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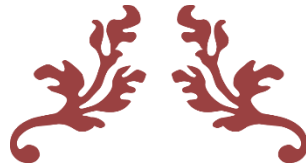
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Hole Farm Woodland Creation Project

Structural Survey Report (December 2022)

The Structural Survey Report was produced by Imperium Engineering in December 2022 prior to the design of the Project being finalised. The Report presents the findings of the structural surveys undertaken on buildings 1, 2, 3 and 4 prior to buildings 3 and 4 being removed from the Project's red line boundary. However, the results of the structural surveys for buildings 1 and 2 remain relevant to the Project and thus the findings of the Report are still valid.





Structural Survey Report

Hole Farm, Great Warley, Brentwood, CM13 3JD



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DECEMBER 8, 2022

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Structural Survey Report

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Introduction

The client has instructed us to carry out a non-intrusive structural survey on buildings 1,2,3 and 4. This is to check the condition of the property and comment on what issues were found during the site visit.

In conjunction with this report, there is also an appendix showing photos taken during the site visit.



Building 1 – Grain Store (17m x 18m)

Steel framed construction on a block plinth with corrugated asbestos elevations, concrete floor, grain walling with a roller shutter door to front elevation and sliding doors to rear.

Building 2 – Agricultural Machinery Store (24m x 24m)

Timber frame construction with block plinth and timber clad elevations under corrugated asbestos sheeted roof. Concrete floor to centre and hard-core either side. The building is open fronted and open to the rear.

Building 3 – Small brick structure (10m x 5m)

Building 4 – Open fronted shed (28m x 6m)

5 bay machinery/general purpose building constructed of concrete posts, block walling, concrete floor and part asbestos cladding. The roof is clad in fibre cement sheeting.

Inspection Methodology

The property was inspected for defects which can be organised into the following categories:




- **Structural Defects** – Where part of the supporting structure is showing signs of mild or moderate failure due to excess loading, fatigue, aging, weathering etc. Structural defects include excess deflection, cracking, spalling, excess movement, and corrosion.
- **Non-Structural Defects** – Where a part of the structure not supporting a structural load is failing, this can be from weathering, corrosion, water damage etc. This can pose a risk at times where elements are able to fall from the structure, or where elements which are specifically designed to protect structural elements have failed, such as weatherproofing.
- **Systematic Defects** – Systematic defects are flaws where the structure is showing the same type of failure in multiple locations, often suggesting that either the original design was at fault or that certain elements are coming close to their design lifespan.
- **Local Defects** – These defects are often caused by unrelated events in concentrated areas, not caused by wear and tear; local defects could be areas where there is a failure in the connecting structures, impact damage, poor workmanship, or lone defective structural elements.

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Assessment

This report categorizes the condition of the structural element, section, or property into Green, Amber and Red.

Assessment		Meaning
Green		No repair is currently needed. The structural element/ section or property must be maintained in the normal way.
Amber		Defects that need repairing or replacing but are not considered to be either serious or urgent. These defects are not currently affecting the structural integrity of the property, so action is optional but advisable. Generally, the structural element/section has a poor aesthetical appearance.
Red		Defects that are serious and need immediate repairs, replacement, or further investigation. There is a high threat to the structural integrity of the structural element/section or property.

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Cracks

Cracking is a subjective matter: The following extract from the Institute of Structural Engineers clarifies the various levels of cracking.

Classification of Visible damage to walls, with Particular Reference to the Type of Repair, & Rectification Considerations.

Category of damage	Approximate crack width (mm)	Definition of cracks and description of damage
0	Up to 0.1mm	HAIRLINE - Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks rarely visible and remedial works rarely justified.
1	0.2 to 2mm	FINE - Internally cracks can be filled or covered by wall covering, and redecorate. Externally, cracks may be visible, sometimes repairs required for weather tightness or aesthetics. Note: Plaster cracks may, in time, become visible again if not covered by a wall covering.
2	2 to 5mm	MODERATE - Internal cracks are likely to need raking out and repairing to a recognised specification. May need to be chopped back, and repaired with expanded metal/plaster, then redecorated. The crack will inevitably become visible again in time if these measures are not carried out. External cracks will require raking out and repointing, cracked bricks may require replacement.
3	5 to 15mm	SERIOUS - Internal cracks repaired as for MODERATE , plus perhaps reconstruction if seriously cracked. Re-bonding will be required. External cracks may require reconstruction perhaps of panels of brickwork. Alternatively, specialist resin bar techniques may need to be employed and/or joint reinforcement.

Extract from The Institution of Structural Engineers – "Subsidence of Low Rise Buildings Table 6.21" 2000

For domestic dwellings, which constitute most cases, damage at or below Category 1 does not normally justify remedial work other than the restoration of the appearance of the building. For the cause of damage at this level to be accurately identified it may be necessary to conduct detailed examinations of the structure, its materials, the foundations, and the local clear ground conditions.

As mentioned in BRE Digest 251, cracks of this magnitude are very difficult to attribute to any one cause. Consequently, unless there are clear indications that the damage is progressing to a higher level it may be expensive and unnecessary to carry out extensive work for what amounts to aesthetic damage.

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Findings

1. Steel Frame Structure

A. Defects with the steel frame structure



Defects found:

1. Presence of corrosion on the steel column
2. Rust on the steelwork

Defects found:

Kindly note, access to the warehouse was not granted. Hence, we can not comment on the structural integrity of the structural elements inside the building.

Assessment:

Amber 

Potential causes:

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1. Age
2. Poor workmanship
3. Lack of maintenance
4. Ungalvanized steel

Potential solutions:

1. There is a need to gain access to the interior of the structure, to enable a full structural assessment of the steel framed structure.
2. We recommend salvaging the steelwork by using a wire brush to scrub partially rusted areas to remove flakes and powdery surface rust. Then all steelwork should be blast cleaned to SA2½ given 1 coat of H.B. zinc phosphate primer dry film thickness of 80 microns and then painted with intumescent paint for further protection in the event of a fire.
3. Also, if during the repair works, the rusting has led to holes in the steelwork, this would immediately indicate its loss of tensile and compressive strength. We recommend replacing the damaged area with a galvanized option.
4. Based on the atmospheric corrosivity and high-risk situation of this area, the solution provided above will provide a protective coating for some years only. Once, the corrosion begins to occur, we recommend a repeat of these remedial works be carried out.
5. In a more long-lasting solution, these will involve the metals being Hot dip galvanized to BS EN ISO 1461 with a minimum coating thickness of 460 gms/m². This needs to be determined by a corrosion expert.

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B. Defects with the wall



Defects found:

1. The wall panels are in poor condition
2. Broken sections on some of the wall panels
3. Presence of moss growth
4. Presence of lichen growth

Kindly note:

The wall covering appears to be made up of asbestos.

Assessment:

Red 

Potential causes:

1. Age
2. Poor workmanship
3. Lack of maintenance
4. Ungalvanized steel

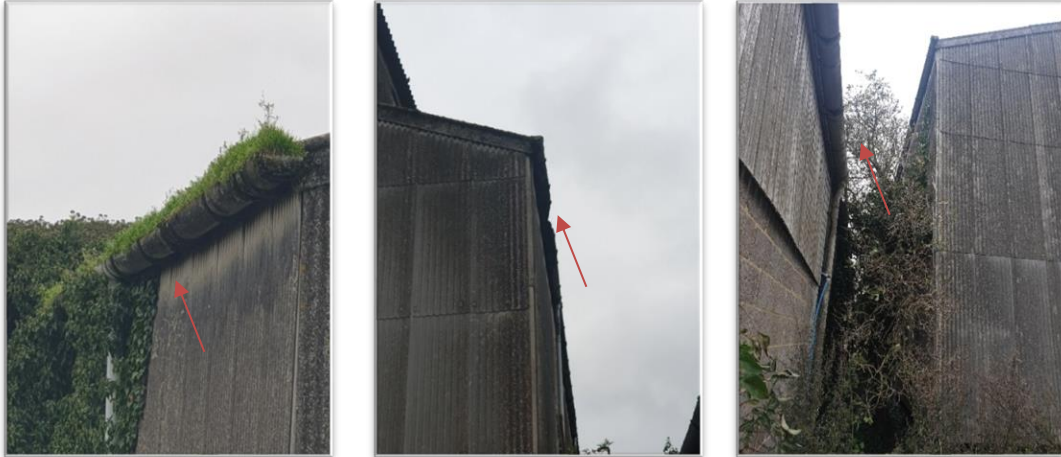
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Solution:

1. The wall panels are in poor condition and can be regarded as unsafe. There is a need to replace all defective sections.
2. Remove all moss/lichen growth on the wall panels
3. We recommend stripping off the wall panels completely.
4. An asbestos survey was carried out and the findings are provided with the report

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C. Defects with the gutter



Defects found:

1. Leaking roof gutter
2. Vegetation growth in the gutter
3. Cracking to the gutter

Assessment:

Amber



Potential causes:

1. Lack of maintenance
2. Dirt or debris in the gutters
3. Loose connection
4. It appears that the gutter is not adequately receiving the rainwater from the roof
5. The gutter is not adequately slopped into the required downpipe
6. Lack of maintenance

Solutions:

1. Remove all vegetation and debris growth from the gutters.
2. We recommend replacing all defective gutters within the property.
3. The existing gutters or new gutters should be fitted in such a way that rainwater from the roof completely discharges into the gutter
4. We suggest immediate repairs to all defective gutter joints and fittings. For aesthetic purposes, existing gutters can be repainted.
5. We suggest regular maintenance of the gutters. If defective gutters are left long term it can lead to undermining of the foundations, dampness, and water ingress.

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D. Defects with the rainwater downpipes



Defects found:

1. Loose connections
2. Rainwater downpipe showing signs of water leakage
3. Moss growth
4. Downpipe is not discharging into the required drain
5. vegetation growth around the downpipe

Assessment:

Amber 

Potential causes:

1. Poor design/workmanship
2. Lack of maintenance
3. Downpipe is disconnected at the joint. This has led to water splashing and moss growth

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Solutions:

1. We recommend that the rainwater downpipe should be checked for loose connections. This should be fixed immediately.
2. All downpipes should be adequately channelled into a drainage system.
3. Remove all vegetation and debris from the rainwater pipe and drains.
4. We suggest regular maintenance of the downpipes and drains. If defective downpipes are left long term it can lead to the undermining of the foundations.
5. We recommend contacting a drainage specialist to have the drainage system checked and all the pipework systems at the rear of the property. Immediate remedial works should be carried out.
6. The pipework network should be checked for blockages.
7. Remove all vegetation and debris from the drains.

These remedial works should be applied to other areas with defective rainwater downpipes.

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E. Vegetation and Plant growth



Defects found:

1. Excessive vegetation growth
2. Plant growth on the internal side of the wall
3. Presence of trees

Assessment:

Amber



Potential causes:

1. Poor workmanship
2. Lack of maintenance

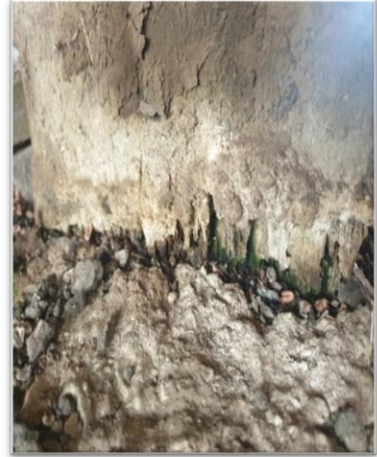
Solution:

1. Remove all vegetation growing close to the property
2. We suggest trimming all overgrown vegetation
3. We suggest removing all trees growing close to the property

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2. Timber Frame

A. Defects with the timber frame



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Defects found:

1. Presence of damp timber
2. Timber rot (some of the timber columns have lost contact with the ground, due to timber rot_
3. Disconnected struct members

Assessment:

Red 

Potential causes:

1. Age
2. Poor workmanship
3. Lack of maintenance

Solution:

1. We recommend replacing all defective timber columns and elements
2. The struct members should be replaced with new members. The new member to match the existing one.
3. The timber element must be properly connected.

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B. Defects with the blockwork



Defects found:

1. Cracking to the junction.
2. Presence of damp
3. Lack of lateral restraint straps
4. Presence of vegetation growth
5. Perishing mortar joints
6. Presence of trees behind the wall

Assessment:

Amber



Potential causes:

1. Lack of maintenance
2. Lack of lateral restraints
3. Poor workmanship

Solution:

1. Once the issue with the vegetation and trees is solved, we recommend that a specialist-approved contractor is instructed to apply a Heli-fix solution to install L-shaped bars to tie the external walls together.
2. Alternatively, the walls can be restitched and toothed together course by course creating a robust connection. However, this would require partial demolishing of the external walls.
3. Another alternative would be to partially demolish the external wall and install a Simpson Strong-tie Crocodile Wall Starter Kit to tie the walls together.

Any of the three options mentioned above are viable and it is down to the client's or contractors' discretion which is used.

4. Replace all defective blockwork and repoint any defective mortar joint

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C. Vegetation and Plant growth



Defects found:

1. Excessive vegetation growth
2. Plant growth on the internal side of the wall
3. Presence of trees

Assessment:

Amber



Potential causes:

1. Poor workmanship
2. Lack of maintenance

Solution:

1. Remove all vegetation growing close to the property
2. We suggest trimming all overgrown vegetation
3. We suggest removing all trees growing close to the property

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3. Concrete Frame Structure

A. Defects with the concrete frame structure



Defects found:

1. Cracking to the concrete column
2. Presence of rust on the exposed reinforcement bars
3. Damp wall
4. The concrete column is leaning, showing signs that it has started to fail

Assessment:

Red 

Potential causes:

1. Age
2. Poor workmanship
3. Lack of maintenance
4. Water ingress
5. Impact damage, possibly vehicular impact to some of the concrete column

Solution

1. Replace the concrete column that has started to lean.
2. The exposed section should be treated for rust, where excessive rust is seen, we recommend replacing the concrete column.
3. There is a need to install a concrete balustrade close to each of the concrete columns to prevent future vehicular impact

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B. Defects with the blockwork



Defects found:

1. Cracking to the junction.
2. Presence of damp wall
3. Presence of vegetation growth
4. Collapsed section of the blockwork
5. Suspended blockwork

Assessment:

Red 

Potential causes:

1. Excessive tree growth
2. Lack of maintenance
3. Lack of lateral restraints

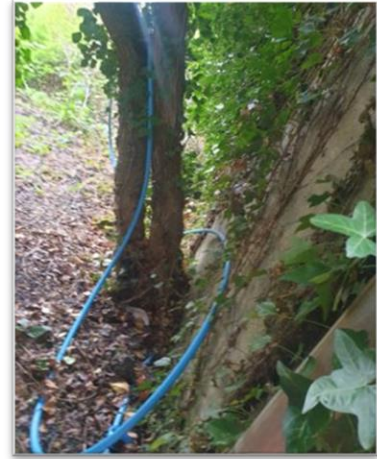
Solution:

1. We recommend resolving the issue with the vegetation and tree growth close to the concrete frame structure. See the "Vegetation and plant growth" section of this report.
2. We recommend carefully deconstructing all the blockwork and rebuilding the blockwork.

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C. Vegetation and Plant growth



Defects found:

1. Excessive vegetation growth
2. Plant growth on the internal side of the wall
3. Presence of trees

Assessment:

Amber



Potential causes:

1. Poor workmanship
2. Lack of maintenance

Solution:

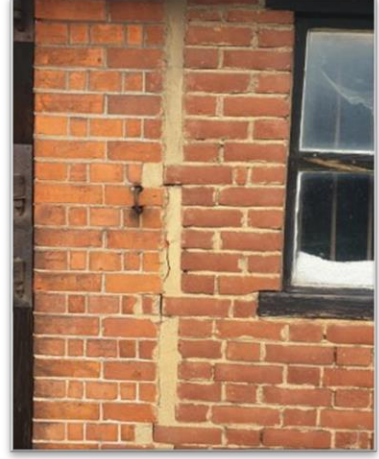
1. Remove all vegetation growing close to the property
2. We suggest trimming all overgrown vegetation
3. We suggest removing all trees growing close to the property

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4. Masonry Structure

A. Defects with the masonry's walls



Defects found

1. Presence of step cracking
2. Missing brick
3. Collapse section
4. Lintel failure
5. Water ingress
6. Poor connection between the main structure and the extensions
7. Blown mortar joints
8. Perishing mortar joints
9. Presence of tree growth
10. Crumbling brickwork
11. Cracking to the brickwork
12. Cracking below the window
13. Daylight through the walls

Assessment:

Red 

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Potential causes

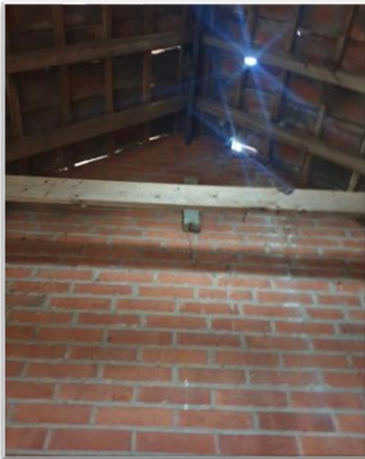
1. Age and weathering
2. Poor workmanship
3. Lack of maintenance
4. Defective/undersized lintel
5. Insufficient bearing length
6. Wall movement
7. Subsidence

Solutions

This structure is in a poor state and their clear signs of some sections of the wall subsiding. It will be prudent to have the structure carefully demolished and rebuilt.

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B. Defects with the masonry's roof structure



Defects found

1. Presence of roof dishing

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2. Missing roof tiles
3. Daylight through the roof
4. Presence of roof spread
5. Moss growth on roof tiles
6. Vegetation growth on the roof tiles
7. Presence of timber rot

Assessment:

Red 

Potential causes

1. Age and weathering
2. Poor workmanship
3. Lack of maintenance
4. Extended period of water ingress through the roof

Solution

We recommend carefully deconstructing the whole roof and having it rebuilt. The new roof needs to be designed by a structural engineer.

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C. Defects with the gutter



Defects found:

1. Leaking roof gutter
2. Vegetation growth in the gutter
3. Cracking to the gutter

Assessment:

Amber



Potential causes:

1. Lack of maintenance
2. Dirt or debris in the gutters
3. Loose connection
4. It appears that the gutter is not adequately receiving the rainwater from the roof
5. The gutter is not adequately slopped into the required downpipe
6. Lack of maintenance

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Solutions:

6. Remove all vegetation and debris growth from the gutters.
7. We recommend replacing all defective gutters within the property.
8. The existing gutters or new gutters should be fitted in such a way that rainwater from the roof completely discharges into the gutter
9. We suggest immediate repairs to all defective gutter joints and fittings. For aesthetic purposes, existing gutters can be repainted.
10. We suggest regular maintenance of the gutters. If defective gutters are left long term it can lead to undermining of the foundations, dampness, and water ingress.

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D. Vegetation and Plant growth



Defects found:

1. Excessive vegetation growth
2. Plant growth on the internal side of the wall
3. Presence of trees

Assessment:

Amber



Potential causes:

1. Poor workmanship
2. Lack of maintenance

Solution:

1. We suggest trimming all overgrown vegetation
2. We suggest removing all trees growing close to the property
3. Remove all vegetation growing close to the property

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General Treatment for Timber Rot

1. The first step is to locate the source of dampness and eliminate the source of dampness. It is important to note that the removal of damp conditions is the key to dealing with the fungal decay of the timbers. Any faults that have contributed to the cause of timber rot must be rectified. Furthermore, measures should be taken to immediately dry all timbers and fabrics nearby.
2. If there is a high possibility of dampness reoccurs in the timbers, we suggest replacing the existing timber with pre-treated options or replacing the timbers with other materials that will not rot. For instance, the use of galvanized steel. The remaining timbers can be treated in situ with preservatives.
3. Remove all defective timber. We recommend taking out sections of the timber 400 mm beyond the timber rot for dry rot. This is to allow for sections of the infected timber that are not visible.
4. We recommend replacing all structural timber elements that cannot be salvaged and have been weakened structurally due to timber rot.

In areas where timber rot is discovered around the property, please apply the remedial action mentioned above to all the defective timbers.

General Treatment for Steelworks

1. We recommend salvaging the steelwork by using a wire brush to scrub partially rusted areas to remove flakes and powdery surface rust. Then all steelwork should be blast cleaned to SA2½ given 1 coat of H.B. zinc phosphate primer dry film thickness of 80 microns and then painted with intumescent paint for further protection in the event of a fire.
2. Also, if during the repair works, the rusting has led to holes in the steelwork, this would immediately indicate its loss of tensile and compressive strength. We recommend replacing the damaged area with a galvanized option.
3. Based on the atmospheric corrosivity and high-risk situation of this area, the solution provided above will provide a protective coating for some years only. Once, the corrosion begins to occur, we recommend a repeat of these remedial works be carried out.
4. In a more long-lasting solution, these will involve the metals being Hot dip galvanized to BS EN ISO 1461 with a minimum coating thickness of 460 gms/m². This needs to be determined by a corrosion expert.

Heli-Bars Remediation to Cracks Over 5mm

Please remove any defective building materials and replace them. Heli-bars can be used to strengthen the walls, create a robust connection, lateral restrain walls to each other and secure lintels where needed. L-Shaped bars can be used to tie in corners.

Below is some information regarding Heli-Bars:

Heli-bar

1. Heli Bar to be long enough to extend a minimum of 500mm on either side of the crack or 500mm beyond the outer cracks if two or more adjacent cracks are being stitched using one rod.
2. Where a crack is less than 500mm from the end of a wall or an opening, the Heli Bar is to be continued for at least 200mm around the corner and bonded into the adjoining wall or bent back and fixed into the reveal, avoiding any DPC.
3. For solid masonry over 225mm thick and in a cavity wall where both leaves are cracked, the wall must be crack-stitched on both sides.
4. If there is render/plaster, this thickness must be added to the depth of the slot. Crack stitching must be installed in the masonry and never in the render.
5. Ensure the masonry is well wetted or primed to prevent premature drying of the Heli Bond due to rapid de-watering, especially in hot conditions. Ideally, additional wetting of the slot should be carried out 1 to 2 minutes before injecting the Heli Bond grout.

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6. Do not use Heli Bond when the air temperature is +4°C and falling or apply over ice. In all instances, the slot must be thoroughly damp or primed before injection of the Heli Bond grout.
7. Rake out or cut slots into the horizontal mortar beds, a minimum of 500mm on either side of the crack.
8. Clean out slots and flush with clean water and thoroughly soak the substrate within the slot
9. Using the Helifix Pointing gun, inject a bead of Heli Bond along the back of the slot
10. Using the Heli Bar insertion tool push one Heli Bar into the grout to obtain good coverage
11. Insert a further bead of Heli Bond over the exposed Heli Bar, finishing 12mm from the face and 'iron' firmly into the slot using the Heli Bar insertion tool
12. Re-point the mortar bed and make good the vertical crack with Crack Bond TE3

Slot Depth and Spacing				
	Single skin/ Cavity wall	Solid Masonry		
		Up to 102.5mm	102.5mm to 225mm	Over 225mm
Depth of slot	25 – 35mm	25 – 40 mm	25 – 40mm On both sides	
Vertical Spacing	Every 4 – 6 courses, 300 – 450mm			

Conclusion

The solutions mentioned in this report will enhance the structural integrity of the property and reduce the risk of movement in the future.

Building 1

The steel frame structure was surveyed only externally due to restricted access. The external perimeter wall is covered in ACM. The external wall panels do not appear to be in good condition, and we will recommend replacing the wall panels. This will also provide a means to fully assess the quality of the hidden sections of the steel frame. Although we were unable to gain access to the steel frame structure, the exposed section of the steel frame is in good condition and appears to be structurally safe for reuse. However, the steel frame needs to be treated for rust. It is important to note that we cannot comment on the hidden steel frames and other structural elements located inside the structure. There is a need to have them assessed before the whole steel frame can be deemed reusable.

Building 2

The timber frame structure can be repaired and restored to use, however, based on the degree of damage to the whole structure, it is prudent to carefully demolish the structure and have it rebuilt. This also applies to the concrete frame structure.

Building 3

The concrete frame structure can be repaired and restored to use, however, based on the degree of damage to the whole structure, it is prudent to carefully demolish the structure and have it rebuilt.

Building 4

The masonry structure suffers from various degrees of structural defects, these ranges from roof spreading, wall movement and foundation issues. The property appears to be subsiding and this will require a trial pit to be dug close to the step cracking location. Furthermore, the main structure and the extension were not properly joined together, hence the cracking to the junction and poor repointing work at the junction. It is prudent to demolish the masonry structure and have it rebuilt.

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These structures are showing signs of lack of maintenance and some of the structures appeared to have been abandoned for a long period of time. Hence, the vegetation and tree growth, moss growth, vegetation growth in the gutters, defective roof covering an extended period of damp walls

The condition of the property will continue to deteriorate if left unattended, therefore we do insist on immediate action in these areas as per the recommendations mentioned in this report.

We noted during the site visit that there were areas of defective mortar joints due to age, weathering, and vegetation growth. We suggest that where mortar joints begin to fail in the future and have begun to perish, or pop off, these should be raked out by 50mm and repointed, and all vegetation or plants should be removed.

Please contact us immediately if you are unsure about any areas mentioned in this report.

Scope of the survey carried out

- a. This report is concerned with the external fabric of the building, in common areas accessible to viewing. These observations were from a single visit at one moment in time, and these should not be taken in isolation.
- b. You are advised to read and consider the report's entire content including the condition statement and terms and conditions. These elements are interrelated and therefore are covered in more than one section or a single section.
- c. The structural surveyor is unable to see through solid objects and any area with decreased visibility. All fitted or solid goods will not be moved.
- d. Please note any sizes mentioned in this report may need to be verified via structural calculations, however, the sizes shown in this report have been selected so that they are safe and fit for purpose.
- e. No surfaces were tested to inspect frames, and no hazardous samples have been taken or tested.
- f. Other elements of the structure may require attention that will only be visibly necessary when work is begun.
- g. You must be aware that our survey is non-intrusive, and this report is non-intrusive. Some defects that are out of sight or not readily visible may have been missed by the structural engineer, as he cannot be reasonably expected to identify failures that are out of sight.
- h. Older buildings or extensions and additions will probably not comply with current building regulations. They will not be specifically identified in this report and will need to be subjected to further possibly intrusive investigation
- i. We do not undertake or comment on insulation, sound or thermal issues. This is subject to advice by specialists in this field which must be provided by the vendor.
- j. You are strongly advised to bring to the attention of either your Structural Engineer or Legal Advisers any issues that you are unclear of, which may, or you feel may not have been brought to your attention in this report or for which you require further and better information.
- k. Structural engineers are not qualified nor permitted by our insurers to undertake inspections requiring specialist statutory reports i.e., oil/gas fired and electrical installations, NICEIC reports etc.

Engineer	TB	Checked	MH
Date	08/12/2022	Date	08/12/2022