StructureMode

Structural Addendum Report

Flat 4, 24 Narrow street, E14 8DQ

Cantilever balconies at Fourth and Fifth Floor Level

Job No.: 00873

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This report is submitted on the basis of the following conditions.

1. The purpose of this report is limited to offering an opinion on the structural condition of the balconies at fourth and fifth floor levels only at the rear of Flat 4, 24 Narrow street. We shall only report on the structural defects that may materially affect the stability of the balconies with the provision that these are reasonably detectable at the time of inspection.

2. Whilst we will use all reasonable skill and care in preparing this report, it should be appreciated that we cannot offer any guarantee that rear balconies will be free from movement in the future. We can only advise on the current condition of the balconies.

3. We have not inspected beyond surface level visibility or those parts of the structure that are covered, unexposed or inaccessible and we are unable therefore to report such parts are free from corrosion, rot, insect infestation or other defects.

4. We have not observed or made any comments on issues relating to electrical wiring, plumbing, drainage, damp issues or deleterious materials (such as asbestos etc) that may exist in the property. Nor have we commented on any other services which would normally be offered by a Building Surveyor.

5. **This report has been provided for the benefit of our Client, Moira Clinch, and her professional advisers.** No liability can pass to any third party who makes use of this report for any purpose whatsoever.

CONTENTS

Text of Addendum Report in Red.

1. Introduction

Geoff Morrow and Stuart Hancock, acting for and on behalf of StructureMode Ltd, visually inspected the rear balconies at Flat 4, 24 Narrow street, E14 8DQ. The inspection took place on 05/12/2018 at 10:30 and then again on 27th October 2020 at 10am, with the surveys confined to a visual inspection of the rear balconies at fourth and fifth floors only. In 2018 it was an overcast day, with rainfall one hour before inspection. A dry spell during inspection was followed by further light at the end of inspection. On 2020 it was a bright and dry but cloudy day.

On both occasions access to the property below, (3rd floor) was granted, enabling inspection of the underside and the topside of each balcony. The balcony steelwork is visible, comprising of a balustrade, steel plate deck, angle iron and I beam structural frame with angle iron propping on the underside.

No testing of materials was conducted; therefore, observations are limited to items that were visible at the time of inspection.

The building is a converted industrial warehouse on the embankment of the river Thames with the balconies (each apartment has at least one balcony) representing a later addition to the building. Exposed timber joist ends remain visible on the exterior, along with signs of wear/abrasion suggesting the warehouse property originally had pulley/hoist jibs to lift goods between river and floors.

The arches above the windows and doors looking out towards the river appear to be solid brickwork, with the surrounding walls also appearing to be solid brickwork, with an approximate thickness of 450mm. The mortar between bricks on the exterior of the wall appears to be of various types, age and condition, indicative of repair at different occasions.

Construction material appears to be an unknown grade of mild steel with multiple layers of paint in different conditions. Some locations show paint with no visible damage, other areas show visible signs of corrosion under paint with oxidation 'bubbles' apparent, with other area completely exposed. The structural frame supporting the deck comprises of 'I beams' and angle section. This is tied back to the wall, acting as a cantilever. The members that run parallel to the wall are supported upon the member that run perpendicular to the wall. The connection method between these members varies: some are welded whilst some others are bolted.

Mild steel plate with a checkered diamond pattern (tread plate) spans between the members beneath. The plate has been welded from the underside to the frame. Propping consisting of angle section has been installed, with bolted connection to both the wall and the steel frame forming a propped cantilever system.

2. Observations and Discussion (5th December 2018)

2.1 The fifth-floor balcony

2.1.1 The fifth-floor balcony spans marginally wider than the width of the double doors that allow access.

2.1.2 The structural system is a cantilever beam with diagonal bracing tying back to the brickwork above as seen in Figure 1, point A

2.1.3 A unusual combination of welded/bolted connections are used shown in Figure 1and Figure 2 , points A,B and C

Figure 1 - Fifth floor balcony

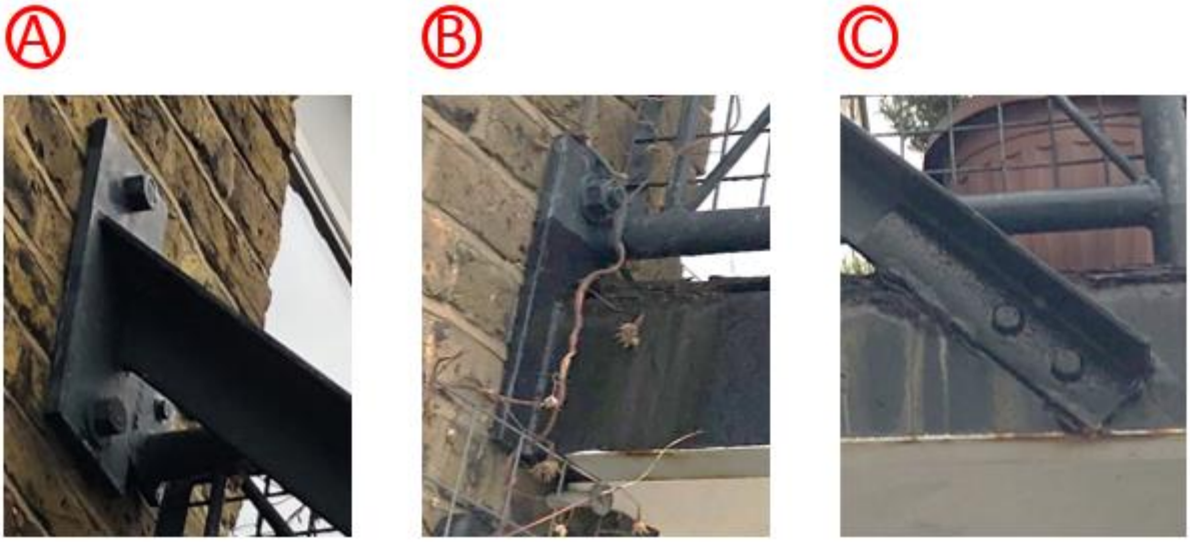


Figure 2 - Close up details of connections

2.1.4 The diagonal support members (props) are bolted to the brickwork and the cantilever structural frame. The propping members are also welded to the connection plate of the balustrade. The bottom of the balustrade is also welded to the cantilever joist, at the plate/brickwork connection. This is also shown in Figure 3.

Figure 3 - Diagonal bracing to brickwork fixing (left) and Cantilever brickwork connection

2.1.5 Two steel treadplates form the deck, which are stitch welded to structural frame. Figure 4 shows plate corrosion at various locations on the 5th floor balcony.

Figure 4 - Corrosion on fifth floor deck, (Top Left) across surface, (Top Right & Lower Right) Butted region of plates in centre of balcony, (Lower Left) design encouraging water to drip and collected at edge of plate.

2.1.6 The underside of the 5th floor deck and frame displaying extensive signs of corrosion. (Figure 5)

Figure 5 - Underside of fifth floor deck

2.1.7 The central member, steel angle section, positioned beneath the butted connection of the plates above, appears to cause entrapment of water, which enters from the crevice above, created by butting the plates and not providing adequate sealing or incline of the deck for drainage

Figure 6 - Central support (Left) and the material flaking away (right)

2.1.8 The steel angle section supporting the central deck plate butt is not fastened to the plates, with the 'spacer' material (this is likely steel which has completely oxidised) between support member and plate, simply flaking away when touched.

2.2 The fourth-floor balcony

2.2.1 The balcony runs along the whole width of the property, accessed via double doors. Figure 7

Figure 7 - Fourth floor balcony

2.2.2 The Balconies decking is designed to be horizontal with no incline for drainage, encouraging water to puddle and pool. This is exacerbated by minor deflection of the tread plate between supporting members creating a depression on the surface. In some locations, holes have been drilled to enable pooled water to drain through the plate, which in turn has encouraged further corrosion loci, displayed below in Figure 8.

Figure 8 - Underside of fourth floor deck and drilled holes

2.2.3 The structural frame is composed of I beam's bolted back to the wall, in a semi continuous fashion, with some elements independently fastened to wall (B), others welded to backing plate (A) shown in Figure 9.

Figure 9 - Underside of fourth floor balcony deck, with diagonal propping

2.2.4 The balustrade design offers some structural rigidity utilising internal cross bracing members. It is not clear whether this was the intention. The connection to the stonework is bolted. The stud that has pulled out (Figure 10 and Figure 11), is short and appears to be a simple bolt (set screw) with the head cast into mortar, situated in a damaged brick. The threaded body of the bolt extends out past the connection plate. This bolt is no longer connected to the wall in any manner, subsequently this balcony connection point is offering no structural support.

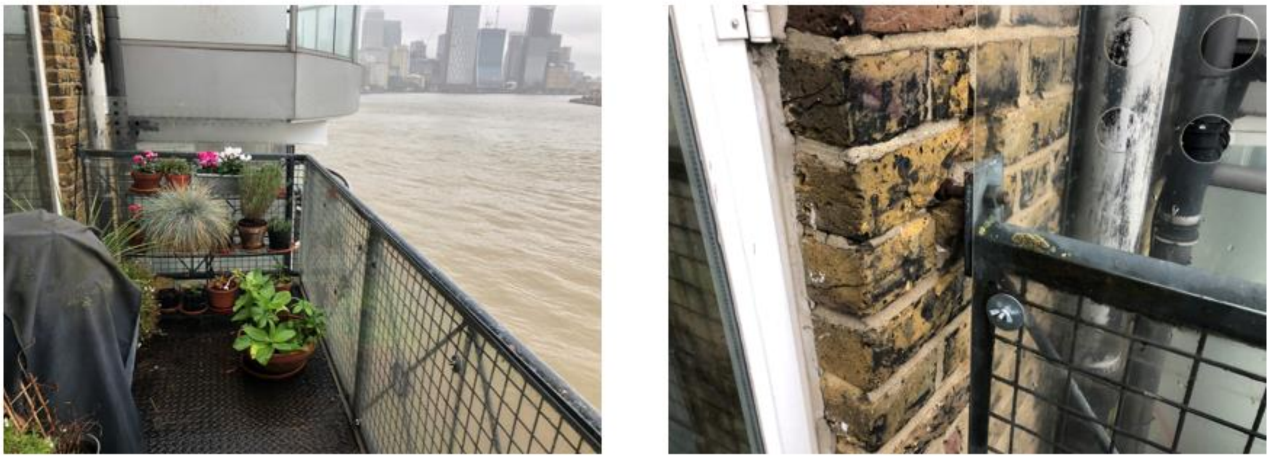


Figure 10 - Balustrade and connection to wall

2.2.5 At the opposing end of the balcony balustrade, the same connection design is utilised but is implemented differently as shown in Figure 11, with a traditional anchoring into the wall, although it is not possible to determine the depth into the brickwork.

Figure 11 - Fourth floor balustrade - both ends connection to wall for comparison

2.2.6 Where the balustrade fixing has pulled out from the wall, the structural frame which supports the tread plate, has also moved outwards from the original surface of the wall. In this instance the surrounding brickwork has moved outwards (Figure 12).

This has created a vertical region where the brick work has moved outwards away from the wall, breaking the mortar, highlighted with red line in Figure 12, a close up in Figure 13.

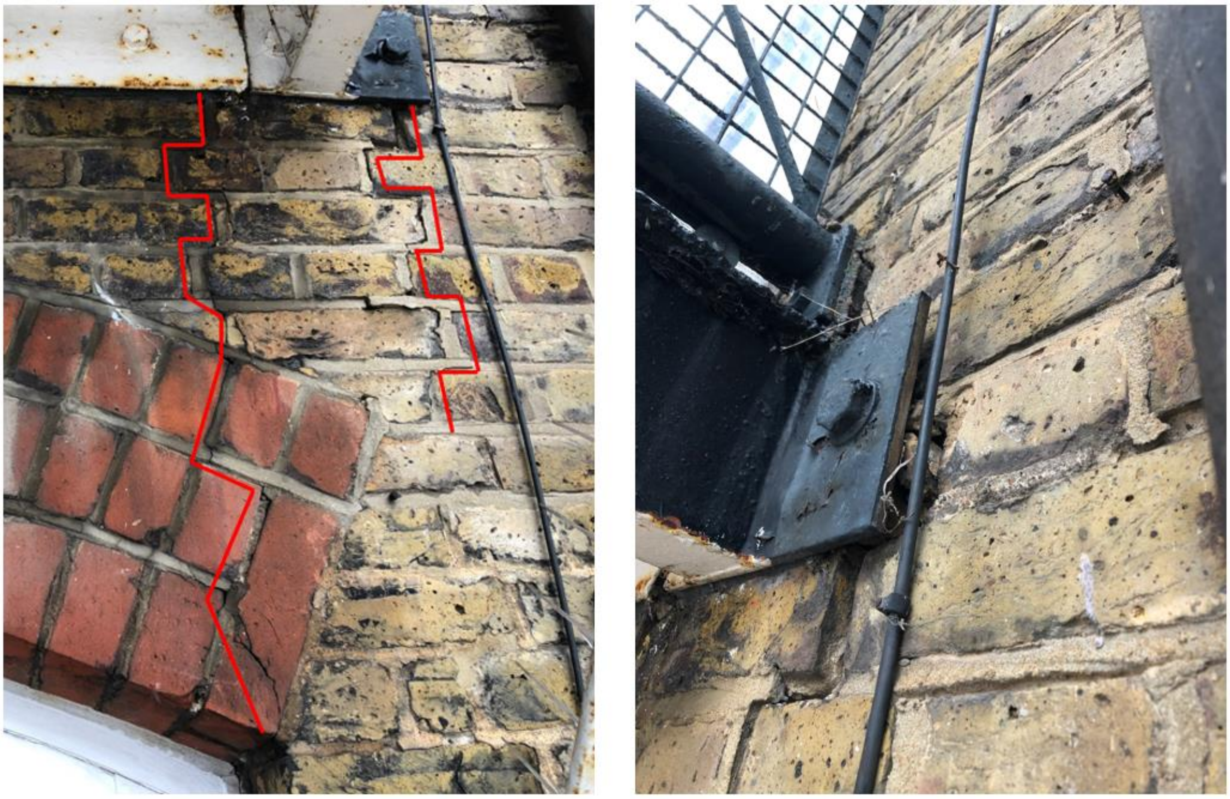


Figure 12 – Displaced brickwork at structural frame level (balcony 4th floor)

Figure 13 - Close up of the brickwork moving forwards

2.2.7 The cracking highlighted in Figure 12 displays horizonal movement only, with no vertical slip visible. This is most likely caused by a combination of; the outward force being imposed by rotation of balcony around the supporting prop, and internal expansion forces created by the steel anchor fitting embedded within the wall.

Problems with the arch would be evidenced by vertical movements at the spring of the arch, or a pattern of tapered cracks at the centre and springs of the arch. These signs are not visible, so the arch is not expected to be a cause of this cracking. However, there may also be underlying less visible issues with the arch.

2.2.8 The structural frame and tread plate are propped from the underside (Figure 14)

Figure 14 - From the double door access point, towards the West (Left) and towards the East (Right)

2.2.9 At the Eastern end of the balcony (Figure 14, Right), the balcony is rotating around the supporting prop (Figure 15, Point A). This corresponds to the distance the brickwork has moved outwards at the level of the deck, and the distance the balustrade has moved outwards from the wall at the detached anchor point (Figure 11).

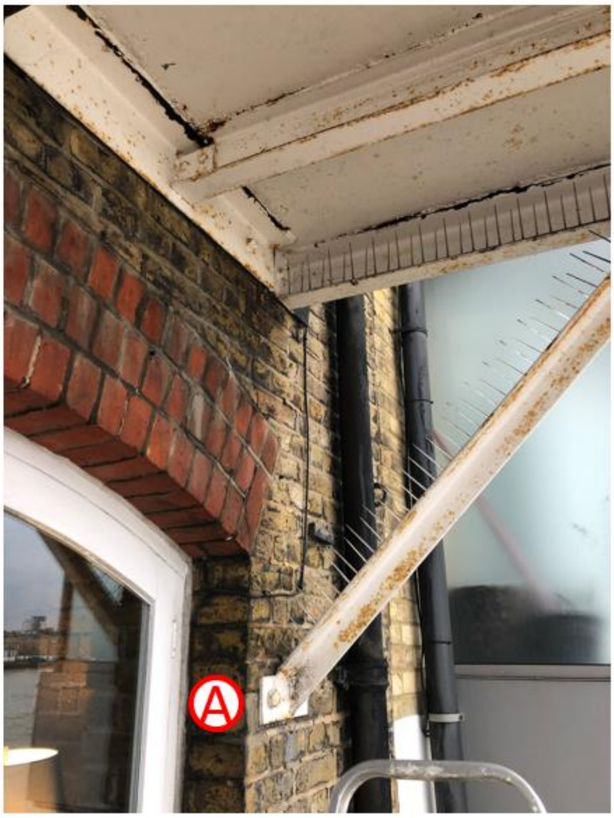


Figure 15 - Prop under balcony at Eastern end

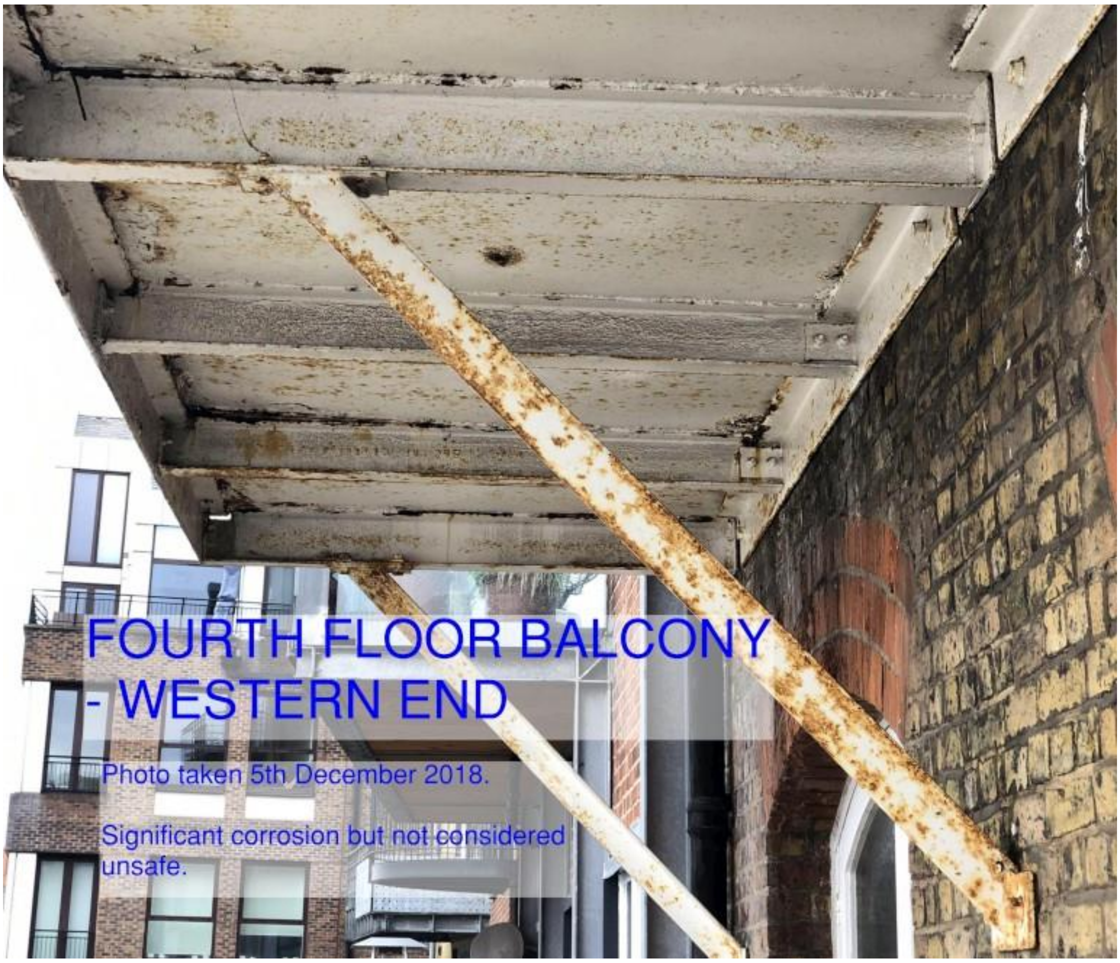
2.2.10 A sketch detail is provided at the end of this document and outlines the approximate movement occurring at the Eastern end of the 4th floor balcony.

3. Observations and Discussion (14th October 2020)

A comparison has been made and annotated onto the photographs in the following photographs.

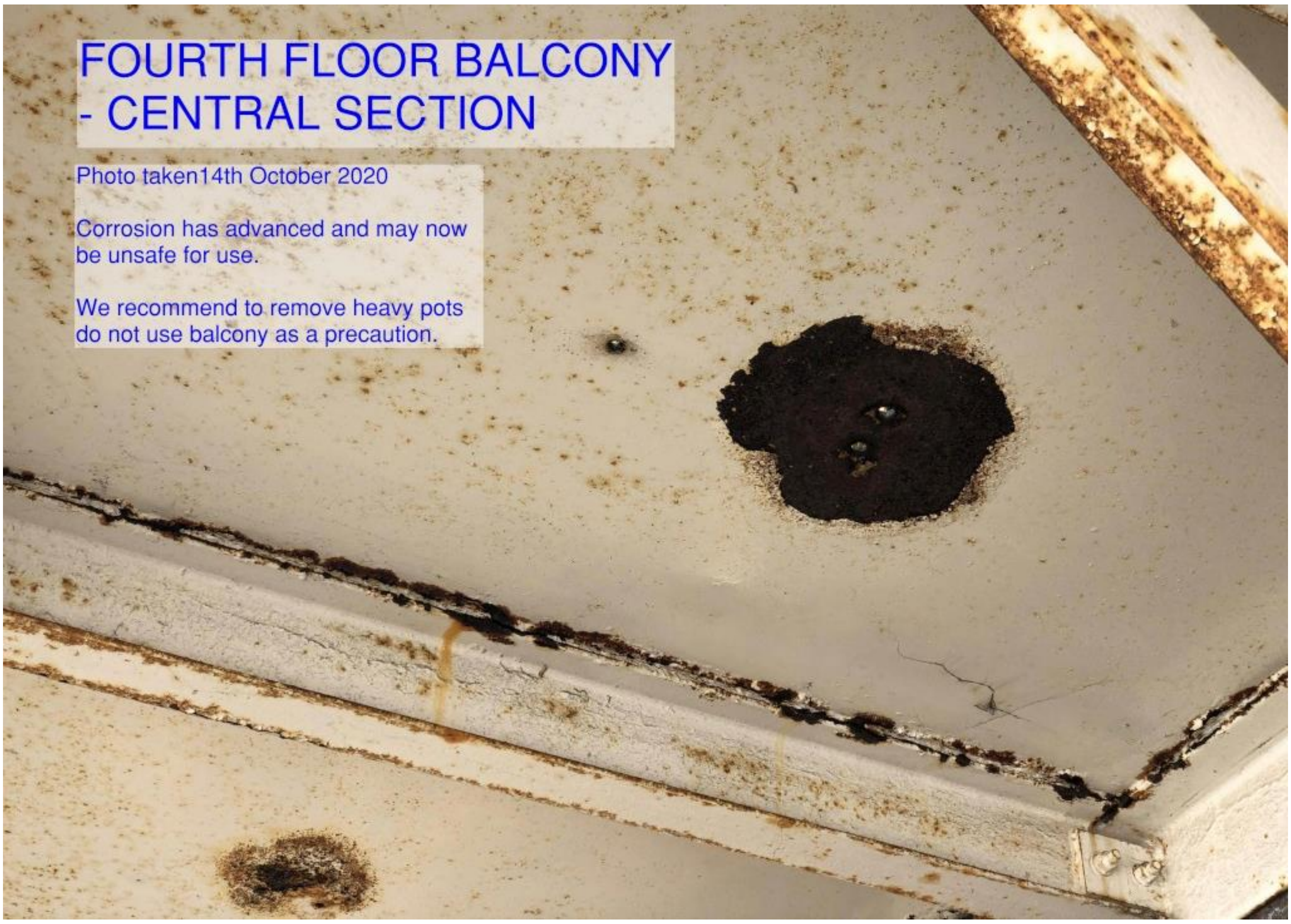

FOURTH FLOOR BALCONY
- WESTERN END
Photo taken 5th December 2018.
Crack around mortar above fixing, but
no significant pulling away from wall.


FOURTH FLOOR BALCONY
- WESTERN END
Photo taken 14th October 2020.
Crack around mortar appears same as
it was before.
Therefore, no detectable movement
since last measurement in 2018


FOURTH FLOOR BALCONY
- WESTERN END
Photo taken 5th December 2018.
Significant corrosion but not considered unsafe.

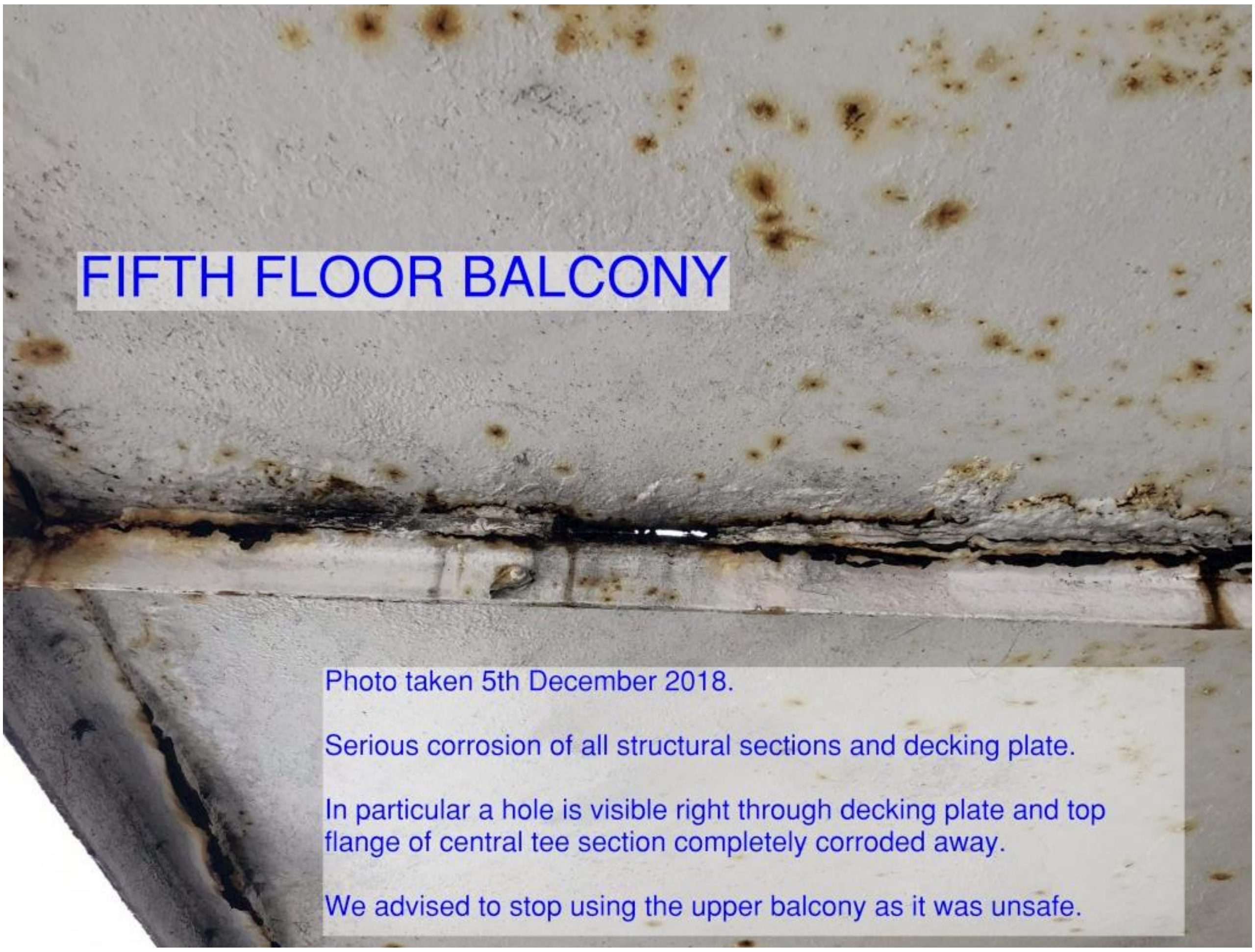

FOURTH FLOOR BALCONY
- WESTERN END
Photo taken14th October 2020
Corrosion has advanced and may now be unsafe for use.
We recommend to remove heavy pots do not use balcony as a precaution.

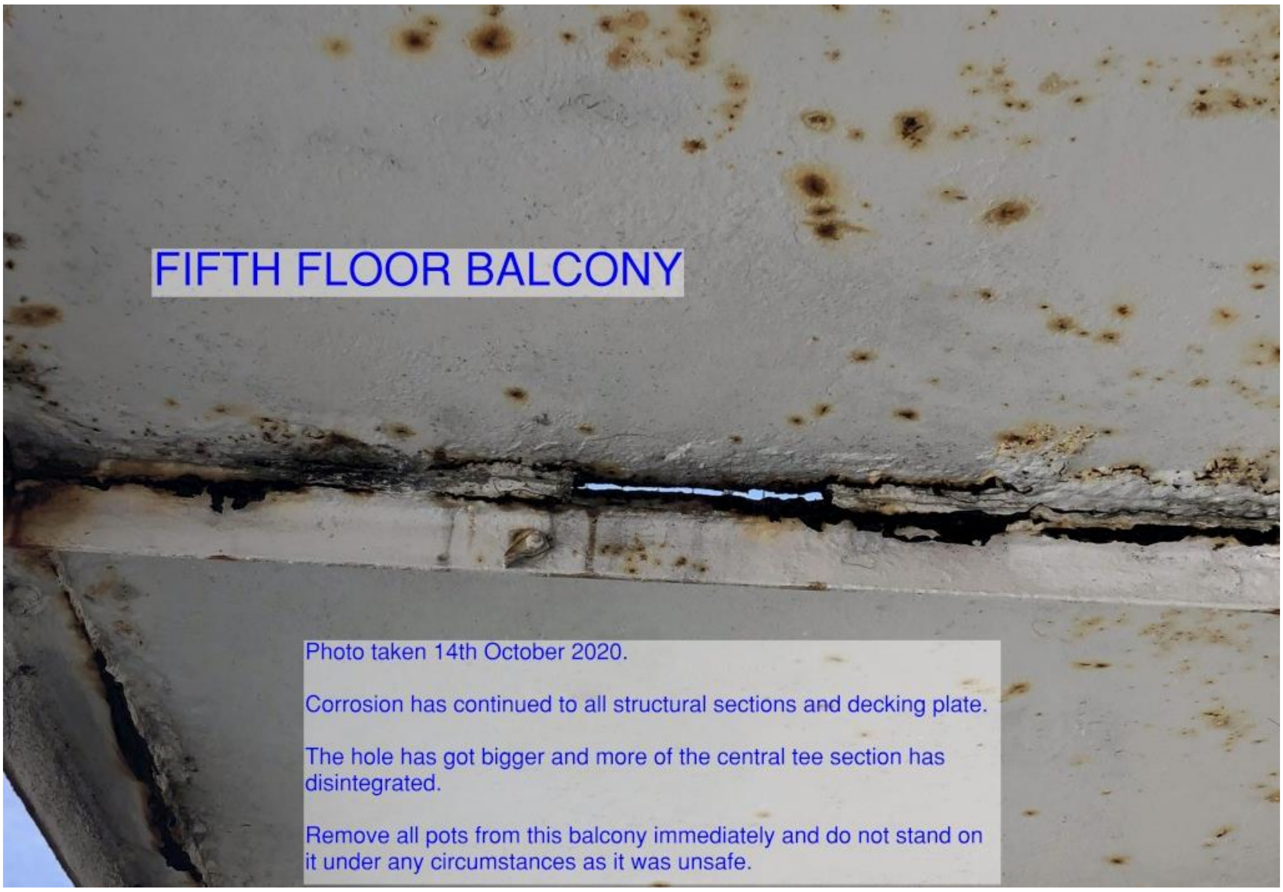

FOURTH FLOOR BALCONY
- CENTRAL SECTION
Photo taken 5th December 2018.
Significant corrosion but not considered unsafe.


FOURTH FLOOR BALCONY
- CENTRAL SECTION
Photo taken14th October 2020
Corrosion has advanced and may now be unsafe for use.
We recommend to remove heavy pots do not use balcony as a precaution.


FOURTH FLOOR BALCONY
- TIP OF WIDER SECTION
Photo taken 5th December 2018.
Significant corrosion but not considered unsafe.


FOURTH FLOOR BALCONY
- TIP OF WIDER SECTION
Photo taken14th October 2020
Corrosion has advanced and may now be unsafe for use.
We recommend to remove heavy pots do not use balcony as a precaution.


FIFTH FLOOR BALCONY
Photo taken 5th December 2018.
Serious corrosion of all structural sections and decking plate.
In particular a hole is visible right through decking plate and top flange of central tee section completely corroded away.
We advised to stop using the upper balcony as it was unsafe.


FIFTH FLOOR BALCONY
Photo taken 14th October 2020.
Corrosion has continued to all structural sections and decking plate.
The hole has got bigger and more of the central tee section has disintegrated.
Remove all pots from this balcony immediately and do not stand on it under any circumstances as it was unsafe.

4. Summary

The 5th floor balcony is displaying clear signs of corrosion, with rust creating openings in the tread plate. The tread plate is supported by a central tee section, where the two decking plates meet, which is severely corroded, and is no longer providing adequate support, and it deflects significantly under the load of a person. This balcony must not be used and all plant pots must be removed asap, We believed this balcony is unsafe and should be replaced as soon as possible.

The 4th floor balcony is also displaying clear signs of corrosion, with regions of extensive rusting having occurred on the tread plate. The structural frame has many 'spots' of rust exposed through the paint. This rusting will certainly continue and at some point cause structural failure.

Corrosion has advanced and we believe the structure is nearing the point where it is structurally unsafe. Therefore, we have recommended that heavy pots are removed and the balcony is taken out of use as a precaution, and should be replaced as soon as possible.

The Eastern end of the balcony has rotated around the last prop by approximately 0.6 degrees, as demonstrated by the gaps where the tie bar, balustrade wall fixings have pulled out of the wall. The balustrade fixing gap was measured to be 30mm. Although these are not the primary system of structural support for the balcony, which is the diagonal props below, they do indicate that significant deflection has occurred.

On 14th October 2020 we measured the gap between the balustrade fixing wall to have remained 30 mm. Therefore, indicating that no further deflection has taken in this area the balcony place since 2018. This is very encouraging and means that removal of the balcony is not urgently required. However, we do recommend that the balcony is taken out of use as a precaution, as noted above.

4.1 Balustrade and tie back connections to wall

The balustrades running the perimeter of both balconies are tied back to the wall. It is not known whether these connection points where designed to offer structural support to the balcony or only to serve and steady the balustrade. The balustrade tie back at the eastern end is detached from the wall and offers no support to the balustrade or balcony.

The tie back connection points of the structural deck are also of an unknown depth although these appear to be consistent.

4.2 Fixings of ties, props and beams to brickwork wall.

The anchoring bolt depths are unknown, and the anchoring appears to be inconsistent. The connection (balustrade tie back) that has detached from the wall (Eastern end) appears to be different and may represent poorly executed repair work. The repair has simple attempted to cast the head of a bolt (of inadequate length) into shallow mortar, rather than drill and installing an anchor.

Vertical cracking travelling from the beam fixing down to the spring of the window arch below, at the Eastern end of the 4th floor balcony, appears to be a result of the surround brickwork being pushed apart by corrosion and resulting expansion of the steel balcony beam fixings. The window arch itself appears to be constructed from solid brick (without a wooden internal lintel) and does not appear to be compromised. However, it is possible underlying problems also exist in the arch.

The existing fixings to the balcony must be removed, the brickwork must be fully repaired using thorough brick stitching methods (using matching bricks and mortar which matches the hydraulic lime mortar used during initial construction and be suitable for the salty environment) and then new stainless-steel fixings installed to re-support the beam.

The new anchors will need to be a lot deeper than the existing ones, to tie into the core of the brickwork wall, or perhaps through bolts with steel backing plates may be required. This can be assessed by a visual inspection by a suitably experienced engineer while the brickwork is being repaired.

~~4.3 Structural frame of the balconies (4th and 5th floor) DELETED IN ADDENDUM REPORT~~

~~The structural frame, with regards to corrosion, requires maintenance, with removal of paint and corrosion before reprotection. The current condition of the structural frame with respect to corrosion appear to be acceptable.~~

~~4.4 Plates of the deck (4th and 5th floor) DELETED IN ADDENDUM REPORT~~

~~Checkered tread plates are used as the deck material on both balconies. Given the multiple layers of paint is it difficult to discern the underlying condition. However, there are many areas showing serious corrosion, some so severe it has penetrated through the plate and a hole has developed.~~

5. Conclusion and Recommendations - replacement of the balcony

Given the advancement of corrosion since 2018, only sensible option at this point is to replace the balconies. StructureMode have been engaged to investigate structural options which is ongoing.

A new balcony can be designed and fabricated in a workshop environment. This should include a galvanisation process for protection against corrosion. During the design process detailing such as an inclined deck and other drainage details can be included. The existing balcony can be dismantled which will require the use of cutting equipment which will be noisy. By completely removing the existing balcony, unrestricted access to repair brickwork and install suitable anchors is made a lot easier. Once this work is complete, the new balcony can be installed. The new balcony can be prefabricated prior to removal of the existing balcony, minimising the duration of disruption on site and the time scaffold would need to be erected.

6. Sketch Detail – eastern end of fourth floor balcony

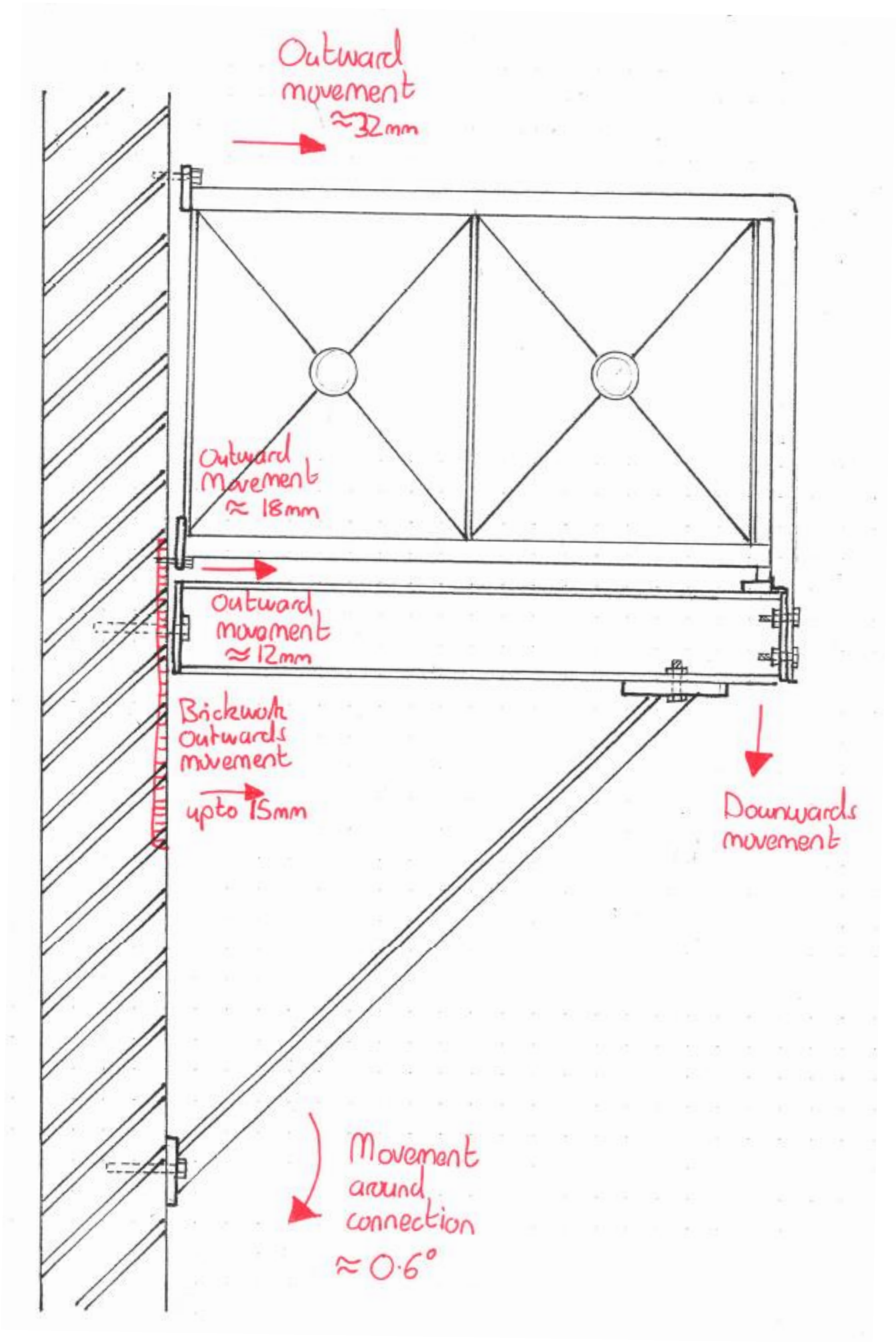


Figure 16 - Sketch of balcony movement at Eastern end