

Hutton + Rostron Environmental Investigations Limited

Southleigh Park, Coach House: Investigation of masonry damp and damp-proof courses

Site note B3 for 18 January 2021, job no. 152.09.

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Distribution:

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1 INTRODUCTION

1.1 AUTHORITY AND REFERENCES

Hutton + Rostron Environmental Investigations Limited carried out a site visit to Southleigh Park on 18 January 2021 in accordance with instructions from Steve Coull of FSL Group by email, on 10 November 2020 at 13:09. Drawings were provided by the client. For the purpose of orientation in this report, the Coach House was taken as facing east, towards the Stables

1.2 AIM

The aim of this survey was to investigate defects likely to have allowed water penetration to the structure and to assess the extent and distribution of surplus residual moisture in the load bearing masonry structures of the ground floor

1.3 LIMITATIONS

Structures were not examined in detail except as described in this report, and no liability can be accepted for defects that may exist in other parts of the building. We have not inspected any parts of the structure which are covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect or in the event that such part of the property is not free from defect it will not contaminate and/or affect any other part of the property. Any design work carried out in conjunction with this report has taken account of available pre-construction or construction phase information to assist in the management of health and safety risks. The sample remedial details and other recommendations in this report are included to advise and inform the design team appointed by the client. The contents of this report do not imply the adoption of the role of Principal Designer by H+R for the purposes of the Construction (Design and Management) (CDM) Regulations 2015. No formal investigation of moisture distribution was made

2 STAFF ON SITE AND CONTACTS

2.1 H+R STAFF ON SITE

Michael Almond
Clive Stonehill

2.2 PERSONNEL CONTACTED

Site security

3 OBSERVATIONS AND RECOMMENDATIONS

3.1 EXTERIORS

3.1.1 North elevation

- 1 Roof coverings and drainage: No rainwater goods were fixed against the north elevation. The 'Dutch' gable drained onto the roof coverings of the single storey secondary structure beneath. The abutments of the roof coverings of this structure were detailed with slates bedded in mortar. The roof coverings and adjacent north elevation were subject to significant biological growth where water had splashed back onto the façade from the eaves, notably on the east side. The single storey structure was covered with fibre cement slates with concrete ridge fittings, which were generally intact and free of defects allowing water penetration to the structure. The gutter below the north hip pitch of the single storey structure deflected at the west end, which may allow water to pond, overflow and drain over structures beneath

If the single storey structure on the north side is to be retained, allowance should be made for re-detailing the abutment of the roof coverings with the façade with, say, an extended fillet or slate/lead flashing to protect the elevation masonry from water penetration. H+R assume that roof coverings are to be overhauled and roof drainage systems replaced on proposed refurbishment. The roof drainage system should be adequately maintained pending refurbishment to ensure that water from roof structures is drained clear of masonry at all times, especially around the base of the building

- 2 Elevation masonry: Uncoursed flints set into mortar, with horizontal band detailing of smaller flints at the roots of the gable wall and below the eaves, was in generally good condition, with no significant defects allowing water penetration identified. Some biological growth was affecting masonry on the east side as described above. Some erosion of pointing mortar and further biological growth was noted at low level, where external ground levels were high in relation to floor levels on the interior

No urgent remedial works are required, subject to detailed inspection on provision of safe and convenient access

- 3 External ground levels and drainage: Fall of ground was generally from north to south, draining ground and surface water towards the base of the structure. The single storey extension to the north was detailed with a trench at the base of the wall, back-filled with soil and chippings. This did not appear to be a fully detailed French drain and would not have significantly reduced the risk of damp penetration. No physical horizontal damp-proof course was identified

Subject to the general specification for refurbishment, consideration should be given to creating a fully detailed French drain, with a 'geo drain' perforated pipe at the base discharging to existing ground and surface drainage systems or to a new soakaway, as directed by the building service engineer

3.1.2 East elevation

- 1 Roof coverings and drainage: High level roof coverings were assumed to be from natural slate on preliminary inspection from ground level, with sheet lead flashings over rolls at the main ridge and the hip ridges to the Dutch gables on the north and south sides. The continuous eaves gutter at high level discharged to a downpipe at the south-east corner of the structure and appeared to have deflected downwards at the north end, which may have allowed surface water to overflow and drain over structures beneath. The profiled fibre cement coverings to the single storey extension, covering approximately 70% of the façade, also appeared to be in fair condition and flashings at the abutment with the south elevation appeared well

detailed, with sheet lead materials not having exceeded their service life and upper edges sealed to masonry with a flexible adhesive material. The eaves gutter of the mono-pitch extension roof discharged to a downpipe at the north end and appeared to be operating effectively

H+R assume that roof coverings are to be overhauled and roof drainage systems replaced on proposed refurbishment. The roof drainage system should be adequately maintained pending refurbishment to ensure that water from roof structures is drained clear of masonry at all times, especially around the base of the building

- 2 Façade masonry: The coursed flint external wall finish and brick embellishments were in generally good condition, with no significant defects identified allowing water penetration into the structure. The dwarf wall at the base of the east extension glazing had been pointed in a cementitious material and appeared to have been of a more recent construction than the original building

No urgent remedial works are required, subject to the general specification for refurbishment

- 3 External ground levels and drainage: Tarmacadam hardstanding was in contact with the elevation across the full width of the structure, isolated from the façade by a strip of insitu concrete, typically 200mm wide. Fall of ground was generally from north to south, parallel to the façade. No evidence of significant ponding was identified but water from the south extension gable appeared to splash back onto the elevation, providing the conditions for biological growth at low level. A slate DPC was identified close to ground level on the east side of the extension. It was assumed to continue throughout the dwarf walls below façade glazing, in which case the DPC would have been extensively bridged by ground levels on the north side, increasing the risk of damp penetration to the interior

On future refurbishment consideration should be given to a general reduction in external ground levels to a minimum 150mm below any horizontal damp proof courses included in the structures and perhaps 200mm below internal floor level where no DPC had been installed. No chemical injected remedial DPCs or internal applications of waterproofing cementitious render are required or recommended. See 3.3 below

3.1.3 South elevation

- 1 Roof coverings and drainage: No rainwater goods were fixed against the elevation. The Dutch gable verges and eaves were not detailed with gutters allowing drainage water to splash back onto the façade from compacted soil at the base of the façade

No urgent remedial works are required. Subject to the general specification for refurbishment, consideration should be given to adding a gutter to the central horizontal eaves of the Dutch gable hip pitch and to re-profiling the verges of the east and west roof pitches to reduce the amount of water draining from the exposed edges of the slate roof coverings

- 2 Façade masonry: The coursed flint façade finish and pointing were in generally good condition. Some hairline cracks had formed in isolated locations, including a diagonal crack on the west side centred approximately 4m above ground level, which may allow water to drain into the structure and track through the interface between the flint external finishes and the brick structure behind. A similar diagonal crack was noted at low level at the centre of the elevation where a vine was fixed against the façade on trainer wires. The south elevation had significant exposure to wind driven rain from the south and would also have been subject to cyclical thermal movement due to solar radiation associated with the southerly orientation. This would tend to reduce the service life of pointing and increase the maintenance requirement

Allowance should be made for detailed inspection of façade masonry and provisional allowance made for specialist repair to open joints and cracks in a suitable flexible lime mortar, gauged to match the existing material. The Structural Engineer should be invited to comment on the more significant cracks, generally towards the centre of the façade at high and low level

- 3 External ground levels and drainage: A planting bed had been created at the base of the façade with soil overlaid in a thin coat of chippings, retained by a kerb at the edge of the tarmac hardstanding, extending to the south from approximately 0.5m away from the façade. Brickwork at low level appeared saturated and was supporting biological growth, notably towards the centre of the façade where water was assumed to drain most directly from the Dutch gable eaves. The pattern of damp was consistent with significant exposure to wind driven rain from the south-west. There was no significant fall of ground across the width of the elevation but the tarmac hardstanding adjacent drained from north/south, away from the masonry and foundations of the structure

Consideration should be given to improving ground drainage at the base of the wall, possibly by installing a French drain as described at 3.1.1(3). See also 3.1.3(3)

3.1.4 West elevation

- 1 Roof coverings and drainage: Slate roof coverings and rolled lead sheet flashings showed significant weathering, consistent with the exposed westerly orientation. A small number of slates appeared to have lifted slightly or shifted from their original positions which may indicate 'nail sickness' or other defects that would limit the service life of the roof coverings. The eaves gutter drained to a downpipe at the south end of the façade with an open joint approximately 3m from the north end allowing water to drain to ground level and splash back onto the façade from hardstanding. This would have significantly increased the risk of water penetration into the structure and of damage to timber and other vulnerable materials on the interior

Allowance should be made for overhaul or replacement of the provision for roof drainage on proposed refurbishment. Consideration should be given to carrying out roof drainage calculations based on up-to-date meteorological data, to ensure that the roof drainage system has the capacity to effectively discharge surface water from roof coverings clear of the building on future occupancy. H+R can provide further advice if required

- 2 Façade masonry: Coursed flint façade finishes and pointing were generally in good condition but a number of shrinkage cracks and hairline cracks in mortar were identified that might allow water penetration to the structure where there was exposure to rain driven by prevailing winds from the south and west. Defects were focused on the north side of the north window openings, which were separated by brick embellishments from an area of façade flint which appeared to have been replaced on a previous refurbishment. Cracks were consistent with thermal expansion and contraction of the façade in relation to the structures beneath, consistent with significant exposure to solar radiation

Allowance should be made for detailed inspection of elevation masonry and for patch repairs to pointing as required in a suitable lime mortar mix

- 3 External ground levels and drainage: Compacted soil, overlaid with chippings, was in contact with the façade at the centre and to the north. The southern section of the elevation was detailed with tarmac hardstanding in direct contact with elevation masonry, with a general fall of ground from north to south, parallel to the façade. No physical damp-proof course was identified and the structure was assumed to rely on the 2 No. courses of engineering brick exposed above ground level to provide protection against rising and penetrating damp into the masonry superstructure. However, increases in ground level over time had bridged the

upper edge of the brick courses, placing potentially saturated soil in contact with the flint façade finishes and increasing the risk of water penetration to the structure generally

Allowance should be made for a general reduction in external ground levels to re-expose the engineering brick courses at the base of the wall and to lower ground levels to a minimum 200mm below floor level on the interior. External hard and soft landscaping should be detailed to direct ground and surface water away from the structure and consideration should be given to installing 'soft' surface finishes, such as large diameter beach cobbles forming the upper surface of a French drain, immediately at the base of the façade to reduce the 'splash back' of water from glazing, sills and the eaves onto elevation masonry

3.2 INTERIORS

3.2.1 Storage extension on north side

- 1 Defects associated with damp: The previously exposed flint faced wall on the south side showed general soiling, indicating that the exposed elevations may have been cleaned on a previous refurbishment, after the extension had been constructed. A section of cementitious render extending to approximately 1.5m above floor level and covering the west half of the south wall was in fair condition and appeared well adhered. This did not appear to have been installed as a remedial damp-proofing measure. 'Streaking' on wall surfaces may indicate previous intermittent failure of the junction between the roof finishes and the north elevation, allowing surface water to drain across contaminated surfaces at high level and onto the render at the base of the wall

No urgent remedial works are required. Roof coverings and roof drainage systems should be adequately maintained pending refurbishment, to ensure that surface water is drained clear of the structure at all times

- 2 Residual moisture in masonry: 2 No. samples from the north wall were classified as moist, with available moisture contents between 2 and 5 per cent. The remaining 4 No. samples from this area were dry (less than 2 per cent available moisture) but all samples showed elevated levels of hygroscopic salt, consistent with long term drainage of ground and surface water into the structure from the north and the absence of a physical dpc

3.2.2 Storage area on south side

- 1 Defects associated with damp: Paint finishes applied to the base of the south wall had failed across the full width, consistent with chronic damp conditions in masonry where water drained persistently from the exterior. Defects associated with the mobilisation and efflorescence of hygroscopic salts extending to approximately 300mm above floor level. Finishes elsewhere were in fair condition but appeared to have failed more generally to full height at the south-west corner. This part of the structure would have had the greatest exposure to rain driven by prevailing winds against the structure, reducing the service life of decorative finishes where moisture and salt transit through the structure was greatest

Works described elsewhere in this report are required to improve ground drainage at the base of the south wall. Some repairs to façade masonry may be required, subject to detailed inspection. Failed internal paint finishes could be brushed off and replaced in a highly breathable and salt resistant paint type, such as limewash or 'clay' paint. These finishes should be regarded as sacrificial and will require periodic maintenance. If robust protection of internal finishes is required consideration should be given to installing independent internal wall structure, to provide a ventilated dry lining system to full height. This should be detailed to fully isolate timber, hygroscopic materials and vulnerable decorative finishes from

masonry vulnerable to moisture and salt transit from the exterior. H+R can provide further advice on remedial detailing if required

- 2 Residual moisture in masonry: 1 No. sample from the south wall was classified as saturated, where water had been noted as splashing back onto the façade from ground surfaces on the exterior. All other samples were dry and around half showed raised salt contents, consistent with ground water draining generally to the south, away from the building

3.2.3 Main central room and east extension

- 1 Defects associated with damp: All external walls had been dry lined in plasterboard on a previous refurbishment, preventing detailed visual inspection from the interior. A solid masonry projection at low level on the north side of the east extension showed extensive failure of impermeable paint finishes, consistent with interstitial efflorescence of hygroscopic salts following water penetration from the exterior. External ground levels were approximately 500mm above internal floor level in this location, increasing the risk of laterally penetrating damp from below ground affecting the structure. Exposed brickwork below the staircase on the south side was in fair condition with no evidence of significant problems of water penetration. Some salt efflorescence at the wall/floor junction may indicate ground moisture penetration at the perimeters of concrete ground bearing slabs laid over horizontal damp-proof membranes on a previous refurbishment, increasing the moisture and vapour pressure at the base of a loadbearing internal wall, with no provision for horizontal damp-proofing
- 2 *Works are required to lower external ground levels generally around the structure and to improve ground drainage. Options for internal decoration on refurbishment are discussed at 3.2.2(1) above*
- 3 Residual moisture in masonry: A sample from the north end of the west wall, where roof-drainage water was seen to be splashing onto the façade at low level on the exterior, was classified by H+R as saturated, with an available moisture content above 8 per cent. 3 No. moist samples were extracted from the east, north and south sides of the east extension, where raised external ground levels were likely to have bridged any provision for horizontal damp-proofing installed in the external walls

4 H+R WORK ON SITE

- 4.1** H+R inspected the structure for defects liable to allow water penetration before and after refurbishment
- 4.2** H+R took samples from representative masonry masses, so as to determine their gravimetric and hygroscopic moisture content

5 PROPOSED ACTION BY H+R

- 5.1** H+R will advise on remedial detailing, so as to minimise the risk of damp and decay problems after refurbishment if instructed
- 5.2** H+R will advise on conservation of original fabric with regard to damp, decay and salt damage, as necessary and if instructed
- 5.3** H+R will review proposed remedial details as these become available if instructed
- 5.4** H+R will return to site to inspect sample remedial details if instructed
- 5.5** H+R will liaise with conservation and historic building authorities, if instructed, so as to ensure the cost-effective conservation of original fabric
- 5.6** H+R will liaise with building guarantors, as necessary, so as to ensure the issuing of collateral warranties and building guarantees at practical completion, if required

6 INFORMATION REQUIRED BY H+R

- 6.1** H+R require up-to-date copies of project programmes, as these become available
- 6.2** H+R require copies of up-to-date lists of project personnel and contact lists as these become available
- 6.3** H+R require copies of proposed remedial details for comment as these become available
- 6.4** H+R should be informed as a matter of urgency if further significant water penetration occurs onto site; so that advice can be given on cost-effective remedial measures, to minimise the risk of cost or programme overruns and so as to minimise the risk of damp or decay problems during the latent defect period

7 ADMINISTRATION REQUIREMENTS

- 7.1** H+R require formal instructions for further investigations and consultancy on this project
- 7.2** H+R require confirmation of distribution of digital and printed copies of reports and site notes

Attachment A



Fig 1:

North elevation; showing general arrangement of double and single storey structures



Fig 2:

North elevation, east side; showing biological growth affecting façade masonry at the abutment with the single storey roof



Southleigh Park House - Coach House

Masonry damp investigation

18 January 2021

Not to scale

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Fig 3:

North elevation, north-west corner of single storey extension; showing deflected rainwater downpipe that may allow water to overflow and drain over structures beneath



Fig 4:

North elevation, base of single storey extension wall; showing 'drainage' trench with soil and chippings back-fill



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18 January 2021
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Fig 5:

East elevation; showing general arrangement of high level slate and low level asbestos cement roofing



Fig 6:

East elevation, north side of single store extension; showing assumed position of horizontal damp-proof course bridged by a raised external ground level, increasing the risk of water penetration to the interior



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Fig 7:

East elevation, south side of single store extension; showing biological growth on brickwork at low level, where water splashed back onto the façade from hardstanding



Fig 8:

East elevation, east side of single storey extension; showing flexible plastic dpc installed typically 2 no. brick courses above external ground level, but bridged by soil on the north side of the extension



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Fig 9:

South elevation, upper east side of first floor window opening; showing vertical crack in masonry which was likely to allow water penetration to the structure



Fig 10:

South elevation, central section; showing diagonal crack in masonry which was liable to allow water penetration where there was exposure to rain driven by prevailing winds from the south



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Fig 11:

South elevation, east side; showing damp affected brickwork at low level and biological growth on the façade, where water splashed back onto the structure from the Dutch gable eaves above



Fig 12:

West elevation; showing general arrangement of building with single storey extension on north side



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Fig 13:

West elevation, north end; showing cracks formed around brick embellishments to window openings and at the junction between retained façade finishes and patch repairs, increasing the risk of water penetration to the structure



Fig 14:

West elevation, central section; showing typical hairline cracking of mortar between coursed flint or finishes where there was exposure to intermittent solar radiation from the west



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Masonry damp investigation
18 January 2021
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Fig 15:

West elevation, north end; showing biological growth on façade masonry where water splashed back onto the elevation from hardstanding at the base of the wall, due to failure or blockage of the eaves gutter above



Fig 16:

West elevation, south end; showing tarmacadam hardstanding bridging the interface between engineering brick at the base of the wall and the flint elevation finishes above



Southleigh Park House - Coach House

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Fig 17:

Storage unit on north side; showing internal junction between roof surfaces and the north elevation, with 'modern' slate membranes installed on a previous refurbishment



Fig 18:

Storage unit on north side, west end of south wall; showing streaking on painted render surfaces at low level, consistent with water draining over soiled masonry above following the failure of the roof coverings and flashings. No evidence of recent or active water penetration was found



Southleigh Park House - Coach House

Masonry damp investigation

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Fig 19:

Storage area or garage on south side, south wall; showing general failure of decorative finishes at low level, where damp penetration to the structure was noted on the exterior



Fig 20:

Storage area or garage on south side, south-west corner; showing general failure of vapour permeable paint finishes where applied over bricks of variable softness. Bricks where paint had completely failed also showed significant surface erosion consistent with chronic transit of moisture and salt through the structure where there was exposure to wind driven rain on the exterior



Southleigh Park House - Coach House

Masonry damp investigation

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Fig 21:

Main central room, south side below staircase; showing salt efflorescence at the wall/floor junction consistent with moisture and salt transit from below



Fig 22:

East extension, north side; showing salt efflorescence affecting impermeable paint finishes applied to a solid masonry structure at the base of the wall, where external ground levels were raised above internal floor level. See fig.6 above



Southleigh Park House - Coach House

Masonry damp investigation

18 January 2021

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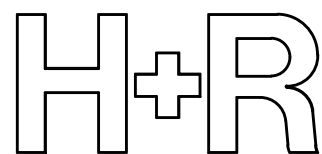
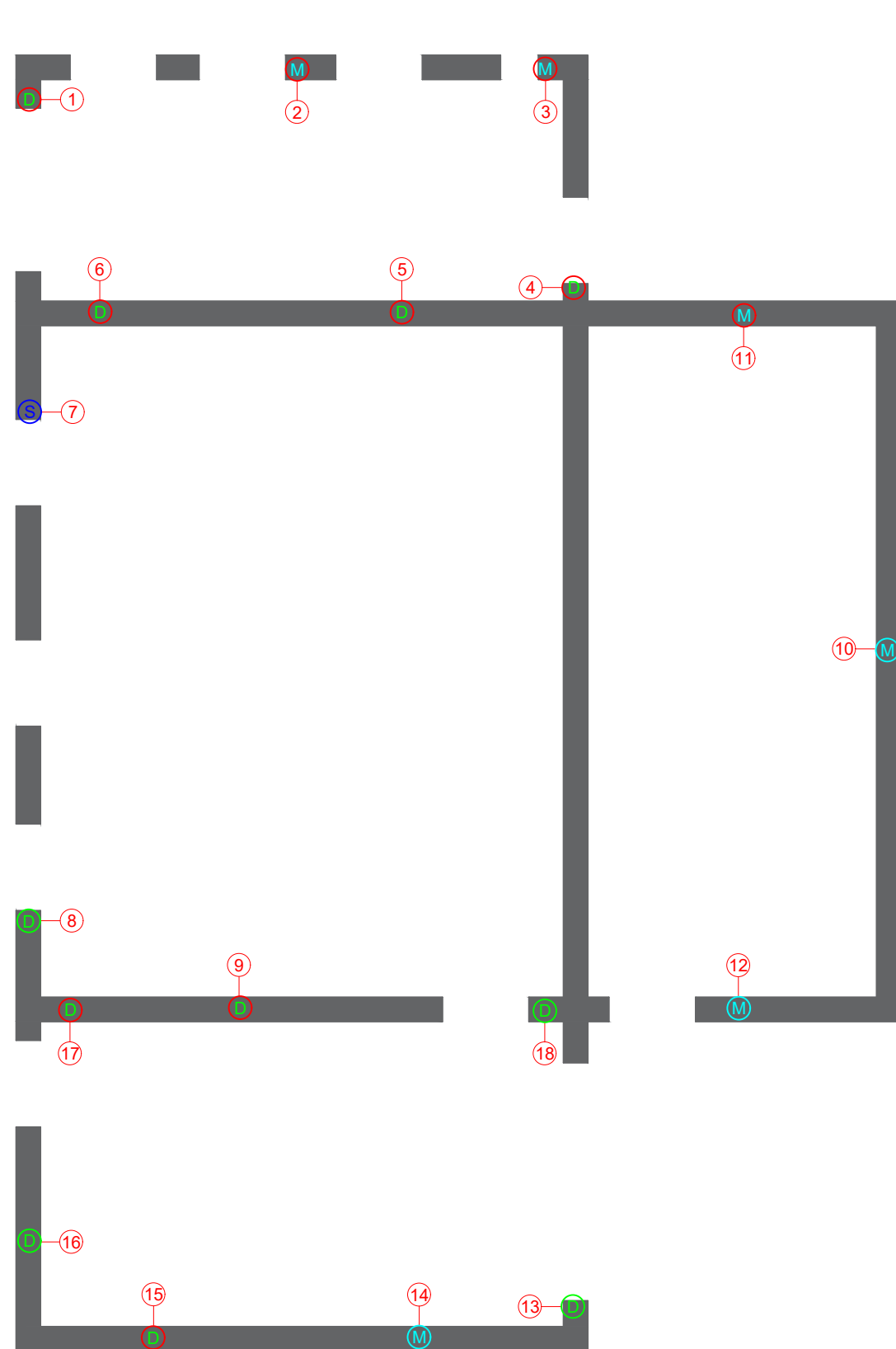
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Attachment B

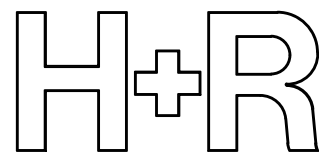
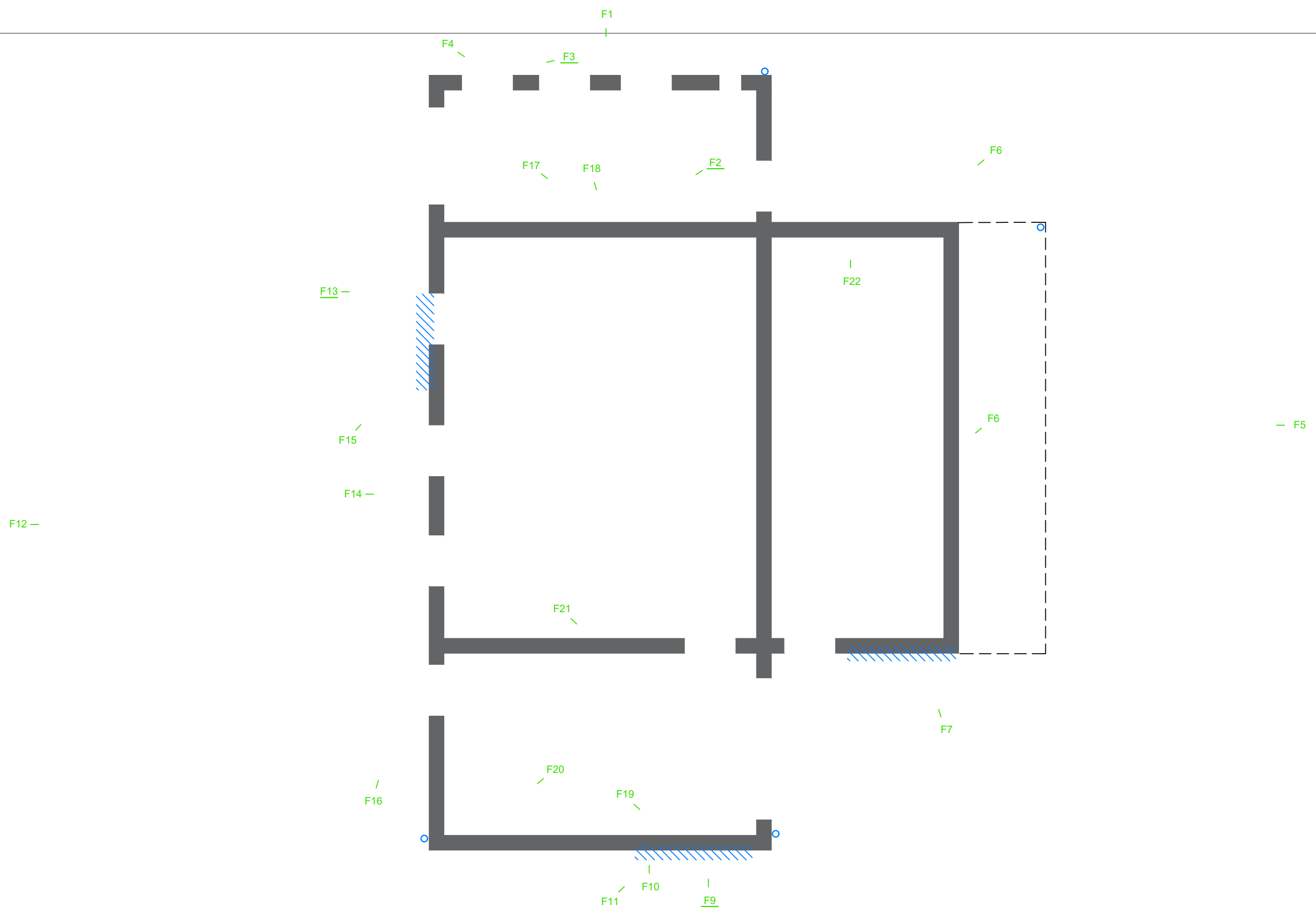
- High salt content
Low salt content
- Dry (D) (D) 0-2% w/w available moisture content
- Moist (M) (M) 2-5% w/w available moisture content
- Wet (W) (W) 5-8% w/w available moisture content
- Saturated (S) (S) 8+% w/w available moisture content
- Super Saturated (SS) (SS) 20+% w/w available moisture content



Southleigh Park, Coach House - Ground Floor
Masonry moisture content
18 January 2021

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Key: —① Masonry sample location



Southleigh Park, Coach House - Ground Floor
Masonry damp and DPC investigation
18 January 2021

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- Key:**
- Masonry affected by damp
 - Approximate location of rainwater downpipe
 - Approximate location of photograph
 - Approximate location of photograph over

Attachment C

Table of material moisture contents

Attachment C

Samples of masonry were drilled from walls in areas vulnerable to damp penetration. The samples were placed in sealed containers and tested at the H+R laboratory in accordance with the procedure for gravimetric measurement of moisture content as described in the appendix to BRE Digest 245

Dish no.	Moisture content % w/w			Hygroscopic moisture content % w/w	Available moisture content % w/w
Coach House					
1	5.46	D	H	3.54	1.92
2	5.51	M	H	2.86	2.65
3	4.46	M	H	2.24	2.23
4	2.83	D	H	2.74	0.09
5	2.46	D	H	2.35	0.12
6	2.53	D	H	2.06	0.46
7	13.21	S		0.81	12.39
8	1.87	D		0.59	1.28
9	4.16	D	H	4.81	-0.66
10	4.50	M		1.88	2.62
11	7.27	M	H	2.26	5.01
12	3.08	M		0.80	2.28
13	1.29	D		0.92	0.37
14	3.64	M		1.51	2.12
15	3.65	D	H	2.34	1.31
16	1.79	D		0.90	0.89
17	2.35	D	H	2.20	0.15
18	2.33	D		1.69	0.64
Stables					
1	14.61	S	H	4.37	10.25
2	1.53	D		1.25	0.28
3	1.30	D		1.49	-0.19
4	16.67	S	H	6.64	10.03

5	2.99	D	H	2.48	0.50
6	13.73	S		0.79	12.94
7	5.16	D	H	6.06	-0.90
8	2.96	D		1.45	1.51
9	5.26	M	H	3.19	2.07
10	2.96	D		1.62	1.34
11	3.31	D		1.60	1.71
12	7.52	D	H	6.46	1.06
13	4.19	M	H	2.01	2.18
14	4.07	M		1.95	2.12
15	5.21	M	H	2.41	2.80
16	11.53	W	H	5.59	5.94
17	13.27	W	H	5.62	7.65
18	8.69	D	H	7.90	0.78
19	1.31	D		1.75	-0.45
20	1.21	D		1.03	0.18
21	1.48	D		1.44	0.04
22	1.34	D		0.79	0.55
23	3.08	D	H	2.40	0.68
24	1.36	D		0.90	0.46
25	1.43	D		0.88	0.55
26	0.74	D		0.44	0.30
27	1.06	D		0.59	0.48
28	13.23	S	H	2.47	10.76

Hygroscopic moisture is the 'air dry' moisture content of the sample at 75 per cent relative humidity. High levels above, say, 2 per cent are attributable to salt contamination. Hygroscopic salt commonly accumulates in old plaster and masonry that has been subject to dampness penetrating from the ground over many years. High levels above, say, 2 per cent of available moisture (liquid water) in the sample indicate continuing dampness due to liquid water in the sample usually resulting from faulty rainwater and plumbing goods