MA11046 - R09 - Rev B

Structural Inspection of

5 to 11 Ekin Road, Cambridge

For Cambridge City Council

millward

- Civil & Structural Engineering
- Environmental & Geotechnical
- Flood Risk & Drainage
- Highways & Infrastructure
- Structural Inspections
- Transportation

INTEGRATED ENGINEERING CONSULTANTS

REVISION

Reference	Revision	Author	Date
MA11046-R09	Initial Issue	DBH	Sept 2019
Revision A	Kiwa CMT test results added to appendix C, section 5 and 6 amended to suit.	DBH	Sept 2019
Revision B	Balustrading remedial works added	DBH	Nov 2019

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Appendix C – Further Investigations

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1. INTRODUCTION

1.1 Millward were instructed by Cambridge City Council to carry out a limited structural inspection of six apartment blocks at Ekin Road Estate.

1.2 This structural inspection was requested to determine the current condition of the buildings, in particular the concrete to the rear balconies, the canopy to the stores block and the window boxes to highlight any remedial works required.

1.3 The inspections were carried out during a number of visits during July and August 2019. The weather at the time of the inspections were generally dry and sunny.

1.4 The buildings are understood to have been built in the 1950's and are all three-storey blocks with apartments on each level accessed either side of two access cores creating 12 apartments in each block.

1.5 Access was gained to the site from the public footways surrounding the buildings and the private gardens to the rear of the properties. For the purposes of this report the buildings are referenced from the ground floor access core entrances at the front of the property.

1.6 There are no record drawings of the structure presently available for review however the buildings are understood to be "Easiform" non-traditional cavity wall construction made with either precast or insitu concrete panels.

1.7 Previous reports for the properties that have been provided by Cambridge City Council are reviewed in Section 3 and included in Appendix A as follows:-

- Asbestos Survey by One Sixty Six Ltd.
- Make Safe Survey Report by The Concrete Corrosion Consultancy Practice.
- CCTV Drainage Survey by Metro Rod.

1.8 Photographs from the visual inspections are referenced in the report and can be found in Appendix B.

1.9 Further investigations that have been organised by Millward to supplement the existing information are included in Section 5 and included in Appendix C as follows:-

- Measured building survey of a typical block by Greenhatch
- Concrete testing of the apartment blocks by Kiwa CMT
- Calculation check of existing reinforced concrete balcony beam.
- Dimensional check of Balustrades and Handrailing

1.10 Proposed remedial works details are included in Appendix D.

2 BRIEF AND LIMITATIONS OF REPORT

2.1 The brief was to undertake a visual structural inspection of the property to determine the current condition of the properties and highlight any remedial works required. It is understood that the property may be demolished for redevelopment of the area in the next five years and this should be considered when recommending corrective works.

2.2 Previous investigation reports have been reviewed and considered prior to the visual inspections.

2.3 Access for the visual inspection of the apartment blocks was limited to the external elevations, the access stairwell, and a couple of rear balconies. It has not therefore been possible to inspect the roof construction to the main building. None of the apartments were inspected internally and it was not possible to gain access into the store area.

2.4 During the visual inspection nothing hidden from view or concealed has been inspected and no permanently fixed floor, roof or wall coverings have been lifted. No other destructive methods of inspection have been employed and nothing was removed, tested or sampled.

2.5 Where visible, timber has been assessed based on appearance only. Reference to timber conditions are therefore limited and it is recommended that a specialist timber preservation company is appointed to confirm this diagnosis.

2.6 There are no record drawings of the structure presently available for review although we have been informed by Cambridge City Council that the building is of “Easiform” non-traditional precast or insitu concrete panels.

2.7 Subsequent to the visual inspections a measured building survey has been undertaken of a typical block. A limited number of concrete tests have also been undertaken on the rear recessed balconies where access could be gained and to the rear store block canopy slab.

3 DESKTOP STUDIES / PREVIOUS INVESTIGATIONS & REPORTS

Asbestos Survey

3.1 An asbestos survey was undertaken by One Sixty Six Ltd for TSG Building Services Ltd, the report is dated 8th December 2015 for numbers 9-11 Ekin Road, there is no survey available for numbers 5-7. The survey was limited to visual inspections as no samples were taken.

3.2 The survey covers the entrance area, stairwell, roof loft and external area although it doesn't specify what is the extent of the external survey. The ground floor store buildings could not be accessed during the survey and therefore were not inspected.

3.3 The report states for all of the areas inspected that "no suspected asbestos containing materials observed" however it also notes in the limitations of the survey that no intrusive investigations were undertaken, and that asbestos could be concealed within the fabric of the building. It is recommended that the contractor consider the findings of the report and the proposed refurbishment works to determine whether any further investigations are required before commencing any works on site.

Make Safe Survey Report

3.4 A Make Safe Survey inspection of the building was undertaken by The Concrete Corrosion Consultancy Practice on behalf of Cambridge City Council to note any defects and remove any potentially dangerous elements that would cause an immediate risk to the property users and the public. The inspection involved using binoculars to view the property close to and record defects on photographs.

3.5 The report is dated March 2019 and identified two areas of concern relating to a ground floor window box to the front elevation of the building which were subsequently removed for safety reasons.

Metro Rod CCTV Survey

3.6 A CCTV Drainage survey was undertaken by Metro Rod (Cambridge) on behalf of BSSR to record the condition of the main drainage pipes serving the building to the adjacent highway. The report dated 18th January 2018 has been forwarded to Millward for review however the CCTV footage has not been received.

3.7 The survey covers all of the pipes that can be accessed from manholes but none of the stormwater pipes from the rwps or the main stormwater run to the rear of the building due to problems with the manhole at the head of the run filled with mass roots.

3.8 The survey records all of the defects and gives a cost breakdown for the remedial works required. At the back of the report the structural and service defects are graded from 1 to 5, in the summary they note one drainage runs as grade 5. They suggest that remedial works for grade 5 defects should be repaired immediately to prevent any further deterioration.

4 VISUAL INSPECTION

Building Construction

4.1 The building is a rectangular three-storey block of twelve apartments with a duo pitched roof spanning front to back and gable ends. There are two entrances serving six apartments on the three floors, one either side of the central access stairwell. It is understood from Cambridge City Council that the building is of 'Easiform' type 2 cavity wall construction. The inner walls of these types of buildings are usually constructed with either cast insitu or precast concrete panels bolted together, and the external wall can be either concrete or masonry. This building has a painted render finish covering the wall construction (photos 1 to 6). The internal walls are usually concrete providing good lateral bracing for the structure, the floors can be solid insitu slabs, insitu ribs and hollow blocks or precast ribs and hollow blocks.

4.2 The roof is finished with concrete profiled tiles and the gable verge is sealed with cement to the underside of the profiled and ridge tiles. The timber roof rafters are exposed at the eaves cantilevering over the supporting perimeter walls with UPVC guttering fixed to the face of the timbers without any visible fascia board. There are four brick chimneys to the front of the property and four rainwater downpipes to both the front and rear of the properties (photos 1,4 and 5).

4.3 The front facade architecture is broken up by a mixture of concrete surrounds, cills or plant boxes to the windows and a recessed concrete panel above the main entrances. The main entrance canopy is of UPVC construction replacing the previous concrete unit (photos 1 and 2). The gable walls to both sides of the building are plain apart from one window at each floor level and a window box to the second floor apartment (photo 3).

4.4 To the rear facade there are either concrete surrounds or cills to the windows and recessed balconies to the upper floor apartments above the central access cores (photos 4 and 5). The balconies are separated by a central dividing wall and to the

front is a single skin masonry wall and coping stone with a small section of metal balustrading supported off a downstand concrete beam (photo 6). The balcony has an exposed concrete screed and a single drain hole with an overflow pipe out through the face of the downstand beam.

4.5 To the rear of the building are two single storey brickwork store blocks, one behind each access core (photos 7 to 9). It was not possible to access the individual stores to check but they appeared to be built from single skin brickwork walls (stretcher bond brickwork) built off a raised concrete slab (possibly a raft foundation). The roof is concrete construction and extends towards the building with upstand perimeter beams to provide a protected canopy. The roof is finished with a built up felt waterproof system.

4.6 The access cores have entrance doors and timber framed glazed panels to the front and rear of the block. There is an internal step to the front, an external step to the rear, and a staircase to the upper floors. The floors and staircase are concrete construction with a granolithic screed and skirtings. The wall finishes are all painted plaster (photos 10 and 11).

4.7 There is a shared lawned garden to the front of the building, to the rear is a mixture of open plan and fenced gardens. A concrete path from the rear door gives access to the store blocks and a concrete paved area with rotary lines for communal clothes drying (photos 11 and 12). The access to the garden area from the concrete path either side of the rear access is a mixture of bark chippings concrete paviours and dirt paths.

4.8 The property is segregated from the surrounding highway and adjacent properties by a number of hedges, fences and mature trees.

Observations / Structural Defects

4.9 The external walls appear to be relatively plumb and generally in good condition. The render has been repaired in places where services holes have been formed or removed, the paintwork is weathered and patchy particularly to the side and rear elevations (photos 1 to 5). The windows have all been replaced with UPVC units which

all appear to be in good condition. There are concrete surrounds or cills to the windows and concrete window boxes to a number of windows on the front and side elevations. The front and rear access doors are stepped back from the building line and have traditional timber framed windows (photos 13 and 14). Most of the defects are cosmetic which can be cleaned back, treated and repainted, there are however some notable defects to the walls as follows:-

a) The concrete has spalled in a couple of locations to concrete window surrounds (photos 15 and 16). The concrete needs to be broken back locally to remove any loose material and inspected by the engineer to see if there are any structural concerns. Depending upon the condition of the concrete it can either be simply cleaned back and painted or the concrete can be reinstated back to its original condition with an appropriate repair mortar such as Flexcrete Monolite (or similar approved). Any exposed reinforcement is to be cleaned back and treated with Flexcrete Steel Reinforcement Protector 841 (or similar approved) prior to the concrete repair.

b) A number of concrete window boxes have loss of section at the front top face or the bottom corner where corroded reinforcement can also be seen (photos 17 and 18). The window boxes don't appear to have any fixings into the building but seem to be a single cast unit that has been built into the external leaf (photo 17). The boxes need to be broken back to remove any loose material and inspected by the structural engineer. Depending upon the condition the top section can be trimmed back to create a clean line and painted. The lower section needs to have the reinforcement treated and the concrete repaired as described above. In an extreme situation the window box may need to be cut away from the face of the building and possibly replaced with a GRP item drilled and resin fixed to the wall. In such circumstances the fixings would need to be tested insitu to determine their load capacity.

c) There is one roof tile missing from the front LHS gable wall at the eaves location which needs to be reinstated (photo 19).

d) There is a bird's nest at the top of a rwp to the rear of the building that should be removed and check the seals of the rwp joints (photo 20).

4.10 The condition of the recessed balconies and parapet walls / balustrades vary significantly from balcony to balcony, some appear to be in good condition, but others have serious structural defects that need to be addressed. The balconies and the adjacent link canopy roof to the store buildings have been propped due to the extent of the structural damage, some are obviously necessary whilst others appear precautionary until the structural condition has been determined. The defects that needs to be addressed as follows:-

a) The building supports for the balcony concrete edge beam has failed in the past at a number of locations and the remedial works have cracked and separating from the building wall (photos 21 to 23 and 25). The previous repair works need to be removed during the remedial works contract and inspected by the structural engineer to determine the extent of work required. It is noted that the steel handrail is built into the wall and therefore part of the damage could be due to corrosion and expansion of the steelwork which will need to be cleaned back and treated prior to rebuilding the external leaf of the wall. The damage at the concrete beam support could also be due to corrosion of the edge beam reinforcement which will need to be investigated further to determine the remedial works required (photo 25).

b) Two of the concrete edge beams have minor cracks to the face and underside of the section (photos 21 to 23). The cracks need to be cleaned and examined to determine the extent of the damage. Providing the concrete is in good condition the cracks are to be filled with Flexcrete Monolevel FC mortar (or similar approved), otherwise the concrete is to be broken back, cleaned and treated with repair mortar such as Flexcrete Monolite (or similar approved). Any exposed reinforcement is to be cleaned back and treated with Flexcrete Steel Reinforcement Protector 841 (or similar approved) prior to the concrete repair.

c) Two of the concrete edge beams have severe reinforcement corrosion and section loss (photos 24 to 26). It appears that previous attempts have been made to rectify

the problem however it doesn't look as if the reinforcement has been treated and the reason why the remedial works have failed. Before the work is done the balcony and edge beam will need to be propped, it may also be necessary to remove the parapet wall and handrail over the edge beam in order to reduce the loading onto the beam. The concrete needs to be removed to expose uncorroded reinforcement, at least 25mm behind the bars and 50mm beyond the length of corroded steel. The concrete must be cleaned back so that it is free of all loose material, dust, oil, grease etc and the steelwork must be cleaned back to bright steel with no corrosion. The area is then to be inspected by the structural engineer and may require steelwork reinforcement adding to the beam to replace what has been lost. All exposed steelwork such then be treated with Flexcrete Steel Reinforcement Protector 841 (or similar approved) prior to reforming the beam back to its original profile with Flexcrete Monomix (or similar approved), mixed and applied strictly in accordance with the manufacturer's specifications and instructions.

d) The recessed balcony slab screed has crazing cracks to the top surface due most probably to shrinkage of the concrete as it has cured or possibly from the freeze / thaw effects of being exposed for decades (photo 27). This will not be of any structural concern provided the slab beneath is in good condition. Some of balconies have lateral cracks to the underside (photo 28). These slabs will need to be exposed during the main contract and inspected further to see the depth of the crack and whether or not the reinforcement is affected. It would be prudent to check the concrete cover to each balcony slab and the depth of carbonation to see if there are any potential problems. The repairs would be dependent upon the extent of deterioration but would be one of the solutions noted in 4.10 b) or c) above. For durability the top surface of the balcony should be treated with a waterproof membrane, the drainage hole increased in size and protected to prevent any future blockages. Cambridge City Council have tried a number of systems in the past and have expressed a preference for a MMA (Methyl Methacrylate) resin installed at other locations by Total Protections Ltd (or similar approved). The slab surface treatment and application of the new waterproof

membrane are to be strictly in accordance with the manufacturer's specifications and method of works. Details of the Total Protection Ltd system is included in Appendix D.

e) Upon completion of all the concrete repairs described above the remaining exposed concrete should be prepared and painted with anti-carbonation paint such as Flexcrete Bond-Prime and two coats of Monodex Smooth (or similar approved).

f) There are diagonal cracks in a couple of the parapet walls migrating from the base rail of the balustrading which is built into the wall (photo 29). The cracked has been caused by corrosion of the steelwork which has expanded and lifted the bottom course of brickwork and split the face of the brick (photo 30). There are also examples at the top handrail which has caused the top bricks to dislodge or split and raise the coping stone (photos 31 and 32). The balustrading needs to be exposed and cleaned back before treating and painting with a suitable paint system before being built back into the wall. The parapet wall needs to be dismantled and rebuilt to the original specification.

g) The balustrading and parapet wall do not comply with the latest Housing Health and Safety Rating System guidance document, the parapet wall and/or handrail will need to be raised and any openings greater than 100mm reduced by the addition of steelwork sections as detailed in Appendix D.

4.11 The access core and staircase is generally in good condition, in need of just redecoration (photos 33 and 34). The balustrading however does not comply with the latest Housing Health and Safety Rating System guidance document, the handrail will need to be raised and any openings greater than 100mm reduced by the addition of steelwork sections as detailed in Appendix D. The following minor defect was also noted:-

a) There is a horizontal crack to the internal walls along the line of the second floor slab which is reflected along the front wall (photos 35 and 36). It is recommended that the crack is monitored over a period of 6 to 12 months with tell-tale crack

monitors to check for any movement in order to determine if any remedial works are required.

4.12 The rear store blocks and concrete link canopy roof to the main building are generally in good condition however the following defects were noted:-

a) The link canopy roof and the first floor balcony slab are presently propped, and it would appear that recent improvement works to the brickwork supports have been undertaken judging by the mortar (photos 37 and 38). It should be possible to remove these props once the remedial works have been completed to the balcony and edge beam at first floor. The support to the canopy roof at No's 5 and 7 could not be fully inspected due to the scaffolding in place. This should be inspected once the balcony repairs have been completed and the scaffolding removed.

b) The store ground floor slab level is above the adjacent concrete paths and has spalled along part of the vertical face (photo 39). The concrete should be cleaned back and repaired with Flexcrete Monolite mortar (or similar approved).

c) The ground level has been raised against the face of one store wall and a tree has been planted or seeded against the building (photo 40). It has not been possible to inspect the store internally however the raised ground will impose loadings onto the wall that it most probably wasn't designed to resist and will encourage moisture to penetrate the building. It is recommended that the ground levels are reduced, and the tree removed.

d) It is understood that concerns have been raised in the past regarding settlement of the store building and the possible effect on the concrete link canopy. There is no immediate evidence of settlement although if the stores are supported on raft foundations the brickwork may not crack. It is recommended that the ground slab levels are surveyed and then recorded over a period of 6 to 12 months to see if any movement has occurred before reviewing any remedial works required.

4.13 The rear gardens are a mixture of open plan lawns, segregated gardens and a concrete slab area with rotary lines for communal clothes drying. The concrete slab

has surface cracks migrating from the cast in poles most probably due to shrinkage of the concrete as it cured. There is a concrete path from the rear entrance through the stores to the communal drying area which is weathered but generally in good condition. The pathways to the gardens on either side of the store building vary from laid barking, paved slabs and a dirt track (photos 41 and 42). Some of the paving slabs are uneven and have created a potential trip hazard, these slabs should be re-laid level with the adjacent slabs.

5 FURTHER INVESTIGATIONS

Measured Building Survey

5.1 A measured building of a typical block was undertaken by Greenhatch recording the features to the building elevations. The drawings are included in Appendix C for information and referencing remedial works.

Concrete Testing and Intrusive Investigations of the Recessed Balcony

5.2 Kiwa CMT were appointed to undertake concrete testing to one of the recessed balconies, the perimeter support beam, the link canopy and store roof slabs to each of the six blocks to Ekin Road. The work was undertaken on site from 27th to 29th August 2019.

5.3 The concrete elements were checked on site for depth of concrete cover, reinforcement details and carbonation depth. Samples were also be taken and tested for chloride content, cement content and compressive strength plus petrographic examinations of the concrete were completed to inspect the concrete under the microscope.

5.4 During the intrusive investigations of the recessed balcony it was established that the construction is a concrete screed over a precast or cast insitu reinforced concrete slab with internal voids formed by cardboard. The voids reduce the weight of the slab, use less material and effectively form a number of reinforced concrete beams within the slab at regular centres, similar to a modern day beam and block floor. These “beams” were measured as approximately 150mm wide x 180mm deep with 2 No 6mm diameter plain bars in the top and 2 No 16mm diameter plain bars in the bottom. The floor spans parallel to the external wall, it therefore supports the central dividing wall between the apartments and does not impose any loads onto the perimeter concrete beam. As the balcony is within the footprint of the building it would seem logical that the floor slab is a continuation of the building floor slab spanning across the length of the building supported off the internal and gable load-bearing walls. The reinforcement

cover measured at apartment 5a was 31mm and the carbonation depth was 5mm suggesting that the reinforcement will not be at risk of corrosion due to carbonation of the concrete.

5.5 The condition of the perimeter concrete downstand beam varies across the balconies to the building. Some are in very good condition with no visual signs of corrosion or distress whilst others are in a very poor condition with spalled concrete and exposed, heavily corroded reinforcement. The depth of carbonation has been measured to the first floor beam to apartments 5a and 7a where the reinforcement is exposed. The concrete cover is 25mm to the bottom of the beam and 30mm to the side of the beam, the carbonation depth was recorded as 40mm to the beam at 5a implying that the corrosion is due to the carbonation of the concrete. It was not possible to measure all of the beams however on some of the other blocks the carbonation depth has been measured to be as low as 3mm therefore it would be reasonable to assume that the variation in carbonation depth could be a factor of the concrete condition. It is recommended that during the contract works all of the beams are checked for depth of cover and carbonation and that any remedial works required are agreed with the engineer.

5.6 The full report is included in Appendix C and determined the following:-

- The cement content and compressive strength of the samples taken are indicative that a reasonable to good quality structural concrete was used in the construction of the balconies and canopy / store roof.

- Samples were taken from two of the concrete beams that are suffering from spalling concrete / reinforcement corrosion for petrographic examination. Both of the samples revealed that the concrete was generally in good sound condition with no evidence of disruption caused by alkali silica reaction (ASR) or sulphate attack.

- The concrete cover and depth of carbonation varies across the six buildings. Of the samples tested:-

- 1 of the 6 balcony slab soffits are at high risk of corrosion due to carbonation of the concrete.
- 3 of the 6 balcony edge beams are at high risk of corrosion due to carbonation of the concrete.
- 5 of the 6 canopy / store roof soffits are at high risk of corrosion due to carbonation of the concrete.

- The concrete samples were also tested for chloride content of which 2 of the 6 balcony edge beams tested are at moderate risk of chloride induced corrosion.

Design Checks

5.7 From the Kiwa CMT investigations the concrete and reinforcement details of the concrete edge beam were determined as being 190mm wide x 255mm deep with 2 No 16mm diameter plain bars in the top, 4 No 16mm diameter plain bars in the bottom and 6mm diameter plain bar links at 240mm centres. It has also been established that the balcony slab does not span onto the perimeter beam which therefore the edge beam only supports its own self-weight and the parapet masonry wall over.

5.8 From BS6399 Part 1 all parapets, barriers and balustrades should be capable of supporting an imposed vertical load of 0.6kN/m, this loading would not have been required when the beams were originally designed. This load has been added to the loads described above to check whether the beam has the capacity to meet modern design requirements.

5.9 The calculation included in Appendix C demonstrates that the perimeter beam has sufficient reinforcement to support the original loadings plus the modern vertical imposed loads required from BS6399 part 1 onto parapet walls. The reinforcement is only 73% stressed therefore deemed satisfactory. There is capacity within the beam for some section loss due to corrosion which may explain why the beams have not yet deflected or failed however it is recommended that as part of the remedial works that reinforcement is added to return the beam back to its original state.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 The building is generally in good condition for a property of its age however there are a number of minor defects that needs to be addressed to ensure that it remains in a good safe condition and a pleasant environment for the tenants and owners of the apartments. Easiform buildings were constructed at times when there was a shortage of skilled labour (particularly after the two world wars). As a result, the quality of the construction can vary greatly between two or more buildings of the same form and design. Two such items are the depth of concrete cover and the grade of concrete mixed on site both of which can affect the durability of the structure.

6.2 The main areas of concern are the rear balconies, the concrete canopy link to the store buildings and window boxes however before any work commences to these areas they need to be checked for any possible asbestos. One Sixty Six Ltd have reported that “no suspected asbestos containing materials observed” however they could not access the stores or confirmed the extent of the external survey. They also noted that asbestos could be concealed within the fabric of the building. There will need to be repair works to the cavity wall construction around the balconies which will expose parts of the building that have not been inspected. The One Sixty Six report was written for TSG Building Services and it is not known whether Cambridge City Council can take reliance on the report. It is therefore recommended that One Sixty Six are appointed to clarify their findings and investigate the cavity wall construction, or that a suitably qualified consultant is appointed to inspect these elements. Alternatively, this work could be added to the scope of services for the main contractor.

6.3 From the Kiwa CMT testing of some of the concrete elements it can be seen that the depth of concrete cover and carbonation penetration vary across the six blocks on the Ekin Road estate. It is therefore recommended that during the contract works that the concrete cover and carbonation depths are checked to all of the balconies and edge beams in order to determine if there are likely to be any problems in the foreseeable future.

6.4 From the Kiwa CMT investigations it has been possible to determine the balcony structure and assess the design of the edge beams which have some design redundancy that can then be considered when reviewing the remedial works required.

6.5 During the inspection it has not been possible to inspect the condition of the store block roof finishes. It is therefore recommended that these are inspected during the main contract when safe access can be arranged. Any defects can then be assessed and added to the contracted works as necessary.

6.6 Remedial works recommended for the masonry walls and roof are as follows:-

- Inspect extent of damage to concrete window surrounds and repair as necessary.
- Repair or replace defective window boxes.
- Consider stripping paint off all window surrounds and window boxes, then treat with anti-carbonation paint.
- Replace missing roof tile.
- Remove bird's nest and check rwp joints.

6.7 Remedial works recommended to rear recessed balconies are as follows:-

- Investigate deterioration of building supports for concrete balcony edge beam and balustrading.
- Further investigation and repairs of concrete edge beams.
- Inspect underside of balcony slabs for cracks, check reinforcement and repair as necessary.
- Add MMA waterproof membrane and improve drainage discharge to balcony slabs.

- Strip existing paint finish (where applicable) and treat all exposed concrete with anti-carbonation paint.
- Expose and treat corroded steel balustrading.
- Repair / replace parapet walls.
- Raise the parapet wall and/or handrail level of the balustrading and infill all voids greater than 100mm to comply with the latest Housing Health and Safety Rating System guidance document. Details of remedial works can be found in Appendix D.

6.8 Remedial works recommended for the access core and staircases are as follows:-

- Raise the handrail level of the balustrading and infill all voids greater than 100mm to comply with the latest Housing Health and Safety Rating System guidance document. Details of remedial works can be found in Appendix D.
- Monitor crack in wall with tell-tale crack monitors over a period of 6 to 12 months to check for any movement.
- Redecorate walls and balustrading.

6.9 Remedial works recommended for the store blocks and link canopy roof are as follows:-

- Investigate concrete cover to reinforcement at soffit of canopy / roof store slab and any signs of corrosion. Remove existing paint finish, repair concrete where necessary as instructed by the structural engineer and treat with anti-carbonation paint.
- Possible repairs required to masonry supports of link canopy roof once scaffolding has been removed and the structure can be inspected.
- Repair face of store ground slab.

- Reduce site levels against store wall and remove tree.
- Survey store building ground floor slab and monitor for movement.

6.10 Remedial works recommended for the rear gardens are as follows:-

- Relay some paving slabs to remove trip hazards.

6.11 The Metro Rod CCTV drainage survey reveals numerous faults with the main drains to varying degrees. They have quoted £4,725 for the repairs however only one drain is identified as requiring immediate work to prevent the system failing (£1,520). It is noted however that a number of the stormwater drains to the rear of the property could not be surveyed due to root ingress, these should be investigated further during the remedial works on site. The extent of drainage works is to be agreed with Cambridge City Council and tendered as part of the main refurbishment works.