



47 PETER STREET, MANCHESTER
STRUCTURAL CONCEPT DESIGN REPORT
RIBA STAGE 2

PSM-REN-00-XX-RP-S-00001

Project No. : 1809-01

Date: DEC 2018

Rev: P04

Renaissance Associates Ltd has prepared this report for the sole use of Peter Street Exclusive Developments Limited and for the intended purposes set out within it. This report may not be relied upon, and no part copied or duplicated, without the express written agreement of both the Client and **renaissance** Associates Ltd.

CONTENTS

EXECUTIVE SUMMARY	1
1.0 INTRODUCTION	2
2.0 EXISTING BUILDING & CURRENT CONDITION	3
2.1 STRUCTURE OF EXISTING BUILDINGS	
2.2 GENERAL STRUCTURAL CONDITION	
2.3 STRUCTURAL REMEDIAL WORKS	
2.4 FURTHER INVESTIGATION WORKS	
3.0 STRUCTURAL PROPOSALS	6
3.1 EXISTING STRUCTURE CHANGE OF USE	
3.1.1 RESISTANCE TO DISPROPORTIONATE COLLAPSE	
3.1.2 FLOOR LOADINGS	
3.1.3 FIRE RESISTANCE	
3.2 ALTERATIONS & INTERVENTIONS	
3.2.1 NEW MEZZANINE FLOOR	
3.2.2 STAIRCASE INFILL AT SECOND AND THIRD FLOOR	
3.2.3 FIRE DAMAGED PRIMARY TIMBER BEAM	
3.2.4 BEAM REMEDIAL AT 2ND & 3RD FLOOR	
3.2.5 PROVISION OF BIN STORE AT GROUND LEVEL OFF BOOTLE STREET	
3.2.6 REMOVAL OF CHIMNEY STACK IN PART FROM SECOND AND THIRD FLOOR	

Rev	Date	Purpose
P00 /P01	19.12.18	RIBA Stage 2 Issue / Section 3.2.4 Amended
P02	28.06.19	Revised Stage 2 Issue
P03	20.12.19	Revised Stage 2 Issue - Section 3.2 amended
P04	15.05.20	General Arrangements updated

Author: Helen Gribbon, Director



Date: 15 May 2020

Reviewer: Kevin Gilsenan, Director



Date: 15 May 2020

EXECUTIVE SUMMARY

Renaissance have been appointed by Peter Street Exclusive Developments Limited to provide civil and structural engineering services to support the proposed refurbishment of the Grade II listed former warehouse building located at 47 Peter Street, in Manchester. This report has been produced to communicate the development of the structural design to RIBA Stage 2+ (Concept Design) and reflects the ongoing co-ordination with the Design Team and information currently know about the existing building.

Existing Building

- the building is in a reasonable structural condition with limit localised remedial works required
- the building has suffered from some localised fire damage at third floor level in 2012, where the timber floor boards and joists as well as the primary timber cross beam have been affected.
- original timber cross beams have been cut back in the location of a masonry cross wall which is believed to have been installed to facilitate a modification to accommodate a new staircase off Southmill Street.
- The existing roof covering is in a poor condition resulting in localised areas of water ingress

Structural Proposals

- The extension of the building into the roof trusses with the introduction of a new mezzanine at this level. This will require the buildings to be assessed for change in loadings and also resistance to disproportionate collapse.
- At this stage provision for horizontal and vertical tying to the building is proposed following an initial detail assessment of the existing.
- additional floors are to be formed with timber joists and the introduction of a localised timber box beam to support the mezzanine floor
- Remediation of the fire damaged primary timber and replacement of the fire damaged boards and joists.
- Reinstatement of the primary timber beams which have been historically cut back
- New lift core and staircase within the existing stairwell: pit and lift overrun details to be developed further once the lift manufacturer has been appointed.

ORIGINALLY CONSTRUCTED 1868

NEW STAIRCASE ADDED 1896 WITH NEW DOORWAY TO THE SOUTHMILL STREET SIDE (WEST)

PETER STREET ENTRANCE MODIFIED IN 1963

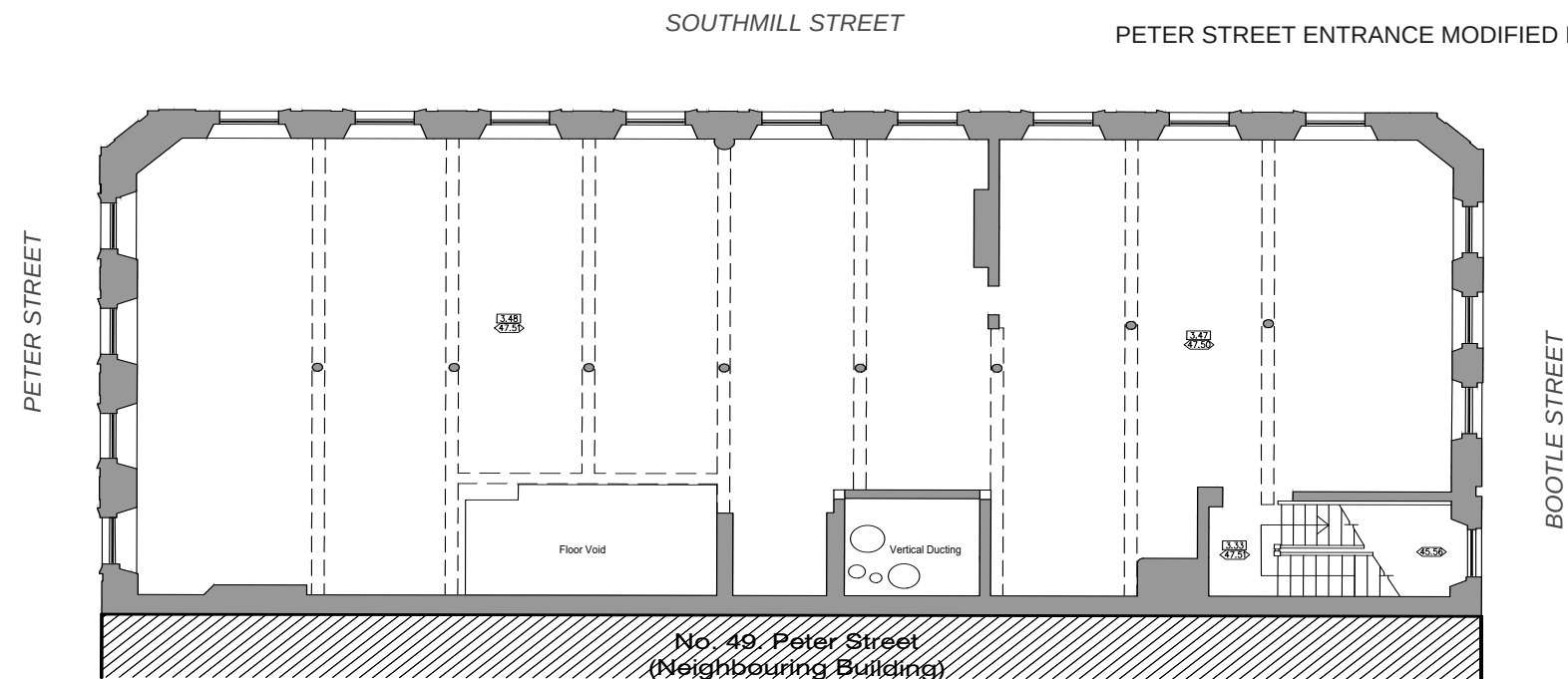


Figure 0.1: Typical Floor Layout

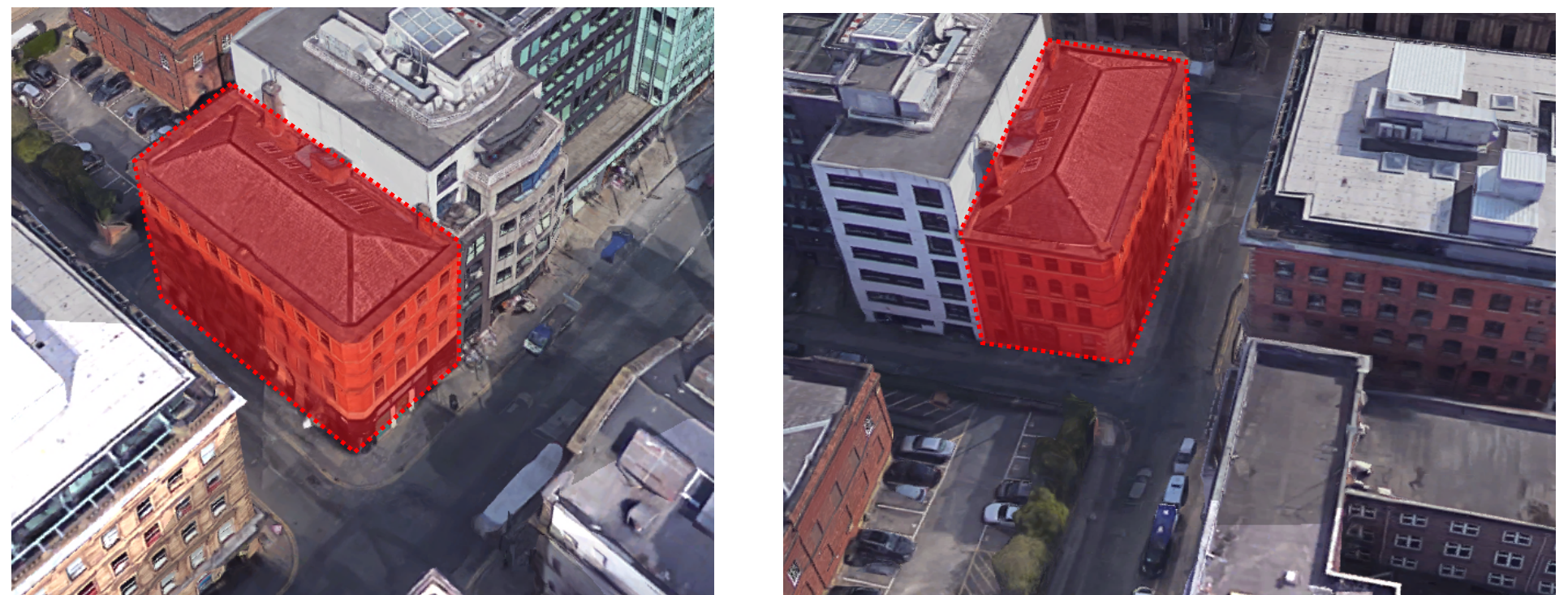


Figure 0.2: Aerial Views of Building

1.0 INTRODUCTION

Renaissance have been appointed by Peter Street Exclusive Developments Limited to provide civil and structural engineering services to support the proposed refurbishment of the Grade II listed building at 47 Peter Street, in Manchester.

This report has been produced to communicate the development of the structural design to RIBA Stage 2 (Concept Design) and reflects the ongoing co-ordination with the Design Team. The information contained within this report is intended to:-

- Provide a summary of the existing building, the general structural condition, and recommendations for repair works.
- Present outline civil and structural engineering solutions resulting from the proposed change of use and associated interventions,
- Allow an initial cost appraisal to be undertaken to verify the commercial viability of the proposals,
- Identify areas of potential investigation works and design development to be progressed through RIBA Stage 3, post-planning.

A brief structural overview of the existing building, its general structural condition and recommendations for structural repair works are presented in Section 2 and Appendix A.

The structural engineering implications of the proposed change of use and proposed alterations and interventions are presented in Section 3 and Appendix B. This includes an assessment of the existing building to comply with the requirements of Building Regulations Part A in relation to resistance to disproportionate collapse and change in floor loadings. It also outline structural remedial works and structural solutions for the proposed alteration works.

Section 4 provides a summary of the proposals and highlights key considerations to be addressed as the design develops to RIBA Stage 3.

The report and findings are based on visual observation and outline scheme assessment suitable for RIBA Stage 2, Concept Design. As more information becomes available on the exact construction and details of the existing buildings and emerging architectural proposals the structural proposal will be assessed and developed.

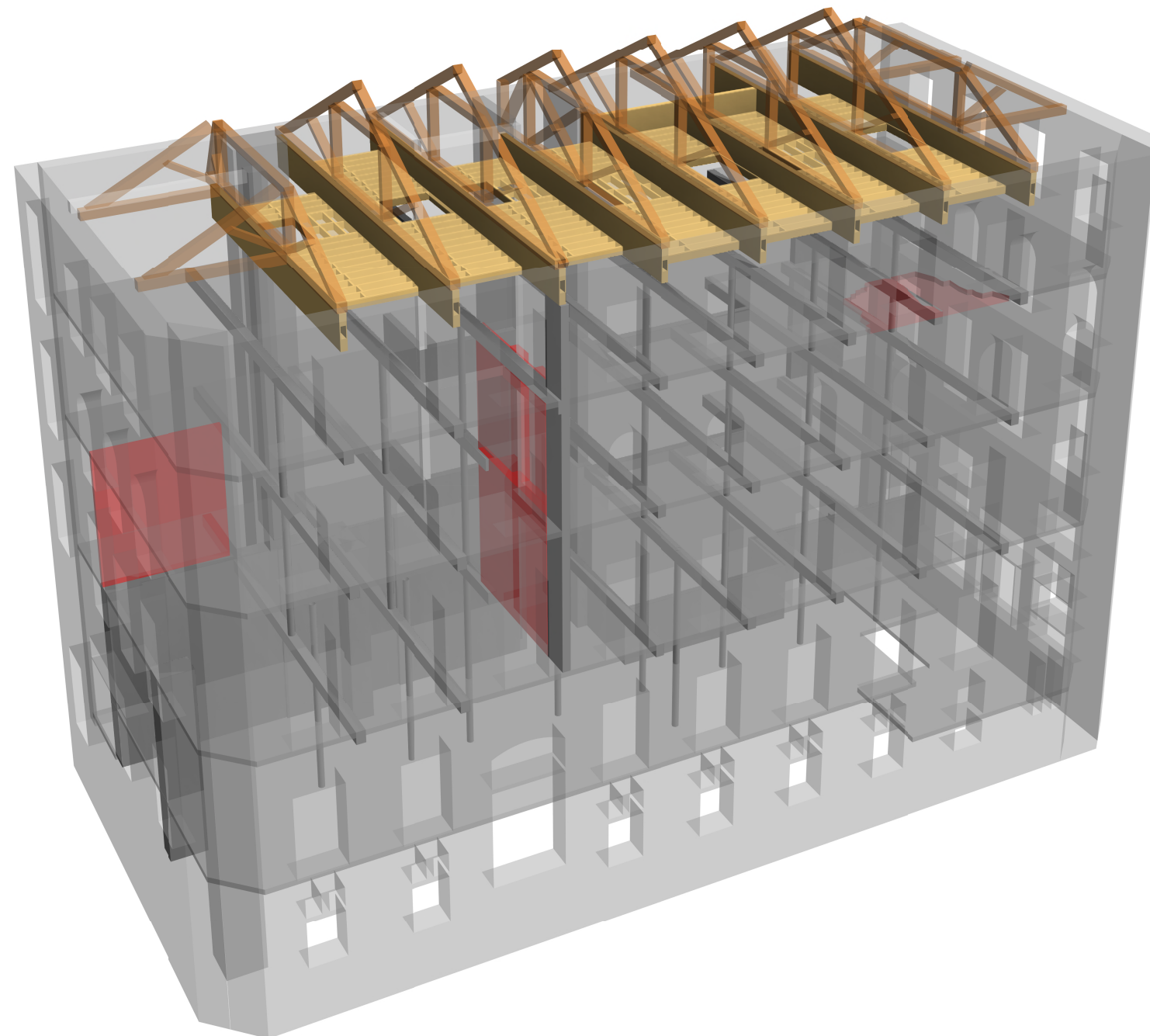


Figure 1.1: Model of Building Modifications

2.0 EXISTING BUILDING & CURRENT CONDITION

This section provides an overview of the existing building to be re-developed, its form of construction, general structural condition, and recommendation for repair and further investigation works.

2.1 STRUCTURE OF EXISTING BUILDINGS

47 Peter Street remains today in a very similar layout to when it was originally constructed in 1868, is bounded by Peter Street to the South, Southmill Street to the West and Bootle Street to the North and is located in the Deansgate / Peter Street conservation area.

Originally constructed in 1868 as a commercial office and warehouse building, there have been various alterations during its life, namely: -

- new staircase added in 1896 with new doorway to the Southmill Street side.
- minor bomb damage in 1941
- modifications to the entrance on Peter Street in 1963

The internal layout generally remains unaltered and in recent times has been used for commercial office.

Existing Building - Built 1868

The building is circa 26.0 x 12.0m on plan and is five storeys high, including the lower ground floor which is formed as semi-basement. It is of load-bearing masonry construction with stone and brickwork façades. The lower ground and ground floor lintels are of stone, with the levels above built as shallow masonry arches.

The floor construction is of timber boards on joists, spanning circa 2.75m between timber support beams. These beams span circa 5.9m from the façade to a central line of cast iron columns and onto the party wall. The roof trusses span between façade and party wall.

The floor beams and trusses are supported on stone padstones in the facade and party walls.

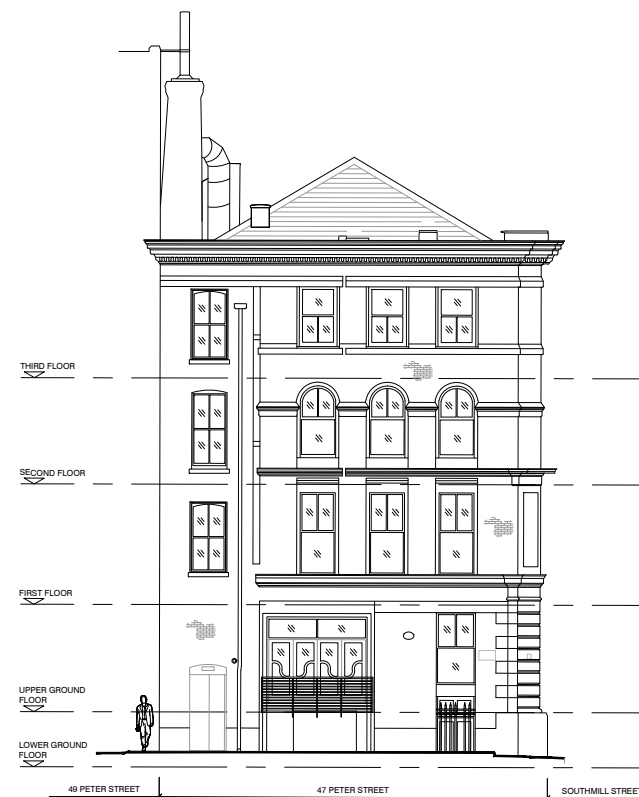


Figure 2.1.1: Bootle Street Elevation

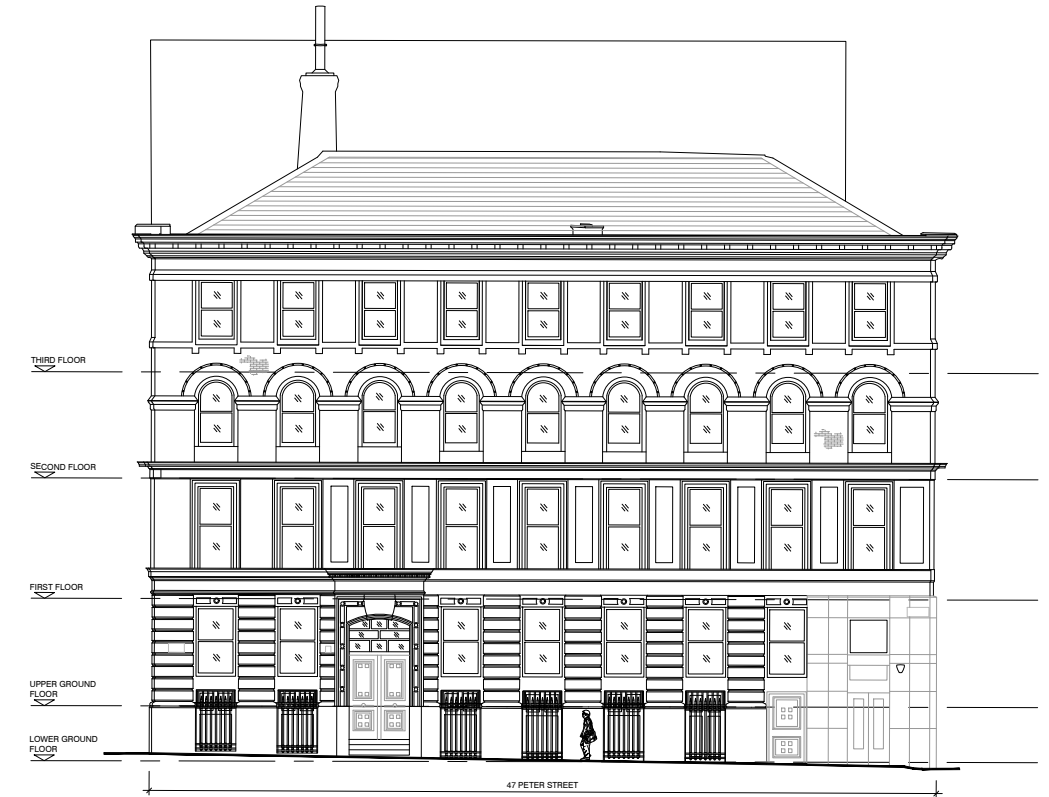


Figure 2.1.2: Southmill Street Elevation

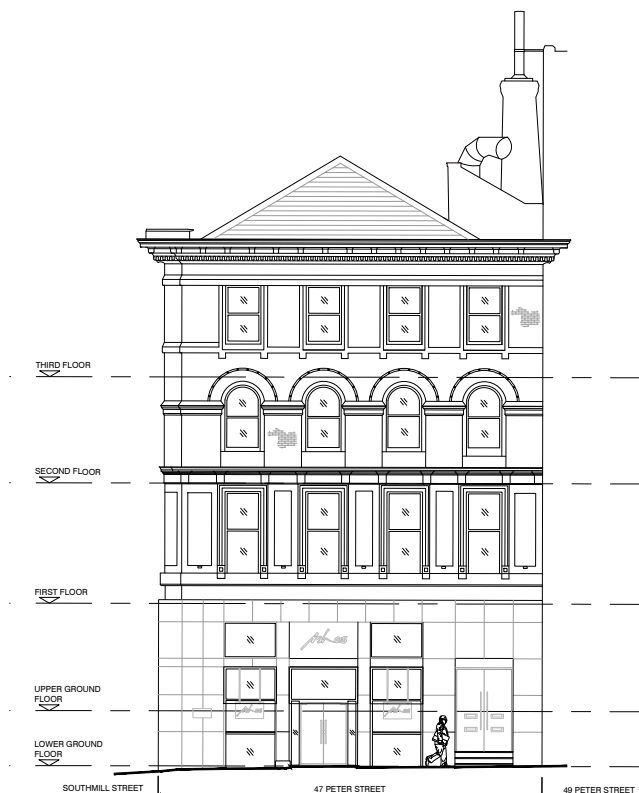


Figure 2.1.3: Peter Street Elevation

2.0 EXISTING BUILDING & CURRENT CONDITION

2.2 GENERAL STRUCTURAL CONDITION

A visual structural survey has been undertaken from accessible floor levels, and without additional finishes removed. The observations should therefore be considered within these constraints and appropriate risk allowances made for potential unknowns.

In brief summary the general condition is as follows:

The building structure is considered to generally be in reasonable conditions.

Roof - The covering has possibly been replaced in the lifespan of the building to date, though insulation is not present. There are visible signs of water leaks within the roof coverings and these should be addressed as a matter of urgency.

Façades - The façades are generally in good condition. There are localised areas where the mortar joints have deteriorated. From street level the use of cement based mortar which would accelerate deterioration of the façade brickwork over time was not evident. All new repointing where required should be lime based.

Internal Structure - The main timber and cast iron structure which is largely visible appears to be in good condition. Timber built into the façade should be investigated further. See below for other items.

Existing Timber Repairs - The main timber floor beams and roof trusses are solidly built into the masonry façades. Whilst the ends appear to be robust, it would be prudent to ensure that this is the case through localised opening up works.

Manipulation of the original 1868 structure - when the new staircase and entrance off Southmill Street was added in 1896, the floor beams to the underside of second and third floor were cut back and removed on the line of new masonry walls.

Fire damaged timber to the underside of third floor - The timber structure at third floor was fire damaged in 2012. Two bays of timber joists and overlying boards were damaged as well as the primary timber cross beam. This area should be investigated further to determine the exact extent of joists and floor boards required to be replaced.



Figure 2.1: Photograph of Roof Trusses



Figure 2.2: Photograph of Fire Damaged Floor at Third Floor

2.0 EXISTING BUILDING CURRENT CONDITION

2.3 STRUCTURAL REMEDIAL WORKS

Based upon the finding of the structural survey there are a number of areas that will require remedial works. The scope of these will need to be developed with the Architect and Conservation officer, and will also be subject to review as further investigation works are undertaken. Reference should also be made to any specialist reports by others such as timber and damp.

At this stage it is recommended that the following structural remedial works are allowed for. These are in addition to any Architects requirements:

General

The following should be allowed for to the building:

Façades, Parapet & Chimneys - Where existing brickwork and mortar joints have perished by more than 20mm in depth an allowance should be made for localised brick replacement and repointing with a suitable lime based mortar, to Heritage Architects details. Where vegetation is removed allow for localised removal of brickwork to ensure roots are removed, with all voids solidly packed with mortar as areas are made good.

Water tightness - Rainwater goods, parapets, flaunching and waterproofing to façade features, etc. to be remediated to Architects and Heritage Architects detail to avoid deterioration of structure.

2.4 FURTHER INVESTIGATION WORKS

The above recommendations are based upon an initial visual survey. In order to confirm the full extent of remedial structural works to the existing building fabric the following further investigation works are recommended. Given the scale of the buildings these may need to be undertaken in stages as more of the building fabric is exposed:

General

The following site wide investigations should be undertaken:

Timber and damp survey - with particular focus on timber beam, and truss ends within the masonry walls

Opening Up Works - To verify key structural items such as: floor beam interfaces; embedment of timbers into façade walls; cast iron column thickness and floor to floor tying details; existing foundations.

Concrete Encased Steelwork frame to lightwell - local removal of concrete encasement to verify condition of steelwork internally. Allow for possible treatment of steelwork and reinstatement of concrete encasement.



Figure 2.3: Photograph of Concrete Encased Steelwork



Figure 2.2: Photograph of Fire Damaged Floor at Third Floor

3.0 STRUCTURAL PROPOSALS

This section provides an overview of the outline structural proposals in response to the proposed refurbishment, alteration and addition of a roof level mezzanine of the existing Grade II listed building at 47 Peter Street.

The proposed redevelopment of the 47 Peter Street comprises various structural works associated with converting the building to hotel use, with the room layout respecting the existing building fabric. Figure 3.1 present a mind map of some of the general and key structural considerations to be addressed.

To present the findings in a logical way the following sections are split into existing building considerations and then proposed interventions.

3.1 EXISTING STRUCTURE CHANGE OF USE

The change from office to hotel use is considered a material change of use and therefore the requirements of Building Regulations Part A need to be considered in relation to; Resistance to Disproportionate Collapse, Floor Loadings, and fire resistance. Additional Building Regulations considerations also apply that are non-structural.

3.1.1 RESISTANCE TO DISPROPORTIONATE COLLAPSE

The building is affected by the change of use and addition of a new mezzanine floor.

Under Regulation 5 changing from office to hotel use is a 'material change of use'. Regulation 6 only requires parts A1, A2 and A3 of the regulations to be applied if the building is to be used as a hotel, boarding house, institution, or public building. If the building was to remain unaltered in terms of its use, there would therefore be no requirement to satisfy section A3 for resistance to disproportionate collapse. This approach is based on the level of risk to occupiers being unchanged.

However the proposals for the building include the addition of a mezzanine floor, which will change the risk and also alter the loading within the building. It will therefore be necessary to justify the building for the proposed alterations.

It is generally not feasible to demonstrate that existing masonry buildings comply with the prescriptive requirements of the part A. However, a risk based assessment is permitted within BS EN 1991-1-7, and guidance within BRE Digest DG366 'Structural Appraisal of Existing Buildings, including for a Material Change of Use', Part 1, June 2012. This approach allows accidental scenarios to be considered in detail and generally results in demonstrating compliance of existing buildings with limited interventions. The requirements will be assess for the building as a whole.

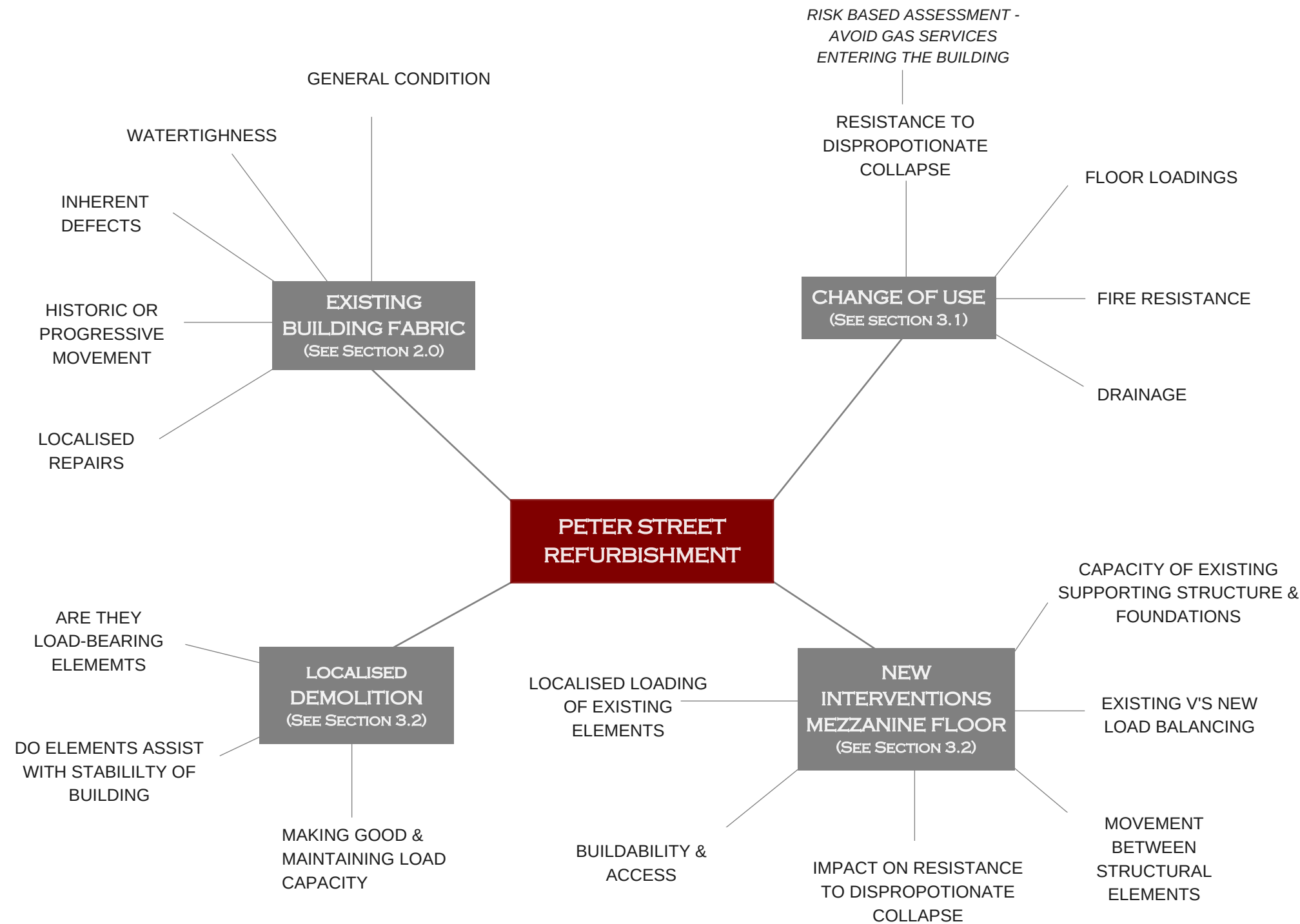


Figure 3.1: Refurbishment & Alteration Mind Map of Key Considerations

3.0 STRUCTURAL PROPOSALS

3.1.1 RESISTANCE TO DISPROPORTIONATE COLLAPSE (CONT)

To demonstrate compliance for resistance to disproportionate collapse the structure will be assessed for horizontal and tying requirements. Where this can not be achieved notional removal of elements one at a time will be considered. Where notional removal of an element results in an excessive area of floor collapse the element will be design as a key element.

Whilst there is a gas supply to the building this is isolated within the the basement which is a contained area. it has therefore been assumed that the key element loading will be reduced from 34kN/m² to circa 17kN/m², in accordance with BRE digest DC366. In addition, a detailed assessment of accidental scenarios, including blast loading allowing for venting, will be undertaken to demonstrate lower loadings and hence demonstrate structural resilience.

The existing construction tying details are to be confirmed by opening up works. However, at this stage it is recommended that the following is allowed for:

Horizontal Tying

- Allow for 2No 1.0m long 30mm x 2.5mm galvanised steel straps to each joists.
 - Allow for 2No 1.5m long 30mm x 5mm galvanised straps either side of primary beams
 - Allow 1No 100 x 100 x 8 RSA, continuous to top side and at pier locations to underside.
 - Allow for 2No 30mm x 5mm galvanised straps either side of column heads.
- All provide enhanced tying resistance against blast loading.

Vertical Tying

- Allow for 2No 30mm x 5mm galvanised straps either side of column heads.
 - Allow for 1No 180 x 90 x 26 PFC tp piers on Southmill Street and gable ends
- Provide 260 x 90 x 35 PFC to Party Wall at same centres.

Subject to the findings of localised opening up works and detailed assessment it may be feasible to reduce the above allowances. However, it should be considered a risk allowance until it can be quantified.

The new mezzanine floor infill between existing roof trusses will be designed to achieve current horizontal tying requirements.

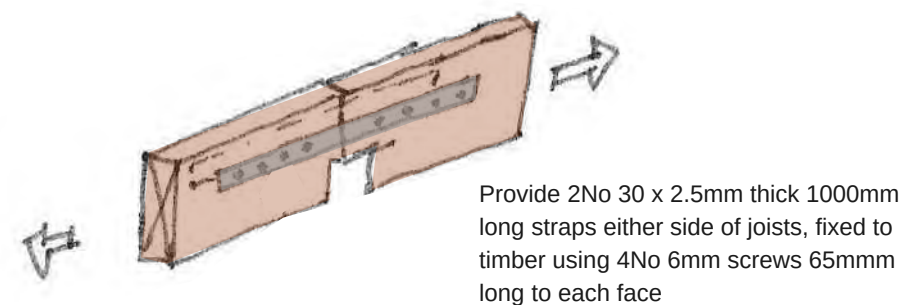


Figure 3.1.1: Horizontal Tying of Timber Joists.

NOTE: If joists are continuous across supports, straps not required

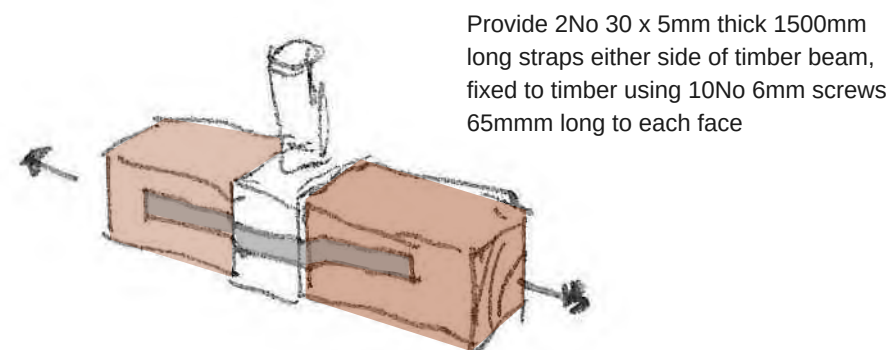


Figure 3.1.2: Horizontal Tying of Primary Timber Beams

NOTE: If beams are continuous across column supports, straps not required

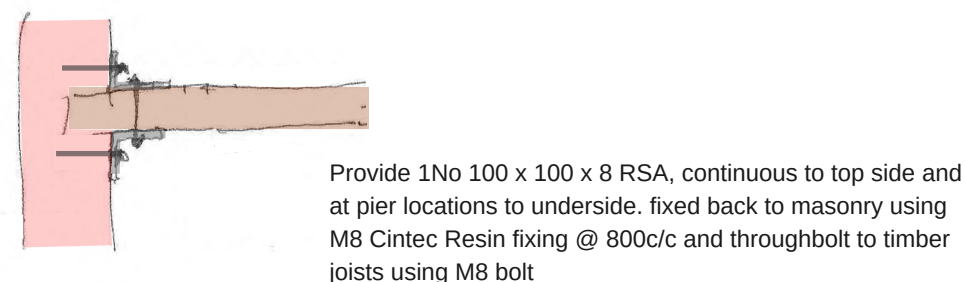


Figure 3.1.3: Horizontal Tying of Gable Walls

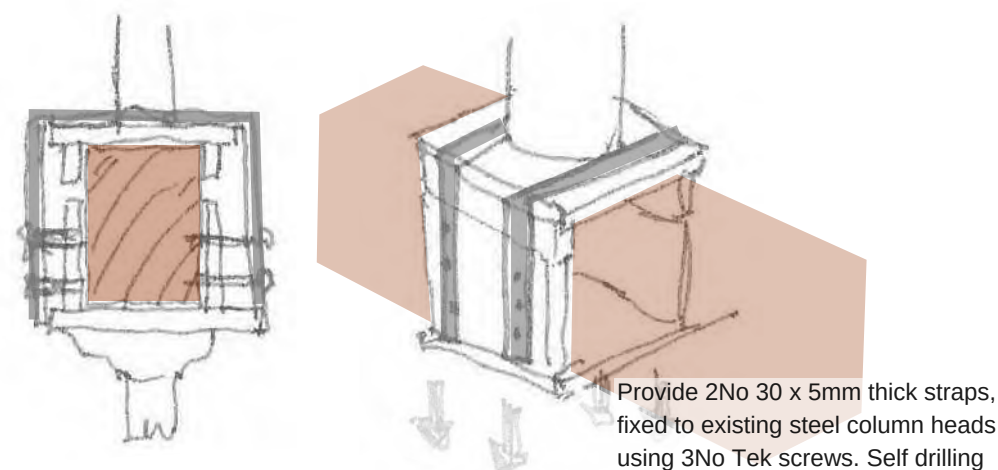


Figure 3.1.4: Vertical Tying of Existing Cast Iron Columns

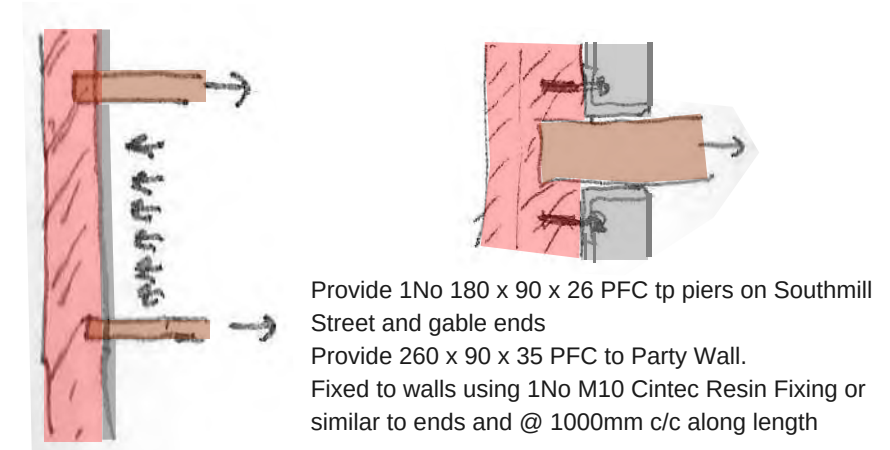


Figure 3.1.5: Vertical Tying of Masonry Piers

3.1.2 FLOOR LOADINGS

The building was built prior to the codification of floor loadings and would of therefore be based on contemporary guidance such as the Dorman Long and Company handbook which gave office loading live load allowance as 80lbs/sq ft (3.83kN/m²) and warehouse and light industrial as 120-320lbs/sq ft (5.74-15.32kN/m²) , increasing to 220-420 (10.53-20.11kN/m²) for heavy machinery.

The proposed alteration will typically result in a live load of 1.5kN/m² and additional dead loads from finishes and partitions of circa 1.8kN/m². The existing structure is therefore considered to be acceptable and it is not envisaged that strengthening works will be required.

In addition to localised design checks to verify the above a load take down will also be undertaken. This will be to assess the increase in façade loads from the additional floor within the roof space to determine if it is within the 10% increase normally permitted on existing foundations.

3.1.3 FIRE RESISTANCE

The additional floor will require the fire resistance of the existing structure to be assessed. The threshold for 60 minutes fire rating is <18m height from to the upper most floor from ground, increasing to 90 minutes for < 30m height.

The height from ground to the upper most floor will be circa 15.6m. The existing frame therefore needs to achieve 60 minute fire rating.

At this stage assume that ceiling are to be under-drawn with a fire-line board to achieve the required rating. Where cast iron columns and are exposed an allowance should be made for applying a thin-film intumescent fire protection. It is also assumed that all timber elements such as the main timber floor beams and the the roof trusses to the upper floors will be 'boxed in'. Where this is not the case then they will need to be assessed for charring to achieve the required fire rating.

3.0 STRUCTURAL PROPOSALS

3.2 ALTERATIONS & INTERVENTIONS

3.2.1 NEW MEZZANINE FLOOR

Within the roof space a new mezzanine floor will be introduced forming a duplex with the upper floor rooms for the hotel.

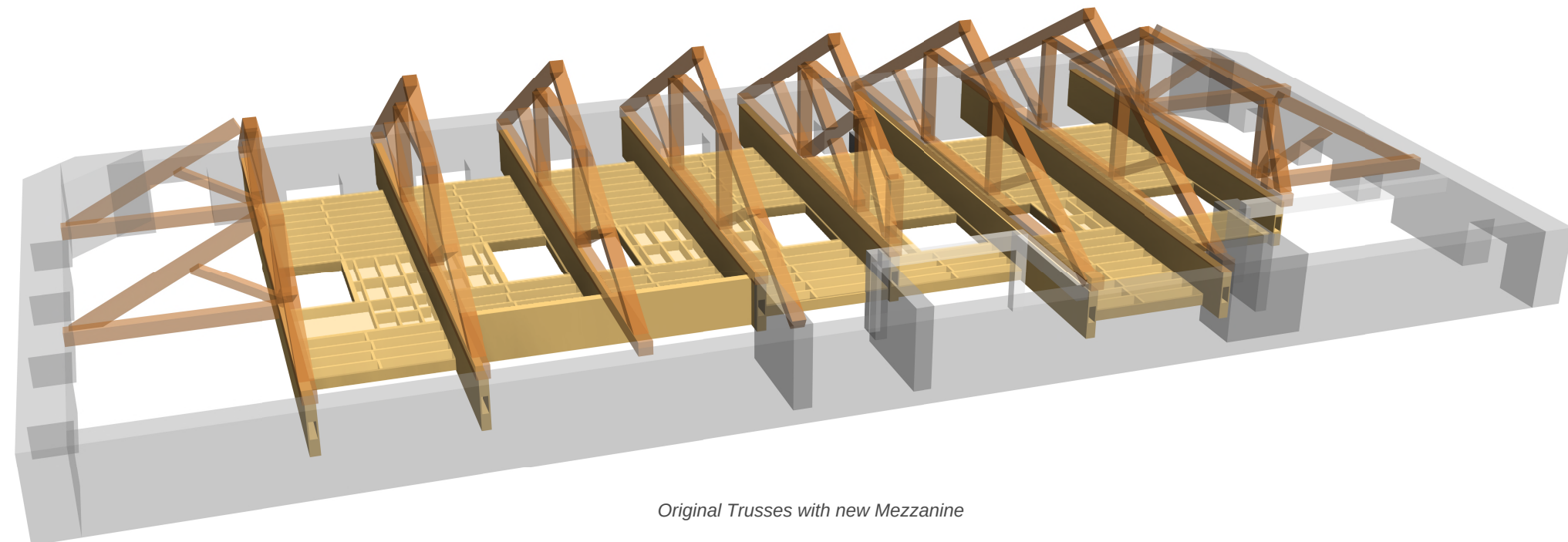
The additional floor will be supported off timber box beams located below the bottom chord of the existing timber trusses. the box beams will be formed using timber top and bottom chords and plywood sides as per the sketch opposite. The box beam will require a bespoke steel hanger support, providing a 300mm bearing, which will be fixed back to the masonry walls using 3/4 No Cintec Resin fixings.

Steel beam options have been considered, however require extensive temporary works to prop the timber trusses during installation.

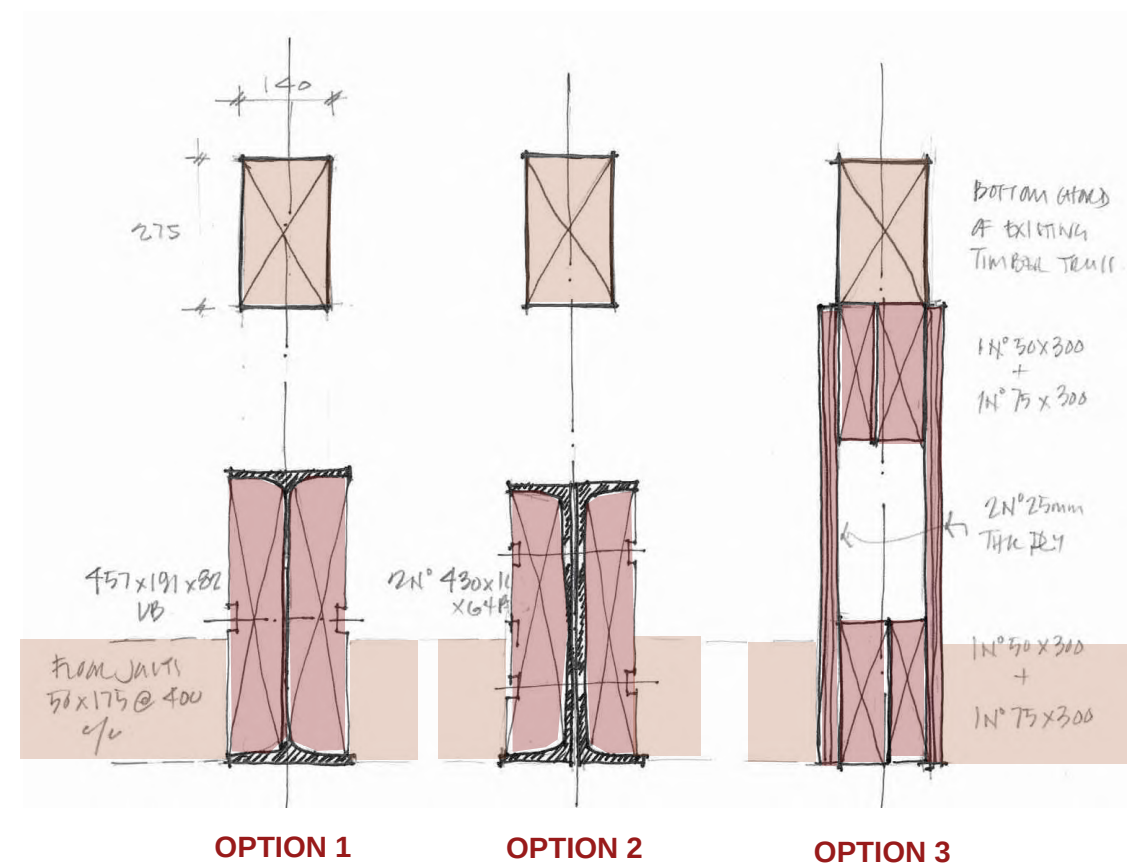
3.2.2 STAIRCASE INFILL AT SECOND AND THIRD FLOOR

The proposals include for the removal of the staircase to the rear and infilling with a new timber floor. The staircase void is trimmed on one side with an existing beam - this beam is to be exposed during the next stage of the design development to confirm capacity. The existing side wall to the stairwell is to also be removed and a steel beam will be required to support the existing floor.

A new PFC wind post has been introduced where the wall / chimney breast abuts the wall and the buttressing effects have been removed.



Original Trusses with new Mezzanine



OPTION 1 - 457 X 191 x 82 UB S355

Lightest steel option;
Requires splicing to install- will increase overall depth locally by 50-80mm
Requires independent padstone and temporary propping of existing timber truss

OPTION 2 - 2 No. 430 x 100 x 64 PFCs S355 back to back
overall heavier steel option-however lighter individual elements
Requires splicing - will increase overall depth locally by 50-80mm
Requires independent padstone and temporary propping of existing timber truss

PREFERRED OPTION

OPTION 3 - 910 x 175 C24 timber box beam
Comprising 50 x 300 plus 75 x 300 top and bottom flanges with 2 no. 910 x 25 ply webs as shown
Box beam fabricated on site will also require steel support shoe fixed to masonry using 3-4 no. Cintec heavy duty fixings TBC

Figure 3.2.1: New Mezzanine

3.0 STRUCTURAL PROPOSALS

3.2 NEW STRUCTURE (Contd)

3.2.3 FIRE DAMAGED PRIMARY TIMBER BEAM

During the 2012 fire, one of the primary timber beams supporting the third floor was heavily fire damaged and requires remediation as part of the proposed works. The extent of beam which has been affected for half of the width of the building.

The proposal is to provide 2No 8mm x 300mm deep steel plates either side of the existing beam which have the equivalent capacity of the original timber section. In preparation for the plates being inserted, the sections of charred timber are removed and the beam section locally rebuilt in timber.

3.2.4 BEAM REMEDIAL AT 2ND & 3RD FLOOR

When the staircase was added in the late 1800's, a masonry wall was introduced and floor beams cut back at second and third floor level.

The proposals for the hotel require these walls to be removed and therefore the beam sections are to be reinstated. The proposals include the introduction of a flitched timber formed using 4No 63 x 200 C24 timbers with an 8mm x 300mm deep steel plate located centrally. The new beam will bear onto the original stone padstone located in the perimeter wall and be spliced with the original beam section using 2No 8mm x 275mm deep plates.

3.2.5 PROVISION OF BIN STORE AT GROUND LEVEL OFF BOOTLE STREET

New floor inserted to accommodate bin storage off-street. Steelwork beam supports to 150mm deep profiled metal deck with insitu concrete topping and mesh reinforcement. Tanking to floor to architects details and specification.

3.2.6 REMOVAL OF CHIMNEY STACK IN PART FROM SECOND AND THIRD FLOOR

Insitu RC capping slab provided at second floor and column support threaded through to underside of mezzanine to steelwork grillage with plate over which supports retained stack at roof level.



MASONRY TO BE DEMOLISHED AND
NEW TIMBER FLITCH BEAM TO BE
SPLICED ONTO EXISTING BEAM

Figure 3.2.2: Proposed Remedial Detail at 2nd and 3rd Floor



DAMAGED TIMBER TO BE REMOVED
AND PACKED

Figure 3.2.3: Proposed Remedial Detail to Fire Damaged Beam

