[2020] EWHC 1523 (TCC)

Case No: E50MA036

**IN THE HIGH COURT OF JUSTICE**
**BUSINESS AND PROPERTY COURTS IN MANCHESTER**
**TECHNOLOGY AND CONSTRUCTION COURT (QB)**

Manchester Civil Justice Centre,
1 Bridge Street West, Manchester M60 9DJ
Draft judgment circulated 26 May 2020
Date: 15 June 2020

**Before**:

**HIS HONOUR JUDGE STEPHEN DAVIES**
**SITTING AS A JUDGE OF THE HIGH COURT**

**Between:**

**BLACKPOOL BOROUGH COUNCIL**

**Claimant**

**-and-**

**VOLKERFITZPATRICK LIMITED**

**Defendant**

**-and-**

**RANGE ROOFING & CLADDING LTD**

**Third Party**

**-and-**

**RPS PLANNING & DEVELOPMENT LTD**

**Fourth Party**

**-and-**

**CAUNTON ENGINEERING LTD**

**Fifth Party**

**Martin Bowdery QC & Robert Clay**
(instructed by **Squire Patton Boggs (UK) LLP, Birmingham B3**) for the **Claimant**

**Anneliese Day QC and Sanjay Patel**
(instructed by **Fieldfisher LLP, London EC4**) for the **Defendant**

**Serena Cheng QC**
(instructed by **Beale & Co Solicitors LLP, London EC4**) for the **Fourth Party** (on 25 February 2020)

**Simon Hale**
(instructed by **Clyde & Co LLP, London EC3**) for the **Fifth Party**

**Hearing dates: 25, 26, 27, 28 February, 2, 3, 4, 5, 6, 9, 10, 11, 12 March, 1, 2 April 2020**

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# APPROVED JUDGMENT

I direct that pursuant to CPR PD 39A paragraph 6.1 no official shorthand note shall be taken of this Judgment and that copies of this version as handed down may be treated as authentic.

COVID-19: This judgment was handed down remotely by circulation to the parties' representatives by email. It will also be released for publication on BAILII and other websites. The date and time of hand-down was 10:00am on 15th June 2020.

**His Honour Judge Stephen Davies:**


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## A. Introduction and summary of decision

1. Trams have run along the promenade at Blackpool for over 130 years. In 2007 Blackpool Borough Council, the claimant, secured central government funding for a major upgrade to the tramway system, including the supply of a fleet of modern trams and the construction of a new tram depot at Starr Gate. The tram depot was designed and constructed to be a landmark building at the principal southern approach for those visiting Blackpool by car. It has a striking modern design, with a curved aluminium roof with deep cantilevered soffits, an aluminium wall looking west out to sea, long bands of 3-dimensionally curved "wave-formed" decorative blue cladding features along the south and east elevations and fully glazed double bi-folding tram doors to the north. The tram depot was procured by a design and build main contract made between the claimant and Volkerfitzpatrick Limited, the defendant, in 2009, completed in 2011 and brought into operation in 2012.

2. In these proceedings the claimant, as the owner of the tram depot, complains that significant parts of the tram depot as designed and constructed do not meet their intended design life of 50 years and nor are they suitable for the exposed coastal marine environment where the tram depot is located and where it suffers from regular exposure to the elements.

3. The complaints are set out in more detail in the Scott schedule attached to the Particulars of Claim. The claimant contends that substantial remedial works are required at a total cost said to be in excess of £6M.

4. The claims fall into 7 principal categories, namely:

   a. The galvanised steel cold formed components connecting the wall and roof sections to the portal frame, namely the purlins, the cladding rails and the connecting brackets (items 1-3 of the Scott schedule).

   b. The galvanised steel internal components of the roof, namely rails, clips and spacers (item 4 of the Scott schedule).

   c. The wall cladding panels to the north, east and south elevations (items 5 and 6 of the Scott schedule).

   d. The soffit panels to the underside of the roof overhangs on the north, east and part south elevations (item 7 of the Scott schedule).

   e. The decorative wave form cladding panels affixed to the wall cladding panels to the east and part north and south elevations (item 8 of the Scott schedule).

   f. The tram access doors, glazed side panels and supports and operating mechanisms in the north elevation ("the tram doors") (items 9 and 10 of the Scott schedule).

   g. Other general defects in and associated with the depot building (items 11 – 80 of the Scott schedule).

5. Against each item in the Scott schedule an amount is stated for the "estimated quantum", without particulars being given as to what works are said to be required or how the amount was calculated. At the end of the Scott schedule there is added to the sub-total of the individual items (£5,765,736.45) claims for five additional items, again without particulars being given: (a) design of remedial scheme (£333,000); (b) procurement of remedial works (£100,000); (c) legal advice in connection with remedial works programme (£25,000); (d) project management time estimate for remedial works (£287,500); and (e) project management time to date dealing with defects (£187,500).

6. By its defence the defendant disputes that the contract required the individual elements of the tram depot in respect of which complaint is made to have a design life of 50 years, contending that the contractual design life is either 25 years or 20 years depending upon the element in question.

7. Save for some limited admissions the defendant disputes that the elements do not meet their specified design life or are otherwise unsuitable. It contends that such corrosion as has been experienced has been caused by the claimant's failure to maintain the tram depot appropriately, in particular to clean the exterior of the tram depot with sufficient frequency. It complains that the claimant has unreasonably refused to accept its offers to undertake remedial works in relation to some elements which it admits require attention. It disputes the remedial works proposed and the costs claimed, contending that the claimant is unreasonably seeking to obtain a full-scale replacement of the relevant elements when that is wholly unnecessary and when the costs claimed are wholly excessive.

8. The defendant brought additional proceedings against the third party ("Range") as the specialist roofing and cladding subcontractor engaged to carry out design and construction works in relation to

the roof and external cladding. Those proceedings related to the design and construction of the roof and wall cladding. Shortly before trial they were compromised.

9. The defendant also brought additional proceedings against the fourth party ("RPS"), which was the lead multi-disciplinary design consultant engaged by the defendant in relation to the main contract works. The claims made against RPS related to the design and specification of the structural and secondary steelwork, the roof steel components, wall cladding panels, cantilever roof soffit panels, wave form cladding panels, tram doors and other general defects. Those claims were compromised on the first day of trial, so that Ms Cheng QC only appeared on that day before withdrawing.

10. Finally, the defendant also brought additional proceedings against the fifth party, Caunton Engineering Limited ("Caunton"), which was the specialist steelwork subcontractor engaged by the defendant to carry out steelwork design and construction works. The claims made against Caunton relate to the cold formed components and four specified items in the Scott schedule. Those claims have not been compromised and remain for determination, as do the contribution proceedings brought by Caunton against RPS in respect of which, as part of its settlement with RPS, the defendant took over conduct on its behalf.

11. The case was listed at the first case management conference in February 2019 for a 4-week trial commencing 24 February 2020. The trial took place as scheduled. Fortunately, the oral evidence concluded before the restrictions due to the Covid-19 epidemic and subsequently I was able to hear 2 days of oral closing submissions remotely. In addition, I have received helpful written opening and closing submissions from all counsel (to each of whom I am very grateful). I have had regard to those submissions, which each made detailed reference to the oral evidence from the factual and the expert witnesses as well as to the voluminous documents in the trial bundles (conveniently provided both in paper and in electronic format) to which my attention has been drawn.

12. I have included a short glossary at the end of the judgment. Reference has been made in the evidence and in the submissions to a number of various British Standards ("BS") and International Standards ("ISO"). After the first reference I refer to them simply by their number and date, so that BS EN ISO 9224:2012 is abbreviated to 9224:2012. Reference is also made to the thickness of very thin components in micrometres, correctly abbreviated to "μm", but frequently also referred to as microns and abbreviated to "mi", which is what I shall use.

13. In summary, I award the claimant the total sum of £1,110,781.80 broken down in the table below. This, whilst a substantial sum, is significantly less than was claimed. The principal reasons why the claimant has failed to recover a more substantial award are because: (a) I am satisfied that the design life obligation period is either 20 or 25 years rather than 50 years; (b) I do not accept the claimant's case that the cold formed components are inadequate for their design life or otherwise unsuitable (nor in any event that they need replacement); (c) in a number of cases I am satisfied that limited replacement or repair rather than full replacement is required.

| **Section** | **Item** | **Amount awarded (£)** |
|---|---|---:|
| H | The cold formed components | Nil |
| K | The roof components | £150,304.88 |
| L | The wall cladding panels | £67,342.23 |
| M | The roof overhang soffit panels | £107,525 |
| N | The wave form cladding panels | £122,000 |

| | | |
|---|---|---|
| O | The tram doors | £311,729.91 |
| P | The other Scott schedule items | £246,330.68 |
| | Sub-total | £1,005,232.70 |
| Q | The add-on claims at 10.5% | £105,549.40 |
| | **Total award** | **£1,110,782.10** |

## B. The location and construction of the tram depot

14. The depot is, broadly speaking, the size of a rugby pitch, with a maximum length of around 100m along the west side and a maximum width of around 66m. It covers approx. 7,000m$^2$, with a further 1,000m$^2$ approx. of roof overhang area. Within the overall structure there are two separate sections. The west section is known as the maintenance workshop building ("the maintenance building" sometimes also referred to as the workshop building) because it is where the trams are maintained. The east section is known as the stabling building because it is used to stable the trams overnight or otherwise when not in service. Trams access both sections from the full height doors to the north elevation. Tram rails and electrified overhead line equipment ("OLE") to power the trams enter these doors at low and high level respectively. Above the workshop is a mezzanine office area. External to the depot there is a tram washing facility and a sanding plant.

15. The tram depot is sited directly on the coastline, adjacent to the promenade at its southern end point. Directly to the south and west of the tram depot, on the other side of the promenade, lies the Irish Sea. As was stated in the Works Information at paragraph 3.2.10:

    "The site is in a very prominent position at the southern end of Blackpool Promenade, which is overlooked [to the north and east] by residential properties. This is also a very exposed position with the site being prone to high winds, salt spray and wind driven sand. So, as well as meeting the visual requirements for this facility, great attention is required as to material suitability, robustness, fixing and future maintenance requirements."

16. I consider this in more detail below when addressing the issue of the appropriate corrosivity categories to which the building was designed and which the parties say apply.

17. Structurally the tram depot is a conventional portal framed building of no particular complexity, rather disparagingly referred to by one witness as an "industrial shed". The portal frames are made from galvanised hot rolled steel joists. These are carbon steel members which are formed - "hot rolled" - in a foundry and galvanised with a zinc rich finish to produce a galvanised coating. This protects the carbon steel against corrosion because zinc has a much lower corrosion rate than carbon steel. The portal frames comprise the columns (running vertically up the sides of the building) and the rafters (running horizontally along the roof of the building), together with bracing along the line of the columns and in the plane of the roof, eaves beams and gable posts. The portal frame avoids the need for internal columns to provide structural support. No complaint is made as to the portal frame components in this case.

18. The wall cladding panels and the roof structure form the external skin of the building. The wall cladding panels are fixed to the columns by cladding rails and the roof structure both in the main roof and in the roof overhangs is fixed to the portal frame by purlins. The cladding rails run both horizontally and vertically and are connected to each other by the connecting brackets. These cladding

rails, purlins and connecting brackets are cold formed components, which differ from the columns and rafters both as regards their method of production and also because they are significantly thinner than the columns and rafters. They were supplied and installed by Caunton and are the subject of complaint as to their galvanised coating. I refer to the cold formed components in a little more detail below from paragraph 25 onwards.

19. The wall cladding panels are composite panels, manufactured by the business known as Kingspan. They are sometimes described as sandwich panels, with an inner insulation section encased on both sides by 0.5mm steel outer skins. Applied to the steel skins is a relatively thin (c. 20-25mi) galvanised zinc aluminium coating. Applied to the galvanised coating on the external side is a relatively thick (typically c. 200mi) top coating of textured-finish PVC plastisol. Applied to the galvanised coating on the internal side is a 15mi top coating of polyester paint. Kingspan provided a 25-year guarantee for these panels. The panels used on different sections of the depot are not all of the same type. The wall cladding panels are the subject of complaint both as to their external and internal facings.

20. Feature wave form cladding panels are fixed onto the Kingspan wall cladding panels. The claimant's complaints as to the defective nature of the wave form cladding panels are admitted by the defendant.

21. The roof is a curved aluminium roof which covers the whole of the tram depot and the cantilevered roof overhangs as well as extending down to ground level along the whole of the west elevation of the building. The aluminium top sheet (as to which no complaint is made) is connected to the roof liner underneath using secret fixing clips on the underside, avoiding the need for the roofing top sheet to be penetrated with the aim of reducing the risk of water ingress and corrosion. The roof was designed by Range based on a proprietary SpeedDeck system.

22. The roof system is described in more detail by the structural experts in their joint statement as consisting of "Walkliner" profiled steel sheets, spacer brackets, spacer bars and roof clips, which support a profiled aluminium outer sheet. The brackets, spacer bars and roof clips are all formed from Z275 galvanised steel. The 190mm deep void between the Walkliner and the top sheet over the roof area, together with the 140mm deep void between the liner and the outer sheet on the west wall, with the exception of the ribs in the outer sheet, are filled with mineral fibre quilt insulation. In the roof overhang on the east elevation roof clips supporting the profiled aluminium outer sheet are directly attached to the purlins. In this area there is no insulation, liner, spacer brackets or spacer bar. The roof overhangs contain further light gauge galvanised steel components to support the facia and soffit panels together with ancillary components for the roof purlins. It is the brackets, spacer bars and roof clips (collectively "the roof components") which are the subject of complaint in this case.

23. It is common ground that the roof was designed to be weathertight but also to be ventilated, so that whilst wind or rain should not penetrate into the roof-space air should be able to enter and to leave. This was achieved by the provision of eaves and ridge closure pieces to provide weathertightness, with vented foam fillers in such locations providing ventilation. Air was then able to circulate through the roof-space in the gap between the insulation layer and the top sheet. Issues arise as to the extent to which in fact the roof as constructed was weathertight and as to the extent to which the provision for ventilation allows moisture and chlorides to enter the roof-space through air being drawn in at night when the temperature within the roof falls.

24. The roof overhangs have proprietary Coverworld CW20 soffit panels which form the underside of the overhanging roof section and which comprise a steel core with PVC plastisol coating applied to their

external faces. The claimant's complaints as to defects in the soffit panels are admitted by the defendant.

25. In more detail, the cold formed components are very thin, lightweight components, formed from pre-galvanised steel coil sheeting. They are referred to as cold rolled because they are formed into their required shape whilst cold, as opposed to being formed into shape in the foundry. Although very thin (the purlins and cladding rails are typically only around 1.6mm thick and the connecting brackets only around 3mm thick) they are very strong and very durable. To make them stronger they may be formed into more complex shapes, such as H or I shapes. This is relevant because airborne particles may more easily settle and remain on the horizontal part enclosed sides which may be found on such shapes.

26. There is a range of galvanised zinc coated products available, each with its own nominal thickness of galvanised coating. Because the steel is galvanised before being cut, the cut edges do not have a galvanised coating. Although that means that the steel at the cut edges is liable to corrode, it is well recognised that because zinc has a galvanic action (sometimes also referred to as a cathodic or sacrificial action or property) the surrounding zinc will operate so as to protect the exposed steel and so that the corrosion cannot penetrate the steel to any depth. Therefore, although the cut edges will have a corroded appearance which may alarm the lay observer this has no effect on the structural integrity of the component. (As appears later, this same galvanic action will also typically protect a small pinhole area of steel exposed to the elements due to damage to the galvanised coating above, although there is an issue as to for how long it will do so.)

27. As already explained, the cladding rails connect the portal columns to the wall cladding and the purlins connect the rafters to the roof. Thus, each support the walls or the roof respectively and each transfer the load from the walls or roof (together with any M&E plant suspended from the ceilings and any temporary loading such as snow from the elements on the walls or roof) down to the columns and the rafters as the primary load-bearing structure of the building. The structural engineers are agreed that the purlins, cladding rails and connecting brackets form part of the secondary structure of the tram depot.

28. Since the cold formed components sit inside the cladding they would not be expected to be exposed to the external elements unless the doors are open or because the tram depot as designed or constructed suffers from some defect (as here, it is said, due to an ineffective seal at the roof verges). The purlins and cladding rails are formed from Z600 galvanised steel plate, which is the thickest commercially available form of galvanised coating for cold rolled steel. The "Z600" designation identifies the type of galvanised coating that has been applied; the "Z" denotes that the coating is a zinc galvanized coating[1] and the "600" shows that the steel plate has a minimum total coating mass on both surfaces of 600 g/m$^2$. Some of the connecting brackets are also formed from Z600 whereas others are formed from Z275 galvanised steel plate, meaning that the coating is zinc galvanised with a minimum total coating mass of 275 g/m$^2$.

29. The total coating mass will not always be equally divided between all sides of the component in question because of the way in which the galvanised coating is applied. Therefore, Z600 coating requires a nominal thickness of 42 mi of coating on each side of the steel. BS EN 10346: 2009 allows

[1] This coating was previously referred to as G600 but references to G600 are still references to zinc coating.

a tolerance for the coating thickness for Z600 galvanised coating of 32 mi to 55 mi (i.e. 20% either side of the nominal thickness). Z275 coating typically provides for a nominal thickness of 19 mi per side, with the equivalent tolerance being 15 mi to 23 mi.

30. The roof steel components generally consist of steel trusses (which were fabricated using Z600 steel plate) and steel clips (which were fabricated using Z275 steel plate). There are two distinct categories of roof steelwork which are the subject of the claimant's claims. The first category is the internal components within the building, which sit in the small gap between the SpeedDeck roof and the internal liner sheet. These galvanised parts are located in an insulated area. The second category is the components inside the roof overhangs on the north, east and southerly sides, which are not insulated areas.

31. The tram doors are full length doors made of zinc galvanised coating over a steel door frame with a polyester powder coating applied to provide extra protection against the elements.

32. There are also a number of smaller components in and around the tram depot which were supplied and installed by the defendant and in respect of which complaint is made. These are the subject of the remaining items in the Scott schedule. Of these only 4 were supplied and installed by Caunton.

## C. Summary of relevant events: (a) pre 2015; (b) 2015 onwards

33. This is only intended to be a sufficient summary to understand the sequence of events and principal factual issues and claims. More detail will be provided to the extent necessary when addressing the individual issues and claims.

### (a) Pre-2015

34. The claimant decided to procure the tram depot through a design and build contract. It invited tenders in compliance with the applicable public procurement regime. In preparing the tender documents the claimant used its own in-house resource - including Mr Grocott whose role and evidence is described in more detail in [D] below - and external assistance from Mott MacDonald consulting engineers and DLA Piper solicitors.

35. With assistance from the legal advisers Mr Grocott produced the Invitation to Tender ("ITT") which was issued on 22 January 2009 and which included the proposed standard and bespoke conditions of contract together with documents identified as the Contract Data Part 1, the Works Information and the Functional Procurement Specification, the latter being produced by Mott MacDonald. I shall have to refer to all of these documents in more detail in [E] and [F] below. However, it is worth setting the scene at this stage by noting that the Works Information provided that the design life should be 20 years save where specified to the contrary in the Functional Procurement Specification and that the latter itself required that the "building structure" should achieve a 50-year design life, so that the question of what was comprised within the term "building structure" was always of obvious importance.

36. The defendant was interested in tendering for the works. Its intention was always to subcontract the design work to external consultants and the construction work in works packages to subcontractors. To that end it approached RPS in February 2009 to undertake the design work for the defendant's tender. It provided RPS with the first issue of the Functional Procurement Specification. The defendant and RPS had previously worked together on a number of other projects and the contract

between them was entered on a relatively informal basis by exchange of emails. Although the defendant had intended to provide a formal consultancy agreement in fact none was ever produced or thus concluded. I will refer to the terms of the contract as necessary in [J] below when addressing the Caunton contribution claim against RPS.

37. The tender procedure permitted tenderers to raise clarification queries. As part of that process, the claimant produced and issued to all tenderers an answer to a question asked by another bidder about the intended lifespan of the building which, it says, made clear the wide ambit of the term "building structure". I address the significance of this in section [F] below.

38. RPS began the process of developing the design in order to enable the defendant to produce a tender for the works. By April 2009: (a) Mott MacDonald had produced, and the defendant and RPS had received, revision D of the Functional Procurement Specification, which duly became a contract document; (b) RPS had produced version A of its "technical design log tender development" document ("the RPS design log"). The RPS design log also duly became a contract document. It suffices to say at this stage that it is relied upon by the defendant as demonstrating that none of the elements the subject of this claim fell within the definition of "building structure" because, it says, the design log made clear that the minimum design life required of the "external shell" was expressly stated to be only 25 years. Again, I address this in detail in [F] below.

39. The defendant submitted a tender offer dated 9 April 2009, offering to undertake the works in accordance with the works contract as specified in the ITT for the total price of £18,041,863. The tender document was in a number of parts. Of most relevance to this case is Part D, to which I shall refer in more detail in [E] below.

40. Also included within the tender documents submitted, but with no supporting explanation as to why it had been included, was the RPS design log. Mr Grocott's evidence was that he read this as part of the tender documentation and was sufficiently concerned to raise one query in relation to it which was duly answered by the defendant. I shall refer to this exchange in more detail in [F] below.

41. The defendant was the successful tenderer and a main contract was entered into on 8 July 2009. I refer below at [E] and [F] to its detailed terms.

42. On 21 July 2009 a start-up meeting was held at which it was agreed that the "design approval process will be to submit the relevant package to Paul Grocott and then follow up with a client check certificate meeting one week after submission to formally comment and sign the designs off subject to the comments". This must be read in the context of the detailed provisions of the main contract in relation to design development, to which I refer in [E] below.

43. On 21 August 2009 RPS produced a technical detailed design freeze log, the stated purposes of which were to "optimise and integrate [the solutions] and clarify and refine the detailed design assumptions and intent". It repeated what had appeared in the earlier RPS design log but also made further reference to the external shell, from which it was clear that the defendant was proceeding on the basis of a 25-year "minimum service life without intensive maintenance".

44. At around the same time RPS also produced specifications for the works packages in accordance with the design freeze log. As relevant to this case it produced an external envelope specification and a structural steel specification, both of which proceeded through a number of revisions. If the claimant or its advisers had conducted a thorough review of these documents they could have been in no doubt that the defendant and RPS were proceeding on the same basis as previously stated in the RPS design

log, namely that the external shell was being designed on the basis of a minimum design life of 25 years.

45. Thus, the initial external envelope specification produced on 18 August 2009 included, at [100], a reference to the design life of the external shell - including all fixings, fittings and internal sheets - as being 25 years. Furthermore, the structural steel specification rev. A, produced on 24 August 2009, also included a section G10, headed structural steel framing, which stated what was required of the steelwork contractor and thus which is of primary relevance to the position of Caunton. Paragraph [100] required the steelwork contractor to take on design responsibility in accordance with the Functional Procurement Specification and the technical design freeze log, specifically referring to the minimum design lives stated in the RPS design log. Paragraph [135] identified the "likely" corrosion rates based on initial feedback from the Galvanizers Association. It continued by stating that the steelwork contractor was required to "satisfy himself about the adequacy of above general guidance prior to adopting it within his detailed designs and specifications assuring the quoted minimum design and coating lives". It also stated at [170], entitled cold formed materials, that purlins and sheeting rails should achieve a minimum design life of 25 years and that "Z275 coatings appear to require the application of additional protective coating in order to achieve minimum coating life equal to or exceeding 20 years".

46. On 24 August 2009 the defendant submitted a number of documents and drawings to the claimant for approval under a client check certificate, including the design freeze log and the external envelope specification. The document records that the claimant raised some queries which were answered by the defendant, including confirmation that the wall cladding panels had a "25-year life span" (it was later also confirmed that Kingspan would provide a 25-year guarantee for the wall cladding panels) and that the roof system would also be suitable to provide a 25-year design life. There was no specific query raised in relation to the design freeze log.

47. The next stage was that the design was then developed by the specialist subcontractors.

48. Caunton had provided an initial quotation in March 2009 which had not been taken up. In September 2009 the defendant asked it to quote again as a matter of urgency because the defendant had been unable to reach agreement with the previous successful proposed subcontractor. Caunton did so and the defendant proceeded to enter into a formal subcontract with Caunton on 28 September 2009. There is no dispute as to its terms. Caunton undertook to design and execute the structural steelworks within its scope of works and also agreed that it was deemed to have full knowledge of the provisions of the main contract and obliged to undertake the steelworks in accordance with the Functional Procurement Specification and the RPS structural steelwork specification.

49. On 5 October 2009 there was a meeting between the defendant, RPS and Caunton. The minutes produced by Mr Grenville Griffiths of Caunton record that: (a) it was for Caunton to check and confirm the actual galvanising thickness; (b) Caunton was informed and agreed that Z600 coating should be applied to the internal cold formed components.

50. As requested by RPS, Caunton wrote to the defendant on 11 November 2009 to confirm that its proposals for galvanised finishes complied with the 20-year corrosion protection system. This letter confirmed that the cold formed components would achieve a life expectancy of 31 years and, thus, comply with the design life requirement. It stated that taking an assumed corrosion rate of 1.35 mi p.a. (which was clearly based on the information provided in the structural steelwork specification as taken

from the information provided by the Galvanizers Association) the purlins and cladding rails would give a life expectancy of 31 years if supplied as Z600 galvanised coated components.

51. The claimant accepts that this letter was enclosed as part of the client check certificate procedure and that it made no comment upon its contents. Mr Grocott does not dispute that he received the letter. He did not say in his witness statement whether he read it or noted the reference to the 31-year life expectancy. In cross-examination he accepted that he reviewed the letter. He was not asked in terms of whether or not he noted the reference to the 31-year life expectancy. Insofar as relevant I am satisfied that he did and that his silence in response was entirely consistent with his silence in response to the previous communications and consistent with, as I find, his being aware at the time that the defendant was intending to design the external shell to a minimum design life of 25 years and his being content to accept the cold formed components, as part of the external shell, as also having a minimum design life of 25 years. To be fair to him I accept that by 2015, when this point assumed importance, he had forgotten all about these exchanges which had taken place over 5 years previously.

52. Once the civils works were completed the superstructure works were begun. Caunton started work on site at the start of January 2010. The steel frame was completed on 11 February 2010 and the roof installation began the next day. The wall cladding panels were erected once the roof installation had been completed. The process was completed in around April 2010. It is common ground that although Caunton had agreed to supply all of the cold formed components with a Z600 galvanised coating in fact some of the connecting brackets were supplied with only a Z275 coating. The explanation appears to be that Caunton was unable to obtain sufficient Z600 galvanised coated cold formed components to meet the contract programme and took the decision believing (as Mr Griffiths still does) that a Z275 coating was sufficient to meet the design specification. However, Mr Griffiths accepts that Caunton did not inform the defendant at the time that this is what it had done and Caunton also accepts that in supplying this alternative specification it was in breach of its contract with the defendant.

53. It is also apparent from the timeline that there was opportunity for the components the subject of this case to be affected by the elements both whilst stored on site awaiting utilisation and whilst the portal frame was erected but the works to the roof and then the walls were still ongoing. There is however no hard evidence as to over what period and to what extent this happened.

54. Practical completion of the tram depot was certified on 16 May 2011. By this date Mr Simmons of the defendant had been moved off the project and Mr Kennedy had taken over as site agent to deal with the final stages.

55. Mr Kennedy's evidence is that the health and safety file was provided to the claimant in what he described as a substantially complete state on 1 August 2011. Mr Grocott accepted that in August 2011 the claimant was provided with a substantial quantity of operating and maintenance (O&M) manuals, including the Kingspan maintenance guide to which I refer in [L] below. Subsequently the defendant was requested and agreed to provide the O&M manuals in electronic format with an introductory maintenance matrix, summarising the recommended maintenance and containing hyperlinks through to the individual sections. However I am satisfied that neither the time it took to provide this nor the content of the matrix (which in fact was provided as a first draft by the claimant itself) are relevant to the issues which arise in this case.

56. It is common ground that throughout the defects correction period and after the defects certificate was issued the defendant attended site to rectify a number of defects. By autumn 2011 the schedule of outstanding defects included reference to corrosion to the tram sanding plant and to the tram access doors.

57. The new tram service was launched in spring 2012. Although the claimant remains the owner of the tram depot the tram service is operated by Blackpool Transport Services ("BTS") who, as I understand it, occupy the tram depot pursuant to some form of licence agreement with the claimant.

58. The defects completion date was 14 May 2012 and the defects certificate was issued on 11 June 2012, as being the end of the last defect correction period subject to a number of outstanding matters. These included item 7 which stated that where there was corrosion occurring "suitability of materials for marine environment to be checked and attended to for acceptable life cycle".

59. The tram doors were replaced in around May 2012 and the tram silo was refurbished in around October 2012, both at the defendant's expense. The evidence of Mr Grocott and Mr Kennedy makes clear that although the original proposal was to refurbish the tram doors the supplier, an Italian business known as Moreschi, decided to replace them and shoulder the additional expense, whilst re-using the existing glass panels to save cost. Thus, it charged the defendant no more than the original quotation and its invoice gave the appearance that it had repaired rather than replaced the tram doors. The paint coating applied to the surfaces of the replacement tram doors was specifically selected in order to withstand a C5 marine environment. It is admitted that the paint coating applied to the replacement tram doors has also subsequently deteriorated, but there are disputes as to why this has happened and as to whether the presence of the blisters means that the tram doors will not meet their contractual design life. These issues are investigated in section [O] below.

### (b) 2015 onwards

60. On 10 January 2015 a large section of the roof to the north-west corner became detached during high winds. The defendant attended site in early 2015 to carry out remedial works to the roof at its own expense. During subsequent inspections the claimant says that it discovered that the steel components in the roof space had lost galvanized coating and were corroded to a significantly greater extent than should have been seen after 4 years of operational life. It is clear that the roof overhangs had been affected by unsealed flashings leading to localised water ingress which had affected the corrosion environment and the condition of some of the purlins.

61. On 5 February 2015 the claimant wrote to the defendant raising its concerns. It referred specifically to signs of failure of the wave form cladding panels and the wall cladding panels. It also referred more generally to its concern that the 50-year design life, which it said was applicable to the tram depot as a whole, would not be met. On 12 February 2015 Mr Grocott wrote a lengthy letter which ended by him saying that having inspected internally "virtually every single vertical sheeting rail … is now showing signs of edge corrosion". In cross-examination he admitted that this was the first and only time in which any inspection of the cold formed components had been undertaken prior to the litigation and that it was solely a visual inspection from ground level. As I have said, although Mr Grocott did not appreciate this at the time, edge corrosion is not in fact a problem as regards the structural integrity or design life of the cold formed components.

62. In April 2015 Mr Grocott had an exchange of correspondence with the Galvanizers Association in relation to his concerns about the cold formed components in which he was given advice that if remedial action was needed in any area the usual course of action was to clean the affected area and apply a zinc rich paint or paste. In cross-examination Mr Grocott clarified that at this time the only evidence of corrosion to the cold formed components within the tram depot (leaving aside the roof components in the roof overhang) was the edge corrosion.

63. In April 2015 RPS produced a report following a visual inspection of the tram depot undertaken at the defendant's request. The stated purpose was to identify any apparent corrosion or weathering which might suggest that the relevant materials may not achieve their expected design lives. It is a detailed report which addresses a number of items in the Scott schedule. It was not shared with the claimant at the time. It is relied upon by the claimant as identifying a number of areas of corrosion requiring attention where there was no suggestion at the time that it was due to a lack of maintenance.

64. The issue of maintenance has loomed large in this case. The defendant has pleaded that "the claimant has failed properly to maintain the depot in that it has allowed salt and debris to accumulate on external surfaces of the depot". It pleads that "had the claimant implemented a maintenance regime for the depot which took into account its seafront location, salt and debris would not have been allowed to accumulate over substantial periods of time. Further, various pleaded defects (such as corrosion to external wall cladding, tram doors and glazed side panels) would not have occurred".

65. As regards maintenance of the wall cladding panels, Mr Grocott was cross-examined at some length on this topic. It appears that the defendant cleaned the exterior of the tram depot on 3 occasions during 2010 and 2011, namely on completion of the cladding works, on completion of the tram depot and on the launch of the new trams. After taking over the tram depot the claimant arranged for the exterior to be cleaned approximately every 12 months by the claimant's cleaning department. Mr Grocott's evidence was that the operatives cleaned the exterior using a hose, a brush and a mild detergent. Additionally, Mr Grocott's evidence is that the building operators BTS inspected the tram depot every month and cleaned the front of the building, including the glass and tram doors, every 6 weeks.

66. Although the claimant has been able to produce only limited documentary records, and nothing has been obtained from BTS, nonetheless I accept Mr Grocott's evidence on this point. There are sufficient documentary references to support his evidence. Thus there are documents which refer to cleaning taking place in April 2012 and June 2013, there is a receipt for £1,500 for an external clean on all metal fascias undertaken in June 2014 and there is a further documentary reference to a 2 day cleaning operation using long reach poles being arranged in August 2015.

67. It appears that Kingspan was involved as regards a possible claim under the guarantee in early 2015. They arranged for an inspection in June 2015 which was undertaken by Tata Steel, which had provided the steel to make the Kingspan panels. Tata Steel arranged for two samples of areas of cladding subject to blistering to be tested. I shall refer to the results in [L] below.

68. By July 2015 Kingspan's stated position was that the tests revealed no defect for which it was responsible and that without maintenance cleaning records it was unable to take matters further. In November 2015 Kingspan wrote to Range rejecting the warranty claim on the basis that maintenance had not taken place as required, either by the defendant pre-handover or by the claimant subsequently, and on the further basis that annual maintenance was not sufficient for the marine environment,

particularly where areas were not subject to rain-washing. Kingspan communicated this decision and its reasons direct to the claimant in March 2016, recommending that the existing damage be remedied and proper maintenance undertaken thereafter.

69. Mr Grocott accepted that the claimant did not take any action either to address the damage or to wash the exterior more frequently than once annually. Nor did it take advice from a specialist as to whether Kingspan was right or wrong. His evidence was that since neither the guarantee itself stated, nor Kingspan nor the defendant when asked was willing or able to say, how frequently it would be necessary to clean such areas, without such information it was simply not practicable to implement a more frequent cleaning schedule. I reject that explanation. In my view the claimant was simply unwilling to undertake any action itself because its view was that it was for the defendant to do so. Whether that was the right stance to take is a matter I will have to determine in [L] below.

70. Returning to the chronology, Caunton arranged for a site inspection to be undertaken by a company known as Hadley, which had supplied the cold formed components, which took place in March 2015. Again, I will refer to their report in [L] below. A little later, in May 2015, Mr Kennedy undertook some testing of the cold formed components to the eastern elevation of the depot with the permission of Mr Grocott. He did so because, having seen the Hadley test results, he was interested to see what the galvanised coating thickness would be away from the door areas where Hadley had tested. Although Mr Kennedy has little by way of detailed recollection of his testing it is possible, from a combination of the documentary evidence of the results obtained and the remaining visual evidence as to where the tests were made, to ascertain where the readings were taken and what results were obtained. I am therefore satisfied that this is a reasonably reliable contemporaneous record of what was done and where. The significance of the readings is another matter to which I shall have to return at [H] below.

71. The defendant provided initial proposals to undertake limited repairs to the roof in July 2015. Mr Grocott rejected them on 16 July 2015 on a number of grounds, including that the defendant had not addressed the long-term design and integrity of the roof or proposed to replace roof components showing evidence of corrosion. I see no basis for criticising that response as written at that stage.

72. By correspondence in July and August 2015 the claimant formally notified the defendant of its case that the cold formed components, the roof steel components, the wall cladding panels, the external soffit panels and the wave form cladding panels were not in accordance with the contract requirements. The claimant commenced an adjudication against the defendant in August 2015 seeking declaratory relief in relation to the ambit of the 50-year design life requirement. It secured a declaration that it covered both the workshop and the stabling building but it did not secure a declaration that it also covered the walls or the roof.

73. The defendant instructed Dr Harris of the engineering consultancy Sandberg to review the complaints regarding the building envelope on the assumption that the design life was 25 years. He inspected the tram depot in 2015 and had some samples tested and produced a report in January 2016.

74. He considered that the roof design was defective in that it allowed moisture to enter the roof and had caused some corrosion in some roof edge locations. He considered that remedial works were required to the roof.

75. He also addressed the defects in the soffit panels, considered that the soffit panels were inappropriate to achieve a 25-year design life and concluded that they should be replaced. I will refer to his observations as regards the Kingspan wall cladding panels in [L] below.

76. As regards the wave form cladding panels he agreed that delamination had occurred, due to the attempt to fold the edges, but suggested that a limited remedial scheme would resolve the problem. The defendant does not pursue this point in this case.

77. Dr Harris proceeded to work with the defendant and with RPS to produce detailed remedial proposals, which were the subject of a more detailed report from RPS which was submitted to the claimant, together with the Sandberg report, in early February 2016. The summary identified the roof perimeter where roof components had been affected by corrosion due to corrosive environmental penetration and proposed remedial works both to prevent or limit further penetration and to replace or repair affected components. It identified the roof soffits and affected internal roof steel components as requiring replacement and improvement to limit future penetration. As regards the Kingspan wall cladding panels, it referred to localised blistering and it proposed involving Kingspan in providing details of an approved method of coating repair, for a trial repair to be undertaken in one area and then for the extent of cladding repair to be agreed. It recommended remedial works to the roof overhang soffits, proposing the use of uncoated aluminium sheets in lieu of white colour coated sheets subject to planning approval.

78. The claimant was not prepared to accept these proposals. It would appear from Mr Grocott's letter dated 31 May 2016 that the claimant's view was that no weight could be placed upon Dr Harris' views, that the proposals did not go far enough because they did not address the full range of issues, including the design life issues which it had identified, and that the proposals were not sufficiently detailed. The defendant decided to involve a Mr Williamson, as an engineer with specific expertise in roofing and cladding, instead of Dr Harris. That did not achieve any resolution either. Indeed it appears from the correspondence referred to in Mr Grocott's third witness statement, that the parties were unable even to agree about what had been agreed at a meeting held in June 2016 involving Mr Grocott, Mr Williamson and a representative of the defendant as regards any need to replace the cold formed components and the wall cladding panels.

79. In April 2016 the claimant commenced a second adjudication against the defendant, seeking further declaratory relief as regards the contractual design life in relation to the cold formed components. The adjudication was resolved by the defendant agreeing "unless and until a court decides otherwise" that the design life of the cold formed components was 50 years. The defendant now contends that the court should decide otherwise. The fact that the defendant elected not to contest the adjudication is of no relevance to my decision on the contractual design life issue, both because the answer to that question turns on the proper construction of the main contract and because choosing not to contest the adjudication in such circumstances cannot be viewed as an admission from which then defendant cannot resile.

80. In July 2016 Mr Wilbram took over responsibility for the project on behalf of the defendant. In the same month the defendant also submitted a proposed testing regime as designed by Mr Williamson to determine the amount of any zinc coating loss to the cold formed components at regular 6-monthly intervals. The claimant did not respond substantively until November 2016, when Mr Grocott refused agreement on the basis that there was no point in doing so when the defendant had already conceded the 50 year design life issue in the adjudication and when the evidence it had already produced made

clear that the cold formed components had not been designed to that standard. That, as it transpires, was an unwise decision because I have no doubt that it would have revealed that there was no zinc coating loss of any significance which might have led the claimant to think again about whether, and if so on what basis, it could pursue a claim in relation to those items.

81. The defendant provided revised and more detailed proposals in August 2016 in relation to the roof and it also proposed that RPS should undertake a further survey in relation to the wall cladding panels, the roof overhang soffits and the wave form cladding panels. The claimant's belated response in October 2016 stated that since the defendant had recently instructed solicitors to commence legal proceedings to determine the contractual design life issue there was little point in considering the current proposals until that issue had been resolved. In an attempt to resolve the impasse the defendant offered to carry out the works at its own risk in the event that the claimant's position on the contractual design life issue was upheld. These proposals were also rejected by Mr Grocott by letter dated 1 December 2016 in which he made a number of detailed criticisms of the proposals. In short, it was said that the remedial roof proposals concentrated on the limited roof perimeter area as opposed to addressing the problems with the whole roof. I shall consider the implications of this refusal in [K] below.

82. The claimant did however grant permission for RPS to conduct a detailed survey in relation to the wall cladding panels, on the basis that it was a full and detailed survey the results of which would be shared in full with the claimant. RPS undertook the survey over a number of weeks in late 2016. I shall refer to the detail of the survey and reports in [L] below. For present purposes it suffices to say that in March 2017 the defendant provided the claimant with copies of: (a) a report from RPS in relation to the soffit cladding and wave form cladding panels; and (b) a report from RPS headed "lack of cleaning and maintenance" relating to the wall cladding panels. Mr Grocott contends that the defendant failed to provide the photographic and written results of the detailed survey in relation to the wall cladding panels. Mr Wilbram asserts that they had been provided on a CD. There is no contemporaneous documentary evidence which records the provision of these documents. In re-examination Mr Wilbram was referred to the cleaning and maintenance report which stated "for full details of the survey, please refer to the survey record sheets and photographs, which will be provided separately in digital format". Mr Wilbram suggested that if these had not been provided to the claimant at the time Mr Grocott would have identified the omission and complained. This would have been a good point had it not been for Mr Grocott's subsequent letter of 18 August 2017 in which he made that very complaint in clear terms and to which it appears there was no response. Although Ms Day argued that this complaint related to the absence of a report, rather than to the non-provision of the underlying photographs and survey sheets, I am not persuaded by that argument, since Mr Grocott was clearly complaining about the absence of the detailed results of the survey rather than the absence of a report on that data. I am also not surprised that Mr Wilbram would not have wished to provide the detailed survey results given his decision to instruct RPS not to continue with the full survey and instead to instruct RPS to provide the separate cleaning and maintenance report. Accordingly, I am satisfied that this data was not provided prior to disclosure.

83. The defendant's March 2017 letter, enclosing the reports, made its position clear that it did not accept responsibility for the defects to the wall cladding panels on the basis that the problem lay in a lack of maintenance for which the claimant was responsible. That has remained its position ever since.

84. In October 2017 the claimant formally notified the defendant of defects in the tram doors and in respect of the other minor items contained in the Scott schedule.

85. In November 2017[2] the defendant provided updated remedial proposals in respect of the roof as well as remedial proposals in respect of the external soffit panels and wave form cladding panels. The proposals were as contained in RPS' remedial proposals report dated 26 September 2017. The two significant changes were that the defendant was now proposing to replace the existing white soffit panels with aluminium sheets (and to obtain planning permission for that change at its own expense) and to replace the wave form cladding panels instead of attempting to repair them.

86. As regards the external soffit panels Mr Grocott was not willing to accept this: (a) without confirmation as to the grade of aluminium proposed; (b) without the provision of detailed O&M information, including information as to what maintenance the replacement soffit panels would require; and (c) because the colour did not provide the white colour finish that the planning permission for the depot required, it did not comply with the accepted design.

87. The defendant was able to overcome objection (c) by unilaterally applying for and obtaining planning permission to change the colour of the soffit panels; however the claimant's case is that it did not address objections (a) or (b). I shall address this in [M] below.

88. As regards the wave form cladding panels, the defendant stated that it proposed to replace the existing panels with the Rockpanel system initially proposed by the claimant in the Works Information. Mr Grocott responded asking for detailed proposals and, on his case, there was no satisfactory response. I address this at [M] below.

89. There are significant issues as to whether the claimant ought reasonably to have accepted the defendant's remedial proposals and, if so, whether the claimant's recoverable damages ought to be reduced in consequence, which I shall address below as appropriate.

90. In December 2017 the defendant wrote a letter in response to the claimant's notification of a number of claims which now form the subject of the minor Scott schedule claims. In the majority of items the defendant blamed any problem on a lack of maintenance.

91. The claimant has not undertaken any of the works claimed in relation to any of the significant value items that are the subject of this claim. Mr Grocott's evidence was that the claimant was not in a financial position to do so in relation to the substantial value items.

92. At the first case management conference it was agreed between the parties, and the court ordered, that the corrosion and materials engineering experts should agree a procedure for inspection and testing in relation to the cold formed components, the roof steel components, the wall cladding panels and the tram doors. After some delay the experts agreed that a number of specified tests should be undertaken by an independent testing house known as Socotec. Those tests were undertaken in July 2019 with those experts who wished to attend being permitted to do so. They included: (1) testing of the thickness of the galvanised coating in no less than 118 agreed internal locations; (2) testing of the environmental conditions in a number of agreed locations over an extended period from July to December 2019; (3) testing of the degree of contamination of galvanised surfaces in a number of agreed locations; (4) taking samples in various locations to obtain microsections, from which were produced micrograph images which provide a very accurate picture of the thickness and condition of

[2] The proposals in relation to the soffit panels were contained in a letter dated September 2017.

the galvanised coating. The experts attended site in July 2019 and some made further observations and - in the case of the defendant – undertook some further tests, upon which some reliance is placed.

93. Socotec was subsequently also instructed by the claimant, acting unilaterally and without prior reference to the other parties or to the court, to take further samples of blistering in the wall cladding panels in order to obtain further microsections and micrographs for analysis.

94. The circumstances in which the decision was taken by the claimant to instruct Socotec to undertake this additional testing were explored in some detail in the course of an application made by the defendant shortly before trial for an order that the claimant might not rely on the evidence of Dr Clarke or Mr Davis which I refused: see my judgment reported as [2020] EWHC 387 (TCC). For present purposes it is sufficient to record that at trial no suggestion was made or evidence given by any of the other parties or their experts to the effect that the results of that further testing were unreliable.

## D. Witnesses

95. I shall refer first to the witnesses of fact and second to the expert witnesses.

96. As regards the witnesses of fact all of the factual witnesses were honest witnesses whose evidence was in general terms consistent with the contemporaneous documents and reasonably reliable. The main distinction was between those whose evidence was so genuine and non-partisan that it could be safely accepted even where hotly contested and not corroborated by contemporaneous documents and those whose evidence was not.

97. Mr Paul Grocott was the only factual witness called by the claimant. He has been contracted to the claimant as project manager for this project throughout with some gaps. He is a civil engineer by training who has worked extensively in the construction industry. He was heavily involved in the procurement and implementation of the contract for the tram depot under the supervision of Mr Phil Fairclough. He was also heavily involved in the investigation of the defects and the subsequent dealings with the defendant in relation to the proposed remedial works. He has also been heavily involved in this litigation throughout.

98. His witness statements were far longer than they needed to have been, containing far too much unnecessary recital of the content of documents and far too much in the way of opinion and argument. The same was true of his oral evidence. Whilst undoubtedly having a good grasp of detail he showed himself to be far too argumentative and partisan for me to feel that I could place significant reliance on his evidence on key issues where uncorroborated.

99. Mr Ian Simmons was employed by the defendant as its building package manager on the project from early 2009 until early 2011, reporting to the project manager Mr Corker. As building package manager he was responsible for the elements of the tram depot the subject of this case and he liaised with the representatives of the other parties involved in this case. He was an open witness who answered according to the best of his recollection and regardless of the interests of his employer.

100. Mr Charles Kennedy was employed by the defendant as its site agent from early 2011, when he took over from Mr Simmons, until early 2015, after which he continued to be involved on an ad hoc and as necessary basis. As I have said at [C] above he undertook some tests in May 2015 which have assumed some importance in the case and which I find reliable. He was another open witness who answered according to the best of his recollection and regardless of the interests of his employer.

101. Mr Wilbram is employed by the defendant as a group risk director and has been involved in managing the issues which have arisen in relation to this project since 2016. Accordingly, he has been heavily involved in dealing with the claim and the litigation. No doubt in consequence his evidence came across to me as rather more partisan than did that of his fellow employees and thus not quite so reliable where uncorroborated.

102. Mr Grenville Griffiths was Caunton's contracts director at the relevant time and was responsible for design co-ordination and for the performance of the subcontracted works. He subsequently became joint managing director before retiring in 2018. His evidence was open and genuine.

103. This is not a case where there were other obviously relevant witnesses of fact who were not called without good reason.

104. Turning to the expert witnesses, I will refer to them by way of discipline, reflecting the order in which they were called. By way of introductory observation however I should say straight away that this is not a case where the evidence of any one or more of the experts was so deficient that I should reject his evidence in its entirety. All were genuine experts in their respective disciplines who were seeking to fulfil their duties as Part 35 experts in the particular circumstances of the case.

105. I should also say that in my view the claimant has not helped its case with its approach to expert evidence. The claimant instructed Mr Davis as a structural engineer sometime in 2015 to investigate and advise generally. That advice has not been disclosed as privileged. Subsequently, in 2017, it instructed Dr Clarke as a further expert, initially to deal only with the wall cladding panels issues, but shortly afterwards to deal with corrosion issues generally. However, until very shortly before his report was due to be served he was instructed to assume that the contractual design life was 50 years rather than to address the corrosion issues on the basis of the alternative possibilities of a 50-year or a 25-year design life. In my view that was a high risk strategy which left Dr Clarke exposed to criticism on the basis that he had approached the case with a skewed perspective.

106. The decision to instruct Dr Clarke on this extended basis also appears to have left Mr Davis with little of substance to address other than the issue of the original design and this, presumably, only on the basis that it was not appropriate to ask Dr Clarke, as a corrosion specialist, to criticise design work undertaken by a structural engineer. Even though Mr Davis also had expertise in designing remedial schemes he was not also instructed to deal with remedial design issues, in contrast to his counterparts Mr Erwee and Mr Rushton. Instead, the claimant proceeded to instruct a third expert, Prof. Lambert, to address those issues. Prof. Lambert also had extensive experience in relation to corrosion issues which he was not permitted (as the price of my permitting him to give evidence as a third expert) to deploy. I reject however Mr Hale's submission that the decision to instruct Prof. Lambert was taken on the tactical basis that for Mr Davis to have to acknowledge the limited evidence of actual corrosion would weaken his criticisms of the original design approach.

107. The decision to involve Prof. Lambert as an additional expert, coupled with the claimant's failure to undertake or to agree to the defendant undertaking a detailed staged condition survey (i.e. one which tested a sufficient number of representative locations on a repeat basis over a sufficient period) before issuing these proceedings, apparently in the misplaced expectation that it was unnecessary given the claimant's confidence that the minimum design life requirement was 50 years, has caused the claimant problems in terms of the timing of the expert evidence. It also prevented the claimant from gaining at

an early stage an informed understanding of the case which it would be able to advance in relation to the nature and extent of any loss of galvanised coating to the cold formed components.

108. In consequence, in relation to the two most substantial claims, viz the cold formed components claim and the wall cladding panels claim, the claimant attempted to hedge its bets by backing two horses (uniform corrosion loss and localised corrosion) until receipt of the Socotec results (which only became available in dribs and drabs from August 2019 through to December 2019) made it apparent that the claimant could not credibly advance a case based on uniform loss of corrosion, whether internally or externally. From that point the claimant was driven to advance a case based solely on the existence of widespread localised corrosion. However at that point the absence of a suitably detailed staged survey and the lack of time or opportunity to obtain one meant that all that Dr Clarke had to go on was his own limited observations, coupled with such other limited evidence as was also made available to him, including the additional evidence belatedly obtained from the additional Socotec testing.

109. The consequence of all this was that in January 2020 Dr Clarke finally produced a report which was lengthy, discursive and full of scientific detail but short on hard material to back it up. In turn Prof. Lambert was faced with the difficulty of having to assimilate that report, as well as a substantial report from Mr Davis, and then to produce - under severe time pressure - a remedial works specification without being entitled to use his own undoubted knowledge in corrosion issues to guide him in that process. The quality and detail of his report and his responsive report undoubtedly suffered in those circumstances, as did that of Mr Jackson, the claimant's quantity surveyor quantum expert, who had to work in very challenging circumstances to produce a detailed remedial valuation exercise and who had insufficient time to offer any detailed critique of the costings produced by the other quantum experts.

110. Whilst it would be unfair to suggest that it was only the claimant who was responsible for the delay in producing expert evidence or who experienced difficulties in the preparation and assembly of its expert evidence, nonetheless it is the claimant whose case has been most prejudiced as a result.

111. Turning to the experts themselves Dr Clarke is, as I have said, the corrosion expert called by the claimant. Dr Callow is the corrosion expert called by the defendant, who also gave evidence on the remedial works design issues. Mr Deacon is Caunton's corrosion expert, taking over at short notice following the untimely death of his colleague Dr Cox. Both Dr Clarke and Dr Callow are well qualified academically and by practice in the field of corrosion over a very long period. They have come to significantly differing views on the key issues in the case. In my view this case has taken on something of the character of a personal contest between the two, leading both to take approaches and to express views which on occasion appeared over-dogmatic and a little partisan. In addition, Dr Clarke's approach sometimes appeared overly theoretical (as came through very clearly in his lengthy and detailed analyses in Appendix 1 to his principal report) but, even so, his methodology did not as I find fully accord with that prescribed in the relevant technical standards. In contrast, Dr Callow appeared sometimes to adopt an overly relaxed approach to the corrosion which is undoubtedly present in the tram depot and to be rather too ready to blame everything on a lack of maintenance by the claimant. I am, however, satisfied that it was through oversight rather than through wilfulness or ignorance that Dr Callow's reports did not contain the required statement of compliance with his duties under CPR Part 35, albeit that the mistake was a surprising one for an experienced expert instructed by experienced solicitors to make. I do not accept Mr Bowdery's submission that Dr Callow was a hired gun upon whose evidence I can effectively place no weight. However, I did gain

the impression that he had left a fair amount of the detail to his assistant Dr Lomas and that his involvement was less "hands-on" than was that of Dr Clarke.

112. Mr Deacon provided at times a valuable counter-balance to both. Whilst he does not have an academic background and has not been expert in the field of corrosion for as long as Dr Clarke or Dr Callow, his evidence was genuine and reasonable and, it must be said, rather less dogmatic than that of either Dr Clarke or Dr Callow. I found his contemporaneous reports, including his joint reports produced with Dr Cox prior to the latter's death, of particular value.

113. As regards the three structural engineers, all were sensible and experienced structural engineers. I formed the view that Mr Davis had adopted rather too conservative an approach to corrosion-related design issues, in circumstances where he had undoubtedly been influenced by the conclusions expressed by Dr Clarke in relation to the nature and extent of the corrosion. I was impressed both by the evidence of Mr Erwee for the defendant and Mr Rushton for Caunton in relation to design issues and remedial works issues; Mr Rushton in particular came across as sensible and pragmatic.

114. Prof. Lambert had a rather difficult task, as I have explained, and whilst I do not doubt his ability or integrity I found myself unable to place very much weight on his evidence on key issues where it differed from that of Mr Erwee and Mr Rushton.

115. As to the three quantity surveyors called by the parties, as I have explained Mr Jackson for the claimant faced the difficulty of having to produce a valuation at short notice based on a scheme which had not been the subject of any detailed design before proceedings were issued or thereafter until Prof. Lambert was involved at a late stage in the proceedings. Even then it was by no means fully designed. This was particularly the case in relation to the temporary protective works which, as the quantum experts agreed, were the real risk items for remedial works of this kind. Mr Jackson and his assistant – upon whom it was clear he had placed considerable reliance - did their best in those difficult circumstances but it became apparent at trial that with more time a number of errors, omissions and inadequacies, some of major importance in terms of their value, could and would have been identified and corrected or addressed.

116. Mr Tapper for Caunton had produced detailed costings in relation to some of the works options which seemed to me to have been prepared with thoroughness and with care. Mr Linnett for the defendant had not undertaken the same exercise as had Mr Jackson or Mr Tapper of producing his own costings. That was in part due to time constraints and in part because, as he said, there was little to be gained, given the lack of details in relation to remedial works, in producing a third valuation from scratch. He had therefore provided a commentary on the costings of his fellow experts, including the result of his own investigations where appropriate, and had also relied on some costings obtained by his client direct. As he said more than once in his evidence, it is probable that had the three experts been provided in good time with a sufficiently detailed remedial scheme (or series of competing schemes) to price they would probably have been able to reach substantial if not complete agreement. I am grateful to all of them for doing their best in such challenging circumstances.

117. I should also refer to the fact that although the experts instructed by RPS and Range did not give evidence they had already produced reports and engaged in joint discussions before the defendant compromised its claims against them. All of the parties referred on occasion to the opinions of one or more of those experts. I have read and had some regard to their reports, bearing in mind of course

that: (a) their opinions have not been tested by cross-examination; and (b) it would be wrong to prefer the evidence of one expert simply because it is supported by other experts.

## E. Terms of the main contract

118. The main contract is a modified NEC3 standard form design and build contract which is contained in a number of documents of some detail and, in some respects, of some complexity, so that I shall need to refer to it at some length.

*The memorandum of agreement*

119. The primary contract document is the memorandum of agreement. This is a short form of contract by deed which records the documents forming the main contract as comprising: (a) the memorandum of agreement; (b) the additional conditions of contract attached as Appendix Z; (c) the Contract Data; (d) the Works Information and its appendices; (e) the conditions of contract.

*The additional conditions of contract*

120. These comprise amendments and additions to the NEC3 standard terms (see (e) above and below) and are also referred to as "Option Z" or the "Z terms". It is a substantial document, extending to 42 pages and 7 appendices. Its effect is that the NEC standard terms are to be read as amended by and added to the bespoke Z terms.

121. Whilst I shall have to consider the amended NEC terms in more detail as relevant to this case, it is worth referring at this stage to clause 17, which provides that where the provisions of the main contract or any part of it are inconsistent they have the following order of priority: (a) the memorandum of agreement (b) the Z clauses; (c) the remainder of the Contract Data; (d) the Works Information provided by the claimant; (e) the appendices to the claimant's Works Information; (f) the conditions of contract; and (g) any part of the Works Information provided by the contractor.

122. It is important to emphasise that the contractual hierarchy provided for in clause 17 is only relevant to the extent that there is an inconsistency between the contractual documents.

123. It is also worth noting that the conditions themselves do not expressly distinguish between the Works Information as provided by the employer and the Works Information as provided by the contractor. They simply define the Works Information as information which specifies and describes the works or states any constraints on how the contractor provides the works and is either in a document which the Contract Data specifies or is in an instruction given in accordance with the contract.

*The Contract Data*

124. The Contract Data is divided into Parts 1 and 2.

125. Part 1 is a relatively short document, entitled "contract data part one data provided by the employer", which contains a number of important contract details as provided by the employer. It defines the "works" as comprising "the design and construction of a new maintenance workshop building … together with a stabling building and all associated equipment … as further described in the Works Information". It also identifies the contract project manager and the contract supervisor, both of whom were employees of the claimant.

126. Part 2 is also a relatively short document, entitled "contract data part two data provided by the contractor", which contains a number of important contract details as provided by the contractor. There were various appendices to Part 2. As relevant to this case: (a) Appendix 1 was the activity schedule, which set out the price breakdown as between individual work elements; (b) clause 2, entitled "optional statements", stated that "the Works Information provided by the contractor is set out in Appendix 4. Appendix 4 was entitled "Works Information provided by the contractor" and referred to a CD labelled as such and dated June 2009. I refer to this below in more detail. However, I should note that it is not, and nor could it be, suggested that the information in Appendix 4 formed part of the Part 2 Contract Data; it is merely identified in the Part 2 Contract Data as the Works Information provided by the contractor.

*The Works Information*

127. The Works Information as provided by the claimant is a document divided into 4 separate sections, entitled: (1) general requirements; (2) design and construction requirements; (3) specification; and (4) proviso respectively, together with 21 appendices, of which the first and the only one of relevance to this case is the Functional Procurement Specification. I shall need to refer to the Works Information and to the Functional Procurement Specification in more detail below.

128. The Works Information as provided by the defendant comprises a number of declarations made by the defendant as part of its tender. As relevant to this case they include the following:

129. D1 - a declaration in accordance with the ITT that the defendant's proposal was fully compliant with the Functional Procurement Specification and associated drawings.

130. D2 – a confirmation of compatibility with the visual impression and elevation drawings, referring to works drawings being included in support. It also referred to the submission of an alternative similar design proposal in Part O, which was never taken up. However, I refer to it briefly in [F] to address and answer an argument relying on it which is raised by the claimant in relation to the minimum design life issue.

131. D6 – entitled "building and architectural specifications". This provided a summary of the specification as proposed by the defendant, referring to an attached layout drawing and including various details as to the design of the superstructure to which I shall need to refer later in [F].

132. Attached to the Works Information and forming part of Appendix 4 to the Part 2 Contract data, although not referred to expressly within it, was the RPS technical design log referred to in [C] above.

133. The essential contractual obligations undertaken by the defendant upon which the claimant relies are as follows.

*The conditions*

134. By clause 20.1 of the conditions, the contractor is to provide the works in accordance with the Works Information. As I have stated the contract data part 1 defines the works as including the design. Hence, this obligation extended to the design ("the design obligations") as much as to the construction of the tram depot ("the construction obligation").

135. By clause 20.5 of the conditions, introduced as a Z condition, the contractor "warranted and undertook" that the works, when completed, would satisfy any performance specification or other requirement included or referred to in the contract ("the performance obligation"). Again, given the

definition of the works, this obligation embraces the construction obligation and the design obligations.

136. I shall return to the nature and extent of these obligations once I have referred to the construction and design obligations undertaken by the defendant under the contract.

137. Clause 21.1 of the conditions records that the contractor had exercised and would continue to exercise in the design of the works the skill, care and diligence reasonably to be expected of a properly qualified and competent professional architect, or as the case may be, other appropriate professional designer experienced in the design of works of a similar size, scope and complexity as the works. The claimant acknowledges that this is a "reasonable care" obligation.

138. Clause 26.1 of the conditions provides that the defendant is responsible for works provided by a subcontractor as if the works had not been subcontracted. The defendant accepts, as it must, that it is liable for any breach of obligations imposed upon it, including the design obligations, regardless of whether it had acted perfectly reasonably in delegating the performance of those obligations to a perfectly competent subcontractor or designer.

139. Clause 21.1 of the conditions also provides that where the Works Information provides proposals regarding design development and where the contractor suggests changes to such proposals then such changes may be agreed provided that any change does not affect other parts of the Works Information including the performance standards, outputs and design life unless it is expressly agreed in writing as part of the change. To similar and more general effect was clause 14.1, which provides that "the Project Manager or the Supervisor's acceptance of a communication from the Contractor or of his work does not change the Contractor's responsibility to Provide the Works or his liability for his design".

140. Clause 14.1 is also relevant to clause 21.2 which, as amended and as read with clause 21.3, provides that the contractor should submit all designs to the project manager for acceptance and should not proceed with the relevant work until the design (or relevant part) is accepted.

141. However, it should be noted that these contractual provisions regarding changes, whether in terms of design development or otherwise, were not intended to nor did they apply to anything introduced in the Works Information provided by the defendant. The contract assumed, as would be expected, that the Works Information provided by the employer and the Works Information provided by the contractor were mutually consistent and should be read together, on the basis that insofar as there was any inconsistency the contractual hierarchy provided for by condition 17 should apply.

*The claimant's Works Information*

142. Turning to the Works Information provided by the employer, section 1, entitled "general requirements" contains nothing of particular relevance to the issues in this case save that paragraph 1.22.2 confirms the contractor's general obligation to design and construct the works in accordance with the designs as proposed by the employer and included in the contract.

143. Section 2 is entitled "design and construction requirements" and contains a number of relevant provisions.

144. Section 2.2 states that "Preliminary Information" means information provided by the employer in the Functional Procurement Specification and in other stated documents which is provided for guidance purposes only so that the employer should not be responsible for its accuracy or sufficiency. In short,

it is not open to the contractor to assert that it is not responsible for design or construction defects because they are the result of following the requirements of the Functional Procurement Specification which have proved to be inaccurate or insufficient in some way.

145. Section 2.3 of the Works Information, entitled "detailed design", states that the contractor should be responsible for all design and for the co-ordination of all such design.

146. Section 2.3.5, entitled "compliance with design standards" is heavily relied upon by the claimant in this case. It provides that the contractor should ensure that its design for all elements of the works complied with the following matters, namely (as relevant to this case):

(a) the contract;

(b) the law;

(c) the relevant British and European Standards;

(d) that "there are no 'non-standard' or 'unusually onerous' operation and/or maintenance requirements in respect of the works having regard to normal construction operations and maintenance requirements which are applicable for works of a similar character as the works" ("the maintenance obligation");

(e) that "the materials and design are suitable, durable and appropriate for a sea front location" ("the suitability obligation");

(f) that "unless otherwise specified in the Functional Procurement Specification, have a design life of at least 20 years" ("the minimum design life obligation")

(g) "other standards as set out in the Functional Procurement Specification";

(h) "good industry practice".

147. It follows that the minimum design life obligation, the suitability obligation and the maintenance obligation engage the design obligation in clause 20.1 above.

148. As regards the minimum design life obligation, as I have said it is common ground that the Functional Procurement Specification did indeed otherwise specify in relation to the "building structure" by specifying a design of 50 years, which raises the important issue as to what is included within the building structure which I determine at [F] below, but first I must resolve some important issues which arise as to the ambit of the suitability and the design life obligations.

149. The first is that the claimant submits that when read with the works provision obligation and the performance obligations in clauses 20.1 and 20.5 of the conditions the minimum design life obligation, the suitability obligation and the maintenance obligation all impose strict contractual obligations upon the defendant. The defendant, supported by Caunton (as it is in relation to all issues of contract construction in relation to the main contract), submits that they are reasonable care obligations. All counsel place reliance on the decision of the Supreme Court in *MT Hojgaard v E.ON* [2017] UKSC 59. That was a case originally decided by Edwards-Stuart J in favour of the employer, which decision was overturned by the Court of Appeal, where the only substantive judgment was given by Jackson LJ, but whose decision was itself duly overturned by the Supreme Court, where Lord Neuberger gave the only substantive judgment.

150. It is unnecessary to provide a detailed account of the facts of the *Hojgaard* case or of the judgments at each level because, as all counsel agree, it is a decision which turns on the terms of the particular contract in question, so that it follows that the answer to the question in that case is not dispositive of the present claim. It is however helpful insofar as Lord Neuberger does include some illuminating observations as to the ambit of a design life obligation in a contract with some similarities to the present. In that case an employer made a claim against a design and build contractor where the allegation was that design life obligations similar, but not identical to, the obligations imposed in this case had been breached. Whilst rejecting the allegations based on a lack of reasonable care, Edwards-Stuart J found that clause 3.2.2.2(ii) of the Technical Requirements contract document, which required that "the design of the foundations shall ensure a lifetime of 20 years without replacement", operated when read with clause 8.1(x) of the contract, which required the works to be fit for purpose, as a strict warranty and had been breached. Jackson LJ allowed the appeal on the basis that to construe the clause to impose a strict contractual warranty was inconsistent with the terms of the contract as a whole. The Supreme Court allowed the employer's appeal, holding that the clause should be construed as a strict liability obligation which had been breached on the basis of the facts as found.

151. Lord Neuberger was of the view at [30] that the clause on its proper construction was a contractual term that the design of the foundations was such that they would have a lifetime of 20 years, as opposed to a being a warranty that they would last 20 years without replacement. He observed at [31] that, given the forces of nature, a lifetime of any specified period could never in practice be guaranteed. In that case it appears from [31] that it was possible to give the design life obligation specific meaning in terms of annual probability of failure by reference to a contractually incorporated design standard. However, as he said at [32], he did not consider it necessary to decide the question, on the basis that whichever the answer the same result would follow in that case.

152. In my view there is no basis for treating the decision in that case as support for any argument that the suitability and the design life obligations in this case should be construed as being only "reasonable care" obligations. I am satisfied that they have the same essentially strict character as the Supreme Court held that the clauses in issue did in that case. For what it is worth, I tend to the view that applying Lord Neuberger's preferred construction to this case allows the defendant to contend that a particular element of the tram depot would not last its minimum design life notwithstanding any design which might feasibly have been adopted. As in that case, however, it is not necessary to grapple with the difference between the two alternative formulations, because this is not a case where it was argued so that I would need to decide whether or not it would have been impossible for these obligations to have been met regardless of any design the defendant might feasibly have adopted.

153. It is also important to understand what is meant by "design life". There is no contractual definition of the phrase. However, the structural experts were agreed that helpful references are found in a number of relevant standards which were available at the time, of which I found two particularly useful.

154. BS ISO 15686-1:2000, entitled "buildings and constructed assets - service life planning", contains a definition of design life as the service life intended by the designer. In turn the service life is defined as the period of time after installation during which a building or its parts meets or exceeds the performance requirements. A performance requirement is defined as a minimum acceptable level of a critical property. There is also a definition of durability as the capability of a building or its parts to perform its required function over a specified period of time under the influence of the agents anticipated in service.

155. The interplay between design life, service life, performance and durability is usefully illustrated by these definitions.

156. BS EN 1990:2002, entitled "basis of structural design", contains at 1.5.2.8 a reference to "design working life", which means the "assumed period for which a structure or part of it is to be used for its intended purpose with anticipated maintenance but without major repair being necessary". Maintenance is defined in the same standard as being the "set of activities performed during the working life of the structure in order to enable it to fulfil the requirements for reliability".

157. This analysis is useful. It cannot realistically be thought that a structure should be intended to be maintenance free for the whole of its design life, whereas it can reasonably be assumed that it ought not to need major repairs over that period.

158. Thus, the distinction lies between anticipated maintenance and major repair. That is, of course, a question of fact and degree in any given case. In my view it must also be the case, given the terms of the maintenance design obligation found in this contract, that what is acceptable maintenance in this case is limited to maintenance which is not 'non-standard' or not 'unusually onerous' having regard to normal construction operations and maintenance requirements which are applicable for works of a similar character.

159. An important issue which arises in this case is how this design life requirement applies in relation to individual components which have a steel substrate with either a galvanised coating or a paint or similar type coating or – such as the wall cladding panels and the tram doors - a galvanised coating and a plastisol or paint coating respectively applied on top of the galvanised coating.

160. The claimant's case is that the design life applies to the component in question as a whole, so that major repair should not be required to the plastisol or paint coating or to the galvanised coating during the design life of that component. The defendant's case is that these coatings are intended to provide protection for the steel structure below, so that it is envisaged that they may well be consumed (or "sacrificed") during the lifetime of the component in question, with the consequence that any question as to whether the design life will be met can only be answered by reference to the required performance applicable to the steel substrate. On that basis the defendant says, for example, that: (a) the criterion for failure of the cold formed components is loss of the galvanised coating and sufficient loss of the steel substrate that it cannot perform its structural function of transferring the loads from the roof or walls to the rafters and columns; and (b) the criterion for failure of the wall cladding panels is loss of the plastisol coating, the galvanised coating and perforation of the steel substrate.

161. This issue has been considered by some of the experts. Some, including Mr Davis, note that a number of standards adopt the term "life to first maintenance" or "life to first major maintenance" ("LTFM") in relation to protective coatings. This refers to the time to which major or general maintenance of the coating becomes necessary. This will usually be different from the design life of the underlying structure, save in those rare cases where access for repair or maintenance of the coating is impossible. The experts also observe that it not infrequently occurs that contract specifications include a specific requirement to this effect. Here, for example, it will be seen that the RPS design log provides for a 50-year design life in relation to the "structural frame" with a further requirement that the "coating life to first maintenance" should be 20 years.

162. However, since there is no such equivalent provision in relation to components not forming part of the structural frame, the question arises as to whether there is a separate design life in relation to the

coatings applied to those components and, if so, what it is? It cannot be said in my view that the standards referred to by the experts provide some definitive answer to this question. As Mr Davis says, it may be that in the absence of some express contractual LTFM provision the coating is expected to achieve the same design life as the structure underneath. Alternatively, as the defendant submits, it may be that there is no design life obligation at all in relation to such coatings and the only design life obligation relates to the underlying structure.

163. In my view the answer to this question cannot be answered separately from the question as to what is the design life of the component itself, so that I will decide this point at that stage in the following section [F].

164. However a further important issue also arises in relation to the proper construction of the maintenance design obligation, which is whether the comparator is: (a) the requirements applicable to works of a similar character; or (b) the requirements applicable to works of a similar character which would only also apply to works in a similar location to the tram depot. This is an important issue in the context of the defendant's case that the claimant ought to have maintained areas affected by corrosion with such frequency as to ensure that they were kept clean, even if that would be far more frequent than a similar building in a non-coastal or less exposed position. Whilst I note that the structural experts instructed by the parties other than the claimant express a different opinion, I have no doubt that as a matter of construction of the contract the comparator is simply to a similar building in any location rather than a similar building in a similar location. If the defendant's design required non-standard or unduly onerous operation or maintenance requirements because of the particular location of the tram depot then it was the defendant's obligation to identify those requirements and to obtain the claimant's express consent to those requirements. I would accept that it must follow that what is non-standard or unduly onerous will be a question of fact and degree in the context of the particular case.

165. This conclusion is based primarily on the wording used in the clause itself. In my view the references to "normal" maintenance requirements and to works of a "similar character" indicate that the comparator is intended to be general to structures of this kind rather than to be specific to this particular structure of this particular location. If the question could only be answered by reference to a structure of a similar character in the same location it is difficult to see what the clause was intended to achieve, since any maintenance requirements which were reasonably necessary for this particular tram depot at this particular location could never be said to be "non-standard" or "unduly onerous" in such a case, whereas if the maintenance requirements were unnecessary the clause would be otiose.

166. This conclusion is reinforced in my view by section 3.2.10, entitled "Maintenance Workshop Building/Stabling Building and Ancillary Buildings Elevational Treatment - Fundamental Issues", which stated that: "the site is in a … very exposed position with the site being prone to high winds, salt spray and wind driven sand. So, as well as meeting the visual requirements for this facility, great attention is required as to material suitability, robustness, fixing and future maintenance requirements". This section makes it clear in my judgment that the defendant was not permitted to design the tram depot as if it were located in a "standard" non-coastal or less exposed environment because the design would still work so long as maintenance requirements which would be regarded as non-standard or unduly onerous in the context of standard locations were adopted. If the defendant wished to secure this outcome it would have to obtain the claimant's consent in accordance with clause 21.1.

167. Section 2.3.6 of the Works Information made provision for the contractor to submit design information to the project manager for review on the express basis that acceptance of such design should not absolve the contractor of his responsibility for that design. It also described the detailed design submissions which the contractor was required to submit. As regards the depot and stabling design, section 2.5 stated that the requirements in this regard were as set out in the Functional Procurement Specification.

168. The effect of these provisions, in my view, is that it was envisaged that the contractor would be responsible for the evolution of the detailed design post-contract in the manner specified in the Works Information, but that the evolution of the detailed design did not operate so as to override the contractor's fundamental contractual obligations as found in the contractual documents unless or to the extent that it was expressly agreed in writing that it should.

169. The conditions of contract as amended also contain a definition of "design freeze date", which is stated to be 6 months after the date that the project manager submits the agreed design to the contractor to enable it to make an application for detailed planning approval. So far as I am aware there is no other reference in the contract documents to the design freeze date, but it would appear that the intention was to ensure that the developed design was agreed by a specified date so as to ensure that it was frozen for the purposes of submitting the planning application, but that this would not operate to prevent further design changes assuming that they went through the contractual procedure for such changes.

170. Section 3.2.10 of the Works Information summarised what was required of the tram depot in terms of appearance and materials. It explained that the roofing system should "give good resistance properties to the harsh environment, excellent prevention to water ingress and a visually acceptable appearance". In relation to the walls it specified insulated composite panels, stating that the polyurethane coating system should be "suitable to withstand the marine environment". The construction obligation clearly applied to these requirements, as did as well as the design obligations including the suitability obligation. In my view these are also, whilst generally expressed, nonetheless in the nature of a performance specification or other requirement to which the performance obligation applied.

*The Functional Procurement Specification*

171. Section 1.1 of the Works Information stated that it was supplemented by the appendices and, in particular, the Functional Procurement Specification and that "the works are set out in this Works Information and in particular in the Functional Procurement Specification". It follows that the strict contractual works provision and performance obligations imposed by clauses 20.1 and 20.5 applied as much to what was contained in the Functional Procurement Specification as they did to what was contained in the Works Information.

172. The contract version of the Functional Procurement Specification is the 4$^{th}$ issue revised March 2009 and it contained a number of provisions of significance in relation to the defendant's obligations as relevant to this case.

173. Clause 1.2 stated that:

"The … contractor … shall ensure that the depot works shall be designed, manufactured, constructed, installed, commission and tested as appropriate so that they can provide a safe, reliable, efficient and cost-effective depot to maintain and service the tram fleet. The depot shall be designed, manufactured

and constructed in accordance with the concept functional and operational requirements set out in this specification and the Works Information".

"All elements to be supplied for the depot at Starr Gate shall be suitable for installation in an environment having a high saline atmosphere and high wind loadings".

174. In my view the construction and the suitability obligations apply to these requirements as does the performance obligation on the basis that whilst general they are nonetheless in the nature of performance specifications or requirements. In particular, the references to cost-effectiveness and suitability for the particular environment are both material to some of the issues raised in this case.

175. Clause 1.8 stated that: "In developing the detailed design for the depot the Contractor shall ensure that: "all elements of the Works should be suitable for the environment within which they are to operate. Where equipment or components are exposed to the elements they should be capable of delivering the required functionality and/or safety within the weather conditions generally experienced within the Blackpool area and particularly on the Site."

176. Again, in my view the construction obligation, the suitability obligation and the performance obligation apply to these requirements.

177. Clause 3, entitled "maintenance workshop building", begins at clause 3.1 by stating what was required in relation to what was described as the "building form and structure". It did not purport to define the term "building structure" and it is simply not possible in my view to discern a clear statement as to what, if anything, was intended to be within that term as it was used in the Works Information. So it referred, for example, to the "structural philosophy" as being a "steel double portal frame superstructure" and also referred to the "main structural form" as comprising steel portal frames, also referring to bracing to provide stability in the form of horizontal roof bracing, vertical bracing and K and cross bracing in the gable end frames. It stated that "all surfaces of the steel structure are to be galvanised".

178. It referred to the provision of external wall cladding separately to this main structural form. It stated that:

"In the development of this concept, it is understood that the proposed location of the depot building is in close proximity and open to the sea air, with associated harsh environmental conditions. It proposed that: "external wall cladding to the structures be selected and designed to suit these local environmental conditions".

179. It did not specify what particular type of wall cladding should be provided, nor did it make any express reference to how the wall cladding panels should be affixed to the portal frame and, thus, no express reference to the cladding rails which in due course would be used for such purpose. The performance obligation and the suitability obligation applied to this obligation to select and design the external wall cladding.

180. In the same way it proposed that the roof should be: "multi-bay duo pitch with a lightweight trapezoidal insulated roof system to suit the local environmental conditions" (again the performance obligation and the suitability obligation applied) and to be "supported by purlins spanning between the portal frames". It was not, therefore, being suggested that the purlins were to be considered as part of the main structural form.

181. Clause 3.3.1, entitled "design requirements", included a number of provisions of relevance to this case.

182. Under "(iii) Design Life" it was stated, baldly, that: "The design life of the building structure shall be a minimum of 50 years [142]". There was no express definition of the phrase "building structure" and its true meaning and effect is a matter which is hotly disputed as between the parties.

183. The reference to [142] is a reference to a document entitled "Blackpool and Fleetwood Tramway, Depot Works ITT Clarifications, Depot Clarification 142" which read as follows: "Query: What is the intended lifespan of the building. Answer: The overall design life requirement is 50 years but there are separate design life requirements specified in the Functional Procurement Specification in respect of certain items of equipment …".

184. I shall have to consider the relevance of this question and answer when dealing with the controversy as to the proper meaning of the term "building structure".

185. Under "(iv) Design Standards" it stated that: "All structural elements shall be designed using their appropriate current UK design codes". A number were specifically identified, including BS5950 Part 1 to 4 for structural steelwork design and BS5628 Part 1: 2005 for "load bearing masonry and wall panelling", foundations and water retaining structures. This does not assist in determining whether or not either the cold formed components or the roof components would be included as structural steelwork or whether the wall cladding panels would be regarded as load-bearing or non-load bearing. Under "(v) Fire Resistance of Structural Elements" it stated that: "The structural elements of the Maintenance Workshop Building shall be designed for 1 hour fire resistance at the building perimeter" but again there was no express reference to what those structural elements might be, particularly in the context of the further statement that: "The building elements will be designed to 1 hr fire resistance at detailed design stage to Building Regulations, Part B compliance".

*The defendant's Works Information*

186. Turning then to the Works Information as provided by the defendant, I have already referred to sections D1 and D2 and D6. D6 is divided into 3 separate sections, the first headed "superstructure", the second headed "building envelope" and the third headed "internal superstructure, finishes and fixtures".

187. The superstructure section, in the same way as the Functional Procurement Specification, referred to the "main structural form" as comprising a steel framed portal structure, the "main components" of which are the portal rafters, gable rafters, external stanchions, valley stanchions and gable posts". It also referred in this section to "galvanised cold rolled purlins" to accommodate profile steel cladding and to other purlins to accommodate the roof sections, including the east overhang, and to a "galvanised cold rolled side rail system to accommodate the vertical cladding". It then referred to "secondary steelwork … to provide support and restraint" for certain items and to "additional steel" for the canopies at the ends of the stabling area and the north overhang. It stated that "all hot rolled steels are to receive heavy duty galvanising (nominal 140 mi coating)" whereas "the cold formed steelwork has been formed from galvanised coil to class G275".

188. Under the following building envelope section the proposed roof was an "aluminium standing seam roofing system, giving good resistance properties to the harsh environment [and] excellent prevention to water ingress" which would be continued to low level on the west elevation, and below which would be glass fibre insulation on top of "0.7mm thick standard white lining, polyester colour coated profiled galvanised steel liner panel". The proposed wall cladding was Kingspan composite panels

with differing thickness as between the maintenance building and the stabling building. Reference was also made to the wave form cladding panels and to the soffit panels to the overhang and canopies.

189. Thus, the purlins and cladding rails are within the superstructure section whereas the wall, roof and soffit panels are within the building envelope sections of this section. However, within the superstructure section the main portal frame structure is separate from the purlins and cladding rails. Moreover, a distinction is drawn between hot rolled steel and cold formed steelwork and it is clear that the purlins and cladding rails were to be cold formed components whereas, although not stated in terms, it would be well known to any building professional that the portal frame structure envisaged in this case would be made of hot rolled steel. No express reference is made to the "building structure".

*The RPS design log*

190. The design log is entitled "RPS technical design log tender development architecture civil & structure". Its stated aims are to "optimise and integrate structural, civil and architectural solutions [and] clarify technical tender design assumptions and intent". There follows a table over 7 pages with the following column headings: "design issue" (this summarised the particular design issue raised), "tender development" (this summarised the nature of the particular design development), "reason for development" (this summarised the reason for the particular design development), "ref (RPS)" (this identified the relevant RPS drawing(s)); and "BBC feedback" (this was left empty to enable the claimant to provide feedback).

191. Design issue numbered 1.4 is entitled "environment classification". The tender development is stated to be: "structural steel: superstructure category C3 (for internal environment)" with the stated reason being: "to clarify assumptions and intent".

192. Design issue numbered 1.9 is entitled "minimum design life". The tender development column reads as follows:

"Structural frame and rail support structures = 50 years
* coating life to first maintenance $^{o}$ 20 years
Substructure and foundation = 50 years
External shell = 25 years
Internal drainage = 50 years
Floor finishes within offices = 10 years
Floor paint within workshop / maintenance / stabling areas = 5 years".

193. Again, the stated reason is "to clarify assumptions and intent."

194. The rail support structure is the structure which provides support for the tram rails in the repair pits in the workshop area and, hence, is not directly material to this case. It is common ground that trams entering the tram depot could be wet and, thus, that the rail support structure would frequently be exposed to moisture whilst the trams were in the repair pits.

195. There is no express definition of what is meant by or included within either the structural frame or the external shell.

196. On receipt Mr Grocott sent an email to the defendant which related to item 1.4 and, stating that the Functional Procurement Specification required the main structural steelwork to be galvanised, queried whether a C3 specification as opposed to a C5M was appropriate for the climatic conditions and asked for confirmation that the galvanised steelwork protection would be provided in accordance with those

conditions. The defendant's response was to refer to corrosion rates taken from a map produced by the Galvanizers Association (as to which more later) and to say that using those rates the specified design life of 50 years would be exceeded by 20 years. However, this exchange does not shed any light on the question of construction, since the words "structural steel: superstructure" as used in item 1.4 do not make clear whether this is referring solely to the primary portal frame or to all steelwork within the superstructure. Furthermore, since this letter did not become part of the contract it is, as a matter of law, irrelevant as an aide to the proper construction of the contract and nor, realistically in the circumstances, is it relied upon by the claimant as grounding any form of estoppel or similar argument.

197. Having set out in some detail the relevant provisions of the main contract, I must now consider and determine the primary arguments as to its proper construction.

## F. Contractual design life of the various components in the tram depot

198. The claimant's primary case is that the contractual design life for the various components of the tram depot in issue in this case is 50 years. Its fallback case is that the design life is 25 years.

199. In contrast, the defendant contends that the contractual design life of the wall cladding panels is only 25 years and that the contractual design life of the cold formed components, roof steel components and other components in issue in this case is only 20 years. Alternatively, in relation to the cold formed components the defendant seeks to rely upon as estoppel which prevents the claimant from asserting that the design life should be greater than 31 years.

200. The claimant's case is that, notwithstanding the absence of an express definition, on a proper construction of the term "building structure" as used in clause 3.3.1 all of the components the subject of this case are included. The claimant's case is that in the case of a portal frame structure the building structure comprises three essential elements, namely the primary steel structure, the secondary steel structure and the external walls and roof, so that all are within the definition. The claimant contends that: (a) the term building structure naturally includes all load bearing or load transmitting elements of the depot building; (b) the cold formed components and the roof components are secondary structural elements within the building; (c) the wall cladding panels and cantilever soffits form part of the walls and the roof and, thus, form part of the building structure because: (i) as such, they are part of the overall structure of the building; and (ii) the walls and the roof transmit wind and other loads which bear on them as external structures.

201. The claimant submits that this conclusion is reinforced by: (1) the terms of clarification [142] referred to in [E] above; (2) the price breakdown submitted by the defendant and included in the contract in the Activity Schedule included in the contract at Appendix 1 to Contract Data Part 2 (in which the sum of £2,207,474.11 is included for the "building structure" in circumstances where none of the other items priced could conceivably include either the cold formed components, the roof steel components or the wall cladding panels; (3) other relevant terms of the contract documents, specifically the Works Information, the Functional Procurement Specification and section D6 of the tender. The claimant submits that section 1.9 of the design log is irrelevant and ineffective in that: (a) by submitting its certificate of compliance the defendant agreed to provide a tram depot with a 50 year design life for the building structure; (b) the submission of the RPS design log alongside the tender cannot alter that position, in circumstances where: (i) in the event of an inconsistency the employer's Works

Information and the Functional Procurement Specification have priority over the contractor's Works Information; (ii) the contractually agreed procedures for making design changes were not followed.

202. The defendant's case is that in the absence of an express definition of the term building structure its meaning, both as a matter of its ordinary meaning and the other relevant terms of the contract documents as a whole, is limited to the primary structural frame as made from hot rolled steel (i.e. the columns, rafters and cross-bracing). It thus excludes: (a) the cold formed components (on the basis that their only function is to connect the wall cladding panels and roof structure to the structural frame, so that they are not load bearing (as opposed to load transmitting) structures); (b) the wall cladding panels and everything forming part of the roof structure (on the basis that neither the walls nor the roof have any structural function). It also submits that insofar as there is any ambiguity it is conclusively answered in their favour by the content of the RPS design log as a contractual document which is neither inconsistent with the terms of the employer's Works Information nor the Functional Procurement Specification.

203. It is common ground that well-established principles of contract construction govern the approach which should be taken to answering this question. These, as recently and conveniently summarised by O'Farrell J in *Entertain Video Ltd v Sony DADC Europe Ltd* [2020] EWHC 972 (TCC) at [221], are as follows:

"When interpreting a written contract, the court's task is to ascertain the objective meaning of the language which the parties have chosen to express their agreement. It does so, having regard to the meaning of the relevant words in their documentary, factual and commercial context. That meaning has to be assessed in the light of:

(i) the natural and ordinary meaning of the clause;

(ii) any other relevant provisions of the contract;

(iii) the overall purpose of the clause and the contract;

(iv) the facts and circumstances known or assumed by the parties at the time that the document was executed; and

(v) commercial common sense; but

(vi) disregarding subjective evidence of any party's intentions.

See: *Arnold v Britton* [2015] UKSC 36 per Lord Neuberger at paras. [15] to [23]; *Wood v Capita Insurance Services Ltd* [2017] UKSC 24 per Lord Hodge at paras. [8] to [15]."

204. Since the contractual hierarchy provision only applies in cases of inconsistency it is important to read the contractual documents together to see if there is, on their proper construction, any inconsistency.

205. The meaning and ambit of a "building structure" is reasonably clear in general terms, particularly in the context of a traditional brick walled slate roofed structure. However, it is not so easy to identify which individual elements within a building fall within its ambit, particularly in the context of more modern structures such as a portal frame structure such as the tram depot. Reference to the ordinary or common meaning of the phrase cannot answer the question. Nor can reference to established legal precedent, whether statute, regulation, British Standard or case law.

206. Thus 1990:2002, to which I referred in [E] above, defines a structure as "an organised combination of connected parts designed to carry loads and provide adequate rigidity". This is helpful but not

decisive in a particular case. The same is true of the evidence of the structural engineers, which helpfully explains how the tram depot is constructed and the functions of each separate element in question. As I indicated during the course of the trial, whilst the evidence of the structural engineers was useful on that basis, their opinion evidence as to which elements of the tram depot they believed the term encompassed was irrelevant. It would be wrong in my view to reach a decision on the basis of evidence from structural engineers about the role each particular component played in terms of carrying or transmitting loadings and providing support or rigidity when that detailed understanding would not necessarily have been known to those who drafted the contract documents or executed the contract.

207. In the context of a modern steel framed building such as the tram depot there can be no dispute that the primary streel structural frame is part of the building structure. However, in my view it is neither plain nor obvious whether or not the secondary steel structures, such as the purlins and cladding rails, are also part of the building structure. Non-load bearing external structures such as the wall cladding panels and the roof panels and soffits are perhaps less obviously within the definition, but a respectable argument to the contrary can be made. As Mr Bowdery submitted, an employer who contracted with a builder to provide the building structure of such a building with nothing further said might be justifiably upset if on practical completion he found that the builder had only provided steel framing and no roof or walls. In this case the complexity of the roof structure and a consideration of the form and function of each individual element forming the composite roof shows the difficulty of drawing a clear dividing line.

208. Counsel have not referred me to and nor have I been able to find, any prior judicial consideration of the term. The detailed consideration of the term "structure" in the well-known textbook *Dilapidations: The Modern Law and Practice* (6th edition) at paragraph 7.34 and following demonstrates that there is no easy or obvious answer to the question.

209. Both the claimant and the defendant have referred to other relevant standards which refer to the term "structure".

210. The claimant seeks to rely upon SCI P346 (2006), which is a publication produced by the Steel Construction Institute titled Best Practice for the Specification and Installation of Metal Cladding and Secondary Steelwork. This is the source of the three-part structure as comprising the primary steel frame, the secondary steelwork and the roof and wall cladding. However, this reference falls within an introductory section 1.3, headed "the building envelope", within a sub-section 1.2.1 headed "the principal building components", so that I do not think that it is intending to do any more than provide a helpful general outline description of the structure of the building envelope.

211. Nor in my view can any clear meaning be derived from the content of the claimant's Works Information, from the Functional Procurement Specification or from the Works Information as provided by the defendant - excluding for present purposes the RPS design log. In my view both the claimant and the defendant can point to certain parts of each which provide some support for their respective cases, but nothing which is decisive.

212. Thus, whilst it is true that the activity schedule only contains one lump sum item for the building structure and that this clearly does include all of the components which form the subject of this dispute, this high level price breakdown is highly unlikely ever to have been intended, objectively considered, to assist in defining the term for the purposes of establishing the contractually required

design life for a whole variety of individual components also included within the term. To give one example, the price must also include the floor paint to be applied within the tram depot yet it could not sensibly be thought that this means that the floor should also be part of the building structure for the purpose of prescribing a 50 year design life. Furthermore, the building foundations are a separately priced item. On the claimant's case this would mean that the foundations are not part of the building structure which would, I think, be a surprising conclusion if – as is the case - they are not also separately specified as requiring a 50 year minimum design life.

213. Nor is it possible in my view to discern any clear intention from the other parts of the relevant documents. In particular, it is too simplistic in my view to say that just because the purlins and cladding rails fall within the "superstructure" section of section D6 of the tender they must be regarded as forming part of the "building structure", not least because the superstructure section itself distinguishes between the steel components of the main portal frame on the one hand and the other steelwork components on the other, both in terms of their order within the superstructure section and the fact that the former are hot rolled whereas the latter are cold formed.

214. Nor do I consider that clarification [142] provides any real assistance on this particular point when scrutinised with care. First, neither the question nor the answer is specifically directed to the meaning of the term "building structure" or to the required design life of any particular component, let alone the particular components in issue in this case. The question "what is the intended lifespan of the building?" is not a particularly clear or precise question. It is not obviously seeking clarification as to what was meant by the term building structure in terms of what is covered. Nor does the answer that "the overall design life requirement [of the building] is 50 years" assist in my view in answering that question. I do not accept the claimant's submission that the question and answer show a clear intention that the term "building structure" was to be read as if it meant the same as "building". If that was the case, then it would mean that each and every constituent part of the building, whether structural or non-structural, was required to have a 50-year design life, which plainly was not what was intended by including the word "structure".

215. In my view the defendant is right to say that item 1.9 of the RPS design log provides the clearest guidance as to what is and what is not included with the definition of the building structure for this particular purpose. It is headed "minimum design life". It draws a clear distinction between the required design life of the "structural frame" and the "external shell", in the context of also making clear what is understood as being required as regards other items such as the substructure, the foundations and the floor finishes. It is information which one would expect a structural designer tasked with the design of a building such as the tram depot to produce.

216. In my view the phrase external shell as used in the RPS design log must include both the wall cladding panels and the external aluminium roof trays. If not, the phrase would be deprived of any sensible meaning or effect, which could not be right. I am also confident that on any sensible reading of item 1.9 also included within the external shell must be each and every separate component forming part of the roof. Although it is true that the roof is connected to the purlins by means of the roof steel components it is nonetheless an entirely separate and self-contained structure, so that it would be entirely artificial to seek to disengage the rest of the roof structure from the aluminium outer roof.

217. There is rather more difficulty about the purlins, cladding rails and connecting brackets. In my view it is neither plain nor obvious from this particular section of the RPS design log when read in isolation that they fall within either phrase. I shall return to this question further below but, before I do so, I

should address the claimant's submissions as to why this reference in the RPS design log should not be given effect.

218. First, the claimant submits that there is a plain conflict between the 50-year design life of the building structure and the 25-year design life of the external shell. But in my view this assertion that there is a conflict begs the very question, since the conflict only arises if it is assumed that the building structure must, read with the remainder of the Works Information and the Functional Procurement Specification, include the external shell. For the reasons given above I am satisfied that there is no compelling basis for such an assumption because of the lack of clarity in those other contractual documents as to what is included within the building structure. It follows, in my view, that the claimant's argument to the effect that the defendant cannot rely on the design log as inconsistent with the claimant's Works Information or the Functional Procurement Specification, either because of the contractual hierarchy or because of the certificate of compliancy in section D1 of the tender, simply does not arise.

219. Second, the claimant submits that nonetheless it would be unsafe to place any reliance on the RPS design log when seeking to ascertain the required contractual design life of the components in question, because it does not purport to be a document which contains contractual definitions. The claimant submits that its clear purpose is to record the development of the design which, as envisaged by the terms of the main contract to which I have already referred, is a post-contractual process.

220. There is some force in this submission. It is certainly true that there is no clear statement of the contractual purpose or effect of the RPS design log either in the defendant's Works Information or in the document itself. However, I do not accept the claimant's submission that the only purpose of the RPS design log is to identify the development of the design. One of its two stated aims is to "clarify technical design assumptions and intent". That statement, coupled with the fact that it was sent to accompany the tender and the defendant's Works Information, makes clear in my view that one of its purposes was to clarify the assumptions and intentions behind the defendant's tender in terms of technical design. I accept that not every section of the RPS design log contains a similarly clear statement to that found in section 1.9. I also accept that some sections are more consistent with a beginning of the design development process. I also accept that it would not be possible to treat the design log as overriding a clear provision in the Works Information or Functional Procurement Specification by seeking to argue that in some way it constituted a counter-offer which the claimant accepted by implication in entering into the contract without challenge.

221. However, in my view none of those arguments have any traction if section 1.9 is to be read, as I am satisfied it should be, as constituting an attempt to resolve legitimate uncertainty as to the minimum design life requirements of the Works Information and Functional Procurement Specification due to the uncertainty as to what was meant by building structure, by RPS on behalf of defendant setting out an attempt at clarification of that question. Since the parties had expressly agreed, by their contract, that the RPS design log was a contractual document, it cannot in my view simply be ignored as irrelevant contractually. Whatever Mr Grocott may have thought the position was on receipt of the RPS design log is irrelevant for this purpose.

222. Nor can the claimant credibly argue that the status of section 1.9 was unclear because it might have been intended to include provisions relating only to the alternative non-compliant offer for two reasons. The first is that there is nothing in section 1.9 which suggests that this was its intention. In contrast in section 7.0, referred to by the claimant, that possibility was clearly stated as an alternative

to the detail set out in relation to the compliant bid. The second is that it was appended as a contract document on the basis that the defendant had indeed submitted and the claimant had indeed accepted a compliant design.

223. Nor is it relevant that post-contractually the design log proceeded through a number of further iterations. It is design log version A dated April 2009 which was agreed as being a contract document. The claimant cannot rely upon the contractual restrictions in relation to post-contract design development as seeking to subvert its contractual effect.

224. Thus, I am satisfied that section 1.9 should be given contractual effect. I must therefore return to the difficult question as to whether or not, taking section 1.9 of the design log into account, the purlins, cladding rails and connecting brackets form part of the building structure and, in particular, whether they form part of the structural frame or the external shell. As with "building structure", neither party has been able to identify a clear reference in the contract or in any relevant statute, regulation, British Standard or case law to the effect that the "structural steelwork" does or does not include the purlins and cladding rails used to connect the external roof and wall structures to the primary frame in the case of a portal frame building such as the tram depot.

225. In favour of the claimant's case are the points that these components: (a) are included in the superstructure section rather than the building envelope section of section D6 of the tender; and (b) form part of the secondary steel structure, even if not part of the primary steel structure, since they transmit substantial loads (including applied loads) from the wall cladding panels and roof structures through to the columns and rafters. In favour of the defendant's case are the points that the purlins and cladding rails: (a) would not be needed if there was no separate wall cladding or roof structure, since their only purpose is to connect the latter to the primary steel structure, so that there would be no obvious need to specify them as having a 50-year design life when the structures they are provided to support only have a 25-year design life; (b) are not part of the primary steel structure; and (c) are formed of cold formed rather than hot rolled steel.

226. In my view, the defendant's arguments are the stronger. They also derive strong support when one takes into account, as one should, the other relevant sections of the RPS design log, specifically sections 1.4 and 1.7 referred to in [E] above. Section 1.4 is material because it draws a distinction between the environmental classification of the superstructure and the rail support structure. The former is C3 and the latter is C5. As will be discussed in more detail later, but as would undoubtedly have been known to both the representatives of the claimant and the defendant involved in this contract process, C3 is a less corrosive category than C5. This explains why, in section 1.7 of the design log, a distinction is drawn within the "structural steel" category between the superstructure and the rail support structure. The former is to have a galvanised finish of 85 mi, whereas the latter is to have a galvanised finish of 140 mi. In contrast, the "sheeting rails and purlins" are to have a galvanised finish of unspecified thickness. Thus, there is a clear distinction being drawn between the structural steel on the one hand, which is clearly a reference to the rafters and columns forming the primary steel structure, and the purlins and cladding rails on the other. It would be very surprising in my view for the phrase "structural frame" in section 1.9 to have a different meaning from the phrase "structural steel" in section 1.7. It is plain from sections 1.4 and 1.7 that the purlins and cladding rails are not regarded as structural steel forming part of the superstructure since they are not specified as having the same minimum galvanised coating as are the primary steel structures. It follows, in my view, that they are not included in the phrase "structural frame" in section 1.9.

227. I should note in parenthesis that the stated finish of 85 mi was not consistent with section D6 of the Works Information as submitted by the defendant, which stated that "all hot rolled steels are to receive heavy duty galvanising (nominal 140 mi coating) … [whereas] … the cold formed steelwork has been formed from galvanised coil to class G275". This inconsistency was clarified by the email of 21 April 2009 referred to above, which made it clear that the intention was to allow for 140 mi. However, this point does not detract from the fact that, nonetheless, there is still a clear difference in treatment as between the galvanising of the hot rolled and the cold rolled steelwork.

228. This analysis also makes sense of the reference to "coating life to first maintenance 20 years" in relation to the structural frame. It makes perfect sense to specify a separate maintenance life for a coating in respect of which a minimum thickness is specified where the contractual design life for the steel structure onto which the galvanised coating is to be applied is 50 years. By contrast, it would make little sense for the designer to specify a separate maintenance life for a coating where no minimum thickness is specified and to which, on this analysis, the 50 year design life was never intended to apply. It would also make little sense to specify a separate maintenance life of 20 years for the coating of the purlins and cladding rails in circumstances where their only function was to support the wall cladding panels and the roof as components of the external shell which, themselves, only had a design life of 25 years.

229. In the circumstances I am satisfied that the cold formed components, on a true construction, are subject to a contractual design life of 25 years.

230. I am also satisfied that the defendant's primary position, that the minimum design life of the cold formed components (or indeed any of the other galvanised coated components the subject of the claim) is only 20 years, must be rejected. There are two reasons for that.

231. The first is that on any sensible view these components form a part of the building structure. It follows that they must either fall with the structural frame or the external shell. It cannot sensibly be argued that because section 1.9 of the design log is not immediately clear into which category they fall they must fall within neither and, hence, fall into the default 20 year required design life as stated in the Works Information. The second is that on any objective analysis it could not have been intended that the cold formed components, upon whose structural integrity the wall cladding panels and roof are dependent, should only have a design life of 20 years whereas the wall cladding panels and roof should have a design life of 25 years.

232. Finally, I should deal with the design life of the other relevant components the subject of the remainder of the Scott schedule.

233. For the reasons stated above I am satisfied that the cantilever roof soffit panels and the wave form cladding panels form part of the external shell and, hence, are subject to the 25-year design life requirement.

234. As regards the tram doors and supports and side panels (Scott schedule items 9 and 10) on the evidence it makes little or no difference whether the design life is 25 years or 20 years and the claimant does not contend that it should be 50 years. On balance I am satisfied that since the tram doors cannot sensibly be regarded as forming part of the building structure it is not necessary to engage in the more difficult argument as to whether or not they form part of the external shell. In the circumstances I am satisfied that the default 20-year design life requirement applies. The same is true in relation to the remainder of the items in the Scott schedule which are clearly discrete separate

components which do not form part of the building structure and, thus, are components to which the default 20-year design life obligation applies.

235. I must now return to and address the issue of what is required in relation to the design life of these components as regards their coatings. It will be apparent from the discussion in the preceding section [E] that in the absence of an express LTFM provision there are two competing arguments: the first is that the coating should be required to have the same design life as the underlying structure; the second is that the coating should have no design life and should be regarded as purely a sacrificial structure.

236. It does not seem to me that there is anything in the contractual documents which specifically addresses, let alone answers, this question. In my view however the claimant's case is plainly to be preferred in relation to the double coated external facing components such as the wall cladding panels and tram doors, as well as the other coated external components including the remaining Scott schedule items for the following four reasons: (a) first, the repeated general reference in the contractual documents to the defendant's obligation to provide a design for the materials to be used for the external facings of the tram depot which are capable of withstanding the harsh external environment – it is inherently implausible in my view that it was intended that the defendant could nonetheless have designed and supplied external coatings which were purely sacrificial and incapable of doing so for the required 25-year design life; (b) second, the repeated general reference in the contractual documents to the importance of the aesthetic qualities of the design - it is inherently implausible in my view that it was intended that the defendant could nonetheless have designed and supplied external coatings which could fail in service during the required 25-year design life in a way which could leave large sections of the roof and walls blistering, corroding and delaminating over an extended area and for an extended period; (c) third, the maintenance obligation – for the defendant to have designed and supplied external coatings which could require early and repeat major repairs or even recoating over the 25-year design life at the claimant's expense - unless the claimant was prepared to contemplate the aesthetic harm due to early failure - would breach the maintenance obligation; and (d) fourth, the practical difficulty of undertaking major repairs to or recoating the coatings whilst leaving the underlying structure in situ – it is inherently unlikely the parties intended that the claimant should be expected to undertake such works to the composite wall cladding panels or to tram doors within their 25-year or 20-year design lives respectively. The fact that the wall cladding panels were composite structures, not limited to the underlying steel structure, is also not irrelevant in this context.

237. I do not, however, consider that the same arguments apply to the cold formed components. They are not sited externally so that they do not have the same aesthetic importance as the wall cladding panels or the tram doors or other external facing items. The evidence shows that it is expected that galvanised coatings will lose their initial bright and shiny appearance over time if subjected even to modest moisture and contamination. (The maintenance information provided by Caunton stated that: "the galvanised cold rolled items will lose their original shiny appearance and become dark grey with a matt finish over a period of time. This is quite normal and has no adverse effect on the performance of the protection system".) As I have already said at [C] these cold formed components will experience red rusting at their cut edges which albeit unsightly is of no structural significance. Although – as will be discussed in more detail later – Dr Clarke makes much of the phenomenon of localised pitting corrosion the standards envisage that the zinc galvanised coating on these cold formed components would be consumed uniformly so that unsightly localised patches of red rusting corrosion towards the end of the 25-year design life would not have been envisaged as likely.

238. It follows that none of the maintenance or aesthetic related considerations which apply to the external facing components have anything like the same impact as regards the galvanised coating or the steel structure underneath as regards the cold formed components. There is no need to repair or replace cold formed components unless and until they reach the point where they cannot perform their structural function of supporting the roof and walls. There are many thousands of such components within the tram depot, extending over many thousands of linear or square metres, some concealed within the roof-spaces and others not easily visible or accessible, either because they are at roof height or at high wall level. Even where the components themselves are visible many of their faces would not be visible without closer inspection. It follows that, considered objectively, I do not consider that it could have been intended that the cold formed components would need to have been designed or supplied so as to ensure that they would not need major repairs to or full replacement of the galvanised coating within their 25-year lifetime even where that had no actual impact on the structural integrity of the tram depot.

239. I have considered whether or not the conclusion I have reached as regards the wall cladding panels and tram doors is inconsistent with the 20-year LTFM provision as regards the structural frame. It could be argued that the consequence of such a finding would be that the obligations in relation to the coatings of the wall cladding panels and tram doors, with only a 25-year or a 20-year design life, are more onerous than those in relation to the (thicker galvanised) coating of the structural frame. However, the answer to any such objection in my view is that a provision specially made applicable to components with a 50-year design life, intended solely for internal functional purposes, should not necessarily be expected to be consistent with provisions applicable with components with a 25-year or a 20-year design life intended for external and aesthetic purposes and, thus, the absence of a specific shorter coating LTFM provision in relation to the latter category of components is neutral in such circumstances.

240. That almost concludes my review of these important design life issues. Shortly, and for completeness only, I should deal with the alternative estoppel argument raised by the defendant if I had found that on a proper construction the cold formed components were required to achieve a 50-year design life.

241. In short, I agree with the claimant that in the absence of an express request by the defendant to confirm the particular point at issue (i.e. that everyone on the defendant's side was correct to proceed on the basis that the contractual minimum design life requirement applicable to the cold formed components was 25 years rather than 50 years) it is simply not possible in the context of the contractual framework to conclude that the claimant's failure to make any response at all could amount to a representation that it agreed the defendant's position. Nor could it reasonably have led to the parties proceeding on the basis of a shared assumption to that effect. If the defendant had really wanted clarification of that point from the claimant on the basis that it was unsure what the contractual obligation actually was then it could and should have raised the issue explicitly. It did not and if contractually the minimum design life for the cold formed components had been 50 years then the defendant could not in my judgment have avoided that result by alleging an estoppel.

## G. Corrosion and its categorisation

242. I should begin by summarising what is meant by corrosion in the context of this case before considering corrosivity categorisation.

243. Corrosion is a process of oxidation which converts metals into their compounds. Red rust is the familiar corrosion product of carbon steel. White rust is the corrosion product of zinc. It is because zinc has a much lower rate of corrosion than steel that it is used as a protective coating for steel. Under normal conditions zinc will react with the atmosphere to form an oxide film which provides further protection against further corrosion whilst also resulting in it losing its bright metallic finish. Over a period of time which will vary according to the corrosivity of the conditions this oxide film will thicken and become duller and darker. Eventually all of the zinc will be consumed by corrosion and no longer protect the steel underneath which itself will start to corrode. The thicker the zinc coating the longer this takes.

244. Corrosion can only occur when the surface of a metal object comes into contact both with water and a source of pollution. In this case the source of pollution is the chlorides which are present in sea water. When both water and these chlorides are in contact with the surface of a metal object corrosion can occur. A metal structure on the coast may be splashed at high tides by seawater from breaking waves. When this happens, the structure lies within what is known as the "splash zone". In this case there is no positive evidence that the tram depot is regularly splashed in this way. It is not however disputed that the tram depot is regularly subjected to wind driven sea spray and salty sands – although more so in some areas than others and the extent will depend on the prevailing conditions - which will carry moisture and chlorides to the tram depot.

245. If chlorides have settled on the exterior of the tram depot they will in due course dry out but may be wetted again through rainfall or condensation or through attracting moisture from water vapour in the atmosphere. Rainfall will however normally wash chlorides off the exterior of the tram depot so that those parts of the exterior which are regularly subjected to rainfall are unlikely to retain chlorides on their surfaces. The same however is not the case in relation to those parts of the exterior which are sheltered from prevailing rainfall, such as the areas protected by the roof overhangs.

246. As regards the interior of the tram depot the same may apply if and to the extent that moisture and chlorides can penetrate the interior via the tram doors and the other doors which are set into the building. It is known that chloride deposits have been found on some of the cold formed components within the tram depot, especially on horizontal and protected surfaces.

247. It is accepted that if and to the extent that moisture is present in the interior there is the possibility for corrosion to occur. It is common ground that this will be the case if water condenses on the surface of a metal object. In scientific terms, the quantity of water vapour present in the atmosphere is known as its humidity and it is possible to measure the quantity of such water vapour at any given temperature as its relative humidity (RH), where 100% is fully saturated and 0% is completely dry. Water vapour will condense on a surface at or below the dew point temperature for a particular atmosphere.

248. Corrosion may also occur if there is sufficient moisture in the air inside the tram depot to be extracted by chlorides which have settled on the surface of a metal object. Chlorides are hygroscopic, meaning that they can extract water from an atmosphere which is moist but not saturated. These chlorides are electrolytic and thus may support the electrochemical processes of corrosion. This can occur in conditions of critical humidity, where condensation does not occur, although there is a dispute as to how likely this is to occur in the tram depot. Since atmospheric conditions will vary from day to day and from season to season it may in a particular case be important to know over what proportion of the year the critical humidity value is exceeded. This is known as the time of wetness ("TOW") about which I shall have to say more later.

249. The major function of corrosivity categorisation is to enable those involved with the design of a structure to forecast the extent of exposure to corrosion which a structure may suffer over its life. There are a number of possible testing methods which may be used for this purpose. The most accurate is to hang a standard metal specimen in controlled conditions at the desired location and to weigh that specimen over the course of a year to establish the loss of metal by corrosion over the year. It is important to note that this method will only measure the total loss of weight from the specimen so that this result would require extrapolation to ascertain what loss of thickness would occur. If, as in this case, the aim is to predict the loss of thickness of a galvanised coating it is necessary either to be confident that the coating was equally spread over the surfaces of the specimen or to build in some factor of safety to take account of any likely variation in thickness.

250. At the risk of stating the obvious, in the vast majority of cases it will be impracticable or impossible to use this specimen testing method where an employer or a design and build contractor wishes to know the corrosivity conditions to which a proposed structure will be subjected, externally or internally, in order to ascertain how much protection is reasonably required to guard against the impact of the corrosion to which it is likely to be subjected over its intended design life. That is because: (a) waiting for a year to allow the specimen to be measured is unlikely to be attractive to anyone who wants to proceed with a project without undue delay; and (b) internal conditions cannot, by definition, be measured until there is a structure in place. It is to seek to overcome those practical difficulties that alternative approaches are found in the relevant corrosivity categorisation standards.

251. At the time the tram depot was designed the relevant standards were ISO 9223:1992 and ISO 9224:1992 whereas in 2012 new standards were introduced. It is necessary to attempt a brief summary of each so that the parties' respective cases can be understood.

252. Taking the 1992 versions first, 9223:1992 is the corrosivity classification standard. It explains that the choice of corrosivity category "provides a basis for the selection of materials and protective measures in atmospheric conditions subject to the demands of the specific application, particularly with regard to service life". It provides for 5 corrosivity categories ranging from very low (C1) to very high (C5). It explains that the corrosivity categories are defined by the corrosion effects on standard specimens as specified in ISO 9226. This is the most accurate method as described above. The alternative option provided for by 9223:1992 is to use an environmental classification in terms of TOW, critical humidity and pollution. This TOW calculation method involves ascertaining the time of wetness over the year, using the relative humidity figure of 80%, and applying that figure to arrive at a corrosivity categorisation.

253. 9223:1992 does not make specific reference to other testing methods which may also be used in certain circumstances. In particular, it does not refer to the method of using magnetic thickness tests ("MTTs"), also known as dry film thickness tests ("DFTs")) which use a meter to measure the thickness of a coating applied to a metal component. Nor does it refer to obtaining a specimen by taking a sample from an existing surface. Again, however, these other methods are of little use when designing a structure which is not yet built.

254. 9224:1992 is the corrosivity categories guiding values standard. As it says in section 1, headed "scope", the use of guiding corrosion values, based on experience from a large number of site exposures and service performances, gives corrosion rates for standard structural values which can be used for engineering calculations, to predict the service life for metals used in atmospheres corresponding to different corrosivity categories, and to provide a technical basis for determining the

need for protective measures. It is common ground that the corrosion rates for zinc and steel decrease from the initial first year rate and that 9224:1992 reflects this, giving an average corrosion rate for the first 10 years and a steady state corrosion rate for long term exposure thereafter.

255. BS EN ISO 12944-2:1998 is a standard produced in 1998 which deals specifically with the classification of the principal environments to which steel structures are exposed and the corrosivity of these environments in the context of the protection of steel from corrosion by paint systems. It is not significantly different from previous or subsequent standards.

256. In this standard category C5 is divided into separate categories of industrial (C5-I) and marine (C5-M). In relation to the choice of 80% for RH, whilst it states that "experience has shown that significant corrosion is likely to take place if the relative humidity is above 80% and the temperature above $0^oC$", it also states "however, if pollutants and/or hygroscopic salts are present, corrosion occurs at much lower humidity levels." Dr Clarke relies on this to justify his use of a lower RH in undertaking his TOW calculation in accordance with 9223:1992, which is a subject to which I shall have to return.

257. Less controversially, Table 1 to 12944:1998, entitled "Atmospheric-corrosivity categories and examples of typical environments" contains a helpful summary of the relevant categories and examples of the conditions to which they relate which, as relevant to this case and thus deleting irrelevant content, is as follows:

| Corrosivity category | Mass loss per unit surface/thickness loss (after first year of exposure) | | | | Examples of typical environments in a temperate climate (informative only) | |
|---|---|---|---|---|---|---|
| | Low-carbon steel | | Zinc | | | |
| | | | Mass loss $g/m^2$ | Thickness loss mi | Exterior | Interior |
| C1 very low | | | ≤ 0.7 | ≤ 0.1 | -- | Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels. |
| C2 Low | | | > 0.7 to 5 | > 0.1 to 0.7 | Atmospheres with low level of pollution. Mostly rural areas. | Unheated buildings where condensation may occur, e.g. depots, sports halls. |
| C3 medium | | | > 5 to 15 | > 0.7 to 2.1 | Urban and industrial atmospheres, moderate sulfur dioxide pollution. Coastal areas with low salinity. | Production rooms with high humidity and some air pollution, e.g. food-processing plants, laundries, breweries, dairies. |
| C4 high | | | > 15 to 30 | > 2.1 to 4.2 | Industrial areas and coastal areas with moderate salinity. | Chemical plants, swimming pools, coastal ship- and boatyards. |
| C5.1 very high (industrial) | | | > 30 to 60 | >4.2 to 8.4 | Industrial areas with high humidity and aggressive atmosphere. | Buildings or areas with almost permanent condensation and with high pollution. |
| C5.M very high (marine) | | | > 30 to 60 | > 4.2 to 8.4 | Coastal and offshore areas with high salinity. | Buildings or areas with almost permanent condensation and with high pollution. |

NOTE 1 The loss values used for the corrosivity categories are identical to those given in ISO 9223."

258. It should be noted that the thickness loss in mi is taken from the mass loss in g/m2, with the latter being the specimen measurement method described above. It will be seen that: (1) these loss rates exclude the loss in the first year; (2) there is a relatively wide range of loss in each category so that, for example, C3 ranges from 0.7 mi to 2.1 mi (i.e. the highest is three times the lowest) and C4 ranges from 2.1 to 4.2; (3) the examples are provided for information, as opposed to being intended as an exhaustive list which would, of course, be impossible given the infinite variety of locations and uses. As Ms Day put it in cross-examination of Dr Clarke, a high C3 location is far closer to a low C4 location than it is to a low C3 location, which illustrates the danger inherent in seeking to elevate broad ranges, intended for design purposes where more precision is unobtainable, into precise predictions about the extent of actual corrosion in relation to an as-built structure.

259. BS EN ISO 9223:2012 is similar in purpose and substance to 9223:1992. There is a recognition in this standard that there is a significant difference in reliability terms as between the determination method (i.e. the specimen testing method), which it states is reliable to +/-5% as regards zinc, and the estimation method (i.e. the TOW calculation method), which it states is only reliable as to -33% to +50%. It no longer propounds the TOW calculation method to predict future corrosion. Instead, it states that "information on calculated time of wetness is helpful for informative atmospheric corrosivity estimation" and produces a table (B1) which gives example of 5 different TOW range levels but without either predicting the loss of metal in a specified period or correlating the TOW level to a corrosivity category level. It does however also state in Note 2 to that table that "sheltered surfaces in marine atmospheres, where chlorides are deposited, can experience substantially increased times of wetness, due to the presence of hygroscopic salts".

260. Table C1, which is the corrosivity categories table, is similar to that appearing in 9223:1992. Table 2 gives corrosion rates for the first year of exposure for each corrosivity category, whilst stating explicitly that "the first-year corrosion rates cannot be simply extrapolated for the prediction of long-term corrosion behaviour. Specific calculation models, guiding corrosion values and additional information on long-term corrosion behaviour, are given in ISO 9224". In section 8.2 it provides equations to be used for a number of metals including carbon steel and zinc to estimate the first-year corrosion loss, taking into account factors such as temperature, RH and annual average chloride deposition.

261. Dr Clarke has used the data obtained from the Socotec investigations to undertake a TOW calculation in order to arrive at the appropriate corrosivity categories for the various parts of the tram depot in issue. His approach is heavily criticised by the defendant and by Caunton on a number of grounds. In summary, the defendant contends that: (a) in 2008-09, when the actual design took place, the data would not have been available to conduct this exercise; (b) in 2020 there is no utility in conducting what is a theoretical and unreliable exercise in circumstances where actual data is now available; (c) the approach which Dr Clarke has taken is inconsistent with the approach mandated by 9223:2012 in any event, such that its essential validity is undermined even if the other objections are overcome.

262. Whilst I shall address the detail of these objections in relation to the cold formed components claim at [H] below, where it primarily arises, I should say at this stage that the point made at (a) above is clearly well-founded, so that - insofar as relevant - the results cannot necessarily justify criticising the approach taken in 2008-09. It also seems to me that the point made at (b) above has obvious merit; if and insofar as there is actual reliable data available in 2020 from which the conditions in the relevant parts of the tram depot can be ascertained it is difficult to justify using an essentially theoretical and

unreliable exercise. The question for me is whether such data is available, which is a point I address in [H] below.

263. 9224:2012 is similar in purpose and substance to 9224:1992. In sections 4 and 5 it provides a method, using an equation, to allow the calculation of the corrosion rate for particular metals over an extended period of years if the corrosion rate in the first year is known. This is a calculation which Dr Clarke has undertaken. Annex A provides examples of maximum corrosion attack after extended exposures for corrosivity categories. It is to be noted that the 10 year and steady state corrosion rates used in this Table A.1 are different to those used in 9224:1992. In 9224:1992 the corrosion rates for zinc are the same for both the 10 year and steady states whereas in 9224:2012 the equivalent rates are both less in each category for each state and also less in the steady state compared with the 10 year state. This alteration, I accept, reflects a change in the view of the body of scientific opinion as between 1992 and 2012 as to how zinc will respond to corrosivity, both generally and in the long term.

264. It is also worth noting that the commentary to these corrosion rates states that "the uncertainty level for guiding corrosion values defined as averages for initial and steady-state periods is high". It also contains a specific warning against placing reliance on the guidance "in cases where localised corrosion can be more important than general attack" and in relation to "pitting corrosion" issues.

265. Dr Clarke, using the equation in 9224:2012, considers that taking the maximum corrosion rate within each range for each corrosivity category and also taking the nominal thicknesses for each galvanised coating, a Z600 zinc coating would be expected to survive 25 years in a C3 area but not in a C4 area, whereas a Z275 coating would not survive 25 years in either area. The defendant makes the point that the results produced by the use of this equation are not consistent with the reality of what has happened thus far, which is a point to which I must return in [H].

266. The defendant criticises Dr Clarke for using the maximum corrosion rate, observing that by reference to the ranges in Table A.1: (a) if the average corrosion rate in C3 is used then, taking its nominal thickness, a Z600 zinc coating would be expected to last 56 years and a Z275 coating 25 years; (b) if the average corrosion rate in C4 is used then a Z600 coating would last 25 years albeit a Z275 would not. In short, the defendant makes the point that insofar as any guidance is to be used for this purpose then: (a) there is no basis for using the highest rate as opposed to the mid-rate; and (b) unless the corrosivity categories are above mid C3 all of the cold formed components and roof components will achieve their design life; (c) unless the corrosivity categories are above mid C4 the Z600 cold formed components will also do so. Again, I address this in [H] below.

267. There was at least by the time of trial some measure of agreement as to the appropriate corrosivity category for the exterior of the tram depot. By reference to the actual location of the tram depot it is common ground that it falls within category C5 and, as a coastal location, C5-M was plainly the appropriate categorisation. There is however a further issue as to whether or not Dr Clarke is right in his opinion that the tram depot, given its location immediately adjacent to the Irish Sea coast with no protection from the impact of sea spray or stormy, wet or windy weather, is in a location to which the maximum first year corrosion rate for corrosivity category C5 applies, with the minimum being applicable at the inland boundary of the zone, 2 to 3 km in from the coast. I will address this point when it arises in relation to the wall cladding panels at [L] below.

268. Dr Clarke rightly accepted that for the interior areas of the tram depot the relevant corrosivity categories would be less severe depending on the extent to which they are sheltered from the external

marine environment. However, there was a substantial dispute as to what the relevant corrosivity categories should be in relation to each area which I deal with at [H].

269. For present purposes it suffices to say that Dr Clarke's view has fluctuated somewhat. In his principal report, having considered the results of the Socotec investigations, his view was that the maintenance building, the stabling building and the roof overhangs are all C4 environments whereas the roof space is a C3 environment. At trial his view had altered somewhat so that in his view the maintenance building is only a C3 environment whereas the roof overhang areas are C5 environments. His view was that in each case the higher ends of these rates should be selected given the particular location of the tram depot.

270. It will be recalled that the view at design stage was that the tram depot interior should be treated as a C3 category throughout.

271. In contrast, Dr Callow's view is that based on current evidence the tram depot interior is generally a category C1 to C2.

272. Mr Deacon's view on the same basis was that the tram depot interior was generally a category C2 although he accepted that in areas adjacent to the doors there were localised micro-climates where the category was C3 or even C4, as was the south roof overhang area. He considered that in its current defective state the north roof overhang area was C4 but, once repaired, would fall to C3.

273. The actual corrosivity categorisations at the tram depot were not within the remit or expertise of the structural engineering experts. They were asked to express an opinion on the separate issue of what corrosivity categorisations the tram depot ought to have been designed to, based on the information which was available to, or ought reasonably to have been taken into account by, those designing the tram depot in 2008-2009.

## H. Claim against the defendant in respect of the cold formed components

**(Scott schedule items 1-3)**

274. These Scott schedule claims are by far the most substantial in monetary terms. They have also taken up a large proportion of the time at trial and have involved Caunton as well as the defendant, so that it is necessary to consider the evidence and arguments in some detail. I address them under the following sub-sections.


| Sect. | Title | Paras. |
|---|---|---|
| (a) | Introduction | 275 - 288 |
| (b) | Evidence as to the current state of the cold formed components | 289 - 316 |
| (c) | Prognosis in relation to the cold formed components | 317 - 342 |
| (d) | Breach | 343 - 359 |
| (e) | Remedial works and costs | 360 - 380 |


### (a) Introduction

275. The claimant's pleaded case is that the design life of the cold formed components is to be assessed by reference to the corrosivity category of that part of the tram depot within which they are situated. It pleaded that by applying appropriate guidance, particularly that contained in Steel Construction

Institute (SCI) Publication P262 ("SCI P262"), the cold formed components, whether the Z600 purlins and cladding rails or the Z275 connecting brackets, do not meet that design life, whether that be 20, 25 or 50 years. It pleaded that the appropriate corrosivity category for the interior of the tram depot and the roof overhang is C4. (As I have said, Dr Clarke's view is now that the maintenance building is C3, the stabling building C4 and the roof overhang C5.)

276. The claimant also pleaded that "many of the cold formed components (particularly in the cantilevered roof area above the soffit panels) are already exhibiting signs of corrosion, for example white rust pustules and some areas of red rust, indicating excessive levels of corrosion or degradation in the galvanized coatings to the components beyond that to be expected after only 6 years of operational life since completion". It pleaded that the cold formed components were "not designed or constructed by the Defendant so as to be suitable, durable and appropriate to the Depot's seafront location". It pleaded that the cold formed components "will continue to corrode and degrade at excessive levels requiring extensive remedial and replacement works" and that "in designing and specifying the cold formed components [the defendant] failed either to design or specify additional thickness of galvanization and/or additional protective coatings (e.g. paint or alternatives) and/or failed to design or specify use of alternative, suitable and durable materials for these components (e.g. stainless steel or aluminium)".

277. Neither the Particulars of Claim nor the Scott schedule identified the remedial or replacement works contended for, notwithstanding that the claimant pleaded in the Scott schedule that the total estimated quantum for the cold formed components amounted to £2,765,000. Although there were a number of disputes between the parties in relation to the remedial scheme, the principal issues in terms of cost impact are: (a) whether or not limited remedial works or complete replacement of the cold formed components is required; (b) if a complete replacement of the purlins is required, whether or not the roof must be replaced in order to do so with temporary protection being required.

278. The defendant's pleaded case is that: (a) the cold formed components were designed and constructed to achieve a design life of 25 years; (b) the coating used was the thickest commercially available form of galvanized coating for thin-gauge secondary steel members such as purlins and cladding rails; (c) the appropriate corrosivity category was C3 and not C4; (d) in any event, the coating specified is suitable for a C4 category; (e) the claimant's assumed average rate of zinc loss is wrong, whereas that adopted by the defendant was both conservative and hence appropriate; (f) the claimant has wrongly assumed that the design life is not satisfied if the coating does not meet the design life, whereas the steel beneath the coating must also be taken into account in that regard; (g) the presence of white rust is not in itself a problem.

279. The defendant did not plead that the claimant had failed to maintain the cold formed components or that such failure was the cause of any problem with them. Nor did the defendant plead that the claimant had failed to mitigate its loss in not so doing.

280. In closing submissions the claimant invited me to accept Dr Clarke's opinion that: (a) "pitting of the zinc coatings by white rusting corrosion, caused by moisture films attracted by hygroscopic salts present on the surfaces, has caused significant loss of the zinc within 10 years of the completion of the structure"; (b) this pitting is consistent with the RH and temperature logs taken by Socotec; and (c) since a variation in the degree of corrosion is to be expected, the absence of such corrosion in places does not mean that there is an absence of corrosion everywhere.

281. Dr Clarke relies upon the evidence of: (i) his analysis of the metal samples taken by Socotec; (ii) the temperature and humidity readings and chloride swabs taken by Socotec; (iii) the visual evidence of white rust within the depot. His opinion is that of the 31 samples taken by Socotec from the cold formed components within the tram depot the majority (18) showed pitting, with some indicating that the pit had entered the steel below the zinc coating. The remainder he identified as being either "rough" (6) or "ok" (7). He considers that although there are locations where little corrosion was found on surfaces that is simply explained on the basis that those locations are such that it is unlikely that chloride particles would gather or remain there in any event.

282. Dr Clarke considers that inside the tram depot uniform corrosion would not be expected because: (a) airborne chloride particles entering through open doors are unlikely to gather and remain uniformly on all components and on all parts of all components; and (b) it is the combination of chloride particles and a moisture film on a surface which leads to corrosion. He said that the evidence of the MTTs is of no assistance in determining whether or not there is localised pitting corrosion, since it is not designed to and cannot identify localised pitting corrosion. He accepted that uniform loss of coating is not a problem in relation to the interior environment. (Although, therefore, strictly irrelevant he goes further and contends that: (a) thickness readings are not approved by any standard as a method of ascertaining the correct corrosivity categorisation; and (b) in this case the thickness readings are of no real utility in measuring the nature and extent of uniform loss of thickness, because of the lack of reliable data as to the starting thickness and the failure to undertake reliable readings over a sufficient time period from installation to date.)

283. In closing the defendant took issue root and branch with Dr Clarke's evidence and the claimant's case and submitted, in short, that the totality of the available evidence demonstrated that there was no evidence of any real problem with the cold formed components given the actual corrosivity conditions within the tram depot and nor any basis for concluding that they would not satisfy their contractual minimum design life. They submitted that Dr Clarke's opinion was based on an irrelevant and flawed analysis which should be rejected in favour of the common-sense opinion of Dr Callow. They submitted that there is no basis for criticising the original design and that Mr Erwee's approach should be preferred to that of Mr Davis.

284. All of these submissions were supported by Caunton who added further detail in certain respects.

285. Given the differences between the parties as to the nature and extent of the contractual obligations undertaken by the defendant and the many disputes of a factual and expert nature which this case has generated in relation to the cold formed components, if I had to address every permutation in the same level of detail this section of the judgment would be even more lengthy than it already is. I shall devote the most attention on the important issues which needs to be decided, given my primary conclusions that the contractual minimum design life for the cold formed components is 25 years and that the contractual obligations imposed by clauses 20.1 and 20.5 are strict obligations. I deal with the other issues far more briefly.

286. On that basis the most important issues I have to decide are whether or not the cold formed components have been designed so as to achieve a minimum of 25 years of use for their intended purpose (without major repair but undertaking required maintenance - other than 'non-standard' or 'unusually onerous' maintenance – over that period) and whether or not they comply with the performance obligations, in particular the suitability obligation.

287. Since these are strict liability obligations the question is to be decided by reference to the design which ought to have been adopted having regard to all of the relevant circumstances, rather than by reference to whether or not the design choice fell within a range of designs which a reasonably careful designer might, without negligence, have adopted in 2009 with the knowledge then reasonably available. By reference to the *Hojgaard* case a difficult question might have arisen as to whether or not the issue was to be decided by reference only to the information available in 2009 or by reference to all of the evidence now available. However, since on my factual conclusions there is no material difference between the two, that is not a question which I need to decide.

288. Moreover, even if I had to decide the question based only on the information available in 2009 I would also have needed to go on to consider the current condition of and prognosis for the cold formed components on the basis of the evidence now available. That is because if, as matters currently stand, the cold formed components will perform in accordance with the requirements of the contract for the contractual design life without the need for any remedial works then, even if the defendant was in breach by reference only to the information available in 2009, the claimant will have suffered no relevant loss. Further if, on the basis of the evidence now available, the cold formed components will perform in accordance with the requirements of the contract for the contractual design life if only limited remedial work are undertaken, then the claimant will be limited in its claim to the recovery of the reasonable costs of those works and will not be entitled to cover the reasonable cost of replacing the cold formed components. Thus, questions as to what, if any, remedial works are properly required and at what cost must be addressed.

### (b) The evidence as to the current state of the cold formed components

289. The evidence relating to the nature and extent of any defects in or deterioration of the cold formed components is best addressed in chronological order.

290. By June 2015 four inspections had been undertaken and information produced in relation to the condition of the cold formed components, all of which were made available to the claimant and were broadly consistent with each other.

291. As I have already noted in [C] Hadley, the supplier of the cold formed components to Caunton, had visited site in March 2015, and prepared a report on the corrosion protection to the cold formed components. Its representatives inspected the areas around the tram doors and the south access doors as those which would likely be most exposed to the external elements. They noted that both Z600 and Z275 components had been used. They undertook MTTs in the area of the south access doors, which they considered were the worst affected. Apart from one Z275 section, which was 1 mi below the requisite tolerance, all were within tolerance. They concluded that whilst there was some reduction in coating thickness it was no more than was to be expected given the "harsh micro-environment" in the area. They noted the presence of white rust in these worst affected areas but concluded that this was merely indicative of zinc oxidation and not a cause for concern. They recommended that these areas should be monitored in order to "initiate planned first maintenance" as and when necessary.

292. The report comes across as balanced and sensible and based on a reasonable decision to investigate the worst areas. Mr Grocott confirmed that he received a copy of this report but that the claimant did not follow its recommendations.

293. Caunton itself also produced a report. This was more in the nature of a review of the evidence obtained from others and a defence of its performance rather than a report following a detailed survey undertaken by Caunton itself. However, Mr Griffiths' contemporaneous view was plainly that the nature and extent of visible corrosion was far less than he had feared; in an email he wrote at the time he said that he was "pleasantly surprised at Blackpool as was expecting to see rusty rails and purlins all over the place. Turns out it's a few rusty M12 nuts, diagonal wires and the white rust on the rails but mainly around the doorways as we expected. 95% of cold rolled is fine".

294. Caunton did however also agree with Hadley in recommending further inspection and maintenance as necessary in the areas around the door areas and it also accepted that it would, without admission of fault, replace some minor components showing signs of rust. Mr Grocott accepted in evidence that Caunton's offer was not taken up.

295. The third was the April 2015 RPS report referred to in [C] following a site visit. Its conclusions were entirely consistent with those reached by Hadley.

296. The fourth was the results of the MTTs undertaken by Mr Kennedy in May 2015. He tested 12 locations in the horizontal and vertical cladding rails in each of the bays along the length of the east elevation of the stables to which he could obtain access. He began by cleaning the area around each test location and then took either 3 or 5 separate readings at each location, which the proprietary software supplied with the testing meter then averaged to produce one reading for each test point. He exercised his judgment to re-test at those locations where the reading showed an implausibly high thickness of coating. He marked each location with a white mark so that the area could be located for any future testing. The cleaned areas and white marks are still visible today. He took photographs of the areas tested which he also uploaded into the proprietary software. He sent the results produced by the software from the information input into the test meter to Mr Grocott on 3 June 2015.

297. Although it appeared prior to trial and prior to hearing Mr Kennedy's evidence that his reliability as a witness and the reliability of these readings might be open to serious dispute, in the event it quickly became clear, to me at least, that there was no basis for querying his conduct and the reliability of his readings. The results indicated that there was no significant loss of thickness of the galvanised coating in the locations tested, assuming that the coating had been within tolerance when supplied.

298. Dr Clarke first visited site to inspect the cold formed components in September 2017. He undertook various tests and measurements described in his principal report at section [10] but did not at that stage produce a formal report for disclosure. He said that he noted white rusting in both the stabling building and the maintenance building. He referred to 5 photographs as showing the presence of white rust in 5 areas. He did not, however, undertake or arrange for any detailed or comprehensive survey of the condition of the cold formed components throughout the tram depot and nor did he undertake or arrange for any sections to be taken for detailed analysis.

299. Dr Callow first visited site at around the same time. He took a large number of photographs to which he has referred in his principal report to support his view that there was little evidence of corrosion to the cold formed components. Like Dr Clarke he did not produce a formal report for disclosure at that stage.

300. As I said at [C], the corrosion experts visited site in July 2019 at the same time as Socotec attended to take measurements. Dr Callow's assistant Dr Lomas took MTTs in the same area as Mr Kennedy had done in 2015. It is clear that she took her tests in the same locations as Mr Kennedy had done albeit

probably not at the same precise spots. Since there is no visible or micro-graph evidence of any pitting corrosion in these areas, nor reason to think that there would be significant pitting corrosion affecting these sections, being both vertical (thus, unlikely to gather chloride deposits) and remote from opening doors, the argument advanced by the claimant that the results might have been affected by the presence of corrosion or localised pitting falls away. The plain fact is that these tests showed, consistently with those taken by Mr Kennedy, that the thickness of the cladding rails was within tolerance and, assuming that they were within tolerance when supplied and installed, had not undergone any uniform corrosion loss of any significance.

301. The MTTs undertaken by Socotec, as re-ordered by Dr Callow in his report, demonstrated that in the vast majority of areas the coating thickness, both for the Z600 and the Z275 components, was within the 20% either way permitted tolerance in 2019, some 8 years after practical completion. Socotec undertook over 400 MTTs on the purlins and cladding rails. Dr Clarke attempted to cast some doubt on the reliability of the Socotec results by noting that in one location (RO8) the MTT had recorded 4.8 mi thickness but, since the micro-graph from that location showed that all the zinc has been consumed, that thickness must be the product of steel corrosion rather than remaining zinc coating. Dr Clarke's explanation may well be correct, assuming the MTT and the micro-graph were taken from precisely the same location.

302. However, in my view the far more significant point which emerges from this evidence is that this location was the only one where the thickness recorded by the MTTs was significantly less than the required tolerance. Further investigation revealed that it was this location where the components had suffered from localised corrosion in the roof overhang caused by localised water leakage. As the defendant submitted, if the roof overhangs really are a C5 environment throughout one would have expected far more widespread corrosion in the roof overhangs to have been revealed either by more discrepant MTT results or micro-graphs or visual inspection. The possibility that the MTT results in the roof overhangs are all misleading is inherently unlikely since it assumes that in each of the MTTs undertaken in that location the product of the zinc or steel corrosion product happened by complete coincidence to be within the original specified thickness tolerance of the galvanised coating. The overall consistency in the MTTs is a powerful indicator that the readings are genuine and reveal no evidence of widespread corrosion.

303. I do agree with Dr Clarke, supported as he was by Mr Rushton, that the thickness testing evidence relied upon by the defendant cannot be said to be 100% conclusive, given that: (a) there is no positive evidence that the coating thickness as at the time of installation was either at the required point or even within the 20% tolerance; (b) the evidence does not demonstrate conclusively that the tests carried out by Mr Kennedy in 2015 and Dr Lomas in 2019 were undertaken in precisely the same location or in the same way so as to be directly comparable with each other; (c) the Socotec thickness testing, whilst widespread and professionally undertaken, only provides a snapshot of the position in July 2019 and does include some outlier measurements.

304. Nonetheless, when I have regard to the totality of the evidence in relation to coating thickness I am completely satisfied on the balance of probabilities that there has been no significant uniform thickness loss in relation to the cold formed components. In particular it is noteworthy that: (a) if the cold formed components when supplied had been significantly out of tolerance that would almost certainly have been picked up by the MTTs undertaken by Socotec as an agreed control in the office area which, all experts agreed, was unlikely to have been subjected to any significant corrosion since

installation; (b) the micro-sections taken by Socotec are inconsistent with there being any significant uniform thickness loss in the vast majority of locations; (c) the micro-section taken by Socotec in a similar location to the MTTs taken by Mr Kennedy and Dr Lomas produced a similar result in terms of coating thickness; (d) the MTTs taken by Socotec are consistent with those taken by Dr Cox and Mr Deacon as well as those taken by Mr Kennedy and Dr Lomas; (e) the consistency between the MTT results taken on the cold formed components in the affected areas and those taken in the office area as a control is powerful evidence that the former have not been affected by conditions significantly different from those experienced in the office.

305. Turning to the micro-sections these are, of course, extremely small sections of the coating. The pits to which Dr Clarke refers in these micro-sections are also extremely small, around 30 mi across (in comparison with a coating depth tolerance of 42 mi for Z600) and thus invisible to the naked eye.

306. Dr Clarke's opinion is that these pits are, where present, caused by localised corrosion and are of significance since over time they will develop in depth and overall area until the whole galvanised coating is lost and corrosion of the steel underneath occurs.

307. I accept that the evidence indicates that a significant number of the micro-graphs reveal evidence of localised microscopic pitting corrosion. I also accept that this phenomenon may be reasonably widespread throughout the tram depot since there is no reason to think that the areas selected by the experts for these micro-sections to be obtained are unrepresentative of the whole.

308. The real issue is as to the cause and significance of this micro-pitting. Dr Callow disagrees with Dr Clarke and considers that the pits are so small that the galvanic action of the surrounding zinc will prevent them from deepening or widening in any reasonable timeframe. Mr Deacon agreed with Dr Callow. He considered that the timeframe was dependent on the corrosive environment to which the pit was exposed and the thickness of the surrounding protective zinc. In both of their opinions it would be a slow process due to the absence of a corrosive environment, the galvanic protection of the surrounding zinc and the protective effect of the zinc corrosion.

309. I have no doubt in preferring the opinion of Dr Callow and Mr Deacon to that of Dr Clarke on this key point. There is no dispute as between the experts that this type of localised pitting corrosion can occur in particular circumstances, such as where aggressive local conditions act locally on a zinc coating. Nor is there any dispute that in such circumstances localised white rust may be produced. However, it is noteworthy that there is no authoritative or published material to which Dr Clarke has been able to refer which addresses in any detail the phenomenon of localised pitting corrosion in zinc or which provides any basis for measuring it or for forecasting its progression or consequences.

310. In contrast, for example, note 4 to table 2 of 9223:2012 states specifically that: "Aluminium experiences uniform and localised corrosion. The corrosion rates shown in this table are calculated as uniform corrosion. Maximum pit depth or number of pits can be a better indicator of potential damage". There is no similar comment made in respect of zinc. When this point was put to Dr Clarke in cross-examination by Ms Day he was unable in my view to give a satisfactory explanation if it was also a known and serious problem with zinc. Nor was he able to state to what extent the rate of zinc loss associated with white rust and pitting corrosion might be greater than the rate of zinc loss from uniform corrosion referred to in the standards. Again, there appears to be no published research which answers that question.

311. In cross-examination Dr Clarke referred to photographs which he had taken which illustrated the white rust which, he said, represented the tops of the pits. The white rust is visible to the naked eye in these photographs, so that if Dr Clarke is right these must represent pits which have spread in size quite considerably if they were initiated by micro-pitting. However only one is a photograph of a cold formed component and that is taken near the large opening tram doors in the stabling building, which is hardly representative of conditions throughout the whole tram depot. Moreover, the claimant has produced no evidence in the form of surveys and tests in relation to the same locations over the 5 years since it became aware of this alleged corrosion which would have enabled an analysis of any increase in the extent of this white rusting or of its rate of increase. There is, for example, a photograph in Mr Davis' principal report which, according to him, was also taken near the large opening tram doors sometime from 2015 to 2017, but no attempt has been made to see if the condition in that area has worsened since then. It appears from his report and his cross-examination by Mr Hale that is one of the worst areas and the majority of the others are much less badly affected.

312. Socotec noted a build-up of debris to the upper sections of the cladding rails, particularly towards the front of the building where the large opening tram doors are located. They also noted some onset of red corrosion spots but nothing more serious. It is I accept possible that these represent pinholes of localised corrosion where the zinc has been consumed and the steel exposed. However, it is also clear that if that is indeed what they are they have not expanded in area, no doubt due to the sacrificial effect of the surrounding zinc already referred to.

313. Socotec also identified what they described as white spotting from photographs which they took of a number of the cold formed components but, nonetheless, concluded that there was no significant obvious evidence of corrosion damage. Although Dr Clarke disagrees, on the basis that the white spotting is evidence of corrosion, it cannot sensibly be disputed in my judgment that as at 2019 there is no evidence of significant corrosion of the galvanised coating.

314. The other experts had also noted the presence of white rust in certain locations, but did not consider that its presence or its extent was a matter of any real concern. That is true not only of Dr Callow but also of Dr Cox in his joint reports with Mr Deacon and of Mr Simon Clarke (the expert instructed by RPS). It was also the view of RPS, Hadley and Mr Griffiths. Mr Deacon was cross-examined on the basis that the nature and extent of the white rust which was recorded in the stabling building by him and Dr Cox was consistent with corrosion on the majority of the cold formed components due to conditions since it was occupied. He was clear in his response that the corrosion was both limited in extent and probably caused by moisture affecting the components before the tram depot was completed. Whilst the assessment of the reliability of expert evidence should never be based solely on the number of experts who give one view, nonetheless the fact that there is such unanimity among no less than 4 other independent experts (supported in this case by three other parties) suggests that Dr Clarke would have needed to have provided a very clear and well-reasoned argument, supported by independent authoritative standards or publications, to persuade me that they are all wrong in their opinions. I am unable to accept that he has been able to do so.

315. In short, in my view the claimant has been unable to adduce any credible evidence either that there is currently a widespread problem of significant pitting corrosion which could lead to structural failure of the cold formed components within any reasonable timeframe, whether 25 or 50 years, or that the micro-sized pitting observed on the micro-graphs could, within the same timeframe, develop so as to lead to structural failure.

316. In my view the position is no different in relation to the connecting brackets, even though it is accepted that some - albeit not all - of the 1,732 connecting brackets were supplied with a Z275 coating as opposed to the contracted for Z600 coating. As explained in section B above the consequence is that the coating is 19mi nominal, range 15mi to 23mi, as opposed to 42 mi nominal, range 32mi to 55mi. The evidence shows that the rate of coating loss in relation to the connecting brackets has been no more than in relation to the purlins and cladding rails and there is no evidence that they have been corroded locally any differently than have those other components.

### (c) The prognosis in relation to the cold formed components

317. In closing submissions the defendant argued that if the court were to conclude – as it has – that the contractual design life of the cold formed components was only 25 years – then the claimant's case must fail on want of proof of breach on the simple basis that in cross-examination Dr Clarke accepted that on the evidence now before him he could not say that it was more likely than not that the cold formed components would not last a further 15 years.

318. What was surprising was that Dr Clarke had not been asked to, nor had he, previously addressed this same question in his reports. It was clear from his principal report and from his evidence that originally he had been instructed to proceed on the assumption that the design life was 50 years and not to consider the case based upon the alternative 25 year hypothesis. It was only at a late stage that he had been asked to consider the alternative. This he did in what was clearly a late addition to his report at appendix 6. There he had expressed the opinion that a Z600 coating would be suitable for a C3 environment, but not a C4 or C5, and that a Z275 coating would not be suitable for any of these environments. However, as he accepted in cross-examination, that conclusion was entirely derived from applying the maximum corrosion rates from 9223:2012 applicable to each environment, and his assessment of the corrosivity categories of the environments in which the cold formed components are found was entirely derived from his analysis of the temperature, humidity and chloride deposit measurements taken by Socotec in 2019. In short, as he willingly accepted, it was an entirely theoretical exercise which was not influenced by any consideration of the evidence of the actual conditions to which the components have been and will be subjected, other than his reliance upon the evidence of white rust in various places.

319. In contrast, the view of Dr Callow and Mr Deacon (as well as Mr Clarke as a co-signatory to the corrosion experts' joint statement) was that the Z600 components would meet both a 25-year and a 50-year design life requirement and that the Z275 components would meet the 25-year requirement. The experts were not able to state conclusively in the joint statement whether or not the Z275 components would meet a 50-year requirement, although in his report and in his evidence Mr Deacon considered that based upon the Socotec data the majority probably would, subject to careful inspection and localised repairs as necessary.

320. The claimant submits that notwithstanding his concession in cross-examination the court should accept Dr Clarke's primary analysis and his conclusion in appendix 6, since none of the other experts had troubled to undertake the same detailed analysis of the Socotec measurements and, thus, that there was no basis for rejecting his evidence on this point.

321. There are however in my view a number of fundamental flaws in Dr Clarke's general approach and also a number of other serious flaws in the detail of his analysis which have led me to conclude that I

am unable to place any reliance upon his analysis and that I should instead accept the opinion of the other experts. This is coupled with the fact that, as I have said, he could not positively answer the question in favour of the claimant when he was asked to express an opinion based on the totality of the evidence.

322. The most fundamental flaw in Dr Clarke's approach is that he failed to have regard to all of the available relevant evidence. He had chosen to base his analysis on a limited section of the evidence obtained by Socotec for the purpose of conducting a limited and essentially theoretical exercise. As Mr Rushton observed in cross-examination on the remedial options, the experts in this case have a wealth of evidence available to them from Socotec, which would not normally be available to consultants asked to specify corrosion protection for a new development or as remedial works. To ignore significant elements of the evidence obtained by Socotec as well as to ignore the other available evidence is not in my view consistent with the approach which an expert or a designer ought to take in such a case.

323. As I have said, in cross-examination Dr Clarke recognised the limitations of his approach. When taxed with the difference between the actual condition of the cold formed components as shown by Socotec's investigations and what his analysis predicted that their condition would be he said that they have nothing to do with each other. "The prediction is the prediction, like an actuarial table. The actual condition of the corpse is the condition of the corpse. They may not be the same." His view, perfectly reasonably expressed as a scientist, is that his approach only provides a prediction of what would happen and a prediction is not invalidated simply because the actual condition of the object is subsequently found to be different from the prediction. However, it is difficult to justify answering the question solely on the basis of that limited information when other information is now available.

324. Another fundamental flaw in his approach is that, having decided to adopt this limited approach, he then sought to use the TOW calculation method contained in 9223:2012 and 9224:2012 in circumstances where that method is specifically intended for use in estimating future uniform corrosion loss and not localised pitting corrosion. Dr Clarke had chosen to adopt and to persist with this approach notwithstanding his acceptance not only that there is no evidence of uniform corrosion loss in the tram depot but also that he would not expect there to be any. In my view to use a method for a purpose for which it was never intended cannot be justified. Nor can Dr Clarke gain support for his analysis by submitting that his analysis is in accordance with authorised standards when those standards were never intended to be used to estimate future localised pitting corrosion.

325. If Dr Clarke's opinion is based on the presence of localised pitting corrosion then it is necessary for there to be reliable evidence as to the nature and extent of that localised pitting corrosion. I do not consider that the limited evidence of microscopic pitting corrosion and the even more limited photographic evidence of some patches of white rust to be sufficient or reliable. I would have expected the claimant, had it wished to pursue a claim on this basis, to have designed a timed survey on a sound statistical basis, in terms of methods of testing, quantity of testing, locations of testing, and in terms of the period over which repeat tests were to be carried out, so as to be able to establish with reasonable confidence the extent and nature of any localised pitting corrosion and, crucially, the rate at which any such pitting corrosion is spreading, whether horizontally across the zinc coating or vertically down into the steel substrate. Since the maximum pit depth and number of pits is information which is specifically stated in the standards to be an indicator of potential damage in

relation to localised corrosion of aluminium, it can scarcely be said to be irrelevant if a case based on localised corrosion of zinc is to be advanced.

326. Even if that approach was thought to be unrealistic, the claimant could without undue difficulty have undertaken for specimen exposure tests to be carried out in accordance with 9223:2012, by positioning a suitable number of specimens in various suitable locations, leaving them for a year, and then inspecting them both physically and by micro-section and by weighing them to ascertain the extent of mass coating loss. Dr Clarke accepted in cross-examination that weighing them would have revealed the total zinc loss from the specimen, whether through uniform corrosion or through localised pitting corrosion and, accordingly, would have been reliable evidence of the presence and impact of any localised pitting corrosion in a way which MTTs by themselves would not. It was ironic that it was suggested to Mr Deacon in cross-examination that this was something which the defendant could and should have done in order to prove the absence of corrosion when the claimant, who bears the burden of proof, had failed to do so to prove the presence and, crucially, the nature, extent and rate of progression of localised pitting corrosion.

327. In the absence of reliable evidence obtaining from this kind of testing Dr Clarke simply does not, in my view, have the material to make any prediction with any degree of confidence as to whether or not the cold formed components will perform as required for their contractual minimum design life.

328. I fully accept that the court should not insist on evidence which it is unreasonable to expect to be provided. However, it must be remembered that the claims in respect of the cold formed components are extremely substantial in value and have been known to the claimant for five years now since 2015. In my judgment the claimant cannot credibly invite the court to award a substantial seven figure sum in its favour on the basis that these cold formed components will need to be replaced in their entirety because they will not last 25 years, let alone 50 years, without either: (a) adducing reliable evidence along the lines identified above; or (b) offering a cogent explanation as to why it has not been obtained, in circumstances where the claimant had both the time and the opportunity, both before and after issuing proceedings, to obtain that evidence. This omission is particularly important in circumstances where even if Dr Clarke had followed the approach mandated in the 2012 standards to the letter it would still have produced a result which those very standards recognise is subject to a very considerable margin of error of between -33% and +50%, as discussed in section [G] above.

329. Moving on to the detail of Dr Clarke's exercise, another fundamental objection to his approach is that the available data does not permit the use of 9223:2012 in relation to the conditions inside the tram depot. In the context of this case the standard can only be used to obtain what is referred to as a "normative corrosivity estimation" where there is a figure for the annual average deposit rate of chloride from airborne salinity. According to Dr Clarke, that approach is only applicable to external atmospheres, where chlorides are deposited on a structure by the elements but then removed by the elements subsequently. On that basis he has not attempted to undertake the calculation required by section 8.2 of 9223:2012. However, the standard does not mandate any departure from this approach or provide an alternative approach in such circumstances. Indeed, I do not accept why it was not possible for Socotec to have been asked to measure the daily deposit rate inside the tram depot if the claimant had wanted to adopt the approach that it has done. Whilst I accept that deposits inside the tram depot are extremely unlikely to be washed off by rainfall, it cannot simply be assumed in my view without investigation that they would not be dispersed at all, for example by wind entering the tram depot whilst the doors were open.

330. Instead, relying upon note 3 to table C1, which states that "surfaces that are sheltered and not rain-washed in marine atmospheric environments where chlorides are deposited and cumulated can experience a higher corrosivity category due to the presence of hygroscopic salts", Dr Clarke has adopted a completely different method and one which is not mandated in any way by the standard. This has involved his taking the total chloride deposits found by Socotec on certain surfaces and then comparing those with other measurements he has taken from other locations in other marine locations, which he has used as a benchmark to compare the deposits found in this case. To depart in such a radical way from the approach required by 9223:2012 means that it is impossible to claim that the analysis is even substantially in accordance with that standard.

331. I am also unable to accept Dr Clarke's further radical departure from 9223:2012 by using a RH of 70% instead of the mandated 80%. Whilst he justifies the departure by reference to the same Socotec evidence of the presence of chlorides within the tram depot, I am unable to accept that the factors upon which he relies provide objective cogent evidence for using a RH of 70%.

332. As to the first factor on which he relies, note 3 to table C1 of 9223:2012 does not justify selecting an alternative RH figure; it does no more than to suggest that a higher corrosivity category may be appropriate in the case of sheltered surfaces in marine environments.

333. As to the textbooks upon which he relies, they do not in my view provide any support for adopting a RH of 70% whilst still remaining faithful to the approach mandated by 9223:2012. Although they do, I accept, provide some support for the proposition that the percentage figure for critical humidity may be 65% or 70% where there are hygroscopic salts, they do not suggest that either figure should more appropriate to be used rather than the 80% mandated by 9223:2012. That is not surprising since it is apparent that there may have been a number of different considerations behind the decision to use 80%. As Dr Callow said in cross-examination, if the authors of the standard took 80% RH as the appropriate point, on the basis that – as Dr Clarke accepts - it is only above 80% that condensation can occur, then it would not be appropriate unilaterally to adopt 70% instead on the basis that significant corrosion could nonetheless occur due to wet film corrosion below 80%. It can be seen for example from the graph referred to by *Chandler & Baylis* at p17 that, whilst there is a marked increase in corrosion from 70% to 80% RH, it is beyond 80% RH where the far more significant increase begins.

334. Nor do I consider that the claimant can gain support from the view of Dr Cox in the report which he co-authored with Mr Deacon that "corrosion cannot proceed at humidity levels lower than around 70% RH". That was an observation which was merely directed to the question of what was the lowest point at which corrosion could occur, rather than the entirely different question as to whether it was appropriate to use 70% instead of the mandated 80% RH in 9223:2012.

335. In this regard, it is also a matter of some concern that, as the defendant has demonstrated, the decision to depart from 80% RH to 70% RH may make a very significant difference to the outcome, increasing the TOW six-fold in a number of cases and thus changing the TOW category (and, hence, the corrosivity category) from a C4 to a C3 in the case of the stabling building. Moreover, the analysis undertaken by Mr Deacon of the Socotec results also shows that a RH above 80% for any length of time only occurs, as does condensation, within that part of the roof where defects have caused water ingress.

336. Indeed, it is evident from Dr Clarke's approach that it could only apply to those surfaces of those cold formed components in those locations where Socotec found quantities of deposited chloride. It would

appear to follow that in the majority of such surfaces and locations where, I am satisfied, there is no chloride in anything like the same quantities, the same approach would result in a completely different result which would be far closer to the defendant's case. Although when this point was put to him in cross-examination by Mr Hale Dr Clarke suggested that all that was needed was a thin layer of chloride to secure the same hygroscopic effect, that argument seemed to me to contradict his previous approach of using the quantity of chloride settled on these surfaces to make a comparison with chloride deposition rates in other marine environments he had been involved with.

337. Moreover, having obtained corrosivity categories on the basis of this flawed approach Dr Clarke has then chosen to forecast corrosion rates which do not take into account that the galvanised coatings on the cold formed components have already been in place for some 10 years and will, therefore, already have experienced their maximum corrosion rate. In addition, in my view there can be no justification for using the highest corrosion rate within the relevant corrosivity category for the interior of the tram depot, when the only justification offered is by reference to the aggressivity of the external conditions.

338. Since the decision as to which corrosivity category to apply is, on the claimant's case, of such significance to the outcome of the claim, I would have needed to have been satisfied by the clearest of evidence that every significant step in Dr Clarke's chain was sufficiently substantiated by cogent independent evidence. I am not able to be so satisfied. To the contrary, the nature and extent of his departures from the standard are so significant, individually and cumulatively, as to lead to my being unable to place any real weight on them when compared with the alternative approach of reaching a holistic assessment based on all of the available evidence.

339. Dr Callow accepted that some airborne moisture and chlorides would enter the tram depot and that some chlorides would settle on the vertical surfaces of the cold formed components which they reached. He also accepted that there was a risk – albeit a very modest risk in the absence of any frequent condensation or high moisture levels – of some localised pitting corrosion occurring as a result. His view however was that such corrosion would not be expected to be – and demonstrably was not – significant and would be kept in check by the galvanic properties of the surrounding zinc. He was supported in that view by Mr Deacon. I accept and prefer that evidence. Dr Clarke's analysis does not assist in understanding, let alone quantifying, the risk of corrosion occurring on the majority of surfaces or locations or the consequences of any such corrosion over time. It is impossible in my judgment to place any weight on this analysis as justifying a conclusion that all of the cold formed components need to be replaced on this basis. Indeed it is impossible in my judgment even to place any weight on this analysis as justifying a conclusion that the cold formed components, where there are these affected surfaces, need to be replaced given as Dr Clarke admitted in response to cross-examination from Mr Hale, that if each such surface was wiped clean of deposits the whole edifice of his analysis would be removed at that one swipe.

340. In that respect Dr Callow also said that insofar as this had occurred due to the failure to clean the surfaces of the depot that was the claimant's responsibility. This is not a pleaded allegation but it was investigated at trial since it is an integral part of the claimant's case that moisture and chlorides are carried through the open doors and cause the cold formed components to corrode where the chlorides are deposited.

341. The defendant relies upon the maintenance schedule provided by Caunton, which recommended an annual inspection coupled with attention to any localised signs of deterioration, comprising rubbing down any affected areas to the bare metal, feathering the edges and then applying a form of zinc

enriched paint (Galvafroid primer) over the affected area. This document was sent to the defendant in 2010 and provided to the claimant at some later stage by the defendant. The claimant accepts that it has never undertaken an annual inspection or any localised remedial works.

342. Although Mr Davis in the joint statement stated that he believed that this was an unusual and onerous maintenance requirement, it is to be noted that neither Mr Grocott nor Dr Clarke took issue with it. I accept that an annual visual inspection from ground height, followed by localised attention if required, would be entirely reasonable. This was effectively what Mr Rushton said. I would not have accepted that the claimant could sensibly have been required on an annual basis to hire a cherry-picker and conduct an inspection of every side of each of the cold formed components throughout the tram depot, let alone in the concealed roof areas where they are largely if not wholly inaccessible. Dr Callow accepted in cross-examination that he had never previously had experience of purlins and cladding in a building such as this being regularly washed. Nonetheless, as Mr Deacon pointed out, if the claimant had noted significant evidence of white or red rusting at low level which required attention it would have been imprudent not to have checked whether the position was the same at high level and, if necessary, to have undertaken some system of regular phased inspection and remedial work if there was evidence of a serious problem. Whilst I would not have regarded the claimant's failure to do so in this case as a complete defence to the claim, nonetheless this point is of relevance to what remedial works might reasonably have been necessary, which I address further at (e) below.

### (d) Breach

343. Given the findings I have already made I can deal with the question as to whether or not the claimant has made out its case on breach relatively shortly. It will be recalled from the introduction at (a) above that in order to succeed the claimant must establish either that the contractual obligations on which it relies have been breached by reference to the position as it can now be understood to be or by reference to the position as it was understood in 2009. However, in this second case the claimant must also establish that the position as it is now understood to be is sufficiently serious to justify the conclusion that the remedial works for which it contends are reasonably necessary in order to ensure that the cold formed components perform their required functions for their design life or are otherwise in accordance with the relevant contractual obligations undertaken by the defendant.

344. The primary conclusion that I reach on the basis of the evidence discussed above is that the claimant has not satisfied me on the balance of probabilities, by reference to the evidence of Dr Clarke, that the cold formed components have not been designed so as to satisfy the 25-year design life obligation or any other relevant obligation, regardless of whether those components are Z600 or Z275. That is because: (a) I do not accept Mr Clarke's theoretical approach can satisfy me either that the corrosivity categories are as contended for by him or that the cold formed components are in such a state as at the present time that they will not meet the 25-year design life requirement or any other relevant obligation; (b) I prefer the opinion of Dr Callow and Mr Deacon that, on the basis of an evaluation of all of the relevant evidence including the evidence of corrosion thus far occurring and any reasonable forecast of future corrosion, the cold formed components have been designed to and are able to satisfy the 25-year design life and any other relevant obligation.

345. In my view the most which can be said in the claimant's favour is that there is evidence of some localised white rusting due to zinc corrosion in a small number of specific locations, in particular: (a)

some localised areas close to the opening doors, especially the tram doors; (b) some localised upwards facing surfaces where chlorides have settled having entered through the opening doors and reacted with moisture in the air. That is also the case in relation to some isolated areas of the roof areas where I am satisfied that, due to localised moisture ingress, the worst localised corrosion has occurred. However, in none of these cases is there evidence of any appreciable uniform corrosion loss or reliable evidence as to the prognosis in respect of any localised pitting corrosion such as to satisfy me that the cold formed components in these affected areas will not meet their 25-year design life.

346. I also note that on a true construction of the contract as I have found it the defendant's obligations would only be breached if I was satisfied that the cold formed components would be unable to continue to perform their required structural function due to the effect of ongoing corrosion within the 25-year design life. In relation to the cold formed components loss of the galvanised coating by itself is insufficient. The steel itself provides a margin of safety before there is any risk of structural failure, especially in relation to those components where it has been over-specified. Moreover, I am satisfied that over the remainder of the 25-year period a prudent owner of the tram depot, with knowledge of the limited localised zinc corrosion and its causes, might reasonably be expected to take steps to undertake limited and localised works, not going beyond reasonable maintenance, namely: (a) removing the worst of the deposits on the affected surfaces of upwards facing components; (b) removing any modest zinc corrosion near the tram doors; and (c) if and where necessary, applying localised zinc paint to replace any zinc lost by such modest corrosion. This is not requiring the claimant to undertake non-standard or unduly onerous maintenance.

347. As will be apparent, I have decided this case on the basis of the totality of the evidence as to the nature, extent and causes of the corrosion which has occurred to the cold formed components since completion of the tram depot and the prognosis for the remainder of the 25-year design life. Whilst I entirely understand why Dr Callow and Mr Deacon felt that they had to express an opinion on the actual corrosivity categories within the tram depot in response to Dr Clarke's approach, in the end that has not been necessary. Indeed, once it became apparent when Dr Clarke's report was served that his opinion was that uniform coating loss was not the issue in relation to the tram depot interior and the issue was localised pitting corrosion, the whole question of corrosivity categories ought really to have fallen away. But for Dr Clarke's attempt to use the standards relating to corrosivity categories in support of his case in relation to pitting corrosion doubtless it would have done.

348. If I had needed to make findings in relation to actual corrosivity categories I would have found that the evidence overall justifies a finding of C2 internally, save for the immediate locality of the opening doors where a finding of C3 is appropriate. On those findings, applying the corrosion rates specified in the 2012 standards, all of the cold formed components would have complied with the 25-year minimum design life obligation on any basis, with the possible exception of those sections of Z275 coating close to the opening doors. However, even as to those I am satisfied on the same basis as above there is no evidence that of anything more than a need for localised attention which does not amount to a breach of contract. No tests have been undertaken on the Z275 connecting brackets in these locations. Although the claimant referred to the admission in cross-examination by Mr Griffiths that Caunton was in breach of contract in supplying connecting brackets with a Z275 instead of a Z600 coating, that admission is of no relevance to the claimant's claim against the defendant, since the documents in which Caunton undertook to supply only Z600 coated components to the defendant did not form any part of the contract as between the claimant and the defendant.

349. As regards the purlins in the roof overhangs I also agree with Mr Hale in his closing submissions that, subject to the necessary repairs being undertaken to the north and south roof overhangs to prevent any further moisture ingress and to appropriate cleaning and application of localised zinc paint where necessary to areas of localised corrosion, these will also meet the minimum design life requirement of 25 years. I have considered whether this analysis is affected by the fact that this corrosion has occurred in part due to design and construction defects for which the defendant (but not Caunton) is responsible. However, I am not satisfied that it should. That is because there appear to be three separate reasons for the remedial works suggested to the roof overhangs. In relation to the east roof overhang there is no basis for any claim since there are no actual defects or evidence of corrosion and, insofar as the case is based on the analysis of its corrosivity categorisation, I have rejected Dr Clarke's opinion. In relation to the north and south overhangs I reject the case based on corrosivity categorisation on the same basis. Insofar as complaint is also made about chlorides and moisture entering through gaps in the soffit panels, there is no separate pleaded case about this being a consequence of the defects in the soffit panels. Whilst it might have been possible for the claimant to have been able to advance a separate case that remedial works are required to the purlins in the north and south overhangs solely due to water ingress due to the defects in the eaves and gutters there is insufficient evidence to establish such a claim in the absence – as I discuss in more detail in [K] below - of any sufficient investigation of the condition of the purlins generally or as to what limited localised remedial works might be reasonably required to remedy the problem.

350. Finally, even had the contractual minimum design life been 50 years I would still have been satisfied that the Z600 and the Z275 coating met that requirement, for the following reasons:

    (a) On the basis of the evidence and my findings as summarised above I am satisfied that the Z600 would not need anything more than localised attention of the kind described above for the full 50-year design life.

    (b) If the 50-year design life obligation had applied to the cold formed components then by reference to section 1.9 of the RPS design log the 20-year LTFM obligation would also have applied to those components, whether Z600 or Z275. The consequence would have been that the appropriate question to ask would have been whether the coating would have lasted for 20 years without major repair and I would have been satisfied, for the reasons explained above, that it would. It would only have been if the 20-year LTFM obligation had not applied that I would have found that the Z275 components could not have met a 50-year minimum design life obligation.

*Negligent design in 2008/2009?*

351. Finally, since it was addressed in some detail, I should also set out my conclusions in relation to the allegation that the defendant ought to have designed the cold formed components on the basis that the appropriate corrosivity categories in 2009 were C4. This case really depends on the evidence of Mr Davis for the claimant, Mr Erwee for the defendant and Mr Rushton for Caunton.

352. Mr Davis accepted, fairly and reasonably in cross-examination, that the starting point for a reasonable designer in 2009 would have been to treat the interior of the tram depot as a C2 category and then to consider whether there were any particular features which justified increasing or decreasing the category. He accepted that the designer could only have had regard to the information contained in the Works Information and the Functional Procurement Specification as well as any other enquiries which

it would have been appropriate to undertake in circumstances where – as I have already indicated – there was no existing information in terms of data since the tram depot at that point existed on paper only.

353. It is clear that the major consideration was the extent to which the external C5-M environment would impact internally. As to that, the designer would of course have been aware of the substantial number of full-size tram doors to the northern elevation, as well as the more modest number of smaller sized doors elsewhere. The designer would of course have expected that the tram doors would be opened on a regular basis to allow trams to enter and leave and that the other doors would also be opened for usual access purposes. The designer would not have been able to forecast just how often the doors would be opened or for how long. Nonetheless, I am satisfied that it would have been reasonable for the designer to assume that: (a) for most of the time during operating hours the doors would only be opened intermittently for access purposes and that they would be closed outside operating hours; (b) the owner or operator would not leave the doors open for extended periods, particularly at times of wet or windy weather. Thus, there was no sensible reason for the designer to consider that the tram depot was in any way comparable to the typically open sided buildings used as examples in the standards such as a barn or aircraft hangar or, in a coastal zone, a boatyard. Although Mr Davis suggested that a designer should always design on the most conservative basis and that the designer should therefore assume that the doors might be left open for extended periods in wet and windy conditions that, to my mind, is not a reasonable suggestion. The whole purpose of the standards is to provide practical guidance to designers. To require the designer to default to the worst-case scenario even where there is no reasonable basis for doing so would not be justified.

354. I agree with Mr Davis, Mr Erwee and Mr Rushton that a careful designer should have proceeded on the assumption that, given the C5-M external conditions and the large opening doors, it was appropriate to upgrade the corrosivity category to C3 to reflect the particular risk of localised heightened corrosion risk adjacent to the opening doors and the more general risk of chlorides and moisture entering the interior. However, I do not accept Mr Davis' view, not supported by the other experts, that the careful designer, should have moved from C2 to C4 locally around the tram doors because of the increased risk in that localised area and then, having done so, should have adopted C4 for the whole of the tram depot on the basis that a dividing line could not be drawn between the C3 and the C4 areas. That would be using the same factor twice to justify a double upgrading. Nor do I accept that there are any other significant risk factors such as would justify upgrading to C4. It is true that the designer would know that trams would be washed before entering the unheated stabling building so that the internal humidity would increase to some extent. However, the careful designer would keep a sense of proportion; this involves a relatively small number of trams shedding modest volumes of clean water whilst stabled overnight in a substantial building with natural ventilation. In the same way the careful designer would note that the maintenance building would be heated to 13$^{o}$C in order to ensure a reasonable working environment, but would also note that maintenance would only be undertaken on a small number of trams at any one time so that movements through the tram doors would not be expected to be frequent.

355. As regards the roof overhangs again the debate was as between Mr Davis, who put them in a C4 category, and the other experts, who put them in a C3. It is common ground that those designing the cold formed components would have been entitled to assume that the roof overhangs were designed to be sealed against water ingress and there is not – nor could there be – any suggestion that they should have been designed to guard against the risk that the detailed design or construction would be

defective and allow water to penetrate. I reject Mr Davis' opinion that the mere fact that they were designed to allow air passage into the roof overhangs meant that they should be categorised as a C4, even though they were not designed to be insulated in the same way as the main roof space.

356. Nor do I accept that the careful designer ought to have used the maximum corrosion rate within the C3 range as opposed to the average C3 corrosion rate. The argument is that a conservative approach involves taking the maximum within the category range, all other things being equal. However, I am not persuaded that this argument should have applied where the starting point was C2 so that the question was then to what extent one should go beyond that. I bear in mind that taking the mid-point of the C3 range was the equivalent of doubling the estimated corrosion rate from the maximum of C2. I also accept that by 2009 it was well known that the approach adopted in 9224:1992 was already conservative, because it applied the first year corrosion rate on a straight line basis, whereas it was well known that in fact the rate decreased significantly over time, as was recognised in the revisions which came into place in 9224:2012, so that the mid-rate of C3 became the equivalent of the lower rate in C4 under the revised guidance.

357. Nor was I impressed by Mr Davis' attempt to pick and choose in relation to adopting just one part of SCI P262. I accept that this was not an applicable standard and there was no basis for a designer using it in preference to the existing standards. If, however, a designer chose to adopt it instead of the existing standards then in my view he would have to use it in full rather than in part, with the result that an even lesser corrosion rate would have been obtained.

358. In summary, however, I am satisfied that there is no basis for criticising the C3 corrosivity category adopted by the defendant and its designers for the interior or for the decision to adopt a corrosion rate based on the mid-point of the corrosion range for C3.

359. It follows that the claim based on breach in relation to the original design fails on this fundamental basis.

### (e) Remedial works and costs

360. I will address this for completeness and in a little detail, notwithstanding my conclusions on liability, bearing in mind that it received significant attention at trial due to its being by far the highest value claim put forwards. The Scott schedule divides the cold formed components into the purlins, the cladding rails and the connecting brackets and I will address each separately, although they raise similar issues. The only issue I do not address is the question of uplifts for base costs by way of preliminaries, overhead and profit ("OHP") and contingency, since it is better that I address those on a claim item where it does matter. I also leave out of account the costs relative to the remedial works to the cold formed components in the roof overhangs since those are addressed in section [K] below.

361. In relation to the purlins the claimant's case is that if the design life is 25 years then a remedial scheme involving the provision of additional corrosion protection to all accessible areas of the structural Z600 purlins in the maintenance and stabling areas using zinc tape is appropriate, whereas if the design life is 50 years the existing structural Z600 purlins in the maintenance and stabling areas should all be replaced with new duplex coated purlins. The replacement option hugely increases the extent and cost of the works because the claimant contends that it would not be possible to replace the purlins without removing and then replacing the roof and the roof components, which would inevitably require extensive and expensive temporary protective works so as to allow the tram depot to continue to be

used whilst the remedial works were ongoing. Thus, the claimant's cost for the replacement option amounted to £2,070,529.29 compared to an adjusted figure of £215,866.53 for the remedial scheme.

362. The significant discrepancy between these two figures itself indicates the need for a close scrutiny of the justification for a full replacement. To state the obvious, it would be cheaper to undertake remedial works now, which Prof. Lambert says will give them corrosion protection at least up to year 25, and then again when necessary in order to obtain a total 50-year lifetime if required, than to undertake a full replacement now. That is particularly so where, as Mr Erwee observed, any rational building owner would want to tie this into a decision whether or not the condition of the roof at year 25 was such that it would need to be replaced (in which case the purlins would be replaced at the same time anyway) or could be extended to up to 50 years with suitable maintenance (as appears likely, given the current good condition of the aluminium roof). The claimant never appeared to engage with this practical objection in their preference for the replacement option which, I have no doubt, was driven purely by a desire to maximise its financial recovery. Whilst I appreciate that this would involve works being undertaken twice[3] rather than only once, nonetheless the works as undertaken would be far less disruptive than would the claimant's proposed works, involving as they do a full roof replacement.

363. There are other fundamental problems in my view with the claimant's preferred replacement option and its costing.

364. The first problem is that there is no clear evidence from Prof. Lambert or from anyone else with any suitable experience which satisfies me on the balance of probabilities that the purlins cannot be replaced without removing the roof. Mr Jackson had assumed that this was the case, relying on his practical knowledge gained as a quantity surveyor over many years, but he did not have the qualifications or experience to give expert evidence that this was the only way in which it could practicably be done. In an attempt to prove the case Mr Clay cross-examined Mr Linnett by reference to various photographs and suggested to him that it would be necessary to remove the roof. Whilst Mr Linnett did not disagree with this suggestion I do not regard this point as conclusive since, as he said when he was also cross-examined on the basis that he had not priced an alternative scheme, this was not something which was within his expertise as a quantity surveyor. If the question was to be put, it ought to have been put in clear terms in cross-examination of Mr Erwee and Mr Rushton and of the remedial scheme experts. Although in oral closing submissions Mr Clay ingeniously suggested that I could infer what Mr Erwee's response might have been from his answer to a different question, I am not persuaded that I can make such a finding on such an important point.

365. In written closing submissions the claimant also argued that it was for the defendant and its experts to address the question of how the purlins could be replaced without removing the roof and that their failure is explained by the fact that it is self-evident that it is not possible. There is some force in this submission. However, its force is much less than it would have been had it been made clear in the Scott schedule and in Prof. Lambert's principal report that the roof would need to be removed, regardless of any defective components within the roof itself, in order to replace the purlins. This point only emerged at the (very late) stage of the quantum experts' joint statement on 7 February 2020

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[3] Although it could be argued that to achieve 50 years the works would need to be done three times (i.e. now, at 25 years and again at around 35-40 years) I do not accept that this is realistic, given that Prof. Lambert's proposal involved applying 80 mi zinc tape which would give twice the original protection for the Z600 coating.

when it became clear that Mr Jackson had priced for the roof removal under item 1. Further, and fundamentally, the question of whether the roof could have been temporarily secured for this exercise to be undertaken was something which really ought to have been investigated by the claimant if it wished to secure very substantial damages on the basis that this was not possible, however it neglected to do so.

366. The second problem is that the claimant's proposed scheme involves providing a replacement with a duplex coating[4]. The expected design life of the second paint coating would only be around 10 – 15 years. The result is that it would begin to delaminate at that stage and would either need to be replaced or the components would be left looking unsightly for the remainder of the 50 years. That would be no better than repairing the existing galvanised coatings twice over the 50-year period.

367. The third problem is that there was no engineering assessment of the need for a tin hat roof or a design for the tin hat roof, whether by Prof. Lambert or by anyone else, so that Mr Jackson had priced for one purely as a precaution – as he put it "a risk which had to be priced" - without any positive evidence that it was practicable or that no alternative less expensive protection system was available. Given the significant extra cost of the tin hat roof (£792,200) I would not have been prepared to allow anything for this item, which the claimant had claimed in full, notwithstanding that – as I accept - the point had not been specifically considered by the other parties' experts either.

368. In short, even had I accepted the claimant's 50-year case, I would not have agreed that a full replacement exercise was necessary and would have awarded the claimant damages on the basis of the cost of undertaking two remedial exercises. Whilst, strictly speaking, there would have needed to have been a reduction for early receipt of the cost of the second exercise, since no evidence or submissions to that effect or as to the countervailing risk of price inflation was before me I would not have felt able to value that discount.

369. The defendant also submitted that the claimant would have needed to give credit for betterment. The argument was advanced on the basis that if the claimant obtained a judgment for the cost of a 50-year design life replacement to be undertaken now then it would effectively obtain a design life of 50 years without giving credit for the c. 10 years benefit it would already have obtained from the date of practical completion. I was referred to my own consideration of this topic in my judgment in *Amey v Cumbria County Council* [2016] EWHC 2856 (TCC) where I said at [25.184] that:

> "In my view the more appropriate way to address this issue is that if Cumbria accepts, as it does in its pleaded case, that each patch has a service life, then by making a claim for the full cost of replacement or repair at a point along the continuum between the date it was laid and the end of the service life, Cumbria is required to give a credit for the fact that at the point of replacement or repair one is getting the benefit of a new patch or a newly repaired patch, with the benefit of a new service life, for an old one with a reduced service life. That approach seems to me to be consistent with the principles which ought to be applied in a case such as the present, and which I have taken from the authorities, particularly the *Voaden* case to which I have already referred."

[4] It was a surprise when in cross-examination of Mr Jackson it was revealed that the replacement purlins and cladding rails had not been specified in any detail, whether as to their galvanised coating thickness or their paint coating, so that Mr Jackson's price was merely one given by a supplier in response to a standard enquiry for a standard product.

370. The claimant submitted that betterment does not arise in this case because Prof. Lambert had said in cross-examination that he had specifically and intentionally designed the remedial works to achieve no more than the original design life having regard to the time already elapsed, i.e. for a 40 year design life in this case. The defendant was sceptical of this, given that it had not been expressly stated in the pleaded case or in Prof. Lambert's reports that the remedial scheme was expressly designed on this basis. Leaving that forensic point aside, the claimant's argument is inconsistent with Prof. Lambert's specification of a zinc tape with a nominal thickness of 80 mi which is, as was put to him in cross-examination, almost twice that of the original galvanised coating. If I had awarded the claimant anything, whether for the replacement or the full remedial scheme, I would have discounted on a pro rata basis (i.e. by reducing the 50-year scheme by $1/6^{th}$ and the 25-year scheme by $2/7^{th}$).

371. Turning to the claimant's 25-year design life remedial scheme, the defendant objected to it because it involves the treatment of all accessible areas, regardless of whether or not they are all currently displaying any evidence of pitting corrosion or, if so, how much. It is clear from Prof. Lambert's report and evidence that, for essentially pragmatic reasons, he has proposed the same remedial works for a 25-year design life throughout the whole range of corrosivity environments from low C3 right up to high C5. I am satisfied that this approach cannot be justified since there is plainly a very significant difference in the rate of corrosion loss between these two extremes. Indeed, on the basis of the figures contained in Appendix 6 to Dr Clarke's report, there is no justification for any remedial works in a C3 environment for a 25-year design life. It is clear that Prof. Lambert had not considered it appropriate for him to consider any more focussed remedial scheme based on the actual condition of the purlins. It appears clear that he has proceeded on the basis of a worst case C5 maximum condition and then selected a remedial scheme for that, which he had then applied throughout. That does not seem to me to be an approach which can be justified by reference to the evidence as to the current state of the purlins or their projected condition after 25 years.

372. If I had been satisfied that there was a serious risk of unacceptable pitting corrosion over a 25-year lifetime to those surfaces of the purlins currently displaying evidence of pitting corrosion or at risk of doing so due to their location then the obvious and rational solution in my judgment would be for the claimant to undertake a system for the regular cleaning of those surfaces and areas and, as necessary, any localised application of zinc tape or touching up with zinc paint over their lifetime. That would obviously be far less expensive than full scale repairs to all purlins, given that on the evidence before me they are fairly limited in extent, so that I do not accept Prof. Lambert's view that it makes more sense simply to repair all of the purlins rather than to pick and choose. This exercise would also have addressed the need to undertake any limited works to limited areas within the roof spaces and roof overhangs where there may be localised corrosion due to water leakage or ingress.

373. The claimant has not pleaded or presented a claim on this specific basis. The closest that one gets is Mr Tapper's valuation of £78,364 in his supplemental report for the one-off exercise of cleaning and applying additional zinc paint protection to accessible surfaces. Prof. Lambert has not commented on this exercise nor has Mr Jackson squarely addressed this valuation. Mr Tapper has used figures from the building price book Spons to arrive at his valuation. The claimant raised an issue as to whether or not the labour rate of 0.15 gang hours / m2 had been adjusted to reflect the complexity of this remedial work when compared with new build work. Mr Tapper said that it had because he had treated the Spons rate per operative as applicable to a gang of four, the effect being to treat the work as taking four times longer than it would if it was new build work. This was queried by Mr Jackson in his supplementary report dated 10 March 2020 at [11.2.4]. However, it seems to me that all that Mr

Jackson was saying was that he was unable to find a gang output of 0.15, which is not surprising if it was in fact an individual output. The claimant attempted to refer to further evidence from Spons in closing submissions but the view I take is that it was too late to put in more evidence at that stage in circumstances where the point was not put to Mr Tapper.

374. It follows that this is the amount I would have awarded for the 25-year design life and, if I had concluded that it was a 50-year design life, I would have allowed twice that amount for the cost of undertaking the same exercise on 2 occasions. The same approach would have applied to Mr Tapper's valuations for the cladding rails (£54,100) and connecting brackets (£2,357) respectively.

375. Addressing briefly the dispute as between the rival costs for a full remedial scheme, as I have said Mr Tapper's valuation was arrived at on the basis of the use of zinc paint, whereas Prof. Lambert and Mr Jackson had proceeded on the basis of using more expensive zinc tape. To some extent the significance of this dispute was diminished by the fact that Mr Linnett was able to obtain a significantly lower price for zinc tape than had Mr Jackson who, when referred to this price difference, accepted that his price should be reduced accordingly. Mr Jackson also accepted that his price for a cherrypicker was higher than that obtained by Mr Tapper and should be reduced accordingly. On that basis the claimant's adjusted cost was significantly less than had originally been claimed.

376. Professor Lambert preferred zinc tape as being more effective because it is a relatively easy and reliable way of adding a great deal of zinc to a component whereas, in his view, the application of zinc paint is time-consuming (it needs two coats and a stripe coat at edges) and not always completely effective (if, for example, it is not regularly stirred the zinc tends to settle to the bottom of the pail or there may be "holidays" – small gaps in application). In contrast, the other experts considered zinc paint a more established and a better remedial solution because zinc tape would be challenging to apply to the more complex shapes into which the purlins are formed. It seems clear to me that a combination of the two would be best, so that zinc tape could be applied where application is easy, such as long straight sections, and zinc paint where not.

377. Unfortunately, I do not have any price for this combined approach. If I had needed to choose between the two options which have been priced, since it is clear that applying zinc tape would result in a very considerable increase in the zinc protection reasonably required for the remainder of a 25-year design life I would have chosen the zinc paint option and accepted Mr Tapper's valuation.

378. In relation to the cladding rails the same arguments apply, although the respective costs are much less, reflecting the lesser materials costs, the greater ease of access and the lesser need for temporary protection works, and amount to £227,885.34 for the 50-year scheme and £97,883.57 for the 25-year scheme. My conclusions would have been the same as in relation to the purlins. I would have accepted Mr Tapper's valuation of £54,100 for 25 years and twice that for 50 years. I add only that the lack of reality in the claimant's proposed replacement works was further emphasised in relation to the cladding rails on the west elevation. Mr Jackson's evidence was that it would not have been viable to replace the cladding rails without also removing the wall cladding which, it will be recalled, comprised the same aluminium coated system as the roof and as to which no pleaded or other complaint is made. Thus the logic of the claimant's scheme requires the removal of a perfectly good external cladding in order to replace cladding fixing it to the structure, where there is no hard evidence either that the cladding rails are currently defective or that they will not provide adequate support for the remaining 25-year design life of the external cladding.

379. In relation to the connecting brackets, because some have been supplied with a Z275 coating the claimant's case is that they require to be replaced with more durable duplex coated brackets whichever design life applies, whereas the defendant's case is that painting them with zinc paint would be sufficient to provide additional protection. When asked in cross-examination Prof. Lambert said that he had some concerns but was prepared to accept that if the application was appropriately specified he would not argue against painting, especially if the purlins and coating did not need replacement. I am satisfied that this would be a reasonable approach.

380. Thus, I would have accepted Mr Tapper's valuation for the more limited works. In his principal report he had valued this at £39,152, but this was reduced in his supplemental report to £2,357 for reasons which were only explained in examination-in-chief. His explanation was that: (a) he had already included an allowance within items 1 and 2 for the associated connecting brackets; (2) he had then priced item 3 of the Scott schedule on the mistaken assumption that it referred to various other components when in fact it did not; (3) he had assumed that no works were required for the west elevation. Although this came out in a rather confused way, nonetheless I have no doubt that it was a genuine mistake, so that I would have allowed this amount and again twice that for the 50-year scheme.

## I. The claim over in respect of the cold formed components as against Caunton

381. Given that the claim against the defendant has failed it is unnecessary to make a decision on the defendant's claim over against Caunton, so that I need only explain briefly the decision I would have reached and my reasons for reaching them had I needed to do so.

382. The starting point is that it is common ground that the terms of the subcontract between the defendant and Caunton mirrored those as between the claimant and the defendant. It follows that Caunton owed precisely the same obligations to the defendant as regards the design and execution of the cold formed components as the defendant owed to the claimant. As the defendant submits, it also follows that if the defendant was liable to the claimant in relation to the cold formed components then Caunton must also be liable to the defendant on the same basis.

383. In the circumstances it is not necessary to go on to consider the defendant's further case based on the terms of the RPS structural steelwork specification which was also incorporated into the subcontract as between the defendant and Caunton.

384. Nor it is necessary to do more than to record that Caunton admitted, as was inevitably the case, that it was also and separately in breach of contract in supplying Z275 components instead of Z600 components.

385. Finally, I need also only record that Caunton could not have been liable for any separate claim which the claimant might have established against the defendant in relation to the cold formed components in the roof overhang areas based solely or substantially on the impact of localised water ingress, since it is clear that Caunton was not in any way responsible for the circumstances in which the cold formed components in that location came to be affected by such water ingress.

## J. The contribution claim by Caunton against RPS

386. The practical impact of this contribution claim is that because the defendant has taken over from RPS the defence of this claim then to the extent that it succeeded it would operate in effect to reduce accordingly the amount which the defendant could recover against Caunton. Again, therefore, it is now theoretical I need address it only briefly.

387. In closing submissions it was clarified that Caunton could not make a claim for contribution against RPS in relation to any liability arising from the supply of the Z275 components since there was no basis for saying that RPS was aware of, let alone responsible for, the decision to supply Z275 components.

388. It is common ground that for Caunton to succeed it would first have needed to establish that RPS was liable to the defendant in respect of the cold formed components contribution claim. Accordingly, in closing submissions Ms Day commended to me the reasons for disputing liability given by Ms Cheng for RPS in her written opening for trial, notwithstanding that the defendant had previously submitted in its written opening that the equivalent contentions in RPS' defence and evidence lacked merit. Mr Hale commended to me those very self-same submissions by the defendant.

389. An important point to note here is the difference between the respective obligations undertaken by Caunton and RPS. As I have said, Caunton had entered into back-to-back terms with the defendant and, thus, would have been as much liable to the defendant for failure to comply with the 50-year design life obligation as would the defendant to the claimant had I found that the main contract provided for a 50-year design life. In contrast, RPS had not done so and had produced its design log and structural steelwork specification on the express basis that the design life for the cold formed components should only be 25 years. There is no basis for a finding that RPS was contractually obliged to produce a design based on a 50-year design or was negligent in failing to do so, especially where it had been made very clear that it was working on a 25-year design life and that neither the claimant, the defendant nor Caunton had questioned that. It would have followed that, had I found that the contractual design life requirement was 50 years and that there would have been no liability had the contractual design life been 25 years, there would have been no basis for the claimant succeeding against RPS and, hence, no basis for any contribution claim.

390. However, on the basis of the 25-year finding I have made I have no doubt that had I found breach established against the defendant I would also have found breach established against RPS, on the basis that regardless of the subsequent intervention of Caunton the fact is that it was RPS which prepared the tender design log with an assumed annual internal galvanised coating loss rate of 1.35 mi (the mid-point of a C3 environment) and which subsequently produced the structural steelwork specification on the same basis (with the addition of a further apparent requirement for a 20 year coating LTFM requirement). I would not have considered that RPS could have avoided liability to the defendant on the basis that it had also drafted the specification on the basis that it was for the steelwork contractor to satisfy itself as to the accuracy of these assumptions.

391. Thus, I would have needed to go on to consider what allocation of responsibility was just and equitable as between RPS and Caunton by reference to the well-established principles laid down by the authorities, as to which there was no dispute.

392. In my judgment the real issue between Caunton and RPS is the extent to which both were responsible for the assumption as to the annual corrosion rate to be designed for which drove the design decision to specify Z600 galvanised coating. I have already referred in [C] above to the circumstances in which

Caunton and RPS were both involved in the design decision to specify and use Z600 galvanised coating on the basis of an assumed design life of 25 years, an assumed coating life of 20 years and an assumed annual rate of zinc loss of 1.35 mi.

393. The essential argument made by Caunton is that it was RPS, as lead designer with overall knowledge of and design responsibility for the project, which had decided, based on the information produced by the Galvanizers Association in relation to the Blackpool area generally, to proceed on the basis of an assumed 1.35 mi annual zinc loss for the internal areas. Whilst it admits that it was required to and did confirm that this was suitable nonetheless it contends that where its role was a steelwork subcontractor coming late into the project its responsibility for this error would have been far less than that of RPS.

394. In contrast the essential argument made by the defendant is that Caunton was a specialist steelwork supplier, which was content to take on a full design responsibility and to confirm that the assumptions made by RPS were correct, so that it cannot now seek to put responsibility back onto RPS having freely taken on that responsibility.

395. Caunton can gain some support from evidence secured in cross-examination. Thus, Mr Simmons agreed with Mr Hale's suggestion that RPS as lead designer with a holistic perspective on the development was well placed to make the initial design assumption as to the corrosivity category to adopt for the internal elements. The claimant's design expert, Mr Davis, gave a similar answer when cross-examined by Ms Day, saying that whilst a steelwork fabricator such as Caunton was often required to provide a coating which met the specified environment it was much less common for it to be asked to determine the specification for the environment, since their knowledge of the overall building was very limited compared with RPS who, as lead designer, had access to all of the relevant information.

396. In my judgment the crux of this case, had I found for the claimant, would have been the decision to adopt a C3 mid-point corrosion rate for the interior of the tram depot, in circumstances where the designer knew or should have known that the combination of wet trams and the opportunity for the severe coastal external conditions to enter the interior and expose it to significant airborne moisture and chlorides meant that there was such a serious risk of localised pitting corrosion that a C3 high point corrosion rate at the very least - if not a C4 – should have been used.

397. In such circumstances it seems to me that whilst Caunton is right to emphasise RPS' greater overall knowledge and design responsibility of the overall project the defendant is also right to emphasise that Caunton had taken on a much wider contractual obligation, had more detailed knowledge about how galvanised steel components work in varying locations and had expressly agreed to satisfy itself that RPS' assumptions were right and had done so. Balancing these relevant factors, if I had needed to decide between the two parties I would have found Caunton two-thirds responsible and RPS one-third responsible.

## K. Claim in respect of the roof steel components (Scott schedule item 4)

398. The claimant's primary pleaded case was similar to its case in relation to the cold formed components. In particular it contended that: (a) the appropriate corrosivity category for the roof structure is C3; (b) the roof steel components do not have a design life of 50 years and, given the use of Z275 coating, do not meet a 25-year or 20 year design life; (c) the roof steel components were not suitable, durable and appropriate to the tram depot's seafront location. These allegations followed the earlier pleading that

"during inspections following the failure of the roof on 10 January 2015, the Claimant discovered that the galvanized steel components in the roof space (including clips, spacer bars and brackets) had lost galvanized coating and were corroded to a significantly greater extent than should have been exhibited after 4 years of operational life". Again, it was pleaded that the defendant was in breach in relation to the design, specification and construction of the defective components. Again, no remedial works were specified although the estimated cost was pleaded in the Scott schedule as being £1,010,000.

399. Further, and importantly, in the Scott schedule under item 4 the claimant also pleaded that "in addition, the foam profile fillers at the eaves were not adequately secured, resulting in greater ingress of seawater spray and salt-laden air to the building roof and therefore increasing the severity of the corrosive environment."

400. The defendant's pleaded case was that the roof steel components meet the design life of 20 years on the basis that the specified galvanised coating was suitable and the claimant's calculation of coating loss was erroneous. In response to the further and separate allegation in the Scott schedule the defendant pleaded:

"As to the pleaded defect regarding the foam profile fillers at the eaves, the Defendant has made repeated offers to carry out remedial works in relation to the same. Paragraph 33 of the Defence is repeated. To the extent that the Claimant's refusal to accept these remedial proposals has increased the severity of the corrosive environment, the Defendant is not liable for additional corrosion caused by ingress of seawater air and salty air in the building roof."

401. Thus, although the defendant did not expressly admit this further and separate allegation, it did not deny it and nor has it ever presented a positive case to the effect that there is no such defect or that it is not liable for it if it is present.

402. In its written closing the claimant put its case on a far more limited basis, reflecting the views of Mr Davis and Prof. Lambert in their reports to the effect that the evidence from the roof inspections undertaken from 2015 onwards is that the roof steel components are suffering from corrosion at the perimeter for two reasons.

403. The first is the further and separate allegation identified above, namely that the roof verges at the roof eaves and gutters allow water to penetrate the roof even though the design was such that the roof-space ought to be have been sealed against water penetration. The second is that the roof design, being ventilated, allows air containing moisture and chlorides to enter the roof space where they are liable to cause corrosion.

404. In closing submissions the defendant contended that: (1) the only pleaded allegation related to the failure to achieve the required design life and there was no separate pleaded allegation in relation to the design or construction of the roof steel components whether generally or on the more limited basis now advanced by the claimant; and (2) other than the (discredited) evidence of Dr Clarke in relation to the corrosivity categorisation of the roof space there was no expert evidence to prove the claimant's case as advanced in closing submissions.

405. However, in my judgment the claimant clearly did plead this alternative more limited case both in relation to the suitability obligation and in relation to the construction obligation and the defendant responded to it in the Scott schedule, without suggesting that it was not open to the claimant to advance this as a further or alternative case. It follows that the pleading point is not a good one.

406. Moreover, there is expert evidence which addresses this case, since Mr Davis was asked to consider the adequacy of the roof system and the proposed repairs to it in his principal report and did so in some detail, referring to the observations recorded by Atkins in 2015 and by Sandberg in 2016 as well as to his own observations in 2015, 2017 and 2018. He noted the severe corrosion in areas adjacent to the gutters and he considered at some length why this was occurring, concluding that it was indeed due to water penetration due to the defective design and construction of the eaves and gutters: see [10.29 – 30]. He was not cross-examined on this part of his evidence.

407. Separately, he considered the issue of the corrosivity conditions within the roof due to ventilation allowing moisture and chlorides to enter the roof-space.

408. These issues were not addressed by the other structural engineers. There was no need for Caunton's expert to do so since this claim did not relate to Caunton. However, there was no reason why Mr Erwee should not have been instructed to do so. Given the terms of the reply to the Scott schedule it may be that the defendant did not have anything to say about liability in relation to this aspect of the case. In cross-examination Dr Callow was asked on day two of his evidence about the roof and expressed his view that the insulation would prevent any risk of moisture ingress to any degree to the main roof area. On day one he had been asked generally about the evidence in relation to the water ingress and accepted that it would "inevitably cause salt contamination and then corrosion". On day two, when asked about where the roof generally was not fully sealed, he fairly answered that he was a corrosion expert not an expert in structural issues. When he was taken to the Sandberg report in relation to the evidence of corrosion adjacent to the eaves and gutters he said that he was unable to comment because he had not inspected it as part of the joint investigations.

409. Prof. Lambert considered that it was necessary to replace the roof components for at least 2m in from the edges. In his principal report he allowed for replacement of a minimum of 2m in from the perimeter, subject to sight of the actual condition. He also concluded that it was prudent to allow for a minimum of 3m given the roof ventilation issue.

410. In closing submissions the claimant said that Prof. Lambert had not pressed in his report the primary pleaded case in relation to the need to replace the roof components in their totality give that the claimant's case was that the roof would have to be replaced anyway in order to remove the purlins. Whilst it does not appear that the claimant was seeking to reserve the right to argue this point if I found against them in relation to the purlins (as I have) I should, for completeness, record that I reject this case in any event for the following reasons.

411. I do not accept Dr Clarke's evidence as to the actual condition of the roof as a whole for the following reasons. First, although Dr Clarke took issue with Socotec's conclusion that its inspection did not reveal any "significant obvious evidence of corrosion" and that the roof steelwork had "a generally bright appearance" (save for RO8, where red rust was visible due to water leakage) I am unable to accept his opinion on that point since: (i) he has not personally inspected the roof space; (ii) his analysis of some of the photographs is different to that of Socotec and the other experts, whose views I prefer. Second, he appears to rely on localised white rusting as being indicative of pitting corrosion, yet he provides no detailed analysis as to their extent or importance in the areas inspected. Third, he agrees that there is no evidence of any uniform loss of coating thickness. Fourth, since Socotec was not instructed to examine any of the perimeter areas, he has no credible evidence for asserting that there is a significant and widespread corrosion problem around the perimeter which is more extensive

than the 2m assessed by Prof. Lambert or that it is due to ventilation as opposed to localised water ingress.

412. Nor do I accept his assessment of the roof as being a C3 category or worse based on the Socotec data for the following reasons: (a) there is no evidence of any condensation occurring within the roof as a whole; (b) there is no evidence that the corrosion as is present has been caused by the intrinsic design of the roof in contrast to localised deposits during the construction process and localised defects at the ridges and eaves.

413. I am prepared to accept that there is, as with the cold formed components, evidence of some deposits on some horizontal sections and that some localised minor white rusting has occurred in some of these locations. What I am wholly unable to accept is that this evidence establishes either that: (a) the roof as a whole is a C3 environment or worse; or (b) the roof components will not meet the contractual requirement of a 25-year minimum life expectancy.

414. I do however accept that there is significant corrosion around the perimeter caused by water penetration due to defects in the design and construction of the eaves and the gutters and that in consequence the roof components do need replacement up to 2m in from the perimeter. For the reasons I have given I reject the defendant's case based on the absence of a pleaded case or expert evidence. Whilst it is true that Prof. Lambert's assessment of the remedial works was stated to be based on the current conditions and exposure environment as confirmed by Dr Clarke in his expert report, his report makes clear that he had read and had regard to the report of Mr Davis as well as that of Dr Clarke. There is no basis in my view for treating his assessment of this remedial works as being solely based on the evidence of Dr Clarke, particularly when it is the evidence of Mr Davis which explains and which justifies the need for a more limited remedial exercise such as was considered by Prof. Lambert.

415. Nor is it necessary for me to make a positive finding that the components in this 2m area are all corroded to the same extent or that they will not last for their minimum design life of 20 years. It is sufficient for me to be satisfied, as I am, that the roof in this area has not been designed or constructed in compliance with the construction obligation and the suitability obligation and that as a result of such breaches there is corrosion to such an extent that replacement of this limited area is reasonably required and that this goes beyond reasonable maintenance. This is confirmed as necessary by expert evidence, which has not seriously been challenged by the defendant, who has openly recognised the need for replacement works and pleaded a positive defence on that very basis.

416. However, I am not satisfied that the claimant has made out its case in relation to a serious or significant problem due to the impact of ventilation so that a case has been made for replacement over 3m as opposed to 2m.

*Failure to mitigate*

417. I have already referred to the fact that the defendant offered to undertake remedial repairs to the roof perimeters in 2016 and again in 2017 which the claimant refused on the basis that they were not sufficient. The question is what if any consequence flows from this. The claimant submits that an offer to undertake remedial repairs to this limited area in isolation was not satisfactory because: (a) it did not address all of the defects to the roof of the tram depot; (b) the claimant had already agreed to the defendant undertaking the emergency roof repairs in 2015, as well as other works after practical completion (such as the replacement tram doors), so that it cannot be said that the claimant was

unreasonably setting its face against any remedial works; (c) the proposals were unacceptable because the extent of the replacement of the spacer bars and brackets was left to the discretion of the defendant and RPS and the design life issue was not addressed.

418. I am not persuaded by any of these objections. The defendant had already said that it would undertake these repairs at its own risk if it turned out to be wrong on the design life issue. There was no reason why these repairs could not be done separately from any others (and, indeed, they were put forward as part of a more comprehensive package). Since they were external repairs only they would not have inconvenienced the claimant's use of the tram depot. It is not relevant that the claimant had previously agreed to other remedial works.

419. More significantly, it is true that the extent of the replacement was left to the discretion of the defendant and RPS. However, the proposed remedial measures as specified in the RPS remedial works schedule were comprehensive and detailed and included reference to replacement of clips suffering from corrosion. There is no suggestion that the claimant or its expert representative would have been prevented from observing the state of the roof components once the roof was opened up so that if, for whatever reason, there had been a dispute as to the extent of the replacement the claimant would not have been prejudiced by agreeing to such works. Indeed, it is worth observing that the current remedial proposals themselves are based to some extent on an estimate as to how much replacement is required. It is also to be noted that Mr Grocott did not refer to this as a problem in his detailed letter of response dated 21 November 2017.

420. In the circumstances I am satisfied that there was, judged objectively, an unreasonable failure to agree to the defendant's proposals. The reality is that the claimant took the view, which I have found to be erroneous, that the required design life for the whole of the tram depot was 50 years, that the whole of the roof needed to be removed because the purlins and the roof steel components were not sufficient for a 50-year or a 25-year design life, and that it was for those reasons rather than due to any genuine or justified concern as to the detail that it set its face against the defendant's proposals which were, in fact, entirely reasonable on my findings.

421. However, the next question is what consequences flow from this finding. In relation to this element of the claim there is a simple answer, which is that – as will be seen below – the defendant obtained a quotation for the work to be carried out at its cost, which I accept as genuine and reasonable. It follows that this is the cost that the defendant would have incurred had the claimant accepted its proposal. In the circumstances the claimant ought not to recover anything more. Equally, it would be wrong in my judgment to find that since the claimant could have had the work done free of charge it can recover nothing. The work still has to be done so that the only consequence is that the claimant should not be able to require the defendant to pay for that part of the cost which could have been saved had the claimant reasonably accepted the defendant's offer.

*Remedial costs*

422. In its closing submissions at [166] the claimant divided the remedial works and costs into the costs relative to the perimeter edge and the costs relative to the roof overhangs. As regards the former the total cost as valued by Mr Jackson on the basis of a 3m replacement is £186,179.82 and as regards the latter the total cost is valued at £194,507.27, both inclusive of his figures for preliminaries, OHP and contingency. In contrast Mr Linnett had valued the former in the sum of £150,304.88 on the basis of a

quotation obtained by the defendant in 2017 plus 10% for contingency and had not valued the latter. Mr Tapper had valued the former in the sum of £108,620 and the latter in the sum of £46,700.

423. So far as the perimeter edge is concerned, I am satisfied that Mr Linnett's valuation is to be preferred on the basis that it is founded on a quotation which appears both genuine and reliable. It also limits the remedial works to 2m in from the perimeter, as opposed to the 3m valued by Mr Jackson. I agree with Mr Linnett that a contingency of only 10% is reasonably required, notwithstanding that Mr Wilbram had suggested an allowance of 25% for "mission creep".

424. In his supplemental report Mr Linnett had also identified a betterment issue and also an issue about inflation. I do not accept that betterment is relevant here where the issue is not about design life and where there is no evidence of over specification and I do not allow anything for inflation because I am satisfied that there is no basis here to do so given my conclusions on failure to mitigate.

425. The claim in relation to the roof overhangs is confused and confusing. It appears that in relation to the east roof overhang there are only (or at least principally) cold formed components (purlins and connecting brackets) as supplied by Caunton. In relation to the north and south roof overhangs there are the same cold formed components as well as the other roof steel components the subject of this claim. It is also the case that some localised repairs to the north roof overhang area were undertaken in 2015.

426. For the reasons given in section [H] above I am satisfied that no claim is maintainable in relation to the cold formed components in the roof overhangs. There is no hard evidence as to the position in relation to the roof steel components in the roof overhangs. There has been some suggestion that they are, or may be, affected by water leakages from the eaves and gutters and some suggestion that they are, or may be, affected by moisture ingress due to the (admittedly) defective state of the roof overhang soffits. However, there is no hard evidence in respect of these roof components in these areas such as would justify my concluding that they are all defective due to a specific breach or breaches by the defendant such as would justify their complete replacement.

427. Further, and in any event, there has been some real confusion as to what has been valued by Mr Jackson and on what basis. Prof. Lambert in his principal report had added an item 4a as an item of remedial work which he referred to as the internal components of the roof overhangs. It is plain from his report at [6.13.1] that they comprised at least principally the purlins. It is also reasonably clear from the responsive reports of the other remedial works experts that they proceeded on the same assumption. This explains why Mr Tapper has undoubtedly valued this item as comprising repairs to the purlins of the same kind as addressed in item 1 above.

428. However, Mr Jackson's approach is unclear. In his principal report he referred at [5.3.16] to this item as comprising the "application of additional protective coatings within the overhangs". However, it appears from his breakdown in his Appendix C that he has priced for remedial works for the whole of the east, south and north roof overhangs in very similar terms to his approach to the perimeter works. It is unclear to me whether he is valuing for replacement of only the purlins and connecting brackets or for repair of only those components, or whether he is limiting the claim to the other roof steel components, or whether it includes for both and, if so, on what basis. Mr Linnett believed that this claim related only to the purlins, which he also believed had been included in item 1 and which explains why he had not priced this item.

429. This confusion was never really addressed or explained during the trial. The end result is that for these additional reasons (i.e. the lack of justification for pricing works to the whole area of the roof overhangs as well as the lack of clarity as to what is included in this item by Mr Jackson) I am unable to allow anything under this head of claim.

430. It follows that I award the claimant **£150,304.88** as an inclusive figure under item 4.

## L. Claim in respect of the wall cladding panels (Scott schedule items 6 and 6)

431. I address this claim, which has attracted the most attention after the cold formed components claim, under the following sub-sections:


| Sect. | Title | Paras. |
|---|---|---|
| (a) | Introduction | 432 - 443 |
| (b) | The cause and extent of the blistering | 444 - 487 |
| (c) | Maintenance | 488 - 509 |
| (d) | Breach | 510 - 514 |
| (e) | Remedial works | 515 - 543 |


### (a) Introduction

432. The claimant's pleaded case is that the exterior wall cladding panels are already exhibiting widespread blistering due to corrosion underneath the outer plastisol coating and that where the blisters have burst it is apparent that corrosion is occurring to the steel core underneath. It contended that the nature and extent of the blistering and corrosion indicates that the corrosion protection does not satisfy the design life, whether it be 50 or 25 years, in the C5-M exposed marine environment of the tram depot and that the wall cladding panels were not designed or constructed to be suitable, durable or appropriate to the tram depot's location.

433. The claimant also contended that the interior painted metal liner sheets are already exhibiting widespread degradation which indicates that the corrosion protection does not satisfy the design life, again whether 50, 25 or 20 years and that they were not designed or constructed to be suitable, durable or appropriate to the tram depot's location. The pleaded estimated cost of remedial works amounts to £1,037,000.

434. The defendant: (a) admitted the presence of blistering to the exterior panels, without pleading a positive case that it was not "widespread" as alleged; (b) contended that it was not liable for such blistering, because it was caused by a lack of maintenance to remove accumulations of salt, dirt and debris; (c) asserted that the corrosion protection was sufficient to achieve the design life of 25 years; and (d) relied upon the fact that the manufacturer, Kingspan, had provided a 25-year guarantee but rejected a claim on the basis of a failure to maintain.

435. The defendant also pleaded that the blistering was caused by lack of maintenance which led to what it referred to as "wet poultice" corrosion. However in their evidence Dr Clarke and Dr Callow agreed that this was not the case since wet poultice corrosion properly so called could only occur where a sufficient quantity of material containing moisture and pollutants gathered and remained on the surface

to create a permanent feature, which they agreed has not and could not have happened on the vertical wall cladding panels in issue here.

436. In closing submissions, the claimant made the good point that since the cladding panels are composite structures it follows that if either the external or the internal section need replacement then the whole panel must be replaced. That argument does not, of course, hold true if only lesser remedial works short of replacement are reasonably required to either or both.

437. I am satisfied that having regard to the exposed location of the tram depot (as was so repeatedly emphasised in the contractual documents produced by the claimant) the exterior of the tram depot was plainly a C5-M category[5]. I am also satisfied that no reasonable designer would have proceeded on the basis of anything other than a conservative assumption that the rate of the corrosion to the exterior of the tram depot was likely to be at the high end of the C5-M corrosion range given that the location of the tram depot was in as exposed a position as any along the Blackpool seafront. I am satisfied that no reasonable designer could have proceeded – if indeed anyone did in this case – on the basis that the Galvanizers Association estimate for Blackpool as a whole could sensibly have been applied to the exterior of the tram depot.

438. The corrosion experts agreed in their joint statement that the Kingspan panels would be expected to last for 25 years in this environment, whereas it would not be possible to predict their condition after 50 years with any certainty. Although in cross-examination Dr Clarke tried to row back a little from this agreement as regards the 25-year lifespan, when pressed he agreed that he had no positive evidence to the contrary and he also agreed that he would have expected them to have lasted for 25 years if properly manufactured, accepting that it was a product with "quite a long, successful history". Thus, the defendant submits, and I agree, that in the circumstances it is not realistically open to the claimant to invite me to find that the selection of Kingspan panels as the wall cladding panels to use in this location was in itself and as such a breach of the design life obligation or the suitability obligation.

439. The only qualification to this conclusion is that if I had found that Dr Callow was right, so that the blistering was due to a known manufacturing issue whereby the plastisol coating suffered from pinhole openings due to the manufacturing process and which allowed moisture and corrosive contaminants to penetrate, I would have needed to revisit this question. However, that does not arise given the findings I have made as to the cause.

440. The claimant relies on the evidence of Dr Clarke to establish that there was a manufacturing defect. In its closing submissions the defendant argued that the only pleaded allegation was a design allegation. That is plainly not the case: see paragraphs 45 to 47 and 69 of the Amended Particulars of Claim which specifically plead that the defendant was in breach as regards the construction as well as the design of the wall cladding panels.

441. The claimant also submits that it is not essential to the success of their pleaded case to establish a manufacturing defect as the cause of the blistering. The claimant contends that even if the court was to accept the defendant's case that insufficient maintenance was the cause of the blistering the defendant would be in breach of the maintenance design obligation. This is on the basis that the defendant's case amounts to an assertion that the Kingspan panels were not suitable for the seafront location unless they were washed sufficiently frequently to remove sand and salt from their surfaces

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5 There was a sterile dispute as to whether it was a C5 or a C5-M, but it makes no difference either way.

and more frequently than the annual washing conducted by the claimant. This case was specifically pleaded by the claimant in paragraph 14 of the Reply to Defence so that it is not a new point.

442. In my view the crux of the case is whether or not the defendant was in breach as regards the supply and installation of the wall cladding panels having regard to the allegations that: (a) the wall cladding panels were not constructed to be suitable, durable or appropriate to the tram depot's location; (b) the wall cladding panels were not designed to be suitable in relation to those areas where they suffer from blistering, having regard to the defendant's obligation to ensure that there were no non-standard or unduly onerous maintenance obligations.

443. In the same way as with the roof steel components I do not accept Ms Day's submissions in closing that: (a) the only pleaded case in relation to the wall cladding panels is the design life obligation so that if the claimant fails on that case it cannot succeed on any other basis; (b) there is no pleaded case in relation to breach of the defendant's construction obligations, so that unless the claimant can establish a breach of a design obligation it cannot succeed at all.

### (b) The cause and extent of the blistering

444. There is a significant dispute as to the cause and extent of the blistering to the wall cladding panels which it is useful to address after referring in some detail to the evidence about the blistering.

445. It is important to be clear about terminology and, in particular, what is meant by blistering in the context of the wall cladding panels claim. In short, blistering as such is a reference to a small circular upwards protrusion of the plastisol coating. This occurs due to the impact of corrosion under the plastisol exerting outward pressure on the plastisol (because the product of the corrosion is greater in volume than the metal from which it derives). This is sometimes also described as localised debonding, or dis-bonding or delamination, because the plastisol coating has separated from the substrate at the point of the blister. Plastisol, having a degree of flexibility, can accommodate a certain amount of upwards pressure before rupturing. However, once the pressure exerted by an increasing volume of corrosion product is too great for the plastisol to accommodate the plastisol coating will rupture. What will then be visible will be white rust, being the product of corrosion of the zinc galvanised coating and, potentially, red rust, being the product of corrosion of the steel panel underneath. It is common ground that once the plastisol has ruptured there will be no barrier to the passage of moisture and chlorides to the substrate so that further corrosion will undoubtedly occur. The point will be reached at some stage thereafter where there will be extensive delamination of the plastisol coating, where the galvanised coating will have been wholly consumed by corrosion and, eventually, where the steel panel will be perforated by corrosion. Once that happens and moisture enters the insulation under the steel panel the cladding panel will be unable to fulfil its intended functions. Even before that time the panel may have become incapable of economic repair if what is required is repair of the affected steel, re-application of the affected galvanised coating and re-application of the affected plastisol coating.

446. It is Dr Clarke's opinion that long before the steel panel is perforated the wall cladding panels will be unacceptable to a reasonable owner, both because of what he considers to be the inevitable progression from blister to eventual perforation and on the basis of their physical appearance. He suggests that even before rupturing occurs the blisters themselves are objectionable. This is disputed by the other

experts who contend that if the accumulated debris is removed from the area of blistering not only will that prevent the blistering from worsening but also it will make the blisters far less visible.

447. As to cause, in summary Dr Clarke's opinion as stated in his principal report was that the blisters have occurred where a defect in the manufacturing process has allowed small traces of an electrolyte salt to be present under the plastisol coating where it has caused corrosion of the galvanised coating underneath. However, in cross-examination he was a little less certain, describing it as a "suggestion" which is "nearly a conclusion".

448. In contrast, Dr Callow's opinion is that chlorides are able to penetrate the plastic coating in the first place because there will always be microscopic openings in the coating which allow them to do so. Dr Callow's evidence is that water containing salts can and does enter through these microscopic openings and that this is well known to be an unavoidable part of the application process. Dr Clarke disagrees with Dr Callow about this, saying that there is no material to support this opinion.

449. Having summarised the battle lines I shall now review the evidence as to the cause and extent of the blistering in chronological order.

450. In February 2015 Mr Grocott had written to the defendant to say that "the wall cladding to the depot building structure is already showing signs of failure and is not expected to achieve the stipulated design life". On 6 August 2015 Mr Grocott wrote asserting that "widespread defects are present in the face of the wall cladding panels" and alleging that at a meeting on 23 June 2015, attended by representatives of the defendant, Tata and Kingspan, this was accepted. In his witness statement Mr Kennedy explained that Tata Steel were involved because it supplied the plastisol coated steel to Kingspan who had proceeded to make it into panels.

451. In an email from Tata to the defendant dated 13 July 2015 Tata had enclosed test results from an independent laboratory which stated that: (i) one sample, where there was white and red rust, showed some evidence of mechanical damage; (ii) the other, where there was white rust, did not; (iii) the thickness of the metallic coating layer was measured at 21-25 mi, well within the specification. Tata made two comments. The first was that the affected areas were seen to be visibly dirty under the roof overhang where not effectively washed by rainfall. The second was that "we had a good look at a sample from site at high magnification in my office and it appears that at every spot of corrosion there is a cut or pinhole through the coating indicating mechanical damage … It is likely that a combination of road salt and coastal sea salt have accumulated on the plastisol due to a lack of maintenance resulting in corrosion wherever the coating is scratched".

452. I referred in the summary of events to the report by Dr Harris of Sandberg produced on the defendant's instructions in January 2016. He noted some blistering of the plastisol coating and some associated corrosion of the steel substrate. He did not say how much. He concluded that the wall cladding panels would achieve a 25-year design life. This was on the basis that, regardless of whether the plastisol blistering was caused by manufacturing defect or by accidental damage allowing salt water to penetrate and cause localised corrosion and blistering, in either case it would not impact on its 25-year design life so long as it was treated early through suitable maintenance which he regarded as "not unusual … early in the life of a system". He recommended stripping back the affected plastisol, repairing any damage to the zinc coating with zinc-rich paint and applying a repair plastisol coating. He did not suggest that the damage had been caused by a lack of maintenance or of cleaning.

453. I also referred in the summary of events to the fact that in November 2016 Mr Wilbram had instructed RPS to conduct a cladding survey. He said in his witness statement that "having viewed the Kingspan wall cladding myself, my impression was that blistering was apparent at that time on some of the wall cladding panels, but it was certainly not the case that all panels were so affected. In my view a survey of the cladding would help the parties to establish precisely where blistering had occurred, the quantity and nature of the blistering and whether there was any correlation between the appearance of blistering and the particular location and orientation of panels" [6.2]. It is now known that he instructed RPS to discontinue the survey part way through because, according to him, the nature and extent and reasons for the blistering had already become clear and in his view nothing was to be gained by completing the survey on every elevation.

454. I have already referred to the two reports which RPS produced on 27 March 2017; the first entitled "cladding condition survey" and the second entitled "report on lack of cleaning and maintenance".

455. The first report covered only the wave form cladding panels and the soffit panels. It stated that it did not address the wall cladding panels because "any defects recorded to the Kingspan panels are considered by VFL to have arisen as a direct result of a lack of sufficient maintenance and cleaning".

456. As foreshadowed by the title, in its second report RPS recorded that whilst "there were areas of the envelope that were suffering from damage and/or deterioration" this was the result of the external envelope of the building not receiving an "appropriate level of cleaning and maintenance". If Mr Grocott's evidence is correct the exterior would have been last cleaned in September 2016. RPS noted a build-up of localised dirt and salt deposits in areas such as horizontal panel joints where such deposits would naturally accumulate, that they could generally be removed by light abrasion and that upon removal "significant blistering and coating damage" was seen directly below. Throughout the report RPS was critical both of the frequency and thoroughness of the cleaning. RPS also noted accumulated layers of dirt across all elevations (save for the south elevation to gridline 1 - see fig. 47 - which was "highly exposed to wind driven rainfall") and which had resulted in "numerous defects to the coating surface, such as blistering and flaking, which have been recorded during the survey". RPS noted heavy dirt retention and blistering behind the wave form cladding panels. The dirt layers could be removed by cleaning thoroughly with water and sponge and, where heavier ingrained, with a mild detergent. RPS noted a heavy build-up of salt around the north elevation main entrance and to the doors, frames and windows in the same area and in other locations, notwithstanding that the windows were, on Mr Grocott's evidence, washed every 6 weeks. RPS noted sand build-up at low level with blistering and some coating breakdown.

457. In section 4, where RPS considered the state of each elevation separately, they clearly associated the worst extent of dirt retention and blistering with areas which were protected from rainfall. However, it is also right to record that as regards the north -west elevation gridline 18 (where the trams enter the maintenance building) they noted that this also suffered from heavy deposits and blistering even though it was "severely exposed to wind, rain and salt spray" with only "minimal shelter".

458. I found it surprising that whereas the first report was, as instructed, a straightforward condition survey of the cladding in question, the second was a rather curious hybrid report comprising part condition survey and part substantiation for the defendant's stated view that the defects recorded to the Kingspan panels had arisen as a direct result of a lack of sufficient maintenance and cleaning, in circumstances when there was little serious attempt to analyse the connection between the two. It is impossible to see

anything other than the hand of Mr Wilbram behind this rather obvious attempt to improve the defendant's negotiating position vis-à-vis the claimant.

459. It is also important to note that there is no suggestion either in the RPS report or by Mr Wilbram in his evidence that the blistering and coating damage at this point in time was extremely limited in extent.

460. The claimant has not, however, undertaken its own detailed survey, whether through Dr Clarke or Prof. Lambert or otherwise, as to the location and extent of the blistering. Nor has the claimant pleaded reliance upon, nor have Dr Clarke, Mr Davis or Prof. Lambert referred in their reports to, the detailed survey sheets and supporting photographs produced by RPS in relation to the wall cladding panels. Whilst I accept that the claimant could not have pleaded reliance upon the survey sheets prior to disclosure, it did not make any attempt to plead reliance upon them in the Amended Particulars of Claim or refer to them in support of its case in its written or oral opening submissions. Nor did Dr Clarke refer to them in his principal report.

461. During the course of the trial the claimant sought to introduce the survey sheets into the trial bundle and, in the face of an objection from the defendant, I permitted the claimant to place reliance upon them for the purpose of cross-examination of Dr Callow on his report as to the extent of the blistering, but not in support of a positive case, which had not been advanced, as to the precise extent of the blistering. The survey sheets are consistent with the RPS reports themselves in that they are indicative of widespread blistering and coating damage, both at joints and edges and across the panels. By reference for example to the south-eastern elevation it recorded the extent of the blistering in 7 locations. In some of those areas the blistering was recorded as being limited to joints and other specific areas whereas in others blistering was recorded across panels where the total area was recorded as being 10% and 15% respectively.

462. Dr Callow was critical of the RPS survey sheets in a supplemental report which he produced on 9 March 2020 and in his oral evidence. He suggested that the reported extent of blistering was overstated because it was difficult to apply the approach in ISO 4628:2003 to a case where much of the blistering was linear along joints rather than across the surface of the panel. He also suggested that the reference to coating breakdown is a reference to a loss of the glossy finish rather than to localised delamination or blistering. He suggested that the RPS data, when properly assessed, was broadly consistent with his own assessment because it produced an overall assessment of some 0.24%. He suggested that save for 3 areas the extent of blistering would only justify local remedial touching up as opposed to full recoating, let alone replacement.

463. Dr Callow was also critical of the RPS survey on the basis that he did not believe that the survey had been undertaken by anyone with a background in corrosion surveying and that, in his view, what was recorded on the survey sheets did not accord with what could be seen from the photographs. However, he had not made any enquiry himself as to the qualifications or experience of the person at RPS who undertook the survey. He also accepted that it was difficult to identify the extent of the blistering from the photographs. He also accepted that the exact percentage of blistering is very hard to estimate with any certainty and that realistically it would be impossible to count and measure all of them.

464. Dr Callow had not himself attempted to express an opinion as to the extent of the blistering until his remedial works report of 29 January 2020. In that report he said that his opinion was based on his "many years of experience in estimating percentage areas of blisters" and his inspections of the tram depot during the course of the Socotec testing in July 2019 and before that on 31 October 2017. He

had not undertaken a detailed survey or a specific inspection with a view to providing an assessment of this kind which, as I have said, he had not attempted in his principal report. His opinion was as follows:

"2.8 It is my opinion that the amount of surface area that has blisters present is less than 1% on the majority of more severely affected panels, which represent a small number out of the total number of panels.

2.9 The less severely affected panels show less than 0.5% of the total area showed blistering.

2.10 The overall level of blistering is therefore in the order of less than 0.1% on average, when the unblistered panels are taken into account."

465. The claimant criticises Dr Callow's opinion in closing on the basis that: (a) unlike RPS, he had not undertaken a detailed survey of the wall cladding panels; (c) unlike RPS, he had not recorded his findings on individual survey sheets – RPS's survey was recorded on a total of some 70 survey sheets in all; (c) he had produced any document recording the basis of his analysis. He admitted in cross-examination that "There is no piece of paper currently that shows my workings out".

466. I accept that Dr Callow is right when he says that it is difficult to treat RPS' assessment of the overall extent of blistering as a formal quantitative percentage area based analysis, especially given the difficulty of combining linear blistering along edges and area blistering on panel faces, especially where the relevant standard requires the overall amount of blistering to be arrived at by a combination of an assessment of the density and the size of such blisters. However, that criticism does not in my view in any way detract from the reliability of the RPS survey sheets as accurate records of the condition of the wall cladding panels. They are clearly carefully produced and detailed and there is no basis for regarding them as overly favourable to the claimant. Whilst they report very little evidence of rusting or of coating breakdown (which I am satisfied is a reference to blister rupture), as I have said they nonetheless record significant blistering, particularly along the panel edges and the ridges in the panels.

467. The RPS survey sheets are also consistent with the observations of Dr Cox and Mr Deacon in their March 2019 report that, on conducting a visual external inspection, they noted that: (a) the panels had blistered and disbonded completely at corners and edges and that substantial disbondment was taking place at cut edges of the cladding sheeting, exposing the thin zinc layer beneath which, in such aggressive service conditions, was being quickly consumed, thereby allowing corrosion of the thin carbon steel substrate; (b) there were pock-marks in flat areas of the cladding sheets, where corrosion attack, probably at porosity in the plastic coating, had allowed corrosion to commence randomly all over the sheets. They noted that although the cladding had only been in service for six years damage such as this was "likely to result in widespread disbondment and corrosion attack of the substrate within a relatively short period". They contrasted the condition of the Kingspan wall cladding panels with the aluminium panels on the west elevation which formed part of the external roof construction.

468. The defendant suggested that these observations should not be given weight because they were made almost in passing by Dr Cox, in circumstances where his client Caunton was not directly interested in the wall cladding panels. Dr Callow also suggested in evidence that his understanding was that Dr Cox's expertise was more in relation to corrosion in metals rather than defects in composite wall cladding panels. Whilst this suggestion is borne out from looking at Dr Cox's curriculum vitae I do not consider that it undermines the validity of the views expressed by Dr Cox and Mr Deacon (who is

experienced in corrosion inspection across a wide field) as to the widespread nature and extent of the blistering as at the date of their inspections.

469. The issue as to the nature and extent of the corrosion and blistering is relevant both as to breach and as to remedial works. The defendant, unsurprisingly, seized on the evidence in Prof. Lambert's principal report where he said this:

> "6.14.4 With respect to corrosion (rusting), BS EN ISO 12944-1:2017 suggests that when the extent of corrosion has reached a classification of Ri3 to the visual standard in BS EN ISO 4628-3:2016 (equivalent to 1% by surface area) then maintenance of the coating is required. This can be locally by touch up or to the whole element by re-coating or replacement if the total area of the affected locations exceeds 10% of the surface.
>
> 6.14.5 For blistering, because this is dependent on both size and frequency, there is no equivalent guidance [as in relation to corrosion] but values in the order of 2 to 3% of surface area have been suggested as the boundary between touch-up and full re-coat. BS EN ISO 4628-2:2016 contains visual standards for assessing the size and density of blisters but does not equate these to the percentage of surface area affected".

470. The defendant submits that in the absence of any evidence from the claimant as to the extent of the blistering the court is bound to accept Dr Callow's evidence that the overall extent of blistering was significantly less than this 2-3% dividing line between local remedial works and full re-coating.

471. However, having given this careful consideration I prefer the opinions of Dr Clarke, supported by Dr Cox and Mr Deacon, over those of Dr Callow, as regards the general nature and general extent of the blistering. Dr Callow's minimisation of the nature and extent of the blistering is inconsistent in my view with their evidence and also with the evidence of RPS which I regard as reliable as a record of what was visible at the time. In comparison Dr Callow's evidence on this point came late in the day and without any detailed analysis in support.

472. Nonetheless, I do accept that the claimant has failed to establish that at the present time the blistering in percentage terms is in excess of 2-3% of the total area of the wall cladding panels. Nor has the claimant established that areas currently unaffected by blistering are likely to develop new blisters over the next 15 years. There is limited evidence of rupturing and there is no hard evidence that the corrosion does now or is likely in the medium term to exceed the 1% by surface area referred to in the standards. However, there is I accept evidence of significant rupturing along a number of the edges and corners. Moreover, what the claimant has established to my satisfaction is that there is a widespread problem of significant blistering to the wall cladding panels along the north elevation, east elevation and part south elevation, particularly in areas which are sheltered from rainfall by the roof overhangs and where deposits can settle, such as under and around the wave form cladding panels and around the edges and corners.

473. In relation to the cause of the blistering both Dr Clarke and Dr Callow were of course cross-examined on their opinions. Dr Clarke maintained that the evidence indicated that the wall cladding panels to the south-west elevation, to the rear of the maintenance building, and to the tram wash area, where no blistering had occurred, were of a different type to the wall cladding panels elsewhere and, hence, must have come from different batches. This explained, he said, why they had not blistered whereas the others had. There is, I accept, good evidence that the cladding panels in those areas are of a different type and hence from different batches to the others. Nonetheless he also had to accept that

the panels in these areas were also in the areas subject to regular washing, either by rainfall in the case of the south-west elevation (where there is no roof overhang) or to spray whilst the trams were being washed in the tram wash area.

474. He maintained his evidence that he had had personal experience of blistering having been caused by manufacturing defects, albeit that this was a rare occurrence. He had to accept that there was no supportive documentary evidence of manufacturing defects in the form of production records. He had made enquiries to see if they could be obtained but without success. However, stating the obvious, these records would not have been in the claimant's possession or control in any event. None were disclosed by the defendant. If and insofar as any are held by Tata or by Kingspan there is no evidence that the defendant has made any attempt to obtain them. If they had indeed provided evidence of production problems it is a matter for conjecture whether or not they would have been disclosed voluntarily.

475. Dr Clarke also maintained his opinion that it was not possible for chlorides to pass through the plastisol coating unless there was some opening which would allow their passage and that, whilst it was possible for moisture to do so, it was not possible for water or any materials found in debris to cause the plastisol coating to degrade so as to allow chlorides to attack the galvanised coating below. I note that Dr Callow produced no authoritative or other published material to show that Dr Clarke was wrong in scientific terms on these points.

476. Dr Callow addressed the external wall cladding panels in his principal report at [13.2]. He explained that the manufacturing process creates microscopic pores in the plastisol coating and that "it is how these pores develop with time that determines the lifetime of the plastisol sheet". He said that "it has been well known in the industry for many years that if dirt and contamination are allowed to build-up on these types of products, eventually it will penetrate into the pores at the interface with the metal and cause corrosion of the underlying galvanising layer". He said that normally the disbonding is limited by the size of the pores but that if the outer coating splits this local delamination would penetrate into the steel and cause corrosion. He stated that in this case the penetration into the steel had only occurred in a very small number of areas, which could easily be repaired, whereas the vast majority of the local delaminations are merely areas of raised coating, with very little zinc corrosion occurring underneath.

477. He did not however provide any assessment of the likelihood in this case as to how and in what circumstances the outer coating would split. Nor did he state in terms that there was no material risk of the delamination progressing to corrosion of the steel substrate over the course of the lifetime of the cladding. Nor did he seek to express an opinion as to the extent of the blistering. He suggested at [14.1.3] that "a criterion of failure for the cladding panels would be when the outer metal skin of the steel was penetrated and water could enter the foam layer underneath", although it would appear to follow that by this stage the galvanised coating would have completely disappeared.

478. In one sense the issue as to whether or not the blisters occur because of the presence of localised residual impurities under an unbroken plastisol coating or because of local pinholes in the plastisol coating as part of the manufacturing process is of no direct relevance, since in either case the end result is that it results in localised blistering which can then lead to rupturing and eventual failure. I do not read either of the reports of Dr Cox and Mr Deacon as expressing any clear view either way as to how the localised blistering has been caused in this case. Mr Clarke in his report appears to express a different view both to Dr Clarke and Dr Callow, which is that chlorides as well as moisture can pass

through the plastisol coating and cause blistering, particularly where the coating has not properly adhered to the zinc beneath, but without the need for any existing opening such as posited by Dr Callow.

479. If I am required to choose between the views of Dr Clarke and Dr Callow then there are three points which in the end persuade me that Dr Clarke's opinion is to be preferred and that a manufacturing defect in certain batches is the primary cause of the blistering. The first is that Dr Callow has produced no authoritative independent evidence to support his evidence that these pinholes are an inherent part of the process of the application of the plastisol coating. If that was the case and this was, as was the gist of his evidence, an "open secret" in the industry, I would have expected there to be some standard or research or industry published material to substantiate this. I do not regard the maintenance instructions promulgated by Kingspan as amounting to such evidence.

480. The second is that Dr Clarke, who – unlike Dr Callow – had analysed the blister microsections taken by Socotec from the wall cladding panels, noted at [6.3.5] of his report that there was no evidence of pin holing associated with the non-ruptured blister, whereas if Dr Callow was right one would have expected to have seen them.

481. The third concerns the competing explanations for the blistering pattern on the easterly section of the south elevation, behind the stabling building, which I must consider in a little detail. In his principal report Dr Callow expressed the clear opinion that the blistering changed along this section in a diagonal manner, so that the blistering was greater to the more easterly side, where according to Dr Callow there was a deeper roof overhang. From his initial answers in cross-examination I was disposed to think that there had been some confusion and that he had intended to refer to the difference between the westerly section of the south elevation (where there is no roof overhang behind the maintenance building) and the whole of the easterly section. That is because it is very clear from other photographs in his report (e.g. photograph 40) and elsewhere (e.g. photograph 497 in the photographs bundle) that in this easterly section the roof overhang is clearly full depth to the westerly side but curves inwards so as to be less deep towards the easterly side. Although in cross-examination Dr Callow agreed that this was indeed the case, he remained firm in his opinion as to the distribution of the blisters and the correlation with the roof overhang on the basis that on the occasion of his inspection it could be seen that rain was washing the west side but not the east side of the easterly section. He did accept, however, that he had no way of knowing how often that would be the case. Since the evidence is clear that the prevailing winds are from the Irish Sea to the west it is clear that this cannot usually be the case.

482. Moreover, it is quite clear from Dr Callow's report at 13.3.19 to 13.3.22 that not only was he asserting in clear terms that there was a change in the extent of blistering along this easterly section of this elevation in a diagonal pattern but also that he was seeking to explain this by reference to the depth of the roof overhang. I have no doubt that if there is, as appears to be clear, a difference in the extent of blistering along the easterly section of this elevation such as Dr Callow describes in his report, that simply cannot be explained either as due to the relative depth of the roof overhang or to the prevailing rainfall somehow catching the area under the deeper roof overhang but missing the area under the shallower roof overhang. This clear error and inconsistency itself damages Dr Callow's opinion in my view that it is the presence of sand and salt deposits alone due to lack of cleaning which causes corrosion.

483. Moreover, the presence of that difference in blistering in those relative locations also tends in my view to support the defective batch explanation since, as appears from Dr Clarke's analysis in his appendix 3 to his principal report, his testing does indeed record a variation in coating thickness levels along this elevation, which is indicative of a change in batch and which appears to be the only other alternative rational explanation for the difference.

484. Although the defendant sought to make much of Dr Clarke's willingness in cross-examination to admit that he could not be definitive that the cause was a manufacturing defect, in my view his explanation was more convincing due to its being not too dogmatic. In substance his evidence was that in the absence of any other more credible explanation and in the knowledge that there was a difference between batches some manufacturing defect was the most probable explanation, notwithstanding the lack of hard evidence by way of production records or the like to support it.

485. It follows that on the balance of probabilities I am satisfied that the cause of the blistering is some manufacturing defect in the affected wall cladding panel batches which, in consequence, are suffering from blistering with corrosion under the plastisol coating and, in some cases, to rupturing. I accept Dr Clarke's view that this is due to impurities adhering to the zinc coating although it may also be, as Mr Clarke opined in his report, that faults in the manufacturing process have led to poor adhesion between the underside of the plastisol coating and the top of the zinc coating which has also caused or contributed to the process. I also accept that at some point in the process (either after rupture, as Dr Clarke contends, or before rupture, as Mr Clarke believes) chlorides landing on and adhering to the surface of the panels can pass into the blister and accelerate the corrosion which is already occurring.

486. Furthermore, even if Dr Callow's opinion is to be preferred, so that there is no manufacturing defect in a strict sense, the consequence of what he says is that these plastisol coated panels do have these microscopic defects which will allow moisture and chlorides to pass through and to cause corrosion of the zinc coating due to an inherent feature of the manufacturing process. Those areas which retain sand and salt deposits which are not carried off by rainfall, whether because they are sheltered by the roof overhangs or because these deposits collect at the edges and corners and behind the wave form cladding panels, form aggressive micro-environments which, as stated in the standards, form sheltered surfaces in marine atmospheres where chlorides are deposited and which experience a higher corrosivity category due to the presence of hygroscopic salts.

487. Dr Callow accepts that unless these sheltered surfaces are kept sufficiently clean corrosion will occur and that blisters will form and eventually rupture and spread and he also accepts that the wall cladding panels will eventually fail. He does not suggest that the wall cladding panels could last for the minimum design life of 25 years even if no cleaning is undertaken. It follows in my view that on this hypothesis and in any event the wall cladding panels as supplied do not meet the construction obligations nor does their design meet the minimum design life obligation nor the suitability location of the tram depot where the cladding panels are in these sheltered environments, unless it can be said that their failure, whether within the minimum design life or more generally, can and should be avoided by the claimant undertaking and maintaining a maintenance regime which is reasonable in all of the circumstances and which is neither "non-standard" nor "unduly onerous".

(c) **Maintenance**

488. The defendant's pleaded case on this point is that "the Kingspan cladding used at the Depot does have sufficient corrosion protection to achieve a design life of a minimum of 25 years, as required under the

Contract. In order to achieve this design life, the Claimant needed to clean the surface of the cladding sufficiently regularly to ensure that accumulations of dirt, debris and salt did not occur. The blistering of the cladding has occurred because of the Claimant's failure to maintain the cladding rather than because of a shortcoming in the material selected for the wall cladding."

489. As I have already said, Mr Grocott accepted that in August 2011 the claimant was provided with the first draft of the O&M Manuals, which included the Kingspan COSHH and Maintenance Guides. Thus, the fact that the defendant took some time subsequently to produce a final version of the O&M manuals in hard and in electronic format is of no relevance to the question of compliance with the Kingspan guidance. However, there is no clear evidence to the same effect as to when, if at all, the Kingspan guarantee was provided.

490. The Kingspan maintenance guide stated, under the heading "Annual Inspection and Maintenance", that "Parts of a building on which colour coated sheets have been used, especially roofs, should be inspected and if necessary, cleaned regularly. If any defects are found in the coating they should be repaired immediately, in order to ensure long life". It also recommended that building owners should keep a record of inspections and maintenance.

491. Under the heading "Annual Inspection" it recommended annual inspection as good practice and checking for items such as "dirt retention in areas of cladding not washed naturally by rainwater, eg overhangs, this affects the appearance of the building and could, if left, cause breakdown of the coating". The recommended action was to "wash down".

492. Under the heading "Maintenance" it said: "Washing: rainfall alone is often sufficient to keep exterior surfaces looking clean and bright. However, to achieve maximum life from the Kingspan product, it is important that accumulations of dirt and debris which are not removed by normal rain washing are removed regularly by cleaning. This reduces the risk of 'wet poultice' corrosion. Areas of cladding that lie beneath overhanging building details, such as those beneath gutters, for example, are particularly susceptible to a build-up of dirt. Such accumulations may hold water and pollutants, which can lead to 'wet poultice' corrosion. Washing may be carried out with a hose and a soft bristle brush, using fresh water …" It also said "Care: colour coated metal sheets used on the roofs and facades of buildings are exposed to many kinds of pollution in the air. These together with water and increasing amounts of UV radiation affect the coatings. The effects are worst on those areas of the building where impurities are not washed away by rainwater …. In addition, a number of the impurities absorb water, which keeps the damaged area wet longer and as a consequence rusting is active longer. The effect of the impurities in the air is greatest when close to polluted industrial areas and in coastal areas … Impurities stress the coatings and reduce their useful life, so the regular cleaning of wall and roof surfaces is an important part of the servicing and maintenance of coatings".

493. The defendant's approach was rather to treat these requirements as if they were gospel. However, I do not accept that the claimant was in some way obliged to follow these recommendations to the letter. As Dr Clarke pointed out in cross-examination, these instructions cover a wide range of different products, some of which are susceptible to wet poultice corrosion and others (such as those used here) which are not. Moreover, as he also pointed out, these maintenance instructions are not necessarily based on purely scientific but also commercial considerations. Thus advice, for example, that a substantial tower block would need to have all of its exterior cladding thoroughly cleaned from top to bottom on a 3 monthly basis would provide a positive disincentive, due to the heavy maintenance costs this would incur, which might well explain the "headline" advice to inspect annually followed by

further, rather less clear, advice as to when, how, and why the cladding might require more intensive cleaning.

494. I also heard evidence about a "maintenance matrix". This is a summary of the various maintenance requirements in relation to the various elements comprising the tram depot. It was provided at the claimant's request on the basis that the health and safety file was far too voluminous to be a user-friendly tool for those tasked with the maintenance of the tram depot. The first draft was produced by Mr Bowman of the claimant and it included a note at the top that it was only a "first-off indication of the requirements for preventative maintenance for the plant installed as part of this project, that it is expected that with operating experience the plant operator will adjust this schedule in line with experience and refer to manufacturers' instructions for details". In the electronic version it was possible to use a hyperlink to jump to the relevant section of the maintenance manual. As regards the cladding it simply stated that it should be washed down annually with an approved cleaner.

495. I do not consider that either the claimant or the defendant can obtain any assistance from this maintenance matrix insofar as it differed in content from the Kingspan maintenance manual. It is clear that Mr Bowman of the claimant must have referred to the manual itself in order to produce the initial summary. Insofar as relevant, whilst reference to the matrix might well have justified nothing more than an annual inspection and cleaning initially, if and when as the claimant was placed on notice of a problem at a later stage it would have been plainly unreasonable in my view to rely on the "headline" recommendation alone without reference to the manual itself.

496. I was also referred to the Kingspan guarantees, which contained various exclusions in relation to such matters as a failure to follow Kingspan's instructions and a failure or damage due to "accumulations of dirt or debris nor does it apply to failure or damage in areas not exposed to washing by rainfall. Areas not subject to washing by rainfall will need to be washed at a frequency commensurate with the application of the goods and local environment of the building".

497. There was some debate as to what was meant by "a frequency commensurate with the application of the goods and local environment of the building". On any view it is an imprecise term, not surprisingly given the range of Kingspan products and the almost infinite range of potential local environments.

498. In my view the guarantees are of little if any relevance here, in circumstances where: (a) the defendant admits that the guarantees were not forwarded to the claimant until February 2016; (b) the guarantees add nothing of substance to the maintenance instructions; (c) if the claimant complied with the maintenance instructions it could not separately be regarded as culpably blameworthy for non-compliance with the guarantees; and (d) the question of liability under the guarantees has no necessary connection with the question of the defendant's liability under the main contract.

499. It appears that pre-handover the defendant had cleaned the exterior of the tram depot in November 2010, again in May 2011 (prior to completion and handover) and finally in September 2011 (prior to the launch of the new trams). I have already referred to the evidence of Mr Grocott to the effect that the claimant subsequently arranged for the exterior of the tram depot to be cleaned in April 2012, June 2013, June 2014, August 2015, September 2016, October 2017, October 2018 and September 2019 and, thus, approximately every 12 months. Although the documentary evidence is not as good as it might be, I am satisfied that the exterior has indeed been cleaned on those occasions and the documentation shows that the cost per clean has been in the region of £1,500.

500. Mr Grocott also gave evidence that the tram operating company has also entered into a contract with a company known as Smart Look for the cleaning of the tram doors and the windows every six weeks. This is relevant because there is evidence that notwithstanding this much more frequent cleaning they still suffer from a build-up of salts and sands. Thus, Mr Simmons said in his witness statement at [132] that it took only a weekend for his car to be covered with sand. Mr Kennedy's evidence at [19] was that "in windy conditions, when I returned to my car at the end of just one day I would [sic] salt on the bodywork of the car. If the car was parked in an exposed place (and not sheltered by a building) then it was almost impossible to avoid this from happening. It would be necessary for me to put the front and back windscreen washers on for a while before the windows were sufficiently clear for me to drive home. This shows just how quickly the salt builds up on objects at the site". He added at [21] that "I am also aware that the CCTV cameras at the Depot get obscured with salt after just days".

501. However Mr Kennedy was also critical of the quality of this cleaning, stating at [26] that "I understand that the windows of the tram doors are occasionally washed but I do not think that this can possibly include the frames, since whenever I have visited the Depot I have noticed a substantial build-up of salt around the edge of the windows".

502. Mr Simmons was also critical of the quality of the cleaning, saying at [129] that the team he saw "seemed to me to be making a very cursory effort to clean the cladding from the ground with a long pole, without a ladder or elevated platform and without using any cleaning agent or detergent".

503. In their joint report Dr Cox and Mr Deacon had expressed the view that it was unlikely that any degree of cleaning would have prevented the salt accumulation and associated corrosion damage because of the aggressivity of the environment. They suggested that whilst high pressure water jetting might remove the deposits observed it would also remove any disbonding coating. Dr Callow agreed that high pressure water jetting would be inappropriate but considered that it was not necessary. When he was pressed in cross-examination as to what he was suggesting was necessary it really came down to his saying that the panels needed to be cleaned when they became dirty.

504. The difficulty in my judgment with Dr Callow's evidence on this point is that it ignores the practical realities at the tram depot. Dr Callow agreed in cross-examination that the tram depot is in part in direct contact with sea spray. The Kingspan guarantee requires "suitable" washing to be undertaken in such circumstances. Dr Callow said that one should take care of the tram depot in the same way as a reasonably prudent owner would take care of his or her car, by washing it whenever it became visibly dirty, so that the amount of cleaning would depend very heavily on the environment. I am satisfied from the evidence that in order to ensure that the affected areas of wall cladding panels were kept free from salt and sand deposits it would be necessary to clean the three affected elevations on a regular basis and at least four times a year. That might be simply every three months, or perhaps every six weeks over the worst half of the year in terms of weather, given the evidence as to the frequency of windblown carriage of sea spray and salty sands when the tram depot is affected over periods of high winds by sea spray at high tide or by windblown salts and sand. Although when taxed with the implications of this Dr Callow sought to retreat somewhat by saying that the cleaning did not need to take place immediately in order to prevent corrosion from occurring he was not prepared to be very much more specific in any way that I found convincing, particularly given the late emergence of this evidence and its general nature.

505. Moreover, it is obvious from the defendant's criticisms of the cleaning actually undertaken that, whilst a cursory clean with a long pole and a bucket of water would not be sufficient, high pressure jetting

would be even more deleterious to the integrity of the coating. In reality some form of cleaning system would be necessary which would enable each elevation to receive a thorough clean from top to bottom and not forgetting the soffits under the roof overhangs. That would almost certainly involve the use of some form of elevated platform such as a MEWPS which would enable the operator to give the surfaces an effective clean using water, a mild detergent, as well as using some suitable implement which would be able to remove the deposits not just from the flat surfaces but also from the edges, crevices, and corners which attract deposits as well as from, around and behind the wave form cladding panels which do likewise. The textured effect of the wall cladding panels would add to the retention of deposits and the difficulty of removal. On any view such a cleaning exercise, if done properly, is a time-consuming and costly exercise which as Mr Tapper's valuation exercise demonstrates would cost significantly in excess of the £1,500 per visit cost actually incurred by the claimant. It would thus involve a substantial financial commitment over the 25-year minimum design life of the external wall cladding.

506. It has been very easy for the defendant and its witnesses, as well as for Kingspan and other involved parties, to assert repeatedly throughout this case that all that the claimant needed to do to avoid blistering was just to clean the walls on a regular basis. However, in my view the apparent simplicity of that case is actually rather deceptive when one considers what would be involved in terms of frequency and cost. This perhaps explains how assiduously the defendant and its witnesses as well as Kingspan has avoided answering the claimant's repeated question as to what exactly they say that the claimant should do. It was only when Dr Callow was pinned down in cross-examination that the true implications of what he was saying needed to be done fully emerged.

507. In cross-examination Dr Callow said that if he had specified these wall cladding panels for this location he would have written into the specification a clear statement that the operator needed to keep up with the maintenance (by which he explained that he meant that the panels should be kept clean). A rather better idea as to what he might have written is gained from his remedial works report, where he said at [1.3] that "in considering remedial actions it should be remembered that all existing anti-corrosion strategies, in a sandy marine external environment, will require much higher levels of maintenance than similar buildings sited in inland areas", and at [1.5] that: "[wet, wind driven, salty sand] will need to be removed on a regular basis, whatever anti-corrosion strategy is put in place, as there is no strategy currently available that can tolerate this kind of environment without regular maintenance".

508. The equivalent of such statements are noteworthy for their absence from the Works Information produced by the defendant or from the RPS design log.

509. I accept that the claimant has not helped its own case, given its stubborn and steadfast refusal to increase the frequency and intensiveness of cleaning, either since 2015 when it first became aware of the blistering to the wall cladding panels or on any view since 2017 when it ought to have received and acted upon professional advice to increase and intensify cleaning. However, as events have transpired, there is no cogent evidence (I do not regard the evidence of Mr Grocott in cross-examination that the damage had got visibly worse since 2016 as being sufficiently reliable or cogent) of any significant worsening of the position since this time. Nor in my view is there any cogent basis for concluding that the remedial works now necessary are appreciably different from those which would have been necessary in any event had more prompt steps been taken.

### (d) Breach

510. In my judgment, on the basis of this evidence and my conclusions as stated above, the defendant is in breach of the construction obligation and the suitability obligation as well as the design life obligation when read with the maintenance obligation because: (a) the supply and installation of the Kingspan wall cladding panels with manufacturing defects, which either allow corrosion to develop under the plastisol coating or allow moisture and chlorides to penetrate the plastisol coating, and; (b) the specification of the roof overhangs and the wave form cladding panels, which create substantial areas where the wall cladding panels are not subjected to regular effective rain-washing; (c) has had the consequence that the wall cladding panels as supplied and installed are unable to meet the design life obligation and the suitability obligation without the need for suitably intensive and regular cleaning, which goes beyond the annual inspection and clean which would be expected in normal non-extreme conditions and which I would regard as standard and non-onerous.

511. The defendant could only have complied with its contractual obligations, having chosen to supply and install these Kingspan wall cladding panels by: (a) supplying and installing panels the manufacture of which was sufficient to resist the elements in these locations without non-standard or unduly onerous maintenance; or (b) obtaining the claimant's informed express consent to a variation of the maintenance obligation accordingly so that the claimant was aware that it would have to undertake non-standard maintenance and willing to accept that financial and administrative obligation. Having failed to do so, it is in breach of its strict contractual obligations, and the claimant is entitled to be placed in the position it would have been in had the defendant complied with its obligations.

512. The defendant has also contended that the claimant failed to mitigate its loss by pursuing a claim under the Kingspan guarantee. However, that argument is hopeless where the claimant was perfectly entitled to choose to sue the defendant for breach of contract rather than to sue Kingspan under the guarantee. Both this claim and any notional claim against Kingspan would have raised the same essential issues as to the cause of the blistering and the notional claim against Kingspan would have faced further complications given the exceptions and exclusions to cover under the guarantee. It is noteworthy that whilst the defendant brought contribution proceedings against Range and RPS including claims in relation to the wall cladding panels it did not choose to bring a similar claim against Kingspan.

513. As regards the internal coating the position is different. Dr Clarke has not suggested in his principal report that the 15 mi polyester coating for the internal face of the wall cladding panels was insufficient to meet the 25-year design life requirement. Furthermore there is no evidence that the interior panels are inadequate for the internal conditions or that they are defective or otherwise that there is any justification for their wholesale replacement or that anything more than limited cleaning and localised repairs adjacent to the opening doors is required. Although Prof. Lambert in cross-examination said that he regarded the panels as "at best borderline" I remind myself that the claimant did not have permission to rely on his evidence in relation to corrosion issues and nor had he undertaken any detailed analysis in any event, so that this was at best his general view rather than a carefully researched or reasoned conclusion.

514. In the circumstances I have to consider what remedial works are reasonably necessary to remedy the breach which I am satisfied the defendant has committed.

### Remedial works

515. The three alternatives which have been considered are: (a) localised repair and recoating; (b) full recoating; and (c) replacement.

516. Option (b) is not seriously proposed by anyone. That is because the panels cannot be recoated in location and that it is not practicable or economical to remove, recoat and replace, whether individual panels or all panels. When Dr Callow was asked about this option in cross-examination he said that he was not suggesting that they be repainted.

517. Prof. Lambert addressed option (a) in his principal report where he said this:

> "6.14.6 When assessing the suitability of touch-up or re-coating, the ability to access all affected surfaces for surface preparation and coating application must be assessed. Where there are joints and seams it may not be possible to carry out such operations adequately, resulting in the premature failure of the remediation. This may result in replacement being the preferred option, particularly at higher corrosion categories."

> "7.13 I do not consider touch-up or recoating to be the preferred remedial option for the wall cladding panels due to the current extent of blistering to the external face, the need to enhance the performance of the internal 15 µm coating and the difficulties in adequately preparing the substrates and applying the coatings in-situ."

518. The first two reasons given by Prof. Lambert (extent of existing blistering and condition of internal coating) cannot be supported, hence the crucial question is the third, namely the difficulty in preparation and application of replacement coating in situ. In cross-examination he accepted that it was possible to do so in smaller areas and taking great care but questioned whether it was practicable in larger areas. That evidence did not seem to me to be compelling as against local repairs in principle. Prof. Lambert did not, whether in his written or oral evidence, refer to any cogent evidence or reasons for considering that this was not practicable even in larger areas. It must be borne in mind that since the wave form cladding panels will be removed anyway there is no obvious obstacle to the works being done with care to the south and east elevations. The areas to the north are a little more difficult since they involve working in a busy area where there are trams using the tram doors on a regular basis and the OLE to work around, but that would also be the case if they were to be replaced.

519. As to option (c), Prof. Lambert stated in his principal report that "there are several alternative cladding systems which are capable of providing the necessary service life and that can be considered as replacements for the current underperforming system including 3000 series aluminium and proprietary zinc alloy alternatives available are available such as Magnelis, Optigal and Trisomet which can then be provided with an additional protective and aesthetic coating". These alternatives were criticised by Dr Callow and the other experts who addressed this issue on the basis that the alternatives were either no better than Kingspan or were – as Dr Callow put it - "experimental substrates that have only recently become available and therefore have no long term service record … and installing materials with no track record in the marine environment experienced by the Depot would be foolhardy and against normal engineering practice".

520. I agree that there is no compelling evidence that any of the alternatives proposed by Prof. Lambert would offer any significant improvement on a well applied non-defective Kingspan or equivalent wall cladding panels. I am satisfied that: (a) to replace the existing wall cladding panels would not by itself provide the assurance of a further 15 year design life and that what is really necessary is proper remedial work coupled with proper cleaning on a sufficiently regular basis for the future; (b) there is

no justification for replacing the wall cladding panels if more limited remedial works coupled with proper regular cleaning for the further 15 years would suffice, unless it can be said that it makes more economic or other sense to replace.

521. Furthermore, the replacement costs are substantial. For the 25-year design life scheme the inclusive figures are as follows: (a) Mr Jackson's valuation is £531,056.05; (b) Mr Linnett's valuation is £519,961.15; and (c) Mr Tapper's valuation is £247,175.60. I would not be prepared to accept Mr Tapper's much lower valuation unless I was satisfied that the valuations of both Mr Jackson and Mr Linnett are significantly overstated.

522. Mr Linnett's valuation is based on a quotation obtained by Mr Wilbram in October 2019 from a business known as Hathaway Roofing which includes for a complete replacement with a similar system inclusive of preliminaries of £213,000 (of which £169,000 comprises temporary weather protection). That seems to me to be a reasonable and a reliable quotation and thus I accept Mr Linnett's valuation.

523. So far as the remedial works option is concerned, in his principal report Mr Tapper[6] had produced a number of different valuations based on a full internal and external clean of the panels (total area 3,246m$^2$, total cost c. £10,000) together with either (a) in accordance with Dr Callow's approach, the application of a protective coating to 1% of the external panel area (16.23 m$^2$); or (b) in accordance with the approach of Mr Selves, the application of a protective coating to a significantly greater area of the external panel area where blistering has occurred (1,008 m$^2$ of the total 1,623 m$^2$). On that basis, and applying the same add-ons as before, his valuation of Dr Callow's option was £13,687.40 and Mr Selves' option was £56,555.65. (Mr Tapper had also valued the approach of Mr Clarke at £32,072.20; his approach was similar to that of Mr Selves save that nothing is included for cleaning and nothing is included for the east elevation corners.)

524. In his supplemental report Mr Tapper had adopted a different approach, which was to value the cleaning of the external panels only at £3,904.84 and then to value the application of a protective coating on the basis of on an area by area basis. His revised valuation for Dr Callow's 1% approach (inclusive of preliminaries, contingency and inflation) amounted to £5,662.24, whereas his revised valuation for Mr Selves' approach (which he had applied across the board to a 50 year design life category) amounted to £58,558.46.

525. Mr Tapper was asked what the protective coating involved and replied that it involved painting over the face of panels without seeking to sand down or otherwise deal with the existing blisters or to apply paint to the edges between panels.

526. Having regard to the evidence I am not satisfied that the claimant has made out its case for a full replacement, given the nature and extent and seriousness of the blistering or defects and the 25-year minimum design life, especially given the significant difference between the comparative costs. Nor however do I consider that the works proposed by Dr Callow go far enough given that they are based on far too limited an analysis of the overall affected areas.

527. The works as recommended by Mr Selves and valued by Mr Tapper are substantially in accordance with the findings I have made, unlike those proposed by the claimant's experts or by Dr Callow,

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6 Mr Tapper had addressed this item at a time whilst he was still jointly instructed by RPS and Range as well as by Caunton.

notwithstanding that Mr Tapper has now rather confusingly referred to them in the context of a 50-year design life requirement. In short, these proposals reflect the need for the panels to be properly cleaned, so that any existing deposits and loose corrosion are removed, and for a remedial coating to be applied which does not simply address limited localised blistering in localised areas but recognises the need to apply a further paint coating to the existing panels in the areas which are worst affected by a combination of defects and the problem of recurring deposits which will arise unless non-standard and onerous maintenance is undertaken.

528. Both parties would doubtless complain about this works proposal and valuation. Thus the claimant may complain that the works do not make provision for more attention to be given to the localised edges, where the greatest failure has occurred and where corrosion has already begun, or for localised zinc painting of any areas of corroded galvanised coating. Conversely, the defendant may complain that the works make provision for a wholesale recoating of affected panels even where subject to little actual blistering. However, in my view this works proposal and Mr Tapper's valuation of it is sufficiently close to my findings and my assessment of reasonable cost to be accepted as a reasonably reliable indicator of the actual reasonable cost of these limited works.

*Valuation of preliminaries, OHP and contingency*

529. At this point it is convenient to address more generally the issue of preliminaries, OHP and contingency. It is of course accepted that a contractor tendering for works and a quantity surveyor valuing the cost of works will include in the price an allowance for preliminary (or site establishment) items as well as for overheads and profit and that a prudent employer will make an allowance for contingencies, the amount of which will vary according to the evaluation of the risks inherent in the works. Whilst a contractor may include some or all of the preliminaries and OHP in his individual rates or may simply tender a lump sum, it is usual for a quantity surveyor to value the base works cost and to add an allowance for preliminaries, OHP and contingency.

530. In this case Mr Jackson has added a flat percentage rate of 15% for OHP and 10% for contingency in relation to every item of work. However, he has adopted a different approach for preliminaries, which is to arrive at an assessment of the actual cost of these preliminaries based on an 8-month construction period and then divided the cost between the individual work items. It transpires that his assessment produces a percentage of 19% for preliminaries in relation to the 25-year scheme and 11% in relation to the 50-year scheme, on the basis that these costs are the same whichever scheme is adopted whereas the base works cost is less for the 25-year scheme.

531. In contrast, Mr Linnett and Mr Tapper have applied a flat rate percentage of 13% for preliminaries whichever design life is found to apply and whatever works are determined to be needed.

532. Although none of the experts were questioned about this at all or in any detail, it is plain that the accuracy of Mr Jackson's analysis depends not only on the accuracy of his valuation of individual preliminaries items but also on the validity of his estimate of construction duration. Moreover, as was put to him in cross-examination, if – as has happened here in relation to the cold formed components – the court rejects the most substantial element of the claim it must follow that the assessment would have to be done again which, of course, Mr Jackson has been unable to do.

533. It follows that in this case and on my findings the only sensible course is to adopt the flat rate 13% valuation. I should say that I would have preferred this in any event on the basis that a preliminaries rate of 19% is so outside the usual range of preliminaries costs that I would have been satisfied that it

must have been arrived at by applying inflated figures, a conclusion which draws support from the inflated figures which Mr Jackson arrived at in relation to the zinc tape and the cherry-picker by failing to undertake a sufficiently rigorous procurement exercise.

534. There is broadly speaking common ground in relation to the 10% for contingencies and I am satisfied that this is a reasonable figure to adopt. However, neither have allowed anything for OHP. This is explained by Mr Tapper in his report on the basis that he has included OHP in his base costs figures because they are included in the rates which would be applied by a contractor undertaking the works directly. It transpires that what Mr Jackson has done is to assume that the works would be undertaken by a main contractor organising the work to be undertaken in packages by subcontractors (as the defendant did originally) and has thus added 15% for the main contractor's OHP. Mr Tapper explained that in his view no main contractor would be needed for these remedial works whereas it appears that Mr Jackson has assumed that one will be required.

535. Again, in my view the answer depends on the question as to what remedial works will be necessary and what trades will be required to undertake them. I can well see that if I had accepted the claimant's case as regards the need for the 50-year remedial scheme for the cold formed components it would have been unrealistic to expect the works to be procured by the claimant instructing subcontractors direct. It is however rather more marginal where my decision is that far more limited works are necessary. Nonetheless, given that works will be required to the roof edges and overhangs, to the walls, to the tram doors and to a number of external items I do accept that it would be reasonable for the claimant to involve a main contractor and in the absence of challenge to the rate I allow 15% OHP. That does, however, have an impact on the allowance I make for the employer's add-on costs as claimed for by the claimant and addressed further below.

536. The end result therefore (and this applies to every item where the claimant succeeds) is that in addition to the base works cost the claimant is entitled to add: (a) 13% by way of preliminaries; (b) 15% by way of OHP to the sub-total thus produced and (c) 10% by way of contingency to the further sub-total thus produced.

537. Returning therefore to Mr Tapper's valuation I must add 15% OHP to this valuation. By reference to the details which appear at page 7 of 12 of his revised Appendix A that means adding 15% OHP to the sub-total of £52,140.02 and then adding a 10% contingency and a further 2.1% for inflation to the revised sub-totals. According to my calculation that produces a revised total of £67,342.23.

*Further issues*

538. As regards mitigation, I have already said that I am satisfied that the claimant cannot be blamed for not undertaking more frequent cleaning before 2015 or 2017 or that the failure to do so after that time has made any material difference to the remedial works and costs which are now involved. Moreover, I am satisfied that neither the defendant nor Kingspan ever made an offer to undertake remedial works to the wall cladding panels which it could be said that the claimant unreasonably refused to accept. Thus, the only offer made by the defendant in February 2016 was to undertake repairs to the panel coating in accordance with the manufacturer's recommendations. No such recommendations were ever forthcoming before the offer was suspended in August 2016 pending further details being provided by Kingspan and a trial repair which never took place before the defendant withdrew any proposals in 2017 following the RPS report on lack of cleaning and maintenance.

539. Nor is betterment an issue here, in circumstances where I am not allowing the claimant to recover the cost of replacement wall cladding panels.

540. A further point which I have considered with some anxiety is whether the claimant is also entitled to a further award to reflect the additional cost of the non-standard cleaning which I am satisfied that the wall cladding panels under the roof overhangs and wave form cladding panels require in order to meet the design life obligation and the suitability obligation. The claimant might have sought to be indemnified against the additional regular cleaning of the external wall cladding panels above and beyond the annual cleaning which is required by way of standard maintenance.

541. However, the defendant can submit with some justification that the claimant has consciously chosen not to plead or to advance a positive alternative case on this basis, so that if I was to accede to any post judgment application to award the claimant this sum on that basis, then: (a) that would be impermissible without an amendment; and (b) it would be unfair to allow any amendment, not least because if the defendant had always understood that this was the case it had to meet it would have been able to ensure that this issue was investigated in more detail by Dr Callow, Mr Erwee and Mr Linnett and this court cannot speculate what that might have revealed.

542. On balance I am satisfied that it is not open to me to award the claimant damages on this basis and it would be unfair even to invite, let alone to accede, to any application to amend, so that the claim must be restricted to the remedial costs as identified above. The claimant chose to go for a full replacement option without raising a fallback position and cannot therefore complain if it does not receive full recompense on that basis. Indeed, it may be said that the claimant is fortunate because it is only due to Mr Tapper's assiduity that there is any evidential basis for me to award it anything at all.

543. In the circumstances I award the claimant **£67,342.23** under this item.

## M. Claim in respect of the roof overhang soffit panels (Scott schedule item 7)

544. The defendant admits that the roof overhang soffit panels have delaminated and corroded and that they do not meet the contractual design life.

545. The defendant contends that the claimant wrongly refused to accept its remedial proposals on the basis that the aluminium finish was not in accordance with the planning permission which required white panels, notwithstanding that there was no contractual obligation for the panels to be a specific colour and notwithstanding that the defendant subsequently at its own expense obtained planning permission for panels with this finish to be used.

546. The claimant acknowledges that in November 2017 the defendant offered to replace the roof overhang soffit panels without admission of liability but contends that this offer was reasonably rejected by the claimant in Mr Grocott's letter dated 21 November 2017 on the basis that the proposed replacement would not comply with the planning requirements at the time of the contract or the specific design as subsequently accepted and on the basis that the defendant had failed to provide details of the grade of aluminium proposed which was relevant to the nature and extent of maintenance required.

547. Whilst I am not persuaded by the planning permission point, given that the defendant was able to remedy this issue and that there can be no sensible complaint that aluminium was intrinsically unacceptable given that it was used for the roof and west elevation with evident satisfaction, I do accept that the defendant ought to have provided details of the grade of aluminium to be supplied and

what maintenance was said to be needed. These details were directly relevant to the decision as to whether or not the proposed replacement would be acceptable. Without these details it cannot be said in my judgment that the claimant acted unreasonably in failing to accept this proposal. This is in a different category to the remedial works to the roof perimeter. I would accept that the tenor of the letter was not constructive and that with more co-operation on both sides the issue could have been resolved. However, it was for the defendant to make a clear and detailed proposal which can be said with confidence the claimant ought reasonably to have accepted. The defendant did not do so.

548. Following the provision of this judgment in draft the defendant properly drew to my attention the fact that in cross-examination Mr Wilbram had said that he had replied to Mr Grocott in a letter dated 27 November 2017, in which he said that "the grade of aluminium for the soffits has not been stated as this was assumed to be the subject of a technical discussion between the experts. The grade is in fact from the 3000 series". He did however accept that it the selection of the right material was a very important matter for the experts to discuss. Whilst accepting that the point is finely balanced, in my judgment that response, although constructive, was not sufficient to make out the defence of unreasonable failure to accept this proposal. It was for the defendant to state what precise grade of aluminium it was proposing to install and what would be required by way of maintenance. It did neither.

549. Furthermore, and as with the wall cladding panels, even if I had found that the claimant had acted unreasonably in the absence of evidence that the defendant could have had this work done for free the only consequence would have been a modest reduction in the on-costs which would have been saved had the defendant been permitted to undertake the work at its own expense.

550. There is no dispute as to the remedial works which are required. The major issue in relation to quantum is the temporary protection measures.

551. Mr Jackson's valuation is £112,966.82 inclusive of 15% overheads and profit, 11% preliminaries and 10% contingency. He was cross-examined on the fact that his build-up of £81,505.64 included a £40,000 allowance for scaffolding which, as he accepted, was only an estimate in the absence of a worked-up design from an engineer.

552. In comparison, Mr Linnett had relied upon a quotation in the sum of £59,270.85 obtained by a contractor approached by Mr Wilbram which did not contain any specific items for access or protection, although it had included £9,406 for "preliminaries and attendance". Mr Linett had not made any enquiry of the contractor as to what is included due to his belief that nothing more than a working platform was required. However, I do not accept that a working platform alone would be sufficient. I accept Mr Jackson's evidence that something more than a working platform or moveable scaffold is required, given the need for protection for and from the OLE given that it contains live electrical cabling so that careful protection is required both for the personal safety of those working and for the protection of the cabling itself.

553. In the circumstances I am satisfied that Mr Linnett's valuation is too low. However, I would not be prepared to accept Mr Jackson's valuation in full. In my view, starting with the actual quotation obtained by Mr Linnett and then adding on some (but not a full) allowance for protection together with OHP and contingency is the most appropriate course. On that basis I allow £60,000 (inclusive of preliminaries) plus £25,000 for protection plus 15% OHP and plus 10% contingency on each subtotal, producing a total award of **£107,525**.

554. In the circumstances the defendant's reference in closing submissions to its open offer made by letter dated 23 January 2020 from its solicitors to settle the soffit claim in the sum of £100,000 inclusive of costs and interest is of no relevance. Even if I had awarded under £100,000 it is difficult to see how an offer inclusive of costs could have been acceptable.

## N. Claim in respect of the wave form cladding panels (Scott schedule item 8)

555. The defendant admits liability in relation to the wave form cladding panels. The base costs are admitted in the pleaded sum of £122,000.

556. The defendant contends that it made a reasonable offer to undertake remedial proposals and that by rejecting that offer the claimant has failed to act reasonably to mitigate its loss.

557. The claimant contends that the defendant did no more than propose that the existing panels would be replaced with the Rockpanel system which had initially been specified in the tender information. It relies upon the letter written by Mr Grocott on 21 November 2017 where he said that without detailed proposals he could not comment further.

558. As with the soffit panels I agree with the claimant that it cannot sensibly be said that this was an unreasonable failure to mitigate, in circumstances where it must have been obvious to the defendant that it needed to produce a sufficiently detailed proposal to satisfy the claimant that it would provide a satisfactory alternative. Again, it may well be that the claimant's response was not particularly constructive but that is not the question. In any event, and for the same reasons as discussed above, the best that the defendant could hope to achieve would have been a modest reduction in on-costs on the basis that it could have saved such costs had the claimant accepted its proposals.

559. The defendant has also complained that it has offered to pay the claimant the admitted amount of £122,000 but the claimant has refused to accept payment. However, the claimant's position is that it is also entitled to recover a proportion of its on-costs in relation to this sum so that it cannot be criticised for not accepting this offer. Insofar as it matters, and I am not sure that it does save – possibly - in relation to any future costs argument, I agree with the claimant's position. Thus, I award the claimant **£122,000**.

## O. Claim in respect of the tram doors, side panels and supports (Scott schedule items 9-10)

560. The claimant's pleaded case is that in May 2012 the original tram doors and side panels were replaced because they had corroded and degraded but that the replacements have also corroded and degraded to such an extent as indicates that they do not satisfy the design life, whether that be 25 or 20 years, and that they were not designed or constructed to be suitable, durable or appropriate to the tram depot's location. It is said there was a failure to specify additional protective coating or to specify alternative more suitable durable materials. The pleaded claim amounts to £449,230.95, amended to £516,917 at the pre-trial review.

561. In the Defence: (a) it is admitted that the replacement doors and panels have corroded; (b) it is alleged that they met their required design life of 20 years; and (c) it is contended that the corrosion is due to lack of maintenance by the claimant.

562. I have concluded at [F] above that the design life required by the contract is 20 years.

563. Dr Clarke's opinion in his principal report was that there has been a very marked deterioration, in that the factory applied, powder organic coat has blistered and completely detached in places and the exposed zinc coating has suffered from corrosion with visible white rusting. His view was that, properly coated, a durability of 15 to 20 years could have been expected from the tram doors. He attributes the failure to a faulty or non-conforming specification. Although the defendant again submitted that this disposed of this claim, because the pleaded case related only to design, I reject this for the same reasons as I have done in relation to the wall cladding panels.

564. However, Dr Clarke also accepted that the Socotec thickness tests showed that (save for one minimal departure) the thickness of the galvanised coating remained within specification and that the steel substrate had not as yet suffered significant corrosion damage. He also accepted in cross-examination that he would have expected a responsible building owner to have replaced the outer coating once it showed obvious damage. Nonetheless, he maintained his view that a lack of maintenance could not have been the cause of the failure after so short a time, observing that there was some evidence of pin holes in the coating which would explain the damage. He accepted that the tram doors only required remedial work to provide a new coating and that this was only required for aesthetic purposes as well as to provide protection for the galvanised coating and steel substrate. He did not suggest that without such remedial works the tram doors would fail by perforation of the steel or otherwise so as to be unusable within their 20-year minimum design life obligation.

565. Dr Callow agreed with Dr Clarke that: (i) the powder coatings on the tram doors are damaged; and (ii) with maintenance the materials could be expected to achieve a life of at least 20 years. He accepted that the tram doors were in a poor state but maintained that there was no basis for replacing them on a structural basis, since there was no basis for considering that they would not survive for the contractual 25-year minimum design life even without maintenance. He did not dispute that the cosmetic appearance of the tram doors was such as to justify refurbishment or replacement but regarded that as the consequence of a failure regularly to clean them to prevent contamination build-up.

566. Ms Day cross-examined Mr Grocott on the maintenance matrix which, in relation to external painted steelwork, required that it be checked for early signs of corrosion and, if necessary, repainted with marine quality paint. Mr Grocott said that so far as he was concerned the claimant had complied with its maintenance requirements by ensuring that a specialist service contract had been put in place and maintained. His evidence, which I accept, was that the claimant had entered into a contract with a business known as D.C. Spencer which had carried out ongoing and regular maintenance of the tram doors and roller shutter doors since their installation. However Mr Grocott was unable to say whether or not Spencer had inspected every 3 - 4 months, as was specified in the information provided by the original supplier or, indeed, whether Spencer's instructions extended to the physical condition of the tram doors or frames.

567. Mr Grocott also referred to the fact that the tram depot occupiers BTS had entered into a contract for the regular cleaning of the tram doors, glazed side panels and windows, pursuant to which cleaning has been undertaken approximately every 6 weeks. I accept this evidence.

568. Mr Kennedy referred to a product data sheet for the paint which recommended cleaning at least once every two years and he also referred to a data sheet which recommended regular cleaning to prevent corrosion at least once a year and more often where there is "severe environmental pollution, for example in regions with increased salt contamination … within the vicinity of a sea coast".

569. In cross-examination Mr Kennedy agreed that the claimant was "quite good" at cleaning the tram door windows, although he added that there was a bit of salt build-up around some of the rubbers. He also observed that they might be covered in salt "within a matter of hours" of being cleaned.

570. In the light of the totality of this evidence I am unable to accept the opinion of Dr Callow in his report that "no washing or cleaning had occurred since my first visit [in October 2017] and this lack of maintenance had almost certainly accelerated the rate of disbonding of paint coating".

571. In my view the evidence does not support a conclusion that the claimant has failed to maintain the tram doors. The claimant cannot sensibly be criticised in my view when it has entered into and continued with a contract for the regular maintenance of the functioning elements of the tram door systems and when BTS as operator as entered into and continued with the regular cleaning of the tram doors and associated areas. There is no cogent evidence that the standard of maintenance or cleaning has been so poor that the claimant ought to have done something about it. To the contrary, the evidence of the conditions at this location demonstrates to my satisfaction that the problem is that the aggressivity of the environment is such that the coating cannot withstand the impact of moisture and chlorides without undertaking non-standard and unduly onerous maintenance

572. I do however accept that a reasonably prudent owner ought to have perceived the need to take steps to restore the powder coating to a proper condition once it became apparent that it was in such a poor condition that it was not performing either its performance function of providing a barrier between the galvanized coating underneath or its aesthetic function.

573. Nonetheless it is clear, in my judgment, that the powder coating is not suitable for the C5-M external conditions it faces given its rapid deterioration notwithstanding regular cleaning since the replacement doors were installed in 2012. This is so regardless of the claimant's failure to undertake remedial touching up at the point when it ought first to have become apparent that the powder coating was not performing acceptably.

574. Insofar as I need to make a positive finding I am also satisfied on the balance of probabilities that a manufacturing defect leading to small pinholes allowing moisture and chlorides to penetrate the outer coating is the most probable explanation of the early failure, coupled with the effects of the exposure to the harsh external environment which cannot be mitigated save by non-standard and unduly onerous maintenance.

575. The question is whether the claimant has made out its case on this basis, in circumstances where nonetheless the evidence is that the tram doors will not fail from a structural perspective over the course of their design life. It is plain that what is needed now, and what would have been needed once it had become apparent that the powder coating was not performing acceptably, is a full replacement of the powder coating, at the same time remedying any corrosion to the zinc coating and steel substrate. This, coupled with regular cleaning and, where necessary, touching up thereafter should ensure that it meets the contractual design life of 20 years from initial taking into service of the first doors in 2011.

576. The first question is whether or not this remedial work falls within the scope of anticipated maintenance or major repair. I am in no doubt that it falls into the latter category. It cannot reasonably be said that the need for a full replacement of the powder coating after such a short time from installation falls within the scope of anticipated maintenance. Nor can it reasonably be said that the claimant could and should have undertaken localised coating repairs as part of regular maintenance

on a sufficiently regular basis to avoid the need for a full recoating. In my judgment there comes a point where the nature and extent and frequency of coating loss is such that repeated remedial work fall outside standard maintenance. On the evidence that is plainly the case in relation to these tram doors.

577. The second question is whether or not in those circumstances the claimant has made out its case as regards breach. I am satisfied that it has, in that the defendant has failed to ensure that the tram doors as supplied and installed have complied with the construction obligation, the suitability obligation or the design life obligation in the context of the maintenance obligation. It is no answer for the defendant to argue that the claimant has not established that the tram doors would fail from a structural perspective even if nothing was done for the remainder of their design life. Given my conclusions as to what was required under the contract that is not the only touchstone for breach. Dr Clarke rightly stressed that the powder coating needed to be replaced to protect against future zinc loss as well as for aesthetic reasons. As to aesthetic considerations, there is nothing in the contract which says that these are irrelevant and, to the contrary, it is plain from the terms of the contract to which I have referred that aesthetic considerations were indeed material. I do not accept that the defendant can say that the claimant should have no remedy because it cannot complain if these expensive and aesthetically significant full length double opening doors are visibly deteriorating from a pleasing glass and powder coated finish to a delaminating and corroding framed eyesore well within any reasonable period and their contractually required 20 year design life.

578. Nonetheless it follows from these findings that the only remedial works which can properly be justified in terms of the nature of the breach which I have found is for the tram doors to have the existing powder coating and galvanized coating removed and new coatings applied. Replacement could only be justified if I was satisfied that this was more cost effective or was otherwise justified as the most appropriate remedial solution taking all relevant considerations into account.

579. The evidence clearly demonstrates that it would not be realistic to expect this recoating to be done without removing the doors and undertaking the work off site in controlled conditions. No-one has suggested that on-site recoating is a realistic option, given the need for careful quality control. The more difficult question is whether the claimant has also demonstrated that it would be more cost effective or otherwise justified to replace the doors instead. None of the liability experts was able to offer any clear opinion on the point, although Prof. Lambert clearly suspected that it would. Mr Jackson said in his evidence that there would be little or no saving in seeking to repair as opposed to replace the tram doors. However, he had not investigated that issue in any detail; in particular he had not obtained any competitive quotations for both options or investigated the cost or practicability of obtaining temporary replacement doors whilst the existing ones were being recoated.

580. How much would it cost to replace the doors? Mr Jackson's valuation was £371,729.91. This was based on a quotation of £30,000 per door inclusive of OHP and preliminaries, together with some modest additional costs and a substantial allowance of £120,000 for future maintenance. When asked about this he said that it was because he considered it unlikely that a supplier would offer a guarantee for any replacement, given the history of two failures to date, so that this allowance represented a reasonable attempt to price for maintenance over the remaining 15 year design life period. I am unable to accept this explanation since the replacement tram doors have been specified by Prof. Lambert with a high durability alternative on the basis that they would give the claimant the remainder of the 25-year design life without requiring anything more than standard maintenance. There is no

contractual entitlement to a manufacturer's guarantee for the remainder of the design life. On that basis Mr Jackson's valuation reduces by £120,000.

581. The other quantum experts had priced much higher than this net sum. Mr Linnett's valuation net of preliminaries was £414,150, based on a quotation for a replacement obtained by the defendant from a business known as Jewers Doors, net of preliminaries. This is considerably in excess of Mr Jackson's figure. Although Mr Linnett had also suggested that this cost might be reduced by around 20% by re-using the glass that was not the subject of detailed consideration. Mr Tapper's valuation was similarly high at £438,386 net of preliminaries. Nonetheless, Mr Jackson did not revisit his valuation on sight of his fellow experts' valuations, so that at least on the claimant's case it is still feasible to replace the doors for this sum.

582. Mr Linnett had also referred to a cost for regalvanising and recoating which, based on the cost incurred in 2012, adjusted for inflation, would amount to £126,409, together with preliminaries and a 10% contingency. He was cross-examined about this valuation. He relied upon what transpired to be the invoice from the company Moreschi which had replaced the doors in 2012. As I have said, although Moreschi's initial proposal and quotation was to retain the existing structures and to apply a new galvanised coating and paint system, what in fact happened was that the decision was taken to replace the tram doors with an upgraded paint specification and other improvements but at no extra cost to the defendant. It transpired that Moreschi had not recorded this change on its invoice which therefore simply recorded what had been originally quoted rather than what actually been provided.

583. In my judgment the evidence of what actually happened in 2012 provides strong support to the claimant's case. It is good evidence that in the real world a supplier who was prepared to quote on the basis of a recoating had ultimately decided that it was more cost-effective in its own interests to supply new doors at the same price. Whilst it is possible that the claimant might achieve a similar happy outcome that appears unlikely and, indeed, I cannot help but speculate that in such circumstances the supplier may be inclined to cut corners to limit its losses.

584. In the circumstances I am satisfied that the evidence shows that it would be impracticable to recoat at the figure suggested by Mr Linnett. This conclusion is reinforced on the basis that if there was an off-site recoating exercise it would be necessary to allow for the cost of temporary replacement doors whilst the doors were off-site being recoated and that this might well sway the balance between recoating and replacement. Whilst it is true that there is no positive evidence either way on this point it is clearly a factor to be taken into account.

585. In the circumstances I am satisfied that it is appropriate to allow the replacement cost on the basis of Mr Jackson's valuation. Rather than adopting Mr Jackson's artificial approach of discounting the actual quotation for OHP and preliminaries and then adding his own allowance back I take the approach of the actual quoted cost of £300,000 for the 10 doors, add the £11,729.91 additional costs, sub-total £311,729.91. There is no need for contingency on a supply only item and thus I allow **£311,729.91**.

586. This finding means that it is unnecessary to consider separately the tram door mechanisms, which will be included in the replacement exercise. Dr Clarke had addressed the supports separately at [13.51] of his report, where his opinion was that the zinc undercoat is insufficiently thick to protect against the external environment to which the mechanism is in fact permanently exposed. I accept this and, had I

needed to decide the point raised by the defendant, I would have decided that by putting in place a reasonable maintenance regime it cannot be said that the claimant had failed to act reasonably.

## P. Claim in respect of the other defects (Scott schedule items 11 – 80)

587. A number of other components or items of equipment are said to have corroded or degraded such as indicates that they are defective in that they were not designed or constructed to be suitable, durable or appropriate to the tram depot's location or so as to achieve the minimum design life. The majority are external although some are internal. Details are provided in the Scott schedule. The total of the pleaded claims amounted to £228,595.50 according to Mr Linnett.

588. The defendant has responded to these claims in the Scott schedule. The response is the same in the majority of cases, with the defendant pleading: (a) a denial that there has been any breakdown of the protective coating or corrosion of the substrate; (b) a denial that the material used was inappropriate or insufficient; (c) a denial that the external corrosivity category was C5, C5-M or C5-X; and (d) and an allegation that any damage has been caused by a failure to clean and maintain. In nine cases the defect is admitted and it is alleged that the defendant has already offered to undertake remedial works (although no consequence is said to flow from this). In all cases the quantum as pleaded by the claimant is admitted subject where appropriate to liability.

589. At the pre-trial review the claimant applied to amend the quantum of its claim in relation to six of the admitted items in order to plead remedial costs based on actual quotations obtained instead of estimates. Of those six, two were increased whereas the remaining four were decreased. The total amount was increased as a result. The defendant opposed that application but only in relation to the items whose value had increased. The claimant said that it was seeking permission to amend in whole or not at all. I ruled that the claimant should not be permitted to increase the value of claims which had been admitted both as to liability and quantum with the result that no amendment at all in relation to these 6 items was either pursued or allowed.

590. However subsequently, and before the order was drawn up, the defendant suggested in correspondence that the effect of my ruling was that any item where quantum was admitted even though subject to liability could also not be amended. I am satisfied that this was not a submission which was made to me and nor (therefore) was it a ruling which I made. In the circumstances I am satisfied that the claimant was given permission to amend its case in relation to those further seven items.

591. A further issue arises as to whether or not the claimant should be entitled to add its claim for on-costs as pleaded at the end of the Scott schedule to these admitted items. I have no doubt that it is so entitled, since that was the position before the amendment and nothing has changed as a result of the amendment or the ruling. Finally, since it is convenient to deal with it at this point, I confirm that I made no separate costs order in relation to the amendment application or the costs of the amendments.

592. Given the photographic and other evidence I must confess that I am surprised that the defendant felt able to positively deny in every case the fact that there was a breakdown of the protective coating. I also do not understand how the defendant could have denied that the corrosivity category externally was not a C5-M or equivalent.

593. For similar reasons as already given in relation to the preceding items, I reject the defendant's case, as advanced in closing, that the claimant can only succeed if it can prove its case on design life and that it

cannot because Dr Clarke's evidence in relation to corrosivity has been completely discredited. In principle it is open to the claimant to prove its case on the basis of breach of the construction obligation, the suitability obligation and the design life obligation.

594. The claimant submits that Dr Clarke is the only expert of those instructed by the claimant, the defendant and Caunton who has addressed these individual items, having attended site on 28 February 2018 for that specific purpose and having addressed them in section 13 of his principal report. This section of his report was not infected by his erroneous approach to the internal cold formed components. Although the defendant criticised this section of his report as being generic, concluding that each item was defective without addressing his mind to the details, I reject that criticism. In particular Dr Clarke did address each item separately by reference to its condition as observed, albeit – and rather unhelpfully – adopting a different order to that appearing in the Scott schedule. Whilst it true that in the vast majority of cases he concluded that the item in question was defective: (a) he gave individual reasons for that decision in each case; and (b) he did not always do so - see for example items 28 and 29 where he expressed the view that the columns in question were not defective and had sufficient thickness.

595. The claimant also observed that the defendant has failed to provide any equivalent item by item analysis of these Scott schedule items, noting also that the letter written by Mr Wilbram in December 2017 in response to the notification of these defects did not refer back to the previous report produced by RPS in March 2015 which had itself confirmed that a number of the defects complained of did indeed exist.

596. In its closing submissions the claimant provided a helpful table which cross-referred the Scott schedule items to Dr Clarke's report and to the photographs in the photograph bundle.

597. The issues which arise are similar to those which arise under the claims in relation to the wall cladding panels and the tram doors addressed above and can be dealt with relatively briefly on the same basis. In particular, I am satisfied that in relation to those items where the claimant has established that there is corrosion of the coating at this point in time requiring remedial works going above and beyond what was reasonable maintenance then the claimant has established a breach of the construction obligation, the suitability obligation and the design life obligation having regard to the proper construction of those obligations and to the maintenance obligation.

598. I also reject the generic defence based on an alleged lack of maintenance in circumstances where on the defendant's case these items, being for the most part external and thus fully exposed to the elements, ought to have been able to resist corrosion by being regularly rain-washed. There is no credible evidence that a failure to wash down these items on an annual basis has caused or materially contributed to the failures referred to by Dr Clarke. Any suggestion that more was required would be contrary to the maintenance obligation.

599. Having made those over-arching points I now deal with the various items in order.

**Items 11 and 12: the roller shutter doors**.

600. Dr Clarke addressed these items in his principal report at [13.30] and [13.32]. His opinion was that the steel components and guides were defective because the paint coating was not sufficiently durable. He also considered that the corrosion to the plastisol coating in item 12 had occurred due to manufacturing defect in the same way as with the wall cladding panels.

601. In cross-examination Mr Clay referred Mr Wilbram to the RPS April 2015 report in which it was recorded that there were areas of corrosion to the bottom edges, door tracks and slat edges and that RPS considered that they were unlikely to achieve the required lifespan and should be replaced without lack of maintenance being mentioned as a cause.

602. The agreed quantum is £15,912 and £6,120 respectively, total allowed **£22,032**.

**Items 13 and 14: the plant room doors**

603. Item 13 was referred to by the defendant in closing submissions as a good example of the deficiencies in the claimant's case.

604. In the Scott schedule it was pleaded that "the external doors to the plant room adjacent to the main gate exhibits breakdown of the protective coating and corrosion of the substrate. The doors are not formed of an appropriate material and/or have insufficient corrosion protection to meet the performance requirements of the Contract. The doors are not suitable, durable and appropriate for the C5-M corrosivity category and environmental conditions which exist at the exterior of the Depot building".

605. Dr Clarke addressed item 13 at [13.38] of his principal report. He said this:

"State: - rust stains round the doors' perimeter come from the corrosion of the steel frame. The doors are made from an aluminium alloy with an organic coating, paint or a powder-applied polyester.

Opinion: - The organic coating has been detached in a few places from the aluminium alloy door leaves, but the exposed alloy has a high resistance to marine corrosion and has suffered little loss. The steel frame has not received a coating system with enough durability for the environment. Defective."

606. Thus it can be seen that: (a) Dr Clarke gave this item fair-minded consideration, concluding that the doors were not defective; (b) Dr Clarke condemned the door frame because it was corroding indicating that, in contrast to the doors, the coating system had insufficient durability for the environment. Whilst that may be a reasonably summary explanation it suffices in my view to establish a breach of the construction and suitability obligations as well as the design life obligation given the remedial works required.

607. The agreed quantum is £6,120 for both and in the absence of any evidence that any saving could be made by replacing the frames only and retaining the doors, which seems unlikely, I award **£6,120**.

**Items 15 - 17: the Overhead Line Equipment ("OLE") supports and columns.**

608. Dr Clarke's report establishes the claimant's case.

609. The quantum of these items is agreed in the sums of £7,956 each for items 15 and 16 and £7,650 for item 17, total allowed **£23,562**.

610. There is a claim against Caunton in relation to items 15 and 16. This was dealt with by Mr Griffiths in his evidence, on which he was not challenged, to the effect that Caunton supplied these items with a plain galvanised finish to be painted on site by others. There is no problem alleged with the galvanising so that if the paint has deteriorated Caunton is not responsible. On that undisputed basis the claim over against Caunton must fail.

**Items 18 - 24: defects associated with miscellaneous roadside and lineside furniture**

611. Dr Clarke's report establishes the claimant's case.

612. Further, as regards item 18, the RPS April 2015 report also identified corrosion to a number of signs and poles. In cross-examination Mr Wilbram accepted that some showed rust corrosion but asserted that others simply showed a build-up of salt and sand. However, I am satisfied on the balance of probabilities that RPS' contemporaneous comments are more reliable than Mr Wilbram's commentary either in the November 2017 letter or at trial.

613. Yet further as regards item 19, in cross-examination Mr Wilbram suggested that this was either due to impact damage (which I reject) or to paint degradation which ought to have been addressed by maintenance, but I am satisfied that the nature and extent of the deterioration and corrosion goes beyond reasonable maintenance.

614. Quantum is agreed in the sums of £1,530 for each of items 18, 19 and 24 (£4,590), £3,060 for each of items 20 and 23, £765 for each of items 21 and 22. Total allowed **£12,240**.

**Item 25: defects associated with drainage.**

615. Dr Clarke's report establishes the claimant's case. In cross-examination of Mr Wilbram the point was made, with which I agree, that it is unrealistic to blame the corrosion on a lack of maintenance given that the vent pipe is vertical and fully rainwashed so that there was little prospect of significant dirt retention. Total allowed **£765**.

**Items 26 - 32*:* defects associated with lighting, CCTV and their supports**

616. Dr Clarke's report establishes that in relation to item 26 the current degree of corrosion is unacceptable and that the design life requirement will probably not be met. He condemns the down lights comprising item 27 as standard commercial units with a finish already applied by the makers never intended for service in the Starr Gate environment. In relation to item 28 he condemns the luminaires again as a standard unit unsuitable for the environment, albeit not the columns, however there is no evidence that the columns could be retained or a cost saving thus achieved. He does not condemn the columns in item 29 where the luminaires have already been removed so that no award is appropriate. His report establishes the claimant's case in relation to items 30, 31 and 32.

617. I award £765, £6,732, £8,415, £6,120, £1,530 and £1,147.50, total **£24,709.50**.

**Items 33 – 37: defects associated with M&E enclosures**

618. Dr Clarke condemns item 33 as a standard fitment unsuitable for the environment, item 34 as providing inadequate paint protection, item 35 as having failed in its original and being wholly unsuitable in its replaced form, item 36 as being unsuitable for the design life and item 37 as a standard commercial fitment unsuitable for the environment.

619. I allow £6,885, £2,295, £1,147.50, £1,147.50 and £1,147.50, total **£12,622.50**.

**Items 38 – 59 – defects associated with metallic items connected with M&E plant and subject to an external environment**

620. Item 38 is admitted and I allow the unamended claim value of **£1,530**.

621. Item 39 is established because of the corrosion and inadequacy of the paint coating. I award **£765**.

622. Item 40 is established because of the extent of the corrosion and the evidence of inadequate thickness coating for the environment. I award the reduced quantum of **£1,145**.

623. Item 41 is established for the same reasons as item 39. I award the very slightly increased quantum of **£1,150**.

624. Item 42 is admitted and I allow the unamended agreed quantum of **£1,530**.

625. Item 43 is made for the same reasons as item 39 and I allow **£382.50**.

626. Item 44 is established for the detailed reasons explained by Dr Clarke and I allow **£382.50**.

627. Item 45, the coating doors to the substation, are recorded by Dr Clarke as having lost their organic coatings over large areas. However his reference back to item 13 (mistakenly referred to in his report as item 43) makes it clear that the aluminium substrate is highly resistant and, on this basis, only a recoating would be required whereas the agreed quantum of £4,590 must be for complete replacement. I allow **£500** for recoating.

628. Item 46 is made out by the commentary at [13.41] of Dr Clarke's report which, as with item 13, establishes that the steel frame but not the aluminium door is defective and there is no evidence to support any discount, so that I award **£2,295**.

629. Items 47 -50 are admitted and I allow the unamended agreed total quantum of **£11,092.50**.

630. Item 51 is made out by Dr Clarke and I allow **£765**.

631. Item 52 is the external housing and conveyor motor to the underfloor wheel lathe. Dr Clarke confirms that the substrate is corroding on the basis that this is exposed to saltwater spray and wind and that the paint is unsuitable for that aggressive environment. The quantum has been very substantially increased from £3,825 to £48,113.68. This is the subject of a quotation obtained from the claimant which Mr Jackson has considered and expressed the opinion at [5.4] of his principal report that it was reasonable. The defendant did not address this revised quantum in its evidence or in cross-examination of Mr Jackson. That may be because it had nothing to say. Alternatively, if the defendant was under the mistaken impression that the amendment was not permitted that was a clear error on its part. In the absence of a final ruling in its favour it was obliged to put such case as it had. Accordingly, I allow **£48,113.68**.

632. As to item 53, the external gas pipe to the south elevation of the stabling building, Dr Clarke had stated in his report that the steel was corroding, because the only protection applied to the pipe was paint which did not provide sufficient durability for the external C5 environment. This was one of the few items on which he was cross-examined, on the basis that he had not investigated the specification of the coating. His answer was that it was apparent that whatever the specification of the paint it was plainly not suitable. In the absence of a positive case from the defendant I do not see how he can be criticised for this. Nor does it seem to me that any defence based on a lack of maintenance can succeed; the contract required a 20 year minimum design life and it cannot be said in my view either that this was satisfied if the pipe required a full recoating or if it had already begun to suffer corrosion after less than half the minimum design life. It was suggested that his evidence was not sufficient to prove the claimant's case since he had approached the design life on the erroneous assumption that it was 50 years but, in the absence of any positive evidence from the defendant that it would meet a design life of 20 years or an acceptance from Dr Clarke that it would, I am satisfied from his evidence that the claimant has made out its case on the basis of a 20 year design life and in any event of a lack of suitability. I allow **£382.50**.

633. Item 54 are the internal supports to the same gas pipe. Dr Clarke confirmed in his report that the supports and fixings had either lost their paint coat or galvanised coating and had therefore begun to corrode. He was cross-examined on the basis that his opinion was founded on his erroneous assumption that the stabling building as a whole was a C4 environment but, as he said and I accept, in fact it was on the basis of their existing state explained, in his opinion, by the proximity to an external door. I am satisfied that the claimant has made out its case on the basis that regardless of the corrosivity categorisation of the stabling building as a whole this particular component in this particular location does not satisfy the 20 year design life requirement nor is it suitable for its particular location. I award the agreed amount of **£1,530**.

634. Dr Clarke addresses item 55 in his report and I am satisfied that the claimant has established its case, so that I award **£1,530**.

635. Dr Clarke addresses item 56 and concludes that the sanding plant filter nozzles are rusting and do not have the "durability needed for a life to first maintenance of 15 years upwards". I am satisfied that on a proper construction of the contract requirements the claimant has established its case.

636. The quantum of this item has been increased from £2,295 to £11,500. It appears that this is supported by the quotation referred to by Mr Jackson as reasonable so that I allow **£11,500**.

637. As to item 57 the quantum of this item is included in item 40 so that there is no separate award required.

638. Item 58 concerns components in a below ground service trench where Dr Clarke observes that the environment is damp and affected by saltwater and that both the zinc galvanised coating and the steel substrate are heavily corroding. Whilst I must exercise caution as to his TOW and corrosion rate calculations I am satisfied nonetheless that the claimant has proved its case by reference to the actual condition and state of the components and their environment and accordingly I allow the claim at **£9,180**.

639. Item 59 is established by reference to Dr Clarke's evidence as to the severe corrosion due to the unsuitability of the coating applied and I award **£2,295**.

640. Items 60 to 71 concern defects associated with metallic items connected with M&E plant and subject to an internal environment.

641. Item 60 concerns galvanised components including hangers supporting equipment suspended from the roof, fixings, cable trays and equipment supports affecting the workshop building, stabling building and first floor offices. Dr Clarke's opinion in relation to these items is in all essential respects founded on his opinion in relation to the cold formed components which I have rejected. It might have been possible to have identified specific items where the nature and extent of corrosion coupled with the evidence of their structure, initial thickness and current thickness would have been sufficient to establish a case but I am unable to accept the broader case on the generic basis. Nothing allowed.

642. Items 61 - 63 are different because Dr Clarke is able to say that these items are only suitable for a C1 environment, since they have no galvanised coating at all, and are corroding especially where closer to the tram doors and where the environment is on any view greater than a C1. I allow **£765**, **£382.50** and **£6,120**.

643. Item 64 relates to the water pumps within the tram wash where on the same basis I am satisfied that Dr Clarke has established the claimant's case by reference to the actual evidence of the components and the environment and I allow **£535.50**.

644. Item 65 relates to the pipe fittings to the tram wash where the quantum has been increased from £612 to £7,497.55. However as with item 60 there is a mix of components where no claim has been demonstrated in relation to some, which are described as "ok", and others where the generic claim advanced in relation to the cold formed components is raised (the galvanised steel tray is simply said to show "white rust corrosion product" ). In the absence of evidence which would enable me to allow for individual items where I am satisfied the claimant has proved its case I award nothing.

645. No separate amount is claimed in relation to item 66.

646. Item 67 is similar to item 61 and I award **£765**.

647. Items 68 and 69 concern the AC panels in the substation where the only evidence is that there is some corrosion which does not satisfy me that the case is made out so that I award nothing.

648. As to Item 70, sanding plant electrical components, Dr Clarke's report establishes that these are corroding and deteriorating because the enclosure door seals have failed and caused the external environment to affect the components within. I am satisfied that this evidence establishes a breach of the construction and/or suitability obligations. Given that appears to be supported by the quotation referred to by Mr Jackson as reasonable I allow the increased amount of **£24,343**.

649. Dr Clarke in his report establishes the claimant's case in relation to item 71 and I award **£1,530**.

650. Item 72 concerns the HV feeder cabinet enclosure where I am satisfied on Dr Clarke's evidence that the claimant has made out its case and I award **£6,120**.

651. Finally, items 73 to 80 are miscellaneous items.

652. Item 73 concerns the locking components of the entrance and exit gates where again I am satisfied on Dr Clarke's evidence that the claimant has made out its case and I award **£1,530**.

653. Item 74 concerns the roof overhang tubular supports. Dr Clarke refers in his report at [13.15] to these being exposed to an external environment where their paint coatings have deteriorated and failed prematurely although he has no information on the paint used or the specification. At [13.28] he also states however that the paint coating is "beginning to fail, especially at the top of the columns".

654. It is admitted by Caunton that it supplied these items galvanised and that it then arranged for them to be painted to provide additional corrosion protection on the basis that it would be suitable for a C5-M environment. Their current state was not addressed by Mr Deacon and Mr Griffiths limits himself to stating, somewhat opaquely, that he does "not have any concerns with the work that we did in this area".

655. In closing submissions Mr Hale argued that Dr Clarke's evidence that the paint is "beginning to fail especially at the top of the columns" is not enough to prove the case. I agree with this submission. Since there is evidence that there is a galvanised coating under the paint it is not enough for the claimant to be able to establish only that there is some deterioration of the paint coating since the evidence does not establish that what is required or will be required goes beyond reasonable maintenance. On the available evidence this falls on the other side of the line from the tram doors.

656. Items 75 & 76 are admitted and I allow the claimant the unamended total amount of **£1,530**.

657. Item 77 refers to corrosion to holes and fixings of flashings. Dr Clarke identified these as having already failed and having very limited durability and I am satisfied that the claimant has made out its case and I award **£4,590**.

658. Item 78 refers to corrosion of the structural steel diagonal bracings. These items were supplied by Caunton and a claim is made against Caunton by the defendant in respect of them. Dr Clarke says that these are corroding and that it is not possible to protect a galvanised wire rope for 20 years or more in a C4 environment. This in my judgment is a reference to Dr Clarke's "generic" claim where I have rejected his corrosivity categorisation and do not accept that the evidence of corrosion establishes the case.

659. This reason for rejecting this claim is supported by the evidence of Mr Griffiths, where he referred to Caunton's previous offer to replace these items which was not accepted. Caunton submitted that neither the claimant nor the defendant should recover damages in this litigation for the cost of replacing items that Caunton has offered to replace at its own cost.

660. This is a reference to Caunton's June 2015 letter which was sent to the defendant and on to the claimant. It is headed "without prejudice" (although no point has been taken about that at trial) and as relevant stated as follows: "During an early inspection it has been noted that there are some minor components showing signs of rust. i.e. M12 nuts and diagonal tie wires. Although these are structurally sound, they are not aesthetically pleasing to the BBC. We have already agreed with VF that we will "without prejudice" and as a gesture of good will replace the affected items, given the opportunity to do". In his witness statement Mr Griffiths stated that he had never received a response to this offer.

661. I accept that this offer was only made on the basis of aesthetics and am satisfied that there is no basis in relation to these fixings for requiring replacement solely for that reason. Thus I am satisfied that the claimant has not made out its case.

662. Item 79 refers to the plastic cable ties to secure the lighting strips to the wave form cladding panels which it is said are failing on the sharp edges of the steel cladding. It is not addressed by Dr Clarke and notwithstanding the reference in the claimant's closing submissions I am unable to locate where Mr Grocott deals with it. In any event it is not established that this would be an additional cost to the replacement of the wave form cladding panels in any event and thus I award nothing.

663. Finally, item 80 is a complaint that the main electrical isolation panel in the maintenance building is experiencing excessive dust and contamination which is not addressed by Dr Clarke nor, other than in passing at the clumsily numbered paragraph 10.5(xiii)(A) of his witness statement, by Mr Grocott. That passing reference is insufficient to permit an award of £4,590 and I decline to do so.

664. The end result, if my arithmetic is sound, is that the claimant has established a total entitlement in relation to these minor claims in the sum of **£246,330.68**.

## Q. The additional claims including add-on costs on sums awarded

665. As I have said, the Scott schedule made unparticularised claims for the following amounts: (a) design of remedial scheme (£333,000); (b) procurement of remedial works (£100,000); (c) legal advice in connection with remedial works programme (£25,000); (d) project management time estimate for remedial works (£287,500); and (e) project management time to date dealing with defects (£187,500).

666. In the joint statement of quantum experts Mr Jackson widened the ambit of these costs so that they also included claims for: (a) construction inflation; (b) special safety measures; (c) special attendances/ cleaning; (d) rental of laydown area; (e) short haul transport from laydown area; and (f) external OLE isolation.

667. Mr Tapper was prepared to allow 10.5% of construction costs, comprising 2.1% for construction inflation to the assumed date of undertaking works, 5% for design fees and 3% for project management fees. Mr Linnett agreed. In contrast, the impact of Mr Jackson's allowances would add 36% to 25-year scheme costs.

668. I have no hesitation in rejecting the further claims and preferring the approach of the other experts for the following reasons:

669. First, the total appears extremely high compared with the allowances which one often sees in remedial works claims. Whilst that is not a reason in itself for rejecting the claims it is a reason for treading with caution, especially where the other experts do not accept the claims as reasonably made or quantified.

670. Second, there is no pleaded claim for the claims for special safety measures, special attendances/ cleaning, rental of laydown area, short haul transport from laydown area or external OLE isolation. They are not supported by any evidence apart from Mr Jackson's assessment. It is apparent from his principal report where he addresses them that they are broad brush "quantity surveying assessments" without any factual underpinning and additionally are works and hence costs which, if required, ought more obviously to be provided and met by the contractor from its own preliminaries.

671. Third, the claim for design and project management costs was advanced on a timed basis as opposed to a percentage basis. Whilst I understand that in an appropriate case it might be reasonable to advance a claim on such a basis it cannot be justified in this case given the vast disparity between the scope of remedial works claimed and the scope I have allowed. As Mr Jackson accepted in cross-examination there was no simple formula for doing so. In any event I regard the rates claimed as significantly over-generous for the design work involved – there is no independent substantiation and the rates adopted appear extremely high for what is a relatively straightforward remedial works exercise. It would also have been very easy for the claimant to have produced a proper figure for project management based on the actual costs which the claimant would incur in having Mr Grocott undertake this function. I would have reduced the overall claim by two-thirds on a broad brush basis even if I had been prepared to allow it on the basis advanced.

672. Fourth, this is also a very different procurement exercise from that required when the original works were procured. It is not suggested that a formal procurement exercise is required or that legal fees will be required for this purpose. Given that I have accepted that it will be let to a main contractor and have allowed 15% OHP I do not accept a need for the employer to incur £25,000 legal fees.

673. Overall, I prefer and accept Mr Tapper's approach and flat percentage rate, supported as it is by Mr Linnett.

674. A claim was made for "costs incurred to date, to be confirmed". It appears that the intention was to include a claim for staff costs in dealing with the claim. However, no detail or breakdown has been provided and in such circumstances there is no basis for awarding any such costs. In closing submissions the claimant submitted, with hope rather than expectation I suspect, that it was sufficient that Mr Grocott had verified the Particulars of Claim and had answered some preliminary questions

about his involvement in this project over the years. He said that he was paid by the claimant under a full-time contract, but no further details have been provided. By reference to the well-known authorities on recovering in-house costs this evidence is nowhere near sufficient to persuade me to award anything at all under this head. Indeed I cannot help but observe that whilst Mr Grocott has undoubtedly spent a significant amount of time in relation to this claim it cannot be said that that time has resulted in a successful outcome in relation to the cold formed components where I have no doubt a significant amount of his time and effort is concerned.

675. The end result is that a flat rate 10.5% is to be added to the total of all sums awarded.

676. The final result therefore is that the claimant is entitled to the following award as against the defendant, whereas the defendant will not recover anything as against Caunton.

| **Section** | **Item** | **Amount / Total (£)** |
|---|---|---|
| H | The cold formed components | Nil |
| K | The roof components | £150,304.88 |
| L | The wall cladding panels | £67,342.23 |
| M | The roof overhang soffit panels | £107,525 |
| N | The wave form cladding panels | £122,000 |
| O | The tram doors | £311,729.91 |
| P | The other Scott schedule items | £246,330.68 |
| | Sub-total | 1,005,232.70 |
| Q | The add-on claims at 10.5% | 105,549.40 |
| | **Total award** | **£1,110,782.10** |

737. Whilst I do not believe that this claim will attract interest, given that the amounts awarded are all on the basis of costs to be incurred, I will leave any argument on that issue, as well as on any other consequential issues, including costs, to a later stage.

## R. Glossary:

| | |
|---|---|
| BS | British Standard |
| BTS | British Transport Services, who operate the tram service and the tram depot. |
| FPS | Functional Procurement Specification |
| ISO | International Standard |
| ITT | Invitation to Tender |
| LTFM | Life to first maintenance |

| | |
|---|---|
| MTTs | Magnetic thickness tests (also known as Dry Film Thickness tests - DFTs) |
| OLE | Overhead line equipment |
| RH | Relative humidity |
| SCI P262 | Steel Construction Institute (SCI) Publication P262 |
| TOW | Time of wetness |