

Northern Terrace Phase 1
810-812 High Road, Change of use and rear extension

Job No. 15208

Structural Strategy Statement, Stage 2

Dec. 2015 / Aug. 2016

Contents

1. Introduction.....	2
2. Desk Study	3
2.1. Existing Site	3
2.2. Geology / Site Investigation	3
2.3. Hydrology	4
2.4. Contamination.....	4
2.5. UXO – Assessment.....	4
2.6. Archaeological Assessment	4
2.7. Bomb Blast Map	4
3. Structural Design Standards.....	5
3.1. Codes / Standards	5
3.2. Deflection limits.....	5
4. Existing Structure	6
4.1. Existing Live Loads	6
4.2. Roof.....	6
4.3. Floors.....	6
4.4. Walls.....	7
4.5. Foundations	7
5. Proposed Structure	8
5.1. Proposed Loads.....	8
5.2. Roof.....	8
5.3. Floors.....	8
5.4. Walls.....	8
5.5. Rear Extension	9
6. Monitoring	9

Appendices

Appendix A	Existing Structural Drawings
Appendix B	Proposed Structural Drawings
Appendix C	Structural calculations
Appendix D	Historical and Geological Maps

1. Introduction

Within this application it is intended to submit planning for:

- A proposed change of use for a residential building to café and gallery loadings and for the potential future change of use to office loading. The suitability of the existing structure has been investigated and required strengthening works are described.
- A rear single storey extension is also proposed and an assumed structural scheme for this will be included in the report.

No investigations have been completed to determine whether or not any deleterious or hazardous material is present on the site and we are therefore unable to report that the site is free from such risk in this respect. For the purpose of this report we have assumed that further investigations would not disclose the presence of any such material.

Our report is prepared for the sole use of our Client and we are therefore unable to accept any responsibility for disclosure or use by a third party.

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2. Desk Study

2.1. Existing Site

The site is located within the Borough of Haringey (51°36'18.7"N 0°04'03.1"W). The proposed construction works are part of the Northern Terrace Masterplan thus within the Northumberland development project.

The site address is 810-812 High Road, Tottenham. The building is a Grade 2* listed 5 storey town house, built in C1720.

The building is of masonry construction with traditional timber floors and a timber roof. The existing structure is described in more detail in section 3.

Major restoration work took place in 2008. The Structural engineers were Hockley & Dawson Consulting Engineers, and the Architects Butler Hegarty. This involved strengthening of much of the timber floor and roof plates and the masonry walls. This included strapping of the walls and floors and fixing steel plates to timber beams.

A report was undertaken by Hockley & Dawson Consulting Engineers in 2013. Lyons O'Neill has reviewed the report, which concludes that Hockley & Dawson Consulting Engineers have designed the structure for an imposed load of 1.5kN/m².

2.2. Geology / Site Investigation

The British Geological Survey (BGS) map of the area shows the site to be underlain by London Clay, with Superficial deposits have been recorded comprising a Kempton Park gravel formation of sand and gravel, as shown in Appendix D.

Several site investigations for the Northumberland development area project have been carried out. The following reports have been made available to us:

Geotechnics Limited, Volume 1 &2,	November	2009	Ref.#PC094002
Geotechnics Limited, Phase 2,	July	2010	Ref.#PC104225
Soil Technics	November	2005	Ref.#STB0573H-L01/Rev0
Soil Mechanics,	January	1993	Ref.#7508/62
Soil Mechanics,	December	1993	Ref. # 7518/63

Summerising- In general 1-2m of Made Ground is overlying terrace deposits (Kempton Park Gravel) to around 4m to 6m below ground level. The base of the underlying London Clay is at around 22m to 24m below ground level.

The most beneficial investigation down to the load bearing stratum and closest to the proposed works is shown by borehole profile BH09-01 (see report Ref. #PC094002).



Figure 1: Aerial view of the site

2.3. Hydrology

The site investigations recorded groundwater within the layers of the terrace deposits at a depth of approx. 3.0m below the ground level.

Since no basement structures are planned within the proposed structural schemes, groundwater issues will not be relevant for the design of the new permanent structures.

The Environment Agency Flood Map has been reviewed and the site does not lie within any Flood Zones nor is it at risk of fluvial or tidal flooding.



Figure 2 Flood Map extract

2.4. Contamination

A site specific Contamination desk study has been carried out by Southern Testing in Jul 16 Report Reference DS 2625. The report concludes there are no historical on site activities which would be the source of contaminants however containments may have migrated from nearby sites. Further intrusive investigation will form part of the detailed site investigation post planning to establish whether this is indeed the case.

2.5. UXO – Assessment

See separate report: BAE Systems Environmental – Risk Assessment for German Air-dropped UXO

Report Reference: A1075-00-R1-3, April 2015

2.6. Archaeological Assessment

On the site of the Northumberland development area several investigations with regards to archaeological remains have been carried out. The following reports have been made available to us:

All issued by: L~P Archaeology , 91 Brick Lane , E1 6QL London

Desk based assessment, April 2009 Ref.#LP0627L-DBA-v1.2
Archaeological evaluation report, May 2009 Ref.#LP0627L-AER-v1.1 for Lillywhite H.
Archaeological evaluation report, May 2010 Ref.#LP0627L-AER-v2.6 for stadium site

The desktop assessment states that the north west boundary is contained within an Archaeological Priority Area (APA) It houses a stretch of Medieval and Post Medieval listed buildings along the High Road, and an excavation of a Medieval farm house between 1998-1999.

On-site investigation trench 7 (see LP0627L-AER-v1.1) is the aerielly closest to the proposed new and change of structures within this planning application.

Both evaluation reports claim that it is unlikely that further archaeological works will be required on the site in advance of the redevelopment.

2.7. Bomb Blast Map

The Bomb Sight map within Appendix D, shown is for the period between October 7 1940 and June 6 1941, indicates that the nearest high explosive bomb recorded was incident on Pretoria Road, approximately 150m to west of the site.

No bombs are indicated to have fallen any closer than this to the site, though this map is not exhaustive and there may well be other records that indicate that the site itself was hit.

3. Structural Design Standards

3.1. Codes / Standards

The final structural design of the building will be completed to the current suite of Eurocode Standards; with the UK National Annexes key documents are summarized below in Table 1. Up to this stage predesign calculations have been carried out with British Standards.

The design life for the new built structure is 50 years for the determination of wind and snow loads.

Document	Description	National annex Reference
BS EN 1990:2002+A1:2005	Eurocode 0: Basis of structural design	NA to BS EN 1990-1-1 2005
BS EN 1991 - Part 1: 2002	Eurocode 1: Actions on structures	NA to BS EN 1991-1-1 2002
Part 3: 2003	Imposed Loads on Structures	NA to BS EN 1991-1-3 2003
Part 4: 2003	Snow Loads on Structures	NA to BS EN 1991-1-4 2005
Part 6: 2006	Wind Loads on Structures	NA to BS EN 1991-1-6:2005
Part 7: 2006	Actions on Structures During Execution	NA to BS EN 1991-1-7:2006
BS EN 1992 - Part 1: 2004	Eurocode 2: Concrete Design	NA to BS EN 1992-1-1:2004
Part 3: 2006	General Rules for Buildings	NA to BS EN 1992-3:2006
BS EN 1991 - 1 - Part 1: 2005	Eurocode 3: Steel Design	NA to BS EN 1993-1-1:2005
Part 8: 2005	General Rules for Buildings	NA to BS EN 1993-1-8:2005
BS EN 1997 Part 1: 2004	Eurocode 7: Geotechnical Design	NA to BS EN 1997-1:2004
BS 8500-1/2 :2002	Concrete Specification	
BS 8002	Earth Retaining Structures	
BS 8102	Protection of Structures Against Ground and Water	

Table 1: Summary of key Documents

3.2. Deflection limits

The deflection limits in accordance the current suite of Eurocode Standards are set out below.

Vertical

Span/360 under characteristic imposed load

Span/250 under characteristic dead and imposed load

Span/500 Deflection under brittle finishes (i.e. masonry walls)

Horizontal

Where H_i denotes the floor height and u_i denotes the inter-storey drift, the lateral deflection between floors has been limited to between $u_i \leq H_i/500$ to $H_i/300$.

The overall building deflection has been limited to Height/500

4. Existing Structure

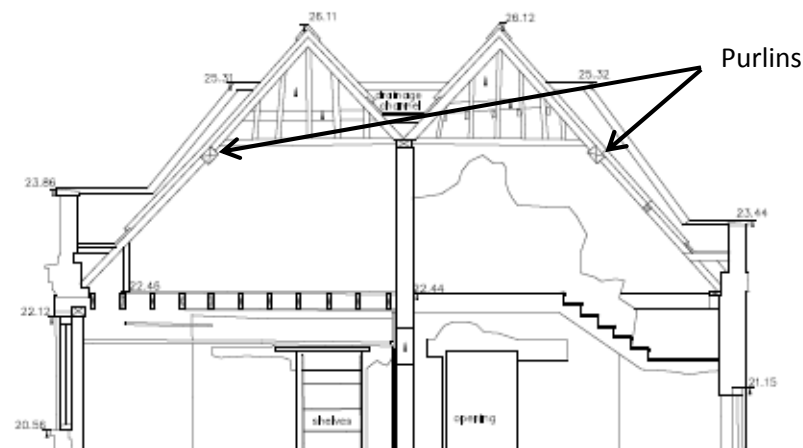
The existing structure is described below. Plans showing details of the existing structure and assumptions of the strengthening works are included in Appendix A.

4.1. Existing Live Loads

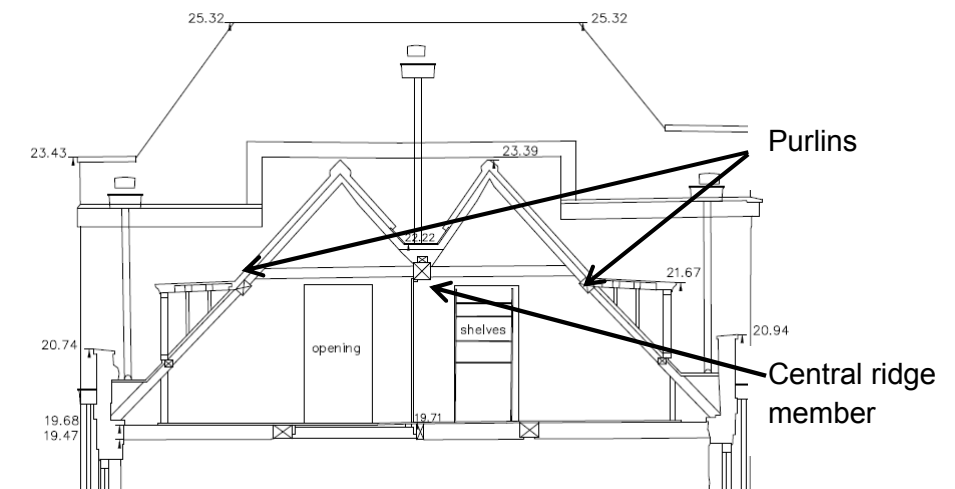
Based on a report by Hockley Dawson in 2013 following the strengthening works that took place in 2008 we know that the structure has been designed for a residential live load of 1.5kN/m²

4.2. Roof

The roof over the main house is of timber construction, the roof profile has 2 pitches, with a butterfly profile in the middle. The roof rafters are supported on the front and rear walls, the internal spine wall and purlins that span side to side. There are two trusses on each side of the building as can be seen in drawing 15208/SK105 in Appendix A The trusses support the purlins at mid span and close to the party wall shared with 808 High Road.



The roof over the coach house is of a similar profile to the roof of the main house. The rafters are supported on 2 purlins and a central ridge member. These members span between the party wall shared with 814 High road and an internal masonry spine wall.



The roofs appear to be of sound condition and there were no signs of any decayed members within the roof. A number of repairs appear to have been undertaken, this work is assumed to have been undertaken in 2009, when repairs to the property are known to have taken place. One of the trusses within the main house and the central ridge member over the coach house appears to have been strengthened with steel plates, as can be seen in image 1,2 and 4/SK105 in Appendix A.

4.3. Floors

The ground-third floors are of timber construction, with timber floor joists, a lath and plaster ceiling and timber floor boards. In the main part of the house there are primary timber beams that typically span front to back, from the rear wall to the spine wall and from the spine wall to the front wall.

In the part of the house that is the former couch house the primary beams span between the party wall and an internal masonry spine wall. There are timber joists that span front to back between the front and rear walls and the primary timber beams.

Some of the primary timber members appear to have been strengthened with steel plates. This can be seen in images 6/SK101 in Appendix A. The exact details for this are not known as the joists could not be viewed from above. Further investigations would be required to determine this.

In some locations there are signs of decayed timber, particularly on the ground floor as can be seen in image 4/SK01 in Appendix A. Some of the timber members are likely to require replacing or splicing to remediate this. Further inspections of all timber are likely to be required by a specialist.

Some of the joists appear to have been spliced at their ends. It is assumed that this work was undertaken with the works that took place in 2009. The splice appears to be a scarf joint. This is likely to have been due to decayed timber.

Straps appear to have been installed to strap the floor joists to the walls as can be seen in image 5/SK103 in Appendix A.

Data for the strength properties for the timber is not currently known. The original timber is assumed, at this stage, to be oak. The strength properties for a D40 grade have been used. The newer timber appears to be softwood and has been assumed to be grade C16. Both of these assumptions are conservative. Tests on timber samples could be undertaken to determine the strength properties.

4.4. Walls

The external walls, party walls and spine wall are of masonry construction. Partition walls are typically of light weight timber construction.

It was not possible to determine the details of the bearing for the primary timber members; the beam end in most cases was covered and could not be inspected. It was also not possible to determine the bearing length of the timber at this stage. Further investigations to determine this are likely to be required.

At this stage the length of the bearing is assumed to be 100mm. Mortar appeared soft and is assumed to be lime mortar. Therefore concentrated bearing stress capacity should be assumed to be 0.62N/mm^2 .

The member GB1 appears to have a new bearing plate as can be seen in image 6/SK102.

Straps have been installed to strap the front and rear walls to the party/boundary walls as can be seen in image 2/SK103.

4.5. Foundations

No information on the foundations is known at this stage. It is assumed that the foundations will be shallow brick corbeled strip foundations and bear onto clay.

5. Proposed Structure

The proposed structure and the proposed design loads are described below; members have been checked for the live loads for the proposed change of use. Recommended remedial and strengthening works are also described below.

5.1. Proposed Loads

It is proposed for the building to have a change of use from residential to café and Gallery use, with the potential for a future change of use to office use in the future.

The required design live loadings for cafés is 2kN/m^2 , and for offices it is 2.5kN/m^2 . Galleries are usually required to be designed for 4kN/m^2 , however the gallery requirements in the majority of locations are to hang art from the wall; therefore there will be no additional live loading to the floors. The second floor floor zone in the coach house is proposed to have a gallery space to house sculptures. This zone will be designed for a live load of 2.5kN/m^2 . Any sculptures in this zone will be limited to this loading.

Therefore all floors will be designed for a live loading of 2.5kN/m^2

5.2. Roof

The existing roof, as described in 3.2, appears to be of sound condition. There will be no change in loading onto the roof therefore no checks have been made and it is assumed that no remedial or repair work to the roof will be required.

5.3. Floors

The existing floor joists and beams have been checked for proposed dead loads and an office live load of 2.5kN/m^2 . Initially the members were checked to British standards for the permissible stresses. All members were within the permissible stress limits for bending and shear. The highest utilisation factor was 0.843 for the bending stress (FB3) and 0.661 for the shear stress (GB3). Therefore this suggests that all members are sound in terms of their bending and shear stress capacities.

All of the joists that were checked met the British standard requirements for deflection limits. The Ground floor primary beams that were checked also met the British standard for deflections.

The primary beams on the first, second and third floors did not meet the British standard for

deflection limits. The worst case members were then checked based on first principles to calculate the existing and proposed deflections. The value for the Young's Modulus was taken as $E = 7500\text{ N/mm}^2$ for the original timber members, assumed to be a hardwood. As can be seen in the calculations section 3 in Appendix C the worst case increase in deflection is SB1 with an increase of 8.5mm (page 3.4). Strengthening of the timber members is therefore likely to be required. It is proposed that these members are strengthened with the use of a steel plate fixed to the underside of the members with screws. These screws will need to transfer the horizontal shear between the timber and the plate to ensure they act compositely, therefore the screws will be required to be at regular centres, i.e. little and often. A typical calculation for this is shown in Appendix C Section 4 and a detail for this is shown in appendix B drawing SK201.

The members that appear to have been strengthened with steel plates GB1, and TB1 cannot be checked as their make-up is not known. Further investigation is recommended to investigate the strengthening works that have taken place so that these members can be analysed further,

It is recommended that further testing is undertaken to determine the strength properties of the timber, so that more accurate checks can be undertaken on the members, and so that the full extent of strengthening works required can be determined.

The member TB1 bears onto a timber member over a window, the timber member does not appear to be continuous over the opening (Image 6/SK104) and therefore the bearing is not satisfactory. It is recommended that a new PFC Lintel is installed over this opening to support this member as shown in drawing SK108 in Appendix B.

Straps between joist and wall should be checked and additional fixings should be used closer to the wall/floor junction to ensure that the strap won't need to deform before it can transfer lateral loads. The image 5/SK103 for example shows that the current fixings are not close to the wall/floor junction and are therefore inadequate.

5.4. Walls

At this stage the length of the bearing is assumed to be 100mm and the proposed concentrated bearing stress has been checked for the primary beams, to determine if the stress is less than 0.63N/mm^2 . This check is included in section 5 of Appendix C

Based on the assumptions four of the primary members don't meet the bearing stress limit of 0.63N/mm^2 . Further checks will be required to determine the bearing length of the members, and also a visual inspection to investigate whether the timber appears to have failed at the bearing i.e. crushed. Following this and the testing of the timber beams, the primary beam bearings can be checked further. It is possible that strengthening of the timber

bearing may be required.

Straps between front/rear and the party walls should be checked to ensure that they are fixings into each wall with fixings that are close the corner to insure that the strap is able to restrain the walls adequately. If the last fixings are too far from the corners the strap could deform and allow lateral movement to occur.

It is proposed by the Architect that approximately 300mm of the pier within the courthouse shown in image 2/SK102 in Appendix B is removed to allow a wider opening for the new stairs. This has been checked and it is considered possible that the party wall is spanning horizontally between the piers and that the piers are effectively buttressing the walls. The pier is also supporting the fireplace and a timber floor beam. It is proposed that a new steel frame is installed, formed in PFC sections, this will ensure that there is still enough capacity to buttress the party wall. It will also mean that support to the fireplace and timber floor beam is maintained. The location and details for this are shown on the proposed ground floor plan in Appendix B.

5.5. Rear Extension

A single storey rear extension is proposed. The extension will abutt the boundary wall to No 814. It is proposed that any foundations spanning immediately adjacent to the boundary are avoided so as not to surcharge the existing boundary wall. Therefore three localised mass strip footings are proposed perpendicular to the boundary wall. The strip closest to the house will be constructed adjacent to the existing rear wall footing, this will be say 500mm from the footing to ensure that the new footing does not surcharge the existing footing. It is recommended that the existing footing profile is investigated with trial pits to finalise the details of the new footing.

It is proposed that blockwork dwarf walls are built off the new strip foundations. A beam and block floor will span between the three strip footings. This will cantilever over the footing that is built close to the rear wall. As can be seen in Section A, drawing SK109.

Two portalised steel 'goal post' frame are proposed to span the short direction in approximately the middle of the extension and within the rear elevation of the extension. The frame will be supported on the central and rear strip footings. The steel frames will support the roof joists, and will also provide stability to the extension.

The roof is proposed to be constructed in timber joists spanning between the new extension rear wall and the new steel frame and from the new steel frame onto a timber wall plate resin fixed into the existing rear masonry wall. 18mm ply will be screw fixed to the roof joists so that the roof will work as a diaphragm to transfer lateral wind loads back to the steel frames.

Proposed plans and sections can be seen on drawings SK106, SK107 and SK109 in Appendix B.

6. Monitoring

If party wall actions are required for the proposed construction works it is recommended to install a monitoring system. It should cover the following:

All items of temporary works and surrounding existing structures to be monitored in a manner and frequency commensurate with the construction activity taking place. As a minimum the monitoring should include a daily full visual survey of all temporary works and surrounding structures and a measured survey using fixed survey points to be agreed with the Party Wall Surveyors.

The limits of any movement must be set against the colours green, amber and red.

Green: Settlement recorded within predicted movements.

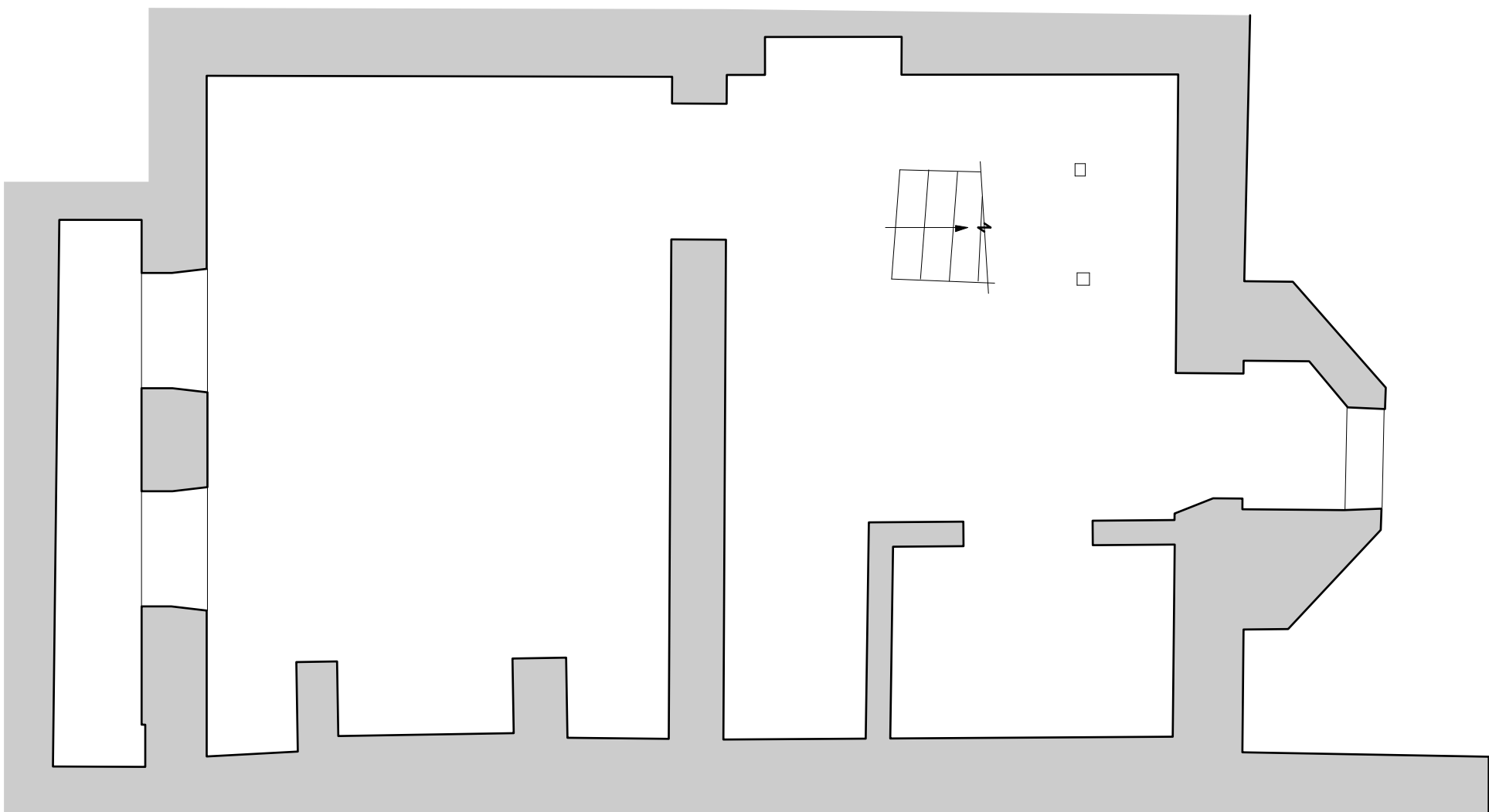
Amber: Settlement recorded is approaching the predicted movements.

Red: Settlement recorded is above the predicted movements.

Such as sequence, locations, performance criteria and numerical limits will have to be specified further with the involved parties and their representatives.

Appendix A

Existing Structure Drawings



Existing - Basement Level (1:50)

NOTES

1. This drawing is to be read in conjunction with all relevant architect's and engineers drawings and specifications

2. This drawing is only to be scaled from for the purposes of estimating and approximate sizing only. If exact dimensions are relied upon, written dimensions supersede any scaled dimension. Overall setting out is to Architect's details and this drawing therefore should be read in conjunction with their information.

Preliminary

STATUS

REV

COMMENTS

PROJECT

810/812 Tottenham High Road

SUBJECT

Existing - Basement Level

SCALE @A1

1:50

BY

DON

DATE

Dec 15

CHECKED

CF

DRAWING No.

15208/SK100

REV

P1

Lyons O'Neill

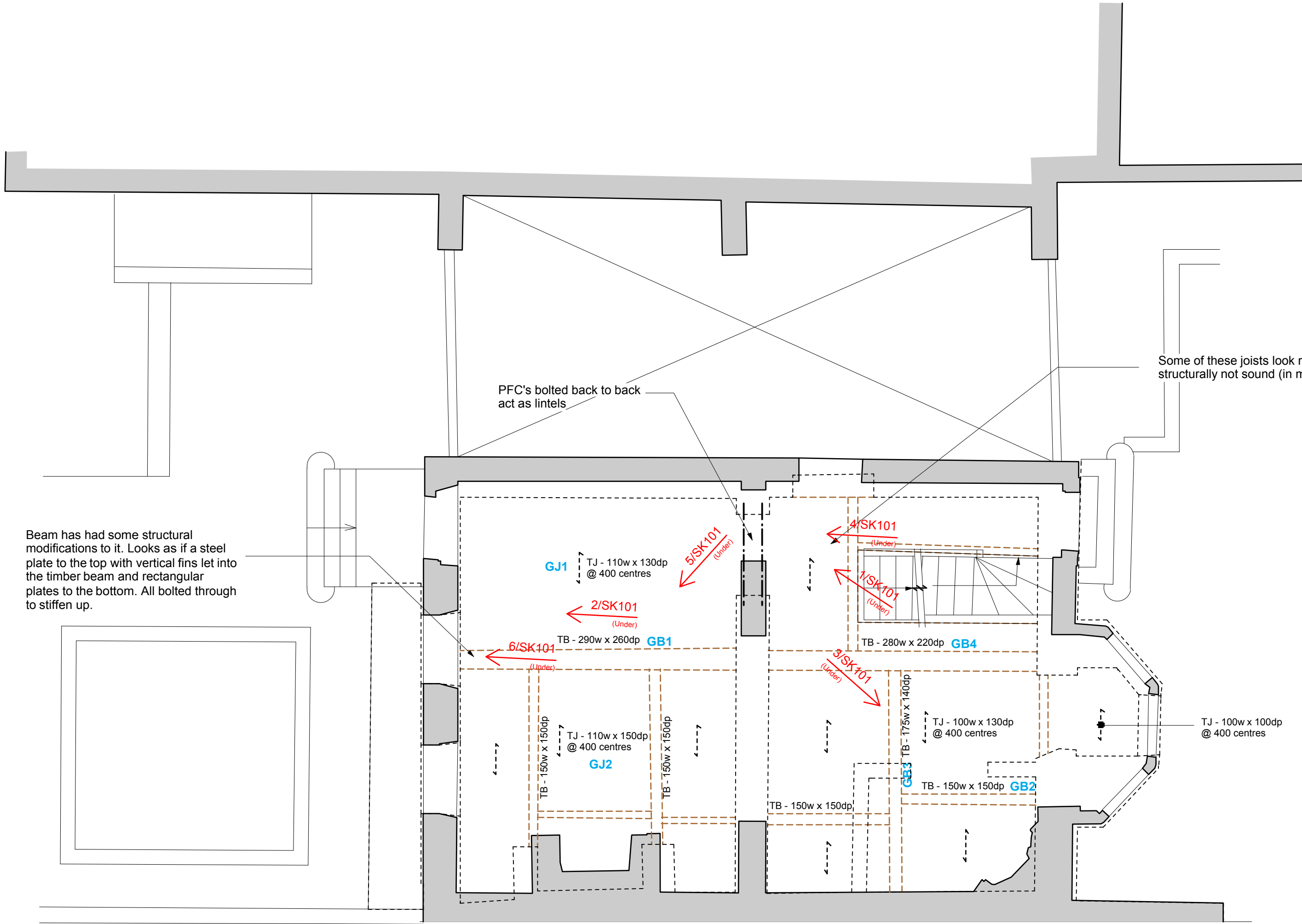
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45 Great Guildford Street
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DATE

CHK



Existing - Ground Floor Level (1:50)



Image 1/SK101



Image 2/SK101



Image 3/SK101



Image 4/SK101



Image 5/SK101



Image 6/SK101

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45 Great Guildford Street
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+44 (20) 7223 7222
info@lyonsoneill.co.uk
lyonsoneill.co.uk

SCALE @A1

1:50

BY

DON

DATE

Dec 15

CHECKED

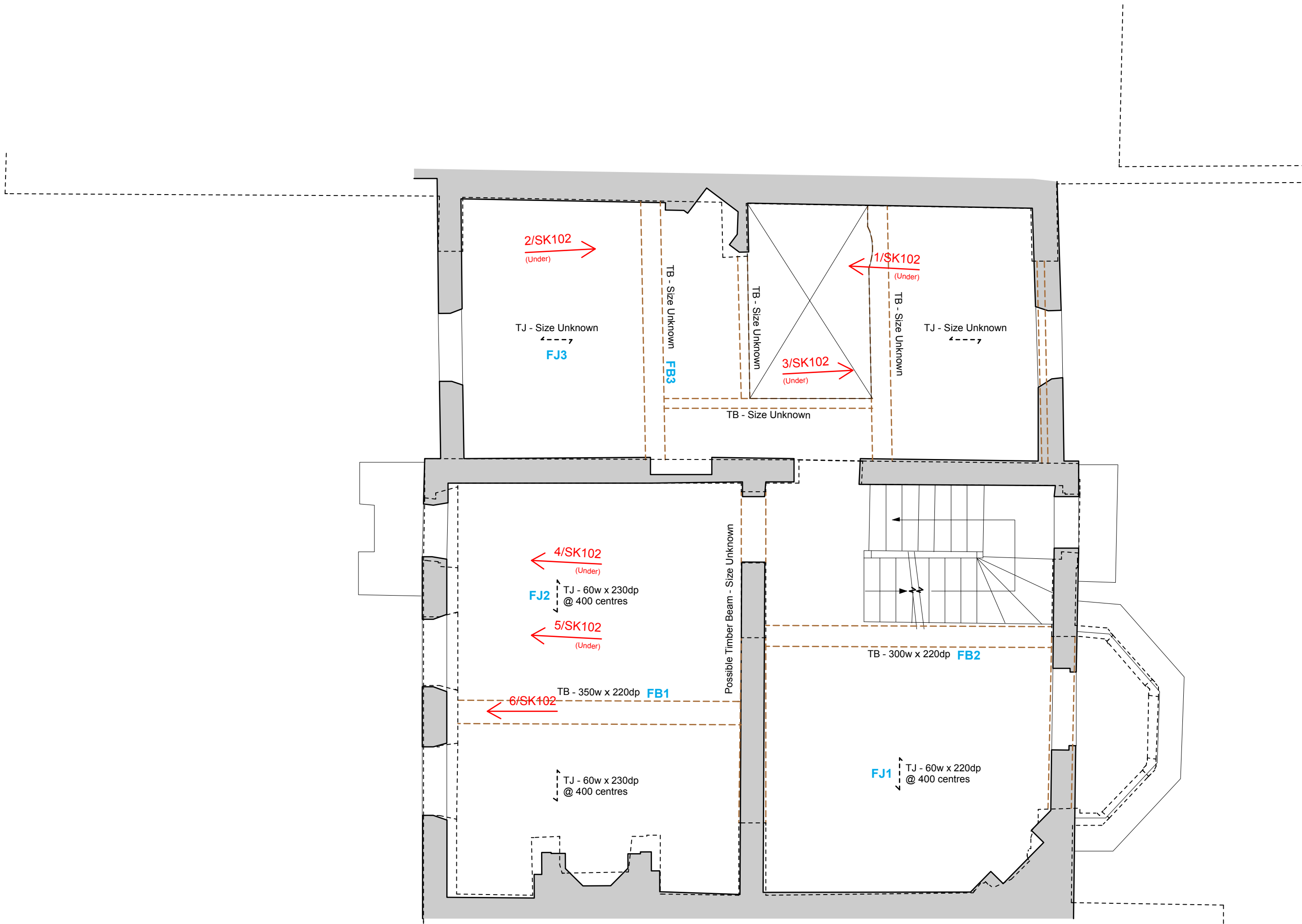
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DRAWING No.

15208/SK101

REV

P1



Existing - First Floor Level (1:50)



Image 1/SK102



Image 2/SK102



Image 3/SK102



Image 4/SK102



Image 5/SK102



Image 6/SK102

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SCALE @A1

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15208/SK102

REV

P1