Science & Industry Museum
Gantry Restoration

Gantry Restoration
Design & Access Statement
September 2023

Version history

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Contents

1.0 Introduction 4

1.1 Executive Summary 5
1.2 Background 5
1.3 Overview of Works 5
1.4 Purpose 5
1.5 Limitations 5
1.6 Exclusions 5
1.7 Other Specialist Reports 5
1.8 Drawings and Other Documents 5
1.9 Acknowledgements 5
1.10 Application and Project Team 5

2.0 Background & Context 7

2.1 Location 8
2.2 The Gantry 9
2.3 Heritage and History 10
2.4 Historic Images 11
2.5 Key External Views 13
2.6 Gantry photographs from 2009 15
2.7 Planning Context 16
2.8 Listing Description 16
2.9 Heritage Assessment 16
2.10 Asset Form 16

3.0 Summary of findings 17

3.1 Current Condition 18

4.0 Surveys 20

4.1 Paint Analysis 21
4.2 Metal Testing 22

5.0 Conservation Approach 23

5.1 Gantry Conservation Philosophy 24
5.2 General Considerations 24
5.3 Painting 24
5.4 Previous Repairs 24
5.5 Additional Interventions 24
5.6 Approach for Secondary Items 24

6.0 Proposals 25

6.1 Improvements 26
6.2 Photographs of the existing interface with the Power Hall 27
6.3 Proposed details of the interface with the Power Hall and Gantry South Beam 28
6.4 Proposed details of bird prevention netting 29
6.5 Access and Maintenance 29
6.6 Schedule of Works 31

7.0 Summary 32

1.0

Introduction

1.0 Introduction

1.1 Executive Summary

1.1.1 The statement has been prepared by Buttress Architects Ltd on behalf of the Science & Industry Museum (SIM). It explains our response to the work that is required to repair and restore the Gantry. It has been prepared in line with the guidance document 'Design and Access Statements: How to Write, Read and Use Them,' published by CABE.

1.2 Background

1.2.1 Buttress Architects have been commissioned by the Science Museum Group (SMG) to deliver the Gantry Restoration.

1.2.2 This report focuses on the **Gantry restoration only** however, there is focused interfacing with the Grade II listed Power Hall to the south side of the Gantry.

1.2.3 Following a RIBA Stage 2 technical report, Buttress Architects have been commissioned along side Structural Engineers from Buro Happold to further develop and prepare designs and specifications for the following:

- To undertake necessary conservation and restoration works across the Gantry in its current configuration.
- Redecoration of the existing Gantry.
- Removal of existing redundant services.
- Improve weatherings and flashings.

1.3 Overview of Works

1.3.1 The brief from the client is to conserve and restore the Gantry which will remain as a static exhibit within the Upper Yard. The current protective coatings to the Gantry have failed across many locations, which has led to widespread corrosion and degradation of the structure.

1.3.2 The Gantry is now at a point in its existence, where extensive conservation and restoration works are now necessary to stop the progressive deterioration and corrosion of the superstructure and safeguard its future, for people to enjoy for years to come.

1.4 Purpose

1.4.1 Buttress Architects have prepared this Design & Access statement to support a Listed Building application for the Gantry restoration.

1.4.2 Authorship

1.4.3 The report has been prepared by Emily Green, Architect, BA (Hons), MArch under the direction of Alex Scrimshaw Associate Technologist BSc (Hons), MCIAT, CIAT-Accredited Conservationist with Buttress Architects Ltd.

1.5 Limitations

1.5.1 The report is based on inspections made from ground level, floor levels and other accessible vantage points by mewp.

1.5.2 Inspections were undertaken of those areas only where access was available. These were entirely visual and sufficient only to give an impression of the condition of the fabric.

1.5.3 Unless otherwise stated the inspection(s) were purely visual and no enclosed spaces or inaccessible parts have been opened up for inspection.

1.5.4 The report indicates the current condition of the asset at the time of survey. It does not purport to be wholly comprehensive but to indicate the principal areas of concern. It is a report on the condition and the recommendations contained herein are not intended to be a specification for repair and must not be used for such purposes. Any repairs carried out should be based on full specification following further investigation of the items contained within the report.

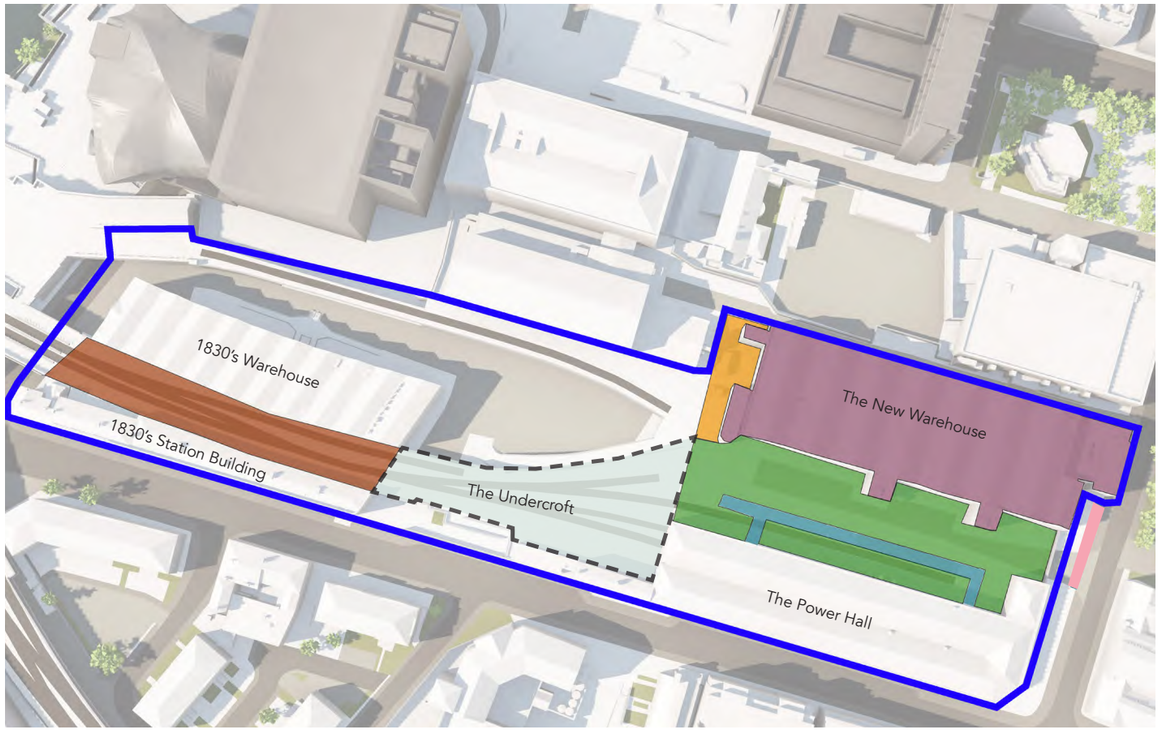
1.5.5 It is of paramount importance that any repairs are correctly carried out based on professional advice. Insensitive repairs, even correctly carried out, can easily destroy the architectural character of a building and inappropriate solutions to defects may prove unsatisfactory in the long term or in some cases aggravate the problem.

1.6 Exclusions

1.6.1 This report excludes any external works across the Power Hall and Upper Yard unless otherwise stated.

1.7 Other Specialist Reports

1.7.1 Buro Happold have been appointed to carry out a Structural report developing through RIBA Stages. The RIBA Stage 3 reports can be found appended to this document.



1.8 Drawings and Other Documents

1.8.1 The drawings contained within this report and used during the surveys are based on information provided by the client and/or sourced from archival resources.

1.8.2 Any diagrams and illustrations provided are for information

1.9 Acknowledgements

1.9.1 Buttress gratefully acknowledges the assistance provided by the SIM site staff.

1.10 Application and Project Team

Science and Industry Museum

Applicant and Client

SIM Capital Projects

- SIM Ownership Boundary
- New Warehouse roof & fabric repairs
- Upper Yard
- Gantry
- Special Exhibitions Gallery (SEG)
- 1830's Viaduct
- Site entrance bollards & barriers

Buttress

Lead Consultant, Architects, Heritage Consultants

Buro Happold

Structural Engineers

Appleyard & Trew

Quantity Surveyors

Deloitte

Planning Consultant

Keelagher Okey Klein

Principal Designer

2.0

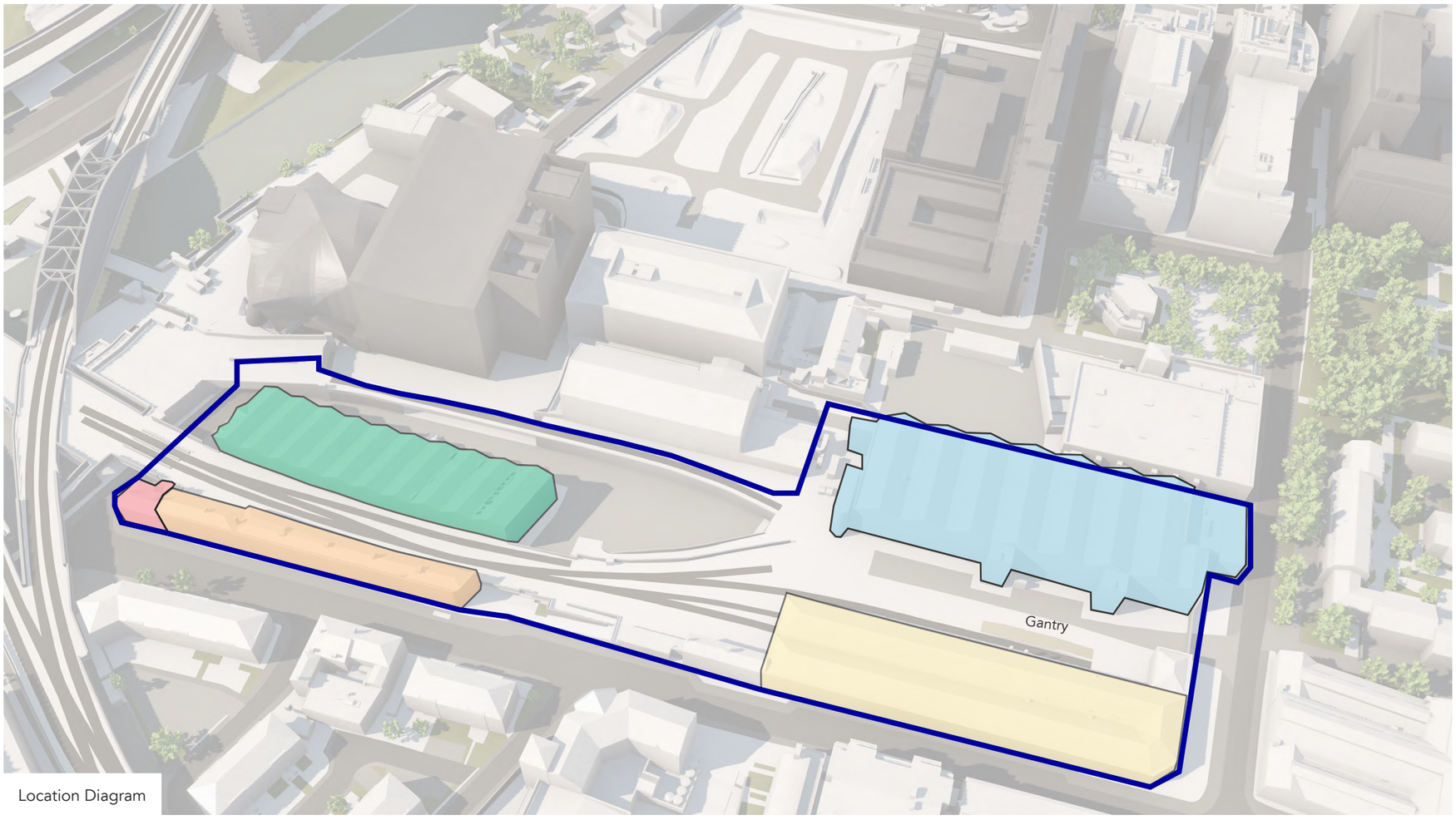
Background & Context

2.0 Background & Context

2.1 Location

2.1.1 The Science and Industry Museum is located to the north-west of central Manchester, to the east of the River Irwell and within the Castlefield Conservation Area and Castlefield Urban Heritage Park. The Science and Industry Museum includes a number of Grade I and II listed buildings and structures.

2.1.2 This report focuses on the Gantry Restoration. The site is within close proximity to Deansgate, Spinningfields and the Castlefield Basin. The site is well connected with Deansgate train station and Metrolink approximately 550m away.



Location Diagram

Key

- SIM Ownership Boundary
- The 1830's Warehouse
- The Liverpool Road 1830's Station Building
- The Station Masters House
- The New Warehouse
- The Power Hall

2.2 The Gantry

2.2.1 The Gantry is attached to / embedded and directly interfaces with the north elevation of the Power Hall which is Grade II Listed. Although this is not formally mentioned within the official listing - it was constructed around the same time and sits within the curtilage of two Grade II Listed Buildings.













2.3 Heritage and History

2.3.1 The history of overhead cranes

2.3.2 The earliest powered overhead crane was McNicoll and Vernon's Patent Steam Travelling Crane introduced 1858. In 1861, John Ramsbottom oversaw the construction of an overhead steam crane at L&NWR's Crewe Works.1 The first electrically powered overhead cranes were developed by Ludwig Stuckenholz in 1887.

2.3.3 The shipping shed

2.3.4 What is now the Power Hall of the Science and Industry Museum was built as the new shipping shed at Liverpool Road Goods Station in 1855 to speed up the transhipment of goods. The building was designed for freight transfer: produce and goods could be quickly unloaded from railway wagons, then collected by delivery drivers for distribution by road across the city. Goods from across the world were transferred from rail to road transport and out across the North-West, using innovative machinery like the gantry crane.

2.3.5 The gantry crane

2.3.6 The gantry was erected during 1889. It runs almost the entire length of the shipping shed (Power Hall) and was built to support two 10-ton travelling cranes operating on two moving bridges of twin fish-bellied spans. This type of overhead travelling crane was used in various industrial applications such as foundries, boiler shops, or any factory, workshop or goods yard where it is necessary to frequently move heavy loads over a large area. There were commonly referred to as "travellers". When the gantry was built, the land was excavated 12cm deep, the eighteen column foundations made of concrete.

2.3.7 Power source

2.3.8 The gantry's motive power was originally from 'crab' steam engines with that travelled along with the crane. Overhead gantry cranes with their own vertical boilers were commonplace on outdoor and machine shop gantries where the smoke and steam could dissipate, but not very popular with workers underneath as they shuffled up and down dropping cinders. D.H.F Meacock in his 1912 review of Liverpool Road operations for Railway Magazine reported that there were two overhead steam powered travelling transporter cranes with 10-ton capacity each. Meacock noted that the cranes covered two roads each of 16 wagon lengths and that they could be connected simply using a steel bar to increase lifting capacity to 20 tons.5 The hoists would have been converted to electricity in about the 1920s.

-Sarah Baines, Curator of Engineering, SIM 23/11/2018

2.4 Historic Images



Liverpool Road Station Progress shots - We believe that the remnant framing structure from the Gantry was in fact this cabin to the underside of the eastern travelling crane



The Gantry in 1950



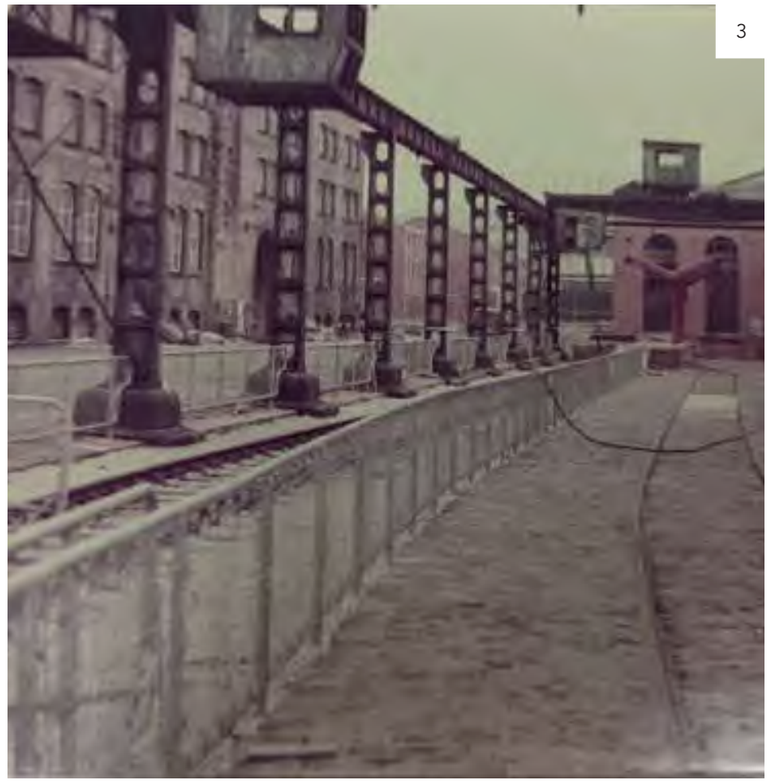
Liverpool Road Station Progress shots



1



2



3



4



5

1. The Gantry 1994
2. The Gantry 1993
3. The Gantry 1993
4. The Gantry 1993
5. The Gantry 1993

2.5 Key External Views



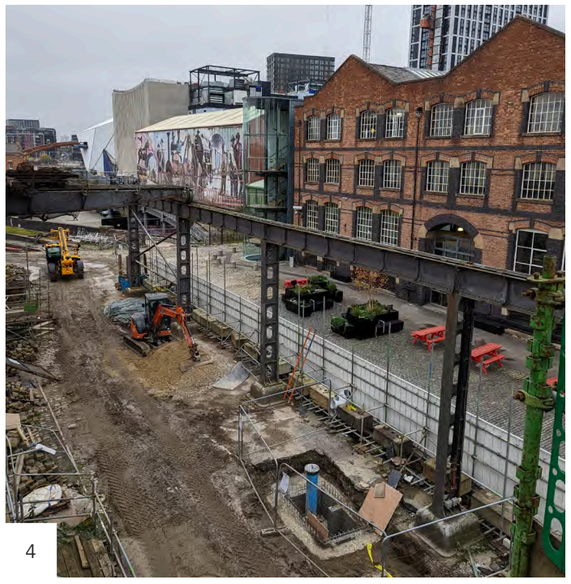
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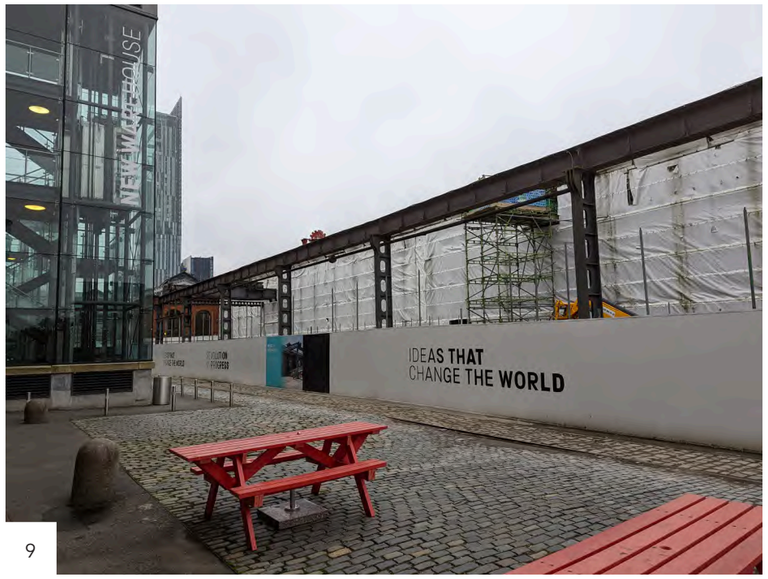


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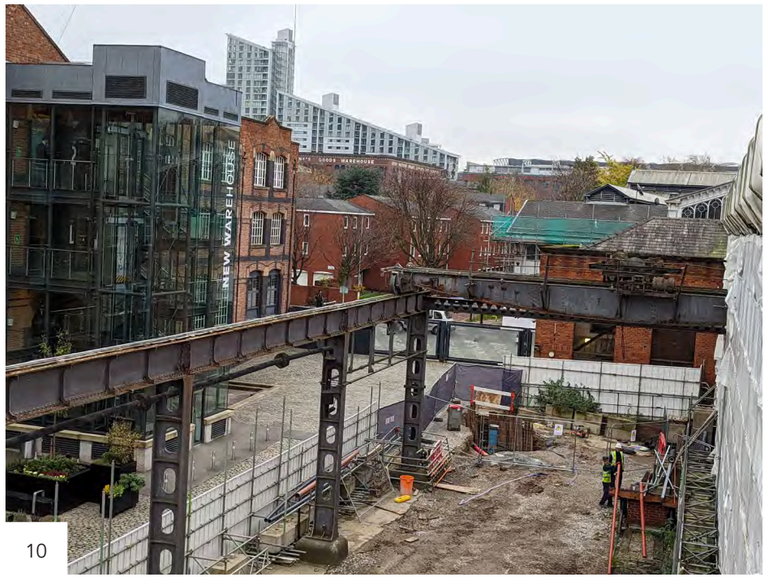


8

1. East end of the Gantry
2. Gantry with the New Warehouse behind
3. View looking west of the Gantry within the Power Hall site boundary
4. View from the Power Hall scaffold showing the Gantry below
5. The Gantry meeting the Power Hall - taken from the scaffold
6. View of the Gantry at ground level within the Power Hall site boundary
7. View through the cast iron columns of the Gantry
8. Typical plinth base to the Gantry



9



10



12



11

9. View of the Gantry from the Upper Yard
10. Eastern view of the Gantry from the Power Hall scaffold
11. View looking east of the Gantry at ground level within the Power Hall site boundary
12. Example of corrosion at high level

2.6 Gantry photographs from 2009







2.7 Planning Context

2.7.1 124421/FO/2019 | Erection of a temporary enclosure (roof, scaffold wrap and hoarding to the vertical elevations), and an internal crash deck, to provide protection of the fabric and interior of the Power Hall and Gantry. | Power Hall & Gantry Science And Industry Museum Liverpool Road Manchester M3 4FP

2.7.2 124422/LO/2019 | Listed Building Consent for the erection of a temporary enclosure (roof, scaffold wrap and hoarding to the vertical elevations), and an internal crash deck, to provide protection of the fabric and interior of the Power Hall and Gantry. | Power Hall & Gantry Museum Of Science And Industry Liverpool Road Manchester M3 4FP

2.7.3 105307/2014 Installation of a vinyl graphic internally to the large window on the corner of the east elevation of the Power Hall building.

2.7.4 LISTED BUILDING CONSENT - For the removal of existing vinyl graphics applied to the glazed entrance doors, and installation of a new vinyl graphic to the glazing panel above the entrance doors.

2.7.5 LISTED BUILDING CONSENT - for the installation of a vinyl graphic internally to the large window on the corner of the east elevation of the Power Hall building.

2.7.6 105303/2014 Installation of a new vinyl graphic to the glazing panel above the entrance doors, following the removal of existing vinyl graphics applied to the glazed entrance doors.

2.7.7 104988/ 2014 LISTED BUILDING CONSENT - for the removal of existing signage at main entrance, and the installation of 2no. individual letter fascia signs and 2no. banner signs.

2.7.8 104984/2014 Installation of 2no. individual letter fascia signs and 2no. banner signs, following the removal of the existing signage at the main entrance.

2.7.9 091271/2009 LISTED BUILDING CONSENT Installation of a new steam boiler adjacent to existing mechanical and electrical equipment within the south-west corner of the power hall including flue and vent at roof level.

2.7.10 103464/LO/2013/C1 LISTED BUILDING CONSENT for the reinstatement of north elevation masonry of the Power Hall, and associated works, including the erection of a retaining wall and hard landscaping, following the demolition of existing 2 storey Visitor Services block.

2.8 Listing Description

2.8.1 **Heritage Category:** Listed Building

2.8.2 **Grade:** II

2.8.3 **List Entry Number:** 1291458

2.8.4 Date first listed: 06-Jun-1994

2.8.5 **List Entry Name:**

2.8.6 POWER HALL OF MUSEUM OF SCIENCE AND INDUSTRY

2.8.7 **Statutory Address 1:** POWER HALL OF MUSEUM OF SCIENCE AND INDUSTRY, LIVERPOOL ROAD

2.8.8 **Location**

2.8.9 **Statutory Address:** POWER HALL OF MUSEUM OF SCIENCE AND INDUSTRY, LIVERPOOL ROAD

2.8.10 **The building or site itself may lie within the boundary of more than one authority.**

2.8.11 **District:** Manchester (Metropolitan Authority)

2.8.12 **Parish:** Non Civil Parish

2.8.13 **National Grid Reference:** SJ 83155 97820

2.8.14 **Details**

2.8.15 This list entry was subject to a Minor Amendment on 15/11/2016

2.8.16 SJ8397NW 698-1/30/218

2.8.17 MANCHESTER LIVERPOOL ROAD (North side) Power Hall of Museum of Science and Industry

2.8.18 GV II Railway goods transfer shed, now museum exhibition hall. 1855, for London and North Western Railway. Red brick with some sandstone dressings, hipped slate roof. Very long rectangular plan parallel to street, with wide splayed corner and short return to Lower Byrom Street. Single storey, 6:7:4 blind windows with wagon entrances between these groups and another in the splayed corner; round-headed blind windows with stepped surrounds and raised stone sills, large square-headed wagon doorways with flat-arched heads and stone fenders at the bases of the jambs (formerly furnished with sliding wooden doors but now glazed); continuous brick frieze with simplified corbel table and white brick band, brick parapet with stone coping. Three-bay return side similar.

2.8.19 Includes offices at the W end with four pairs of arched windows with keystones and shared stone sills to each of the two storeys, which are separated by a dentillated string course (formerly eaves, prior to the addition of the first floor). Rubbed-brick arched doorway on Liverpool Road with stone open pediment above retains timber double doors and later fanlight. Four-pane timber sash windows to front and rear elevation (some to rear altered during conversion to museum). Modillioned timber box gutter, central four-pot chimney stack and two-pot end stack. Rear (N) wall has carriage stones at each corner. Office interior said to retain fireplaces and cornices.

2.8.20 Listing NGR: SJ8315597820

2.9 Heritage Assessment

2.9.1 Conclusion and Justification Statement

2.9.1.1 The below is an extract from the Heritage Assessment by Buttress Architects Heritage Consultancy Team, the full document is included within the application:

2.9.1.2 The proposals will result in a significant enhancement to the condition of the Power Hall and Gantry, serving to provide essential upgrades and fabric repairs, securing its future for years to come.

2.9.1.3 The scheme will respond appropriately and sensitively to the character and fabric of the Grade II listed asset with minimal visual impact to the museum estate, whilst also providing numerous benefits to the building. Where negligible harm may occur, this will be outweighed by the following benefits, in accordance with Para 202 of Chapter 16 of the NPPF:

- *Building fabric repaired including structural enhancements.*
- *Aesthetic enhancement across the external appearance of the Gantry, resulting from the reinstatement of a more appropriate colour scheme and finish.*
- *New detailing to prevent future issues relating to water ingress, debris build up, and damage from nesting birds*

2.10 Asset Form

2.10.1 The Gantry is located to the eastern end of the museum estate and is positioned to the south of the Upper Yard, abutting the north wall of the Power Hall, with the New Warehouse to the north. It is understood to have been erected in the 1880s to facilitate underloading goods from train wagons.

2.10.2 The Gantry superstructure is approximately 15m wide x 72m long, consisting of two rows of nine columns with longitudinal beams running between the column heads, extending east to west. These beams support two paired crane beams which when operational, were able to transition along the length of the railway tracks below. Affixed to the beams were metal framed timber clad cabins, two per travelling crane with a cabin sat on top and a cabin positioned to the underside.

2.10.3 The southern columns abut and in some instances are embedded into the north masonry wall of the Power Hall. The beam sits off the masonry wall by approximately 75-100mm.

2.10.4 The columns sit upon large protruding ferrous bases, which are understood to sit upon a deep masonry foundation.

2.10.5 The cabins or framing members no longer exist, presumably removed due to poor condition and dilapidation during the mid-1980s.

2.10.6 Heavy duty thick gauge bird preventative and/or debris catchment netting has been installed across the southern beam.

3.0

Summary of findings

3.0 Summary of findings

3.1 Current Condition

3.1.1 Buttress Architects and the design team obtained access to the Power Hall site in November 2022 to inspect the Gantry at ground level and via the access scaffolding which was erected around the Power Hall for the purposes of a re-roofing project.

3.1.2 This allowed Buttress and other members of the design team to carry out a high-level inspection of the Gantry in its current condition and assess what further surveys and investigations may be needed. The scaffold only facilitated access along the north wall of the PH, the provision of the scaffolding members and layout did limit visibility of the Gantry within areas.

3.1.3 The access provided allowed only partial close-up inspection of elements and components across the Gantry at the level with the primary beam to the south, which sits in close proximity with the north wall of the Power Hall.

3.1.4 The beam is set off the masonry wall by approximately 75mm, though this distance reduces in areas. A strip of mesh has been placed on the top and bottom to presumably close the gap to potential wildlife entry, this includes the provision of a nylon net fixed across the front face of the beam, again likely a bird deterrent. A thick layer of guano and detritus was spread across the top surface.

3.1.5 There was evidence of soft vegetation growth to the back side of the beam with areas of the masonry soiled with open defective mortar joints.

3.1.6 The top surface of the beam and flat ledges and surfaces are all susceptible to ponding, leading to the process of freeze/ thaw cycle, which is likely exacerbating corrosion.

3.1.7 The current detail and placement of the gantry, particularly the columns and beams to the south side have been positioned too close to the Power Hall. This has restricted access to undertake cyclical maintenance tasks to the rear side, as access is simply not possible. This has led to previously protective coatings being lost, resulting in extensive corrosion within an area that is inaccessible without dismantling key elements and features.

3.1.8 Fast forward to May 2023 and Buttress Architects accompanied Buro Happold to undertake a detailed MEWP-assisted high-level survey of the Gantry superstructure. Buro Happold led the survey as the conservation and restoration project has a strong structural emphasis. The following bullet points summerise the findings of the condition survey by Buro Happold Surveys.



Figure 2-1 extracted from Buro Happolds Gantry Conservation Philosophy Document

3.1.9 The Gantry superstructure is widely corroded due to failed paint coatings. The severity of corrosion varies. In some places the level of corrosion is judged to have led to a reduction in structural capacity. In other areas corrosion may be less significant, but unless addressed will lead to future problems. See Figure 2-1 for examples.

3.1.10

- A high-build paint finish, thought to be micaceous iron oxide containing, has been applied to visual surfaces, but this has now failed in several locations. Inaccessible areas such as the rear face of the southern columns and beams do not appear to have been coated.
- Gantry columns and plinth bases appear to be in good condition throughout, although there is some evidence of localised failure of paint finishes and associated minor corrosion.
- There is evidence of previous repair work in several locations across the Gantry. These are visually obvious and would not necessarily be considered best practice by modern conservation standards due to the use of face-welded plates.
- Longitudinal Gantry beams show widespread evidence of corrosion, ranging from minor surface corrosion to localised severe corrosion and loss of structural capacity. Corrosion can generally be grouped into 3 types:

  - Southern face of south beams. Severe corrosion of the top and bottom flanges has reduced the section width by up to 50mm.

  - Lower part of beam web, at stiffener/column head locations – south and north. These areas appear to have trapped water leading to moderate/severe corrosion in most instances along the length of the beams.

  - Top face of the beams – south and north. Moderate/severe corrosion is present across the Gantry in these locations, particularly affecting the rail section which allows movement of the crane beams.
- The 4 no. crane beams also show widespread corrosion, ranging from minor to localised severe cases, which can be categorised into 3 types:

  - Moderate/severe corrosion to the lower section of the beams along their full length. Similar to the Gantry beams this typically affects the angle which connects the web to the bottom flange, but also includes corrosion of the web and flange themselves.

  - Minor/moderate corrosion to the beam webs – particularly affecting the outside faces of beams 2 and 3.

  - Moderate severe corrosion to the top face of beams, with details as per the Gantry beams.
- The crane beams host several secondary structures including balustrades and lifting gear. Balustrades are typically in poor condition due to deformation and corrosion. The lifting gear appears to be sound, but with widespread minor corrosion. As the gear supports cabled hooks etc, it is suggested that this apparatus is inspected by a cranage specialist subcontractor who can advise on how best to preserve and make safe the gear.
- It is apparent that changes have been made to the Gantry over time. These include alterations to the bracing to the north row of columns, the addition of secondary structures and the removal/addition of transverse beams.

4.0

Surveys

4.0 Surveys

4.1 Paint Analysis

4.1.1 Crick Smith were commissioned to carry out a historic paint research and analysis report in August 2020. This will aid the specification for redecoration of the Gantry.

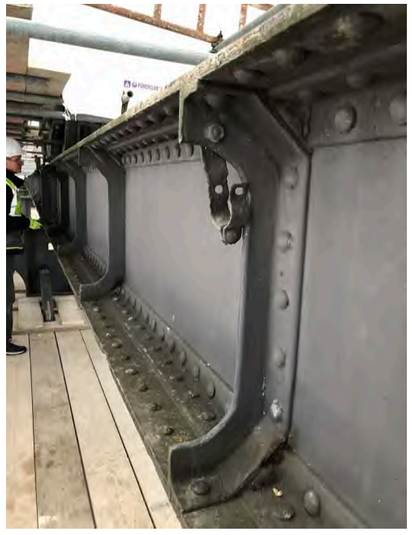
4.1.2 The extract adjacent shows the sampling and descriptions of layers found on the Gantry.

4.1.3 Similarly, the history of paint types and colours applied to the Crane/Gantry is also interesting. The whole structure has always been painted in a single colour as one would expect. The early and most significant phase of schemes, again continues up to scheme 8. Unlike the more recent grey oil paints, the earlier decorations were in very similar, but slightly differing red/brown lead oil paints. These colours being commonly used on industrial sites. The current grey appearing in later schemes but having no historic precedent for the original and earlier period of the structure.- Extract taken from the Crick Smith report.

4.1.4 Further discussions are to be carried out with the client with respect to paint colour proposals.

Scheme chart recording the paint schemes and history, surviving at the Power Hall and on the Crane Gantry at the MoSI, Manchester

Element / Scheme details	Rainwater goods generally	Large cast iron columns	Cast iron column 'capitals'	Iron straps and plates to beams (various)	Main roof timbers, beams etc (limewash traces)	Crane Gantry, representative of all areas sampled
11: extant 2020	Black oil paint over a grey undercoat	Black oil paint over a grey undercoat	Black oil paint over a grey undercoat	Black oil paint over a grey undercoat		Dark grey oil paint over a mid grey undercoat
10: Major refurb. RWG replaced, columns restored? 1980s?	Red lead oil paints	Red lead pigmented oil varnish	Mid cream lead oil paint	Disrupted schemes of various stone colour lead oil paints with varnish coats. Varnish was often applied to extend the life of the paint, particularly in harsh environmental conditions, such as seen here in train sheds	Traces of later stone colour limewashes, which are now heavily fragmented and lost from the majority of areas	Dark grey lead oil paint
9:	Evidence for surface rust but no traces of earlier finishes, RWG possibly replaced? The good condition of the cast iron and the nature of the few applied paint layers, indicates that these are twentieth century replacements	Extensive surface rust and pitting Evidence suggesting that any original paint has been lost and the surface oxidised, forming its own protective surface	Mid cream lead oil paint			Mid grey lead oil paint
8:			Pale pinky/cream lead oil paint with heavy surface dirt			Mid grey lead oil paint
7:			Warm pink/cream lead oil paint			There is a large phase of red/brown lead oil paints applied directly to the iron surfaces. A minimum of four schemes can be seen, there are possibly more
6:			Warm pink/cream lead oil paint			
5:			Warm pink/cream lead oil paint			
4:			Warm pink/cream lead oil paint			
3:			Pale cream stone colour lead oil paint		3 schemes of pale cream and very dirty limewashes. Applied directly to the timber indicating an original finish.	
2:			Mid stone colour lead oil paint			
1: Earliest evidence for paint schemes			Mid stone colour lead oil paint x 2			
Substrate	**Cast iron**	**Cast iron, heavily oxidised (rust)**	**Cast iron, no rust**	**Cast iron, some rust**	**Softwood but no surface dirt beneath paints**	**Iron possibly both cast and forged Date not known.**



All of the Crane Gantry samples showed the same surviving history or traces of, that tie in with the representative sample shown here.



DESCRIPTION OF LAYERS:

Modern grey lead undercoat with a dark grey top coat

A thin red lead primer, with a thick coat of aluminium in a dark varnish base as an additional primer.

There is then a dark grey lead oil paint top coat

This scheme repeats the previous decoration.

A move away from the earliest phase is this scheme of red lead primer with a mid grey undercoat and finish coat.
The surface of the scheme has extensive sooty deposits.

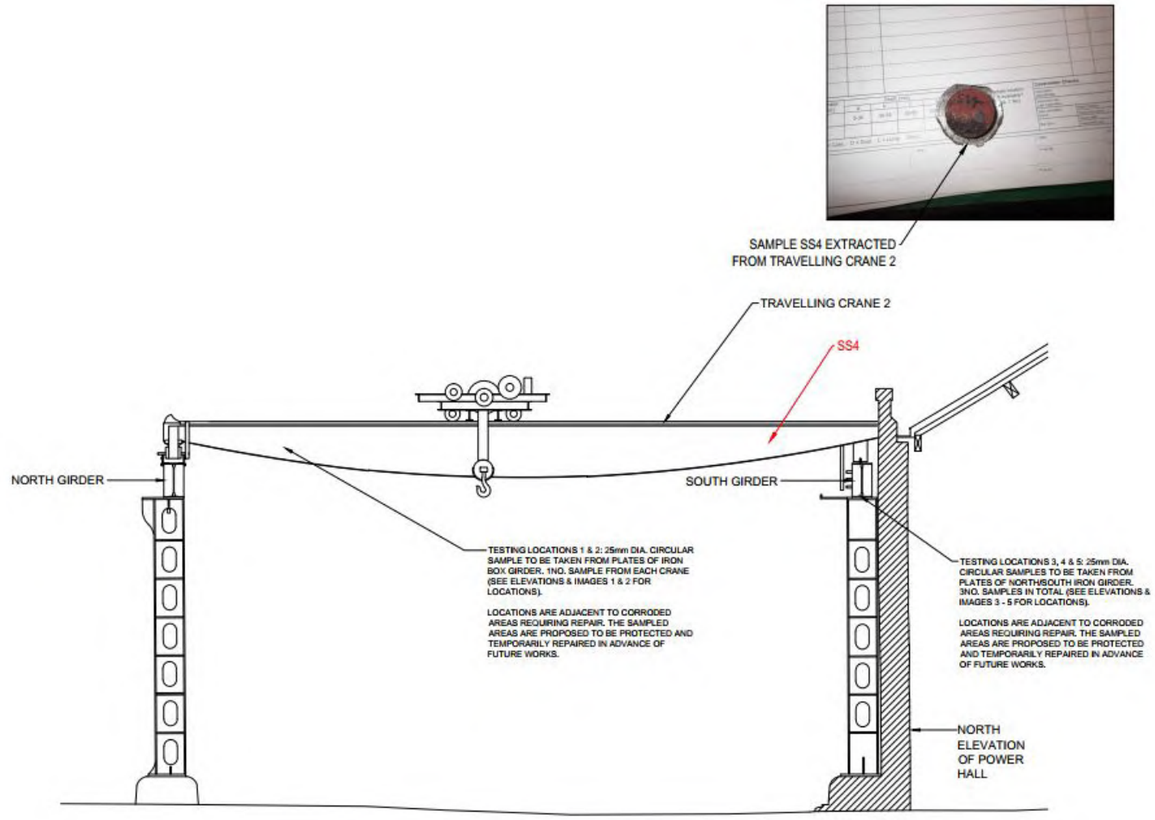
The earliest and highly significant paint schemes identified on the crane gantry all consist of this phase of at least 4 decorations. Each is virtually identical, in dark red/brown ochre and iron oxide pigmented lead oil paints.

Substrate iron, some mill scale

4.2 Metal Testing

4.2.1 RSK were appointed in 2021 to undertake metal testing analysis across the Power Hall and Gantry. Samples were taken across key features across metallurgical structure, which underwent laboratory testing.

4.2.2 The results are presented on the table below, directly extracted from the RSK report.



SECTION A-A - TYPICAL METAL TESTING LOCATIONS

Table 4.1 – Type of Materials & Tensile Strength & Material

RSK Ref.	Building	Element	Tensile Strength, N/mm²	Proof Stress (0.2%) N/mm²	Material
SS1	Power Hall	Flitch Beam	-	-	Wrought Iron
SS2a	Power Hall	Flitch Beam	360	239	
SS2b	Power Hall	Flitch Beam	-	-	
SS3a	Power Hall	Flitch Beam	385	277	
SS3b	Power Hall	Flitch Beam	-	-	
SS4	Gantry	Travelling Crane 2	-	-	Low Carbon Steel (contains ferrite & pearlite)
SS5	Gantry	South Girder	-	-	Low Carbon Steel (contains martensite & austenite)
SS6	Gantry	South Girder	-	-	
SS7	Gantry	North Girder	-	-	Low Carbon Steel (contains ferrite & pearlite)
SS8	Gantry	Travelling Crane 1	-	-	Low Carbon Steel (contains ferrite & austenite)

* Based on BS 4360: 1986

5.0

Conservation Approach

5.0 Conservation Approach

5.1 Gantry Conservation Philosophy

5.1.1 The following text has been extracted from the Buro Happold Gantry Conservation Philosophy Document:

5.2 General Considerations

5.2.1.1 The proposed conservation approach outlined in this document is based on the following principles and comments:

- *The Gantry superstructure is to be retained as a static historic exhibition, which no longer functions as a working*
- *piece of equipment. Note that this has been the case since the 1980s when the Gantry is understood to have last been in use.*
- *This assumption means that the structural requirements for the Gantry can be reduced considerably – the only relevant design loads being its own selfweight and wind/ snow loading. In use, the Gantry would have been subject to much larger loads from cranage and dynamic actions from moving loads.*
- *The intent is for the Gantry to be conserved in its current state, rather than be restored to a previous configuration or have historic changes or repairs reversed. This affects several items including reinstatement of timber cabins, changes to bracing layouts and 'sanitising' previous repair works. This approach is judged to be in keeping with best practice approach to conservation.*

5.3 Painting

5.3.1.1 A properly installed, appropriately specified paint finish is the Gantry structure's most important line of defence against corrosion and future decay. Failure of the current paint finish is the primary reason for the widespread corrosion present on the Gantry. It is understood that the last re-painting took place in the 1980's, and as such it is not surprising that the existing paint covering has failed. Properly applied paint finishes typically have a design life of 20-25years, meaning that the finish applied in the 1980's is c. 20 years beyond its anticipated design life. Paint sampling carried out for the Gantry shows that the 1980's finish was also applied directly over the top of the previous paint layers which was likely detrimental to its longevity.

5.3.1.2 To safeguard the Gantry superstructure against future deterioration a new paint coating is required. To achieve the

5.3.1.3 maximum design life and reduce the risk of failures it is proposed that this should be applied onto the prepared bare metal of the Gantry, rather than over existing coatings. Failure to properly prepare the surface is likely to have a detrimental effect on the life of any applied coating, and it is unlikely that an adequate warranty could be provided for coatings applied over existing paint finishes.

5.3.1.4 It is also important to note that due to the widespread corrosion heavy cleaning is unavoidable in multiple areas across the Gantry. At a minimum any existing corrosion needs to be fully removed before any painting takes place, either by grinding or by blast cleaning. If existing paint finishes were to be left in place away from areas of corrosion, this would create a mix of backgrounds for the new paint finish, which may present issues with consistency of finish and the issues noted previously regarding warranties and reduced design life.

5.3.1.5 Any proposed blast cleaning would be carried out with a blasting medium chosen to minimise damage to the underlying structural fabric – except for where corroded material is to be removed.

5.3.1.6 Based on BS EN ISO 12944-2 the gantry is considered to be in exposure class C3 (medium corrosivity - exterior, urban). A recommended coating specification for this environment would be as perr section 5.0 Proposals. This requires blast cleaning prior to a 3-coat finish being applied. This specification is proposed for the works, to achieve a coating design life of 25 years.

5.4 Previous Repairs

5.4.1.1 It is proposed that previous repairs are retained as part of the visual history of the Gantry structure. As there is no sign that these repairs are failing, there is no structural reason for their alteration.

5.4.1 New Repairs

5.4.1.1 Where repair works are judged to be required to safeguard the structural capacity and safety of the structure, these will be carried out to be to be visually unobtrusive and achieve a seamless repair which is not visible in the finished, painted structure.

5.4.1.2 The workflow is anticipated to be as follows:

1. *Remove heavily corroded metalwork back to competent material.*
2. *Fabricate infill section of metalwork, with material to match existing as closely as possible.*
3. *Weld replacement metal section to existing to achieve full structural continuity.*
4. *Grind/polish weld flush.*

5.4.1.3 An alternative conservation approach might call for repairs which are more 'readable' and are also reversible. This type of repair has been considered but ultimately judged to be less appropriate for the repairs required to the Gantry, with the following comments noted:

- *More 'readable' repairs would typically include additional or replacement steel plates, bolted to the superstructure. Bolt heads would be rounded to match the appearance of the existing rivets.*
- *Bolted repair options may be reversible, but they still require the existing fabric to be drilled to accommodate new bolts. The drilled holes are not reversible, so there is still permanent change to the existing fabric.*
- *Most alternative methods of repair are better suited to tying linear cracks through metalwork, whereas the primary corrosion issues present on the Gantry include patches of corrosion. Strapping or tying is less appropriate in these locations.*
- *Carbon fibre strengthening was discounted due to the technique being at odds with the character and construction of the existing structure.*
- *The addition of secondary structures to support areas of decay was considered but discounted as the visual impact of additional elements would detract significantly from the original structure, and are likely to be excessive for the level of repair required. Adding these elements would also require the same intrusive works as any other repairs – i.e. new bolt boles.*

5.5 Additional Interventions

5.5.1.1 Much of the current corrosion has been exacerbated by details within the design of the Gantry which cause water to pool at certain locations. Two specific interventions are proposed to address this:

- *New canopy to be installed to cover the southern Gantry beam to divert rainwater away from the superstructure. As the southern beam directly abuts the Power Hall's northern elevation applying coatings to the rear face is extremely challenging. This has led to widespread serious corrosion of the rear of the southern beam. Whilst it is judged that adequate structural capacity remains, stopping further deterioration is a priority and diverting water away from this area is the most robust way of achieving this. It is unlikely that this face will be able to be properly protected by painting and so diverting water away appears to be the most robust means to safeguard. Details of the proposed canopy are included in the architectural information, with an extract shown in section 5.0 Proposals.*
- *Crane beams are understood to be hollow and the lack of drain holes means that they are likely to trap water, leading to internal corrosion. This is likely exacerbated by internal stiffeners which will trap water at various locations along the length of the beam. It is suggested that the conservation works address this by adding drainage points to the bottom of the beams at the positions of all vertical stiffeners to allow any trapped water to drain out – reducing the risk of further serious internal corrosion which may ultimately compromise the structure.*

5.6 Approach for Secondary Items

5.6.1.1 It is proposed that balustrades and cranage associated with the crane beams are retained in their current state. Where structurally required, balustrades will be repaired in line with the intent discussed in section 3.4. Cranage will require inspection by a specialist subcontractor, to ensure that it is retained in a safe state. The intention is for the crane hook to remain suspended as it currently is. It is possible that retaining the hook in a suspended position will require the supporting cable to be replaced with a modern galvanised or non-metallic cable to guarantee safety for visitors.

5.6.1 The rest of this report is appended to this document. Please see section 5.0 for Proposals.

6.0

Proposals

6.0 Proposals

6.1 Improvements

6.1.1 The Gantry frame, elements and components are to undergo wholesale conservation and restoration works as outlined separately within Buro Happold's structural assessment and conservation philosophy reports, including recommendations for an appropriate paint system.

6.1.2 In addition, and to supplement the general restoration works proposed by the structural engineers, there are several original design flaws which have been observed. It would be beneficial if these aspects were improved during the restoration package and in doing so would positively enhance, protect, and limit future maintenance liabilities.

6.1.3 The primary beam to the south side of the Gantry which sits in close proximity to the north wall of the Power Hall is highly susceptible to ongoing degradation, in particular to the rear face of the beam due to the narrow gap which runs the entire length of the Gantry. If the Gantry is to remain within its current position, the interface arrangement and detail here are recommended to be improved to limit further deterioration, as well as restricting water from pooling across the flat cappings, ledges and surfaces and lastly limiting the transfer of guano, which can lead to corrosive and irreversible damage if not appropriately maintained and regularly cleaned.

6.1.4 It is therefore recommended that the gap is closed, to both limit entry from wildlife to the rear side of the beam (nesting birds etc), as well as stopping moisture from entering this inaccessible void and lastly, this improvement would encourage surface water to drain clear of the top surface, away from the structure.

6.1.5 A weathered capping / ledge is proposed to be introduced, which would be directly fixed and secured into the Power Hall masonry wall, to extend across the entire length of the Gantry beam.

6.1.6 The capping would be positioned just above the top beam and former travelling crane rail, with suitably sized stainless-steel clips / brackets fixed into the masonry wall (@ circa 500mm cts), with intermediate steel straps / bracing providing mid support. Code 7 lead sheets will be dressed over the support frame with welted joints at 1.5m centres, with a code 5 lead flashing and mastic seal at the abutment and interface with the Power Hall. The capping would maintain cross ventilation to the periphery of the beam, using a series of packers to offset the capping from the rail.

6.1.7 As lead is a malleable material, it will be carefully dressed and welded to cloak the unusual shapes, projections and cogs around the travelling crane bases, to close up all gaps and access to the rear of the beam. The lead will be dressed as such, that no depressions or pockets for standing water will be left.

6.1.8 A new stainless-steel mesh would be positioned to the underside of the beam and at the drip interface, to restrict entry from local wildlife / insects, whilst maintaining appropriate cross ventilation.

6.1.9 See item 6.3 sketch proposals of the proposed lead capping. The details are not to scale, shown indicatively only.

6.2 Photographs of the existing interface with the Power Hall



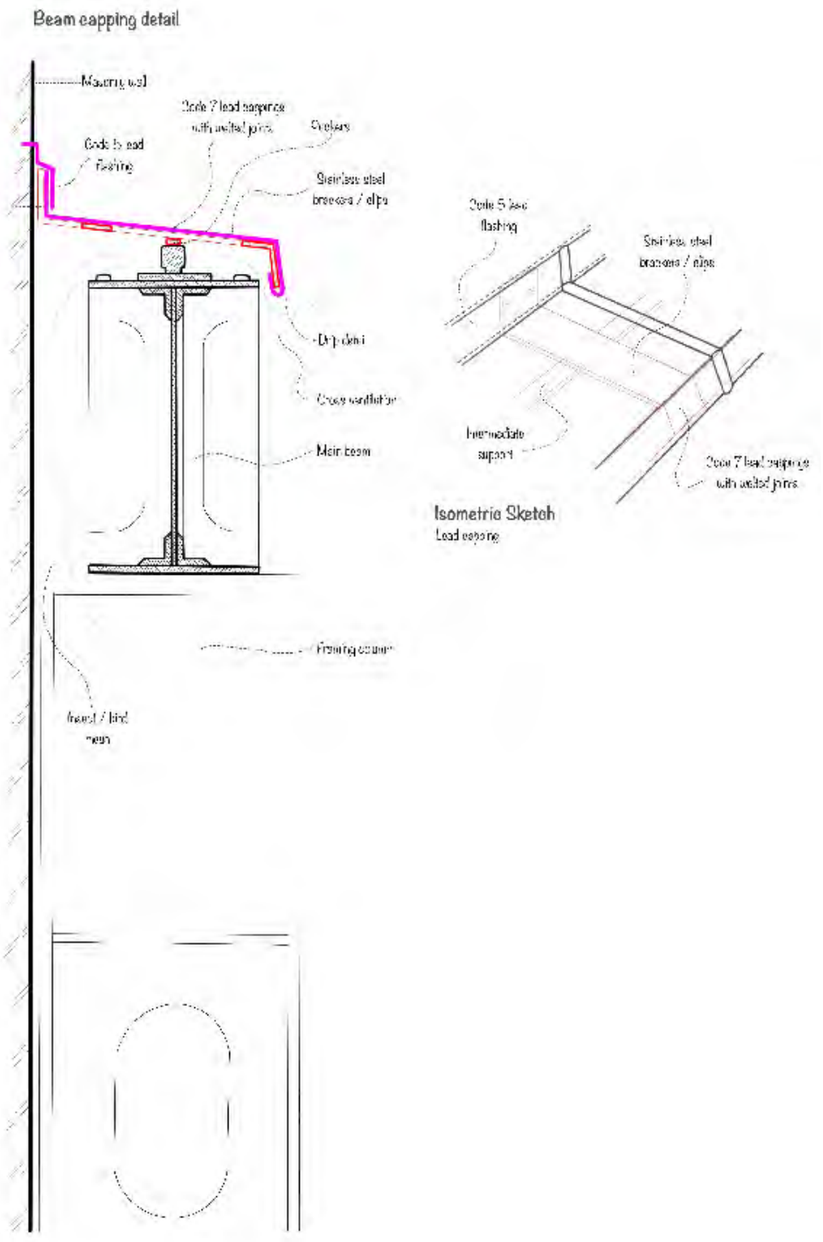


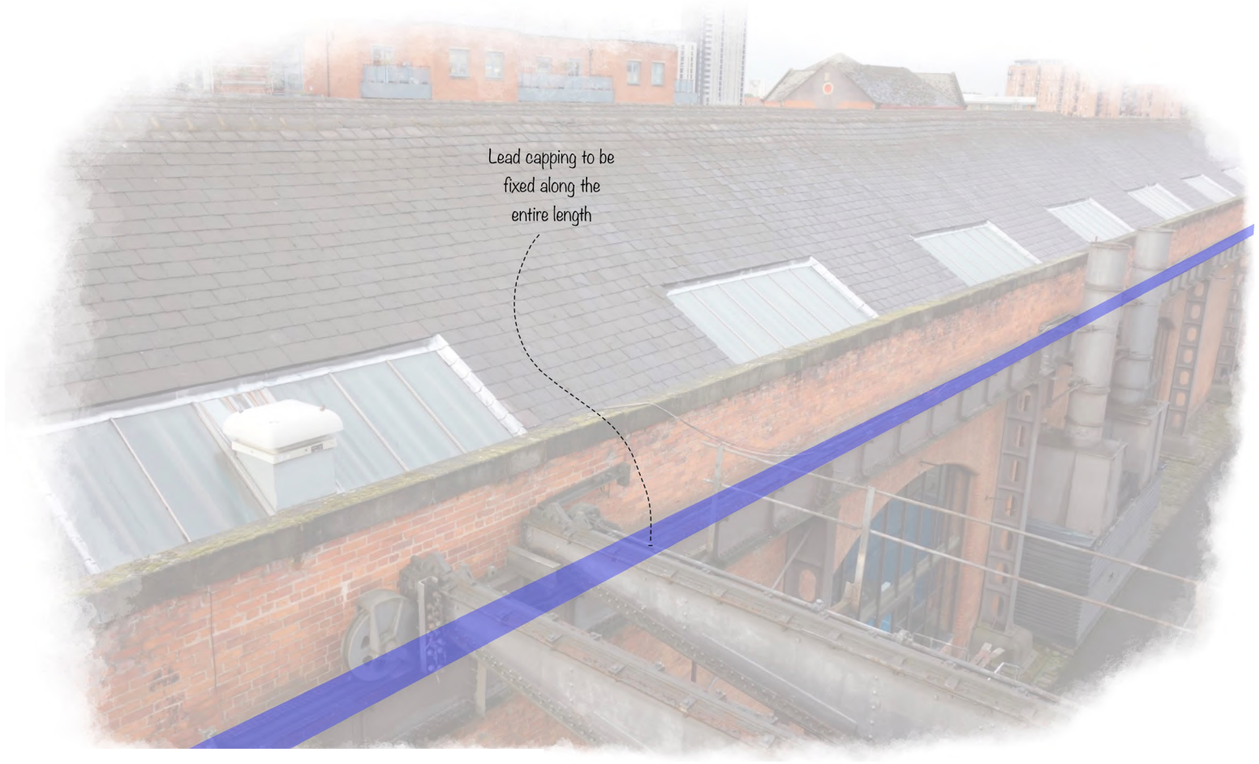




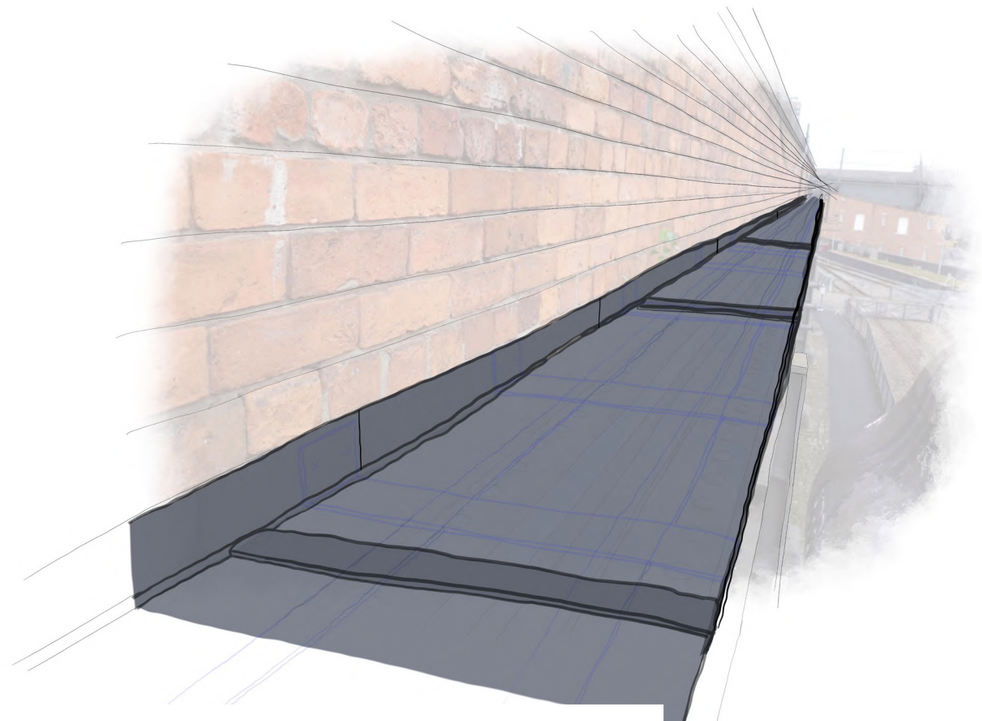
Photographs of the interface between the Gantry and the Power Hall

6.3 Proposed details of the interface with the Power Hall and Gantry South Beam





Proposed graphic showing extent of the lead capping



Artistic impression of the lead capping at the interface with the Power Hall

6.4 Proposed details of bird prevention netting

6.4.1 We have engaged with a Environmental specialist to develop a detail for implementing a bird proofing system for the Gantry. The objectives were as follows:

- To prevent pest birds (pigeons) sitting under and around beam area.
- To supply and install deterrent measures to prevent the above
- To remove the old existing bird net
- To remove any nests and debris during installation
- To provide a system that is discreet

6.4.2 NBC Environment attended a site survey and proposed a system called Avishock which is a small and discreet rubber track that houses 2 copper strips covered by a conductive plastic cover. It has been tested and trialled by The Food and Research Agency (FERA) and found to be harmless to birds and is viewed positively by other organisations such as Natural England, RSPB and RSPCA.

6.4.3 By implementing these proposed measures, several notable outcomes can be anticipated. Firstly, there will be a noticeable decrease in guano accumulation on the floor, thereby minimizing the presence of nesting birds. Additionally, the potential for staining along the newly refurbished Power Hall and Gantry areas will be significantly reduced. Furthermore, this endeavour will contribute to fostering a safer working environment for both staff and visitors.

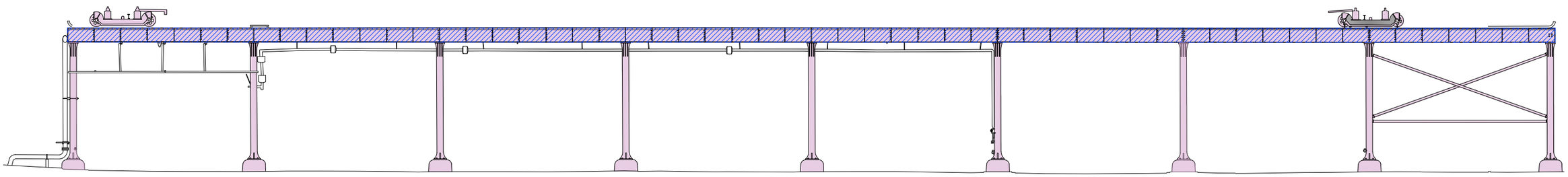
6.4.4 It is proposed that this system extends across all high level elements and components across the Gantry.

6.5 Access and Maintenance

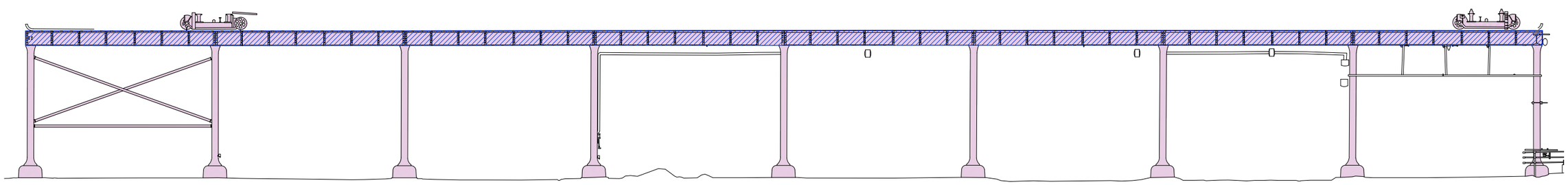
6.5.1 The maintenance and cleaning strategies for the Gantry must take into account that it is a heritage asset within the curtilage of listed buildings.

6.5.2 It is proposed that any future maintenance tasks will be undertaken via a MEWP or a cherry picker. All maintenance access will need to be undertaken by specialist access contractors, experienced with working in and around heritage / listed assets.

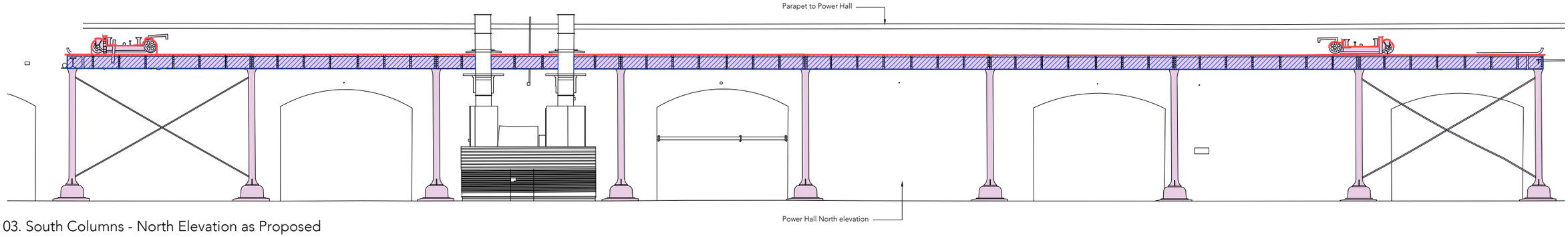
6.5.3 No access will be changed to or around the Gantry.



01. North Columns - North Elevation as Proposed



02. North Columns - South Elevation as Proposed



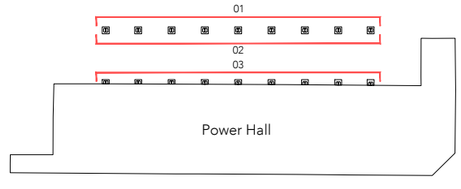
03. South Columns - North Elevation as Proposed

KEY

Install lead capping and flashing across the full length of the South beam to the Gantry at the interface with the Power Hall

All elements, components and all other associated items are to be blasted, repaired, prepared and redecorated

Bird prevention system to be installed



Key Plan
NTS

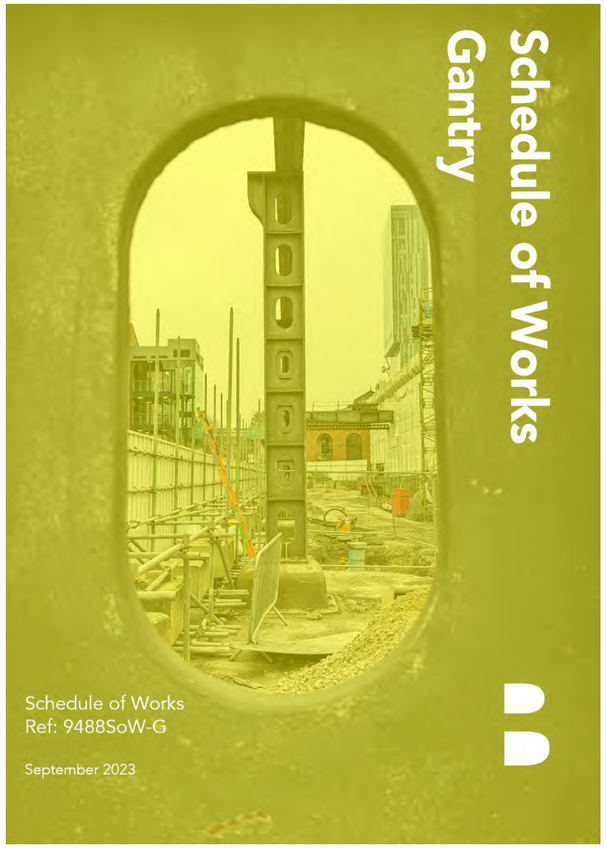
6.6 Schedule of Works

6.6.1 General

6.6.2 A separate schedule of works document is included in the application documents and outlines all the envisaged work items across the Gantry restoration.

6.6.3 The schedule also refers to the accompanying Architectural Restoration specification.

6.6.4 All specifications, schedules, reports, and drawings must be read in conjunction with this Design and Access Statement.





7.0

Summary

7.0 Summary

7.6.1 Major restoration and/or cyclical maintenance tasks have not been undertaken for a considerable period of time, which has resulted in a package of significant high priority remediation works now being required, to halt further degradation and protect the gantry for years to come.

7.6.2 The Gantry has come to a point in its history where it now requires extensive restoration and conservation works to be implemented, to halt further degradation, protect and secure the Gantry for years to come.

7.6.3 The superstructure is widely corroded due to failed paint coatings. The severity of corrosion varies, in some places the level of corrosion is judged to have led to a reduction in structural capacity.

7.6.4 A high-build paint finish, thought to be micaceous iron oxide containing, has been applied to visual surfaces but has now failed across a wide area. Inaccessible areas appear to have not been protected.

7.6.5 There is evidence of previous repair work across several locations, these are visually obvious and would likely be considered not to be best practice by modern construction standards.

7.6.6 The Gantry superstructure is to be retained as a static historic exhibit within the Upper Yard, which will not be returned to be functionable or have any mobile elements.

7.6.7 The structure will be conserved in its current form, rather than returned to match its original use and intent.

7.6.8 The existing frame and all associated elements and components will be meticulously blast cleaned back to bare metal, to provide the most appropriate base for a newly applied paint system.

7.6.9 Any proposed blast cleaning will be carried out with a blasting medium chosen to minimise damage to the underlying structural fabric, except for where corroded material is to be removed.

7.6.10 Previous repairs will be retained as part of the visual history. New repairs will be carried out in such a way to be visually unobstructive where possible and provide a seamless repair, which will not be visible when overpainted, however, it should be noted that in some instances, repairs may be more contrasting where appropriate or where the previous arrangement precludes any other more less discrete methods.

7.6.11 In addition to the complete restoration and conservation of the superstructure, a series of subtle improvement packages will be undertaken, to limit future degradation and enhance the setting and presentation of the Gantry. These will include the introduction of a lead capping over the southern beam of the main frame and the introduction of a bird prevention system.

7.6.12 The proposals outlined within this report and supplementary reports, drawings specifications and schedules will limit further deterioration of the structure, secure and protect its future for visitors to marvel and enjoy, what was once a significant mobile engineering asset. The works will also enhance the visual setting within the Upper Yard, nestled between two Grade II listed buildings.

Buttress

Architects | Masterplanners | Heritage Consultants