



Hexagon Tower

Deterioration of Cladding
Pre-planning Report

March 2021

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Executive Summary

Significant deterioration of the original bonded mosaic tile cladding to the elevations of Hexagon Tower and associated machine hall annexes has been observed since at least 2014. Mott MacDonald has undertaken a series of investigations into the deterioration of the cladding beginning in 2015. These have identified that failure is almost exclusively due to debonding occurring at the interface between the concrete structure and the adhesive render used to secure the cladding. The debonding of the cladding has been shown to be progressive, and will continue to worsen without significant remediation.

It may be possible to secure the existing mosaic tile cladding, most likely through mechanical pinning, the application of a reinforced coating or through vacuum assisted grouting, as discussed in Section 4.1 of this report. There are however major disadvantages to the retention of the existing façade by any one, or a combination of, these approaches. Primarily - ongoing deterioration is unlikely to be fully arrested. It would still be recommended that surveys of the condition of the cladding be undertaken, and further periodic repairs are expected to be required in order to prevent the loss of further material. In addition to the works required to stabilise the cladding, aesthetic repairs would also be required to pre-existing areas of deterioration. The final appearance of the repaired areas is unlikely to fully match that of the original cladding.

Replacement of the existing cladding with a similar system, or rendering of the external elevations of the building is unlikely to be favourable due to additional considerations resulting from the removal and disposal of the existing cladding, waste produced due to preparation of the surface of the concrete substrate and the critical role of the surface condition on the durability of the façade.

The installation of a modern over-cladding system could be undertaken without it being necessary to remove the existing mosaic tiling. The fixings used to support the new cladding system would be anchored into the structural concrete and a suitable arrangement of batons and mesh would then be used to restrain the mosaic tile cladding and prevent the spalling of any additional material. There are a range of benefits to this option which are outlined in Section 4.3 of this report. These include the greatest opportunity (of the options considered) to improve the appearance of the building, is likely to achieve the greatest warranty period, and minimal anticipated requirement for further surveys and remedial works resulting in less disturbance to the occupants of the building in the long-term. The installation of an over-cladding system with suitable measures to restrain the existing bonded cladding is therefore considered to be the preferred remedial option.

1 Introduction

Hexagon Tower is a commercial building which houses office and laboratory space. It comprises a main 13 storey tower with associated 2-storey annexes to the east and west sides. The building dates from the 1970's and is of reinforced concrete construction, with external bonded mosaic tile cladding furnishing the elevations of the tower and both annexes.

More recently, metallic cladding was installed to the fascia of the upper cantilever of both annexes. The installation of this cladding is understood to have been undertaken as part of a wider refurbishment of the roofs of the annexes during 2018. It is believed that the metallic cladding has been installed over the deteriorated mosaic cladding.

Deterioration of the mosaic cladding has been observed since at least 2014 and has been the subject of several previous investigations. The intention of this report is to provide a review of the existing information from these previous investigations, and to highlight the following:

- Identify areas of specific concern;
- Comment on the rate of deterioration;
- Discuss recommendations for the future (i.e. remedial options).

2 Overview of Cladding and Failure Modes

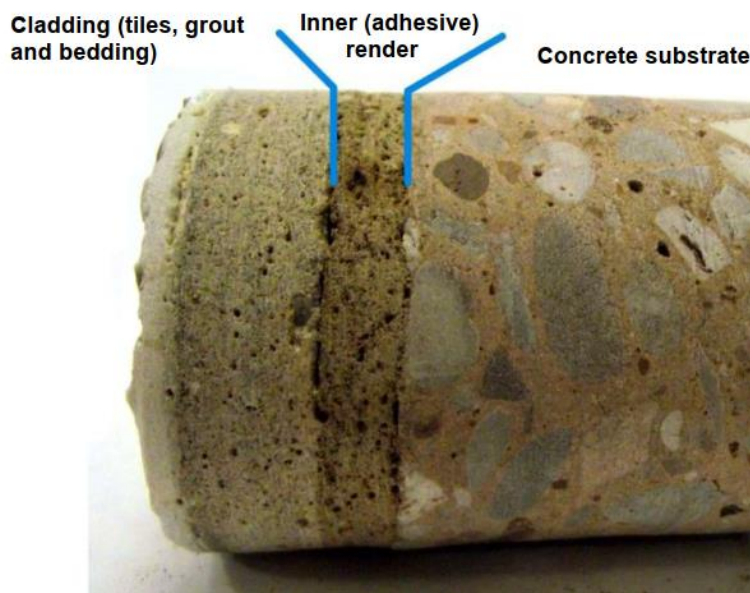
2.1 Description of the Cladding

Mott MacDonald removed several cores from the south elevation of the main tower during an investigation in 2015. This allowed the typical build-up of the cladding to be determined. Figure 2.1 is reproduced from the 2015 report to illustrate the typical nature of the cladding. The cladding comprises tiles, grout and a mortar backing. An adhesive render layer was used to bond the cladding to the reinforced concrete of the structure.

The cladding component (tiles, grout and bedding) was found to have a typical combined thickness of 15mm to 20mm. The inner (adhesive) render is cementitious, and has a typical thickness of 10mm to 15mm.

An additional photograph is included in Figure 2.2 which shows that the mosaic tile surface of the cladding is not formed from individual 'mini-mosaics' but rather comprises a sheet of material. It can also be seen that porosity often exists at the grout-bedding render interface.

Figure 2.1: Typical failure of the cladding at the concrete-adhesive render interface



Source: Mott MacDonald, Report: 352360/A/01, May 2015

2.2 Mode of Failure

Where cladding has spalled or has been removed due to being deemed unsafe, debonding failure has been observed to be occurring almost exclusively at the interface between the concrete and the adhesive mortar. An example of this is shown in Figure 2.3.

Petrographic analysis was undertaken to investigate the composition and condition of each of the layers of the cladding system and the underlying concrete. Investigation of two cores taken from the south elevation of the main tower did not find any evidence of deterioration of the materials (for example due to reactive components). The debonding of cladding is therefore considered to be restricted to the interface between the render and the concrete, rather than due to processes occurring within the bulk of the materials.

Figure 2.2: Additional core photograph showing the form of the cladding



Source: Mott MacDonald site visit March 2015

Figure 2.3: Failure of the cladding at the concrete-adhesive render interface



Source: Mott MacDonald site visit March 2015

The petrographic investigation found an abundance of microcracks near to the concrete surface, most likely resulting from mechanical preparation of the surface to receive the adhesive mortar. The presence of microcracks beneath the concrete surface is expected to weaken the cohesive strength of the interface. In addition, no evidence of primers or bonding coats was found between layers.

It is likely that the ingress of water behind the cladding, leading to expansive freeze-thaw action during winter months, is the principal cause of debonding. The presence of sub-surface cracks within the concrete reduces the strength of the material and can provide an accelerated path for

water ingress along the interface between the cladding and the concrete. The forces induced by freeze-thaw action are expected to lead to coalescence of the cracks within this weakened plane. Subsequent water ingress will then penetrate further behind the cladding, gradually advancing the extent of debonding.

The pattern of damage, by which the most significant deterioration has occurred on the southern face of the building, suggests that thermal movements may also be a contributing factor to debondment.

Several other defects have been observed which are likely to contribute to the rate of deterioration by allowing the penetration of water behind the cladding. These include:

- Cracking through the cladding;
- Areas of missing tiles;
- Degraded sealant between panels and at windows;
- Degraded flashing.

In addition to the debonding of sections of the cladding at the concrete-mortar interface, localised instances of spalling caused by corrosion of reinforcing steel or other embedded steel objects have been observed. It is not considered that the corrosion of reinforcement is a large contributor to the failure of the cladding at this time. However, the presence of isolated areas of spalled concrete due to corrosion may indicate an emerging problem. An example of an area of spalling due to corrosion is shown in Figure 2.4.

Figure 2.4: Area of spalling due to corrosion of an embedded steel object



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

3 Extent and rate of deterioration

3.1 Survey Approach

Roped access surveys have proven to be the most successful approach to quantifying the nature and extent of deterioration to the cladding. These surveys are undertaken to visually inspect the condition of the cladding from within touching distance and to allow a hammer tap test. Poorly bonded areas of the cladding may be identified by the dull sound produced by the impact from a hammer.

The results are subject to the interpretation of the inspector however, and weather conditions may hinder the inspection. Some smaller areas of deterioration may be missed, or the extent of a defect underestimated. Assessment of the size of debonded areas is also semi-quantitative, therefore different inspectors may report slightly differing results.

The surveys which have been undertaken are:

- HRS services – July 2014
- Mott MacDonald / Up and Under – March 2018
- Mott MacDonald / Up and Under – November/December 2019.

A repeat visual inspection and hammer tap survey to the full extent of the main tower and machine hall annexes is to be undertaken in the second quarter of 2021.

3.2 Pattern of Deterioration and Rate of Development

Deterioration of the cladding has been identified to each elevation of the main tower and both annexes during all three surveys. The type and general distribution of the cladding defects has been found to be similar at each survey, and has worsened on each occasion. Debonding of cladding tends to be associated with panel edges, most likely as a result of water ingress at these areas.

The full defect schematics from the most recent (2019) survey are reproduced in Appendix A for reference. Photographs which accompany these elevation schematics are presented in Appendix B.

A significant increase in the number of defects was observed between the 2014 and 2018 surveys. The 2019 survey found that the development of defects had continued, although this was more modest. The majority of the known defects were found to be of a similar size and condition. Despite this, a number of new defects were identified and a small number of the known defects were observed to have worsened. From the information which is currently available, and owing to the different time periods between inspections and the subjective nature of the survey, it would be difficult to assess whether the rate of deterioration is steady or whether this is increasing.

External factors such as the weather and the implementation of remedial works, for example to seal the edges between cladding panels, is also expected to have an effect on the rate of debonding.

3.3 Areas of Particular Concern

Without intervention, larger areas of debonded cladding represent a serious hazard due to the increased likelihood of material falling from the building. It was previously suggested that any panel with a debonded area greater than 30% of the panel be considered high risk.

Due to the large size of the cladding panels present on the north and south elevations of the main tower, these are the areas of greatest concern. The south elevation in particular has a number of panels with multiple defects.

The defects noted to the east and west elevations of the main tower tend to be smaller in size, likely a combination of the smaller size of the cladding panels and better detailing between panels. The exception to this is at second floor level (above the annexe roof level), where there are a number of large areas of debonded cladding. These defects are almost continuous along the eastern elevation of the tower.

Many of the cladding defects which were identified to the machine hall annexes affected the first floor cantilever, which has now been over-clad. The most severe defects which remain affect the south elevation of both annexes, however these tend to be at ground level therefore have a reduced risk of causing injury or damage by spalling.

Several existing areas in which the cladding has been removed and reinstated with a cementitious material have been identified as hollow sounding. This includes areas of the repairs to the south elevation of the tower and also areas to the east elevation of the main tower.

4 Remedial Considerations

4.1 Retention of Existing Cladding

4.1.1 General

It may be possible to secure the existing mosaic tile cladding, most likely through mechanical pinning, the application of a reinforced coating or vacuum assisted grouting as outlined below.

There are major disadvantages to the retention of the existing façade by any one, or a combination, of these approaches.

For each approach consideration would have to be given to the final appearance of the building, as existing areas of deterioration (missing tiles, areas of removed cladding and areas of spalled concrete etc.) would not be addressed. Although it may be possible to source a similar product to the existing tiles, this is unlikely to seamlessly match the appearance of the original cladding.

Retention of the existing cladding would provide limited opportunity to gain the benefits of a modern cladding system.

A partial approach to the repair of the existing cladding, for example focussed on the debonded areas only, would tend to allow deterioration to continue in other areas. Further works to stabilise these additional areas of cladding would be required in the future, resulting in a greater lifetime repair cost and additional disruption to local residents and the occupants of the building.

4.1.1.1 Mechanical Fixing

Mechanical fixing comprises the installation of fixings through the cladding panels and into the structural concrete, to retain the cladding panels against the structure. Multiple fixings would be required per cladding panel (this would also depend on the presence of cracks). The fixings would need to be stainless steel to ensure that corrosion of these, which would induce further deterioration in the cladding panels, does not occur.

Mechanical fixing would restrain the cladding panels but would not prevent water ingress. As a result, the cladding would be expected to debond further, and the spalling of smaller areas of cladding from between fixing points would remain a possibility. Installation of an expanded metal mesh would therefore be recommended to retain loose cladding material in the area between fixings.

This approach may not be considered to be desirable due to the visibility of the fixings and mesh on the surface of the cladding, and the fact that it does not prevent further deterioration but merely holds on the loose material. Periodic removal of spalled material is likely to be required.

It may be considered as a short to medium term solution.

4.1.1.2 Reinforced Coatings

Reinforced coatings have been successfully used to stabilise smaller spalls in other structures, however this approach would be unlikely to have sufficient strength to restrain larger areas of debonded cladding.

The application of a reinforced coating would likely have to be used in combination with another approach to secure larger areas of debonded cladding. The coating manufacturer would be

required to determine the minimum area of debonded cladding which would not require additional fixing.

Typically, a reinforced coating would comprise an initial bonding coat followed by a glass reinforced scrim, which is then over-coated with a different colour top coat. If the base coat is applied too thinly the scrim cannot be fixed in, and if the top coat is applied too thinly the scrim will show through so there is some degree of in built quality control.

The coating would provide a moisture barrier to limit further water ingress and control further deterioration. It would also provide a uniform finish to the structure if applied to all areas.

The longevity of this approach would be equal to the longevity of the coating plus a period afterwards where moisture would penetrate and further debonding occur. This would be expected to provide a medium-term solution, however periodic maintenance is expected to be required.

4.1.1.3 Vacuum Assisted Grouting

The basis of the technique is to create a sealed system to allow the air to be extracted from the void behind a debonded cladding panel, and introduce resin to the void under low pressure to form a bond between the rear of the cladding panel and the structural concrete.

Vacuum assisted grouting would be preferred over positive pressure resin injection, as the latter would risk further debonding of panels. Resin is also better able to enter blind cracks when a vacuum is used rather than positive pressure.

The repair method is carried out to the existing cladding with minimal alteration to its appearance. A trial of vacuum assisted grouting was undertaken in August 2018 by Balvac Ltd, which confirmed that satisfactory results can be achieved. The void behind the panel was filled and the bond strength achieved was adequate.

Quantification of the volume of resin which would be required is difficult on the basis of the hammer tap survey however, as the depth of the void behind each hollow sounding panel is unknown.

The major disadvantage is that the technique can only be utilised in areas where there is an existing void behind the cladding panel. Debonding of the cladding would be expected to continue in other areas which had not been treated, therefore it would still be recommended that annual hammer tap surveys be undertaken to identify the emerging risk. Additional repairs would be expected to be required at regular intervals, resulting in additional costs and disruption similar to the other options for retention of the existing cladding.

To minimise the need for ongoing repairs vacuum assisted grouting could be supplemented by mechanical fixing. This would however result in there being visible fixings in some areas, creating an overall poor final appearance.

Grouting of the void between the concrete and the adhesive render would also not prevent the spalling of tiles or the cladding bedding layer, the risk of spalling material therefore would not be fully eliminated.

4.2 Replacement of Cladding with a Similar System

Removal of the existing mosaic tile cladding to allow the installation of a similar system or rendering of the exterior of the building would fully remove the immediate risk from debonded cladding and provide an aesthetic benefit, but will not provide a large opportunity for additional benefits such as improvement of the thermal efficiency of the building.

Replacement of the cladding is likely to receive a longer guarantee than the repair options discussed above.

Ultimately a similar replacement system or render will be expected to eventually debond and require future replacement.

The controlled removal and disposal of the existing cladding, waste produced by surface preparation of the concrete substrate and the critical role of the surface condition make this option less attractive than the installation of cladding over the existing mosaic tiling.

4.3 Installation of Over-cladding

The installation of a modern fire compliant over-cladding system could be undertaken without it being necessary to remove the existing mosaic tiling. The fixings used to support the new cladding system would be anchored into the structural concrete. A suitable arrangement of batons and mesh would then be used to restrain the mosaic tile cladding and prevent the spalling of any additional material.

The installation of over-cladding would be expected to prevent all but minor ingress of water to the existing cladding surface, and would also provide a less variable range of temperature exposure by limiting direct sunlight. Both of these factors would be expected to contribute to a reduction in the rate of additional debonding of the existing cladding. Combined with the installation of a suitable arrangement of batons and mesh, this is expected to result in a very low risk of further material spalling from the mosaic cladding.

Over-cladding of the building would provide the greatest opportunity to improve the appearance of the building as the installation can be undertaken to all areas within a single programme of works. This being the case, the disruption to occupants of the building is expected to be minimised due to the avoidance of additional cycles of work (which, as described above, is expected for retention of the existing cladding).

It would be necessary to size the fixings to accommodate the self-weight loading from both the existing mosaic tile cladding and the newly installed cladding system, in addition to any dynamic loads. As for the mechanical fixing option, it is recommended that stainless steel fixings would be used to avoid corrosion causing further deterioration of the existing cladding.

There are various design considerations, for example the detailing around window reveals and other openings and the compatibility with glazing systems which may be installed, however these would be addressed with the Manufacturer following the selection of a cladding system.

This option would also typically provide a longer guarantee period than the options for retention of the existing cladding as the façade of the building.

4.4 Discussion

Five potential remedial approaches have been reviewed as part of this study. Three of these are for the repair of the existing cladding, one is for replacement, and the final described approach is to retain and over-clad the existing bonded mosaic cladding.

Should the existing cladding be repaired by either vacuum injection or reinforced coating methods, the hazards associated with debonded cladding will not be fully eliminated. It is expected that regular inspections and periodic repairs would continue to be required to manage the ongoing risk. The third option for repair, mechanical fixing, is associated with obtrusive disruption to the appearance of the building. It is therefore unlikely to be consistent with the principles used in the original design of the building, or those to be used in the design of any remedial scheme.

Replacement of the existing cladding with a similar system, or rendering of the external elevations of the building is unlikely to be favourable due to additional considerations resulting from the removal and disposal of the existing cladding, waste produced due to preparation of the surface of the concrete substrate and the critical role of the surface condition on the durability of the façade.

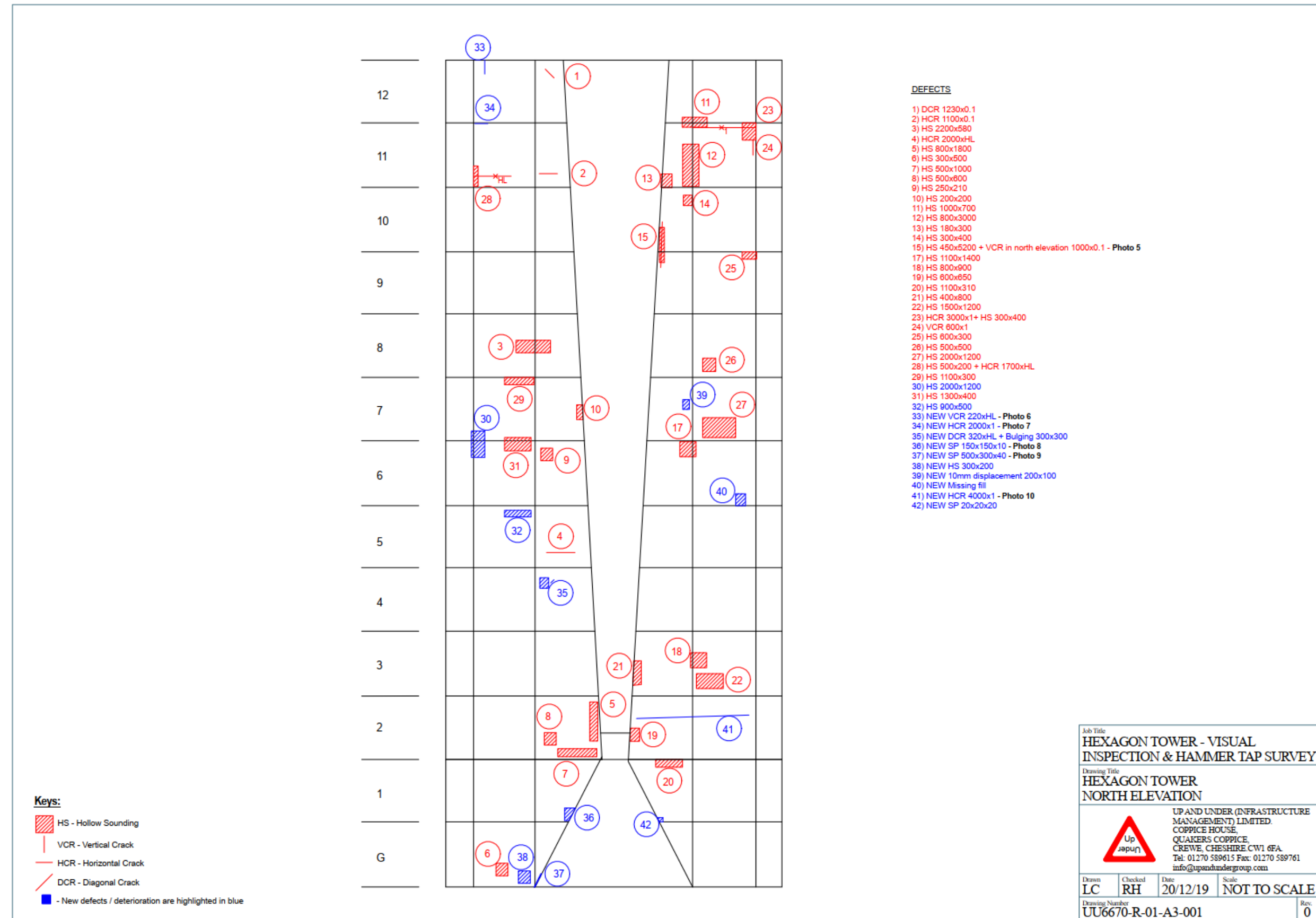
It is considered that over-cladding represents the greatest opportunity to provide an attractive and low-maintenance building façade which retains the existing architectural form, whilst eliminating the risk of debris falling from the building without necessitating removal of the existing cladding. As the regular surveys and periodic remedial work which would be associated with retention of the existing façade will not be required, this option is expected to cause the least disruption for the tenants of the building in the long term. It is also likely to be associated with the greatest guarantee period of the options considered, allowing future investment in the building to be better planned and delivered.

Appendices

A.	Defect Schematics (December 2019)	13
B.	Defect Photographs (December 2019)	24

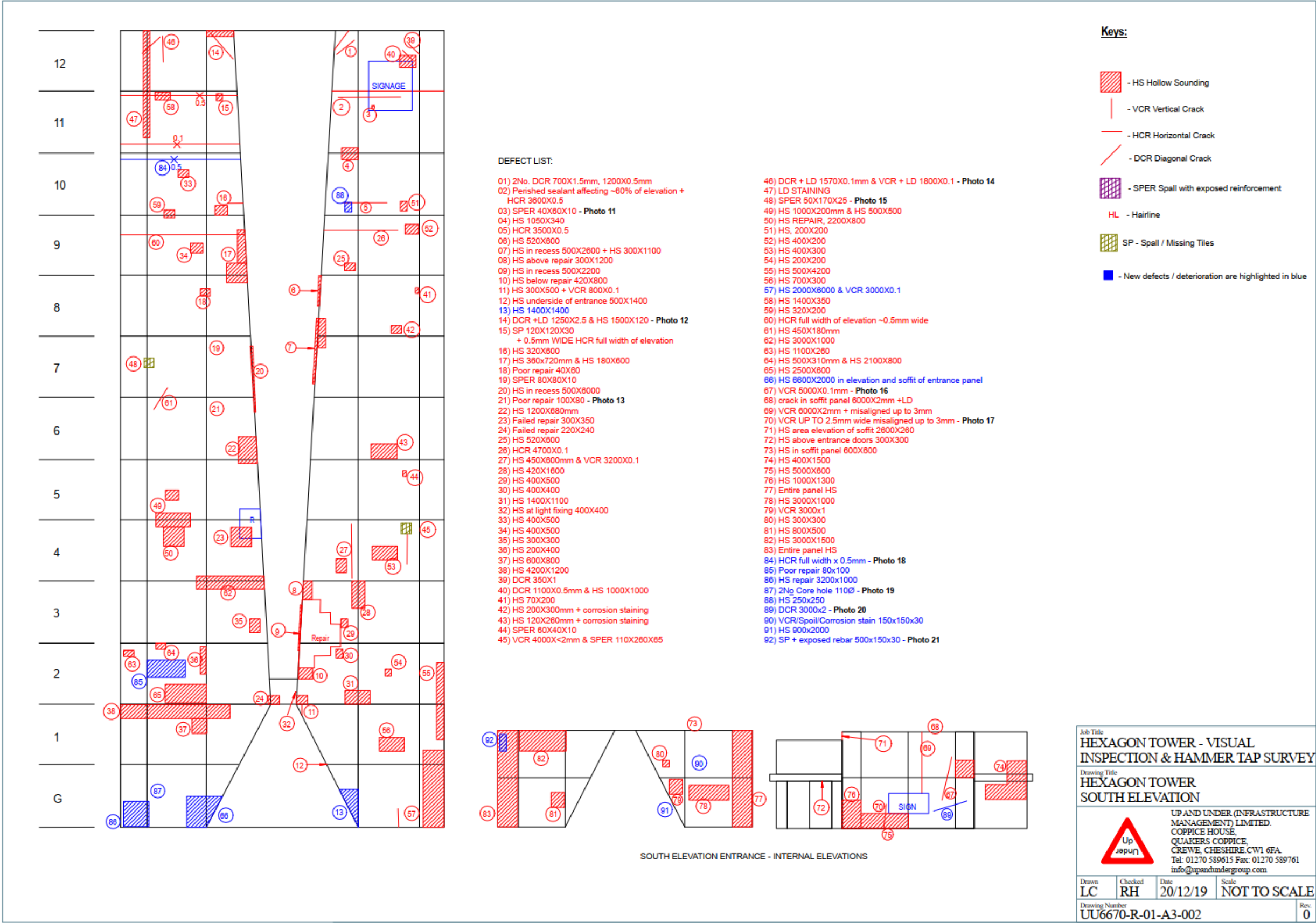
A. Defect Schematics (December 2019)

Figure A.1: Hexagon Tower north elevation defects (December 2019)



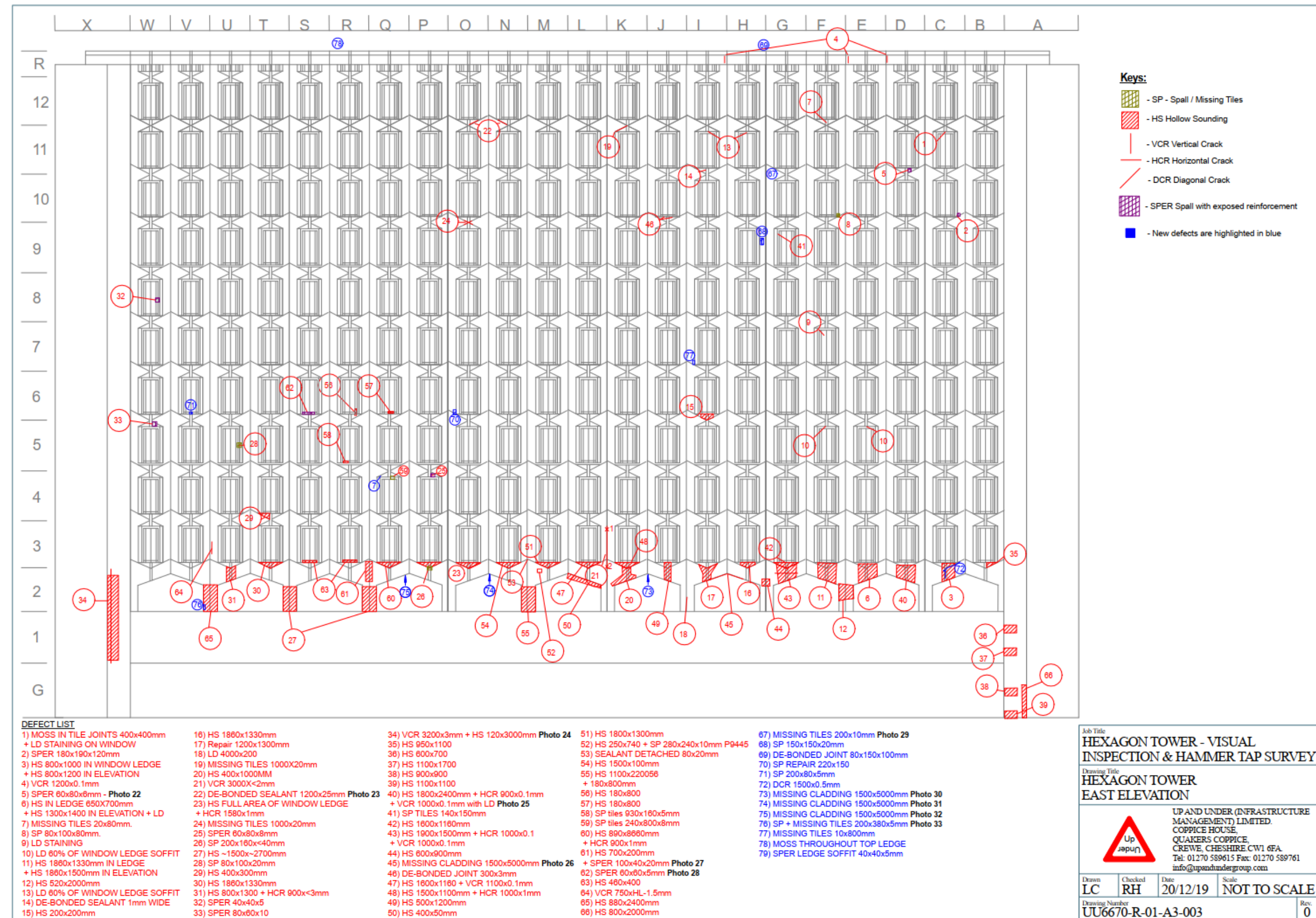
Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019 (note that these drawings were produced by Up and Under Ltd for Mott MacDonald Ltd, and should not be relied upon by any Third Party)

Figure A.2: Hexagon Tower south elevation defects (December 2019)



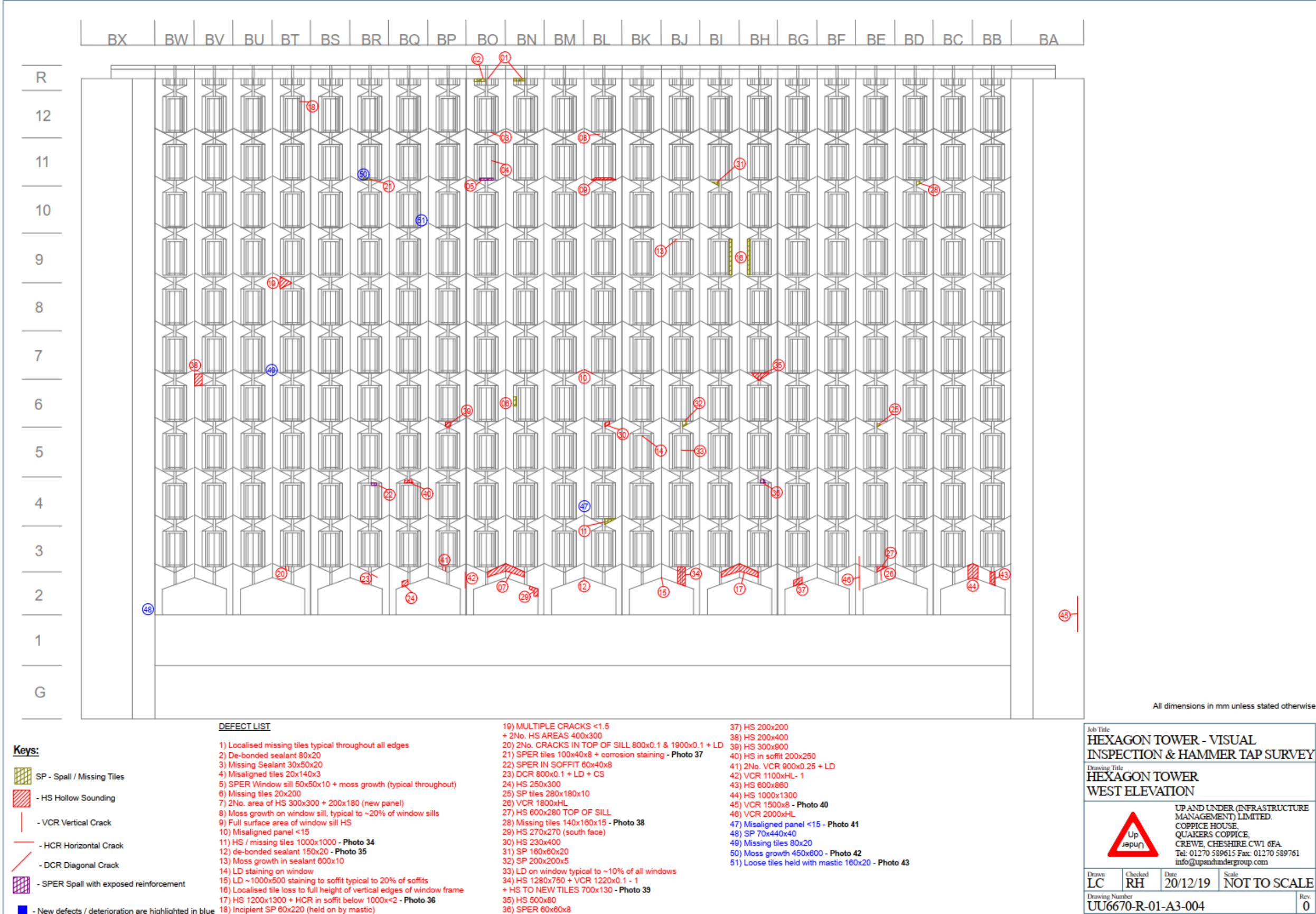
Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019 (note that these drawings were produced by Up and Under Ltd for Mott MacDonald Ltd, and should not be relied upon by any Third Party)

Figure A.3: Hexagon Tower east elevation defects (December 2019)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019 (note that these drawings were produced by Up and Under Ltd for Mott MacDonald Ltd, and should not be relied upon by any Third Party)

Figure A.4: Hexagon Tower west elevation defects (December 2019)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019 (note that these drawings were produced by Up and Under Ltd for Mott MacDonald Ltd, and should not be relied upon by any Third Party)

Area covered in metal cladding, so defects could not be confirmed.

2

1

G

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

DEFECT LIST:

01) HS 200x940 (covered in metal cladding)
 02) SP 3800x180x20 (covered in metal cladding)
 03) HS 900x940 (covered in metal cladding)
 04) SP 1250x400x20 (covered in metal cladding)
 05) SP 2000x250x40 (covered in metal cladding)
 06) 3No. HCR 2800x0.1 + LD Photo 45
 07) HS 1150x280 + LD
 08) SP 900x300x20 + HCR 1800x <2 (covered in metal cladding)
 09) HS 720x900 + LD (covered in metal cladding)
 10) SP 690x280x50
 11) HS 800x450 (covered in metal cladding)
 12) HS 750x900 (covered in metal cladding)
 13) HS 1200x940 + LD (covered in metal cladding)
 14) HS 50x520 (covered in metal cladding)
 15) HCR 1700x0.1 (covered in metal cladding)
 16) HS 900x940 (covered in metal cladding)
 17) Multiple HCR throughout 1800x4 (covered in metal cladding)
 18) HS 420x560 (covered in metal cladding)
 19) HS 1200x250
 20) SP 1500x320x50
 21) VCR 1100xHL + LD Photo 46
 22) VCR 3200x0.5 + LD Repaired Photo 47
 23) VCR 3000x3 Photo 48
 24) SP 20x50x10 Photo 49
 25) SP 110x240x30 Photo 50
 26) SP 40x30x5
 27) VCR 1800x5 Photo 51 and 52
 28) VCR 900xHL + HCR 900xHL

Keys:

HS - Hollow Sounding
 VCR - Vertical Crack
 HCR - Horizontal Crack
 DCR - Diagonal Crack
 SP - Spall / Missing Tiles
 LD - Leached Deposits
 - New defects / deterioration are highlighted in blue

All dimensions in mm unless stated otherwise

Job Title
HEXAGON TOWER

Drawing Title
**WEST MACHINE HALL
 NORTH ELEVATION**

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Date
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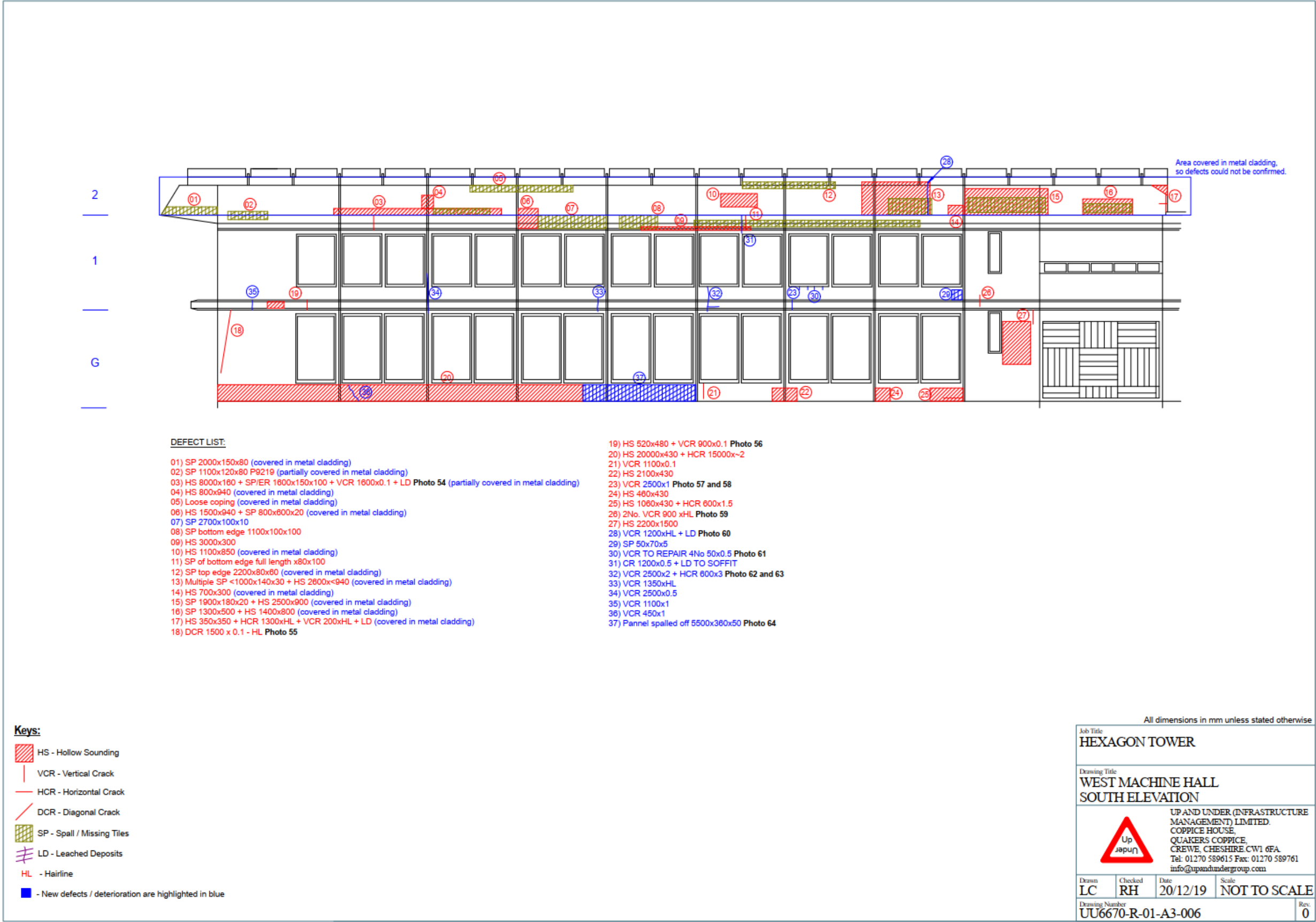
Scale
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Drawing Number
 UU6670-R-01-A3-005

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 0

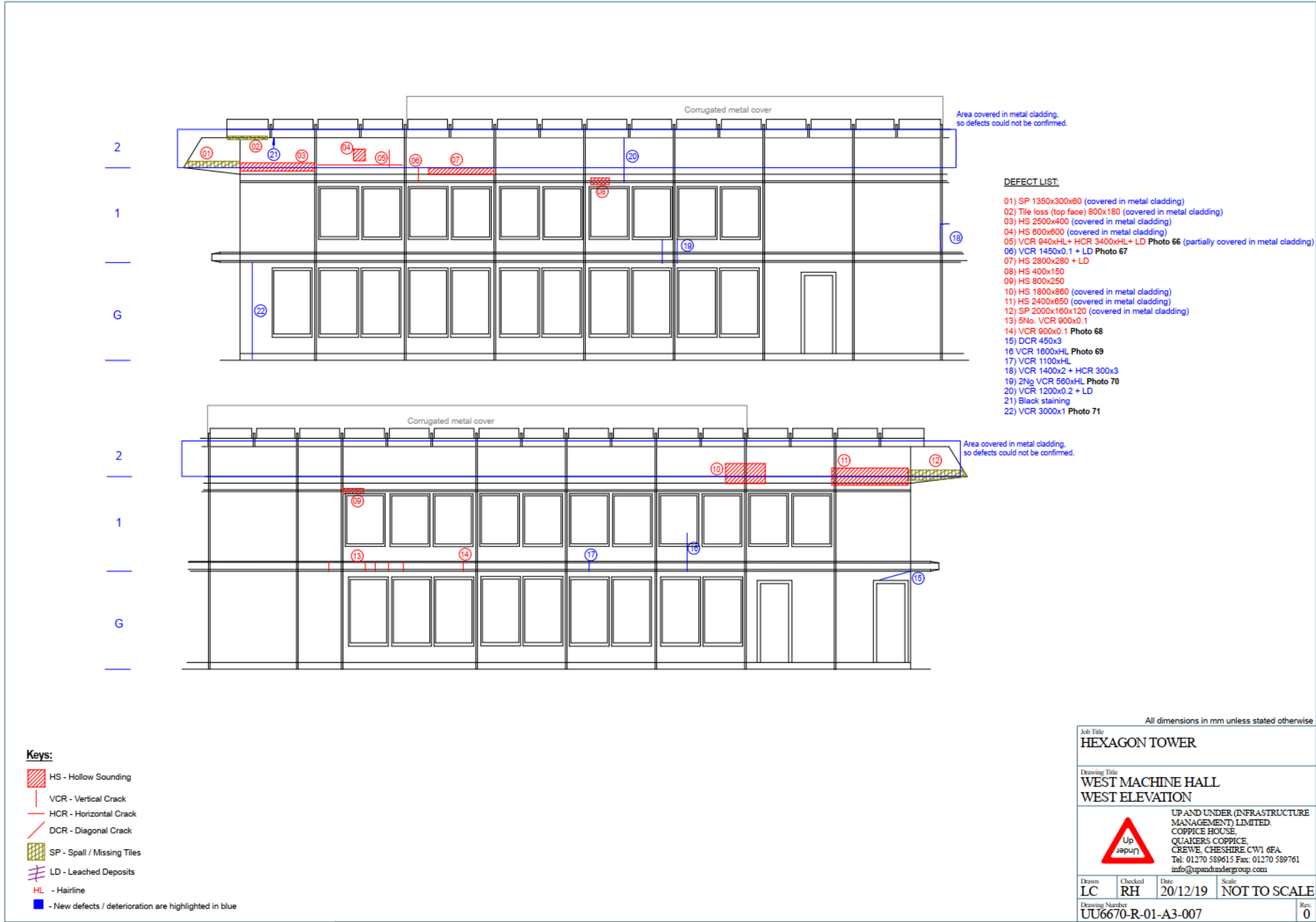
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Figure A.6: Hexagon Tower West Machine Hall south elevation defects (December 2019)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019 (note that these drawings were produced by Up and Under Ltd for Mott MacDonald Ltd, and should not be relied upon by any Third Party)

Figure A.7: Hexagon Tower West Machine Hall west elevation defects (December 2019)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019 (note that these drawings were produced by Up and Under Ltd for Mott MacDonald Ltd, and should not be relied upon by any Third Party)

DETECT LIST:

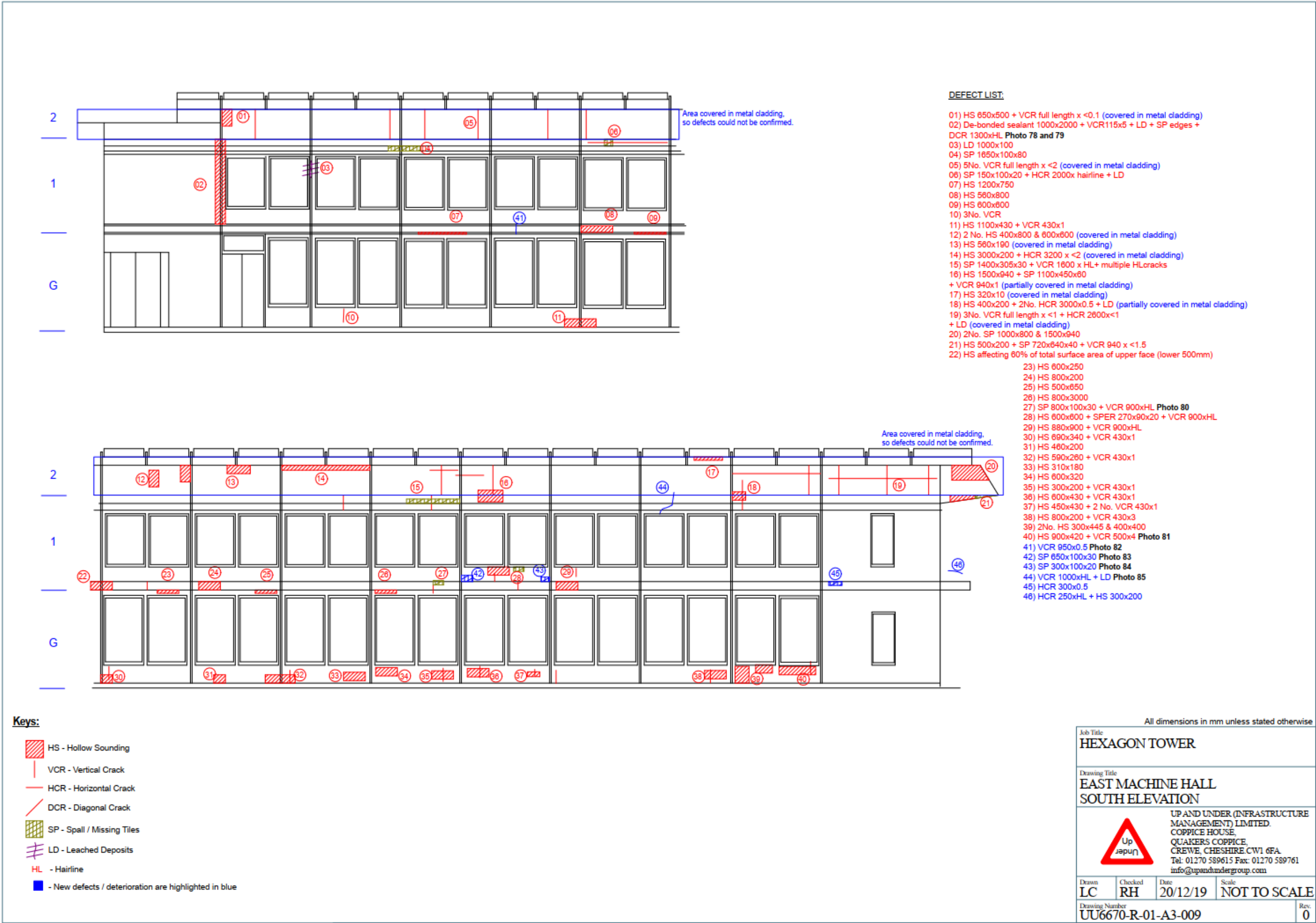
- 01) HS 3100x300 (covered in metal cladding)
- 02) VCR 940x3 (covered in metal cladding)
- 03) HS full length of edge (covered in metal cladding)
- 04) 2 No. SP 320x480 & 380x250 + HS 600x300 (covered in metal cladding)
- 05) HS + LD + CR 1100x400 (covered in metal cladding)
- 06) VCR + HCR + LD typically 940x0.1 (covered in metal cladding)
- 07) VCR 940x0.1 (covered in metal cladding)
- 08) VCR 940x0.1 + HS 700x400 (covered in metal cladding)
- 09) HS 300 x 200
- 10) SP 250x250x30 Photo 73
- 11) VCR 850xHL Photo 74
- 12) SP 60x60x10 + HS 400x400
- 13) HS 2000x300
- 14) HCR 1000x0.2
- 15) VCR 500x0.4
- 16) Localised SP typically 1200x40x40 + HCR full length x< 5 (covered in metal cladding)
- 17) HS 900x900 + VCR 940x0.1 + LD (partially covered in metal cladding)
- 18) SP 1580x400 (covered in metal cladding)
- 19) LD 120x700
- 20) HS 1000x280
- 21) HS 500x500 + VCR 1000xHL
- 22) HS 1000x1000
- 23) HS 1000x1000
- 24) HS 9000x280 + SP 450x400x5
- 25) HS 1000x400
- 26) VCR 2200x0.2 Photo 75
- 27) SP 420x20x50 Photo 76

KEYS:

- HS - Hollow Sounding
- VCR - Vertical Crack
- HCR - Horizontal Crack
- DCR - Diagonal Crack
- SP - Spall / Missing Tiles
- LD - Leached Deposits
- HL - Hairline
- New defects / deterioration are highlighted in blue

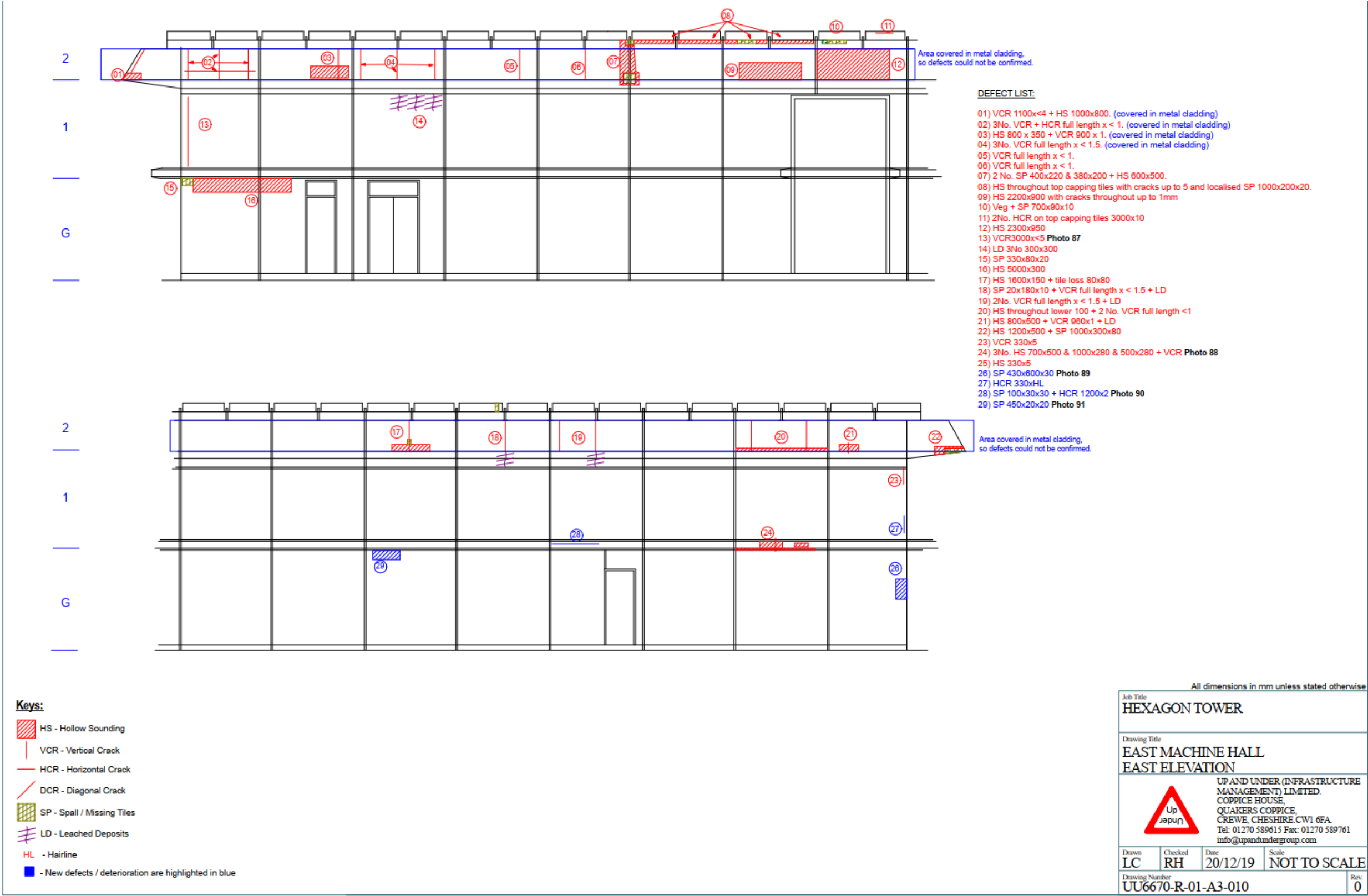
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Figure A.9: Hexagon Tower East Machine Hall south elevation defects (December 2019)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019 (note that these drawings were produced by Up and Under Ltd for Mott MacDonald Ltd, and should not be relied upon by any Third Party)

Figure A.10: Hexagon Tower East Machine Hall east elevation defects (December 2019)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019 (note that these drawings were produced by Up and Under Ltd for Mott MacDonald Ltd, and should not be relied upon by any Third Party)

B. Defect Photographs (December 2019)

Photo B.1: General view of the north elevation of Hexagon Tower



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.2: General view of the south elevation of Hexagon Tower



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.3: General view of the east elevation of Hexagon Tower



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.4: General view of the west elevation of Hexagon Tower



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.5: A view showing a vertical crack to the 10th storey of the north elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.6: A view showing a new vertical crack in the 12th storey of the north elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.7: A view showing a new horizontal crack to the 11th storey of the north elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.8: A view showing a 'new' area of spalling to the 1st storey of the north elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.9: A view showing a 'new' area of spalling at ground level in the north elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.10: A view showing a 'new' horizontal crack to the 2nd storey of the north elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.11: A view showing an area of spalling with exposed steel in the 11th storey of the south elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.12: A view showing a diagonal crack with leaching deposits to the 12th storey of the south elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.13: A view showing a poor repair to the 6th storey of the south elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.14: A view showing a diagonal crack with leachate deposits to the 12th storey of the south elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.15: A view showing an area of spalling with exposed reinforcement at a joint in the 7th storey of the south elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.16: A view showing a vertical crack in the internal face of the south entrance



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.17: A view showing a vertical crack in the internal face of the south entrance



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.18: A view showing a full width horizontal crack in the 10th storey of the south elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.19: A view showing two repaired core holes in the south elevation at ground level



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.20: A view showing a diagonal crack in the internal face of the south entrance



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.21: A view showing an area of spalling with exposed reinforcement to the south entrance



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.22: A view showing an area of spalling with exposed reinforcement to the east elevation (row D storey 11)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.23: A view showing de-bonded sealant to the east elevation (row O storey 12)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.24: A view showing a vertical crack with hollow sounding cladding to the east elevation (row X storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.25: A view showing an area of hollow sounding cladding with a vertical and horizontal crack in the east elevation (row D storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.26: A view showing missing cladding to the east elevation (row I storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.27: A view showing spalling with exposed reinforcement to the east elevation (row R storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.28: A view showing spalling with exposed reinforcement to the east elevation (row S storey 6)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.29: A view showing missing tiles to the east elevation (row G storey 11)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.30: A view showing missing cladding to the east elevation (row K storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.31: A view showing missing cladding to the east elevation (row O storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.32: A view showing missing cladding to the east elevation (row Q storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.33: A view showing missing tiles to the east elevation (row V storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.34: A view showing missing tiles to the west elevation (row BL storey 4)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.35: A view showing de-bonded sealant (row BM storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.36: A view showing a horizontal crack in the window reveal soffit of the east elevation (row BI storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.37: A view showing spalling with exposed reinforcement (row BR storey 11)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.38: A view showing missing tiles to the west elevation (row BD storey 11)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.39: A view showing hollow sounding repaired cladding (row BJ storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.40: A view showing a vertical crack in the west elevation (row BA storey 2)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.41: A view showing a misaligned panel to the west elevation (row BM storey 4)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.42: A view showing moss growth to the west elevation (row BR storey 11)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.43: A view showing loose tiles to the west elevation (row BQ storey 10)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.44: General view of the north elevation of the west machine hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.45: A view showing a horizontal crack in the elevation (West machine hall north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.46: A view showing a crack in the soffit of the upper cantilever (West machine hall north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.47: A view showing a repaired vertical crack to the elevation (West machine hall north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.48: A view showing a vertical crack in the north elevation of the West machine hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.49: A view showing spalling to the corner of the doorway (West machine hall north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.50: A view showing spalling to the soffit of the upper cantilever (West machine hall north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.51: A view showing a crack in the top face of the lower cantilever (West machine hall north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.52: A view showing a crack in the soffit of the lower cantilever (West machine hall north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.53: General view of the south elevation of the west machine hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.54: A view showing a crack in soffit of the upper cantilever (West machine hall south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.55: A view showing a diagonal crack in the south elevation (West machine hall)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.56: A view showing a crack in the top face of the lower cantilever (West machine hall, south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.57: A view showing a crack in the top face of the lower cantilever (West machine hall south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.58: A view showing a crack in the lower cantilever elevation (West machine hall south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.59: A view showing a crack to the top face of the lower cantilever (West machine hall, south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.60: A view showing a crack in the soffit of the upper cantilever (West machine hall, south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.61: A view showing vertical cracks in a repair below the window sill (West machine hall south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.62: A view showing a horizontal crack in the elevation of the lower cantilever (West machine hall, south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.63: A view showing a vertical crack in the south elevation of the West machine hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.64: A view showing a section of missing cladding to the south elevation of the West machine hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.65: General view of the west elevation of the west machine hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.66: A view showing a vertical crack in the west elevation of the West Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.67: A view showing a crack in the soffit of the upper cantilever (West Machine Hall, west elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.68: A view showing a crack in the top face of the lower cantilever (West Machine Hall)



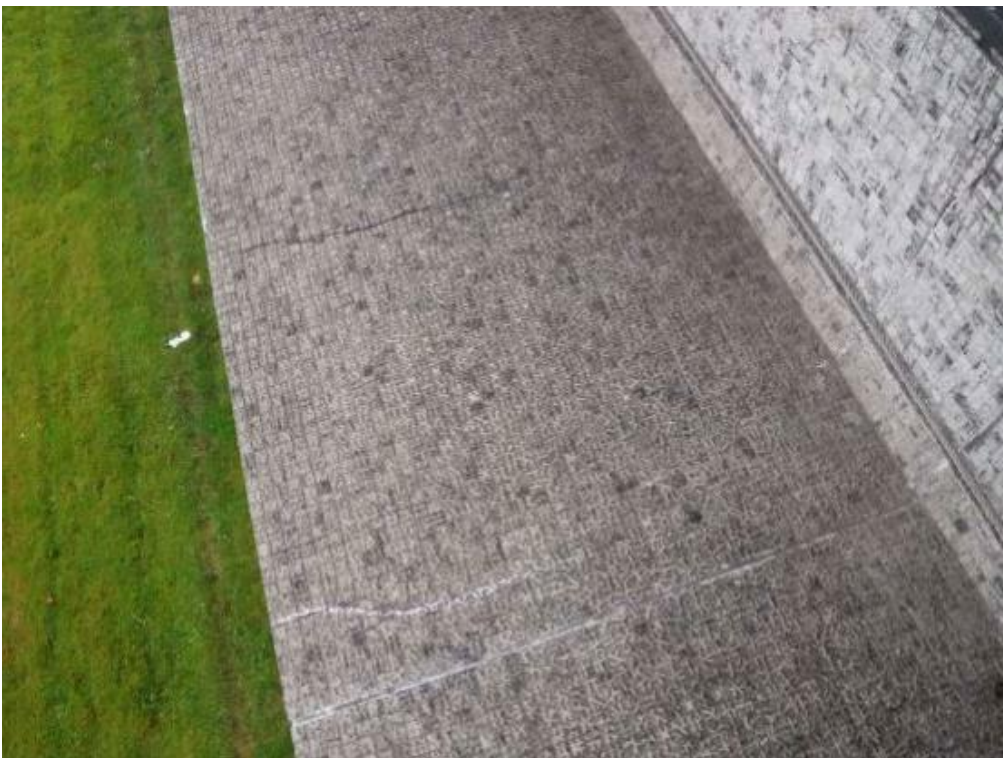
Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.69: A view showing a vertical crack in the west elevation (West Machine Hall)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.70: A view showing two cracks in the top face of the lower cantilever (West Machine Hall, west elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.71: A view showing a vertical crack to the elevation (West machine hall west elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.72: General view of the north elevation of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.73: A view showing spalling to the edge of the lower cantilever (East Machine Hall, north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.74: A view showing a crack in the top of the lower cantilever (East Machine Hall, north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.75: A view showing a crack in the soffit of the lower cantilever (East Machine Hall, north elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.76: A view showing an area of spalling above a window in the north elevation of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.77: General view of the East Machine Hall, south elevation



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.78: A view showing de-bonded sealant in the south elevation of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.79: A view showing de-bonded sealant in the top of the lower cantilever (East Machine Hall, south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.80: A view showing vertical and horizontal cracks in the south elevation of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.81: A view showing a vertical crack in the south elevation of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.82: A view showing a crack in the top face of the lower cantilever (East Machine Hall, south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.83: A view showing an area of spalling to base of the mosaic panel (East Machine Hall, south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.84: A view showing a spall to the base of the mosaic panel (East Machine Hall, south elevation)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.85: A view showing a crack in the soffit of the upper cantilever of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.86: General view of the east elevation of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.87: A view showing a vertical crack in the east elevation of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.88: A view showing a horizontal crack in the east elevation of the lower cantilever (East Machine Hall)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.89: A view showing spalled cladding on the east elevation of the East Machine Hall



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.90: A view showing an area of spalling and a horizontal crack in the east elevation of the lower cantilever (East Machine Hall)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.91: A view showing spalling to the soffit of the lower cantilever (East Machine Hall)



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

Photo B.92: General view of the south entrance to Hexagon Tower



Source: Up and Under Ltd, Report UU6670-R-01 Hexagon Tower (00), December 2019

