8 Newton Street Roof Investigation and Remediation

14/05/2018
1-20289-REP-003
Revision B

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8 NEWTON STREET

ROOF INVESTIGATION AND REMEDIATION

PREPARED FOR

EASTERN GREEN LIMITED

Revision	Date	Author	Approved
A	11.05.18	P. Fleming	G Ellis
B	14.05.18	P. Fleming	G Ellis

Electronic Copy Certified By P Fleming

Date 14/05/18

Time 11:58

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1.0 INTRODUCTION

Eastern Green limited have commissioned Clancy Consulting Ltd (CCL) to assist with structural services in relation to the redevelopment of their property between 8 and 16 Newton Street, Manchester.

The purpose of this report is to specifically consider the building 8 steep sloping roof and how this area of the building can be made safe and ultimately brought back into use.



Figure 1

CCL have previously issued a condition report for the entire block, reference 1-20289-REP-001 and a repair strategy report, reference 1-20289-REP-002. Whilst both of these reports covered the building 8, this report will form a more comprehensive appraisal of the issues associated with this area of the building.

The properties are five adjacent four/three storey buildings located on Newton Street, Manchester. The five properties are made up of a block of two, four story buildings and a block of three, three story buildings believed to be constructed at the same time. To the right-hand side is Dale Street and to the rear, Mangle Street. The building is a former cotton warehouse, constructed between 1850-1891. The buildings are Grade II listed.

For the building No. 8 first to third floors are supported by timber beams that span between internal load bearing masonry wall and rafter which forms the roof/outer wall. Steel/wrought columns are provided to support the floor beams for the first/second floor as the width of the building increases on the lower floors. Building No.8 has a sloping roof which forms the outer walls for the three upper levels. All roofs are covered in Welsh slate.



Figure 2 – External Views of the Building 8 Roof

2.0 EXISTING CONDITION

The inclined roof is in considerable disrepair and will require significant remediation to bring it back into use.

Historically temporary propping has been implemented in the building however due to the ongoing disrepair and failure of beams/elements from the decay due to water ingress further emergency measures will be implemented.

Figure 3 shows the structural form of the roof of building 8. We believe the main roof member running from position 1 to position 6 is intended to support the floors down to the wall at position 1. These principle frames occur at circa 2.35m centres.

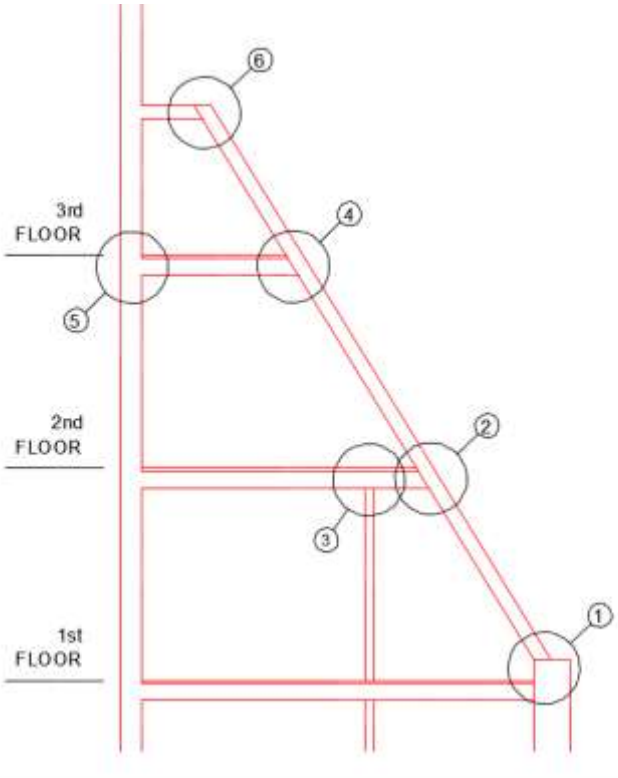


Figure 3 – Structural Layout & Reference Points

The wall/roof elevation is formed by a series of secondary members supported from these principle frames with large area of glazing between. The secondary timbers are only visable for inspection at a few locations and are clearly damaged by historic water ingress. This will have to be monitored on an ongoing basis and where required supplemental timbers introduced.

Ignoring condition, the form of the roof is in our opinion not structurally robust and relies heavily on performance of critical junctions to avoid a mechanism occuring and indeed as can be seen below mechanisms have occurred which have instigated emergency temporary works.

At junction 1, the external wall appears to have moved out , likely as a result of the thrust in the inclined member and the limited tying capacity of the first floor structure. However this area appears to be a particularly bad location for water ingress and therefore timber rot. Figure 4 shows one location where the timber is completely rotted through and several other locations are similar. In many locations the outward edge of the timber is also showing water damage.



Figure 4 – Main Member Completely Rotted Away at the Base

Any movement or lose of support at junction 1 could result in a collapse of the entire roof. It is clear that in several instances this has been averted initially by the contribution of junctions 2 and 3, followed by the extensive temporary works, Figure 5, installed some 10 years ago.

Junction 2 and 3 assist the support of the external elevation by cantilevering over the column at location 3 and picking up the elevation at junction 2. Although this is a possible load path the timber section is not adequate to provide this support and the junction 2 connection is not suitable for the potential load. Many of the timbers are noted to have flexed considerably at junction 3 and one particular timber has actually failed, as shown in Figure 6. At junction 2 the joints have opened up as the elevation has dropped.

The member from junction 4 to junction 5 is a simple span and takes support from the external sloping roof elevation. This is where the bulk of the load is applied to the inclined member. As can be seen in Figure 7, these junctions have opened up and the timber can be seen to have split in several locations.



Figure 5 – Typical Historic Propping Frame



Figure 6 – Second Floor Structure Timber Failed

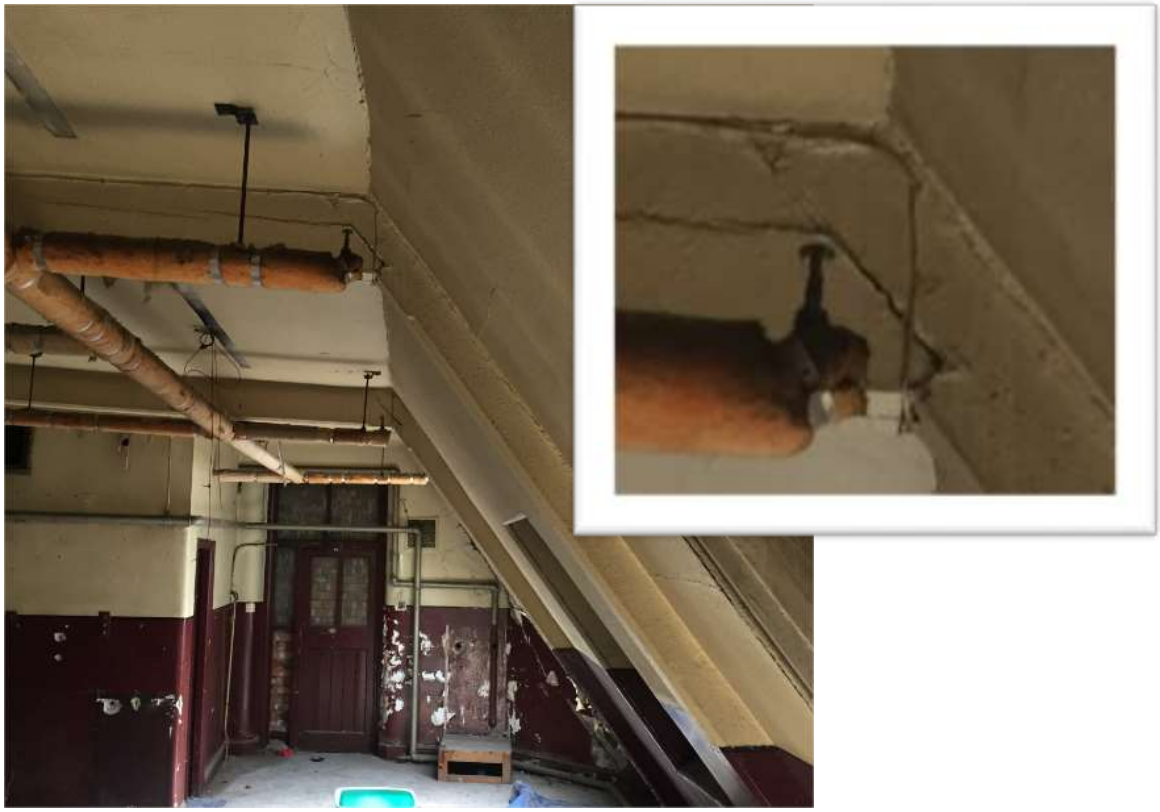


Figure 7 – 2nd Floor View on Underside of 3rd Floor

The connection at junction 4 as can be seen in Figure 7, has a “birds mouth” interface. Unlike a “normal roof” where the rafter would be taking support from the floor, in this case the floor is supported by the rafter. It is our opinion that this detail is particularly vunerable to movement resulting in loss of support to the floor.

At roof level the top of the main inclined member is attached to a nominal timber that forms the flat portion that ties back to the dividing wall line. This is shown in Figure 8. In this particular location, the junction is complicated by the presence of the dormer in the roof. It is our opinion that the tie timber is not proportionate and not adequately restraining to the top of the inclined member. The pin-pin nature of the end connections mean that this could become a mechanism.



Figure 8 – View on Underside of Roof

It is our opinion that significant degradation and movement has made the existing structure unstable. Whilst historic temporary works have prevented collapse, the continued movement and degradation are now more wide spread and a further round of emergency propping is recommended. The propping should be installed from the basement level working upwards.

We also consider that no works or access, other than to undertake the further propping should be permitted until this is completed. Even unloading the structure in the current state could be detrimental to the overall stability.

3.0 FURTHER TEMPORARY WORKS

As noted and for the reasons set out above it is our opinion that a further comprehensive temporary works propping scheme is urgently required to stabilise the roof.

CCL drawing 1-20289-113-P1 shows the detail of the proposed temporary works and Figure 9 shows an extract of this drawing.

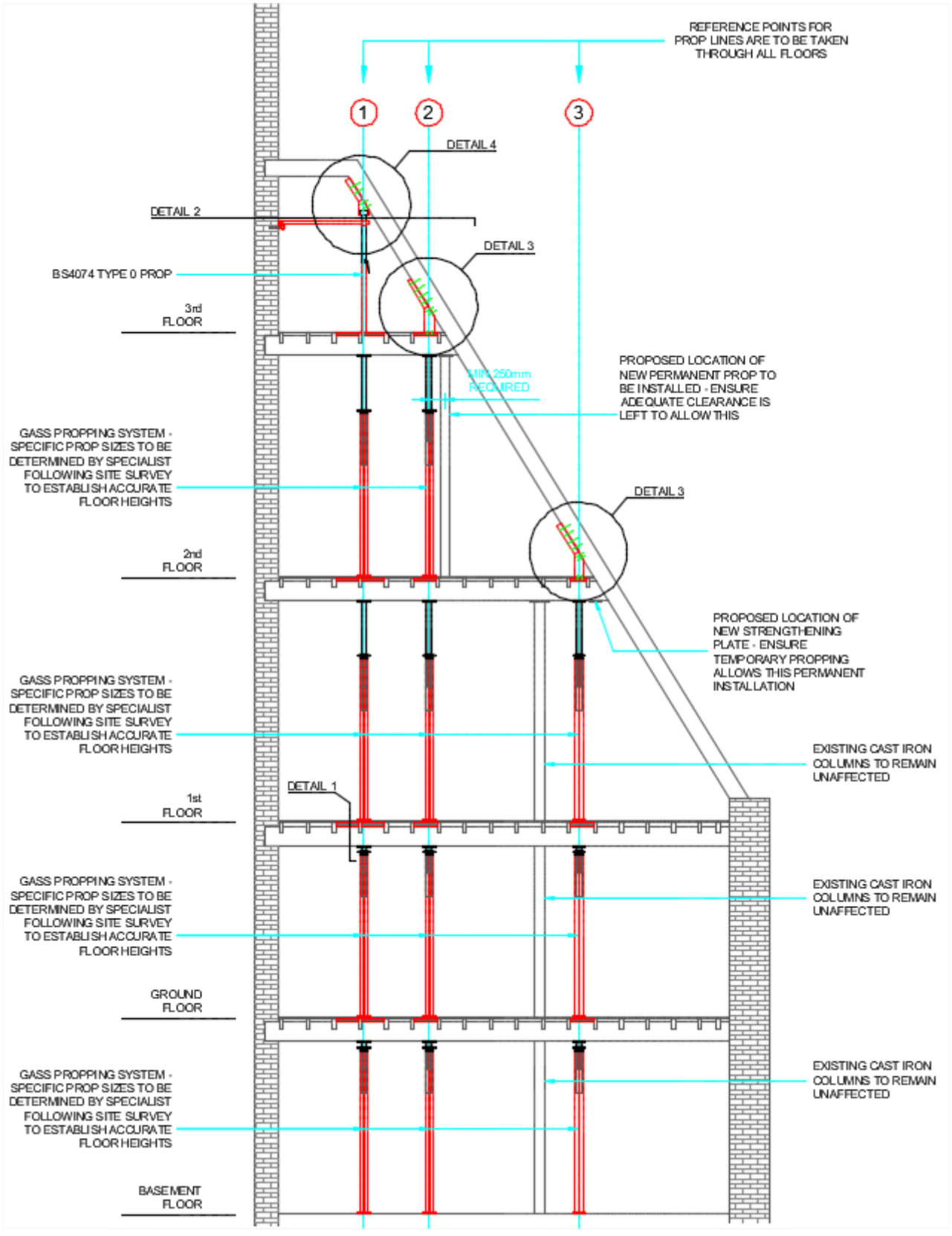


Figure 9 – Recommended Temporary Works

The objective of the temporary works is first to stabilise the structure but it is also considered to be sympathetic to eventually undertaking the proposed remedial works to bring the building back into service.

The propping aims to support the junctions and bring the load down through building footprint. This will leave working room at the outside wall junction to undertake the permanent remediation at this location.

4.0 PROPOSED PERMANENT REMEDIATION

Prior to the installation of the temporary works, it is our opinion that the existing roof was at significant risk of collapse. This is largely due to the timber rot and wall movement. However investigating this further we are of the opinion that the original structural form lacked robustness and several key details were inadequate. Much of the detailing is not tolerant of movement which would result in normal service under floor loading and wind loading, not to mention wall movement given the inclined load induced from the raking elevation.

The proposed remediation therefore has to address these issues and additionally consider the historical conservation value of the building. Several head line approaches were considered and then within these smaller variations of the theme looked at.

The headline options were as follows;

a. Demolish to first floor level, rebuild two new floors and roof with a vertical exterior wall. This is clear structural preference as it removes the weaknesses in the structure, increases useful floor area and the new structure can be designed of purpose. It was discounted on advice due to the historic value of this feature of the building.

b. Demolish to first floor level, rebuild two new floors and roof on a similar basis to existing but strengthened accordingly. This could remove the weaknesses in the structure from the degradation and also the poor original detailing. New structure can be designed of purpose. It was discounted on advice due to the historic value of this feature of the building.

c. Locally repair/replace the defective timber. There would be significant areas of replacement and large areas would have to be dismantled to facilitate the repair/replacement. The structure even ignoring degradation was very poorly detailed and these weakness would remain and would prevent the implementation of the

proposed redevelopment scheme. This was discounted as it would not fulfil the development objectives or deliver the robustness required to comply with current building regulations.

d. Steel reinforcement of the structural members. This approach would allow us to remediate the structural defects but retain the existing members for their historical significance. The structure can also be enhanced to deliver the development objectives. The robustness issues can be addressed and the load path altered to reduce the load in the inclined face. This is the option we chose to pursue as it represents the best compromise.

Having decided on approach ‘d’ in principle, the exact detailing had to be developed. As can be seen from the discussion above the improvement of the junctions is a major objective of the remediation and requires members that can transfer both bending and axial loads.

The system has to be buildable in sections that can be manhandled into location around the temporary propping and the junctions have to be bolted. Insitu welding is completely out of the question.

The proposed remediation is shown on CCL drawings 1-20289-111-P1 and 1-20289-112-P1. The proposed solution is generally a pair of steel channel sections supporting the original timber beams. This was the chosen approach to deliver the required section capacity, achieve the connections and facilitate a modular build whilst still propped on the temporary supports.

Several alternatives were considered, such as;

a. Flitch Plates in place of channels either side of the timbers. These would have had to be impractically thick to achieve the capacity required and very difficult to achieve the required connection robustness. We also have to consider that manoeuvring flexible flat plat into position by hand given the propping would have been challenging. Flitch plates are most suited to strengthening simple single beams with issues in shear or bending.

b. Under drawing the main members with steel members such as UBs, UCs or RHS sections. These would intrude further into the space and achieving continuity up through structure would have required some sort of bypass connection to go around the transverse members. It would also not have been possible to install this with the propping in place, making it unbuildable.

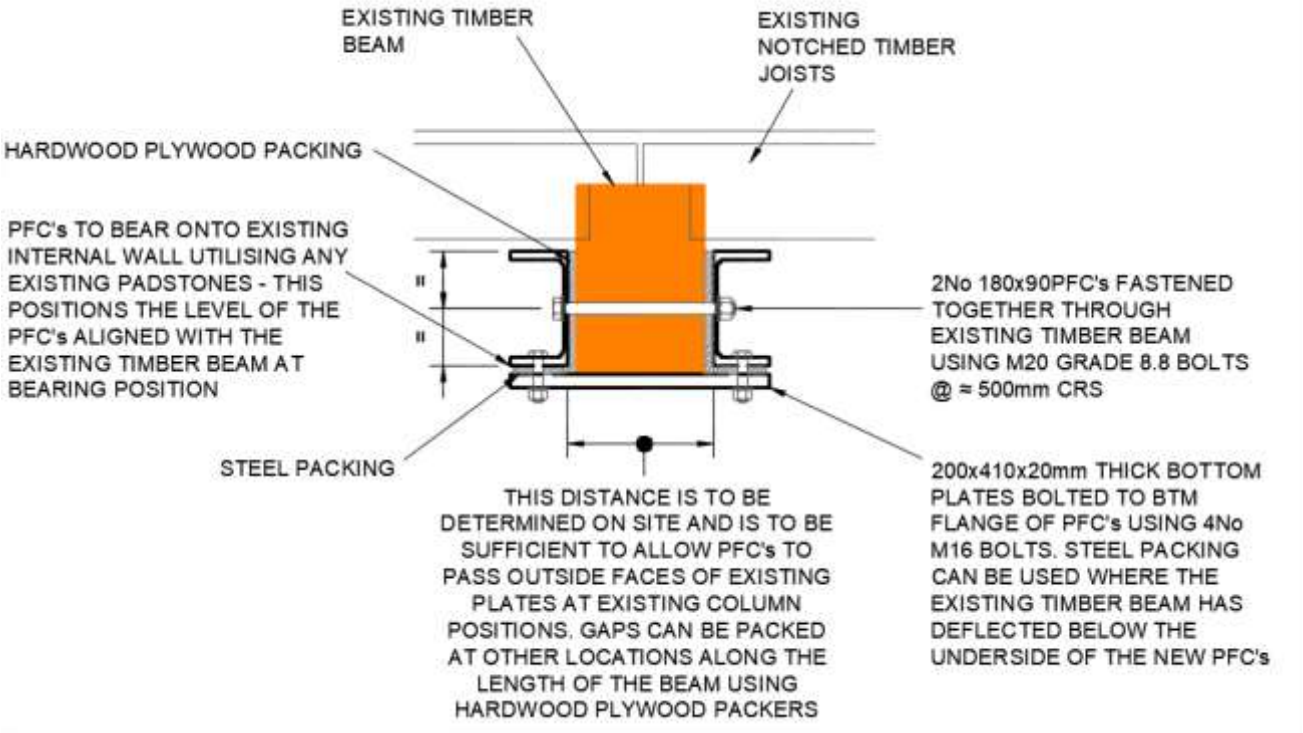


Figure 10 – Typical Strengthening

5.0 CONCLUSION

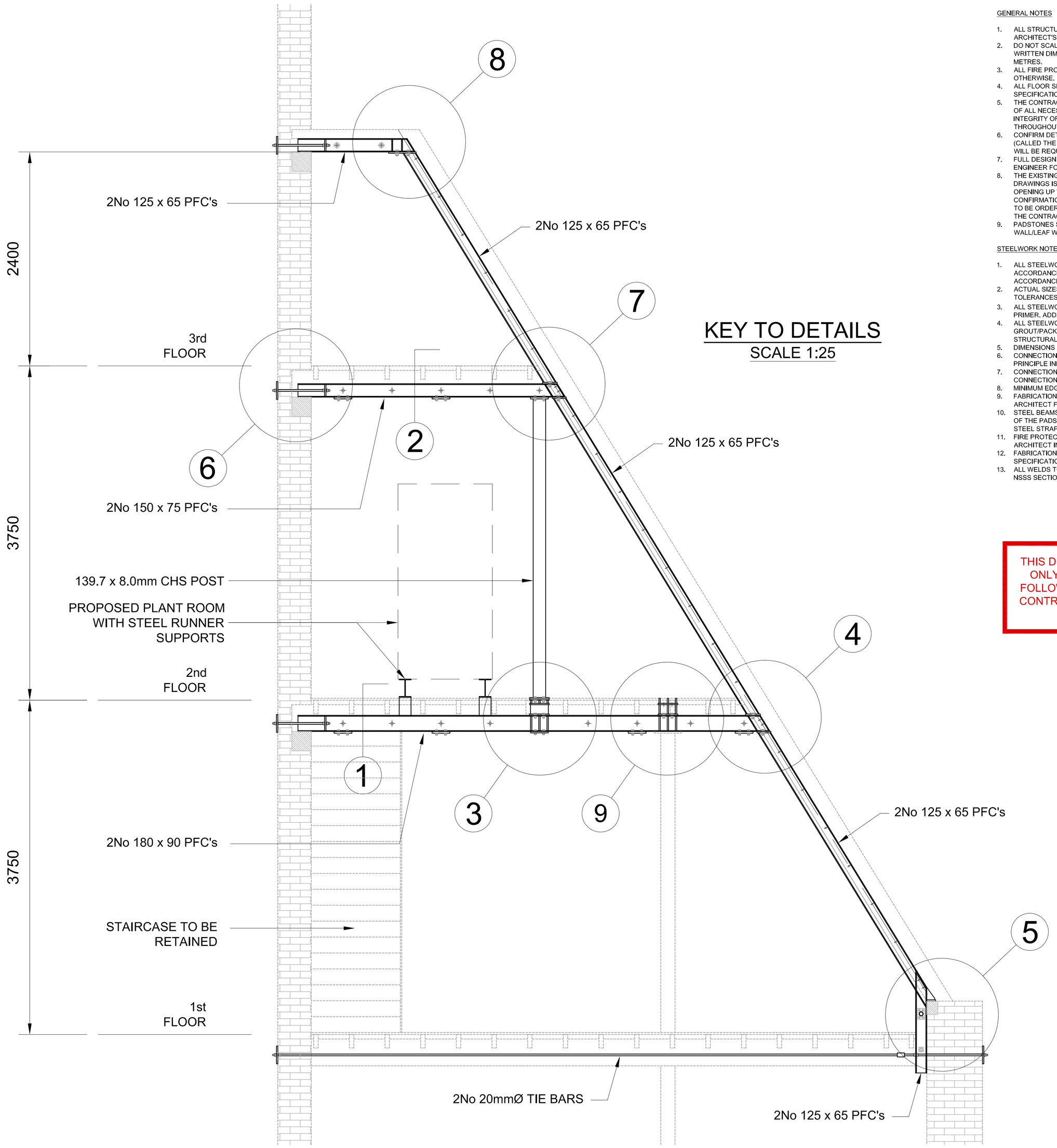
The existing structure in unsafe and requires immediate attention in terms of temporary propping. Refer to the temporary works proposals.

The building can be refurbished using a system of steel strengthening that will provide the additional capacity necessary to facilitate the redevelopment.

The building must remain propped until the permanent remediation is implemented in full.

Appendix A

Drawings



KEY TO DETAILS
SCALE 1:25

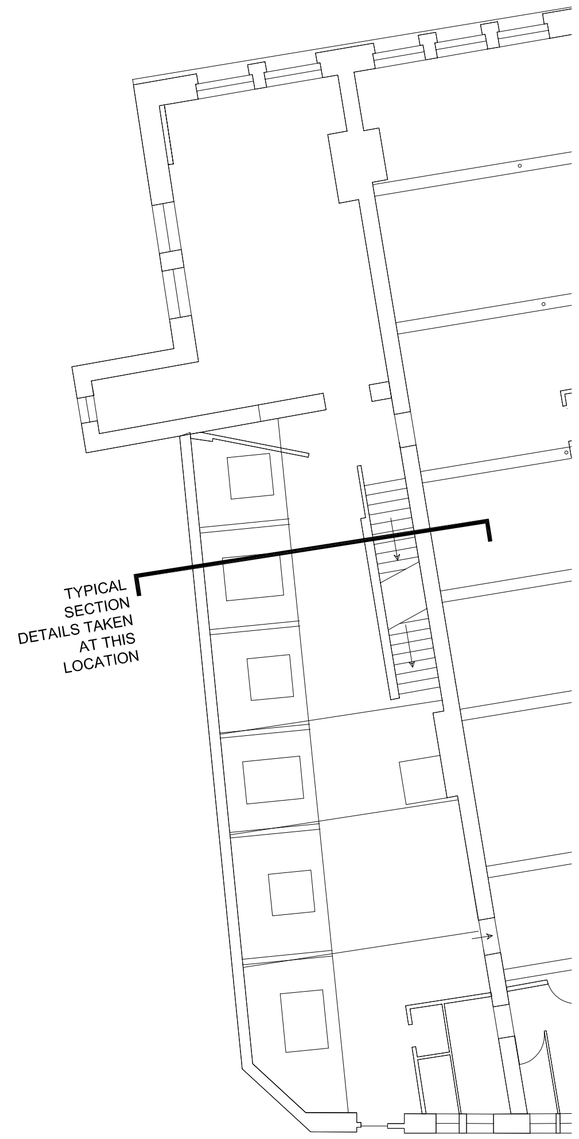
GENERAL NOTES

1. ALL STRUCTURAL ENGINEERING DRAWINGS ARE TO BE READ WITH ALL RELEVANT ARCHITECT'S AND SERVICE ENGINEER'S DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE FROM ANY CLANCY DRAWING, IN EITHER PAPER OR DIGITAL FORM. USE WRITTEN DIMENSIONS ONLY. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES.
3. ALL FIRE PROTECTION IS TO THE ARCHITECT'S DETAILS UNLESS SPECIFICALLY NOTED OTHERWISE.
4. ALL FLOOR SEPARATION AND ACOUSTIC ISOLATION DETAILS TO THE ARCHITECT'S SPECIFICATION.
5. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN, INSTALLATION, AND MAINTENANCE OF ALL NECESSARY TEMPORARY WORKS TO ENSURE THE STRENGTH, STABILITY, AND INTEGRITY OF THE BUILDING AND ANY ADJOINING BUILDINGS OR STRUCTURES THROUGHOUT THE COURSE OF THE WORKS.
6. CONFIRM DETAILS OF THE PERSON RESPONSIBLE FOR THE TEMPORARY WORKS DESIGN (CALLED THE 'TEMPORARY WORKS DESIGNER / COORDINATOR') - DETAILED DISCUSSIONS WILL BE REQUIRED WITH CCL.
7. FULL DESIGN DETAILS AND SEQUENCE OF WORK ARE REQUIRED FOR COMMENT BY THE ENGINEER FOR ALL TEMPORARY SUPPORT SYSTEMS.
8. THE EXISTING STRUCTURAL INFORMATION SHOWN ON THE STRUCTURAL ENGINEERING DRAWINGS IS BASED ON VISUAL INSPECTION OF THE BUILDING AND UPON LIMITED OPENING UP WORKS. ALL DETAILS OF THE EXISTING CONSTRUCTION ARE SUBJECT TO CONFIRMATION BY THE CONTRACTOR DURING THE WORKS ON SITE. NO MATERIALS ARE TO BE ORDERED UNTIL THE RELEVANT DETAILS AND CONDITIONS ARE CONFIRMED BY THE CONTRACTOR ON SITE.
9. PADSTONES SHALL BE A MINIMUM 330x215dp x100*mm wide (THICKNESS TO SUIT WALL/LEAF WIDTH.

STEELWORK NOTES

1. ALL STEELWORK IS TO COMPLY WITH BS EN 1090 AND BE GRADE S355JR INTERNALLY IN ACCORDANCE WITH EN10025-2, AND S355J2H FOR HOLLOW SECTIONS - SHS, RHS & CHS IN ACCORDANCE WITH EN 10210-1, UNLESS NOTED OTHERWISE.
2. ACTUAL SIZES OF SECTIONS ARE SHOWN BUT DO NOT TAKE INTO ACCOUNT ROLLING TOLERANCES.
3. ALL STEELWORK IS TO BE BLAST CLEANED TO SA 2½. 80microns ZINC PHOSPHATE EPOXY PRIMER. ADDITIONAL DECORATIVE COATING TO BE ADVISED BY ARCHITECT.
4. ALL STEELWORK IS TO BE LINED, LEVELED AND PLUMBED AND THE CONTRACTOR IS TO GROUT/PACK AS REQUIRED. PACKING AT TIMBER INTERFACES IS TO BE HARDWOOD STRUCTURAL PLYWOOD U.N.O.
5. DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE PRIOR TO FABRICATION.
6. CONNECTIONS ARE TO BE DETAILED BY THE STEELWORK SUB-CONTRACTOR TO THE PRINCIPLE INDICATED.
7. CONNECTIONS ARE TO HAVE A MINIMUM OF 2No. M16 BOLTS (GRADE 8.8) PER CONNECTION TO BS 4190, GALVANISED IN ACCORDANCE WITH BS EN ISO 1461 U.N.O.
8. MINIMUM EDGE DISTANCE FOR BOLT POSITIONS 1.5 x HOLE DIAMETER.
9. FABRICATION DRAWINGS ARE TO BE SUBMITTED TO THE STRUCTURAL ENGINEER AND ARCHITECT FOR COMMENT A MINIMUM OF 10 WORKING DAYS PRIOR TO FABRICATION.
10. STEEL BEAMS ARE TO BEAR A MINIMUM OF 150mm ONTO PADSTONES OR THE FULL WIDTH OF THE PADSTONE WHERE INSTALLED PERPENDICULAR TO THE WALL, WITH GALVANIZED STEEL STRAPS FOR LOCATION.
11. FIRE PROTECTION & VISIBLE FINISHES SPECIFICATION TO BE PROVIDED BY THE ARCHITECT IN CONSULTATION WITH THE BUILDING CONTROL
12. FABRICATION & ERECTION IN ACCORDANCE WITH NATIONAL STRUCTURAL STEELWORK SPECIFICATION (NSSS) 5th CE MARKING EDITION.
13. ALL WELDS TO BE MIN. 6mm FILLET WELDS TO FULL PERIMETER IN ACCORDANCE WITH NSSS SECTION 5

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SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX
Construction Risks
• The existing building is in a fragile condition. All levels are to be fully propped from basement level prior to any works. • It is critical that movement of the structure is controlled. Therefore, extreme care must be taken to ensure all packing is solid. • Condition of existing timber is a significant concern. In the course of the works, all defects uncovered are to be logged with a photograph and location record. • There is a risk that the works could dislodge tiles on the external elevation. A scaffold or other suitable protection is recommended externally.
Maintenance/cleaning risks
Demolition/adaptation risks
In addition to the hazards / risks normally associated with the type of work detailed on this drawing - the contractor is to take note of the the above & also the hazards identified in the risk assessment document. It is assumed that all works detailed on this drawing will be performed by a competent contractor working, where appropriate, to an approved method statement

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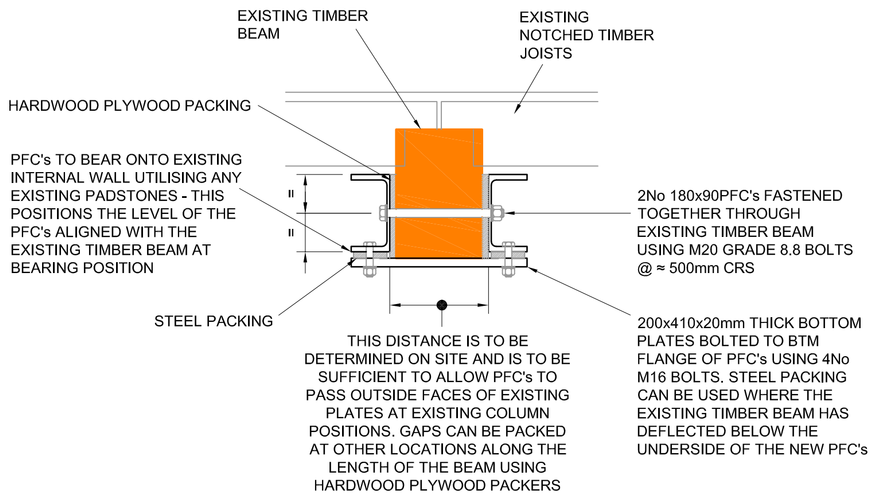
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Project	8 NEWTON STREET MANCHESTER
Office	ALTRINCHAM
Discipline	STRUCTURAL
Title	REMEDIAL WORKS 1st, 2nd & 3rd FLOORS GENERAL ARRANGEMENT

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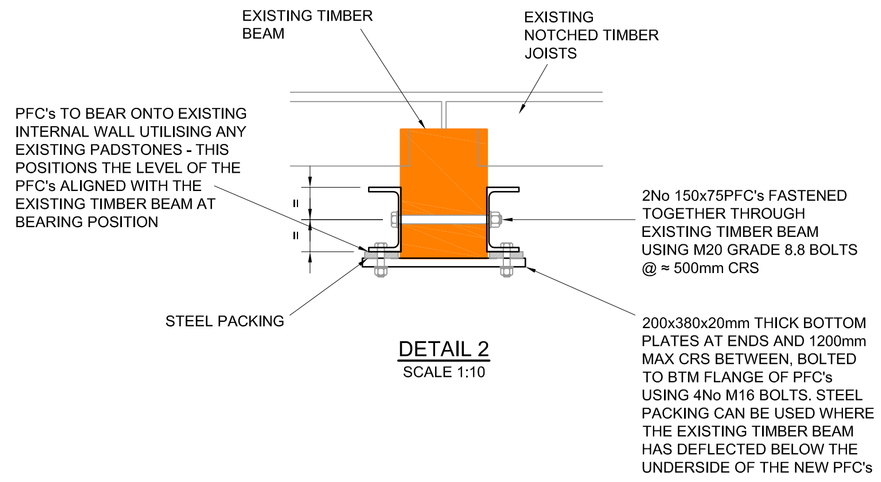
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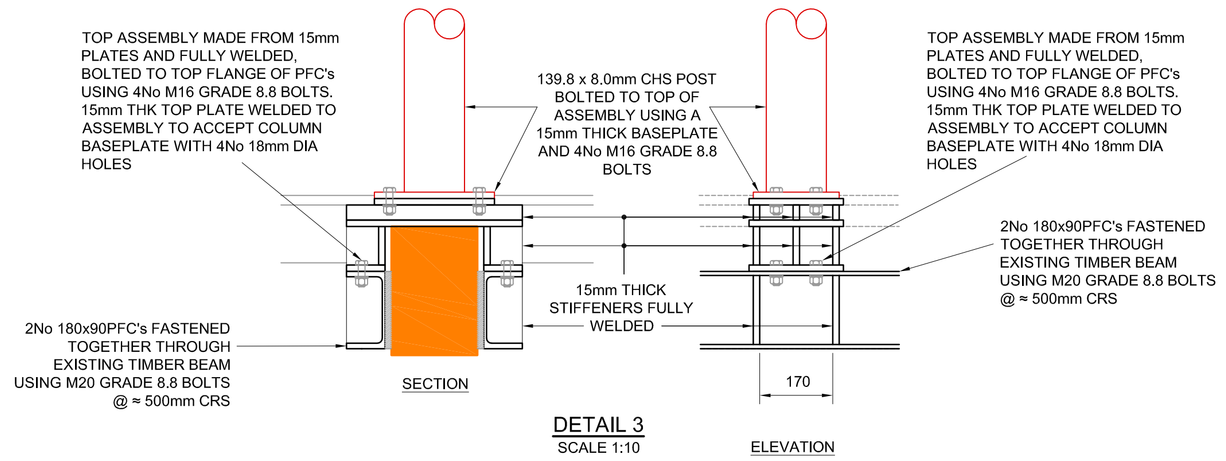


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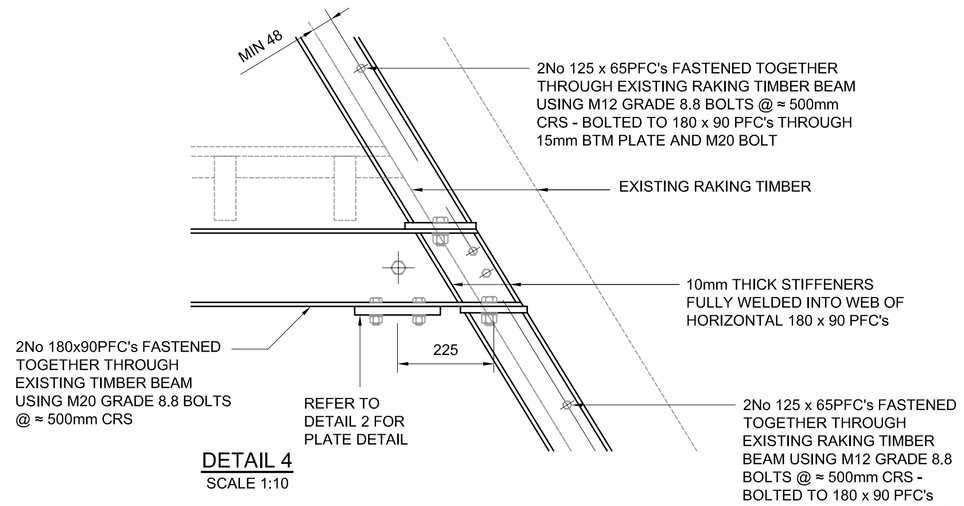
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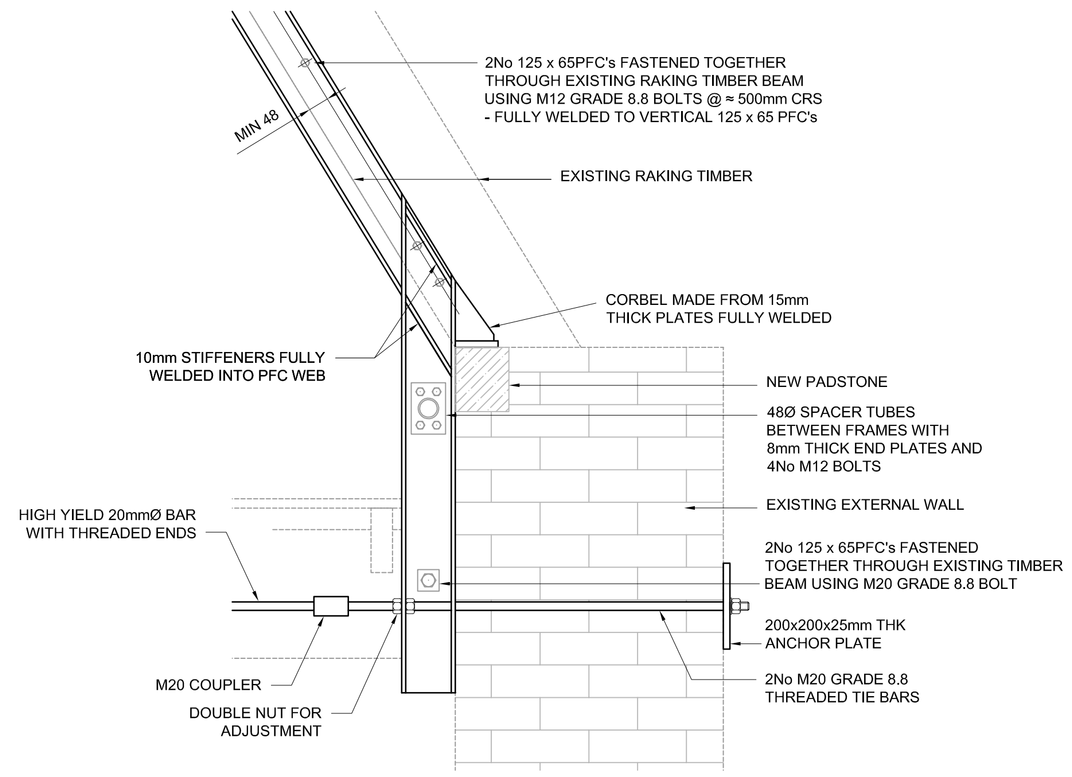
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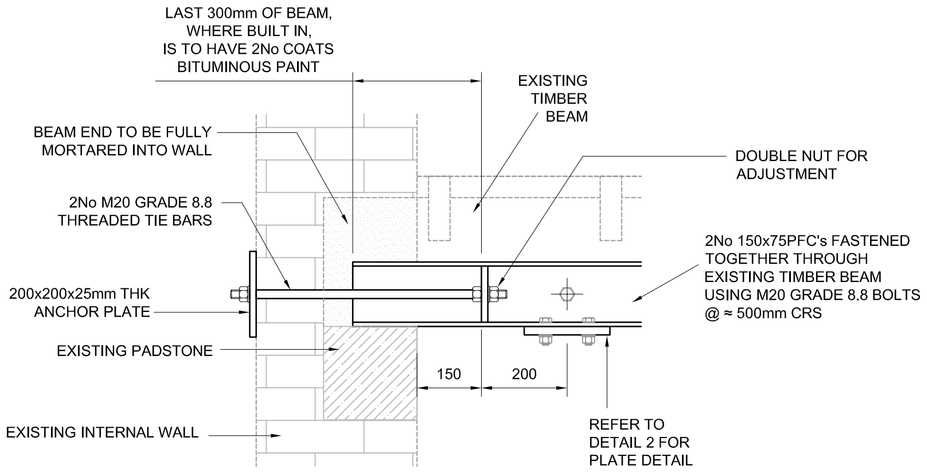
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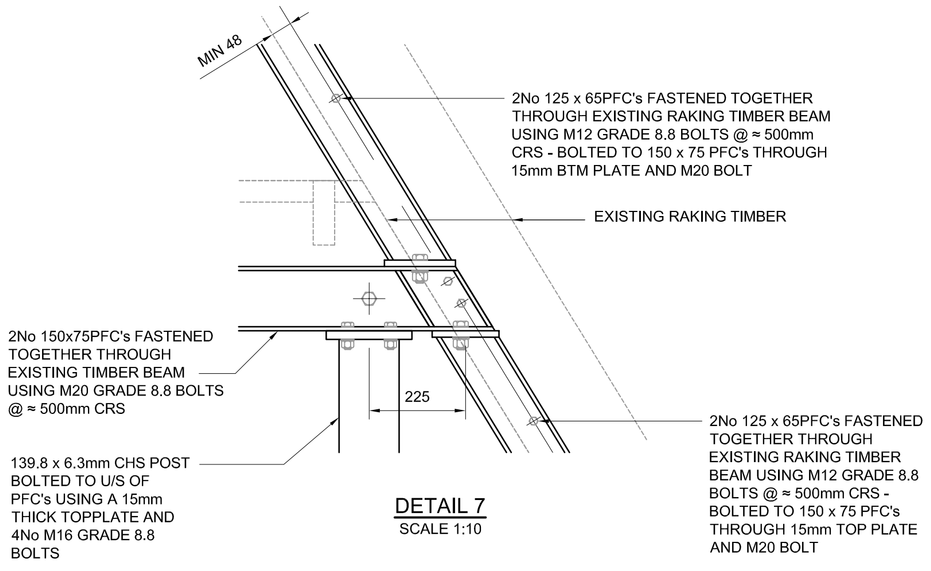
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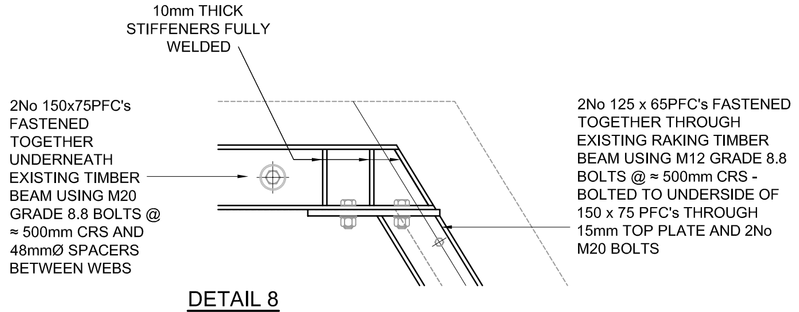
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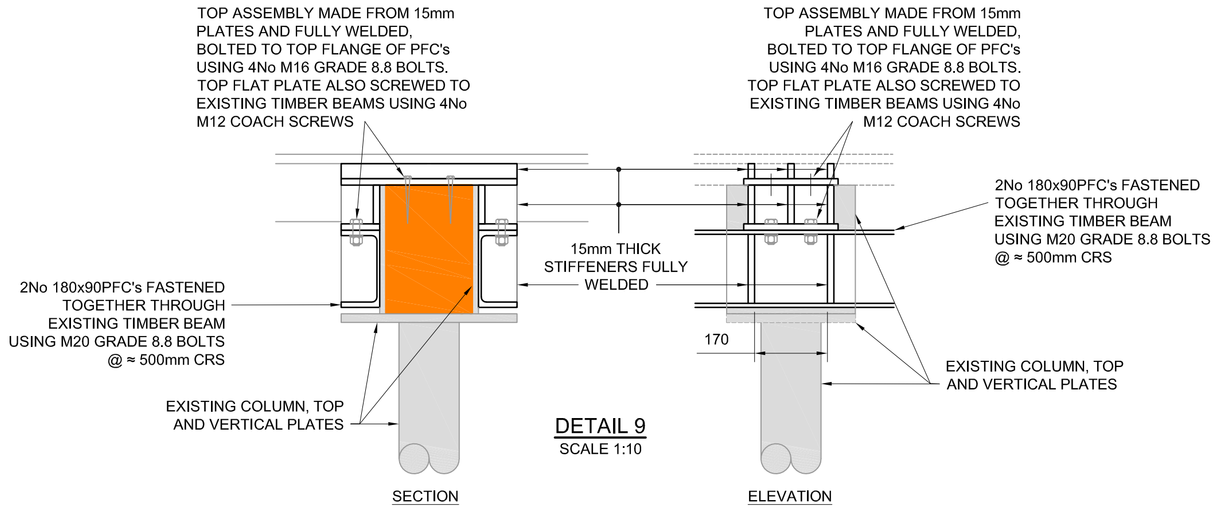
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DETAIL 7
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DETAIL 8
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DETAIL 9
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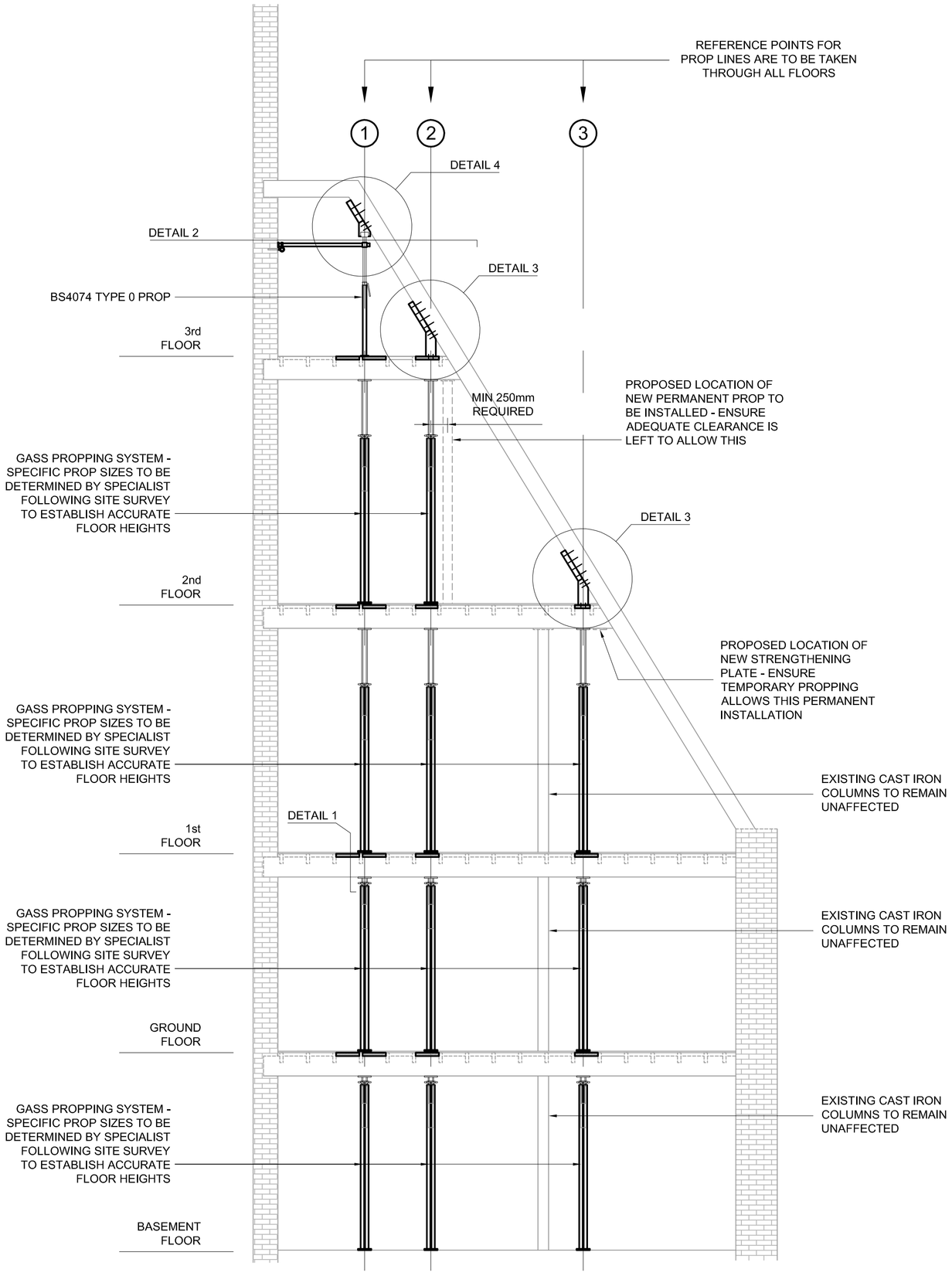
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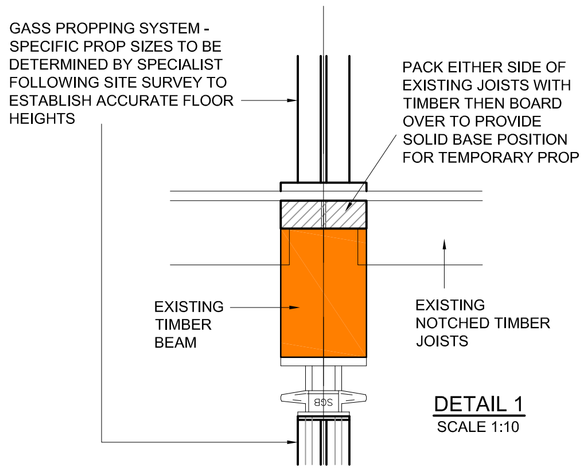
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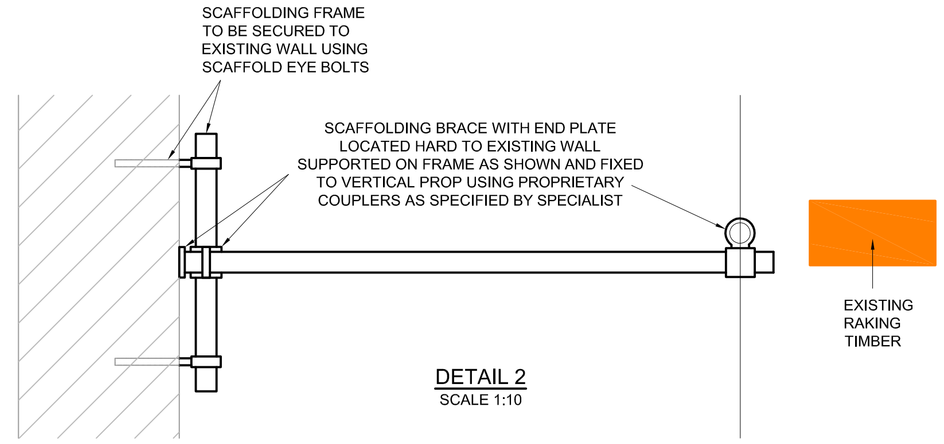
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TYPICAL SECTION THROUGH TEMPORARY PROPPING ARRANGEMENT
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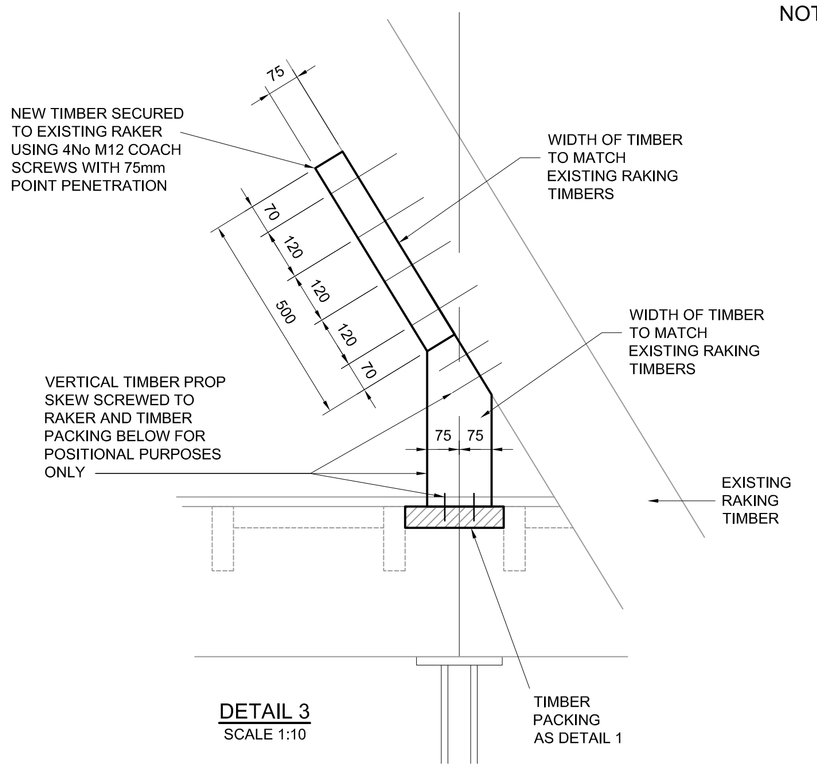


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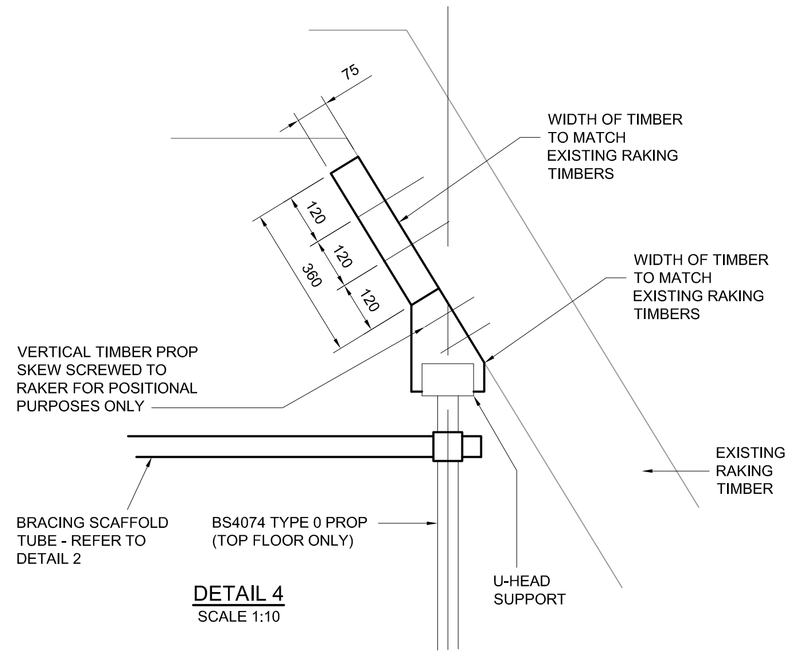


DETAIL 2
SCALE 1:10

ALL NEW TIMBERS ARE TO BE GRADE C24 UNLESS SPECIFICALLY NOTED OTHERWISE



DETAIL 3
SCALE 1:10



DETAIL 4
SCALE 1:10

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX
Construction Risks
• Care must be taken to ensure prop alignment verticality is maintained. • In order to ensure adequate fixing, each location should be inspected and, if defective, reported to the engineer. • Propping must be set out relative to the top junction but MUST be constructed from Basement upwards.
Maintenance/cleaning risks
Demolition/adaptation risks
In addition to the hazards / risks normally associated with the type of work detailed on this drawing - the contractor is to take note of the the above & also the hazards identified in the risk assessment document. It is assumed that all works detailed on this drawing will be performed by a competent contractor working, where appropriate, to an approved method statement

THIS DRAWING IS INTENDED AS INFORMATION ONLY - FINAL POSITIONING OF PROPPING MUST FOLLOW A FULL DIMENSIONAL SURVEY BY CONTRACTOR TO ESTABLISH EXACT EXISTING SITE DIMENSIONS

Rev	Date	Description	By	Check	App.
P1	03.01.18	PLANNING ISSUE	ANC	PCF	GRE

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ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client	EASTERN GREEN LTD ASHLEY RD, ALTRINCHAM
Project	8 NEWTON STREET MANCHESTER
Office	ALTRINCHAM
Discipline	STRUCTURAL
Title	TEMPORARY PROPPING SECTION DETAILS

Drawn	ANC	Date	OCTOBER 2017
Checked	PCF	Scale @ A1	AS NOTED
Approved	GRE	Status	PLANNING

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Job number	Drawing number	Revision
1-20289	113	P1