not prevent them from continuing to operate. It is a principle of railway regulation that rolling stock remains permitted to operate so long as it is considered sufficiently safe.

[310] In around 2019, the mark 3 coaches (including therefore, the coaches forming train 1T08) underwent a life-extension refurbishment, including fitting powered sliding doors to replace the manually operated "slam" doors.

[311] Historically, HSTs have generally performed well in terms of maintaining structural integrity and protecting occupants. Having been in service for around 47 years, their characteristics and behaviour are well known to the ORR as well as the industry as a whole. The crashworthiness of HSTs had been considered before the derailment at Carmont, both in the context of regular inspection, maintenance and refurbishment and following particular incidents.

Train 1T08

[312] The RAIB investigation examined the behaviour and characteristics of train 1T08 and concluded that some of those characteristics positively affected the course of events and minimised the risk to occupants, while others adversely affected the outcome. The following characteristics were considered by the RAIB and by this inquiry.

Driver's cab

[313] At the point of derailment, Mr McCullough was in the driver's cab. The RAIB investigated the characteristics and design of the driver's cab. Their conclusions are set out principally at paragraphs 463 and 484 to 490 of their report. As already outlined earlier in this determination, on striking the washout, the leading power car collided with the end of the parapet of bridge 325, veering off the bridge and down on to the embankment. On striking the embankment, the driver's cab (attached to the front of the leading power car) broke up and completely detached from the leading power car. The cab roof, windscreen and left-hand side remained together and were located around 22 metres from the power car towards the bottom of the slope. Mr McCullough's body was found nearby. The cab floor, left and right-hand doors, driver's desk and seat all detached to the left of the power car and came to rest at various positions, either close to the power car or further down the slope (RAIB report paragraph 486).

[314] The driver's cab was manufactured from glass fibre reinforced plastic (GRP) and bolted directly to a bulkhead at the forward end of the engine compartment and the underframe of the power car. That was unlike most other modern train cabs, which have a steel or aluminium cab superstructure covered by non-structural GRP. However, the RAIB's investigation concluded that the speed of impact of the cab (around 45mph) was significantly beyond the collision speeds for which modern cabs are designed to provide protection for occupants. The RAIB concluded that "given the severity of the collision conditions, significant damage to this or any other cab's structure was inevitable" (RAIB report; paragraph 487). In light of that conclusion, and on the basis that no participant invited me to make any finding in relation to the modern crashworthiness of the driver's cab, I have declined to make any such finding.

Driver seat belts

[315] The RAIB concluded that the primary cause of the fatal injuries sustained by Mr McCullough was secondary impact with the cab windscreen and interior, as the leading power car struck the embankment below the bridge.

[316] The inquiry heard evidence that driver's cabs of HSTs and more modern trains designed before GM/RT2100 (issue 4, December 2010) are not fitted with seat belts or any other specific secondary impact protection (eg airbags and knee bolsters) for the driver. Train driving cabs designed after GM/RT2100 (issue 4) came into force are required to undergo a dynamic crash test, however, even these more modern cabs are not fitted with seat belts or airbags for secondary impact protection. The evidence from

the RAIB demonstrated that a significant amount of research was undertaken by the rail industry into providing better protections for train drivers, the earliest being between 1992 and 1996 as part of British Rail's crashworthiness development programme and also following the Ladbroke Grove rail accident in 1999. An RSSB project (2003 to 2007) undertook further research into driver protection measures. It concluded that even relatively low speed collisions can result in the driver sustaining serious or fatal injuries. A viability assessment concluded that, following the introduction of safety systems such as the train protection and warning system (which reduce the risk of collision), the cost of measures such as airbags and seat belts would have been grossly disproportionate to the benefits, and that widespread installation within the industry would require wider industry consensus.

[317] On the evidence, I did not accept that the fitting of secondary impact protection (including seat belts) in the driver's cab was a precaution that could reasonably have been taken or indeed that the fitting of seat belts or other protective mechanisms within the driver's cab might realistically have avoided Mr McCullough's death.

[318] The previous detailed industry research referred to by the RAIB and the conclusions from same have persuaded me to the view that the fitting of seat belts in driver cabs was not a precaution that could reasonably have been taken standing the disproportionate cost involved in making those modifications. In addition, on the evidence of Anna O'Connor, given in the context of the implementation of recommendation 17 of the RAIB report following the derailment (recommending further research on secondary impact protection devices for train drivers, including seat belts),

one of the most influential factors in the ORR deciding that there was nothing further that could reasonably practicably be done in this regard was the view of the train driver's union, who were not generally supportive of measures relating to secondary impact protection even after the derailment at Carmont. It is reasonable to infer that that view was also held prior to this derailment.

[319] In addition and in any event, while the RAIB considered that the principal cause of Mr McCullough's fatal injuries was secondary impact with the interior of the cab and windscreen, there was no evidence before the inquiry as to what the outcome might have been had secondary impact protection such as a seat belt been fitted within the cab and used by him. Given the evidence from the RAIB as to the significant collision speed and severe impact conditions experienced by the cab, I do not consider that it can be said there was a real or lively possibility of Mr McCullough's death being avoided if he had been wearing a seat belt.

Coach D

[320] Mr Dinnie was in the leading vestibule of coach D immediately prior to the train striking the washout. Coach D, being the first passenger coach attached to the leading power car, suffered the greatest damage of the passenger vehicles comprising train 1T08. There was severe damage to the gangway pillars and corner pillars at the leading end of the vehicle, which had sheared off at their attachment to the underframe, resulting in a compete loss of survival space in the leading vestibule. The bodysides of coach D had creased along a line below the windows and several bodyside skin panes split along

weld lines. The collapsed roof and bodysides on coach D also caused substantial disruption to the interior furniture, light fittings and trim panels in the leading half of the vehicle, but the seats and tables remained attached. Almost all the windows in the leading half of the vehicle were broken through.

Corrosion

[321] In its investigation, the RAIB found evidence of corrosion in damaged areas of coach D. Although the RAIB found that "unsurprising," given the age of the vehicles, during its thorough investigation it nevertheless considered whether the extent of corrosion may have affected the way the coach structures deformed and, in particular, the loss of survival space in coach D. The corrosion observed is set out in detail in the report at paragraphs 495 and 496. The RAIB also considered the corrosion repairs carried out on coach D in 2019, as well as repairs authorised in relation to corrosion identified on the two gangway pillars at the leading end of coach D at the time of conversion of the mark 3 coaches in May 2020. They found no photographic records of that work. The pillars were too damaged in the accident for the RAIB to carry out any meaningful retrospective assessment of the work. The RAIB concluded that the corrosion of the pillars and associated "loss of material" would have weakened the body-end (vestibule) structure to some extent. However, the forces applied to the pillars at the time of the derailment were not known and therefore the RAIB was not able to assess whether or not the original strength of the pillars, without any material loss due

to corrosion, would have been sufficient to resist the forces applied. For that reason, I have declined to make any findings specific to the corrosion found in coach D.

Anti-climb features and energy absorbing vehicle ends

[322] The inquiry heard evidence that the bodyshells of the mark 3 coaches generally performed well in the accident. With the exception of the leading vestibule of coach D, there was limited loss of survival space even in coaches C and D which had rolled on to their roofs (RAIB report paragraph 491).

[323] However, in the leading vestibule of coach D, where Mr Dinnie was located, there was a complete loss of survival space. The RAIB concluded that was likely to have occurred when coach D overrode the trailing end of the power car, just before the power car veered off the bridge. The vestibule is protected by four body-end pillars, comprising two gangway pillars either side of the flexible gangway, and two corner pillars next to the doors. As outlined above, all the pillars at the leading end were sheared off at their bases.

[324] The RAIB's investigation disclosed that although the pillars on the mark 3 coaches provide a degree of protection, they are vulnerable when overriding occurs and collision forces exceed the strength of the pillars. The mark 3 coaches pre-date the current requirements for vehicle ends to be energy-absorbing. Therefore, when the pillars shear off, the body-end structure loses its ability to resist intrusion into survival spaces.

[325] Modern trains designed and manufactured since GM/RT2100 are fitted with anti-climb features, either as serrated pads fitted to the vehicle ends or built into the couplers and energy-absorbing vehicle ends to prevent override and uncontrolled structural collapse in collisions. The RAIB concluded that had the train been fitted with these features, overriding between the leading power car and coach D was less likely to have occurred. In that scenario, survival space in the leading vestibule of coach D might have been better preserved.

[326] In addition to the evidence from the RAIB, the inquiry also heard evidence from Anna O'Connor speaking to the Angel Trains Report. In relation to "anti-climbers", the report acknowledged the overriding of coach D and the leading power car. However, it also noted that the power car derailed to the left. The report noted that for anti-climbers to be effective it must also be possible for couplers to shear out (break), allowing the coupler shank to retract into the vehicle and the anti-climber pads to mesh together. It noted that was only effective if the vehicles are railed and at a similar level.

Couplers

[327] The RAIB considered the couplers on train 1T08 and how they behaved during the derailment. The RAIB concluded that the HSTs are fitted with "Alliance" couplers which were not able to withstand the forces and relative vehicle movements during the derailment. On derailment, all the vehicles became uncoupled except at the interface of coach A and the trailing power car. The uncoupling of the vehicles allowed the vehicles to scatter and roll over and increased the risk of secondary impact with the

infrastructure and other vehicles and their bogies (see paragraph 502 of the RAIB report).

[328] The RAIB considered what might have happened in the derailment if train 1T08 had been fitted with more modern couplers. It found that in general, modern vehicles feature robust couplers which are better able to resist the large movements and bending forces to which couplers are subjected in derailments, without failure or uncoupling.

[329] In looking at how the train might have behaved if stronger couplers had been fitted, the RAIB considered the possibility that stronger couplers might have resulted in coach D and possibly other coaches, being pulled off the bridge by the leading power car, a matter that was also acknowledged by the Angel Train's report in its analysis of the feasibility of stronger couplers being added to the HST. The RAIB could not discount that possibility, but considered it to be unlikely. That was because stronger couplers, working together with anti-climb devices (if not fitted within the coupling system itself) and energy-absorbing vehicle ends, should have prevented the overriding between the power car and coach D. In the absence of overriding, the rear of the leading power car would be likely to have remained coupled to coach D, increasing the likelihood of coach D continuing to run on its leading bogie and providing greater stability to the rear end of the leading power car. In turn, that might have been sufficient to keep the leading power car on the track for longer, increasing the likelihood of it completely traversing the bridge. However, further jack-knifing between the leading power car and coach D beyond the bridge might still have occurred.

Bogie retention

[330] The RAIB's investigation examined how the train's "bogies" performed in the derailment. Mr Louis described that a bogie is, in layman's terms, a box that connects two wheelsets together, located underneath the body of the vehicle. Unlike vehicles designed to modern crashworthiness standards (after July 1994) the mark 3 coaches are not fitted with any form of bogie retention in the vertical direction. The RAIB concluded that the lack of bogie retention in the vertical direction allowed the vehicle bodies to lift off their bogies during the derailment.

[331] During the derailment, the vehicle bodies of coaches B, C and D became detached from their bogies. The RAIB's investigation found that separation had occurred by the vehicle bodies lifting off the bogies, most likely as a result of severe pitching movements. The consequences of these coaches losing their bogies can be summarised as follows: (i) it adversely affected the ability of the train to dissipate kinetic energy by braking and by bogies running derailed through ballast; (ii) coaches B, C and D were also free to slide and roll in an uncontrolled manner, whereas attached bogies tend to resist sliding because they dig into the ballast; and (iii) the detached bogies became obstacles in the path of the vehicle bodies and coach C was likely to have suffered some of its penetration damage as a result of striking detached bogies.

[332] The RAIB's investigation outlined that retaining bogies (as modern vehicles do) increases the chances of keeping vehicles upright and in line, minimising the risk of jack-knifing and vehicle scatter. Additionally, when retained bogies derail, they dissipate the train's kinetic energy in a benign way by ploughing through the ballast. For those

reasons, in the circumstances of the derailment at Carmont, the RAIB concluded that bogie retention was likely to have led to a "better outcome".

Lifeguards

[333] The RAIB investigation considered the "lifeguards" fitted to train 1T08 and considered what might have happened if more modern lifeguards had been fitted. A lifeguard is a metal bracket fitted in front of the leading wheels of trains. Its purpose is to disperse any relatively small debris on the track, preventing it from getting under the leading wheels and causing a derailment.

[334] The HST lifeguards, and therefore the lifeguards on train 1T08, were designed before the introduction of the modern crashworthiness standards in 1994. Modern lifeguards are able to resist a sustained concentration force (proof load) of at least 20 kilonewtons (kN) applied at their bottom edge, horizontally and in a longitudinal direction towards the adjacent wheel without yielding. A "side to side" (simultaneous traverse) force of 10 kN in either direction is also specified. Beyond the proof load, the lifeguard should deform and be able to resist an ultimate load of at least 35kN and remain securely attached to the bogie without fouling the track or running gear.

[335] The lifeguards on train 1T08, designed before these modern standards, comprised a vertical blade made from mild steel and bolted to a bogie-frame mounted bracket by two bolts. In its investigation, the RAIB concluded that the ultimate strength of the HST lifeguard was around 15kN, less than half the minimum ultimate strength of modern lifeguards. The weakest point of the HST lifeguard is the lower of the two

attachment bolts, which shears when the lifeguard is overloaded, allowing the lifeguard to rotate backwards, preventing it from carrying any significant load and performing its clearing function. During the derailment of train 1T08, both lifeguards on the leading bogie failed at the bolted joint and rotated backwards. The RAIB concluded (see paragraphs 272 and 273 of the report) that, had the left-hand HST lifeguard been designed in accordance with modern standards, it *might* have been better able to cut a path through the washout debris sufficient to prevent the left-hand leading wheel lifting into derailment. However, the RAIB had insufficient evidence to determine the likelihood of that improved outcome. I accepted the evidence of Dominique Louis that, while it is better to have modern and therefore stronger lifeguards on a train faced with washout debris over the tracks, there was insufficient evidence available to the RAIB to know whether a stronger modern lifeguard might have prevented the derailment at Carmont.

[336] I have also taken account of the evidence of Anna O'Connor, who was asked about lifeguards in the context of the recommendations made by the RAIB as well as the Angel Train's report. Despite inviting me to make a finding that forming train 1T08 of stock designed and manufactured to modern standards including lifeguards was a precaution that could reasonably have been taken and had it have been taken, might realistically have resulted in the deaths being avoided, in his questioning of Ms O'Connor the advocate depute appeared to accept that a modern lifeguard would not have made any difference in the case of the derailment at Carmont. Ms O'Connor

agreed with the Advocate Depute's statement that it did not appear that a modern lifeguard, had it been fitted to the HST in Carmont, would have made any difference.

[337] I have concluded that, while the fitting of a modern lifeguard on train 1T08 was a precaution that could reasonably have been taken, the second part of the test in section 26(2)(e) has not been met. I do not consider that there is sufficient evidence on which I could conclude that the fitting of a modern lifeguard might realistically have avoided the deaths.

Obstacle deflectors

[338] Related to lifeguards, and on the basis that there was evidence before the inquiry about this in Mr Louis' evidence and in the RAIB report (paragraph 530), I will briefly state the position relating to obstacle deflectors. Obstacle deflectors are mounted off the vehicle body ahead of the bogie-mounted lifeguards and span the full width of the track. Their purpose is to minimise the risk of derailment in the event of a train striking a large obstacle. Modern trains designed to GM/RT2100 (issue 1, July 1994 and later) with a leading axle load of less than 17 tonnes are fitted with obstacle deflectors. The minimum axle load of an HST is 17.6 tonnes. However, more recent trains, compliant with European Technical Standards for Interoperability have obstacle deflectors regardless of load. The conclusion of the RAIB, with which the Angel Trains report agreed, was that even if train 1T08 had been fitted with an obstacle deflector, the depth of washout on the track was too low to have engaged with the obstacle deflector. Accordingly, I have made no finding under section 26(2)(e) in relation to obstacle deflectors.

RAIB overall conclusion on modern crashworthiness standards

[339] The RAIB's overall conclusion in relation to comparison with modern crashworthiness standards, and in particular the modern standards relating to anti-climb features and energy-absorbing vehicle ends, couplers, bogie retention and lifeguards was that it was more likely than not that the outcome would have been better if the train had been compliant with modern crashworthiness standards. In support of that conclusion, the RAIB referred to the derailment near Grayrigg in, Cumbria in February 2007. In that accident, the train was designed to modern crashworthiness standards, carrying 109 people and travelling at 95 mph. The ratio of kinetic energy to train weight involved in the derailment was around 1.7 times greater than at Carmont. In his evidence to the inquiry, Mr Louis explained that the train at Grayrigg was a nine-car set. In that derailment, the vehicles generally remained coupled together. There was some jack-knifing, but not much. There was no overriding of coaches, or coaches being penetrated by bogies. The leading power car was the only vehicle which rolled over completely on to its roof. Some rolled on to their side. In his evidence, Mr Louis acknowledged that a degree of caution requires to be exercised when comparing different collision events, because of differences in topography, layout and circumstances.

Other physical components examined

[340] The inquiry heard evidence about other aspects of the physical components of the train, not examined by reference to modern crashworthiness standards but which did give rise to recommendations from the RAIB, namely the vehicle's interiors, the vehicle's windows and the absence of passenger seat belts. In summary, the vehicle's interiors generally performed well during the derailment but following observations regarding folded tables at certain seats, the RAIB made a recommendation in that regard. No passengers were sitting at those tables, and they were not relevant to the circumstances of the death. I have not made any findings in relation to the folding tables under section 26 of the Act. Similarly, the windows of the train complied with the standards in place at the time. The RAIB did make a recommendation relating to a review of train glazing standards to reduce ingress of glass shards in an accident without compromising passenger containment (recommendation 15). I was not invited to make any findings in relation to the windows. I did not consider the windows to be relevant to the circumstances of the deaths, although I noted from the evidence that surviving passengers were affected by the performance of the windows during the derailment. That is considered in brief terms in the section of this determination relating to section 26(4) of the Act, namely the work done by the railway industry in response to the RAIB's recommendations. In relation to passenger seat belts, I have explained in more detail why I have not made any finding in that regard under sections 26(2)(e) and (g) in light of the fact that Mr Stuchbury was travelling on train 1T08 as a passenger.

Seat belts

[341] The passenger coaches in train 1T08 were not fitted with seat belts, in common with all other passenger rail vehicles in the UK and other countries. In high energy accidents, train occupants are therefore vulnerable to secondary impact injuries as a result of being thrown around the vehicle interior.

[342] Mr Stuchbury was the only passenger killed during the derailment. He was ejected through the open gangway at the leading end of coach C, most likely when it struck the wooden bank after traversing the bridge and running off to the right-hand side of the track. Mr Louis' evidence to the inquiry, which I accepted, was that Mr Stuchbury (who had been sitting in coach B earlier in the journey) was likely to have been walking through the train and was in the leading vestibule of coach C when the accident happened. Therefore, I have concluded that even if a seat belt had been fitted, it would not have avoided his death. The six surviving passengers sustained injuries as a result of secondary impact, three sustaining serious injuries and three sustaining minor injuries. The RAIB concluded that seat belts could have been effective in reducing the severity of the secondary impact injuries if they had been fitted and worn by the train's occupants at the time of the derailment. Mr Louis referred to previous research carried out by the RSSB following a derailment in 2004 (before the RAIB was established), which had justified the non-fitting of seat belts to passenger coaches and also the RAIB investigation into the Grayrigg derailment and its recommendation that further research by the RSSB in relation to seat belts should be carried out. Ultimately, the ORR reported that the recommendation had been considered, but no further research carried out and

the recommendation was closed. All of that said, the RAIB also acknowledged that there were "many practical difficulties associated with seat belt fitment (such as standing passengers) and the likelihood that any cost benefit evaluation is most unlikely to show that it is reasonably practicable to fit them." Mr Louis confirmed in his evidence that one such practical difficulty would be passengers choosing to wear the seat belts even if fitted.

[343] There was no evidence to suggest that the fitting of seat belts was a precaution that was reasonable to take. On the contrary, the evidence to the inquiry was that the retro-fitting of seat belts to all trains in the UK (including HSTs) would be grossly disproportionate to the benefits derived from having seat belts, particularly given the practical difficulties identified above. In addition, and in any event, there was no evidence in this inquiry to suggest that seat belts in the passenger coaches would have avoided the deaths, in particular, the death of Mr Stuchbury.

Was compliance with modern crashworthiness standards a precaution that could reasonably have been taken?

[344] During supplementary oral submissions to this inquiry, the Crown ultimately conceded that despite inviting me to make the finding set out at paragraph 303 above, forming train 1T08 of stock that complied with modern crashworthiness standards was not a precaution that could reasonably have been taken. In light of the evidence led in this regard, and the detailed submissions made by parties and standing the inquisitorial nature of this process, I have not simply accepted that concession made by the Crown

and have considered the evidence relating to this issue in light of the section 26(2)(e) test.

[345] Having regard to the evidence of Ms O'Connor and the content of the Angel Trains Report spoken to by her, which formed part of the evidence to this inquiry, I have concluded that forming train 1T08 of stock that complied with modern crashworthiness standards was not a precaution that could reasonably have been taken. In that regard, I accepted the evidence of Anna O'Connor that, save for the issue identified by the RAIB in relation to the folding tables (see above), all of the features highlighted by the RAIB's investigation and report about the characteristics of HSTs and the way train 1T08 had behaved in the derailment were known to the industry and had previously been considered. In that regard, she referred to the report prepared by Angel Trains in which previous work reviewing HST performance following other incidents had been outlined. She was clear in her evidence that structural integrity of the HST, including bogie retention and cab design, had already been considered (see further below). In addition, her evidence was that the risk pertaining to HSTs had changed significantly since they were first introduced on to the network and had changed almost beyond recognition since the 1994 modern crashworthiness standards, mainly due to other improvements to railway safety. Ms O'Connor explained this by reference to the following example. A significant known risk to railway safety 30 years ago was train collision occurring due to a train passing a signal "at danger". She explained that this particular risk has reduced considerably in modern times since the introduction of the Train Protection and Warning System. Similarly, improvements have been made in relation to the main

causes of derailment (broken rails and failure of stretcher bars) following other earlier incidents. Overall, the "risk picture" has changed considerably since HSTs were first introduced. Ms O'Connor invited the court to consider the low number of HSTs still in passenger service, namely 25 sets with a limit on how long they will remain in service (see further below). Taking all of that together, her evidence as to the "reasonable practicability" of making changes to the HST fleet to comply with modern crashworthiness standards should be viewed against the background of a much-reduced risk for a very small population of the fleet. The cost and effort in making the changes to bring the various features above up to modern crashworthiness standards (with the exception of changes to lifeguards which have been made following the RAIB recommendations – described at paragraph 353 below) would be, in Ms O'Connor's words, "grossly disproportionate to the risk".

Angel Trains report

[346] Ms O'Connor also spoke to the report prepared by Angel Trains Limited (Crown Production 1691). After the derailment at Carmont and following the investigation and report by the RAIB, Angel Trains Limited produced a report to address recommendation 19 of the RAIB report, relating to HST crashworthiness. The scope of the report included: a review of previous crashworthiness research; a review of previous accidents; findings from the RAIB report; a review of the requirements contained within GM/RT2100 (issue 1, July 1994); the development of practical risk controls; and development of modification options for HST and associated costs. The

report is detailed and thorough. It was spoken to by Anna O'Connor in the context of the work done by industry in implementation of the RAIB recommendations.

[347] I accepted the evidence of Anna O'Connor, speaking to the report, that the characteristics and behaviour of HSTs were well known prior to Carmont (in particular, section 8 of the report as well as appendices A, B and C) as well as her evidence that, although designed before modern crashworthiness standards, the HST does still have a reasonable level of inherent crashworthiness (see paragraph 8.3; and paragraph 14.3 of the report). At slow speeds, the crashworthiness of the HST is comparable to modern trains. At high speed, it will not guarantee a high level of protection. In that regard, I accepted Anna O'Connor's evidence that even in the most modern trains, crashworthiness has limits. I also accepted the evidence contained in the Angel Trains report that high speed derailments are unlikely and that a HST has a relatively high axle load that serves to resist derailment in a wide range of impact scenarios. I accepted the conclusion of the report that the HST cab provides a good level of protection against debris strikes occurring below floor level at relatively high speeds, but performs less well when involved in debris collision at windscreen level and above.

[348] In particular, the report and work carried out by Angel Trains included a detailed cost analysis in relation to each of the modifications that would require to be carried out to bring HSTs up to modern crashworthiness standards. It is unnecessary to outline that cost analysis in detail, on the basis that no participant sought to dispute the conclusions of the report or indeed Anna O'Connor's evidence in this regard.

[349] The report concluded that, based on the remaining lease period of the HST vehicle assets, the crashworthiness modification options that would be required to meet the modern requirements of GM/RT2100 (issue 1, July 1994) were not feasible. The costs were grossly disproportionate to the safety benefit and were not reasonably practicable to implement.

[350] Lifeguards were an exception to that conclusion because, by the time of the report, the decision had already been taken to embark upon a redesign of the lifeguard component on HSTs and redesigned lifeguards had by that time been fitted to the operational HST fleet.

[351] I accept that the evidence from Ms O'Connor and also the conclusions of the Angel Trains report related, in the main, to the reasonableness of making the modifications post-Carmont in response to the RAIB's investigation and recommendations. In considering section 26(2)(e), I must consider the precautions that could reasonably have been taken before the accident that might realistically have avoided the accident or deaths. Crashworthiness would not have avoided the accident, because it did not cause the accident. The cause of the accident was principally the train hitting the washout from the drain. However, crashworthiness is a relevant consideration in relation to the whether the deaths might have been avoided, standing the fact that all three fatalities were caused by multiple non-survivable blunt force injuries sustained in the derailment. So, was modifying the HST fleet (and train 1T08 in particular) to comply with modern crashworthiness standards a precaution that could reasonably have been taken?

[352] I consider that the conclusions reached in the Angel Trains report in response to the derailment, accepted by the ORR are relevant in considering what precautions could reasonably have been taken before the accident, in large part because those conclusions were informed by previous accidents and industry knowledge about HSTs. Having regard to the overall reliability of the HST, its reasonable level of crashworthiness, the low likelihood of high-speed derailments and the significant cost involved in modifying the fleet to comply with the modern standards, I have concluded that, although a precaution that could have been taken prior to the accident was updating the HSTs to comply with modern crashworthiness standards, it was not reasonable for that precaution to have been taken.

Lifeguards

[353] The exception to that conclusion is the installation of new lifeguards. The upgrade to a more modern lifeguard was made promptly following the derailment at Carmont. It is therefore reasonable to infer that modification could have been made prior to the derailment. However, standing my conclusion above that there was insufficient evidence on which to conclude that a more modern lifeguard might realistically have avoided the deaths, I have declined to make a finding under section 26(2)(e) in relation to lifeguards.

Conclusion on reasonableness of precautions and section 26(2)(e)

[354] Standing my conclusion that the modifications (other than lifeguards) to bring train 1T08 in line with modern crashworthiness standards were not precautions that could reasonably have been taken, I have not made any findings under section 26(2)(e) relating to the modern crashworthiness of train 1T08. Strictly speaking, it is therefore unnecessary for me to consider whether or not the modifications outlined above (relating to anti-climb features, energy-absorbing vehicle ends, couplers and bogie retention) might realistically have avoided the deaths, since both parts of the test in section 26(2)(e) require to be met before a finding can be made in terms of that section. However, even if I am wrong in my finding that these were not precautions that could reasonably have been taken, I consider that there was insufficient evidence on which I could conclude that the second part of the test was met in relation to whether or not any precautions if taken might realistically have avoided the deaths.

Section 26(2)(e)(ii): even if precautions could reasonably have been taken in relation to HSTs, had they been taken might they realistically have avoided the accident/deaths?

[355] In respect of this part of the test as it relates to crashworthiness, the position of ScotRail, the ORR and Angel Trains Limited was, in essence, that there was insufficient evidence on which I could conclude that modifications to train 1T08 to bring it in line with modern crashworthiness standards might realistically have avoided the deaths. In that regard, I was referred to both the evidence of the RAIB report (above) as well as the conclusions of the HST report on crashworthiness.

[356] For the RAIB it was submitted that this part of the statutory test is a relatively "low bar". The court is not looking at the balance of probabilities. The prospects of avoiding a death would include prospects of less than 50%. Whether or not there is a real or lively possibility of a precaution avoiding a death is reference to a real, rather than a remote chance. The RAIB invited me to accept that the conclusion at the RAIB report at paragraph 535 met that test, namely the RAIB's conclusion that it was more likely than not that the outcome would have been better if the train had been compliant with modern crashworthiness standards. In relation to the submissions from Angel Trains that modern crashworthiness would have had a minimal impact in a high-speed collision, the RAIB submitted that the speed at which the collision took place was not known. Although the train's speed at the point of derailment was around 73 mph, it would have decelerated as it moved through the ballast, before it hit the parapet, and therefore the speed at the point of collision with the parapet would have been less.

[357] I have already provided my conclusions in relation to this part of the test as it relates to the driver's cab, obstacle deflectors and lifeguards. I have reached those conclusions principally based upon the RAIB's report and the evidence of Dominique Louis on same.

[358] In relation to anti-climb features, couplers, and bogie retention, while I accept the evidence of the RAIB on all of these matters, and their overall conclusion that it was more likely than not that the "outcome" would have been better if the train had complied with modern crashworthiness, on the evidence I do not consider there to be a sufficient evidential basis to conclude that can be equated with a real or lively possibility

that the deaths might have been avoided. No modelling was undertaken as to what might have happened if train 1T08 had the modern crashworthiness features referred to. That there might have been better outcomes was not indicative of a real or lively possibility that the deaths might have been avoided in the particular circumstances of this incident. While reference was made by the RAIB to the accident at Grayrigg to support their conclusion that outcomes would have been better the train had modern crashworthy features, I must bear in mind that the circumstances of the derailments at Carmont and Grayrigg were not identical. We simply do not know whether the modern crashworthiness standards referred to might realistically have avoided the deaths of Mr Stuchbury, Mr Dinnie and Mr McCullough. My conclusion in this regard is not at odds with the RAIB's report. I accept their conclusion that it is more likely than not that the outcome would have been better if the train had complied with modern crashworthiness standards. However, I require to view the evidence, including that conclusion, in the context of the wholly different statutory test in terms of section 26(2)(e). For the reasons already outlined, I am not satisfied that test is met. I do however, consider that the train's non-compliance with modern crashworthiness standards is a fact relevant to the circumstances of the death. Accordingly, I have made a finding in that regard in terms of section 26(2)(g).

(iv) Guidance of derailed vehicles

[359] The RAIB investigation and report considered the absence of any guard rails on the approach to and over bridge 325 at Carmont. The Crown invited me to make a

finding that the installation of guard rails from the point of the washout (around 32 metres from the bridge) is a precaution which could reasonably have been taken and which, had it been taken, might realistically have resulted in the deaths being avoided.

[360] Mr Louis, speaking to the RAIB report, gave evidence that the purpose of guard rails is to contain any derailed wheels so that they remain close to the track and do not allow the train to deviate into collision with the infrastructure (for example, parapets) or trains on adjacent lines. In this case, the curvature of the track to the right after the washout, combined with the cess (part of the track bed outside the ballast shoulder) being lower than sleeper level, meant that the deviation of the leading bogie when it reached the bridge was sufficient for it to collide with the bridge. To be effective in guiding a derailed train approaching a high-risk feature (such as a parapet) guard rails need to extend for a sufficient distance on the approach to that feature.

[361] The RAIB concluded that a guard rail or containment kerb could have prevented excessive deviation of the leading bogie and thereby avoided the collision between the leading power car and the bridge parapet, which, the RAIB concluded, was likely to have led to a "significantly better outcome". However, to be effective, a pair of guard rails would have needed to extend out from the bridge for a minimum distance of around 32 metres.

[362] At the time of the derailment, Network Rail's standard NR/L2/TRK/2102, "design and construction of track" (issue 8, September 2016 with a compliance date of 1 March 2017) was in force. In terms of clause 6.5.3 of that standard, when track was to be renewed adjacent to parapets and the edges of embankments with a vertical face or

where the "consequence of a derailment is high", RAM (track) were obliged to consult RAM (civils) on what was to be provided, taking into account a number of factors set out in clause 6.5.3. In terms of the standard, if it was decided that guard rails should be installed, they were to extend 18m beyond the "location at risk" (here, the parapet) and were to include a set of gathering rails.

[363] Importantly, the standard was not retrospective. Consideration in terms of the standard was to be made at the time of track renewal. The RAIB's investigation disclosed that the last track renewal at the derailment site was between 1966 and 1970, before the standard was in force. There was therefore no obligation in terms of that standard or otherwise to require consideration of guard rails at the derailment site.

[364] In addition and in any event, even if guard rails had been considered to be necessary at the site, in terms of the standard in place, they would have extended 18m beyond the end of the bridge. The RAIB concluded that guard rails extending 18 metres beyond the end of the bridge were unlikely to have significantly affected the outcome of this accident. An 18-metre-long guard rail would not have gathered the right-hand wheels of the leading bogie, which the RAIB determined passed across the centre of the four-foot much earlier at around 32 metres from the bridge.

[365] I accept the submission of the ORR, that installation of guard rails 32 metres from the bridge, while theoretically possible, was not a precaution that could reasonably have been taken in light of the standards for the installation of guard rails in place prior to the accident. For that reason, I have declined to make a finding in terms of section 26(2)(e) in relation to guard rails. In addition, and in any event, even if I am wrong about that,

the RAIB report in considering guard rails at 32 metres beyond the end of the bridge concluded that it could have avoided the collision between the leading power car and bridge parapet, "which is likely to have led to a significantly better outcome". Again, while I accept that evidence and it was not disputed by any other participant, I require to consider whether any reasonable precaution if taken might realistically have avoided the deaths. Like the chapter of evidence relating to crashworthiness, there was no evidence before the inquiry as to whether or not the deaths might have been avoided if guard rails had been installed at 32 metres. There was no modelling in that regard, and there was insufficient evidence that the second part of section 26(2)(e) was met in relation to guard rails. Accordingly, for all of those reasons, I have declined to make the finding invited by the Crown. However, I do consider the absence of guard and gathering rails at bridge 325 to be a fact relevant to the circumstances of the death. I have therefore included a finding in that regard in relation to section 26(2)(g). As a matter of fact, guard and gathering rails have now been installed at bridge 325, extending to beyond the area of the washout.

[366] For the avoidance of doubt, in the submissions to this inquiry, two participants submitted that the Crown's reference to "32 metres" in relation to the distance the guard rails would require to extend was erroneous, and that the correct distance per the RAIB report was "35 metres." In that regard, I was referred to paragraph 538 of the RAIB report. Paragraph 538 of the report lodged in process (v2 dated January 2024 and lodged at production 1661 of process) makes reference to 32 metres, as does paragraph 541 of the report. Similarly, Mr Louis referred to 32 metres in his oral

evidence to the inquiry and in his presentation (production 1711). The only reference to 35 metres relating to guard rails is at paragraph S67 of the synopsis of the report. In light of the repeated references to 32 metres in both the substantive sections of the report relating to guard rails and in Mr Louis' evidence to the inquiry, I consider the reference to "35" at paragraph S67 to be a typographical error. In any event, even if the distance required of the guardrails was 35 metres, that would not alter my decision in relation to this chapter of the evidence.

Any defects in any system of working which contributed to the death or any accident resulting in the death (Section 26(2)(f))

[367] The Crown invited me to make findings under section 26(2)(f), namely that there were defects in a system of working which contributed to the accident resulting the deaths. In light of what I have set out at paragraphs 201 to 218 above, I have made a finding under section 26(2)(f) as follows.

[368] The RAIB concluded at paragraph 160 of its report that the Network Rail project team was probably unaware that the 2011/12 drain was significantly different from that intended by the designer and therefore did not take any action. The RAIB concluded that had the team been aware of this, it is possible that the consequent risk would have been recognised and remedial actions taken. The RAIB reached this conclusion for the reasons set out at paragraphs 161 to 172 of its report.

[369] In particular, the RAIB's investigation uncovered that although there was no requirement for the designated project engineer (DPE) to personally inspect the works

during construction, Network Rail standard NR/L2/INI/02009 required the DPE to formally "accept" the construction on behalf of Network Rail. The standard allowed for the acceptance to be based on a sample review of a submission made by the construction team, and confirmation that proper quality assurance processes were in place. However, the RAIB found no submissions or evidence of formal acceptance of design changes. As outlined above, in light of the nature of the contract arrangements between Network Rail and Carillion, the site inspections/visits that did take place would not have detected any defect as between construction and design. As the RAIB concluded at paragraph 172, the level of supervision meant that site visits conducted by the construction manager did not recognise or report significant deviation from design.

[370] Related to this was the fact that Carillion held a principal contractor licensing scheme licence between March 2008 and April 2018 and was the principal contractor for the works at Carmont. While audits were carried out in terms of the Railway Industry Supplier Qualification scheme, the audits did not uncover any problem with Carillion failing to comply with the design. Indeed, as outlined by the RAIB at paragraph 178, before February 2012 the audits were not carried out at site level.

[371] The Crown invited me to conclude that Network Rail's contractual and project management arrangements provided inadequate oversight of the construction work to prevent the drainage asset being built differently from the approved design, and that was a defect in a system of working which contributed to the accident resulting in the deaths. Network Rail made no substantive submission in this regard, other than to draw my attention to the nature of what Network Rail pled guilty to in the criminal

proceedings against it, namely that Network Rail accepted that it failed to ensure, so far as reasonably practicable, that the drainage asset was constructed properly and in accordance with the design drawings. I was invited to adopt the language used in the criminal proceedings in making any finding in terms of section 26(2)(f).

[372] The RAIB's findings and the evidence regarding Network Rail's oversight and management of the construction of the 2011/12 was not challenged by any participant. On the basis of the evidence, I consider that it can safely be concluded that there was a defect in a system of work – namely, Network Rail's oversight and management of the construction of the 2011/12 drain and the failure to ensure that the drain was constructed properly and in accordance with the design drawings. That defect contributed to the accident result in the deaths, standing the fact that the defective construction – in particular the construction of the bund which did not conform with design – was the substantial cause of the washout of the drain on to the tracks which caused train 1T08 to derail, resulting in the deaths of Mr Stuchbury, Mr Dinnie and Mr McCullough. That explains finding 11.

Any other facts which are relevant to the circumstances of the deaths (section 26(2)(g))

[373] I have made a number of findings under section 26(2)(g) of the 2016 Act, namely facts which I consider to be relevant to the circumstances of the deaths, for the following reasons.

Features of construction of the 2011/12 drain that did not accord with the design

[374] The Crown invited me to note the various defects in construction of the 2011/12 drain (as considered at paragraphs 172 to 194 above) as facts relevant to the circumstances of the deaths. While Network Rail accepted that these comprised an accurate list of deviations from design, on account of the fact that (as the Crown accepted) none of these aspects of the construction caused the washout that led to the derailment, Network rail submitted that they could not therefore be said to be facts relevant to the deaths.

[375] I have not accepted Network Rail's submission for the following reasons. While each individual deviation from design was not established to be the cause of the washout, individually and in combination, they comprise defects found in the drainage system constructed in 2011/12 at the site of the derailment. All of these defects arose from the overall failure by Carillion to construct the drainage system in accordance with the design. None of these deviations, including the construction of the bund, were discovered until after the derailment.

[376] Carillion failed to construct the 2011/12 drain in accordance with the design, in a number of respects, one of which was the substantial cause of the washout which led to the derailment of train 1T08. All of the ways in which the drain failed to accord with the design are therefore, in my view, relevant to the circumstances of the death, in the public interest. It is important in the public interest, that all of the ways in which the drain failed to accord with the design are facts are recorded in this determination. To do otherwise would fail to reflect the extent of the issues concerning the construction of the

drain, which extended beyond one isolated aberration. It is in the public interest that all of these issues are noted, in order that lessons can be learned about how to avoid a similar issue arising in the future. That explains reasons for making finding 12(a).

The drain: record keeping and inspection

[377] The Crown invited me to make a finding in relation to the lack of maintenance record and inspection upslope of catchpit 18 under section 26(2)(g) – namely a fact as relevant to the circumstances of the death. Network Rail submitted that I should not make such a finding, on the basis that while it was accepted that there was an absence of drainage inspections, there was no evidence that it was in any way connected with or was relevant to the deaths. In that regard, they relied upon the RAIB's conclusions summarised at paragraph 220 above. Although the absence of inspections was libelled on the indictment (paragraph 2(c) of the indictment), Network Rail did not accept that there was any causal connection between an absence of inspections and the derailment. It was relevant to the broad terms of the health and safety offence to which Network Rail pled guilty, but not relevant to the circumstances of the deaths.

[378] As already outlined, section 26(2)(g) does not require causation to be established before a finding may be made under that subsection. It is broad in scope and requires to be only a fact relevant to the circumstances of the death. The drainage system was of key relevance to the deaths. It was not constructed as designed. That problem was not identified owing, in part, to Network Rail failing to ensure that it had the information it should have had at the end of the construction project. That in turn led to Network rail

capturing only part of the drainage system on its Ellipse maintenance system. The consequence of that is that only the part that was captured on Ellipse (downslope of catchpit 18) was actually inspected by Network Rail (on 13 May 2020). On the evidence available to the RAIB (and this inquiry) no inspections were carried out upslope of catchpit 18 between March 2013 and the accident. In my view, it is a relevant fact in the public interest that part of the drainage system which ultimately caused the washout, and therefore the accident, was not inspected at all following its installation. Accordingly, I have made finding 12(b) in terms of section 26(2)(g) in this regard, namely that between March 2013 and the accident, no routine inspection was carried out by Network Rail on the section of drain upslope of catchpit 18.

Management of adverse weather

[379] I have considered in detail the various matters relating to the way in which adverse weather was managed and responded to by route control at paragraphs 223 to 284 above. For the reasons already set in those paragraphs, and particularly at paragraphs 283 and 284, I have recorded under section 26(2)(g) the following as being facts relevant to the circumstances of the deaths in respect of the chapter of evidence relating to the management of adverse weather as follows:

- That at the time of the derailment, route control staff in Scotland were not adequately trained in relation to the national standard for managing extreme weather (NR/L2/OPS/21), including route coding per those standards;

- That at the time of the derailment, the National Rail Weather Service was not configured in the control room in Scotland to provide alerts in response to real-time weather data. In any event, at the time of the derailment, control room staff had not been trained on how to use the NRWS in response to real-time weather data to assist decision making;
- That at the time of the derailment, Network Rail competency assessments and audits did not detect that Scotland's control room were not adequately trained in relation to the national standard for managing extreme weather (NR/L2/OPS/21), including route coding per those standards or in the use of the NRWS.
- That at the time of the derailment, there was no basis for the control room to put in place mitigations, such as speed restrictions, based on an extreme rainfall alone, regardless of levels of flooding and regardless of the categorisation of certain sites being "at risk" (findings 12 (c) to (f)).

Implementation of previous RAIB recommendations

[380] I have already set out at paragraphs 265 to 276 above the chapter of evidence relating to implementation of previous RAIB recommendations and why I have not made any finding under section 26(2)(e) in that regard. I was not invited to and nor have I made any finding relating to this chapter under section 26(2)(g). Broadly speaking, the matters which the RAIB considered and gave rise to their conclusion that it was *possible* that more effective implementation of three previous RAIB

recommendations (recommendations 3 and 5 of the Landslips class investigation and recommendation 5 of the Lamington investigation) "would have at least mitigated, if not prevented" the accident at Carmont, arose from the findings that route control staff had not been adequately trained on the use of the NRWS; that although the risks to earthworks not on the "at risk" list were recognised, no mitigations (such as speed restrictions) were triggered by a rainfall event alone; and that Network Rail's systems of competence and assurance had failed to detect a lack of knowledge/training in respect of the allocation of route codes or the use of the NRWS. I have already recorded those matters as facts relevant to the circumstances of the deaths under section 26(2)(g).

Features of the train

[381] I have already examined at paragraphs 312 to 339 the various features of train 1T08 and its comparison with modern crashworthiness standards. While I have declined to make a finding in terms of section 26(2)(e) in relation to that chapter of the evidence, I have made a finding in terms of section 26(2)(g) to formally record, as a fact relevant to the circumstances of the deaths, that train 1T08 did not and was not required to conform with modern crashworthiness standards.

[382] All of the deaths took place as a result of the derailment of train 1T08. The features and characteristics of train 1T08 affected how it behaved during the derailment sequence. In my view, it is in the public interest that I record the fact that train 1T08 did not, and was not required to, conform with modern crashworthiness standards. That explains finding 12(g).

[383] Similarly, the fact that there were no guard or gathering rails installed on the approach to and over bridge 325 at the site of the derailment, and that there was no requirement in terms of the standards in place at the time for them to be installed, is a fact relevant to the circumstances of the deaths. A significant feature of the derailment sequence was train 1T08 striking the parapet of bridge 325. I therefore consider it to be a fact relevant to the circumstances of the deaths that there were no guard or gathering rails, and nor were there required to be in terms of the standards in place at the time. That explains finding 12(h).

Recommendations (section 26(1)(b) and (4)):

[384] In terms of section 26(1)(b) of the Act, I require to consider whether it is appropriate to make any recommendations as to the matters set out in subsection (4), namely recommendations as to the taking of reasonable precautions, making improvements to any system of working, the introduction of a system of working or the taking of any other steps which might realistically prevent other deaths in similar circumstances. The following sets out my reasons for declining to make any recommendations in terms of section 26(1)(b).

Introduction

[385] The inquiry heard evidence about extensive changes made by Network Rail and the rail industry generally, following the accident at Carmont including the industry's response to the twenty recommendations made by the RAIB following its thorough

investigation. In that regard, evidence was led: from Nick Bucknell, Dominque Louis, Mark Hamilton, Ash Gardner and Simon French as to the RAIB recommendations made and the findings of the RAIB's investigation to which they relate; from Anna O'Connor of the ORR as to the what has been done by the rail industry to implement those recommendations; and from Alastair McFarlane, Mona Sihota, Russell Shanley, Stuart White, Karl Grewar and David Harkin regarding the changes made by Network Rail following the accident, and ongoing work in view of the lessons learned from the accident. Their evidence was not challenged on any of these matters and I accepted it in full.

[386] The following paragraphs outline the main changes made since the derailment as well as the status of the recommendations made by the RAIB, all of which have satisfied me that no recommendations fall to be made in terms of section 26(1)(b).

Task forces

[387] Mr Shanley told the inquiry that in the immediate aftermath of the accident at Carmont, Network Rail recognised that the investigations into the accident would take some time and that there was a need to identify improvements that could be made quickly, without waiting on the outcome of the various investigations. It therefore commissioned two expert-led reviews to improve its understanding of earthworks management and potential improvements to mitigation measures. Lord Robert Mair CBE FREng FRS, a civil engineer and geotechnical expert, led an earthworks management task force to advise Network Rail on improvement of management of its

earthworks. Dame Julia Slingo FRS, former chief scientist at the Met Office, led a weather action task force. These task forces and the reports published by both allowed Network Rail to commence work before other formal investigations took place. I do not consider it necessary to set out at length the findings and recommendations of those reports. A number of recommendations were made, many of which are encompassed in the following paragraphs outlining the improvements made by Network Rail since Carmont. However, it is worth noting that by commissioning these reviews so swiftly after the accident, Network Rail demonstrated at an early stage its commitment to ensuring that the tragic events of 12 August 2020 are not repeated. That commitment came across strongly in the evidence of the Network Rail employees, all of whom gave careful and detailed evidence to the inquiry about the changes made following the accident, why those changes were made and how they have been implemented.

Changes at the site of the derailment

Derailment containment

Guard and gathering rails

[388] After the accident, extensive remedial work took place at the site. At track level, guard rails have been installed on both lines on the approach to bridge 325, including gathering rails to improve derailment containment. On the down line, the guard rails extend beyond the site of the washout.

[389] Related to the installation of derailment containment features at the accident site, is the work carried out by the industry generally in response to recommendations 12

and 13 relating to developing a coherent long-term strategy for derailment mitigation (recommendation 12) and looking at what it could do in the interim (recommendation 13).

[390] In response to recommendation 12, the RSSB convened a working group continuing and building upon the work that had already commenced in response to the accident at the Watford tunnel in 2016 by commissioning a new research project in conjunction with the University of Huddersfield. That project is designed to evaluate every available derailment containment method in order to identify what might be effective and reasonably practicable for application to infrastructure and rolling stock on British mainline infrastructure. The modelling undertaken as part of that project is now integrated into a new RSSB risk modelling tool which can be used to assess the case for rolling stock and infrastructure design features that guide trains when derailed. The early indications from the study are that, in relation to train fitment, there is no case for retrospective fitment. However, consideration should be given to the potential benefits of incorporating some form of derailment mitigation on new trains. This is to be included as a design consideration in the industry's Key Train Requirements (issue 9), with publication of that document planned for the end of 2026. In relation to infrastructure fitment, the criteria in the relevant standard (NR/L2/TRK/2102) were updated and enhanced in March 2025 in terms of recommendation 13, assisting track designers in identifying where derailment containment should be considered for track renewals and new lines. This guidance will be reviewed following the full results of the research project referred to above. There will be guidance to determine whether there is

a case for targeted retrospective fitment at a small number of higher-risk sites. These amendments are intended to be included in the next issue of the standard in March 2027. Accordingly, recommendation 12 remains open with an implementation date of 31 March 2027.

[391] Recommendation 13 addresses the interim position. Network Rail's response to it has been informed by the work carried out in relation to recommendation 12, particularly the research and modelling referred to above. Ms O'Connor told the inquiry that Network Rail did some quick and very effective work on what was possible in terms of derailment containment, particularly at high-risk locations. Containment curbs are now a mandatory requirement in any design for new structures, but are not to be retrospectively fitted. In relation to guard rails, there is more detailed new guidance with example cases to show how the principles should be applied to track design. Accordingly, recommendation 13 is deemed by the ORR to be implemented and therefore closed.

Drainage system

[392] A new drainage system was installed with greater capacity than the 2011/2012 drain. Alastair McFarlane gave evidence about that. He spoke to the fact that, prior to the derailment, not all of the area of the drainage asset was within the ownership of Network Rail. Since the derailment, Network Rail has assumed ownership of that area and has installed a staircase access at the site to promote improved access to and inspection of the drainage asset. The soil cutting is reinforced with nailing and mesh to

reduce the likelihood of damage in severe weather. In addition, part of the new drainage system uses an open channel (rather than a gravel filled trench) to mitigate the risk of washout of the gravel on the steepest sloping part of the drain where the water energy is greatest, a stilling basin to remove water energy as it reaches the track and a concrete "baffle" wall to reduce the risk of any washout on to the track. Those features reflect the more holistic view taken of drainage assets following the derailment. In other words, Network Rail have a better understanding of the water flow for an entire catchment, including consideration of the water flow all the way to its outfall (at Carmont, the outfall being into the river Carron) rather than simply viewing it to the point it exits the end of the cutting into a ditch.

National catchment analysis

[393] In that regard, Ms Sihota explained in her evidence that, following Carmont, Network Rail undertook a national catchment analysis to understand all the catchments that flow water towards the railway, capturing the amount of water on various return periods of rainfall and including climate change projections. That mapping and catchment analysis is taken into account in drainage design. Network Rail has changed the requirement of the minimum design of all drainage systems to an annual exceedance probability of "one in fifty" rainfall event – a change from the position pre-Carmont when secondary and primary routes had different rates/tolerances. Standard detail drawings (typical layouts) have been updated and improved with details/notes for the designer to consider a number of matters including limitations and vulnerabilities of the

catchment/site as well as the drainage design standards and drainage design training material.

[394] Mr Shanley spoke to there being a significant focus on the competence, training and development of the drainage and lineside teams so that they have a better understanding of the drainage assets. There are now specific drainage training courses available to maintenance and engineering staff and a developing competence framework overseen by Mona Sihota.

[395] Related to that was Ms Sihota's evidence as to the use of Ellipse as a drainage asset inventory. Ellipse was in use before the accident at Carmont. However, the number of assets recorded on the inventory has greatly increased since this derailment. This record of assets is used to assist with maintenance and assurance activities (including site-based visits involving a comparison of the actual asset and what is recorded on the system). Mr Shanley explained the better understanding and focus upon managing and inspecting drainage as its own asset, rather than as a "child asset" where it might only be inspected if Network Rail was in the area doing other tasks.

[396] Anna O'Connor gave evidence that the ORR was satisfied that the RAIB's recommendation 3 (in general terms relating to Network Rail reviewing and where necessary revising the whole suite of procedures and guidance it has for designing drainage) had been fully implemented by Network Rail. She was highly complimentary of the extensive work carried out by Network Rail in the implementation of recommendation 3.

Health and safety files

[397] The inquiry heard from Stuart White about the work that had commenced but was not completed before the accident at Carmont, relating to a review of historical projects to ascertain whether a health and safety file had been accepted by the national records group and appropriately stored. Following this accident, project managers were briefed and reminded of their obligation to obtain and retain health and safety files for projects and there was an overall renewed focus on the importance of proper record keeping during the construction process. The Network Rail standard relating to assurance and governance of the project management process (including the provision and retention of health and safety files) was simplified – namely the Governance for Rail Improvement Projects (GRIP) process. It was clear from the evidence that following the accident there is a far greater focus on proper record-keeping throughout a construction project, including the preparation and retention of the health and safety file, and an understanding of why that record-keeping process is so important.

[398] The work referred to in evidence to rectify the problems with record-keeping, retention of health and safety files, and generally processes to ensure that works are properly constructed, handed over and incorporated into maintenance processes was carried out in compliance with the RAIB's recommendations 1 and 2. Anna O'Connor spoke to the reasoning behind some of the changes made by Network Rail in this regard. As identified in the case of Carmont, by the time the completed health and safety file was due to be provided there was no incentive for the contractor to comply with that requirement as the work had been finished, the contractor paid and often key personnel

had left. In addition, there was ambiguity as to whose responsibility it was to issue as-built drawings and check that the health and safety file was obtained and properly stored. The simplification of the standard as well as changes to the contractual framework have addressed those problems. The ORR was satisfied that the steps taken by Network Rail in response to recommendations 1 and 2 meant that these recommendations were implemented.

Slope safety review group

[399] Following the recommendations of the Mair review, Network Rail created a Slope Safety Review Group. Alistair McFarlane chairs that group and told the inquiry that it brings together different disciplines involved in the management of assets that could affect the safety or the stability of slopes around the railway. It draws together the geotechnical engineers who manage the earthwork assets, the drainage engineers who manage the drainage assets, structures engineers who deal with culverts and bridges and track engineers. The group meets to discuss past incidents and to review what lessons can be learned. It is also forward-looking, examining problem sites or sites at which flooding or other hazardous events are anticipated. It looks at project delivery plans to strengthen or improve the resilience of earthworks. The cross-disciplinary nature of the review group allows peer review, in order that projects are viewed holistically, rather than in the isolation of one particular discipline. Other groups within Network Rail, for example, the water management group are linked to and can provide information to the Slope Safety Review Group.

Aerial surveys

[400] Since the accident and following the Mair Report, Network Rail makes far greater use of aerial surveys carried out primarily by helicopter but also by drones, to inspect the railway. Alastair McFarlane told the inquiry that aerial surveys are used to carry out routine inspections of earthworks and drainage, with the air observers having rudimentary training in geotechnics. The aerial survey (primarily conducted by helicopter) proactively looks for defects rather than simply responding to calls about specific events, repeating routes and noting any changes at the sites on the route. After a weather event, the helicopter is mobilised as a reactive tool and is used for "route proving" (checking the railway line is clear of obstructions prior to resuming a train service) and looking for damage or debris that might have been caused by a weather event. The dedicated helicopter being based in Scotland means that, unlike the situation prior to Carmont, it can be quickly deployed without travelling from elsewhere in the UK. By its very nature the helicopter can cover a significant distance quickly after a significant rainfall event, identifying any hazards much more quickly than before, with the ability to feedback 360-degree images of the hazard to route control. Unlike a "route proving" train, the helicopter does not become obstructed by any debris on the line.

[401] Anna O'Connor told the inquiry that the RAIB's recommendation 11 (which was intended to bring greater clarity and consistency across the network about the purpose of route proving and when and how it should happen) had been implemented by Network Rail, including the introduction of a new route and line proving procedure in

its national operating procedure manual, covering the objectives of route proving trains, the hazards that staff operating route proving trains are expected to identify and report, the circumstances in which route proving trains should operate and how they should be operated.

Earthwork failure detection systems

[402] Following the Mair report, Network Rail now makes greater use of earthwork failure detection systems (sometimes referred to as "tilt monitors") to remotely monitor movement in slopes. They use wireless technology and can be deployed almost anywhere, regardless of other infrastructure, to provide real-time alerts to the control room if movement is detected in a slope. Although there were a small number of these devices at sites prior to the accident, the recommendations from the Mair report as well as advances in technology have resulted in a "vast increase" in the number of these devices deployed in Scotland. The alerts transmitted by these devices are monitored by the Weather Operations Delivery Managers (see further below) within route control, who are able to bring meteorological context to the alerts. Exactly where these devices are deployed is kept under constant review, taking account of strengthening and improvement works carried out at particular sites. The more extensive deployment of these devices is a key change made by Network Rail in recognition of the risk posed to earthworks by adverse weather, in particular convective rainfall.

Other recommendations relating to earthworks

[403] Anna O'Connor spoke to the ORR being satisfied that recommendations 4 and 5, relating to the examination of "mixed cuttings" (rock and soil cuttings) were fully implemented –and that they addressed an ambiguity in Network Rail's standards at the time of this derailment as to earthworks examination of a mixed cutting. As part of its response to recommendations 4 and 5, Network Rail updated the relevant standards to reflect best practice.

[404] Linked to the changes made in relation to earthworks, drainage and structures, is Network Rail's response to the RAIB's recommendation 10, which aimed to identify and address any further areas of weakness in the mitigating controls that relate to weather-related failures of earthworks, drainage and structures. Essentially, as Ms O'Connor explained, recommendation 10 required a review of Network Rail's bowtie analyses (a visual risk management tool, which takes its name from the shape of the diagram created). Network Rail has done so in conjunction with the RSSB and had previously provided a closure statement to the ORR in this regard (30 August 2023). However, the ORR has kept this recommendation open. It considered at that time that there was insufficient information to demonstrate that the recommendation had been adequately addressed. Ms O'Connor explained that she thought Network Rail had carried out the work required of it but simply not articulated the way in which it had complied. Work is ongoing in relation to this recommendation, which remains open. However, the ORR is satisfied that Network Rail has taken the recommendation into consideration and is taking action to implement it by 31 July 2026.

Responding to adverse weather

[405] Network Rail created a Weather Risk Task Force in 2021 in order to deliver the programme of recommendations from Mair and Slingo reports. The task force persists today. Russell Shanley explained to the inquiry that the role of the task force was four-fold, namely: (i) delivery of projects, for example putting new systems into control rooms; (ii) assurance to monitor the delivery of projects as well as "post-embedment" review; (iii) managing an integrated plan, namely keeping track on delivery and prioritisation; and (iv) sponsorship, namely ensuring whether the change being delivered was delivering value in terms of safety and performance.

[406] Broadly speaking, I accepted on the evidence that there has been a significant cultural shift within Network Rail since this derailment in its understanding the impact of weather and in particular, viewing rainfall as a hazard to railway operations in and of itself. A number of important changes have been delivered in that regard, as follows.

Weather Operations Delivery Managers

[407] In late 2021 Network Rail created the role of Weather Operations Delivery Manager (WODM) and recruited professional meteorologists to those roles. There are seven full-time WODMs in Scotland. They are dedicated meteorologists based in the control room 24/7 bringing professional, meteorological, railway-focussed knowledge and intelligence to the engineers. The introduction of dedicated meteorologists sitting within the control room was described to the inquiry as a truly transformational change. The WODM is responsible for monitoring and interpreting the weather, providing

invaluable advice to the route control team, and monitoring the automated alerting tools related to weather and earthworks failure. Overall, as Russell Shanley explained in his evidence, Network Rail is working more closely and collaboratively with forecasters to better understand the hazards the forecasters identify, and so that the forecasters have a better understanding of the railway, to maximise the utility of the forecast information they provide.

[408] In addition, the WODM has the responsibility for designating the route alert codes and is now the lead presenter at EWATS. Alistair McFarlane, Russell Shanley and Karl Grewar all confirmed that since the derailment EWATs are held much more frequently than before and discuss information at a more granular detail than before.

Weather analysis tools – PAT and CAT

[409] The inquiry heard from Mr McFarlane, Mr Shanley and Mr Grewar about the weather analysis tools now being utilised by the control room since the derailment. A precipitation analysis tool ("PAT") allows the control room to better understand and plan for forecast rain and to apply pre-emptive speed restrictions or other mitigations in areas where heavy rain is forecast. While convective rainfall is still very difficult to predict in terms of exactly where and when it will happen and how intense the rainfall will be, Network Rail now makes use of automated systems based on real-time weather monitoring, (known as "nowcasting") as well as an automated alerting tool known as the "convectional alerting tool" ("CAT"), which alerts route control to any live convective weather events. These forecasts are linked to operational route sections

allowing mitigations to be targeted to particular sections of the route. The information provided by the weather tools, together with the information about critical or at-risk assets within the operational route sections, allows route controllers to make better decisions around operational response including what mitigations to put in place and where. Related to that is the very recent and ongoing rollout of the Rail Operating Weather Service – a new product which introduces better granularity of information into the controls, incorporates the Convective Alerting Tool, and through better mapping and information gives more detail to the route controllers to enable better decision-making in response to adverse weather. The rollout of the Rail Operating Weather Service has recently commenced and will be fully implemented by May 2027.

Weather Academy

[410] Network Rail has introduced a "weather academy" run in collaboration with Met Desk and the Met office, providing improved and ongoing training, events and conferences for route control to improve route control's knowledge of, and decision-making around, weather as well as making improvements to the capability, competence and quality assurance of route control as part of an overhaul of the organisational structure within Network Rail.

[411] What came across strongly in the evidence, particularly that of Russell Shanley, was that the systems and tools available to route control in relation to weather prediction and monitoring prior to this derailment required route control to be trained how to use them and to proactively seek out the relevant information, interpret,

understand and act upon it. By contrast, the tools and systems now in place, in particular the convective alerting tool, generate automatic alerts. If the CAT detects a threshold-exceeding event it will issue alerts to the control room so that route controllers can respond. Russell Shanley told the inquiry about Network Rail's Weather Risk Task Force's plans to improve upon the configuration of the CAT in the short and longer term. He explained that when the CAT was first introduced, in order to roll it out as quickly and straightforwardly as possible, an alert on CAT automatically required a 40 mile per hour speed restriction to be applied. In large-scale weather events it had the potential to overwhelm control by issuing a lot of alerts. Network Rail has refined the CAT, enabling it to be better targeted. In that regard, the Weather Risk Task Force has worked with each operating region to help them refine their own data so they can focus their attention on the highest priority issues. Network Rail continues to refine this technology. The next generation of CAT, which will allow more detailed local configuration, is in the process of being rolled out. In this next phase, the technology is being brought in-house rather than accessing the tool via a third party's web portal. That will allow Network Rail greater flexibility in configuring alerts to local areas. As a long-term aspiration, Network Rail aims to further configure the CAT thresholds using its asset data to focus on the known hazards on particular sections of the line and taking account of the local geography and topography.

[412] All of this evidence was demonstrative of Network Rail's proactive approach to improvement of its weather-related systems and procedures.

Operational route sections

[413] Within around a month of the accident, Network Rail on its own initiative divided the railway into sections known as "operational route sections", in other words, sections of the railway of around 7 to 8 miles in length between two clearly defined points/landmarks capable of being easily identified by train drivers. That was done in conjunction with the asset managers, the control team and the train operating companies. The introduction of operational route sections recognised that under the most extreme rainfall, any earthwork could be vulnerable. Network Rail can apply speed restrictions to specific sections in the event of adverse weather, having regard to the assets, topography and recognised high-risk earthworks within those sections. This allows more precise targeting of speed restrictions.

Speed restrictions

[414] Route controllers now have the ability to impose speed restrictions in response to adverse weather depending on the nature of the weather incident and/or the hazards being managed. Very large named storms tend to have wider impacts, but localised or convective storms may require more local speed restrictions or mitigations. This is linked to the imposition of operational route sections. In addition, Paul Ashton spoke to the use of the Global System for Mobile Communications (GSM-R broadcast) being an integral part of how speed restrictions are applied. That system broadcasts any applicable speed restriction to a loudspeaker within the driver's cab when a train enters the affected section.

Training of route control staff

[415] While route control staff now have access to better technology and improved weather-related expertise and information, that information is only as good as the ability of route control managers to assess it and to make good decisions about it in challenging circumstances. I am satisfied that Network Rail has reviewed and improved the training, development and competence assurance of route control staff so that they are better equipped to make appropriate decisions in challenging circumstances, such as the events of 11 and 12 August 2020.

[416] In that regard the inquiry heard evidence about the RAIB's recommendation 7 and the work done in implementation of that recommendation, which aimed to

> "enhance the ability of route control staff to contribute to the safe operation of a modern railway by making good safety decisions in difficulty circumstances based on a holistic assessment of the most relevant information."

[417] Ms O'Connor described this as one of the fundamental recommendations made by the RAIB as a result of its investigation. As part of this recommendation, Network Rail was asked to look at other industries and their best practice in relation to decision-making and to identify what skills are at the heart of good decision making.
Ms O'Connor explained that Network Rail has done a thorough job so far, however the recommendation remains open largely as a reflection of its wide-ranging nature, the ongoing nature of this work and also in order that the ORR can be satisfied that the changes made by Network Rail have been firmly embedded into their routine business. Her evidence was that, recommendation 7 was nearing closure. In summary, Network

Rail now has a comprehensive training, development and competence management arrangement for controllers and other control room staff. It has looked at other industries, namely the aviation and offshore industries and has researched best practice in decision-making. It has adopted the Rail Safety and Standards Board's "G-force" tool – a decision-making tool specifically tailored for the railway environment. The weather academy has hosted workshops for the control room staff involved in EWATs, facilitated by Newcastle University. The workshops looked at the EWAT process and the learning from the workshops has been incorporated into Network Rail's processes. The National Operating Procedure was updated. Targeted development modules have been created such as "operational decision making," "leading the conversation", "keeping trains safely moving" and "the impact of weather."

[418] Related to recommendation 7 is recommendation 8, aimed at improving the effectiveness of Network Rail's management assurance processes related to safety-critical functions of route control rooms and the overall level of safety performance. In response, Network Rail formed a working group to decide how to best address the recommendation. In particular, the working group considered how to move beyond basic "tick box" compliance checks towards a framework that could evaluate the quality of decisions made. It identified shortcomings in the existing standard for self-assurance and that a radically different approach was needed. The change made is the use and adaptation of the ORR's Risk Management Maturity Model ("RM3") as the framework for checking the safety-critical functions in the control room. This identifies strategic or overarching themes that, if properly implemented, result in a successful safety

management system. Network Rail developed a revised standard for self-assurance. In what was described by Anna O'Connor as a sign of maturity, Network Rail paused the roll-out of this new standard when it became clear that the relevant staff were not ready for the change and did not understand what was intended by it. Renewed training and communications initiatives for all those involved in assurance were provided and the roll-out of the standard was then able to proceed. The ORR has kept recommendation 8 open in order to monitor the effectiveness of these changes. However, Ms O'Connor told the inquiry that the ORR believed that Network Rail had done a really good job in implementing this recommendation, which has the potential to be a significant improvement on how Network Rail assures itself.

[419] The range of changes made by Network Rail in response to recommendations 7 and 8, as well as the fact that the ORR have kept those recommendations open to ensure that the changes are embedded into its processes and working in the long term, satisfied me that there were no further recommendations that I could make in relation to route control operations that might realistically prevent other deaths in similar circumstances. I was confirmed in that view by the fact that the RAIB's recommendation 9 was deemed by the ORR to have been implemented. That recommendation, addressed to both Network Rail and the ORR, was aimed at ensuring that Network Rail makes effective use of safety learning from previous events. In response, Network Rail carried out three audits including use of the ORR RM3 criteria mentioned above. Although recommendation 9 is now implemented, the ORR and Network Rail recognised that it is a continuing process and that there was value in maintaining dialogue between the ORR

and Network Rail about embedding changes from safety recommendations. It is therefore a standing agenda item at their quarterly high-level safety meetings.

Comparison to 2020

[420] Mr Shanley and Mr Grewar gave evidence about what steps would be taken now, if the weather event experienced on 12 August 2020 was to happen now. They both confirmed in their evidence that there would be a different approach. Firstly, route control would have a much clearer understanding of both the forecast weather and the weather as it was developing in real time. In view of the fact that responsibility for declaring the route code/colour for a particular day and leading the EWAT meeting now rests with the WODM, Mr Grewar had a high degree of confidence that if a similar weather event happened today, a "red day" would be declared and an EWAT held. However, even in the event that the forecast weather did not give rise to concern or in the event an EWAT was not held, in the circumstances of a convective storm akin to that which took hold at Carmont on 12 August 2020, route control would now receive a warning via the convective alerting tool (CAT) as the storm formed. Route control would take much quicker action in response to that alert, with the ability to impose immediate speed restrictions to the affected sections of the line. In addition, Network Rail would have a better understanding of the antecedent conditions, in other words the rain that has fallen in advance of the storm, which is another factor in determining risk and response. In general, it was clear from the evidence, particularly that of Russell

Shanley and Karl Grewar, that Network Rail now has a much clearer understanding of the mitigations available to it and how they should be managed.

[421] All of the evidence outlined above in relation to the changes made by Network Rail to its procedures for forecasting and responding to adverse weather was reflected in and accorded with Anna O'Connor's evidence as to why the ORR was satisfied that recommendation 6 (concerning to review of extreme weather processes to address rainfall-related risk at earthworks and drainage assets) was fully implemented by Network Rail.

The railway and our changing climate

[422] The preceding paragraphs consider how the railway forecasts and responds to adverse weather occurring now. However, I am also satisfied that Network Rail recognises the risks posed to the railway by future climate change. David Harkin, Weather Resilience and Climate Change Adaption Strategy Manager for Network Rail, gave detailed and compelling evidence in that regard. His role is to prepare the railway in Scotland for changes in climate by anticipating future climate change and the impact it may have on the railway. He drew attention to Scotland's warming climate. Scotland's 10 warmest years on record have all occurred since 1997 and the average temperature in the last decade (2015 to 2024) was 1°C warmer than between 1961 and 1990. Scotland has also seen an increase in rainfall, with the annual average rainfall in the last decade being 9% wetter than between 1961 and 1990. Winters in particular have been 25% wetter. Mean sea level around the UK has risen by

approximately 19.5cm from the start of the 20th century. The rate of sea level rise has increased over the last 30 years and continues to accelerate. In addition, since the storm naming convention was introduced by the Met Office in 2015, Scotland has been impacted by at least 60 named storms, those being storms which resulted in amber and/or red alerts. These statistics were representative of clear climate change trends affecting Scotland during the 20th century, which have continued into the 21st century. Based on this data, Network Rail has recognised that the trajectory of change in Scotland's climate is towards hotter and drier summers, warmer and wetter winters, more frequent convective rainfall, rising sea-levels, faster rates of coastal erosion and more frequent flooding. However, the full extent to which Scotland's climate *will* change is still to be determined. Mr Harkin described the range of different climate scenarios which might affect Scotland in the future and in which the railway industry will have to be able to operate. Network Rail is attempting to address some of the uncertainty inherent in this approach by undertaking a "climate change risk assessment" for the network. It first considers the "likelihood" of different hazardous weather and climate events occurring in a location on the network (eg the likelihood of an extreme rainfall event or very hot weather). The assessment then determines the potential impact of that event on its operations in that location. "Likelihood" and "impact" come together to give an assessment of risk, to determine the areas of the railway network that are potentially vulnerable to climate change. In relation to the climate risk assessment, Mr Harkin took the inquiry through various potential weather and climate-related hazards and considered the potential impact of those hazards on

railway operations including the railway assets that might be vulnerable to those events such as buildings, structures, drainage assets, lineside boundaries, vegetation and earthworks, telecoms, signalling, power and track. He gave impressive and detailed evidence as to the weather and climate data taken into account and the way in which it has been assessed against vulnerabilities on the rail network and the output of the risk assessment. I am satisfied that Network Rail understands clearly the changing nature of our climate, has acquired expertise (such as Mr Harkin himself) in this area and is taking a proactive approach to anticipating risks posed by weather and climate change to the railway. Mr Harkin described Network Rail's Adaptation Pathways Programme, the vision of which is "to have a well-adapted railway system for Scotland that is flexible, reliable, operates safely and is responsive to a changing climate." Its aim is "to enable flexible, evidence-based investment planning that identifies, prioritises, and sequences adaptation interventions at "high-risk/impact" locations". Adaption pathways are not a new concept. They have been tried and tested in relation to other major infrastructure, such as the Thames Barrier in London. Network Rail's Adaption Pathways Programme is live. Mr Harkin described the climate change risk assessment which has been carried out to screen the network for potential areas of vulnerability to climate change. The next stage is to carry out a more local, desk-based assessment of those locations, assessing whether the necessary work has already been carried out there, what work is planned and what the pathway might look like for that location. The locations deemed to merit a full "pathways-type" approach will then be studied and subjected to further analysis with detailed and costed adaptation pathways developed for locations identified as

requiring a transformational approach to manage the impacts of climate change. As part of the programme, Network Rail has considered the resilience of the various parts of the rail network to disruption as well as looking at the way in which the railway is dependent upon other sectors which are also vulnerable to climate change and vice versa. It is working with other infrastructure operators in developing its resilience plans.

[423] Mr Harkin's evidence was a further example of the steps taken by Network Rail since the accident at Carmont to proactively address weather-related risks to the railway.

The train

[424] A number of the RAIB's recommendations addressed its findings in relation to features of the HST, namely recommendations 14 to 20. All of these recommendations have been deemed to be implemented by the ORR and therefore closed.

[425] The intent of recommendation 14 was to reduce the risk of derailment caused by the HST power car running into obstacles on the track. The industry was tasked with investigating the feasibility of enhancing the strength of the bogie-mounted lifeguards to a level as close to modern standards as reasonably practicable and developing a timebound programme for carrying out any modifications identified. As already outlined, in implementation of this recommendation, a more modern and better performing lifeguard has been retrospectively fitted to the HST power cars. This recommendation is accordingly closed.

[426] Recommendation 15 related to the RAIB's findings as to the broken window glazing found in the passenger coaches, that could have caused injury and may have caused injury to some of the surviving passengers. This recommendation was implemented by the RSSB reviewing railway glazing standards to determine if there were reasonably practicable improvements that could be made. The glazing on train 1T08 did accord with modern standards. Following the RSSB review, it was agreed that the risk of injury from large shards of glass had to be weighed against the need to contain passengers (the primary function of window glazing). The RSSB concluded after detailed technical analysis that it was not reasonably practicable to modify the windows. The ORR accepted this conclusion. However, I note from the evidence that a request by ScotRail for the RSSB to carry out further testing on the behaviour of glazing means that the industry is itself keeping this under review despite the ORR's closure of the recommendation.

[427] The RAIB's findings regarding the danger posed by single folding tables in passenger coaches was addressed by the implementation of recommendation 16. A solution was found and the trains with these tables have been modified accordingly.

[428] Recommendation 17 related to secondary protections within the driver's cab. As I have already indicated, the train drivers' union, ASLEF, was not supportive of any of the proposed secondary protection measures being fitted within the HST driver's cab. Taken together with the RSSB's research on this, the ORR decided that there was nothing reasonably practicable that could be implemented in terms of secondary protections within the driver's cab and this recommendation is therefore closed.

[429] Recommendation 18 related to addressing the RAIB's findings in relation to corrosion. The intent of the recommendation was "for corrosion limits in maintenance and overhaul plans to be based on an adequate engineering analysis so that ageing rail vehicles retain their structural integrity to original design standards." The RSSB published a technical note providing guidance to the industry about the effects of corrosion on vehicle structural integrity and the need to consider that issue in the context of design and maintenance. In response, the owners, operators and maintainers of vehicles commenced a review and revision of maintenance and overhaul instructions. Indeed, owners have gone further and considered fleets other than the HST which are susceptible to corrosion. As a result of this work, the ORR has deemed this recommendation to be implemented and therefore closed.

[430] I have dealt with recommendation 19 in the context of the chapter of this determination dealing with precautions (see paragraphs 346 to 352 above). Recommendation 19 was intended to evaluate the additional risk to train occupants associated with the continued operation of HSTs which entered service before modern crashworthiness standards were introduced in July 1994. A cross-industry working group was established to address this recommendation. As Ms O'Conor outlined in her evidence, a significant part of that work was the knowledge study led by Angel Trains Limited, the outcome of which was set out in a detailed report (CP 1691) that addressed every feature of the HST which does do not meet the modern crashworthiness standard GM/RT/2100, looked at every accident involving an HST and analysed the degree to which any of those features played a part. It identified modification options that would

address the shortfall in crashworthiness and subjected those modifications to a cost benefit analysis in order to assess which modifications would be reasonably practicable. Very few modifications were identified by the report as being reasonably practicable. However, the work led by Angel Trains has resulted in a technical note from the RSSB so that for any other pre-1994 passenger rolling stock there is a clear framework for deciding what needs to be done to keep the risks associated with running those vehicles as low as reasonably practicable. Recommendation 19 is now deemed to be implemented by the ORR.

[431] Recommendation 20 was intended to reduce the risk from train fires originating in or around batteries fitted to passenger vehicles. It arose from the fact that after the derailment, coach B caught fire and the origin of the fire was the batteries and battery casing. At the time of the accident, no one was sitting in coach B. In addition, the fire broke out around 90 minutes after the accident. I have not therefore considered it necessary to explore the full circumstances of the fire in this determination. However, recommendation 20 directed that the RSSB should investigate alternative designs of batteries and their casings which may have greater fire-resistant properties compared to those fitted on current rolling stock and that the output from that investigation should be shared with the UK train and tram industry. In response, the RSSB carried out that investigation. It was found that the batteries involved in train 1T08 carried a greater fire risk than those on current rolling stock. The RSSB also found that many of these casings have ultimately been replaced, although not for reasons of fire performance. The RSSB has produced guidance for the industry summarising the factors informing decisions

about whether or not to retrofit improvements and emphasized that those factors should be considered as part of any proposal for new or modified fleets which employ battery technology. It also produced a technical note reflecting the outcomes of its report. As a result, the ORR found this recommendation to have been implemented.

[432] In addition to the recommendations made in respect of features of the train, I have also taken into account the submissions made on behalf of ScotRail Trains Limited in relation to the limited time HSTs will continue to operate in Scotland.

[433] On the final day of evidence in the inquiry, Mr Brodie KC intimated on behalf of ScotRail Trains Limited that there was a live procurement process ongoing for the replacement of the existing HST fleet in Scotland. By the time of the hearing on submissions, ScotRail Trains Limited confirmed in its written submissions that the procurement process had concluded, and that contracts have been awarded for the provision of 22 class 222 trains. These new trains will enter service by late 2027, replacing the HST in Scotland on a phased basis ,with the final HST expected to be withdrawn from service before the end of 2028. The HST fleet will therefore be withdrawn from service before the end of the current lease period (being the end of 2030).

[434] Having regard to the changes made by the rail industry in response to the accident at Carmont and the evidence, in particular from Anna O'Connor, about the inherent crashworthiness of the HST, the fact that the HST will be fully withdrawn from service by the end of 2028 has further satisfied me that no recommendations should be

made in relation to any particular features of the HST, or in respect of their continued operation for that limited period.

Conclusion on recommendations

[435] The RAIB carried out a detailed and thorough investigation following which it made 20 recommendations addressed to the railway industry. Those recommendations were comprehensive and wide-ranging, addressing all of the ways in which railway safety could be improved in response to the tragic events of 12 August 2020. The vast majority of those recommendations have been implemented. The few remaining "open" recommendations are being actively progressed by the end-implementer with a clear plan for closure and are being carefully scrutinised and overseen by the ORR. The changes and improvements outlined above in response to the RAIB's recommendations and beyond, have satisfied me that the issues identified in both the RAIB's report and in this inquiry either have been or are being addressed by the rail industry. I do not consider there are any other reasonable precautions, improvements or other steps that could be taken which might realistically prevent other deaths in similar circumstances.

10. Closing remarks

[436] An inquiry of this kind is focussed upon the individuals who lost their lives in the accident, and establishing the matters set out in section 26 of the Act. However, I am mindful of the six individuals who survived the derailment, and whose statements formed a crucially important part of the evidence to this inquiry. Their cooperation with

the various investigations arising from the derailment has positively contributed to this inquiry, to the collective understanding of what happened on 12 August 2020 and to the improvements to rail safety which have been introduced since then.

[437] Finally, I wish to join all the participants in this inquiry in expressing my sincere condolences to the families and friends of Christopher Stuchbury, Donald Dinnie and Brett McCullough for the tragic and untimely loss of their loved ones.