CAPSTONE
CONSULTING ENGINEERS

HIGHBANK, STENNER LANE, DIDSBURY

STRUCTURAL APPRAISAL

P668
Aug 2017

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1.0 INTRODUCTION

Capstone Consulting Engineers Ltd has been appointed by Mr and Mrs Vokes to undertake a brief report on the condition of the outbuilding at High Bank, Didsbury, noting that there are plans to consider repairing and converting it back into use. A site visit was undertaken on 14th July 2017. This report details the observations made during that visit. This report has been undertaken in accordance with the appointment details given in the email on 29th June 2017. Bernadette Bone, and colleague, the project architects, were present during the site visit.

No opening up works were undertaken, and observations were made from safely accessible locations. A detailed assessment of timber was not undertaken, the remit of a timber consultant specialist. The details given this report are given solely for the Clients' benefit, and are not intended to be a specification for undertaking remedial work.

2.0 BRIEF DESCRIPTION

The outbuilding is a traditional Victorian brickwork structure, as shown in the photographs in the appendix. There is a northern two storey wing which sits below a mono-pitched roof. The northern wall is also in part a retaining wall (retaining approximately 1.5m of ground to the bowling green on the north side). There is a duo-pitched single storey extension to the south, with three cart shed openings on the west side.

Roof and floor structures are timber, the ground floors are solid, and the perimeter walls are solid brickwork walls, typically a brick thick, and will be bedded in a lime mortar.

3.0 OBSERVATIONS & RECOMMENDATIONS

3.1 East Elevation

The east gable was accessed from the adjacent botanical park open to the public to the east. There is an infilled ground floor level window opening below a Tudor arch, and also evidence of one or two other infilled first floor openings. A late 20th century skin of brickwork has been built up against the gable rising up to around first floor level externally. The brickwork corner to the gable at high level between the gable and the north elevation facing the bowling green has a number of open joints. On the gable, the stone copings to the top of the wall are missing.

***Recommendation**: It is recommended that copings be reintroduced to better protect the wall head.*

It is noted that the adjacent brickwork retaining wall (assumed to be outside of the client's site/ownership) has been strengthened in the late 20th century with a series of raking brickwork buttress.

3.2 North Elevation

The north elevation was visible from the adjacent bowling green. Parts of the elevation were obscured by bushes/ivy. Localised issues seen were as follows:

i) Low level distortion/cavity and cracking at the right hand side (west end). Also the bottom courses of the adjoining rear wall to the garage are loose/dropping. It is likely this is because they lack a foundation. Ref fig 08

***Recommendation**: It is recommended that the cavities be infilled, the loose brickwork be consolidated, and that a trial pit be dug to investigate the extent of the existing foundation to the adjacent garage. It is recommended some bedjoint reinforcement be introduced across the crackline to reinforce the brickwork at this location.*

ii) The stone copings to the top of the wall are missing over the eastern third of the elevation, and the top three or four courses of brickwork have also been dismantled or collapsed.

***Recommendation**: It is recommended that this brickwork be reintroduced along with the copings to better protect the wall head.*

iii) There is a small cavity high up on the wall towards the west end.

***Recommendation**: It is recommended this be infilled with brickwork.*

iv) It is noted it the western end of the wall has an inward lean over the top three courses of brickwork.

***Recommendation**: It is recommended the full extent of these inward leaning courses, and the parapet be dismantled and rebuilt plumb.*

Otherwise, the wall appears to be relatively straight without significant bowing.

3.3 West Elevation

The west gable contains a large opening at ground floor level below a pair of steel lintels. It was noted that the left hand side of the lintel bears onto an area of infill brickwork within what was previously a ground floor window opening, below a shallow brickwork arch. There is a minor crackline between the infill brickwork and the adjacent original window reveal. This is not structurally significant.

There is a vertical gap opening up between the pair of steel lintels and the supported brickwork above. It is likely that the steel lintel is beginning to rust, with the rust causing the brickwork to be jacked up slightly. This will continue to occur over time. The only real remedy will be to remove sections of brickwork, derust the hidden top flange of the lintel, then repainting before reintroducing the brickwork, or fully replacing the steel lintels.

Whilst the wall has some undulations when looking up at it close to, on the whole the wall appears relatively plumb and structurally sound. It will however rely on the internal cross walls and roof structure for its overall satiability. This is discussed further in section 3.12

3.4 South Elevation

The west end:

Ground floor openings are formed below shallow brickwork arches. The central door opening has a fine gauged bullnose brickwork shallow arch, and bullnose jambs. First floor openings are more crude, being more simply brickwork laid on the timber window frames. Minor structural issues noted were as follows:

i) A short vertical crackline and distortion to the brickwork directly below the left hand side first floor window opening. It is unclear what has caused this distortion, but it does appear to be relatively historic. Ref fig 09.

***Recommendation**: It is recommended that the crackline be deep pointed, and horizontal single strand bedjoint reinforcement be introduced across the crackline. Thus the distortion could be retained in-situ without the need to rebuild, whilst improving the strength and robustness of the brickwork here.*

ii) The brickwork above the first floor window openings. In both instances, the brickwork has clearly distorted in recent years, having been repointed in exposed position with cement mortar. It is likely that the timber window frames have decayed to the point where they have allowed the brickwork supported above to move. Ref fig 09.

***Recommendation**: It is recommended that a stainless steel strap be introduced directly below the brickwork, or support introduced between the brickwork and timber frames for improved support.*

The east end:

Ground floor window opening has been boarded up. However, it is apparent that the timber lintel (or possible timber frame) is excessively decayed, noting there has been an issue of long term rainwater running down the wall to the left of this opening due to blocked guttering. Structural issues to this part of the elevation are as follows:

i) Minor diagonal crackline above the ground floor level window opening. This will relate to the decay related failure of the timber lintel, allowing the triangle of brickwork above to drop slightly.

***Recommendation**: It is recommended this lintel be replaced.*

ii) Distortion to brickwork over the first floor window opening. This is similar to the issue noted at the west end of the elevation, with the same recommendation.

The external ground in front of this part of the elevation has been lowered recently. It appears that this has undermined the foundation at this end of the elevation, as shown in Fig 10. This has led to some loosening and settling of brickwork at the right hand side already. Note – it appears that the last few metres of the adjacent single storey wing is also similarly undermined by this excavation, and the recommendations equally apply to this length of wall.

***Recommendation**: It is recommended that this be rectified relatively quickly. Options include reintroducing well compacted ground back into place here, up to the level to the base of the brickwork wall, through to underpinning the wall, by introducing a new lower concrete foundation.*

3.5 East Elevation of the Single Storey Wing

As noted previously, the last few metres at the north end of this elevation have been undermined slightly by the excavation to the adjacent external ground. This has been discussed in the previous section.

There is an infilled doorway (below a dressed stone lintel) at the south end of this elevation. It appears there was a brickwork wall extending out to the west, either side of this doorway, which has recently been removed, with resultant cavities and loose brickwork. The position of this doorway, and the loss of the continuation of the wall to the west, means that there is now a relatively vulnerable slender pier of brickwork to the south west corner of the single storey wing. The brickwork at the base of this corner is collapsing and contains void. This area of brickwork is shown in Fig 11.

***Recommendation**: It is recommended that this area of brickwork be carefully consolidated, rebuilding all loose masonry and infilling all cavities, and that this corner pier of brickwork be tied into the infilled masonry to the doorway on the west elevation, with single strand bedjoint reinforcement passing around the corner of the wall, to improve the robustness of this area of construction.*

3.6 South Elevation of the Single Storey Wing

Other than for the corner of the west end as noted in the previous section, there are no other structural issues to this elevation.

3.7 West Elevation of the Single Storey Wing

This elevation contains a series of three pairs of timber doors below a timber lintel line at eaves level, with brickwork and timber post support, the brickwork being a cross wall separating the wing into two spaces. At the base of the post there is an iron plate. This might be a past repair

to the base of the post, or part of the gate hinge. The plate is excessively corroded. No other structural issues were noted to this elevation.

***Recommendation**: It is recommended that this be fully derusted and further assessed, replacing for repainting as necessary.*

3.8 The Single Storey Wing Roof Structure.

The roof structure was only visible in the northern bay to this part of the building, noting there is a suspended ceiling to the larger southern room. The roof structure consists of a pair of timber purlins spanning from side to side, along with a central ridge beam supporting timber rafters. It is likely that the larger bay to the south has a timber truss to provide a mid-span support to the purlins. Externally it is noted that there is a slight drop to the ridge line to the centre of the southern space, suggesting that there may be an issue with the structure. From ground level no other significant structural issues were noted to this roof structure.

***Recommendation**: It is recommended that an access hatch be introduced through the suspended ceiling to allow inspection and maintenance of the hidden roof structure/truss above.*

3.8 Single Storey Wing, Internal

There was limited access to the southern room to this wing, due to the extent of stored items. No significant structural issues were noted in here from the doorway. Within the other smaller part, it was noted there was some loose brickwork and cavities to the left hand side of the doorway on the east elevation.

***Recommendation**: It was recommended this be consolidated.*

3.9 Two Storey Wing, Roof Structure

The roof structure consists of two lines of timber purlins which in turn support the mono-pitched timber rafters, battens and slate roof finish. There is also a high level wall plate, face fixed to the north wall, supporting the top end of the rafters. The purlin line is split into four bays along the roof, with internal supports off brickwork crosswalls, and at the west end of the building by a horizontal timber beam spanning between the rear and front walls, as shown in Fig 13. This has visibly deflected, suggesting it is undersized.

The first floor structure was not safe to access, and observations were taken from a ladder in one location. It was noted that a number of rafters towards the west end of the roof have been replaced between the ridge and upper purlin in the last bay. It was noted daylight can be seen in a number of places between the top of the roof slope and rear wall. At the far west end of the roof there is a partial collapse to the roof. It appears the rafters have lost their upper bearing onto the rear wall having dropped away from it. The high level wall plate is clearly excessively decayed in places.

At the east end of the building the roof structure is in a poor state and in a state of ongoing collapse, with a void having opened up between the roof and the east gable. Subsequently the eastern end of the purlins have decayed where they bear onto this wall. Rafters towards the top of the roof have lost their bearings onto the rear wall, similar to that seen at the west end of the roof.

***Recommendation**: Clearly sections of this roof need to be dismantled and repaired. It is assumed that all rafters between the upper purlin and high level wallplate will need to be replaced. The horizontal beam will need to be strengthened, or replaced, or ideally replaced with a cross wall. It may be possible to retain the historic purlins, splicing on new timber where excessively decayed. The renewed roof will need to be carefully tied to the surrounding walls for mutual support, and flashed into the upstand parapets/copings.*

3.10 Two Storey Wing, First Floor

Floor Structure:

The first floor structure only partially exists now, in the two western bays and to the easternmost bay, noting that the floor to the bay in between is fully collapsed/lost. The western first floor structure consists of a series of timber beams spanning front to back. All of the joists are missing here, and a lightweight modern timber ceiling structure has been introduced below this position. There is a single east/west spanning beam in this part of the building. This exhibits decay at its eastern end.

It may be possible to retain and reuse the remaining first floor beams, subject to a close-to inspection once close access is available.

At the east end of the building evidence of the first floor structure remains, consisting of timber joists spanning in an east-west direction between the eastern gable and internal cross wall. The remains of this floor are in a poor condition, and full replacement would be practical as part of the refurbishment of this building.

***Recommendation**: Significant replacements are needed to bring the first floor back into good condition. It would be possible to retain the existing beams, strengthening where necessary. The renewed floor needs to fully tie into the surrounding perimeter and cross walls for mutual stability.*

Other first floor structural issues noted were as follows:

i) The east gable contains a ground floor and first floor fireplace. The arch or lintel to the ground floor fireplace has collapsed, as shown in Fig 15. This needs to be reintroduced and the missing brickwork above rebuilt. Internally to the left of the chimney breast there is a diagonal crackline running up from first floor level within the recess to the gable wall formed below the chimney flue.

***Recommendation**: It is recommended that these areas of distress be addressed: a new lintel and consolidation over the fireplace, and deep pointing and the introduction of single strand bedjoint reinforcement to improve the robustness of the cracked wall.*

ii) There is a timber wallplate built into the wall directly below the first floor joists. This is excessively decayed.

***Recommendation**: It is recommended that the decaying inbuilt timber wall plate needs to be removed, replacing in masonry.*

iii) The timber staircase: It is in a relatively poor condition, and it assumed this will be replaced along with a new landing in any refurbishment project.

iv) Cross walls either side of the staircase: These half-brick thick walls are relatively delicate, especially since they are no long adequately restrained at first floor level by the first floor structure. They are both relatively distorted, and it is noted that two of the doorway openings through them lack an adequate lintel.

***Recommendation**: It is recommended that these cross walls are rebuilt either in the same or similar position, to both provide support to the new first floor structure, and also to buttress the rear wall.*

v) Cracking/movement through the arch/flue to the central, as shown in fig 16: This is a relatively new crackline, highlighting there is some movement between the cross wall and the rear elevation. This wall needs to be further inspected from the west side (no safe access).

***Recommendation**: The ideal would be to infill the first floor doorway opening through this cross wall to strengthen it, enabling it to better act as a buttress to the rear elevation. If the opening cannot be infilled, some other means of strengthening needs to be introduced, such as a steel frame here.*

3.11 Ground Floor

The west end of the main wing was full of stored material, but it was possible to note that there is a bulge to the north elevation wall. This area is shown in fig 17. This is where the wall acts as a retaining wall, retaining the ground to the north. The bulge, as judged by eye, appears to extend into the room by up to 200mm or so. The brickwork has a number of fine cracklines in this area, suggesting some minor ongoing movement.

This movement is likely to be the result of lateral pressure of the retained ground beyond. It is possible that the first floor structure is transmitting some of this movement to the south elevation (noting there is some bulging and cracking seen to this elevation).

***Recommendation:** There are various options to strengthen a bulging retaining wall, none of which are relatively straightforward. Options include:*

- Introduce ground anchors back into the retained ground to help hold the wall in place, and strengthening the wall with bedjoint reinforcement. Further reduced movement may occur.

- Introduce new internal buttresses off new foundations, and strengthening the wall with bedjoint reinforcement. Further reduced movement may occur.

. Dismantle this section of the building and rebuild off a new foundation to a new stronger detail to better resist the lateral loads.

- Alternatively, simply accept that movement has taken place, and may continue to take place, and do nothing for the time being.

No other significant issues were noted at ground floor level within the two storey wing of the building.

3.12 Overall Structural Issues

The two storey wing in particular has a relatively tall rear/north elevation, being around 6.5m or so from ground to ridge. The lower part of this elevation is an earth retaining wall, supporting around 1.5 to 2m of ground on the north side. The cross walls, first floor structure, and the roof structure will have originally all contributed towards the overall stability of the building, transferring lateral loads from this tall wall back down towards ground.

Currently the poor condition of the roof structure, and the loss of elements of the first floor structure, means that this rear wall is in a more delicate state than it would be otherwise. The opportunity needs to be taken with the proposed refurbishment plans to ensure that lateral support is reintroduced, and even improved upon, with the new proposed layout. Ideally, the new layout would include a further cross wall at the west end of the main wing, so that the building is separated into four bays. Failing that, a steel frame could be introduced instead of a new cross wall.

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Appendix



Fig 01 - West elevation



Fig 02 - South elevation



Fig 03 - West elevation - south wing



Fig 04 - South gable of south wing above the lower retaining wall



Fig 05 - east end of the main wing, facing south



Fig 06 - North elevation



Fig 07 - East elevation, taken from within the botanical garden





Fig 09 - West end of south elevation


Fig 10 - Lowered ground to east end of south elevation



Fig 11 - Vulnerable corner - south east corner of south wing



Fig 12 - Rusting plate at base of post, west elevation of south wing



Fig 13 - Beam supporting roof, west end of the main wing



Fig 14 - First floor structure



Fig 15 - East gable fireplace



Fig 16 - Cracking through arch/flue to central cross wall



Fig 17 - North wall from within the west end of the main wing