Langtree Group PLC **Duke Street Liverpool** 

Structural Condition Desk Study Report

S001

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# 1 Introduction

This desk study has been undertaken to review the structural options available for the existing buildings on the site proposed for a new office building on Duke Street, Liverpool. The existing buildings are in a poor state of repair, and a number of structural surveys have been undertaken on the site. This desk study has been commissioned to review and summarise the conclusions of these reports.

### **1.1** Site description

The site comprises a number of separate buildings, namely 86, 88 & 90 Duke Street, 71 Henry Street and 14 Suffolk Street. The site also includes the Vinegar Works on Henry Street (65-69 Henry Street). The buildings are sited around an open space, currently used for temporary parking.

82-84 Duke Street, also known as the Frenson's Building, does not form part of the development.

All the buildings are constructed from load bearing masonry, timber floors and roofs; some of the buildings have cellars.

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#### 1.2 Site Layout

# 1.3 References

The following Documents have been reviewed for this desk study:

Ref	Title	Date	Author
1	86-90 Duke Street Liverpool, Photographic survey of the accessible Remains in 2005	Summer 2004	Tween Nuttall Warburton
2	An archaeological desk based assessment at 86-90 Duke Street	10/8/05	Gifford
3	Site Inspection report	21/7/06	White Young Green
4	Structural Report on 90-92 Duke Street	Feb 2009	Roger Hetherington & Associates
5	Creative Ropewalks Buildings at Risk Project: 86-90 Duke Street	25/2/10	2020 Liverpool
6	Korean House Site Condition Survey	19/8/10	Arup
7	Structural Report on 90-92 Duke Street	November 2012	Roger Hetherington & Associates
8	Rear of 92 Duke Street, Liverpool Structural Stability Survey	Jan 2013	RSK

# 2 Brief description of the Reports referred to

# 2.1 Ref 1: 86-90 Duke Street Liverpool, Photographic survey of the accessible Remains in 2005

This report contains a number of external and internal photographs, some basic drawings of 86-90 Duke Street along with an extract from the "2005 Prospectus covering the Conservation Aspects of the Proposed Development as seen at that time".

#### 2.2 Ref 2: An archaeological desk based assessment at 86-90 Duke Street

This document describes the cultural history of the site, and has some information on the structure in the final section. This report covers 86-90 Duke Street and the Suffolk Street frontage.

## 2.3 Ref 3: Site Inspection report, 82/84 Duke Street

This is a short visual report describing the structure to 82/84 Duke Street, the Frenson's Building. This building does not form part of the site and is not referred to further.

### 2.4 Ref 4: Structural Report on 90-92 Duke Street

The building numbering in this document and the updated version (Reference 7) does not match the numbering in other documents. It is interpreted that:

- 90 Duke Street matches 86 Duke Street
- 92 Duke Street refers to 88 & 90 Duke Street.

This document is an external visual survey the buildings.

#### 2.5 Ref 5: Creative Ropewalks Buildings at Risk Survey: 86-90 Duke Street

The survey includes site information, remediation proposals and photographs

#### 2.6 **Ref 6: Korean House Site Condition Survey**

This document is an external only survey of the buildings accessible from the yard.

#### 2.7 Ref 7: Structural Report on 90-92 Duke Street

This is an update to Reference 4 in item 2.4 above. It comprises a visual external inspection only and includes a number of photographs. As in the earlier report, it uses different building numbering.

#### 2.8 Ref 8: Rear of 92 Duke Street, Liverpool Structural Stability Survey

This document refers to 92 Duke Street, which is believed to be 88-90 Duke Street.

This report was commissioned to provide the most suitable means of propping the rear wall of 88-90 Duke Street and a condition review of the single storey café, 14 Suffolk Street.

# **3** Condition of Buildings

#### **3.1 86 -92 Duke Street**

These 3 buildings comprise a terrace of 3 buildings fronting onto Duke Street. They have been vacant for a number of years and have suffered significant internal deterioration. 86 Duke Street is the earliest of the buildings, probably dating from 1750. It comprises a basement, ground floor, first and second floors and an attic. It appears to be constructed from load bearing masonry with timber floors. 86 Duke Street is attached to 88 Duke Street, although it is structurally independent of it. The building is freestanding on the west side with a steel escape stair between it and the Frenson's Building. The building has been altered and updated throughout its life, with a much later addition towards the courtyard area to the south of the Duke Street façade.

88-90 Duke Street formed the central portion of the terrace until the demolition of 92 Duke Street and were probably built as a single building. They date after the construction of 86 Duke Street. The side abutting the site of the former 92 Duke Street is a gable with a valley over the centre of 90 Duke Street, showing where 92 Duke Street was demolished.

Like 86 Duke Street, the construction is load bearing masonry with timber floors and roof and comprises a basement, ground floor, first and second floors and an attic.

It appears that street numbers have changed over time, with 92 Duke Street now being the number of the Monro Pub on the other side of Suffolk Street.

#### **3.1.1 Reference 1**

Internal photos of number 86, 88 & 90 Duke Street show damaged stairs and ceilings, with rot present. External photos show that the valley gutter is full of vegetation, which may have encouraged water penetration.

The document does not contain a textural description of the survey, nor conclusions or recommendations. It does have a dimensioned plan and cross section, showing that floor to floor dimensions vary between 3.3m and 2.5m. The plans also show that 88 Duke Street has cast iron columns at ground floor level supporting a beam at the underside of the 1<sup>st</sup> floor supporting the façade. This is called up in Reference 5 as a bressummer beam.

#### **3.1.2 Reference 2**

This document is mainly a history, but notes that there have been changes to the original layouts, including changes to the Duke Street access, closed up coal holes etc.

#### 3.1.3 Reference 4

As noted in the introduction, the building numbering doesn't match the original numbering. For simplicity, the original numbering has been used in the text below.

The document notes that the interior of the building is believed to be structurally unsafe, so the survey is restricted to an external inspection only.

The defects noted include:

• Cracking of the façade to 86 Duke Street

- Cracking of the side wall to 92 Duke Street (on Suffolk Street)
- Poor bonding of walls (e.g. rear wall to side walls, internal walls etc.). This is especially evident on the rear elevation to 88- 90 Duke Street

#### 3.1.4 Reference 5

The photos in this document are poor black and white photocopies and are not adequate to review issues.

This document notes that for number 86 Duke Street:

- The roof purlins include scarf joints that should be investigated for rot, integrity etc.
- There is a hole in the roof that allows water ingress water has penetrated into the attic and to the floors below
- The roof slates have been overlain by roofing felt reducing natural ventilation giving a suitable environment for dry rot
- The ground 1<sup>st</sup> and 2<sup>nd</sup> floors have evidence of water damage, dry rot and wet rot.
- The rain water goods have failed, contributing to the water damage
- The masonry is painted so that it is difficult to determine the quality of the masonry. However, a number of cracks were noted.

For number 88 & 90 Duke Street, defects include:

- The roof has suffered "extensive damage caused by long term water penetration".
- The ceilings at the second floor have collapsed, with extensive water damage to the party wall between 88 & 90
- The floors in number 88 are "unsalvageable", but some steel beams may be able to be retained. The bressummer beam at 1<sup>st</sup> floor level needs urgent temporary works
- The timber ground floor has partly collapsed in number 88 and has been affected by dry rot adjacent to the party wall. In number 90, the collapse is more significant
- Access to the cellar to number 90 Duke Street was restricted the masonry construction was interpreted from the examination of a photograph. Access to the rear of the cellar was not possible, but an explanation of why is not included.
- A through wall crack at second floor at the rear and also at gable of 90 Duke Street implies reduced stability of the structure of this building.
- The newer additions to the courtyard side of 88 Duke Street had suffered from some water damage, but these were not investigated fully.

The document concludes:

- The façade of 88 Duke Street is salvageable, although all the floors and the roof would need to be replaced
- Number 90 would not be able to be salvaged without significant temporary works. These temporary works would be needed before commencing to allow a more targeted survey to be undertaken

#### **3.1.5** Reference 6

This is an external inspection only of the east elevation of 86 Duke Street.

- The steel escape staircase was noted as being in poor condition
- There is cracking and some mortar loss to areas of the building probably due to the failure of rainwater goods.

#### **3.1.6 Reference** 7

This is an update to Reference 5. As noted in the introduction, the building numbering doesn't match the original numbering. For simplicity, the original numbering has been used in the text below.

The conclusion notes that the rear and side wall of 90 Duke Street appears to be the first walls that will become unstable as there is inadequate masonry bonding at the rear corners. The document notes that this wall is now unstable and should be propped or demolished.

#### **3.1.7 Reference 8**

As noted in the introduction, the building numbering doesn't match the original numbering. For simplicity, the original numbering has been used in the text below.

This document agrees with Reference 7 that the rear wall to 90 Duke Street is likely to collapse and that propping should be installed.

#### 3.1.8 Summary

#### 3.1.8.1 Floors

The internal timber elements, floors, stairs and roof, appear to be damaged beyond repair. Dry rot has been found in the timber. Dry rot can spread and travel through lime mortar in brickwork – all spores will need to be removed and masonry treated.

Some steelwork beams at floor levels may be able to be salvaged. However, it is unlikely they would have been designed for anything but domestic loading. Modern office imposed loading is double domestic imposed load, so the beams may need to be replaced if the usage is changed. A bresummer beam in the façade of 88 Duke Street needs urgent attention.

It is unlikely that the floor-to-floor height would fit with the requirements for a modern office building. However, the floor levels are dictated by the windows

levels causing unsatisfactory or restricted headroom. The narrow aspect of windows would also impair day-lighting of internal spaces and views out. This would affect any BREEAM rating for the building.

#### 3.1.8.2 Walls

The façade on Duke Street may be salvageable, but would require the stripping of finishes to investigate cracking. It may be possible to stich these cracks. The wall would have been designed for domestic loading only, and may need strengthening for any change of use or increase in span.

Several of the walls would require substantial temporary works, including propping in the basement area. This particularly affects 90 Duke Street where the cross walls are not adequately tied together.

The side & rear walls of 90 Duke Street require immediate attention, and even with propping may not be salvageable.

#### 3.1.8.3 Cellar

There is not enough information to judge the condition of the cellars. However, if works are undertaken to try and salvage the façade, it is likely that full propping of the cellar would be required. This would include props to the retaining walls to Duke Street.

#### 3.1.8.4 Other Issues

Hoare Lee note that:

"Although escape stairs should be protected by a fire-rated enclosure and should be a sterile space, Paragraph 5.19 of AD-B requires that the flights and landings of every escape stair serving a basement storey and of every fire-fighting stair are constructed of materials of limited combustibility (i.e. not timber). As with all structural elements, the floors should achieve 60 minutes structural fire resistance".

This would further restrict any options on refurbishing the internal space.

#### **3.2 71 Henry Street, 14 Suffolk Street**

These buildings are made up of a number of smaller masonry buildings.

#### 3.2.1 Reference 8

As part of this report into the rear wall of 90 Duke Street, an external investigation of 71 and 74 Duke Street was included.

The monopitch roof to 94 Duke Street was questioned, with concern that it could collapse. Further investigations were recommended.

# **3.3 65-69 Henry Street (Vinegar Warehouse)**

The only report that refers to this building is Reference 1, where there are some photos of the above ground structure. These photos show that the roof and internal floors have collapsed and that the only remaining structure is the walls.

The eastern elevation is largely window free.

It is understood that this building also includes a cellar, though there is no indication of the construction.

It would be impossible to justify the existing construction to current design standards. That the building is standing gives some confidence, but since it is open to the weather, it can be expected that there will be further deterioration.

### **3.4** Internal courtyard

Geotechnical investigations have been undertaken in the internal courtyard. Several of the trial pits discovered masonry walls, foundations and the top of what was judged to be cellar roofs. This confirms the text in Reference 2 that notes that this area used to be built up containing a warehouse, workshops and the like.

# 4 **Conclusions**

The following points summarise the issues noted in the documents reviewed:

- All the surveys note that the timber parts of the existing buildings are in a poor state of repair having been affected by water ingress leading to decay and collapse. The bresummer beam to 88 Duke Street is of particular concern as it partly supports the façade. The timber floors, stairs and roof members to the frontage of the Duke Street buildings would all need to be replaced.
- Replacing the timber and designing for current loading would, most likely, lead to increased structural depth. To convert to modern office requirements would increase the loading, and hence structural depth, further. Fire restrictions would have additional implications on any refurbishment.
- The masonry façade to Duke Street would need substantial propping, stripping of much of the finishes to treat dry rot and to tie across cracking
- If a façade retention scheme to Duke Street is proposed, the window locations would mean keeping the floor levels. With the increased structural depth, this would lead to reduced floor to ceiling depths, but without being able to increase floor spans.
- There is very limited information on the condition of the cellars. This is an area of risk
- Several buildings are noted as being on the point of collapse, including 14 Suffolk Street and the rear and side walls of 90 Duke Street.

We therefore conclude that, to convert the site for use as an office development, the buildings on Duke Street would not be able to be salvaged. 14 Suffolk Street, 71 Henry Street and the cellars below the courtyard should also be demolished.

The existing Vinegar Works building on Henry Street has limited openings and no internal structure. This could be retained, though floor levels would not match the existing floors so that windows on the façade would not have the same relationship to floor levels that they were designed for.

Appendix A Schedule of defects

# A1 Schedule

Ref	Building	Item	Defect Description	Recommendations
1	86 -90 Duke Street	Timber roof trusses	Water penetration, vegetation growth and subsequent rot has meant affected the timber roof trusses and purlins	replace timber elements
2	86 -90 Duke Street	Rainwater goods	Damaged rainwater goods have led to water ingress and degradation of mortar	Replace rainwater goods
3	86 -90 Duke Street	Internal timber floors	Timber floors damaged by water ingress - leading to wet rot & dry rot.	Replace floors. Since dry rot has been discovered, all timber should be replaced, walls stripped of plaster and treated with appropriate fungicide. The new floor designs are likely to lead to increased structural depth, especially if there is a change of use from domestic. Temporary propping to facade of 90 Duke Street required to allow access.
4	90 Duke Street	Internal stair case	Timber damaged by water ingress - leading to wet rot & dry rot.	Replace stair case - may need to increase size to allow for design to increased loading to meet current regulations. Risk that the stairs may need lengthening to meet current regulations.

Ref	Building	Item	Defect Description	Recommendations
5	90 Duke Street	Gable and end walls	Severe cracking and lack of tying to internal and end walls	Significant temporary propping required, with tying in or rebuilding of walls. Further investigations required as access poor.
6	86 -90 Duke Street	Asbestos	Asbestos survey required	Presumed asbestos containing materials were noted during the surveys. An appropriate survey and management plan should be actioned.
7	86 -90 Duke Street	Cellars	No information available. No access available	Risk item.
8	65-69 Henry Street	Cellars	No information available. No access available Asbestos survey required.	Risk item.
9	86 Duke Street	Masonry	Mortar loss externally, especially close to failed rainwater pipes	Repointing