simpsonhaugh

Port Street, Ancoats – Manchester

BALUSTRADE DESIGN EXPLORATION | August 2023

Z0-SHP-A180-RP-XX-NMA5 | P01

Purpose of document

This supplementary document has been prepared by SimpsonHaugh Architects (SH) with input from the consultant design team, on behalf of Affinity Living for the site known as Port Street in central Manchester. The purpose of the document is to evidence the reasoning behind the change to the balustrade design and the proposed alternative design to inform a Non Material Amendment to application 132489/FO/2021

Firstly, the document will expose the viability of the glass balustrades originally proposed, after thorough exploration by the team of the options available to meet the latest fire and safety requirements.

Secondly the document demonstrates the design exploration by the team, that aim to respond to the historic context in a modern and contemporary way.

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01: Technical assessment

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Glass Balustrade Technical assessment

TECHNICAL APPRAISAL NOTE

DATE:	10 March 2023	**CONFIDENTIALITY:**	Restricted
SUBJECT:	Free Standing Balustrade		
PROJECT:	Port Street, Ancoats	**AUTHOR:**	John Williams (Façade Engineering)
PROJECT NO:	70088544	**REVISION:**	Rev00

The purpose of this technical appraisal note is to provide a brief overview of the appraisal process carried out when considering options for free standing Balustrades on residential balconies within the above-named project, considering performance, functionality, and durability. This note is only relevant for the above-named project and the options considered within, it must not be extended by any means to any other project or specific systems.

PERFORMANCE REQUIREMENTS

The functional performance of a free-standing glass balustrade to residential balconies is to provide guarding, designed in accordance with *Approved Document Part K Protecting from falling, collision and impact* (ADK) and *BS 6180 Barriers in and about buildings* along with the relevant project specifications.

The design of glass balustrades must consider both serviceability and safety to ensure perceived occupancy comfort is achieved along with the resultant stresses from applied loads not exceeding the allowable stresses for that material type. *Approved Document Part B Fire safety* (ADB) and *Regulation 7 Materials and workmanship* (Reg7) are also to be considered and require satisfying.

GUARDING

In accordance with ADK, the glass balustrades are located within a critical zone, therefore safety glass is required. Safety glass can be achieved by a monolithic toughened glass, or laminated glass with heat treatment requirements derived from thermal stress analysis and structural analysis.

NICKEL SULPHIDE INCLUSION

Nickel Sulphide crystals are present in all glass types as they are entered via the raw material batch at the start of the manufacturing process. The crystals do not become an issue until the glass is heat treated. During the toughening process the temperature of the glass (raw materials etc) are

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raised above 600˚C, the crystals go through a phase change to an alpha state, and reduced volume. Over a period of time the crystals revert to the beta state, increasing in volume. When sufficient pressure is exerted to the surrounding glass from the increased volume of the crystal, the allowable stress of the glass is exceeded, and spontaneous failure occurs. This can occur over several years post heat treatment.

Implementing the Heat Soak Testing (HST) process can significantly reduce the failure rate by forcing the failure to occur in the HST oven, however the process cannot completely mitigate the risk, and therefore it is recommended that toughened glass should be avoided where possible.

POST FAILURE MODE

When considering post failure mode of monolithic toughened glass and laminated glass, the laminated glass option with one ply broken in a two-ply assembly, it is possible to provide containment of the broken ply, and guarding utilising the remaining unbroken ply. For the monolithic toughened glass option, neither containment of the broken glass or guarding are achieved. Therefore, from a safety perspective, laminated glass provides the lowest residual risk and therefore is the preferred solution.

FIRE CLASSIFICATION

In accordance with ADB the project is considered a Relevant Building. Restrictions for this building type apply to all the materials used in the external wall and specified attachments, a balcony attached to an external wall is considered a Specified attachment. Materials that are not considered exempt from Regulation 7 are to achieve A2-s1,d0 when classified in accordance with *BS EN 13501-1 Fire classification of construction products and building elements.*

DURABILITY

Laminated Glass shall comply with BS EN 12543 Parts 1 to 6. Part 4 defines the test methods when considering durability.

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APPRAISAL

MONOLITHIC GLASS

When considering the post failure mode of monolithic toughened glass, this option is not recommended.

LAMINATED GLASS, PVB/SGP INTERLAYER

A PVB/SGP interlayer was discounted on the basis the PVB/SGP interlayer of the laminated glass cannot achieve A2-s1,d0 and therefore non-compliant with ADB/Regulation 7.

LAMINATED GLASS, GEL INTERLAYER

A gel interlayer options was considered as compliant with ADB/Regulation 7 with supporting test documentation. This option is only available with two plies of toughened glass.

When considering durability of this glass composition, the gel interlayer is susceptible to moisture and so has a sealant placed to act as a barrier, the sealant is susceptible to UV degradation and so has a tape and or channel along its edge to act as a barrier. When considering interfaces at the tape and channel with the base rail, it could not be determined if the glass composition could achieve the minimum expected service life.

Should both plies of toughened glass fail, the gel interlayer would not be sufficient to prevent the glass separating from its support, therefore increasing the risk when considering health and safety. The gel interlayer option is only available with two plies of toughened glass, of which is susceptible to spontaneous failure due to Nickel Sulphide Inclusions (NiS). Whilst Heat soak Testing (HST) is a means to reducing the probability of NiS failure, it cannot be completely mitigated. This further increases the residual risk for the gel interlayer and toughened glass composition

CONCLUSION

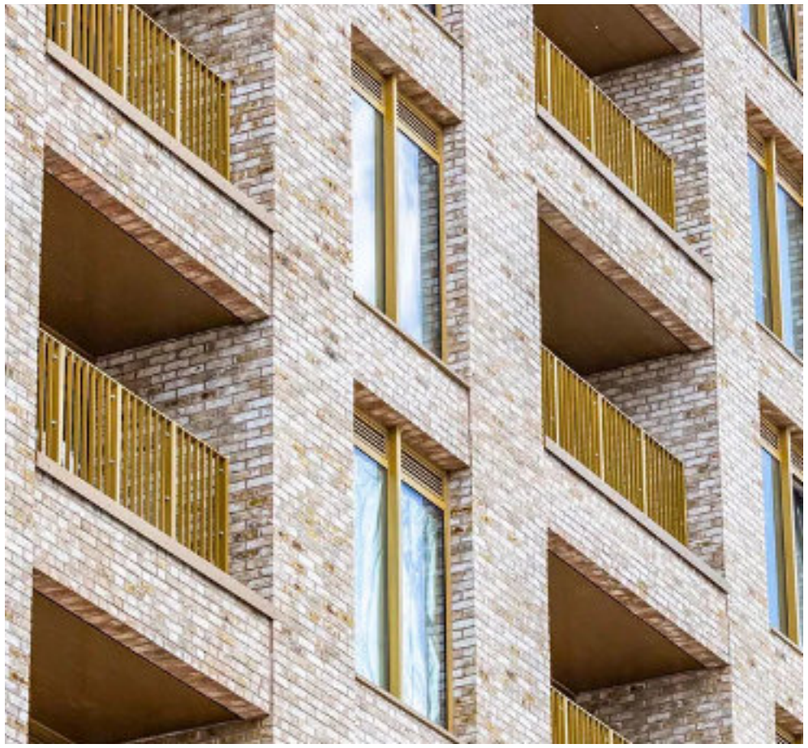
When considering the performance requirements holistically, the free-standing glass balustrade was not able to satisfy all performance requirements that would be reasonably expected. However, a metal balustrade would be able to satisfy the performance requirements that would be reasonably expected.

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The following table summarises the comparative advantages and disadvantages of balustrade types.

Balustrade Type	Comparative Advantages	Comparative Disadvantages
Monolithic Toughened Glass	➢ ADB/Reg7 compliant	➢ Post failure, loss of integrity. ➢ Post failure, glass falling from height ➢ Risk of NiS failure
Laminated Glass PVB/SGP Interlayer	➢ Post failure integrity achievable ➢ Heat treatment can be selected to avoid toughened glass ➢ Durability and expected service life achievable	➢ Non-compliant with ADB/Reg7
Laminated Glass Gel interlayer	➢ ADB/Reg7 compliant	➢ Post failure of both plies, loss of integrity ➢ Post failure of both plies, glass falling from height in larger sections ➢ Risk of NiS failure ➢ Durability and reduced expected service life risk
Metal balustrade	➢ ADB/Reg7 compliant ➢ No risk of glass failure ➢ Durability and expected service life defined and achievable	

Contextual Precedents



The Astley



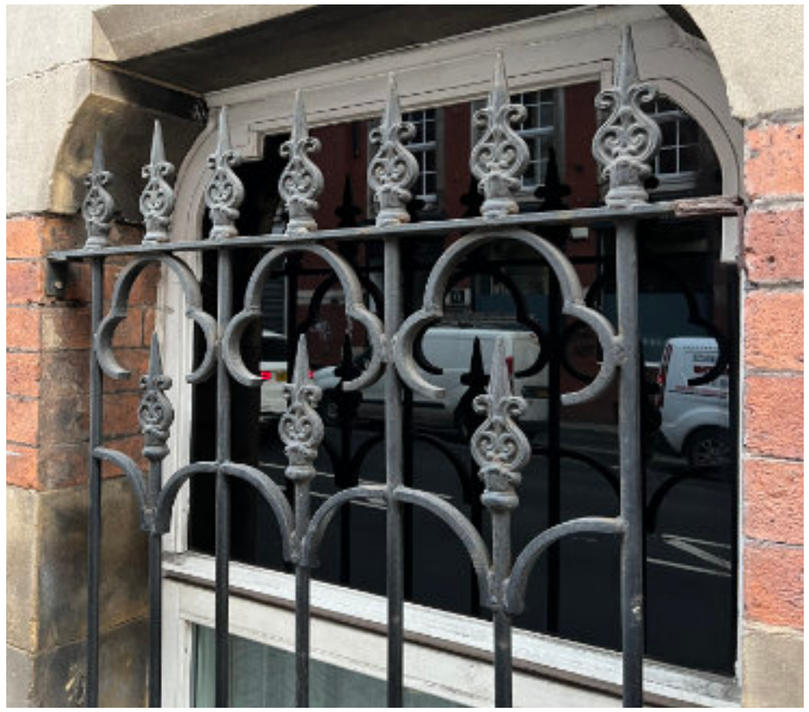
Blossom Street



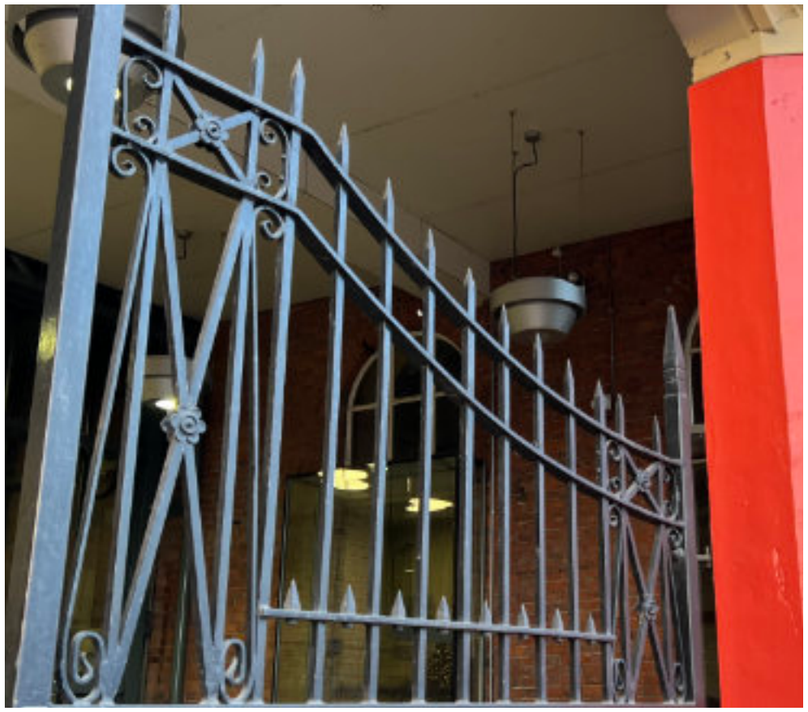
Blossom Street - GAS Block



Murray's Mill gate

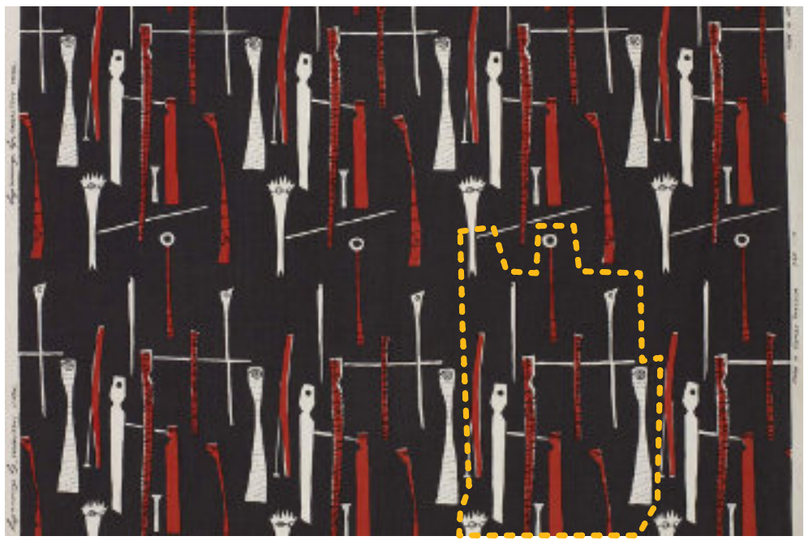


The Wentworth balustrade

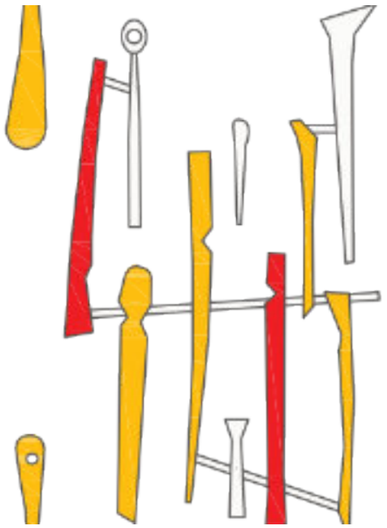


Royal Mill main gate

DESIGN EXPLORATION



LUCIENNE DAY -SPECTATORS



PATTERN REPEAT INTERPRETATION

The proposal aims at creating a unique feature element that reflects the many lives that the site has experienced and the industrial heritage of Ancoats.

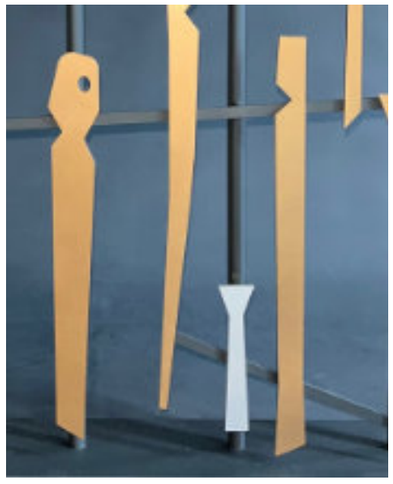
The design takes inspiration on the extensive fabric collection at Manchester Whitworth Art Gallery. It references, in particular, the work Spectators, by Lucienne Day.

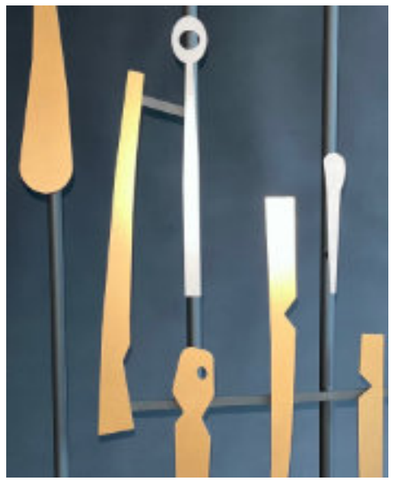
This pattern explores abstractions of people of different size, colour and geometry. They are spectators and witnesses of their time, but their arrangement brings movement and dynamism to the composition. It creates the impression of a busy place in an elegant and modern way. By applying this motif to Port Street we aim at linking the busy activity of its industrial past to the 21st century successful regeneration of Ancoats

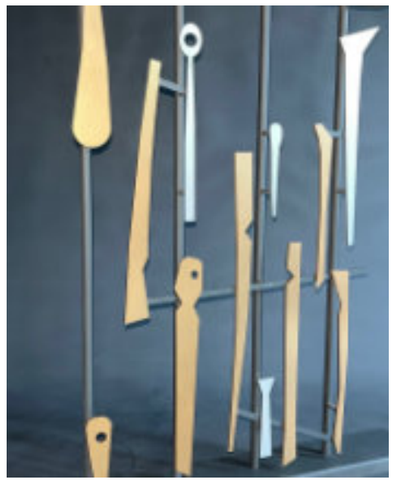
This document will demonstrate in the following pages how the pattern has been developed from a fabric design to a workable architectural solution.

In order to achieve this, the design has gone under an iterative process in which 3d drawings, architectural models and full scale mock ups have been produced to test and refine the design







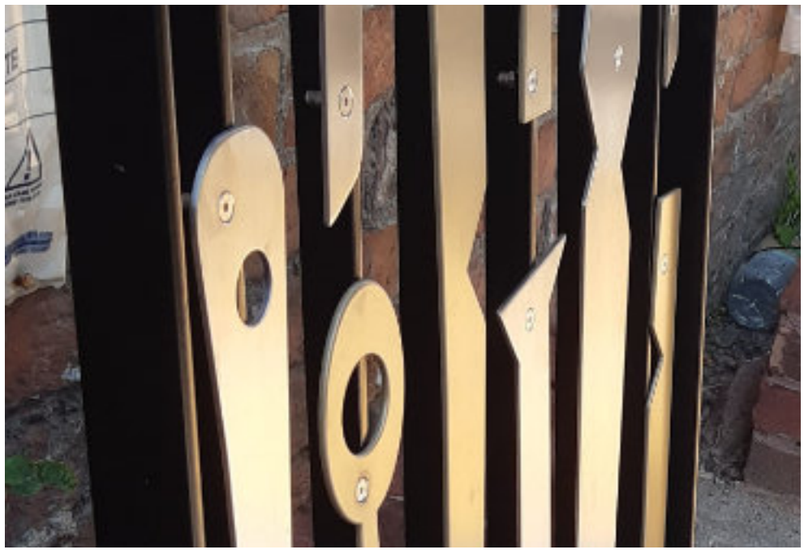


ARCHITECTURAL MODEL EXPLORATION

The images to the left show the interpretation of the repeat pattern. This is then applied to a carrier frame which will perform the balustrade function, This concept was tested in a model, in which the different colours where assigned to different materials and each spectator was supported from at least 2 points to achieve a robust design.

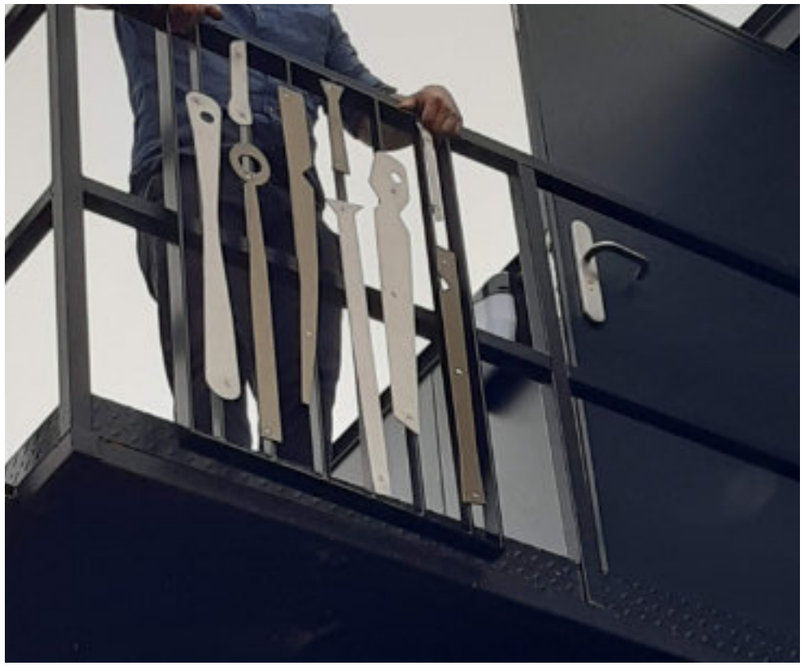
From this exercise the team assessed the figures needed to increase in size so they are readable at street level. This meant the reconfiguration of the pattern to suit the carrier frame,





The team engaged with a local fabricator to ensure the buildability of the proposal, to ensure it can be manufactured at a large scale to a high quality standard. Laser cut Spectators are fixed back to a steel balustrade that frames the design. These Spectators will be delivered in a stainless steel finish and a high quality Metallic powder coat





INITIAL ITERATION AND VIEW FROM GROUND LEVEL



REDUCED BALUSTER AND ADJUSTED FIXING DETAIL



GLASS BALUSTRADE



DECORATIVE BALUSTRADE

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