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Futurist Cinema
Lime Street
Liverpool

Conservation Engineers' Structural Report
Following initial visual survey

Project number 1105

31 May 2016

Revision

Date	Revision	Comments
30 May 2016	/	First issue
2 June 2016	A	Minor legal description revision, additional sketch

Quality Assurance Review

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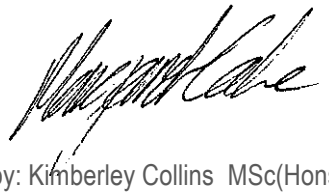
Signature 

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1.0 Introduction

This document reports on the results of a visual inspection of the Futurist Cinema in Liverpool. The inspection was carried out by a Conservation Accredited structural engineer and addresses the question of whether the building (specifically the façade) is unstable or otherwise poses a risk to public safety.

2.0 Our Brief

2.1 Integral were asked jointly by Liverpool City Council and Save Britain's Heritage to carry out a visual structural assessment of the building known as the Futurist Cinema on Lime Street in Liverpool.

2.2 This building is currently the subject of a legal appeal and the Council has undertaken to carry out the minimum of works required to secure public safety until that appeal is heard. There is concern that the building may be unstable and pose an immediate risk to the public and there have been conflicting reports from structural engineers on this matter. Integral Engineering Design Ltd, (specifically Margaret Cooke – a Conservation Accredited Engineer with over 20 years experience in the field of conservation), were jointly appointed as independent engineering experts to determine the method of working.

2.3 Further work may arise, but this first report addresses the immediate question: in her considered judgement does the building pose an immediate risk and if so what steps should be taken.

2.4 Lime Street is currently closed, which has been tenable over the Bank Holiday weekend, however this will create issues for traffic flow around Liverpool and a speedy resolution is desirable.

3.0 Inspection/Investigations

3.1 Margaret Cooke carried out her inspection on the afternoon of Monday 30 May 2016. This inspection was carried out from the street (Lime St closed to traffic), from a cherry picker and from inside the building. The weather was fine and dry. The cherry picker allowed inspection of the front face of the building and allowed views of the roof and down into the second floor structure (where the roof has been dismantled).

3.2 Key areas which were not accessible were the basement (which it is believed cannot be accessed from the cinema building) and the shops at ground level on either side of the main entrance. These areas are noted on the attached drawings. It was also not possible to access many areas of the second floor either because of unstable structures above or because the condition of the floor structure could not be adequately ascertained on the day (see Assessment and Discussion).

3.3 The survey was visual only on this occasion apart from a plumb line measurement taken of the column to the left of the central arch (looking east, directly at the building from Lime Street).

4.0 Description of the Building

4.1 The Cinema dates from 1912 and is believed to be the first cinema in Liverpool.

4.2 It is load bearing masonry with filler joist floor construction spanning between primary steelwork. In many areas there is a secondary floor structure in timber above the filler joist floor – the support system to this timber floor was not confirmed during our initial visit. The roof is either timber (short spans to the front (west) sections of the building) or light steel trusses (large spans over auditorium). The roofs to the projection rooms and lift shafts appear to be concrete which may be filler joist construction or a later reinforced concrete replacement. This form of construction is typical of the era with steel used to create longer clear spans than timber would previously have achieved but still supported on a masonry (rather than steel framed) vertical structure.

4.3 Historic drawings appear to be reasonably accurate, though the structural information is confined to basic layout of walls, floors and stairs. These drawings and our observations have been used as the base for our sketches attached.

5.0 Assessment and Discussion

The primary focus of this report was to assess whether the façade onto Lime Street is in imminent danger of collapse. Our broad assessment is that this is not the case. This discussion focuses on the reasons we have come to that conclusion.

5.1 The building is, in essence a masonry "box" stiffened horizontally by the floor structures and the roof. There are a number of key questions which arise out this observation:

- What is the structural condition of the floor structures?
- What is the structural condition of the wall structures?
- What is the structural condition of the roof?

All three elements need to be in good enough (though by no means immaculate) condition in order for the whole system to be stable.

5.2 Condition of the floor structures:

The floor structures are of filler joist construction. This is a form of construction in common use at this time – where small steel (or, earlier, wrought iron) beams are laid at the level of the floor with formwork set to the underside of the beams. Concrete is then poured around the beams. Structurally the beams span across the space and the concrete supports load by forming an arch between the beams.
Issues that arise with filler joist floors are:

- Corrosion of the steelwork (as usually, as in this case, the steel flanges are not covered and protected by the concrete.). This can be exacerbated by the aggregates in the concrete which sometimes contain elements which can accelerate corrosion if the floor gets wet.
- Punching through of the concrete – this is unusual as the concrete itself is fairly inert – problems happen when changes are made to a building structure without a proper understanding of what the floor is and how it works.

In this case the corrosion to the steel does not appear to be excessive, though it is impossible to tell what. If anything, is happening within the depth of the floor (see recommendations below). There are no signs that the building has been poorly altered in the past leading to issues in the overall integrity of the floor.

Overall, though, inspection of each floor structure from below showed that they appear to be in reasonable order. We could detect no obvious signs of excessive corrosion either down the length of the beams or at the ends where they are supported on the masonry walls.

There are some additional beams at second floor level (visible from the first floor room). These lie under the main filler joist floor, but appear to have been added later. We believe that they were added to provide support for the brick walls at second floor level. These walls do not appear on the original plans and the indications are that they were added later.

NB: At first floor level in the front (west) room there is a secondary timber floor. This is said to be some 1.2m above the filler joist first floor, though careful drawing of the section reveals this may not, in fact, be the case. In any event, this floor is in poor condition in some areas and therefore should be accessed with a reasonable degree of caution, however it is not considered to be critical in terms of the stability of the façade.

5.3 Condition of the wall structures

The front façade is typically made up of 330mm thick brickwork with a 100mm thick faience block forming the front facing. The façade has been dismantled at pediment level and the bond between block and brickwork was found to be a good shear key between the two skins with brick and mortar "toothed" into a hollow in the

back of the faience block. The pediment and parapet heads are believed to be a later addition, however inspection of the window reveals at first floor level shows a very similar detail, implying that the later blocks were probably modelled on the earlier.

This is heartening because it means that the structure is not reliant on metal ties between two skins (ties of this age would be likely to have corroded). Although no one has had the opportunity to run a cover meter (metal detector) over the face of the façade to date, there is no evidence of the sort of cracking we would expect to see if corroded ties were present.

A plumb line was dropped down the more northerly of the two column faces on the façade (just left of the arch, when looking at the building from Lime Street). This column was chosen because both engineers on site (Margaret Cooke – Integral and Greg Allen - LCC) agreed that visually it appears to be the worst case. This plumb line measured an outward lean of the wall of 35mm over 1.9m height. This was analysed to see whether the current lean in inherently unstable (ie that the weight and lean of the wall alone is sufficient that over time it will inevitably fall). A conservative analysis was carried out which assumed that the faience block adds nothing to the structure – ie that the brickwork alone is acting. This analysis of this shows that the centre of gravity of this element of the wall over its full height is still comfortably within the centre third of the wall: it is not inherently unstable. Given that the faience is believed to be acting in shear with the brickwork then this is a conservative assessment (we have, if anything, a great factor of safety than calculated).

There are likely to be three large steels at (or just below) first floor level in the façade to form the three openings for the shops and grand entrance at street level. These beams are not visible as they are hidden behind the hoarding. The faience just above that line was therefore carefully inspected for signs of distress or movement. Our inspection showed no obvious signs of movement. Given that faience is such a brittle material and tends to shows defects rather obviously (as the cracks around the corroded beam ends just above the entrance) then this tends to imply that the supporting beams are in at least reasonable condition.

There are some buddleia plants in the façade which are causing some local movement of the faience blocks, but there is no sign that these are causing overall instability.

In summary, therefore – the wall does not appear to be inherently unstable, it does not appear to contain corroded wall ties and there is no obvious major signs of corrosion in the steel beams that are supported on the façade. There is a lean at the top of the wall above second floor level, but this is not inherently unstable (see recommendations).

5.4 Condition of the Roof

The roof structure to the front portion of the building is now almost entirely missing. This is not an ideal state of affairs either in terms of keeping water out of the building (thus maintaining the condition of the floor structures at least in the short to medium term) or in terms of providing lateral restraint to the façade at parapet level.

On the southern side of the façade (right hand side as viewed from Lime St) there is restraint provided by the later cross walls – these have been strapped (in one case) and the party wall has recently been pinned. This side is therefore reasonably secure. We have some minor concern about the left hand side – while it is not inherently unstable it is none the less slightly vulnerable to unusual weather conditions such as a high wind. The remaining rafter ends with their boarding may be providing some restraint, however we did not manage to get a good look at the fixing detail between rafter and wall and without that information it is impossible to properly assess the level of restraint they provide. See recommendations below.

5.5 Overall Stability of the Building

In overall terms we believe that the building is stable for the time being. In the short term there are some minor works that, should be carried out to give greater comfort to those who have responsibility for public safety (see recommendations 6.3). If the building is to be held into the autumn 2016 or beyond then some further stabilising work should be considered to keep out the higher winds and greater rainfall associated with the winter period.

There are some elements which are locally unstable (eg brickwork perched on top of steel beams and a failed rc beam). If these elements fell they would certainly pose a danger to any individual who happened to be in the vicinity but we do not believe would cause progressive collapse of the structure overall (see recommendations 6.4). These elements are contained within the building and do not pose a risk to public safety.

6.0 Conclusions and Recommendations

6.1 Our primary conclusion is that the front facade of the Futurist Cinema is not inherently unstable. However some minor works should be carried out to hold its position until the end of legal proceedings. It is our understanding that there is a legal process which needs to be completed in proper order, without concern over the stability of the building hindering proceedings.

6.2 The outcome of the legal process may lead to demolition of the building or may lead to retention of at least part of it. Our recommendations therefore are designed to be as minimal as possible but also to be helpful whichever way the final decision goes. Even if the building is to be demolished then demolition will need to be carried out in an orderly and safe manner and this will be aided by the building starting from a position of stability.

6.3 Immediate securing works

- Securing the northern end of the 2nd floor parapet either with a raking prop *or* with a horizontal beam. Preparatory work for raking prop includes:
  - Checking floor structure in that position (this was not checked on the first visit as not enough was understood about the structure. Having carried out some analysis Integral are confident to access the floor in this area, with care).
  - Agreeing precisely where and how raking prop can be attached to façade wall

  Preparatory work for horizontal beam includes:
  - Checking the connection between rafters and façade to see if it is adequate

  This is work that Integral would want to advise on if we are to take responsibility for this.
- Check that the wall to the left of the pediment at second floor level is tied into the façade wall. If not, then add some ties such as have already been added to the party wall at the south end of the building.
- We would suggest that, for peace of mind, laser spots should be fixed to the front parapet and measured remotely. Such remote monitoring can be linked so that if there is any movement outside a specified range then a warning is sent to whoever is best placed to react. We would not suggest such monitoring if we thought the building was going to move. However we are mindful that the local council carry responsibility for the citizens of Liverpool and having some means of being certain that the parapet has *not* moved might provide some very necessary reassurance. Again Integral can provide further advice on this if it is to be taken forward.

6.4 Suggested works which will make the building safer for workers to enter (but which are not strictly necessary purely on the grounds of building stability). These works would be required whatever the final outcome for the building

- An asbestos report is required – either for demolition or for retention. If there is loose asbestos in the building then immediate steps should be taken in any case to prevent dust escaping into the public realm.
- Removal of locally loose and unstable elements (for example the asbestos sheet/profiled metal shed and the water tanks). These works should be carried out from a large cherry picker with care but will provide, we believe, considerable benefit be removing some of the local safety issues. Again if this is a step that LLC wish to take then Integral would want to provide careful advice on which elements could and should be removed and which should not.

6.5 Works required if the building is to be "held" for a longer period than 4 months

If the legal proceedings continue into the autumn then further work might be advisable to ensure that they building remains stable through the winter. This might include some waterproofing of the floors and some intrusive checking of the beam ends and filler joists floors where they are supported on the façade walls. It might also include some further chopping back of the buddleia and other invasive plants in the walls.