ADDENDUM REPORT

ON

CRACKING AND MOVEMENT

At:

15 Gordon Close
Sandown
Isle of Wight
PO36 9AD

For:

Spence Refit Limited
Macmillan House
Paddington Station
London
W2 1FT

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DOCUMENT VERIFICATION

ADDENDUM REPORT

ON:	**CRACKING AND MOVEMENT**
AT:	**15 GORDON CLOSE SANDOWN ISLE OF WIGHT PO36 9AD**
FOR:	**SPENCE REFIT LTD.**
FRANKHAM PROJECT NO:	**441619**

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For Information	P01	25.11.2022	JAB	BH	GL

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1.0 INTRODUCTION

Frankham Consultancy Ltd was originally instructed by Spence Ltd in June 2022 to undertake a visual structural survey and report on cracking and movement at 15 Gordon Close, Sandown, Isle of Wight. The aim of the survey was to inspect the building and provide recommendations for any further intrusive investigations, to aid a remedial works programme. The purpose of the report was to carry out an inspection of cracking and movement to the property.

The non-intrusive visual inspection was undertaken on Wednesday 13th July 2022 by Mr J. Burstow, Chartered Structural Engineer. The subsequent Frankham report, dated 27th July 2022, concluded that the most likely cause of the cracking and movement was believed to be associated with foundation movement due to either tree or drainage related subsidence, or landslip due to the close proximity of a railway cutting to the rear. There was also movement to the floor within the extension to the rear of the property.

A copy of the Frankham report is attached within Appendix A. It was recommended that site investigations were carried out in order to determine the adequacy of the foundations and the ground conditions below. The investigations also included to undertake a check on the condition and adequacy of the drainage pipework below ground.

The site investigations into the foundations and the ground conditions below were carried out by CK Consulting and Geotechnical Limited on Wednesday 12th October 2022. A copy of CK Consulting and Geotechnical Limited's geological report on ground investigations, which is dated November 2022, is attached within Appendix B.

A drainage survey was carried out by Drainline Limited and a copy of their report, which is dated July 2022, is attached within Appendix C.

The Frankham report also recommended strengthening to the roof structure, replacement of the lintels over the Bedroom windows to the front and side elevations of the property and to appoint a PCA Approved Specialist Contractor to inspect and report on damp issues within the property. It was unknown as to whether the extension and alterations carried out to the property had been carried out with Building Regulations approval.

There was also a boundary wall, which retained ground to the neighbouring property to the left, which had been subject to cracking and movement. The distortion to the boundary wall was thought to have been caused by the physical damage of trees and vegetation within the neighbouring garden.

2.0 SUMMARY OF ORIGINAL FRANKHAMS REPORT

There was various tapered stepped and diagonal cracking to the front right-hand corner of the front projection, left hand side elevation of the property and to the rear extension. The floor within the rear extension also fell to the North and away from the main property.

The possibility of the onset of either tree and / or drainage related localised subsidence and foundation movement having taken place to the property could not be entirely ruled out.

There were a number of mature trees and vegetation in close proximity to the property with a potential for a shrinkable ground below. There were also drainage runs in close proximity to the building and which passed below the extension.

The property was also located in close proximity to a railway cutting from the rear boundary. The railway cutting may have been subject to, or will be subject to stabilisation works; however, the extent of any works conducted, if any, is unknown. There were piezometers within the back garden of the property which we understood were in place to monitor ground water levels. It has subsequently come to our attention that inclinometers were also in place to measure any ground movement due to land slippage to the rear. There was evidence of landslip and slumping of the ground to the back garden. The impact of this ground movement on the property was unknown.

The cause of the foundation movement was to be subject to site investigations and further investigations.

There was also inadequate support and restraint to the roof structure over the main property, corrosion to the lintels over windows, issues with damp within the property and movement to the floor slab within the extension.

3.0 OBSERVATIONS

We attended site on Wednesday 12th October 2022, whilst CK Consulting and Geotechnical Limited were undertaking the site investigations.

Whilst on site we noted that additional cracking and movement had taken place since our first visit in July 2022.

The additional damage appeared to include widening of the crack above the back door to the West side elevation of the Kitchen and the presence of cracking above and below, and at the junction between the main property and the Kitchen extension to the East side elevation of the property. The cracking above and below the Kitchen window was not present at our visit in July. The cracking to the concrete slab, previously used as a hardstanding within the garage, also appeared to have been subject to further cracking and movement since our first visit. There was cracking to the concrete slab which ran parallel to the slope to the cutting from the rear boundary. There was also movement to the paving adjacent to the rear of the main building and West of the Kitchen extension.

The Site Investigation team lifted the covers to the inspection chambers whilst we were at the property whereupon it was found that cracking was present to the pipework within the manhole adjacent to the back door to the Kitchen. The drainage passed below the extension.

Photo 1: Crack above the back door to the West side elevation of the Kitchen extension – 13th July 2022

Photo 2: Crack above the back door to the West side elevation of the Kitchen extension – 12th October 2022 Appeared to have increased in width since visit in July.

Photo 3: Wall above the window to the East side elevation of the Kitchen extension. At the junction between the main property and the extension to the rear – 13th July 2022

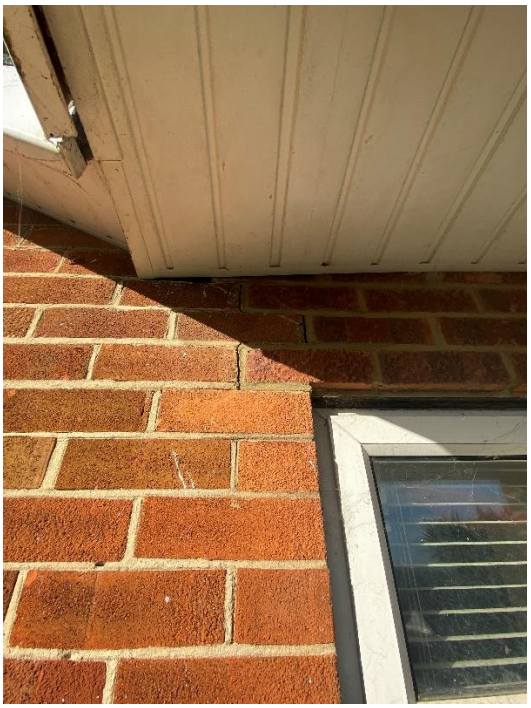

Photo 4: Crack to the wall above the window to the East side elevation of the Kitchen extension. At the junction between the main property and the extension to the rear – 13th October 2022

Photo 5: Crack above the window to the East side elevation of the Kitchen – Additional cracking – 12th October 2022

Photo 6: Crack below the window to the East side elevation of the Kitchen – Additional cracking – 12th October 2022

Photo 7: Crack to the concrete slab adjacent to the West side elevation of the property – 13th July 2022

Photo 8: Appeared to have been widening of cracks and further movement to the concrete slab adjacent to the West side elevation of the property – 12th October 2022

Photo 9: Inspection chamber adjacent to the back door to the West side elevation of Kitchen extension to the rear of the property

Photo 10: Cracking to the pipework to the drainage run which passed below the Kitchen extension. Within the inspection chamber adjacent to the back door

Photo 11: Inspection chamber below the Kitchen window to the East side elevation of the extension

Photo 12: Inspection chamber adjacent to the Southeast corner of the main property

4.0 SITE INVESTIGATIONS

4.1. Subsidence and Foundation Movement – Main Property and Extension, Floor Slab – Extension

4.1.1. Topography / Geology

The ground level directly around the property is relatively level, although the concrete paths fall towards the external elevations of the building. There was a railway cutting to the rear of the property with a sharp fall from the rear boundary to the railway line to the North. The fall in ground level was located at less than 10m from the rear elevation of the building. The back garden to No 15 Gordon Close was thought to be located at approximately 10m above the railway line to the rear. There was a small change in ground level, thought to be less than 500mm, to the right-hand side of the property.

Data from the British Geological Survey (BGS) Map indicated that the underlying stratum below the building is likely to be a Vectis Formation which is made up of Mudstone and Siltstone. The British Geological Survey Map does not indicate any superficial deposits below the building and therefore it is assumed that the Vectis Formation is at, or close to ground level. The Vectis Formation can contain Clay and / or Silt. To the North and East of the site are superficial deposits of Alluvium that typically comprise a series of Clay, Silt, Sand and Gravel strata with horizons of peat. If Clay or Silt are present, then this can shrink or expand according to the level of moisture in the ground. Shrinkage of the ground under the foundations in times of drought or when desiccated by tree roots can cause foundation movement leading to subsidence. The presence of vegetation adjacent to the property would be a potential threat to its stability.

4.1.2. Geotechnical report on ground investigation

We were provided with a geotechnical report on ground investigation which had been prepared by CK Consulting and Geotechnical Limited, dated November 2022.

We understood from the Geotechnical Report that three boreholes were recorded at 17 Gordon Close located to the West of the subject site. The deepest was located to the front of this property and dated from 1991. There was no indication on the BGS website as to the reason for this exploratory hole. However, it should be noted that two other boreholes, progressively closer to the railway butting located to the North, were dated only three years earlier, with the shallowest being located on Network Rail (British Rail at the time) land.

It was also of significance that the subject site had four boreholes constructed within the rear garden. One was installed with a standpipe, whilst inclinometer pipes were within the other three. Each installation was understood to be about 10m deep; however, this could not be confirmed during the course of the fieldwork. The standpipe would have been used for monitoring groundwater levels if present. The inclinometer pipes would have been installed for the purpose of measuring slope movement.

4.1.3. Trial Pits and Boreholes

The site investigations included to excavate 2No Trial Holes and auger of 3No Boreholes to determine the footing profiles to the property and the condition of the ground below and supporting ground to the floor slab within the extension to the rear. The boreholes were augured to a maximum depth of 3.5m below ground level.

Trial Pit TP01 was excavated against the front elevation of Bedroom 1, towards the left-hand external corner of the front projection. Trial Pit TP02 was excavated below the Kitchen window to the West of rear elevation of the extension. The trial pits were excavated to determine the footing profiles and the ground conditions at and below the footings and the floor slab. Boreholes WS01 and WS02 were augered through the base of Trial Pits TP01 and TP02. Borehole WS03 was cored and augured through the Kitchen floor. The boreholes were augered to confirm the ground conditions at depth with in-situ testing being conducted and soil samples being taken for laboratory analysis. Borehole WS03 were augured to confirm the depth and quality of material below the floor slab within the Kitchen extension.

4.1.4. Trial Pit TP01 / Borehole WS01 – Front elevation

WS01 Below concrete hardstanding, Made Ground was encountered to 0.46m below ground level and comprised a sandy, gravelly Clay, with the gravel comprising flint, brick, and concrete. Allow cobble content of brick was also observed within this stratum.

Below the Made Ground, a series of weathered horizons of the Vectis Formation were encountered as typically Clay with notable colour changes and a varying quantity of possible lignite of clay ironstone gravel. The Vectis Formation deposits were encountered to the base of the borehole at 3.5m below ground level.

Within Trial Pit TP01 the concrete footings were noted to be 240mm thick and supported at 0.46m below ground level onto the Clayey Weathered Vectis Formation. The footing projected 180mm from the face of the wall.

4.1.5. Trial Pit TP02 / Borehole WS02 – Rear elevation

WS02 Below the Kitchen window and below the vegetation Made Ground was encountered to a depth of 0.9m below ground level. The Made Ground was initially encountered as a firm, sandy, gravelly Clay; however, with depth the nature of this material changed to a soft consistency. The quantity and nature of the gravel changed with depth, but typically comprised flint, brick wood and metal. Cobbles of brick and wood were observed within the Made Ground from 0.3m to 0.9m below ground level.

Below the Made Ground, soft to firm, greyish brown, bluish grey and brown Clay was encountered and proved to 1.4m below ground level. This stratum has been tentatively described as Alluvium due to its colour, consistency and by cross referencing this stratum with that encountered in WS03, described below.

Weathered strata of the Vectis Formation were encountered below the possible Alluvium, with this material having a similar appearance to that observed in WS01 located to the front of the property.

From 2.6m to 3.1m below ground level in WS02, the stratum had the appearance of the Vectis Formation; however the structure, change in consistency as well as the rapid reduction in directly recorded shear strength using the hand vane would suggest that this could be a zone of possible solifluction material that is typically related to the gradual movement of wet soil or other material down a slope and could be evidential of a slip zone.

Within Trial Pit TP02 the concrete footings were noted to be 280mm thick and supported at 0.88m below ground level onto a Made Ground. The footing projected 130mm from the face of the wall.

4.1.6. Borehole WS03 – Within the Kitchen

WS03 Within the kitchen area an auger was cored through a sand screed and concrete (total depth 200mm) with Made Ground encountered from 0.2m to 0.6m below ground level. This material comprised firm, sandy, gravelly Clay with the gravel observed as being flint and brick.

Beneath the Made Ground, very soft, grey with occasional brown and black streaks, sandy, locally silty Clay was encountered. An organic odour was also recorded throughout this stratum, which has been tentatively described as Alluvium. The similarities in colour between this material and that observed in WS02 from 0.9m to 1.4m below ground level, suggest that an undefined area under the property's footprint is mantled by possible Alluvium.

Stiff, brown mottled grey deposits of the Vectis Formation were encountered below the Alluvium and proved to the base of the borehole at 2m below ground level.

4.1.7. Groundwater

WS01 remained dry whilst open; however, groundwater was encountered in WS02 at 0.8m, rising to 0.54m below ground level upon completion. Groundwater was not encountered during the construction of WS03; however, the borehole was left open overnight and, in the morning, water was measured at 1.33m below ground level.

WS01 encountered predominantly cohesive soils and therefore it is likely that the permeability of the soils to the front of the property is lower than those soils to the rear. Where groundwater was encountered in WS02 and WS03, the groundwater levels may not have attained an equilibrium level due to the relatively short period of time the exploratory hole remained open. It should be noted that groundwater levels may vary both seasonally and in the long term.

4.1.8. Roots

Roots and rootlets were observed in each exploratory borehole to depths of 3.2m (WS01), 2.9m (WS02) and 1.8m (WS03) below ground level. Roots and rootlets were found below the underside of the foundations to the base of the trial pits.

No root samples were taken for laboratory analysis.

4.1.9. Soil Classification

Atterberg Limit tests were conducted on the cohesive samples, from within WS01 and WS02, recovered from the possible Alluvium and underlying Weathered Vectis Formation, including the solifluction zone in WS02.

The laboratory analysis appeared to indicate that the cohesive samples below the foundations within the boreholes had a medium volume change potential as defined in National House Building Council (NHBC) Standards Chapter 4.2 'Building near trees' 2022. Within the WS01, where the roots were encountered to 3.2m below ground level, the Clay at this depth had a high-volume change potential.

The Plasticity Index for the soil samples ranged between 22% and 41%. These soils can be susceptible to significant volume changes depending on their moisture content. Based on the plasticity index and liquid limit laboratory determinations and with reference to BS5930, the Weathered Vectis Formation typically has a high plasticity carrying the designation CH.

The results for the soil samples taken from within Borehole WSO2 appeared to indicate that the moisture contents were less than 0.4 x Liquid Limit indicating that, in accordance with Driscoll's relationship, the soil below the foundations were desiccated to full depth of the borehole. The laboratory analysis for Borehole WS01 were inconclusive but appeared to indicate that the cohesive soil was nearing desiccation.

At equilibrium moisture content, clay soils exhibit a roughly linear increase in strength with depth. As a Clay soil becomes desiccated the strength of the soil increases above that at the equilibrium moisture content. A crude approximation of strength can be determined with the dial gauge penetrometer.

The pocket penetrometer readings taken from WS01 substantiate that desiccation is present to depths of at least 3m below ground level to the front of the property. Reference to the data from WS02 would suggest that the clayey Vectis Formation strata are desiccated to about 2.5m below ground level.

The in-situ testing, with Pocket Penetrometer and Shear Vane, generally indicated that the cohesive soils were Firm to Stiff at depth within Boreholes WS01 and WS02.

The laboratory analysis and the in-situ testing would appear to indicate that the Clay stratum below the foundations would be desiccated to at least the observed depths for the roots which were recorded within the boreholes.

4.1.10. Drainage

There was drainage below ground which ran parallel to the rear and the East side elevations of the main property. The drainage to the rear of the property passed below the Kitchen extension. There was also a rainwater downpipe against the West side elevation of the property. The majority of pipework below ground was understood to be of Pitch Fibre and Vitrified Clay.

Observations made by CK Consulting and Geotechnical Limited during their visit: -

Several of the inspection covers were lifted during the course of the fieldwork, initially as a means to determine the depth and direction of the foul and surface drains but also to assess the observable condition of the manholes.

It could be seen that the foul / surface water drain from the Bathroom (MH1) passed below the Kitchen extension at a relatively shallow depth. Close to the Northeast corner of the property and the Shower Room within the extension, was another manhole cover (MH2) that confirmed the shallow depth of the drains, which might explain the "elevated" level of the shower cubicle inside the bungalow, as this would be the only way to achieve any "fall" and allow the water to drain. This manhole was also noted to be in a poor state of repair. A third cover (MH3) was lifted at the Southeast corner of the main property. Water was poured from MH2 to MH3; however, little of the water was observed in the latter manhole suggesting that the drain run may also be in a poor state of repair. There was vegetation growing within the gulley to the rainwater downpipe adjacent to the manhole (MH3) at the Southeast corner of the property.

We were provided with a Drainage Survey Report which had been prepared by Drainline Limited, dated November 2022.

The report prepared by Drainline identified the following: -

- The drainage serving the site was of pipe diameters 100mm and 150mm.
- The predominately Foul drainage system had one surface water connection, (Rainwater Gully A - RWG A). RWG A requires replacement due to being broken and root infested.
- The rear rainwater downpipe discharged into a water butt for garden usage.
- The other surface water gully located to the West flank wall possibly discharged to a localised "builders" type soakaway, (rubble or shingle filled pit), or other drainage.
- There was an internal manhole chamber, (MH2), that could not be accessed during the survey, this manhole chamber had one in number lateral connection, (usage unknown).
- Three main runs MH2 to MH3, MH3 to MH4 and MH4 to MH5 were observed to be of Pitch Fibre material.
- Two of the Pitch Fibre runs were presently deformed by up to 30% - MH3 to MH4 and MH4 to MH5.
- The run MH5 to Main Manhole was of Vitrified Clay material and had root infestation and displacements along its length.
- The lateral connection to Manhole 5 was observed to be collapsed and root infested, it is assumed that it was disused.
- Manhole 1 had a broken and cracked channel.
- The cover and frame of Manhole 4 required re-bedding due to becoming loose from the surrounding concrete surface finish.
- Manhole 5 required root removal and re-benching.

Summary of the findings: -

The drainage system requires remediation to the defects observed to prevent other and worsening defects.

The already deformed / defective Pitch Fibre pipework within the system requires re-rounding and re-lining and the undefective section of Pitch Fibre requires re-lining to avoid it becoming defective/deformed.

Pitch Fibre pipework was installed during the 1960's and early 1970's as an alternative to Clay pipework, it was manufactured using mainly laminated Bitumen layers, concerns regarding its longevity were raised and its production was ceased. Pitch Fibre has a very short lifespan compared with other materials and will inevitably delaminate, deform, weaken and eventually become crushed from ground weight. At this time, the deformed runs / sections can be re-formed to a round profile and the structurally re-lined, this is far more cost-effective option of excavation and replacement which will inevitably become necessary if the pipework is allowed to deteriorate further beyond the parameters/capabilities of re-forming and re-lining.

The disused connection to Manhole 5 should be sealed off at the manhole chamber to prevent groundwater and debris ingress and rodents nesting.

The defective manhole chambers 1, 4 and 5 require remediation to ensure future service.

Run Manhole 5 to Main Manhole requires root cutting and re-lining to seal the pipework form further root infestation and ensure clear flow.

The defective rainwater gully RWG A requires excavation and replacement to ensure water is not discharged to the sub strata near the property foundations.
Post remediation the system will be returned to a fully serviceable condition.

Drainline Limited recommended the following works to the drainage system: -

1. To re-line the Pitched Fibre pipework between MH2 and MH3.
2. To re-form and re-line the Pitched Fibre pipework between MH3 and MH4.
3. To re-form and re-line the Pitched Fibre pipework between MH4 and MH5.
4. To cut out the roots and re-line the defective pipework between MH5 and the Main Manhole.
5. To excavate and replace the defective gully and surround and reinstate to RWG A.
6. To carry out repairs to Manhole Chambers 1, 4 and 5.
7. To seal off the disused connection / lateral to Manhole 5.

4.2. Roof Structure – Main Property

Refer to Frankham Consultancy Limited's report, dated 12th July 2022, which is attached within Appendix A.

As noted within our original report, dated 12th July 2022, there was cracking to the ceilings within the Entrance Hall and the Reception Rooms together with minor movement at high level to the external walls. There was cracking to the ceilings at the location of struts which were supporting the sloping roof structures within the roof space. There were also gaps present between the sides of the rafters and the ceiling joists over the external walls and between the sides of the ceiling joists where spliced over the central spine wall.

The raking struts which provided support to the purlins below the sloping roofs were laid at a shallow angle and were birdsmouthed to the top of the sections. The raking struts above the Reception Rooms to the East side of the roof space were not directly opposite each other over the central spine wall.

Within the roof space over the main property there was deflection of the purlins which were providing support to the sloping roof structures.

It has been found that the ceiling joists did not align with each other over the central spine wall.

4.3. External Lintels – Main property

Refer to Frankham Consultancy Limited's report, dated 12th July 2022, which is attached within Appendix A.

As noted within our original report, dated 12th July 2022, there was corrosion present to the metal sections which were in place below the outer leaf of brickwork above the Bedroom window openings to the front and side elevation of the property. We believe that the cracking and movement at high level to both sides of the Bedroom windows maybe associated with corrosion and delamination of the metal sections, where built into, and supported onto the walls to each side of the openings. Where the metal has delaminated, it will expand causing the brickwork, at the point where the sections are built into the walls, to lift causing the cracking to the walls.

4.4. Damp and Condensation

Refer to Frankham Consultancy Limited's report, dated 12th July 2022, which is attached within Appendix A.

As noted within our original report, dated 12th July 2022, the external concrete paths, particularly those against the front and left-hand side of the property fell towards the building. Surface water was thought to pool against the elevations of the building. The damp proof course to the front, left hand side and rear elevations of the property were also noted to be less than 150mm above the paths.

Within the property there was damp staining at high and low level to the external walls. We believe that this staining maybe associated with condensation. It appeared that an attempt had been made to address the condensation with vents being present through the external walls.

4.5. Boundary Wall – West side of the property

Refer to Frankham Consultancy Limited's report, dated 12th July 2022, which is attached within Appendix A.

As noted within our original report, dated 12th July 2022, the boundary wall to the left-hand side of the property had been subject to significant cracking and movement. The wall was distorted along its length and was cracked and leaning inwards at high level. There were a number of mature trees, bushes and shrubs growing within the garden of the neighbouring property and directly behind the wall. The cracking and movement to the boundary wall was associated with physical damage caused by the presence of a Cherry tree growing directly behind the wall, within the garden of the neighbouring property, No 16.

The boundary wall was of 110mm wide rendered blockwork construction with block piers at approximately 5m centres. The blockwall was approximately 900mm in height and was also thought to be retaining ground to the adjacent property. However, a detailed inspection behind the wall was not possible due to the presence of vegetation and debris.

4.6. Extension and Alterations

Refer to Frankham Consultancy Limited's report, dated 12th July 2022, which is attached within Appendix A.

As noted within our original report, dated 12th July 2022, the property had been altered in the past with the introduction of a single storey to the rear elevation and openings having between created within the walls which separated the Reception Rooms.

5.0 CONCLUSION

5.1. Subsidence and Foundation Movement – Main Property and Extension, Floor Slab - Extension

5.1.1. Foundations

The brick and concrete foundations to the front of the property would appear to be supported within the shrinkable Clayey Vectis Formation strata that have been impacted by changes in seasonal moisture content as well as variations in moisture uptake by nearby trees, bushes, etc…

The foundations to the Kitchen extension appeared to be locally bearing within the Made Ground. This material would not be normally recommended as a bearing stratum due to this material's unpredictable settlement and strength characteristics and the inherent risk of collapse settlement. In addition, it is possible that the stability of the Made Ground may be impacted by a change in loading, vibration, or inundation of water. Any of these events or a combination may result in possible bearing failure, which would lead to ground movement and subsequent structural damage. The shrinkable Clayey Vectis Formation and Alluvium also appeared to have been impacted by seasonal changes.

The auger through the floor within the Kitchen confirmed that the floor to the extension comprised about 100mm of sand screed over about 100mm of concrete. There was no evidence to suggest that the concrete slab had been reinforced and therefore any ground movement could not be "accommodated" without causing damage to the floor.

The ground investigations ascertained that the site was underlain by deposits of the Weathered Vectis Formation. Possible Alluvium was encountered to the rear of the property. These geological sequences were mantled by Made Ground to a maximum depth of 0.9m below ground level in the trial pit and borehole to the rear of the Kitchen extension.

The investigations into the ground indicated that the shrinkable stratums within the boreholes were desiccated, or nearing desiccation.

5.1.2. Subsidence

In our opinion based on the site investigations carried out we consider that one of the most likely causes of the cracking and movement to the building was associated with subsidence. This included the cracking to the walls and the movement to the extension floor. The most extensive cracking was noted to the extension to the rear of the property. The property was found to be supported onto shallow footings above a shrinkable ground. The extension floor was formed with a ground bearing concrete slab bearing onto made ground above a shrinkable ground. The in-situ testing and soil samples taken from within the boreholes appeared to indicate that the Clay below the foundations was desiccated, or nearing desiccation, which, in our opinion, would indicate that the most likely cause of the subsidence was drying out of the shrinkable Clay subsoil due to the absorption of water by the nearby mature trees. The Clay below the foundations was found to be of intermediate to high plasticity with a medium to high volume change potential. There were a number of mature trees in close proximity to the property and particularly adjacent to the West side and rear elevations. Roots and rootlets were encountered at up to 3.5m below ground level within the boreholes. The roots from the nearby trees were thought to extend below the footprint of the building.

There were a number of mature trees, which included Cypress, Cherry, Oak, Apple, Sycamore and Eucalyptus in close proximity to the property.

There was also cracking and deformation with root ingress to the pipework which formed the drainage below ground. The fractures to the drainage will be allowing escape of water into the ground. This will cause softening of the ground below the foundations and below the floor slab causing them to drop and crack. We believe that the drainage had been altered to accommodate the shower within the extension. The drainage below ground floor was at a shallow depth and, as such, will be susceptible to ground movement due to the nearby trees and any land slip due to the nearby railway cutting to the rear.

5.1.3. Slope Stability

There were inclinometers and a piezometer within the back garden to the property suggesting that slope stability has been a cause for concern.

The cutting slope that leads down from the rear garden of 15 Gordon Close towards the railway line at the toe of the earth structure could not be readily inspected due to the lack of access to the lineside property and the heavily vegetated slope surface. However, there was evidence that movement had taken place, which maybe ongoing: -

- The cracks in the concrete floor that was the base of the former garage located to the West of the property were orientated parallel to the crest of the slope and this crack pattern was mimicked in the undulating paving slabs located outside the Kitchen door.
- The crack pattern of the lintel above the door to the Kitchen would suggest significant clockwise rotational movement. This maybe the failure of foundations to the Northern flank wall, which appeared to locally bear within Made Ground, but also may be as a result of a landslip as suggested by the presence of possible solifluction material in WS02 from 2.6m to 3.1m below ground level; and
- The trees located on the cutting slope did not appear to have straight growth with the angle of some trees suggesting possible "downslope" movement.

We believe that the property is at risk from landslip, and particularly the extension to the rear, which was closest to the railway cutting.

During our most recent inspection on 13th October, it was noted that additional cracking and movement appeared to have taken place to the rear of the property and to the back garden since our original visit on 12th July 2022. This further damage is noted within Item 3.0 above.
As noted above, and within the attached Geological report on ground investigations, we believe that the cracking and movement to the property maybe associated with foundation movement due to a combination of subsidence and landslip. At this stage it is not possible to provide a definitive answer to help stabilise the building. It will be necessary to provide a scheme which will address the issues of both the subsidence and landslip.

5.2. Roof Structure – Main Property

As noted within our original report, dated 12th July 2022, there was cracking to the ceilings within the Entrance Hall and the Reception Rooms together with minor movement at high level to the external walls. There was cracking to the ceilings at the location of struts which were supporting the sloping roof structures within the roof space. There were also gaps present between the sides of the rafters and the ceiling joists over

the external walls and between the sides of the ceiling joists where spliced over the central spine wall.

The raking struts which provided support to the purlins below the sloping roofs were laid at a shallow angle and were birdsmouthed to the top of the sections. The raking struts above the Reception Rooms to the East side of the roof space were not directly opposite each other over the central spine wall.

Within the roof space over the main property there was deflection of the purlins which were providing support to the sloping roof structures.

It was also found that the ceiling joists did not align with each other over the central spine wall.

In our opinion the timber sections which formed the sloping roofs and the ceiling joists over the main property were undersized for their spans and the theoretical loadings which could be placed upon them. This was not untypical for a property of its age and construction.

There did not appear to be any lateral restraint straps in place to tie the gable walls to each side of the main property into the sloping roof and the ceiling structures.

A limited inspection of the roof structure was made using crawl boards over the ceiling joists to gain access to eaves level.

5.3. External Lintels – Main property

As noted within our original report, dated 12th July 2022, there was corrosion present to the metal sections which were in place below the outer leaf of brickwork above the Bedroom window openings to the front and side elevation of the property. We believe that the cracking and movement at high level to both sides of the Bedroom windows maybe associated with corrosion and delamination of the metal sections, where built into, and supported onto the walls to each side of the openings. Where the metal has delaminated, it will expand causing the brickwork, at the point where the sections are built into the walls, to lift causing the cracking to the walls.

5.4. Damp and Condensation

As noted within our original report, dated 12th July 2022, the external concrete paths, particularly those against the front and left-hand side of the property fell towards the building. Surface water was thought to pool against the elevations of the building. The damp proof course to the front, left hand side and rear elevations of the property were also noted to be less than 150mm above the paths.

Within the property there was damp staining at high and low level to the external walls. We believe that this staining maybe associated with condensation. It appeared that an attempt had been made to address the condensation with vents being present through the external walls.

5.5. Boundary Wall – West side of the property

As noted within our original report, dated 12th July 2022, the boundary wall to the left-hand side of the property had been subject to significant cracking and movement. The wall was distorted along its length and was cracked and leaning inwards at high level. There were a number of mature trees, bushes and shrubs growing within the garden of the neighbouring property and behind the wall. The cracking and movement to the

boundary wall was associated with physical damage caused by the presence of a Cherry tree growing directly behind the wall, within the garden of the neighbouring property, No 16.

The boundary wall was of 110mm wide rendered blockwork construction with block piers at approximately 5m centres. The blockwall was approximately 900mm in height and was thought to be retaining ground to the adjacent property. The wall was thought to be retaining the ground to the neighbouring property to a height of approximately 500mm. The roots from the adjacent trees will also apply pressure onto the back of the wall. However, a detailed inspection behind the wall was not possible due to the presence of vegetation and debris.

5.6. Extension and Alterations

As noted within our original report, dated 12th July 2022, the property had been altered in the past with the introduction of a single storey to the rear elevation and openings having between created within the walls which separated the Reception Rooms.

6.0 RECOMMENDATIONS

6.1. Subsidence and Foundation Movement – Main Property and Extension, Floor Slab – Extension

CK Consulting and Geotechnical Limited, who undertook the site investigations, have recommended that based on the site investigations carried out that the building should be underpinned to below the level of desiccation. This will require piled foundations to be provided. However, it will be necessary to carry out further site investigations for design of the piled foundations to be carried out by the specialist piling contractor. It will also be necessary to carry out further site investigations and to obtain further specialist advice with regards to the potential for landslip.
Due to the extent of defects which were present to the drainage and their shallow nature, which will be affected by ground movement, we recommend that an allowance should be made to replace the drainage around the property. This drainage should be designed to take into account any ground movement which could take place due to the ground conditions.

We believe that it could prove to be more cost effective to demolish and rebuild the property onto new piled foundations with slope stabilisation, rather than trying to pile underpin the existing building. This would be subject to a cost benefit analysis being carried out by a Building / Quantity Surveyor.

In the first instance we recommend that enquiries should be made with a Company, such as Geobear, who maybe able to provide advice with regards to underpinning to the property and providing a scheme for stabilising the slope and railway cutting to the rear. This may not be a viable option and will be subject to further investigations. The works will need to be carried out in conjunction with any recommendations made by an Arborist.

Based on the final proposed scheme we recommend that an Arborist should be appointed to inspect and report on any tree management deemed necessary based on the findings of the site investigations. Any recommendations made by the Arborist should be carried out. There are a number of trees which are present outside the boundaries of the property and, as such, it will be necessary to liaise with their owners to carry out the necessary works. It is thought likely that trees will need to be removed or reduced in height and managed. The Arborist should also make recommendation for tree management to help limit the potential for future subsidence. The trees on the railway cutting to the rear of the property maybe helping to provide stability and binding to the sloping ground which will need to be considered by the Arborist. Further development of the existing, or planting of new vegetation within influencing distance of the property should be avoided.

Enquiries should be made to confirm the results and readings from the monitoring which has been carried out with the piezometers and inclinometers in order to ascertain the extent of any ongoing movement which is taking place to the slope of the railway cutting. It should also be confirmed as to whether any works have been attempted to try and stabilise the sloping ground, although this is thought to be unlikely.

If it is intended to retain the existing building, then in order to aid the monitoring procedure we recommend that demac studs should be placed across the cracks and monitored by a qualified Structural Engineer on a two monthly basis in order to review seasonal and any progressive movements.

It should be noted that we are unaware as to whether any of the neighbouring properties or structures are at risk from landslip.

6.2. Roof Structure – Main Property

If the existing building is to be retained, then we recommend that the roof structure over the main property should be strengthened in accordance with a qualified Structural Engineers design and details. We can provide details upon request.

In the first instance you may wish to introduce lateral restraints to help improve the fixing between the rafters and the ceiling joists and where the ceiling joists are spliced over the central spine wall. These works could include to introduce strapping, timber sections and to upgrade fixings between the existing sections. We also suggest that additional struts are introduced, including to the side of the raking struts above the Reception Rooms which are not directly opposite each other to the East side of the roof space. This strengthening will help to limit, but not prevent, the extent of further large deflections and movements which could take place.

However, it should be noted that if the limited strengthening is not successful and future cracking and / or movement takes place at high level on the ground floor then additional support to the sloping roof and ceiling structures will be required. This strengthening, which should be designed and detailed by a qualified Structural Engineer, is likely to include the introduction of a number of steel beams, struts and possibly posts onto pad foundations. The full extent of works will be subject to a measured survey and further investigations.

We recommend that an allowance should be made to introduce lateral restraint straps to help tie the gable walls into the sloping roof and ceiling structures.

We recommend that the strengthening to the roof structure and the introduction of restraint to the gable walls should be carried out with Building Regulations approval.

6.3. External Lintels – Main property

If the existing building is to be retained, then we recommend that the lintels above the Bedroom windows to the front and side elevations of the property should be replaced with lintels of adequate design and loadbearing construction. We recommend that these works should be carried out with Building Regulations approval.

6.4. Damp and Condensation

If the existing building is to be retained, then we recommend that the concrete paths around the property should be removed and replaced with the new paths and ground levels being located at more than 150mm below damp proof course. The new paths should be laid with surfaces to fall away from the property.

We recommend that a PCA Approved Damp and Timber Specialist should be appointed to inspect and report on any issues with damp within the property. This should include to address the areas of damp at high and low level to the external walls which we believe maybe associated with condensation. Any recommendations made by the Specialist PCA Approved Contractor should be carried out.

6.5. Boundary Wall – West side of the property

We recommend that a check should be carried out to confirm the ownership of the boundary wall which is present to the left-hand side of the property. It was thought to be likely that No 15 is responsible for the wall but this will need to be checked with the Deeds for the property.

We recommend that the boundary wall to the left-hand side of the property should be replaced in accordance with design and details prepared by a qualified Structural Engineer.

It will be necessary to liaise closely with the owners of the neighbouring property, No.16, with regards to works required to replace the boundary wall as access onto their land will be necessary. It is likely that it will also be necessary to remove trees within their land in order to undertake the works.

The full extent of works required will be subject to further inspection and investigations with design being prepared as the wall was believed to be retaining land to the neighbouring property. The investigations will include to confirm the height of the retained soil behind the structure.

APPENDIX A
ORIGINAL FRANKHAM REPORT
JULY 2022

STRUCTURAL REPORT

ON

CRACKING AND MOVEMENT

At:

15 Gordon Close,
Sandown,
Isle Of Wight
PO36 9AD

For:

Spence Refit Limited
Macmillan House
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Issue Date:
August 2022

File Reference:
441619-FCG-XX-XX-RP-S-0301-S2-P01

BRINGING IDEAS TO LIFE

DOCUMENT VERIFICATION

STRUCTURAL REPORT

ON: **CRACKING AND MOVEMENT**

AT: **15 GORDON CLOSE, SANDOWN,**

ISLE OF WIGHT, PO36 9AD

FOR: **SPENCE REFIT LTD**

FRANKHAM PROJECT NO: **441619**

	Signature:	Name:
Prepared by:		**J.Burstow**
Reviewed by:		**B.Hillson**
Approved by:		**G.Lane**

Issue Purpose	Revision	Issue Date	Prepared by	Reviewed by	Approved by
For Information	P01	02.08.2022	JBU	BH	GL

CONTENTS

1.0 INTRODUCTION

Frankham Consultancy Ltd was commissioned by Spence Ltd to undertake a structural non-intrusive visual inspection / assessment. The aim of the survey was to inspect and report on cracking and movement, with particular attention to reported cracking above the back door to the Kitchen and to the external walls of the Bedrooms. It was also reported that the external paths around the property were too high in relation to the damp proof course. The report is to provide recommendations for remedial works and any further intrusive investigations deemed necessary.

The inspection was undertaken on Wednesday 13th July 2022 by Mr J. Burstow, Chartered Structural Engineer.

Photographs showing the areas of damage are attached within Appendix A.

15 Gordon Close is a detached bungalow which is 'L' shaped on plan with a projection to the left-hand side of the front elevation. The building is of masonry external walls beneath a pitched tiled roof which spans front to back over the main property and side to side over the front projection. There are gable walls to the side elevations of the main property and to the front elevation of the projection.

The building is thought to have been constructed circa 70 years ago. Internal walls throughout the property were generally thought to be of masonry construction with the floors thought to be of ground bearing concrete slab construction.

The property had been extended in the past with a single storey extension projecting from the right-hand side of the property against the rear elevation of the building. The extension is of masonry external walls beneath a flat roof with the ground floor thought to be of ground bearing concrete slab construction.

The building is of face brickwork elevations, with the exception of the front elevation of the Front Reception Room which is of a stonework facing. Refer to Photos 1 and 2.

A garage, which had been attached to the rear left-hand corner of the property, had been removed. The render finishes to the rear of the property and the concrete slab to the garage floor remained in place.

In describing the property all references to front, rear, left and right assume that the front of property faces Gordon Close. For the purposes of this report the front of the building is assumed to face South.

There are three Bedrooms located to the West side of the property with two Reception Rooms to the East side of the building. The Bathroom is located between the Rear Bedroom and the Rear Reception Room. The Kitchen and a Shower Room are located within the extension to the rear of the property.

2.0 TOPOGRAPHY / GEOLOGY

The ground level directly around the property is relatively level, although the concrete paths fall towards the external elevations of the building. There is a railway embankment to the rear of the property with a sharp fall from the rear boundary to the railway line to the North.

The fall in ground level was located at less than 10m from the rear elevation of the building.

The back garden to No 15 Gordon Close is thought to be located at approximately 10m above the railway line to the rear.

There is a small change in ground level, thought to be less than 500mm, to the right-hand side of the property.

Data from the British Geological Survey Map indicates that the underlying stratum below the building is likely to be a Vectis Formation which is made up of Mudstone and Siltstone.

The British Geological Survey Map does not indicate any superficial deposits below the building and therefore it is assumed that the Vectis Formation is at, or close to ground level. The Vectis Formation can contain Clay. If Clay is present, then this can shrink or expand according to the level of moisture in the ground. Shrinkage of the ground under the foundations in times of drought or when desiccated by tree roots can cause foundation movement leading to subsidence. The presence of vegetation adjacent to the property would be a potential threat to its stability.

3.0 OBSERVATIONS

3.1 External Inspection

The external elevations of the property are weathered and have deteriorated with areas of loose and eroded pointing to the walls. Refer to Photo 3

There are various isolated horizontal, stepped and vertical cracks, less than 2mm wide, to the stone facing to the front elevation of the Front Reception Room. There are also spalled brick faces to the brickwork below the Front Reception Room window. Refer to Photos 4 to 6.

The brickwork above the Bedroom window to the front elevation of the property has been locally repointed in the past. There is isolated horizontal cracking with repaired stepped cracking to the walls to each side of the opening from both sides of the window. There is a metal plate in place below the outer leaf of brickwork which passes over the window. There is corrosion present to the metal support below the brickwork over the opening. Refer to Photos 7 to 10.

The brickwork above the Bedroom window to the side elevation of the property had been locally repointed in the past. There is isolated horizontal and stepped cracking, up to 3mm wide, to the walls to each side of the opening from both sides of the window. There is a metal plate in place below the outer leaf of the brickwork which passes over the window. There is loose mortar to the horizontal crack to the North side of the opening. The loose mortar was removed, and a corroded plate was found to be present. The metal support has delaminated at its bearing onto the wall. There is corrosion present to the metal support below the brickwork over the opening. The horizontal crack at the head of the opening to the North side of the Bedroom window to the side elevation of the property continued towards the middle of the gable wall and then became stepped rising to the rear. The crack, which continues through bricks, was thought to be up to 3mm wide, and rises to the rear by 4 brick courses. The cracking to the South side of the opening rises to the roof line over the main property. There is isolated vertical cracking, which extends into brick courses, below the North side of the window. The windowsill and brickwork to the North side of the opening fell to the rear by upto 1:60 when checked with a spirit level. There are spalled bricks at low level to the wall below the window. Refer to Photos 11 to 16.

The brickwork to the external elevation to the West side of the extension appears to have been repointed in the past. This maybe concealing damage. There is an isolated area of cracked and missing pointing at high level to the North side of the back door to the Kitchen. The brickwork to the East side elevation of the extension is weathered and had deteriorated with eroded pointing. Refer to Photos 17 to 19.

The brickwork and windowsills to the rear elevation of the extension fall to the West by up to 1:60 when checked with a spirit level.

There is isolated stepped cracking with weathered and eroded pointing to the brickwork at high level to the rear external corner on the East side elevation of the extension. Refer to Photo 20.

It appears that the lintel over the Rear Reception Room window has been replaced in the past. Refer to Photo 21.

The damp proof course to the building is, in places, only 10mm above the path to the external elevations of the building. This applied where the concrete paths which are present around the perimeter of the building and in particular to the front and left-hand side of the property. Surface water is thought to pool on the paths adjacent to the property to the front and left-hand side of the building. Refer to Photo 22.

The concrete path and slab to the garage and the rear left-hand corner of the property is cracked and has dropped to the Northwest. Refer to Photos 22 to 25.

The garden which surrounds the property is uneven and undulates. The garden to the Northwest corner of the property appears to have locally slumped towards the railway embankment to the rear. The embankment is formed with a sharp slope down to the railway line which is thought to be up to 10m below the back garden to the property. We were unable to carry out an inspection or take detailed measurements of the embankment. The rear boundary line which separates the garden from the railway embankment is located at approximately 8m from the rear elevation of the building. Refer to Photo 26.

Within the back garden there are 4No tubes encased in concrete above ground level. A tape measure indicates that the tubes extend at least 10m below ground level. We understood that that the tubes are piezometers and used for the measurement of ground water levels. Refer to Photos 27 and 28.

There is a rainwater downpipe which discharges into a gulley, at the junction between the left-hand side elevation of the main property and the front projection. There is also a rainwater downpipe which discharges into a gulley to the front right hand corner of the property. The rainwater gulley to both sides of the property is noted to be blocked with vegetation and debris. There are rainwater and foulwater downpipes with a gulley against the rear elevation of the main property. The concrete path around the gulleys and pipework above the path have cracked. There is a rainwater downpipe to the rear right hand corner of the extension which discharges into a water butt. There is a soil vent pipe with boxing and concrete encasing above ground level against the East side elevation of the extension to the rear of the property. The boxing and concrete encasing is thought to be covering pipework above ground. Refer to Photos 29 to 34.

There are inspection chambers adjacent to the front and rear right hand corners of the property and adjacent to the left-hand side of the extension and the rear elevation of the main property with a further inspection being located within the garden to the front right hand side of the property. The drain runs which served the property are thought to pass below the extension and run-in close proximity and parallel to the right-hand side elevation of the building. Refer to Photos 35 to 38.

There are a number of various species of mature trees, bushes and shrubs within the neighbouring garden to the left, No 16, and within the Network Rail land to the rear of the property. These trees, include Cypress, Cherry, Oak, Apple, Sycamore and Eucalyptus. The trees are up to 20m in height and at less than 5m from the side elevation of the main property and at less than 10m from the rear elevation of the extension. There are trees to the left-hand side of the property which appear to have been reduced in height in the recent past. There is a Cypress tree, less than 4m in height, at less than 2m from the right-hand side of the front projection and front elevation of the main property. There are also various other smaller shrubs and bushes adjacent to the right-hand side elevation of the property. We understand that the back garden to the property had been overgrown although this had been cleared prior to our visit. The vegetation within the back garden was understood to have blocked the view from the Kitchen windows. Refer to Photos 39 to 47.

The boundary wall to the left hand side of the property is of 100mm wide rendered blockwork construction which is in the order of 900mm in height. The blockwall is reinforced with 450mm wide x 210mm deep block piers at approximately 5m centres along its length. The boundary wall is thought to be retaining soil to a height of 500mm on the neighbours' side of the wall although a detailed inspection was not possible due to the presence of debris. The remaining boundaries are formed with fence panels.
There are a number of mature trees, bushes and shrubs within the neighbouring property, No 16. This vegetation is growing directly behind the boundary wall to the left-hand side of the property. The boundary wall is distorted along its length and has cracked and moved outwards at the location of a Cherry tree growing within the adjacent garden. There is a stepped and horizontal crack to the boundary wall at the location of the Cherry tree and the wall is leaning towards the drive at high level when checked with a spirit level. The cracked blockwork has moved over the wall directly above the drive by approximately 110mm due to the physical presence of the tree. Refer to Photos 48 to 52.

3.2 Main Property – Internal Inspection

The property did not appear to have been maintained or decorated for a number of years. The walls within the main property are decorated with a heavily embossed wallpaper which maybe concealing cracking to the walls behind.

Within the Front Bedroom there is diagonal cracking, up to 3mm wide, above the windows at the Southeast corner of the room. The East side wall of the Bedroom is leaning outwards at high level by up to 1:60 over its full height when checked with a spirit level. Refer to Photos 53 to 55.

There is cracking, up to 2mm wide, at the junction between the coving to the Front Bedroom ceiling and the West side wall. Refer to Photo 56.

Within the Middle Bedroom the windowsill falls to the rear by up to 1:60 when checked with a spirit level.

There is stressing to the wallpaper at the junction between the internal wall to the Rear Bedroom and the external wall within the Middle Bedroom. Refer to Photo 57.

Within the Entrance Hall there is a crack which spans front to back over the Rear Bedroom door. The crack is thought to be up to 2mm wide. The crack is generally at the location of supporting struts within the roof space. Refer to Photos 58 and 59.

Within the Bathroom there is cracking to the ceiling, particularly around the trap hatch. Refer to Photos 60 and 61.

Within the Front and Rear Reception Rooms there are cracks, thought to be up to 2mm wide, which span front to back. The cracks are generally at the location of supporting struts within the roof space. There are various cracks, up to 1mm wide, to the Reception Room ceilings. There is cracking at the junction between the Front Reception Room ceiling and the front wall of the property. The front external wall is leaning outwards by up to 1:60 when checked with a spirit level. Refer to Photos 62 to 66.

There is an opening, with a clear span of approximately 1.5m, within the wall which separates the Front and Rear Reception Rooms. The opening is to the West side of the chimney breast. Refer to Photo 67.

There is a tapered vertical crack at the junction between the Bathroom wall and the opening within the wall which separates the Reception Rooms. The crack is up to 1mm wide at high level and closes towards mid height on the wall to the side of the opening. Refer to Photo 68.

There are undulations to the floors throughout the main property.

There are a number of damp patches to the ceilings and at high and low level to the external walls within a number of rooms throughout the property. It appeared that an attempt had been made to address problems with condensation in the past with vents having been introduced. Refer to Photos 69 to 72.

3.3 Extension – Internal Inspection

The extension did not appear to have been decorated or maintained for a number of years.

Within the extension to the rear there are internal walls, of masonry construction, which form the Shower Room. There is cracking, up to 2mm wide, to the ceilings and at the junction between the Kitchen ceiling and the internal walls above the Shower Room door. Refer to Photos 73 to 75.

There is a stepped crack, thought to be up to 4mm wide, above the North side of the back door to the Kitchen. The crack rises to the rear. The external side wall of the Kitchen was noted to be leaning outwards at high level when checked with a spirit level. Refer to Photos 76 to 78.

There are hairline vertical and diagonal cracks at high level to the rear elevation of the main property within the extension. Refer to Photos 79 and 80.

The Kitchen floor falls to the North and rear by up to 1:60 when checked with a spirit level. There is a gap of approximately 20mm between the underside of the skirting boards to the rear external wall of the extension and the floor below. The kitchen units above have dropped with a gap being present between the worktops and the tiles to the wall above. Refer to Photos 81 and 82.

Within the Shower Room there is cracking at the junction between the coving and the perimeter walls and above the Kitchen door. Refer to Photos 83 and 84.

3.4 Roof Space

Access into the roof space over the main property was gained via a trap hatch within the Bathroom ceiling to the rear of the property. We were unable to gain access into the roof space over the front projection. Refer to Photos 85 to 88.

The sloping roof structure over the property is of traditional cut and pitched timber construction. The sloping roofs are of a shallow pitch. The sloping roofs over the main property are formed with rafters supported onto purlins which are, in turn, strut supported onto the central spine wall. There are two sets of raking struts below the purlins to the front and rear roof slopes. The ceiling joists span front to back. There is deflection to the purlins which provide support to the sloping roof structures. Refer to Photo 89.

The sloping roofs are formed with rafters which measured 43mm wide x 100mm deep at approximately 400mm centres. The rafters below the front and rear roof slopes over

the main property are bearing onto purlins which measured 75mm wide x 125mm deep. The purlins had spans which are in excess of 3m.

The struts which are supporting the sloping roofs over the main property are shallow pitched and birds mouthed to the top of the purlins. The raking struts which are present over the Reception Rooms did not align with each other where they are bearing onto the central spine wall below. Refer to Photo 90.

The ceiling joists over the main property, which measured 37mm wide x 105mm deep at approximately 400mm centres, are spliced over the central spine wall. There are binders, which are thought to measure 50mm wide x 100m deep, at the location of the purlins. Refer to Photo 91.

There is poor connection between the ceiling joists where they trim around the trap hatch.

There are gaps present between the sides of the rafters and the ceiling joists where they are supported onto the external walls of the main property and between the sides of the ceiling joists were supported over the central spine wall.

It was noted that there are timber members, including rafters and ceiling joists, which are twisted and distorted along their lengths, and particularly at the ridge board and the central spine wall.

There does not appear to be any lateral restraint straps in place to tie the gable walls into the roof and ceiling structures.

The sloping roof structures over the front projection are supported onto valley beams which are supported onto the purlin below the front roof slope over the main property.

A detailed inspection of the roof and ceiling structures was not possible due to restricted safe access into the roof space with the ceiling joists being covered with insulation. There is also plumbing and pipework within the roof space which restricts safe access. We were unable to gain safe access to carry out an inspection of the chimney stack within the roof space. Refer to Photo 92.

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4.0 DISCUSSION

The writer was unaware as to the detailed history of the property.

4.1 Roof Structure – Main Property

There was cracking to the ceilings within the Entrance Hall and the Reception Rooms together with minor movement at high level to the external walls. There was cracking to the ceilings at the location of struts which were supporting the sloping roof structures within the roof space. There were also gaps present between the sides of the rafters and the ceiling joists over the external walls and between the sides of the ceiling joists where spliced over the central spine wall.

The raking struts which provided support to the purlins below the sloping roofs were laid at a shallow angle and were birds mouthed to the top of the sections. The raking struts above the Reception Rooms to the East side of the roof space were not directly opposite each other over the central spine wall.

Within the roof space over the main property there was deflection of the purlins which were providing support to the sloping roof structures.

In our opinion the timber sections which formed the sloping roofs and the ceiling joists over the main property were undersized for their spans and the theoretical loadings which could be placed upon them. This was not untypical for a property of its age and construction.

There did not appear to be any lateral restraint straps in place to tie the gable walls to each side of the main property into the sloping roof and the ceiling structures.

A detailed inspection of the roof and ceiling structures over the main property was not possible due to restricted safe access into the roof space with the ceiling joists being covered with insulation. There was also plumbing and pipework within the roof space which restricted safe access. We were unable to gain safe access to carry out an inspection of the chimney stack within the roof space.

We were unable to gain access to carry out an inspection of the sloping roofs and the ceiling structure above the front projection.

4.2 External Lintels – Main Property

There was corrosion present to the metal sections which were in place below the outer leaf of brickwork above the Bedroom window openings to the front and side elevation of the property. We believe that the cracking and movement at high level to both sides of the Bedroom windows maybe associated with corrosion and delamination of the metal sections were built into and supported onto the walls to each side of the openings. Where the metal has delaminated, it will expand causing the brickwork, at the point where the sections are built into the walls, to lift causing the cracking to the walls.

4.3 Subsidence and Foundation Movement – Main Property and Extension

There was tapered stepped and diagonal cracking to the front right hand corner of the front projection, left hand side elevation of the property and to the rear extension. The floor within the rear extension also fell to the North and away from the main property.

Unfortunately, in our opinion, the possibility of the onset of either tree and / or drainage related localised subsidence and foundation movement having taken place to the property cannot be entirely ruled out.

There were a number of mature trees and vegetation in close proximity to the property with a potential for a shrinkable ground below. There were also drainage runs in close proximity to the building and which passed below the extension.

If the property is located over a shrinkable ground, then during periods of prolonged dry weather the water demand from the vegetation would cause the ground to shrink in volume causing the foundations which are supported onto the stratum to drop resulting in cracking to the walls above. The shrinkable ground will rehydrate during the wetter winter months causing an increase in the volume of the ground lifting the foundations and closing the cracks to the walls above. The Southeast of England has been subject to a prolonged period of dry weather which will exacerbate demand of water from the nearby trees.

If the drainage pipework below ground is allowing escape of water, then this maybe causing washout of any granular material or softening of any cohesive stratum below the foundations to the property. This washout or softening could have resulted in a loss of load bearing capacity causing the foundations and walls above to drop leading to the cracking and movement which was present.

The cause of the foundation movement will be subject to site investigations, following which the full extent of mitigation and remedial works can be determined.

The property was located in close proximity to a railway embankment from the rear boundary. We understood that the railway embankment may have been subject to, or will be subject to stabilisation works; however, the extent of these works is unknown. There were piezometers within the back garden of the property which we understood were in place to monitor ground water levels. There was evidence of some landslip and slumping of the ground to the Northwest corner of the garden. The impact of this movement on the property was unknown.

4.4 Floor Slab – Extension

The floor within the extension to the rear of the property fell to the North and away from the main property. There was a gap, of 20mm, between the underside of the skirting board and the floor at the rear external wall of extension. The Kitchen units against the rear external wall, which were also supported onto the floor slab below, had dropped with a gap being present between the worktops and the wall tiles above.

The pattern of damage to the extension floor would indicate that the floor slab had dropped with falls to the rear.

In our opinion the movement to the extension floor maybe associated with settlement and consolidation of fill material below the ground bearing concrete floor slab. The extension floor was noted to be over 400mm above the external ground level to the rear. The extent of movement which takes place to the slab will depend on the depth of the fill material below and the level of its compaction. The fill material will settle under its own weight and that of the concrete slab and the imposed loadings which are being placed onto the floor above. Where un-compacted deeper fill material and larger voids are present then greater movements to the floor slabs will take place.

We also consider it possible that if a shrinkable stratum is present below the fill material beneath the extension floor slab, then this may have been subject to ground movement caused by the nearby trees and vegetation, as noted above. There was also drainage which passed below the extension. The cause of the movement to the extension floor will be subject to site investigations, following which the full extent of mitigation and remedial works can be determined.

4.5 Damp and Condensation

The external concrete paths, particularly those against the front and left-hand side of the property fell towards the building. Surface water was thought to pool against the elevations of the building. The damp proof course to the front, left hand side and rear elevations of the property were also noted to be less than 150mm above the paths.

Within the property there was damp staining at high and low level to the external walls. We believe that this staining maybe associated with condensation. It appeared that an attempt had been made to address the condensation with vents being present through the external walls.

4.6 Boundary Wall – West side of the property

The boundary wall to the left-hand side of the property had been subject to significant cracking and movement. The wall was distorted along its length and was cracked and leaning inwards at high level. There were a number of mature trees, bushes and shrubs growing within the garden of the neighbouring property and behind the wall. The cracking and movement to the boundary wall was associated with physical damage caused by the presence of a Cherry tree growing directly behind the wall, within the garden of the neighbouring property, No 16.

The boundary wall was of 110mm wide rendered blockwork construction with block piers at approximately 5m centres. The blockwall was approximately 900mm in height and was thought to be retaining ground to the adjacent property. However, a detailed inspection behind the wall was not possible due to the presence of vegetation and debris.

4.7 Extension and Alterations

The property had been altered in the past with the introduction of a single storey to the rear elevation and openings having between created within the walls which separated the Reception Rooms.

5.0 RECOMMENDATIONS

5.1 Roof Structure – Main Property

We recommend that the roof structure over the main property should be strengthened in accordance with a qualified Structural Engineers design and details.

In the first instance you may wish to introduce lateral restraints to help improve the fixing between the rafters and the ceiling joists and where the ceiling joists are spliced over the central spine wall. These works could include to introduce strapping, timber sections and to upgrade fixings between the existing sections. We also suggest that additional struts are introduced to the side of the raking struts above the Reception Rooms which are not directly opposite each other to the East side of the roof space. This strengthening will help to limit, but not prevent, the extent of further large deflections and movements which could take place.

However, it should be noted that if the limited strengthening is not successful and future cracking and / or movement takes place at high level on the ground floor then additional support to the sloping roof and ceiling structures will be required. This strengthening, which should be designed and detailed by a qualified Structural Engineer, is likely to include the introduction of a number of steel beams, struts and possibly posts onto pad foundations. The full extent of works will be subject to a measured survey and further investigations.

We recommend that an allowance should be made to introduce lateral restraint straps to help tie the gable walls into the sloping roof and ceiling structures.

We recommend that the strengthening to the roof structure and the introduction of restraint to the gable walls should be carried out with Building Regulations approval.

In order to determine the full extent of works involved the insulation within the roof space should be removed in order for a more detailed inspection of the roof structure to be carried out by the Structural Engineer.

5.2 External Lintels – Main Property

We recommend that the lintels above the Bedroom windows to the front and side elevations of the property should be replaced in accordance with a qualified Structural Engineers design and details. The lintels should be of adequate design and loadbearing construction to support the structure above. We recommend that these works should be carried out with Building Regulations approval.

5.3 Subsidence and Foundation Movement – Main Property and Extension

We recommend that site investigations should be carried out to determine the cause of the foundation movement to the property. These investigations will include excavation of trial holes to determine the adequacy of the foundations and auger of boreholes to ascertain the condition of the supporting ground below. It will be necessary to carry out in-situ testing and take soil and root samples for laboratory analysis. The site investigations should be carried out under the supervision of a qualified Structural Engineer.

An Arborist should be appointed to inspect and report on any tree management deemed necessary based on the findings of the site investigations. Any recommendations made by the Arborist should be carried out. There are a number of trees which are present

outside the boundaries of the property and, as such, it will be necessary to liaise with their owners to carry out the necessary works. It is thought likely that trees will need to be removed or reduced in height and managed. The Arborist should also make recommendation for tree management to help limit the potential for future subsidence to the property. Further development of the existing, or planting of new vegetation within influencing distance of the property should be avoided. The trees to the embankment to the rear of the property maybe helping to provide stability and binding to the sloping ground which will need to be considered by the Arborist.

We also recommend that a Specialist Drainage Contractor should undertake a survey of all foul and surface water drainage which serves the property. This should include a CCTV survey and water drop test of all pipework below ground. The Drainage Contractor may need to excavate in order to gain access into the pipework below ground. The Drainage Contractor should also check any nearby water services, including water mains for leaks. Any recommendations made by the Drainage Contractor to prevent escape of water into the ground should be undertaken.

We recommend that monitoring studs should be placed across the cracks and monitored by a qualified Structural Engineer on a two monthly basis to review seasonal progressive movements. Once the appropriate mitigation works have been undertaken and the property has been confirmed as stable the relevant superstructure repairs can then be implemented.

If the monitoring indicates ongoing movement after the mitigation works have been carried out, then an engineered solution will be required. The extent of foundation works required will be subject to the site investigations.

It may be possible that Geobear foundation and floor stabilisation works could be appropriate to help return stability to the external walls of the main property and to the extension where cracking has taken place and where movement to the floor slab within the extension has occurred. This will be subject to further investigations.

If the building is insured, then a claim for subsidence should be made with the insurers of the building. The site investigations will enable the extent of the mitigation and possible foundation works to be determined.

The full extent of works which have or are proposed to stabilise the embankment to the rear should be confirmed and provided to determine whether these will have an impact on the proposed works to the building and vice versa.

5.4 Floor Slab – Extension

We recommend that site investigations should be carried out to confirm the depth and quality of compaction of the fill material below the concrete floor slab to the extension and to confirm the ground conditions below. This will include excavation of trial holes through the extension floor and auger of boreholes. The trial holes are to expose the depth and quality of fill material below the floor slab with the auger of boreholes to confirm the ground conditions with soil and root samples being taken for analysis. The site investigations should be carried out under the supervision of a qualified Structural Engineer.

Where gaps between the underside of the skirting boards and floor below are in excess of 12mm then we would recommend replacement of the floor slab. If the fill material is greater than 600mm then it will be necessary to introduce a suspended floor.

Unfortunately, it cannot be guaranteed that movement will not take place to the extension floor in the future. However, it may be possible to improve the bearing capacity of the fill material below and bring the slabs back to relative level using a floor slab stabilisation technique. A Company, such as Geobear, could drill a series of holes through the effected floors to inject an expanding polymer resin below the slabs. The resin foam will fill the voids within the hard-core material below the slabs to improve the properties of the bearing material. This technique would be subject to further investigations by Geobear who would need to determine whether their system is appropriate based on the depth and quality of fill material below the floor slab and the ground conditions below. The alternative is to replace the extension floor under the supervision of a qualified Structural Engineer which is likely to be more disruptive.

As noted above the Geobear system could also be used to help return relative stability to the external walls of the main property and the extension where necessary. This will be subject to site investigations being carried out and confirmation by Geobear.

5.5 Damp and Condensation

We recommend that the concrete paths around the property are removed with the new paths and ground levels being located at more than 150mm below damp proof course. The new paths should be laid with surfaces to fall away from the property.

We recommend that a PCA Approved Damp and Timber Specialist should be appointed to inspect and report on any issues with damp within the property. This should include to address the areas of damp at high and low level to the external walls which we believe maybe associated with condensation. Any recommendations made by the Specialist PCA Approved Contractor should be carried out.

5.6 Boundary Wall – West side of the property

We recommend that a check should be carried out to confirm the ownership of the boundary wall which is present to the left-hand side of the property. It was thought to be likely that No 15 is responsible for the wall but this will need to be checked with the Deeds for the property.

We recommend that the boundary wall to the left-hand side of the property should be replaced in accordance with design and details prepared by a qualified Structural Engineer.

It will be necessary to liaise closely with the owners of the neighboring property, No 16, with regards to works required to replace the boundary wall as access onto their land will be necessary. It is likely that it will also be necessary to remove trees within their land in order to undertake the works.

The full extent of works required will be subject to further inspection and investigations with design being prepared as the wall was believed to be retaining land to the neighboring property. The investigations will include to confirm the height of the retained soil behind the structure.

5.7 Extension and Alterations

We recommend that a check should be made to confirm that the extension and alterations to the property were carried out with the relevant statutory approvals, including Planning and Building Regulation consents.

If the extension and alterations were not carried out with the relevant approvals and consents, then we recommend that a competent Builder should be appointed to carry out further investigations under the supervision of a qualified Structural Engineer. These investigations could involve removing linings and to expose supporting members for confirmation of adequacy by the Structural Engineer.

We also recommend that a competent Builder should be appointed to undertake remedial works and repairs to the external elevations of the property which were in need or remedial works and repair. The brickwork was, in places, in need of being repointed and spalled bricks were in need of being replaced.

For an additional fee Frankham Consultancy are able to further assist by obtaining price quotations from specialists for the above recommended investigations. We are also able to commission and manage the successful specialist consultants.

APPENDIX A
PHOTOGRAPHS

Photo 1: Front elevation of the property

Photo 2: Rear elevation of the property

Photo 3: General condition of the brickwork to the external elevations of the property

Photo 4: Cracking to the stonework to the front elevation of the Reception Room

Photo 5: Cracking to the stonework to the front elevation of the Reception Room

Photo 6: Spalling of brickwork below the Reception Room window

Photo 7: Repointing to the wall above the Front Bedroom window

Photo 8: Repointing to the wall above the West side of the Front Bedroom window

Photo 9: Corroded metal lintel above the Front Bedroom window

Photo 10: Repointing to the wall above the East side of the Front Bedroom window

Photo 11: Cracking and repointing to the wall above the Middle Bedroom window

Photo 12: Cracking and repointing above the South side of the Middle Bedroom window

Photo 13: Corroded metal lintel above the Middle Bedroom window

Photo 14: Cracking and repointing above the North side of the Middle Bedroom window

Photo 15: Vertical crack to the brickwork below the Middle Bedroom window

Photo 16: Vertical crack to the brickwork below the Middle Bedroom window

Photo 17: Repointed elevation to the West side of the extension to the rear of the property

Photo 18: Area of missing pointing to the brickwork above the North side of the back door to the Kitchen

Photo 19: Weathered pointing to the brickwork to the East side of the extension to the rear of the property

Photo 20: Isolated stepped crack at high level to the rear external corner to the East side elevation of the rear extension

Photo 21: Brickwork and lintel (replaced) above the Rear Reception Room window

Photo 22: Damp proof course only 10mm above the path which falls towards the front of the property. Surface water was thought to pool on the path against the building

Photo 23: Cracked and dropped concrete slab to the rear of the property. Old garage removed. Surface water was thought to pool on the path against the building

Photo 24: Cracked and dropped concrete slab to the rear of the property. Old garage removed.

Photo 25: Cracked and dropped concrete slab to the rear of the property. Old garage removed.

Photo 26: Slumped ground to the North West corner of the garden to the rear of the property

Photo 27: Piezometers within the garden to the rear of the property

Photo 28: Piezometers within the garden to the rear of the property

Photo 29: Rainwater downpipe at the junction between the main property and the front elevation to the left hand side elevation of the property

Photo 30: Rainwater gulley to the left hand side elevation of the property. Blocked with silt and debris

Photo 31: Inspection chambers adjacent to the right hand side elevation of the main property

Photo 32: Inspection chambers adjacent to the right hand side elevation of the main property

Photo 33: Rainwater gulley and inspection chambers adjacent to the right hand side elevation of the main property

Photo 34: Foul and surface water downpipes to the East side elevation of the extension. Inspection chamber adjacent to the rear right hand corner of the main property

Photo 35: Foul and surface water downpipes and inspection chamber (not shown) adjacent to the East side elevation of the extension

Photo 36: Foul and surface water downpipes with gulley and inspection chamber against the rear elevation of the main property, to the West side elevation of the extension

Photo 37: Foul and surface water downpipes with gulley against the rear elevation of the main property, to the West side elevation of the extension. Cracked pipe and path

Photo 38: Inspection chamber to the South East corner of the front garden

Photo 39: Trees surrounding the property

Photo 40: Trees and vegetation on the boundary line to the left hand side of the property

Photo 41: Trees and vegetation adjacent to the left hand side elevation of the property

Photo 42: Trees and vegetation adjacent to the left hand side elevation of the property

Photo 43: Trees and vegetation adjacent to the left hand side elevation of the property

Photo 44: Trees and vegetation adjacent to the left hand side elevation of the property