Appendix H: Structural & Civil Engineering Report

The Harlington, Fleet

Stage 1 Structural Options Appraisal

SD Engineers Project Reference
SDE2035

Issuing Date
20/06/2025

Revision Number
A

Document Reference
02035-SDE-00-XX-DS-S-0004

Introduction

1. Overview

This Stage 1 Feasibility Report presents an initial assessment of the structural and civil engineering aspects of the options for upgrade to the Harlington Centre, in line with the Burrell Foley Fisher proposals.

The objective of this report and submitted concept proposals is to evaluate the current condition and capacity of the building's structural elements and civil infrastructure, and to provide an indication of structural amendments to aid the cost plan for the options put forward.

The report includes:

- A summary of previous condition surveys by Cooper & Withycombe in July 2020
- Strengthening /replacement options for the auditorium roof
- Overview of submitted designs for alterations to the peripheral structures.
- Overview of upgrades to the below ground drainage
- Outline of required surveys to be conducted during RIBA Stage 2

2. Investigations

Note that at this stage no intrusive investigations have been carried out and the summary of the existing structure is based on a visual inspection, conclusions from a previously condition study, and reports form the clients.

Existing Structure

1. Overview

A condition survey of both the existing building as a whole and the condition and capacity of auditorium roof was conducted by Cooper & Withycombe in July 2020. These reports should be referred to and the full detail has not been repeated here.

The key findings have been extracted and summarised where relevant throughout this document.

The auditorium is a reinforced concrete 'box' with concrete columns supporting a ring beam at mid-height. This beam supports infill masonry walls and glulam roof beams on timber posts.

The entrance foyer, dance studio and library are summarised as two-storey reinforced concrete box frame with precast concrete first floor and precast concrete joists at roof level supporting wood wool slabs beneath the flat roof coverings.

The surrounding single storey spaces are loadbearing masonry (cavity walls) supporting woodwool flat roofs. The works carried out in the 1990s encased the flat roofs with new pitched roof formed from trussed rafters which clear span between loadbearing walls (and do not load the woodwool).

The 1993 extensions to the centre (comprising the 'Phoenix' building) are of loadbearing masonry construction with trussed rafter roofs and concrete floors, structurally isolated for the main structure.

2. Structural Condition – Key Recommendations

a. Cracking to walls

There is significant cracking to walls either side of the corridor to the east of the auditorium. The crack occurs at the change of level of the floor and is therefore anticipated to be due to relative foundation movement with the high- and low-level foundations acting separately.

Structurally the walls are adequate to perform their loadbearing role, but the cracking can be snitched to mitigate the further opening of the cracks. Foundation strengthening could be considered to prevent ongoing issues. However, this would only be deemed worthwhile if the proposals required excavation or strengthening requiring access to the substructure.

b. Concrete structure

Unless circumstances change, any natural degradation due to carbonation to the internal concrete frame should be slow and there should be no reason that the condition is compromised.

Strengthening/repair will only be required should strip out works highlight issues or the capacity needs upgrading for new loading (see discussion later).

For the external concrete element subject to periodic inspection and remedial maintenance should any defects be identified, and there are no structural alterations that affect its integrity, it may be anticipated the concrete frame elements will continue to act as present.

c. Auditorium roof

The laminated timber beams exhibit signs of checking / delamination. However, these beams could be reused provided these defects are remediated.

The existing laminated beams will require strengthening to support the proposed roof loading. A feasibility study on the strengthening of the existing roof is included in a separated study in Appendix A.

Option 1 – Structural & Civil Upgrades

3. Overview – Structural

Refer to the following drawings for details of structural modifications associated with Option 1:

- 2035-SDE-00-GF-SK-S-1101 – GF
- 2035-SDE-00-M1-SK-S-1102 – Mezz
- 2035-SDE-00-RF-SK-S-1103 - Roof

It should be noted that a series of assumptions have been made in the preparation of the structural proposals and are included in the drawings, accordingly.

Option 1 of the structural upgrade includes roof strengthening in the form of retrofit trusses as described in the separate report on options for the auditorium roof. Option 1 sees the retention of the laminated timber beams at roof level with retrofit steel sections to form a series of timber-steel hybrid trusses above the auditorium.

New roof joists and secondary steel structures are required in addition to the strengthened roof beams to support the new overhead rigging system and plant equipment positioned on the roof.

A new balcony seating area is proposed to the rear of the auditorium which will be supported with steel beams and columns travelling to the ground floor and supported on new foundations.

Information regarding the existing condition and construction of the ground floor slab is very limited at this stage. This will need to be addressed in the following design stages as it will likely govern the design of new foundations and be required to assess the need for slab strengthening to support the new retractable seating.

Above the stage area, the existing beams can be retained to support new overhead rigging equipment. However, the existing beam above the proscenium will need strengthening or replaced entirely to support the additional load from the rigging equipment.

2. Overview – Civil

A review of the existing drainage network identified structural defects concentrated around the existing toilet block, including fractured pipework, joint displacement, and localised root ingress. These defects compromise the hydraulic performance and long-term integrity of the system and necessitate reinforcement and partial replacement. As a result, the civil engineering strategy must address both remedial measures to the legacy network and upgrades to support new demand and ensure compliance with current standards.

The principles below are reflective for both options.

Best practice under CIRIA C750 – 'Guidance on the Structural Condition of Small Diameter Drains and Sewers' has been used to guide the appraisal of the existing infrastructure. CCTV condition surveys classify many of the defects around the toilet block as Grade 4 and 5, indicating structural failure or imminent risk thereof. Consequently, pipe relining and/or open-cut replacement is required in these sections to prevent surcharge or environmental contamination.

From a policy standpoint, the proposed works support the principles of the Non-Statutory Technical Standards for Sustainable Drainage Systems (DEFRA, 2015) and align with the Building Regulations Part H, which stipulates that drainage systems must be adequately sized, ventilated, and accessible for maintenance. Further, local planning guidance and Lead Local Flood Authority (LLFA) preferences emphasise sustainable approaches to managing surface and foul flows, particularly in areas undergoing change or redevelopment.

Design reinforcement will incorporate upgraded pipe materials such as vitrified clay or twinwall polyethylene, depending on access and depth. These materials provide improved longevity and hydraulic capacity. Junctions will be reformed using factory-fabricated fittings, and chambers will be constructed or re-benched in accordance with Sewer Sector Guidance (SSG) and Sewers for Adoption (where applicable). All manholes shall be designed in compliance with BS EN 752 and will provide rodding and inspection access in accordance with best practice.
Key drainage principles guiding the upgrade include maintaining gravity flow wherever practicable, limiting pipe gradients to prevent scouring, and ensuring self-cleansing velocities are achieved during peak flows. The design ensures all connections are watertight and that all gradients fall within minimum recommendations set out in BS EN 12056 for foul water conveyance. In areas of shallow cover or high traffic loading, pipe protection (concrete encasement or bridging slabs) will be applied to preserve structural performance.

Surface water drainage has been reviewed as part of this process, with opportunities for disconnection and attenuation assessed. However, the primary focus remains on addressing the legacy foul system around the toilet block, which presents the greatest risk of pollution or service failure. Backflow protection and localised attenuation will be considered at key interface points to mitigate against potential surcharging events.
The civil works will also incorporate temporary diversions to ensure continuity of toilet services during the construction phase. Coordination with mechanical and plumbing services will ensure drainage reinstatement matches internal layouts and that foul outlets are sealed and tested in accordance with WRc Manual of Sewer Condition Classification guidelines.

In delivering the reinforced network, consideration will be given to maintenance access and long-term adoption.
Where drainage remains private, proposals will still conform to Water Industry standards to allow for future handover or legal transfer if required. Documentation will include as-built drawings, CCTV records, and compliance statements to evidence workmanship and performance.
Finally, the enhanced drainage system forms part of a wider civil engineering strategy to improve service resilience and asset life. By addressing existing network issues and aligning with policy and technical standards, the scheme

will ensure a robust and compliant system that supports current and future occupancy.

In accordance with both local and national policy, surface water discharge from the site will be reduced to achieve a betterment rate, to be agreed with the Lead Local Flood Authority (LLFA) during the next design stage.

Preliminary calculations indicate that the existing catchment area, approximately 2,100m², currently generates a runoff rate of around 29 l/s. This will be reduced to 15 l/s through a combination of Sustainable Drainage Systems (SuDS) features and below-ground attenuation, including storage tanks designed to balance flows and manage storm events in line with best practice.

Notes

1. These drawings are not to be used for setting out purposes. Refer to the latest Architect's information and site measure as required.
2. Contact SD Engineers in the event of any discrepancies between findings on site and these drawings.
3. Drawing is to be read in conjunction with the SD Engineer's Specification and General Notes.
4. 3D views are indicative only and conflicting 2D information should take precedence. If in doubt contact SD Engineers prior to starting works.

Rev	Date	Amendment	Dra	Rev	App
A	23/05/2025	Costing	AM	RC	RC

S2
Suitable for Information

The Harlington, Fleet
SDE2035

Ground Floor Plan - Initial Costing

Drawn AM	Status Construction
Reviewed RC	Date 19/05/2025
Approved RC	Scale NTS

Project	Orig	Vol	Lev	Typ	Rol	No	Status	Rev
2035	SDE	00	GF	SK	S	1101	S2	A

4th Floor, 1 Throgmorton Avenue
London, EC2N 2JJ
sd-engineers.com
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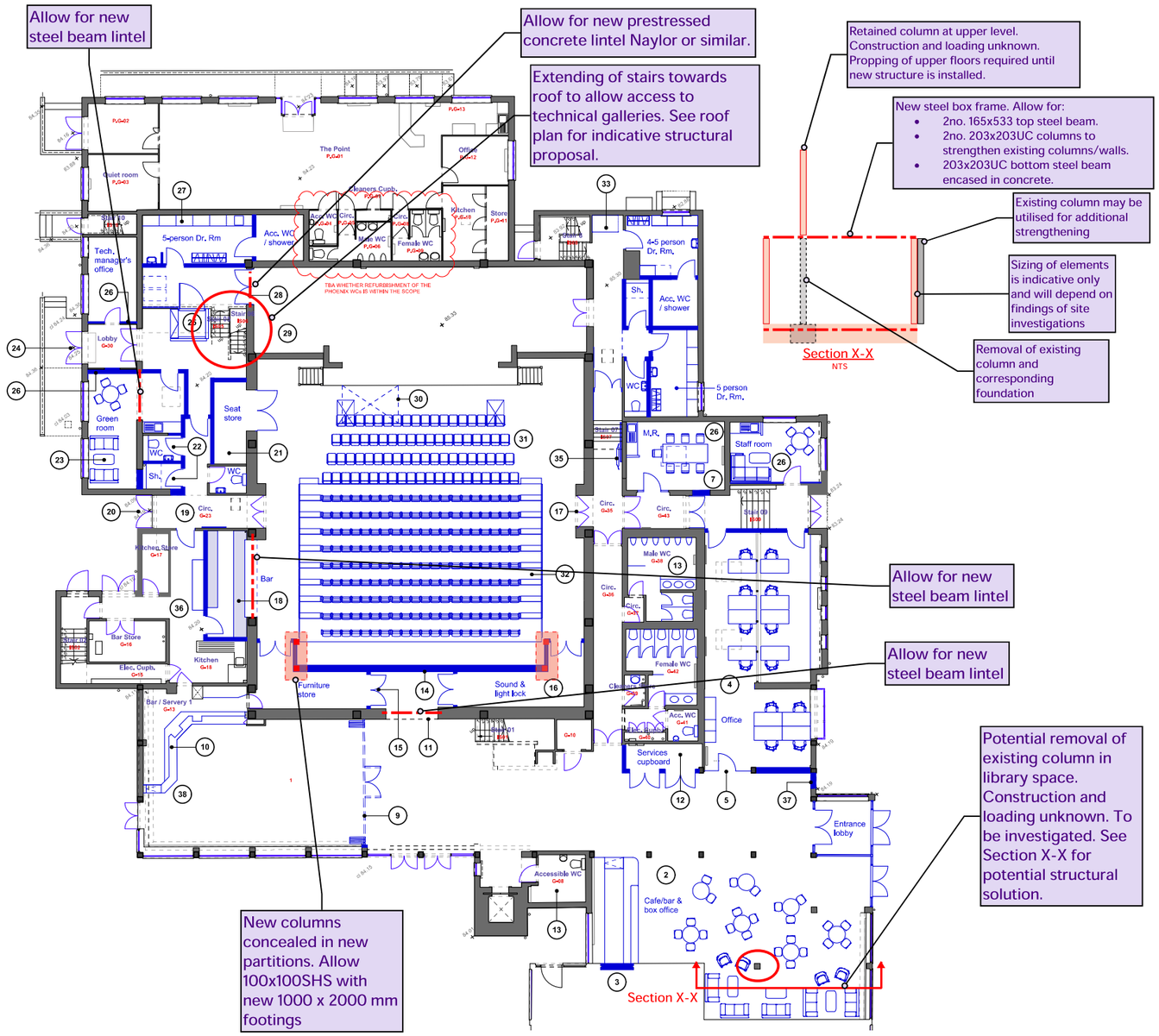
Proposed Structural Works

- Allow £3500 +VAT fee for investigation of existing structure in library area to evaluate potential removal of existing column
- Box frame steel structure to re-support upper floors of library following removal of existing column at ground floor.
- Allow for pre-camber of new box frame
- 4no. columns at ground floor to support mezzanine floor over. New footings to each column.

Assumptions

- Existing masonry wall surrounding main theatre space can sufficiently support additional loading from mezzanine and technical galleries
- Ground floor slab is insufficient to support new loads from column and thus, new footings are required. This can be verified through further geotechnical testing.
- Existing columns/walls are present within library space and can be reused to support new structure in this space

New structure
Existing structure



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Rev	Date	Amendment	Dra	Rev	App
B	23/05/2025	Costing	AM	RC	RC
A	19/05/2025	Costing	AM	RC	RC

S2
Suitable for Information

The Harlington, Fleet
SDE2035

Mezzanine Floor Plan - Initial Costing

Drawn	Status
AM	Costing
Reviewed	**Date**
RC	23/05/2025
Approved	**Scale**
RC	NTS

Project	Orig	Vol	Lev	Typ	Rol	No	Status	Rev
2035	SDE	00	M1	SK	S	1102	S2	B

4th Floor, 1 Throgmorton Avenue
London, EC2N 2JJ
sd-engineers.com
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Proposed Structural Works

- New timber floor joists supported on existing steel grillage to form new technical galleries
- Strengthening of existing primary beam positioned across stage with additional steel elements or entirely new steel beam
- New padstone / steel spreader beam to support primary beam at both ends on existing brick piers
- New timber floor joists to form mezzanine to rear of auditorium space supported on steel edge beams and steel columns

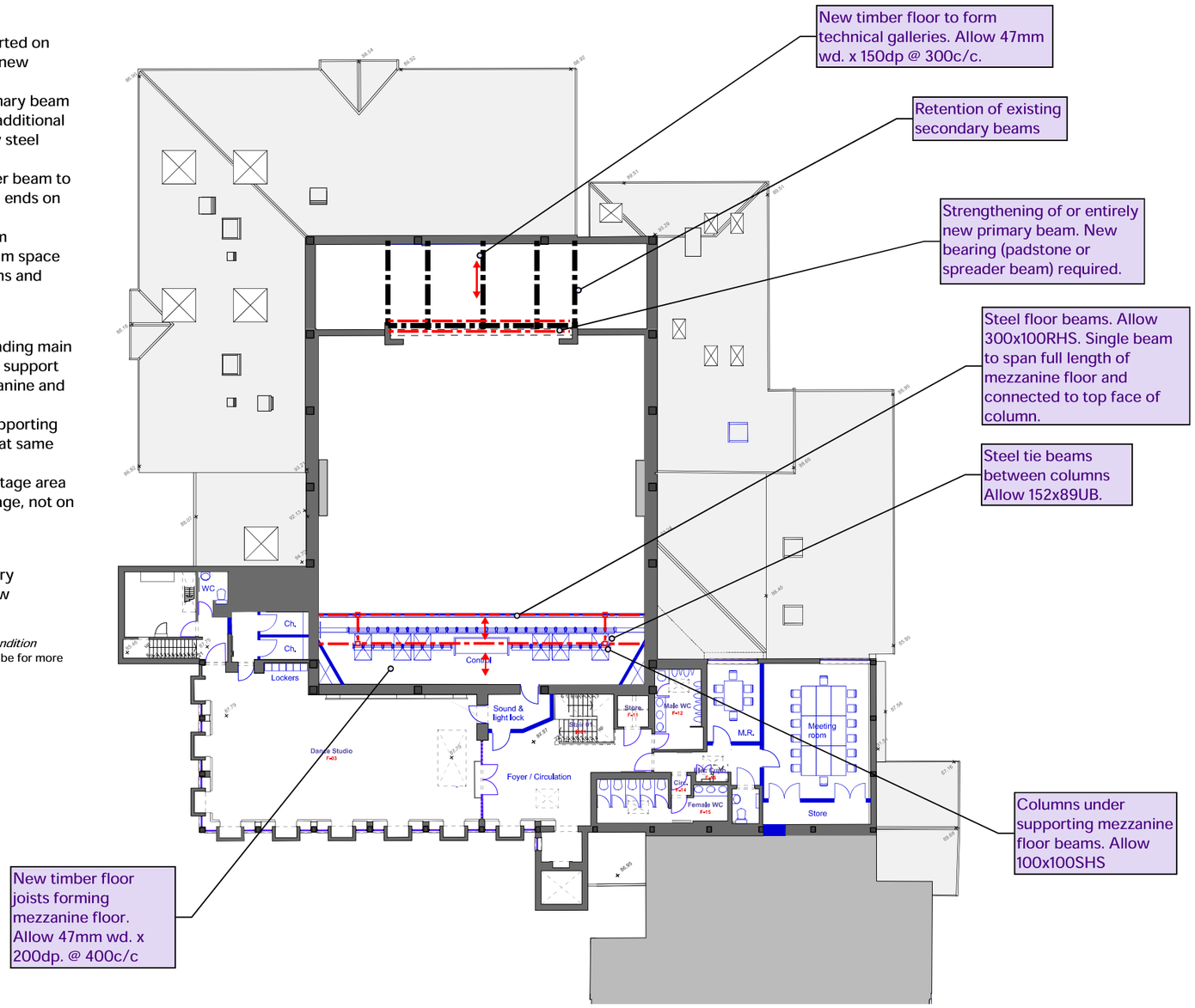
Assumptions

- Existing masonry wall surrounding main theatre space can sufficiently support additional loading from mezzanine and technical galleries
- Existing beam grillage and supporting beam across stage to remain at same level as existing.
- Overhead lighting rig within stage area to be supported on steel grillage, not on timber roof joists.

Remedial works

- Make good to existing masonry following the formation of new openings

This list is not exhaustive. Please refer to *Full Condition Survey*, January 2020 from Cooper & Withycombe for more information.



New structure
Existing structure

Notes

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2. Contact SD Engineers in the event of any discrepancies between findings on site and these drawings.
3. Drawing is to be read in conjunction with the SD Engineer's Specification and General Notes.
4. 3D views are indicative only and conflicting 2D information should take precedence. If in doubt contact SD Engineers prior to starting works.

Rev	Date	Amendment	Dra	Rev	App
B	23/05/2025	Costing	AM	RC	RC
A	19/05/2025	Costing	AM	RC	RC

S2
Suitable for Information

The Harlington, Fleet
SDE2035

Roof Plan - Initial Costing

Drawn AM	Status Information
Reviewed RC	Date 23/05/2025
Approved RC	Scale NTS

2035-SDE- 00- RF- SK- S- 1103 S2 B
Project Orig Vol Lev Typ Rol No Status Rev

4th Floor, 1 Throgmorton Avenue
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Proposed Structural Works

- Removal of existing joists & replacement with new 75wd x 250dp. C24 timber joists @ 300c/c
- Retention of existing laminated timber roof beams with strengthening works in the form of cables / struts / intermediate steel beam supports. 1.2m depth of new truss structure from underside of laminated timber beam to top of bottom steel element.
- Potential pre-camber of new steel elements
- Retention of existing timber posts supporting timber roof beams
- New short spanning steel beams above auditorium space to support new overhead lighting rig system
- New steel trimming out at eaves level to form void for upward extension of existing stairs

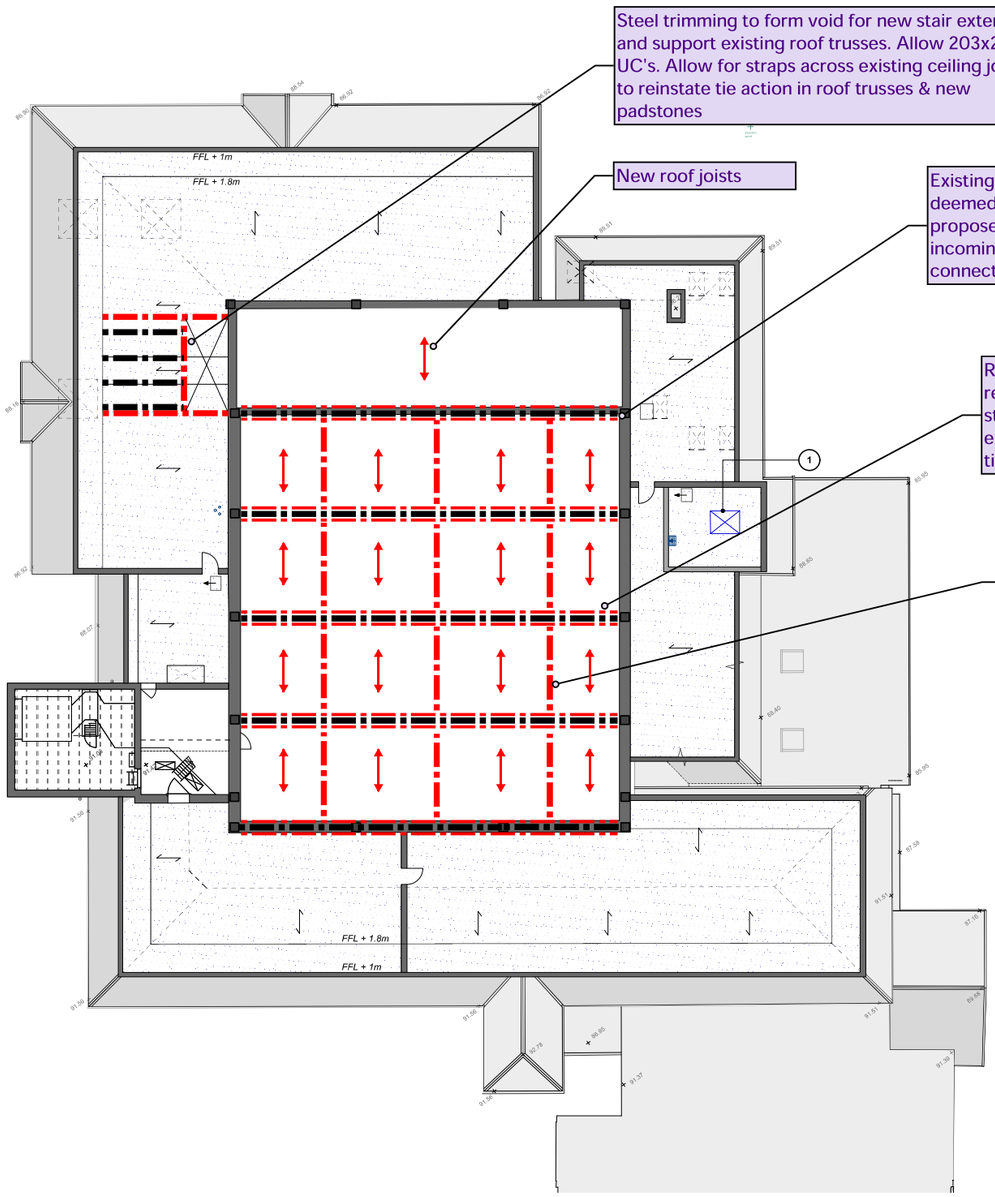
Assumptions

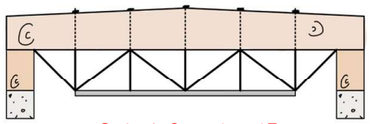
- New plant is contained within roof area directly above auditorium space i.e. no plant is proposed to be located in roof area above stage area
- Plant loading assumed to be 1.50kN/m^2 (dead)
- Roof joists designed for 6mm deflection limit as per requirements for plant equipment
- Loadings for the proposed overhead lighting rig have been extracted from *Structural Loading - Initial Information*, April 2025 from CharcoalBlue. Layout & positioning of fixings have been assumed.
- Overhead lighting rig within stage area to be supported on steel grillage, not on timber roof joists.
- Existing woodwall slabs are sufficient to support new insulation layer such that new structure/strengthening is not required.

Remedial works

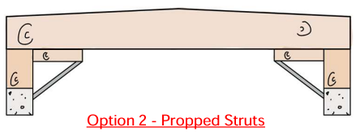
- Checking / delamination of laminated timber roof beams to be addressed
- Reinstate connections of roof beams to timber posts
- Remedial works to woodwool slabs to allow installation of new insulation over

This list is not exhaustive. Please refer to *Full Condition Survey*, January 2020 from Cooper & Withycombe for more information.





Option 1 - Strengthened Truss



Option 2 - Propped Struts

New structure
Existing structure

Option 2 – Structural & Civil Upgrades

1. Overview – Structural

Refer to the following drawings for details of structural modifications associated with Option 1:

- 2035-SDE-00-GF-SK-S-1201 – GF
- 2035-SDE-00-M1-SK-S-1202 – Mezz
- 2035-SDE-00-RF-SK-S-1203 - Roof

It should be noted that a series of assumptions have been made in the preparation of the structural proposals and are included in the drawings, accordingly.

The roof strengthening proposed as part of the Option 2 scheme involves the demolition of the existing laminated timber roof beams and their replacement in the form of new-build steel trusses. This proposal is outlined separately in the report found in Appendix A. The number of trusses required is to be confirmed at the later design stage with a key driver to reduce the depth of the trusses as much as possible.

As with Option 1, new roof joists and secondary steel structures are required to support the new overhead rigging system and plant equipment positioned on the roof.

Option 2 proposes a new balcony seating area, wrapping around the rear perimeter of the auditorium. The edge of this mezzanine floor will be supported by tension elements hung from the new steel trusses at roof level. This structural arrangement is anticipated to will require underpinning of the existing foundations around the perimeter of the auditorium. Alternatively, the balcony can be supported on a series of columns, similarly to that shown in Option 1, bearing on the ground floor slab. These columns which will require new foundations but are likely to avoid the need for underpinning of the existing foundations.

The existing ‘wraparound’ structures will also require modifications at roof level ranging from entirely new roof structures within the eastern region of the site to strengthening works to the south of the site. This is in response to new dormer additions, placement of PV panels and upward extensions of the existing annex buildings.

Within the southern and eastern areas of the building, it is proposed that existing loadbearing elements – columns and walls - are removed to allow for new space types and improved flexibility of certain spaces. This will require strengthening works in some areas such as the existing library and new structural framing in other areas. This will be in the form of new steel beams and columns, where possible. However, further structural investigations may reveal that reinforced concrete elements are better suited for the strengthening of the existing structure.

The removal of the masonry piers on either side of the stage requires a new proscenium beam and, in turn, new steel beams above the stage to support the overhead rigging equipment.

2. Overview – Civil

As outlined in Option 1, the existing foul water sewer and surface water network will require upgrading to support the proposed development. All other requirements identified previously remain applicable to Option 2.