No.67 to 70 Great Russell Street

Structural Engineering Report on Stairs

November 2024

Structural
Assembly

Info@structuralassembly.co.uk

Contents

1.0 - Introduction

This structural engineering report has been prepared for our client, Brentpark Properties Ltd, whom own the freehold. It provides a structural engineering commentary on the arrangement and condition of the original timber staircases within No.67 to No.70 Great Russell Street, Bloomsbury, London. We were asked to complete this review of the stairs following the failure of the plaster ceiling below the first-floor landing in No.70.

The report is based on observations made during our site visit on 3 October 2024, where we had access to the communal stairwell in Nos. 67 to 70 from ground to third-floor levels. In No. 70, borescope investigations were conducted via drilled holes in the soffit and curved wall between the ground and first-floor levels to better understand the structural arrangement of the stair.

No.68 Great Russell St, Front Step

2.0 - Existing Structure

No. 67 to No. 70 Great Russell St were built in 1777-1778 and are the earliest surviving works of the architect John Nash. The terrace is listed Grade II and located within the London Borough of Camden's Bloomsbury Conservation Area. The properties have four storeys above ground with a lower ground floor beneath the footprint of the building. Originally, each property along the terrace would have been a single residential dwelling. However, the buildings have since been divided into residential flats at the first, second, and third floor levels. The ground and lower ground floor levels are let as commercial units at. Our review is limited to the historic staircases within the residential areas of the buildings.

The basis structure of the building comprises solid load-bearing brickwork walls to the elevations and party walls. The internal walls are expected to be brickwork at the lower ground floor level and timber studwork at the levels above. The floors are suspended timber and are likely to comprise joists that span between the external elevations and the central spine walls. The roofs are also expected to be suspended timber. Figure 01 shows a summary of the structural arrangement of the building at the first-floor level.

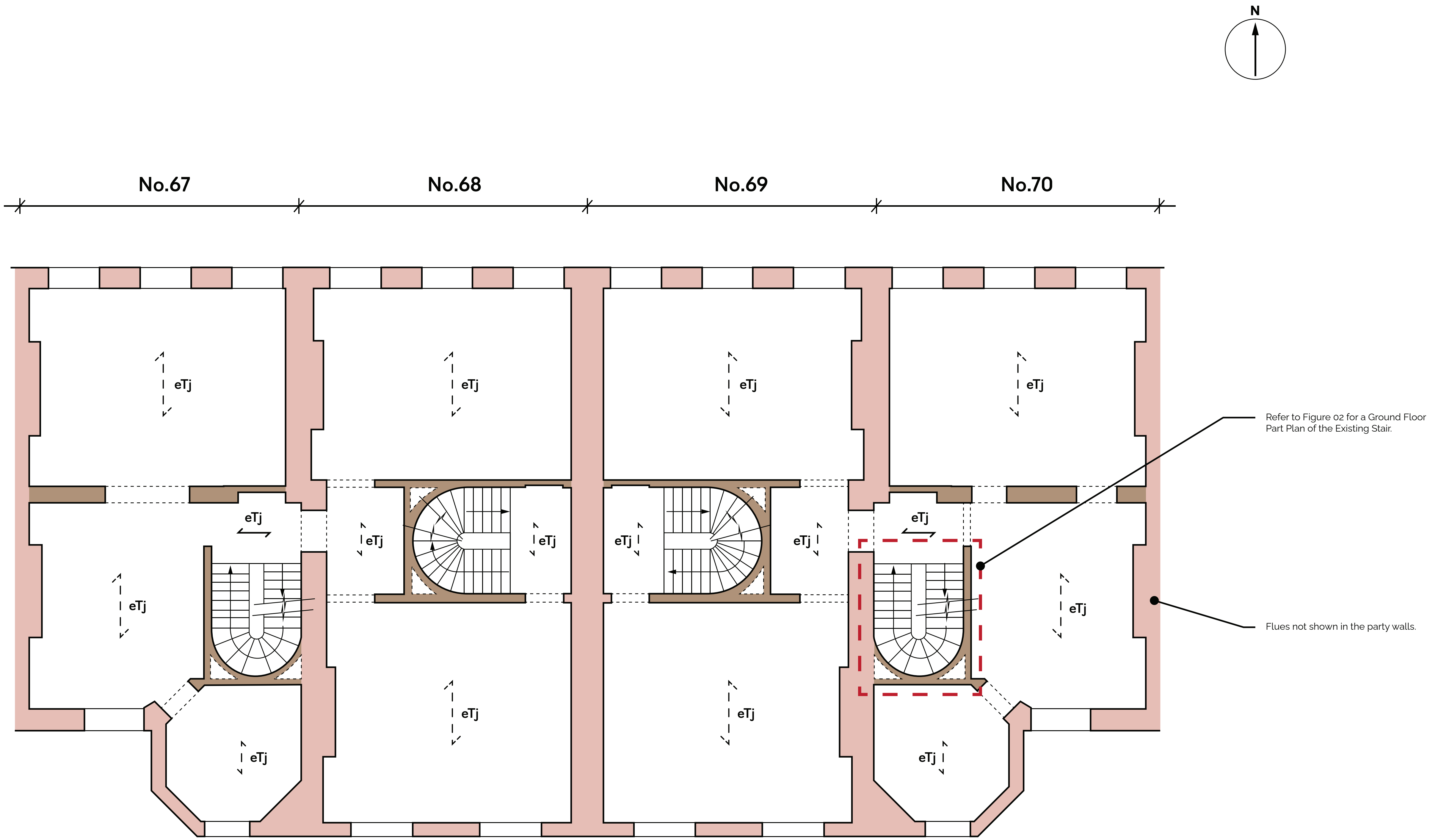
Geological maps indicate that the ground conditions in this area consist of a 5 to 6m thick layer of Kempton Park Gravel overlying London Clay bedrock. We anticipate that the foundations are shallow brick corbels bearing onto the gravel.

The existing staircases between the ground and third floor level are timber. A summary of the structural arrangement is included in the next section of the report.

No.67 to 70 Great Russell St, North Elevation

Structural Key

- Existing Solid Load Bearing Masonry
- Existing Timber Studwork Walls
- eTj — Confirmed Span of Existing Timber Joists
- eTj — Assumed Span of Existing Timber Joists



First Floor Plan of No.67 to 70 Great Russell St

Figure 01 - Summary of the Existing Structure

3.0 - Summary of Stairs

Our understanding of the arrangement of the existing staircases to No.67 to 70 is based on the results of the borescope investigations undertaken during our site visit and our knowledge of other similar historic stairs. Figure 02 provides a summary of the existing stair arrangement in No. 70 at the ground floor level.

Each staircase is arranged around a vertical wellhole extending from the ground to the third floor. Between each floor, the staircase consists of an outward and return flight of straight treads, connected by a curved section with winders.

The straight sections consist of timber treads and risers spanning between three timber strings: the outer, rough, and wall strings. These strings are supported at their base and propped at their top, functioning similarly to a ladder. Figure 03 a cross section of the straight section of the stair.

In the curved section, treads and risers are supported on timber bearers projecting from a curved timber stud wall. These bearers connect to the curved portion of the outer string, known as the "wreathing piece," and gain additional support from the step below. The first and last bearers in the curved section are known as "pitching pieces."

The pitching pieces, like the other bearers, project from the walls surrounding the staircase and gain partial support through their connection to the wreathing piece. The pitching piece below the first winder prop the strings that form the lower outward flight of the staircase, while the pitching piece below the last winder support the strings for the upper return flight.

Connections between the timber elements are secured with cut nails.

The handrail to the stair is continuous timber and is supported on timber spindles.

The original ceiling finish is timber lathes with lime plaster. At ground floor level in No. 70, the soffit of the return stair and the finishes to the curved wall below the stair were found to be non-original and comprised plasterboard.

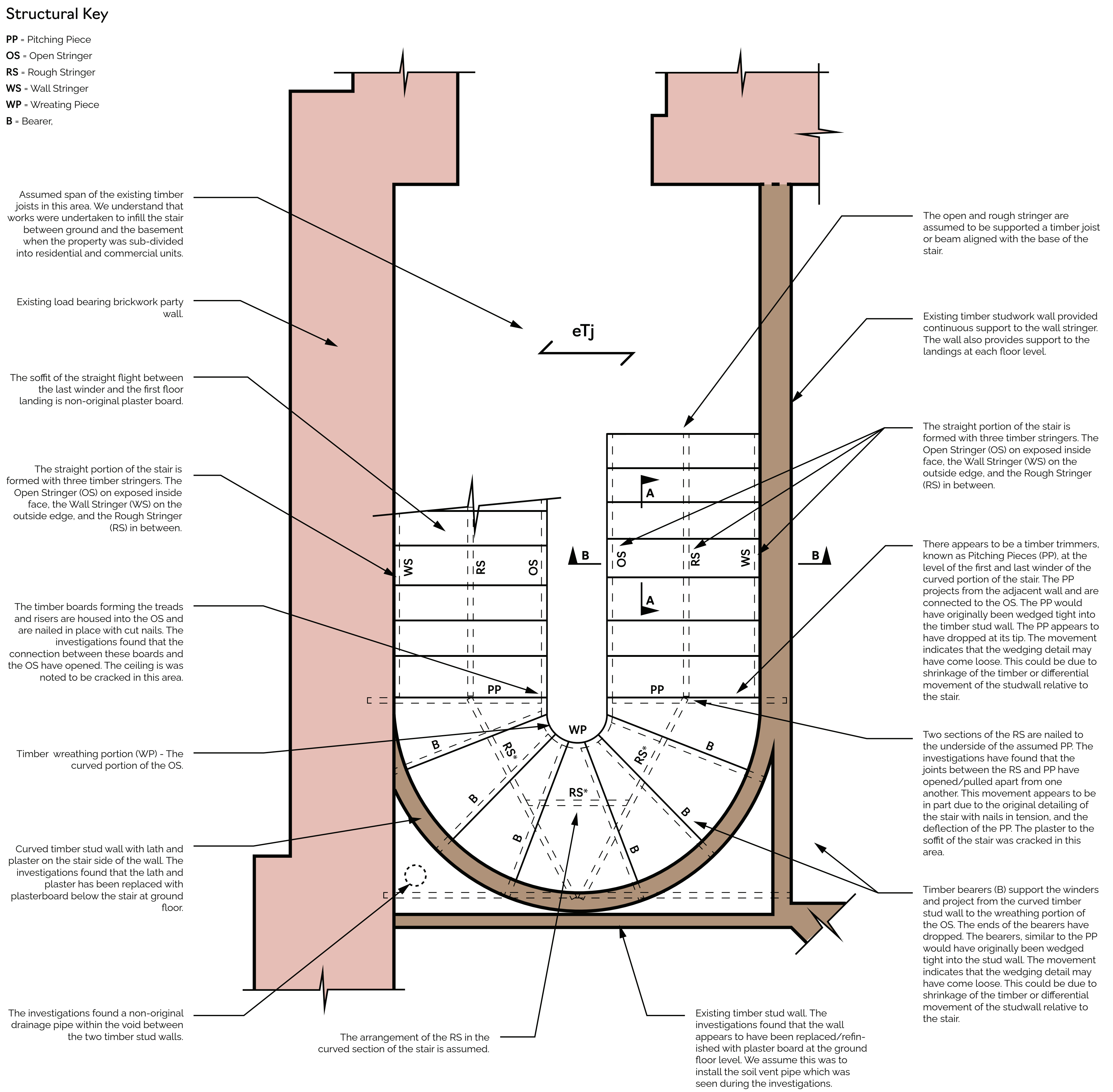
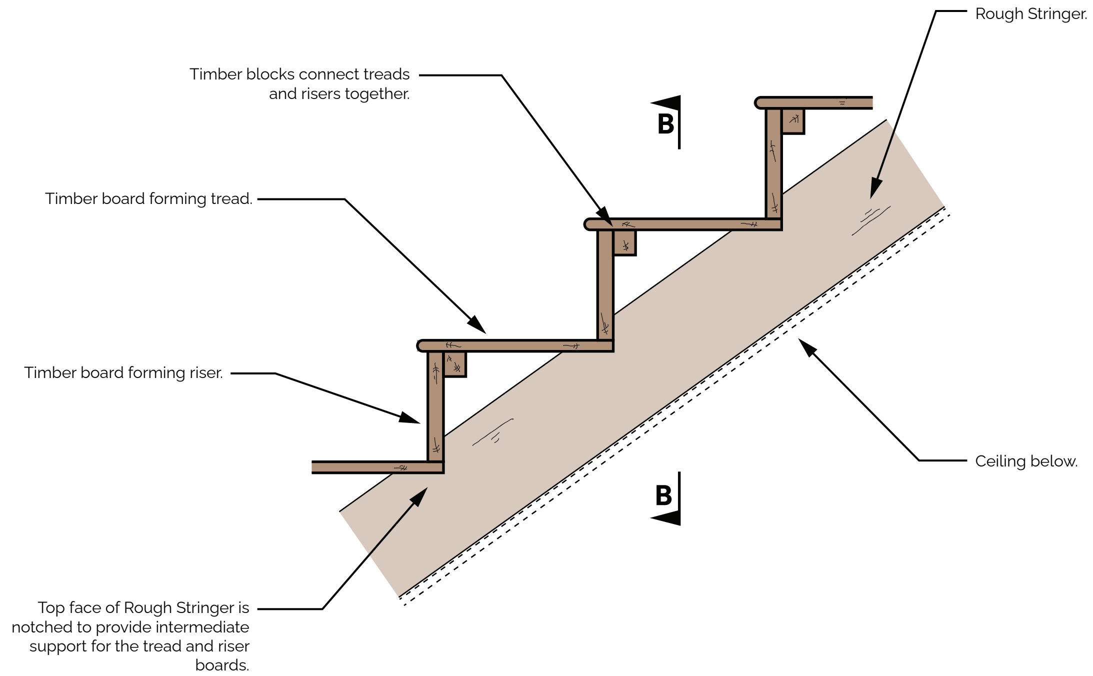
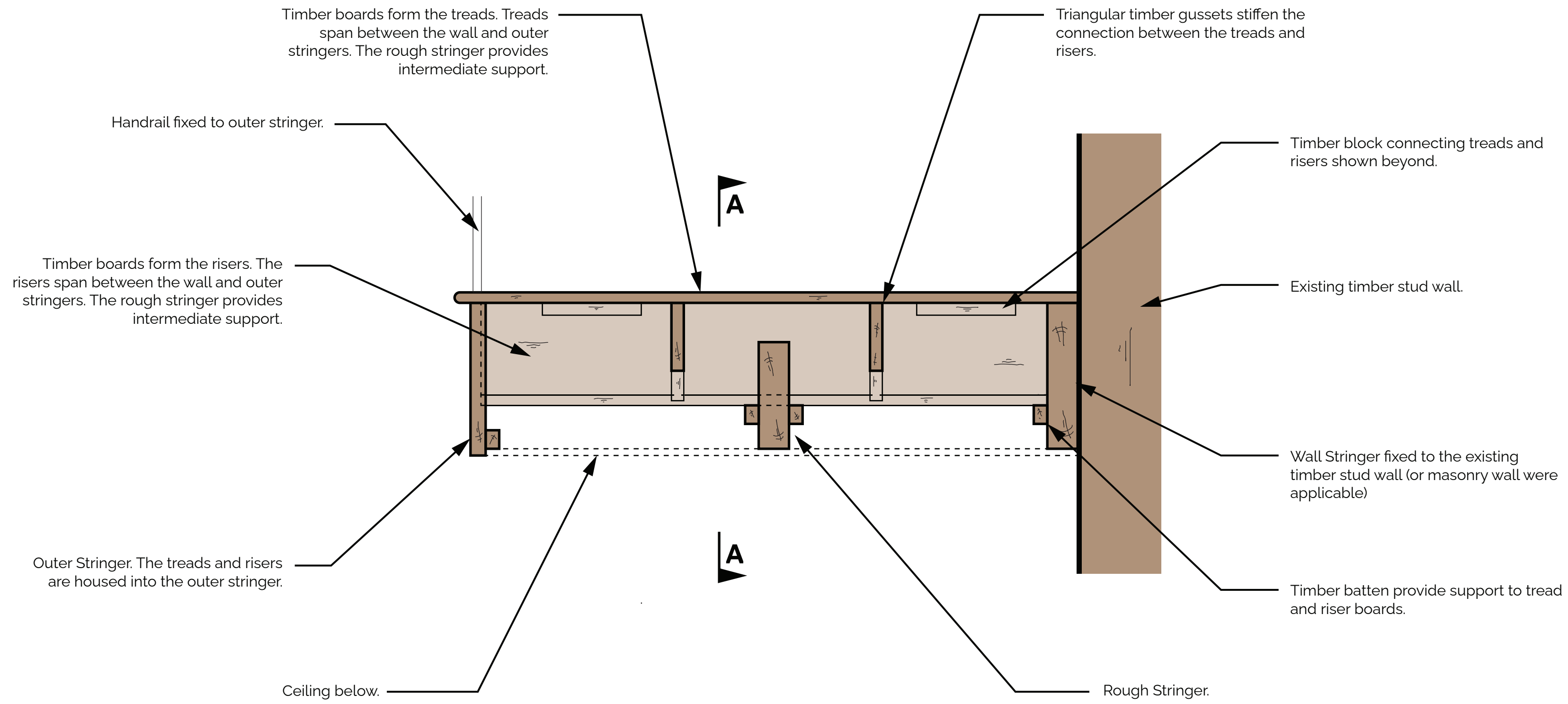


Figure 02 - Summary of Ground Floor Stair In No.70



Section A-A



Section B-B

Figure 03 - Summary of the Straight Stair Structure

4.0 - Observations

The following observations identify the key issues relating to the condition of the existing stair. A summary of the likely causes is also included.

Stair Lean

During our visit, we observed that the staircase in each property is out of level, with the inside edge of the stair being lower than the outside. This lean is most pronounced in the staircase of No. 70 between the ground and first floor, where the total level difference between the inside and outside edges is approximately 50mm In this area, timber firring pieces have been installed over the treads in the past to level the treads, (see Photo 01).

Cracks to Ceiling

In each property, cracks were observed on the soffit of the stairs, primarily concentrated around the transition between the straight and curved sections. In some areas, these cracks extended into the supporting walls both above and below the staircase (see Photos 02 and 03).

Banister Distortion

In several instances, we noted that the connection between the handrail and landing had opened, with the newel post below leaning out of plumb towards the stairwell. This distortion was most pronounced in Nos. 70 and 68 (see Photo 04).

Open Connections

In No. 70, borescope investigations of the stair between the ground and first floor levels revealed that several connections between the timber elements—such as the treads to the outer stringer and the rough stringer to the pitching piece—had pulled opened (see Photos 05).

Photo 01 (Above)
No.70. Non-original firring piece over the existing tread.

Photo 02 (Above)
No.70. Cracking to ceiling and wall below stair.

Photo 03 (Above)
No.68 Cracking to ceiling and wall below stair..

Photo 04 (Above)
No.67. Distortion of Balustrade

Photo 05 (Above)
No.70. Opening of Connection between Outer String and Tread/Riser

5.0 - Comments

It is not uncommon for staircases of this age and construction type to be out of level, and the defects observed on site appear unrelated to the failure of the ceiling below the first-floor landing in No. 70.

The performance of the staircase structure relies heavily on tight connections between timber elements to transfer compressive forces, particularly around the curved section, where bearers and pitching pieces are wedged into the surrounding walls and supported by the wreathing piece. Timber's natural tendency to shrink and expand with changes in moisture content can loosen these wedged connections, causing rotation and tip deflection of bearers and pitching pieces. This deflection, exacerbated by the loads from strings above and below, likely explains the observed movement (illustrated in Figure 04). This movement may also have been extubated by differential movement primary and secondary structural walls around the stair.

This movement also explains other observed defects: cracks on the soffit and opened connections from differential movement between curved and straight sections, and handrail distortion from the outer string pulling away from the landing, placing tension on the balustrade.

Evidence of previous repairs suggests that cracks have been periodically patched, but their recurrence indicates ongoing movement.

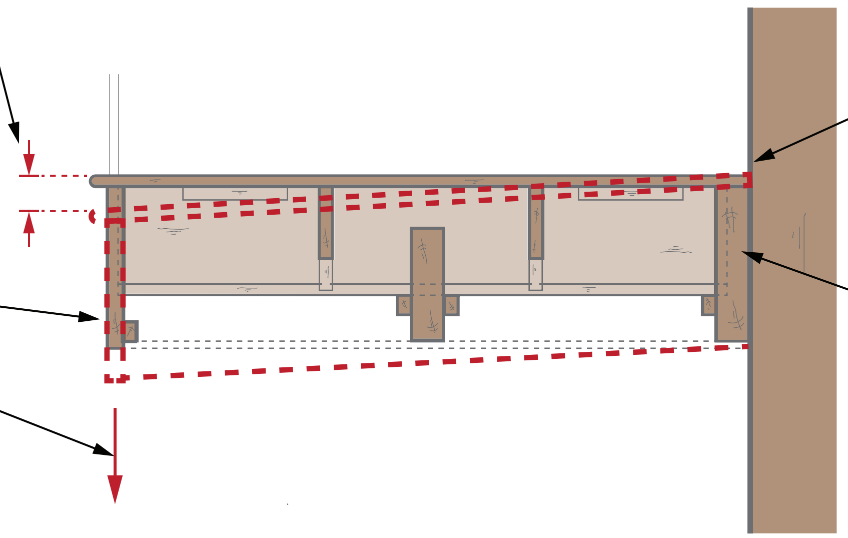


Figure 04 - Summary of Movement to Stair

6.0 - Recommendations

Based on the defects observed during our site visit, we suggest that investigations are undertaken to confirm the condition of the key connections in the stair structure and, if necessary, install localised and targeted strengthening works to be undertaken to improve the robustness of the stair. On similar projects, this has involved installing proprietary steel angle brackets and well-seasoned hardwood wedges/packers to enhance the robustness of the connections and enhance the connections strength and load transfer capacity.

The locations of the proposed investigations are shown on indicatively on Figure 05. We understand from our discussions with the managing agent, Fifield Glen, that the investigations would be targeted in initially in No.70 as this area is due to redecorated in the near future. Subsequent investigations in the other properties may follow based on the results.

Where possible we have proposed these investigations in areas where the finishes are non-original. However, both the investigations and any potential strengthening would require listed building consent, so further discussions with your Architect will likely be necessary.

Given the reduced robustness of the stairs, it would be prudent to avoid heavily loading the stairs until connection conditions are better understood.

Structural Key

Local removal of the existing finishes required to expose key connections.

Indicative Opening Up Schedule

OU01 - Approx 300mm x 300mm square section of plaster to be carefully removed from the soffit of the stair to expose the connection of the open strings to the landing trimmer at first floor.

OU02 - Approx 200mm section of plasterboard to be carefully removed from the soffit over the width of the stair to expose the connection of the open strings to the pitching piece, and the detail of the pitching piece into the masonry wall.

OU03 - Approx 200mm x 200m section of plasterboard to be carefully removed from the soffit of the stair to expose the connection of the bearers and the wreathing piece.

OU04 and OU05 - Plaster board to be removed from the stud wall below the stair to allow access to the rear of the existing stud wall.

OU06 - Approx 300mm x 300mm square section of plaster to be carefully removed from the soffit of the stair to expose the connection between the pitching piece and the timber stud wall.

Note: These investigations will likely require listed building consent and details for making good the existing finishes after the investigations would need to be agreed with the Architect.

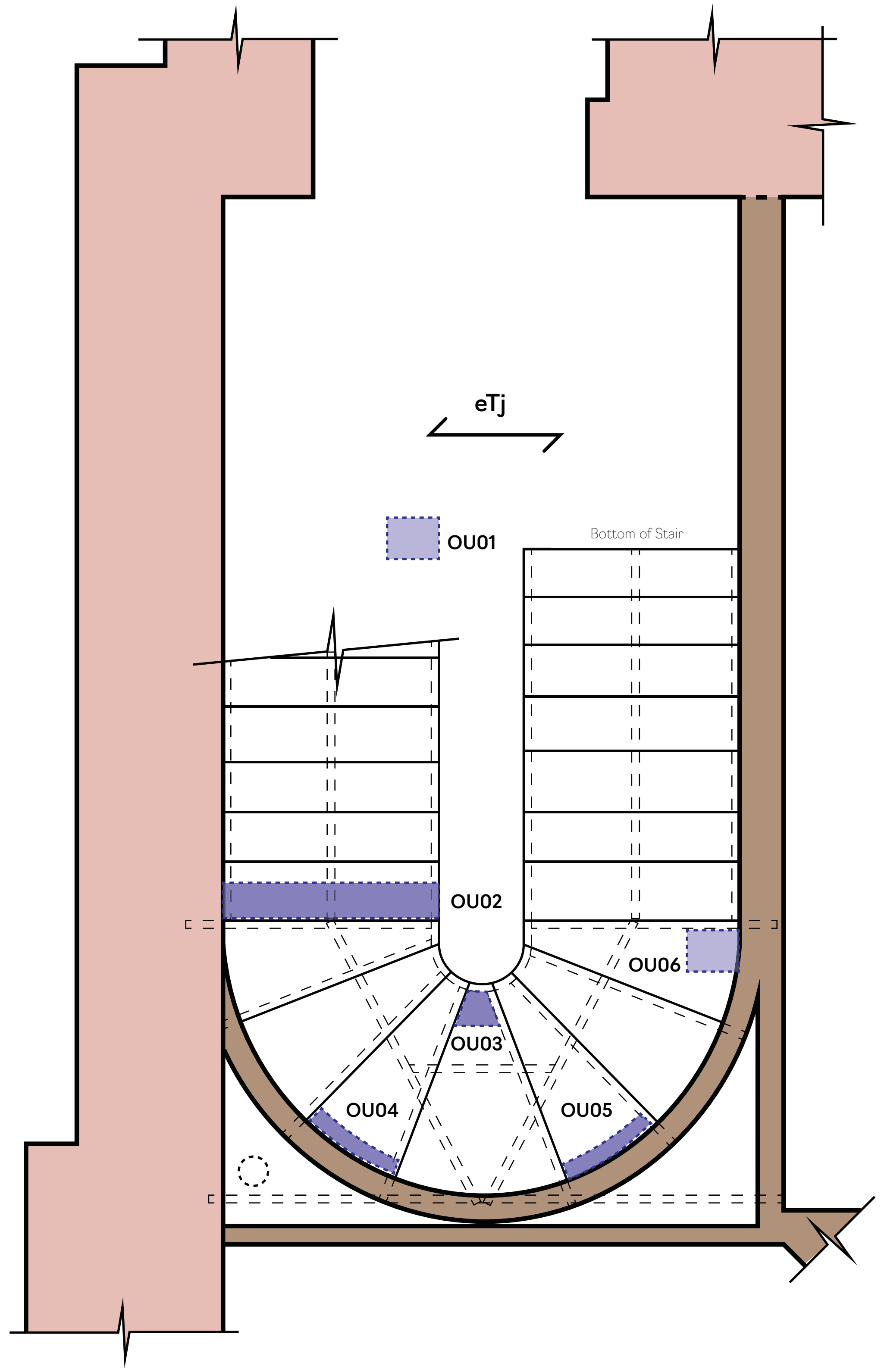


Figure 05 - Indicative Investigation Scope to Stair In No. 70

Prepared by: Robert Walton MEng, CEng, MIStructE
Date: 8 November 2024
Project No.: 0031
Revision: P02

Info@structuralassembly.co.uk

Structural Assembly Ltd is a Private Limited Company registered in England and Wales No.: 14023517
Correspondence Address: 52 Foundling Court, The Brunswick Centre, London, WC1N 1AN
Registered Office: 124 City Road, London, EC1V 2NX

Structural Assembly