MIRANDA HOUSE

STRUCTURAL INVESTIGATIONS AND PROPOSALS

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1.0 INTRODUCTION AND BACKGROUND

1.1 We have been appointed by the Embassy of The Bolivarian Republic of Venezuela to provide structural engineering services to assist with the upgrading of Miranda House in its role as a museum. The project is led by Studio Downie Architects.

1.2 The current proposals fall into two categories;

- Strengthening of the existing Georgian building to prevent further structural damage and to upgrade the floors to a designed capacity.
- Alterations to the rear buildings and the construction of a new glass lift within the courtyard.

2.0 THE EXISTING BUILDING

2.1 We had previously carried out a structural survey and investigation of the existing building in 2006.The report made at the time is available but for convenience a summary of the information within the report has been included below.

2.2 BUILDING FORM AND RELEVENT HISTORY

2.2.1 The property is a five storey mid-terrace former house of traditional construction.

2.2.2 The front and rear walls are constructed in load bearing solid brick and are in comparatively good condition. Sections of brickwork at the rear have been rebuilt and the elevation fully re-pointed – this was possibly as part of the 1980s refurbishment works. Any defects are very minor and are not considered to require further work at this time.

2.2.3 The internal structure comprises timber floors generally supported by the internal walls.

2.2.4 The central spine wall of the house is load-bearing and made up of timber stud walls, with some diagonal timber members. The construction and alignment of the wall varies at each level. The ability of the spine wall to act as a deep truss is very important to the capacity of the house particularly the braced frame at first floor.

2.2.5 Floors from ground to third floor are of timber joist construction and span from the front to the rear of the building at each level, except at ground floor where they span from side to side.

2.2.6 The roof is of a typical ‘valley’ construction, in which the pitched rafters are supported along a beam at the valley base. The beam in Miranda House spans front to back supported on the central spine wall.

2.2.7 The property was a domestic residence from its construction in around 1795 and through the 19th century. It has been recorded that Francisco de Miranda, after whom the house is named, kept a library of some six thousand books on the upper floors of the building.

2.2.8 It is understood that the house was empty and derelict for many years after the Second World War. The property was listed at around the same time that it was acquired by the Venezuelan government in 1978.

2.2.9 In the early to mid-1980s, extensive refurbishment was carried out. Photographs taken at this time indicate that in most of the house the internal spine walls were stripped back to expose the studwork, removing most of the original lath and plaster finishes. After the refurbishment the building was only partially occupied and it is only in the last few years that the property has been used as a museum and offices by staff of the Embassy.

2.2.10 A visual inspection of the rear façade indicated that it underwent significant rebuilding during the 1980s.

2.3 STRUCTURAL CONDITION

2.3.1 We were originally asked to look at the building because it was suffering from severe settlement with evidence of relatively recent movement in the form of cracking.

2.3.2 Our investigation report dated 26th September 2006 provides a detailed description of the condition of each floor and wall where inspected. The report also contains an analysis of the findings and a detailed explanation of the cause. However in summary;

2.3.3 The main external walls and party walls are in reasonable condition

2.3.4 There is no evidence of subsidence or settlement of the foundations or basement walls

2.3.5 The house has suffered substantial settlement of the internal timber structure due to a variety of causes but principally because it appears to have been constructed with limited capacity, which was subsequently eroded by overloading, alterations and typical timber defects.

2.4 The 1985 refurbishment appears to have corrected some of the historic defects but doesn’t appear to have included comprehensive structural upgrading or refurbishment work.

2.4.1 In conclusion the capacity of the existing internal structure is severely limited and any long term upgrade of the building should incorporate an appropriate and sensitive (bearing in mind the listing) set of strengthening works.

2.5 RECENT INVESTIGATION WORKS

2.5.1 Since this initial structural investigation, an enabling phase of construction was undertaken. This allowed us to further investigate previously unknown items. The information gathered during this phase has allowed us to progress and firm-up our structural details.

2.6 ROOF

2.6.1 Access to inspect the roof structure was obtained. The roof is of a typical 'valley' construction, in which the pitched rafters are supported along a beam at the valley base. The valley beam spans front to back and is supported centrally on the spine wall. The rafters are propped at their mid-span by a timber purlin propped back to a beam along the boundary wall. See SSK 015 Appendix A.

2.6.2 The ceiling rafters span from side to side. Their span is broken by a further beam, midway between wall and valley beam, and running front to back.

2.6.3 The roof structure appears to be generally original although many elements are obscured from view by insulation and chicken wire. Where inspected, the timber appears to be in good condition with no evidence of decay. There are a small number of members which have been replaced with modern timber.

2.6.4 The ceiling shows some cracking along the length of the room in line with the valley beam. There is also general cracking and sagging in other rooms.

2.6.5 There is a crack in the masonry above ceiling level at the rear of the west boundary wall

2.7 TRIAL PITS

2.7.1 A number of trial pits were excavated at the rear of the building. The logs from this work can be found in Appendix A. A summary of the findings are;

- The foundations the original masonry are very shallow. There was little evidence that brick corbels existing at the base of the walls.
- The foundations to the wall bounding the Bolivar Hall has been previously underpinned.
- The south wall to the rear archive room as been previously underpinned.

3.0 PROPOSED STRENGTHENING

3.1 FLOOR STRENGTHENING/UPGRADE

3.1.1 The existing use of the building is as a museum and offices although they are only lightly used. It is clear that the proposed use will be more intensive with public access to many of the rooms.

3.1.2 If the existing structure was in good condition we might argue that as a historic structure some relaxation of the Building Regulations was justified, however its poor condition and lack of structural capacity suggest it should be upgraded to a condition closer to current standards.

3.1.3 The loading appropriate to galleries and museum floors is 4kN/m2. Clearly, this seems excessive for the activities possible in a house environment and would lead a disproportionate degree of strengthening works. The team therefore proposes an imposed loading of 2.5kN/m, appropriate to general office loading.

3.1.4 To upgrade the internal structure for the proposed uses will generally require strengthening work to the floors and internal load bearing structure. It should be possible to do this by adding structure to floor and wall zones retaining the existing fabric, so the finished appearance isn't changed. Drawings detailing the proposed strengthening can be found in Appendix B.

3.1.5 Floor joists will be paired with new timber joists or steel PFC sections where necessary.

3.1.6 At level 1 & 2, the supporting wall below does not align with the supported wall above. As the ceilings are to be protected this provides a problem for installing a new member beneath the supported wall. We have provided a spliced detail where is occurs. See SSK 018.

3.1.7 The floor has undergone varied, yet significant deformation. A measured survey of each existing joist to be strengthened should be undertaken during the construction phase to ensure the specified strengthening is geometrically suitable.

3.1.8 At level 3, we propose to install the strengthening timbers level to reduce the packing require. See SSK 017 Appendix B.

3.1.9 The trussed partition at level 1 has insufficient strength to support the floor and roof above that it supports. The proposed strengthening, shown on S402 in Appendix B, involves fixing two 600mm deep steel plates either side of the wall at high level. The plate will be screwed to the existing timbers and bolted to the perimeter masonry via discrete angle bracket. Photographic evidence shows that the plaster on this partition was previously removed.

3.1.10 As part of the upgrade new service distribution is proposed through the existing floors. Vertical risers will be formed between existing joists to avoid trimming. For horizontal distribution, pipes and cables should pass through notches and drilled holes that comply with the British Standards regulations.

3.2 ROOF STRENGTHENING

3.2.1 It is evident that the roof has undergone deformation during its life. There are two contributing factors; the settlement of the supporting 3rd floor and the inadequate sizing of the existing roof members.

3.2.2 The supporting floors will be strengthened as described in section 3.1.

3.2.3 The valley beams and binders are adequate for strength calculations but are undersized when considering deflection. This has caused their deformation and contributed to cracking of the ceiling. At this stage we have specified strengthening to the main valley beam (additional steel PFC sections) and additional support to the ceiling binders in the form of cross timbers (spanning from the party walls to the strengthened valley beams. This strategy can be adjusted once ongoing loading, proposals for retaining/replacing ceiling finishes and aspirations for preventing future cracking are confirmed.

3.3 NEW SPINE WALL OPENINGS

3.3.1 A doorway is proposed at ground floor through the spine wall. The spine wall carries the first floor joists above. Much of the load from 2nd floor and above has been relieved by the strengthening to the first floor trussed partition. A photograph dated 1983 shows the structure within the partition. The opening will require new reveal posts and overhead timber lintels. The partition is currently sitting on one existing timber joist and hence a PFC strengthening steel is specified as part of the general upgrading works. See SSK 019 Appendix B.

3.3.2 At first floor level an opening is proposed through the spine wall. The partition has proposed strengthening works as discussed in 6.1.8. The opening should be confined to the zone below to proposed steel plate.

4.0 PROPOSED NEW BUILD

4.1 A lift shaft is proposed within the rear courtyard. This will be an independent glass structure. To allow this to sit within the courtyard, various alterations are shown to the rear buildings. Services distribution requires horizontal openings through the main rear wall. A detail to show how this can b done without compromising the integrity of the wall is shown in SSK021. Structural sketches can be found in Appendix C.

4.2 NEW LIFT

4.2.1 It is proposed that the lift is self supporting and contained within a glass shaft. This will be a specialist designed structure and independent of the rest of the building.

4.2.2 The lift shaft will require a new pit constructed from reinforced concrete and bearing on the London Clay. The pit will notionally undermine the nearby wall, so provisional underpinning has been allowed. See SSK010 in Appendix C.

4.3 ACCESS LINK

4.3.1 The lift will link to the main house via a short section of glass floor. This will need support on the main wall and this is expected to be via a small angle bolted to the wall. This is shown on SSK013

4.3.2 The masonry panel beneath the windows at each level will be removed to form a doorway. To prevent the solider arch from becoming unstable when the masonry above is removed, it may need some remedial work

4.4 PROPOSED PLANT

4.4.1 To improve the services to the cultural centre, new plant units are proposed on the existing Bolivar Hall. The client has provided photographs of the construction of the hall showing Glulam roof beams at approx. 2m centres supporting timber rafters and ceiling joists at 600 centres. We have also opened an inspection hatch in the ceiling of the hall to confirm exact sizes of the members.

4.4.2 Structural analysis proves that the glulam members have sufficient capacity to carry the additional plant load in the zones notes on drawing SSK 014, Appendix C. However, the timber rafters have insufficient capacity. Steel PFC channels spanning between the glulam beams should be provided to support the plant. These could also provide packing to accommodate the curve in the upper surface of the roof.

5.0 NEXT STAGES

5.1 The strengthening works should be reviewed by Camden Conservation Team with their comments and suggestions fed back into the design.

5.2 Sufficient information has now been obtained to fully define the strengthening works, however due to the historic distortion and the inherent variation of an existing building some minor variations of the standard detail will be required when works actually commence on site.

5.3 Timber joists should be surveyed once they have been exposed during the construction works. This will allow each specific strengthening member to be checked for suitability.