



Goulden Street,
Manchester

Structural Survey

Project number: 3356

Date: September 2018

Revision: 1

Document Control Sheet

Client: Mulbury City

Project No.: 3356

Project Title: Goulden Street, Manchester

Report Title: Structural Survey

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Document Distribution Record:

Issue	Organisation	Quantity
0	MC	1
1	MC/DRE	1

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Table of Contents

1.0 Introduction 1

2.0 Site Description and Proposals 2

2.1 Site Location Description.....2

2.2 Wall Condition 3

3.0 Appendix A Architectural Drawings 12

4.0 Appendix B CRL Chimney Report & Intrusive Survey 13

2.0 Site Description and Proposals

2.1 Site Location Description

The former Victorian fire and police station on Goulden Street in Manchester was constructed in 1872 and Grade II listed in 1992. The building suffered major fire damage in November 2002 when being used as a fireworks store, during the national fire service strike. After demolition to make safe, the remaining structures consisted of the perimeter walls / columns and the main brick chimney. This report will detail the existing condition of the structures and the proposed modifications during the development of the site.

Figure 1 – Site Plan (Tim Groom Architects)



2.2 Wall Condition

The wall construction and condition varies around the site. The below photographs are a record of the current condition. Each elevation will be referenced to a street name on the previous site plan. The north elevation will be referred to as the alleyway. On the Bendix Street alleyway elevation the cast Iron columns will be restored and painted and built into the new elevation of the proposed building. All the rotten timber boarding will be removed. This was the original entrance and exit for the Fire Engines and Ambulances.

Figure 2 – View of existing boundary from the North Elevation Alleyway.



Figure 3 – Cast Iron Columns to be kept, repaired and built into new scheme

Figure 4 – View of existing boundary from Cross Keys Street



The first 4-5m of the wall on this elevation is to be demolished to allow for a new substation and switch room to be constructed on this corner. The remainder of the elevation is to be kept and incorporated into the new façade by creating punched openings into a new retail unit at Ground Floor.

Figure 5 – View of existing boundary from Cross Keys Street



Figure 6 – View of existing boundary from Cross Keys Street/Goulden Street Junction



Figure 7 – View of existing boundary from Goulden Street-Original Feature Entrance



Figure 8 – View of existing boundary from Goulden Street



Figure 9 – View of existing boundary from Chadderton Street



Figure 10 – View of internal space from the main entrance on Goulden Street



Inside the site the walls are in a fair condition considering the history of the site and fire damage. Typically, local masonry repairs will be needed to section of wall to be maintained. Coping stones will need re setting and re bedding and the wall will need to be tied to the new structure where new openings are to be created.

On the northern alleyway side, the cast iron columns are to be retained and built into the new façade. On Cross Keys street the wall is to be largely retained and new openings created to form windows into a retail unit at ground floor. The masonry façade will be repaired and fully tied into the new frame structure to provide long term restraint and structural integrity.

On Goulden Street the ashlar stone main entrance is to be kept and the section adjacent to Chadderton street is to be lowered to create new views into the site. The Chadderton Street wall is to be largely removed to create a new entrance into a square/piazza type space.

Any masonry to be retained will be fully repaired and repointed as well as being cleaned to achieve as close to its original appearance as is practically possible. The preliminary details of the repairs are shown on the attached overmarked drawings. (Appendix A). All repairs will be completed under a conservation specification using lime mortar and original bricks where possible. Full drawings will be provided to the conservation officer for approval ahead of site start.

To create new openings in the existing walls the holes will be punched through and multiple concrete lintels used to support the brickwork. The visual lintel from the road will be stone or similar and specified by the architect to keep in line with the heritage of the building. The wall will be tied back to a new SFS system which will form the inner leaf of the new building. The wall will be tied at 600mm

horizontal centres and 450 vertically with a 225mm spacing around openings. The ties will embed for a minimum 180mm into the existing wall to ensure adequate restraint to the StreetSide elevations.

The Chimney condition is covered in detail by CRL in Appendix B but is to be kept in its entirety. The brickwork requires repair and repointing and the coping stones at the top need resetting and tying in. The brickwork will be repointed with a heritage grade lime mortar and a new feature light will be added to the top of the chimney. The extent of repointing is covered in detail in the elevation drawings in appendix B. The intention for the light box is to create a mesh/open enclosure to avoid adding any additional wind load to the chimney. The chimney has sufficient mass to withstand the site wind load and will form the centre of the open square external space. No new structure will tie into the chimney except for the new feature light. The connections used will be Hilti Resin Anchor HY-270 with the minimum embedment utilised to hold down the new light structural frame. The below sketch detail shows the intent for the new light box. The frame will be secured using straps into the internal flues of the chimney for an anchorage length. The additional wind load will be minimised by making the cladding of the light box porous i.e. mesh or netting.

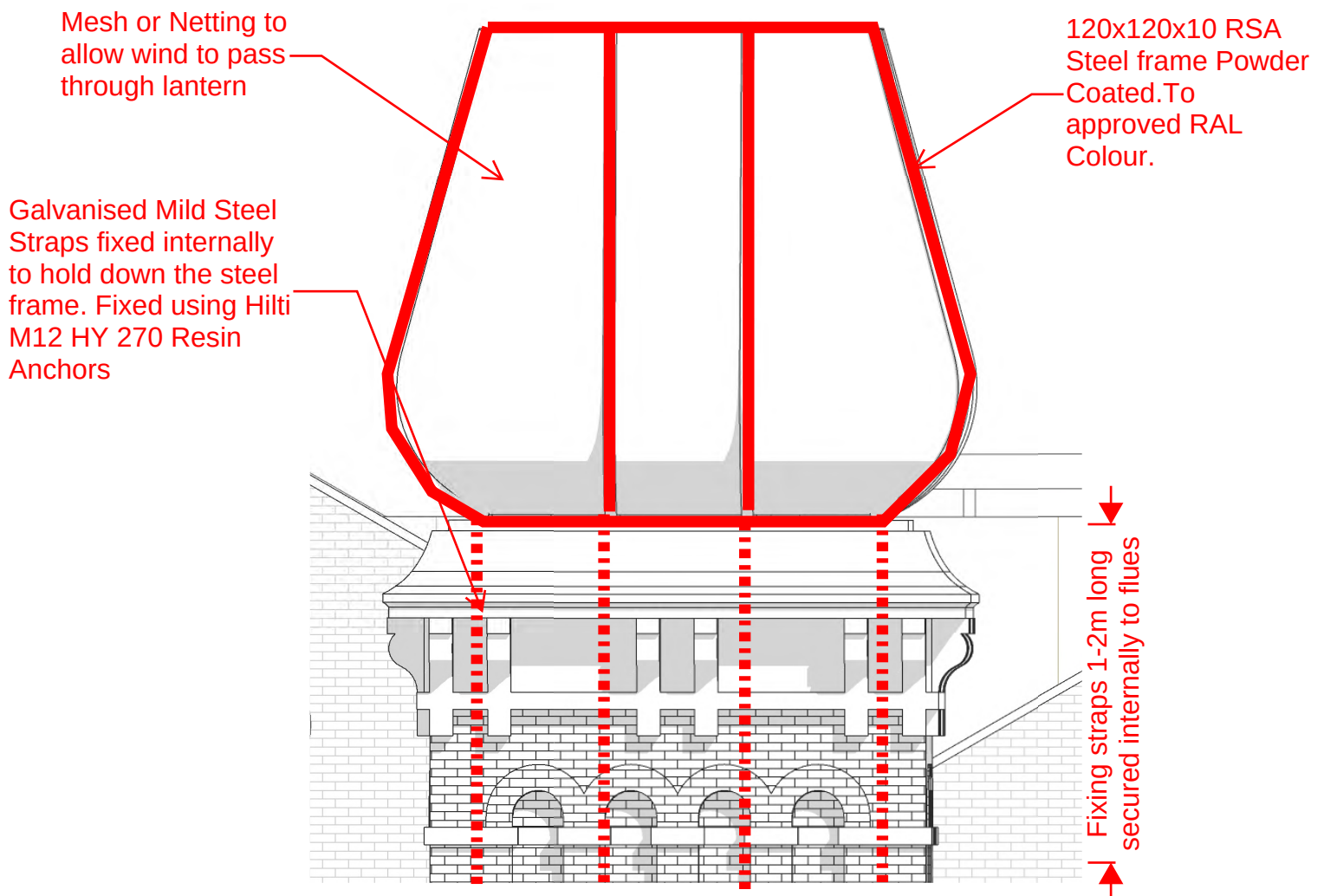


Figure 11 – Proposed Light Box

Figure 12 – View of existing Chimney to be retained and repaired



Figure 13 – View of existing boundary to north alleyway/cast iron columns



Figure 14 – View of existing boundary from Chadderton Street internal elevation of wall to be demolished



Figure 15 – View of existing boundary from Cross Keys Street



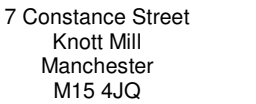
Figure 16 – View of existing boundary on Goulden Street Internal Face



Figure 17 – View of existing boundary from Goulden Street



3.0 Appendix A Architectural Drawings

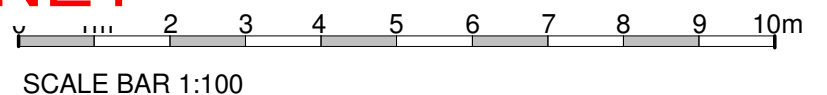


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Rev.	Description	Date
Revision 1		Date 1

Existing Wall is to be demolished down to Ashlar plinth and then new railings/fence line inserted

PROPOSED ALTERATIONS AND RESTORATION TO THE LISTED WALL AND CHIMNEY



Client	Mulbury City
Project	Goulden Street
Title	Ground Floor Plan
Status	Information
Project number	0321
Date	08/20/18
Drawn by	SA
Checked by	Checker
Scale	1 : 100@A1
Drawing No.	0321-TGA-XX-00-DR-A-0300
Revision	

19/12/2018 18:13:42



7 Constance Street
Knott Mill
Manchester
M15 4JQ
Tel: +44 (0)161 870 1152
www.timgroomarchitects.com

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Rev.	Description	Date
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Client	Mulbury City
Project	Goulden Street
Title	Demolition Ground Floor Plan
Status	Information
Project number	0321
Date	01/03/19
Drawn by	Author
Checked by	Checker
Scale	As indicated@A1
Drawing No.	0321-TGA-XX-00-DR-A-0320
Revision	

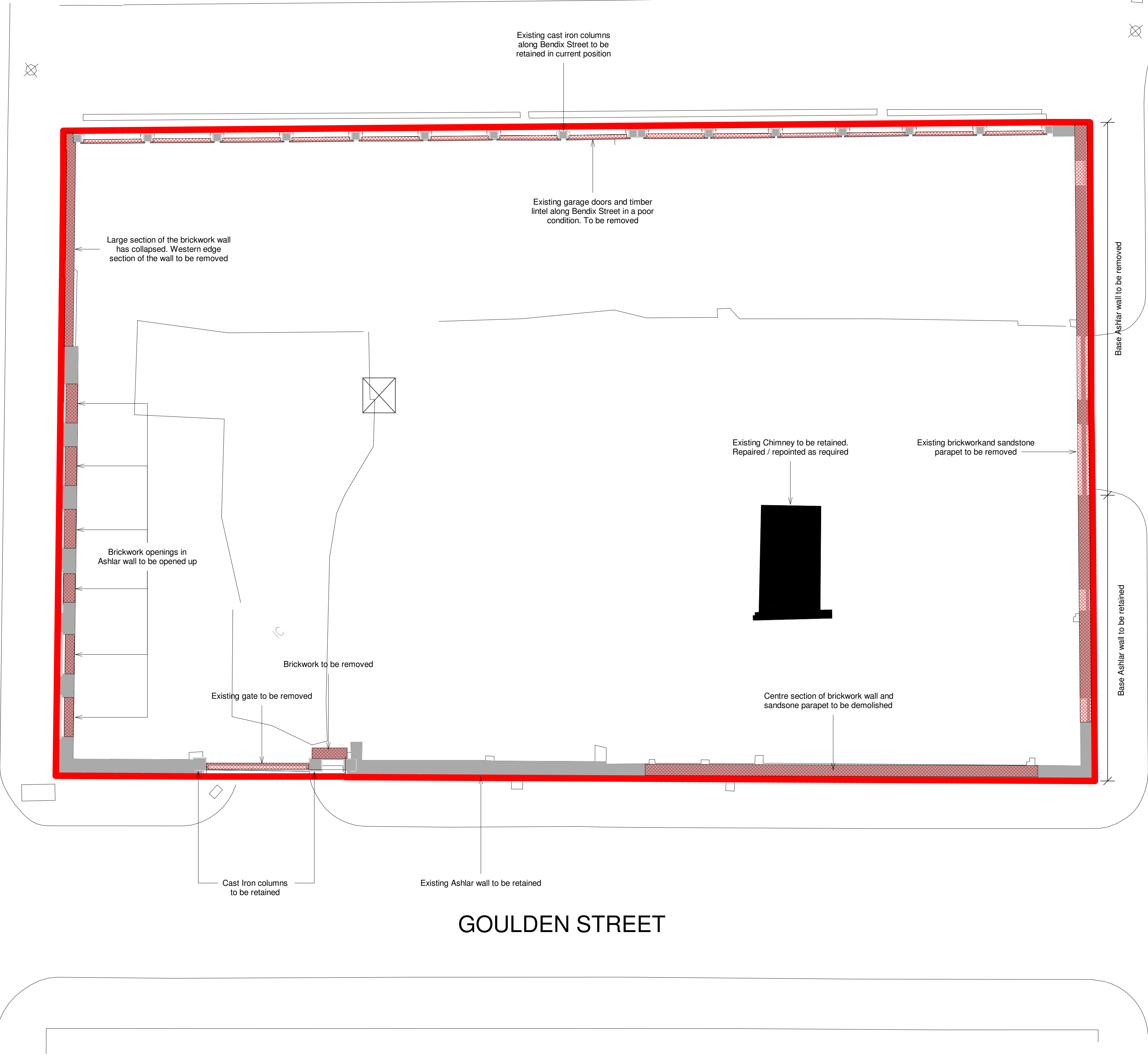
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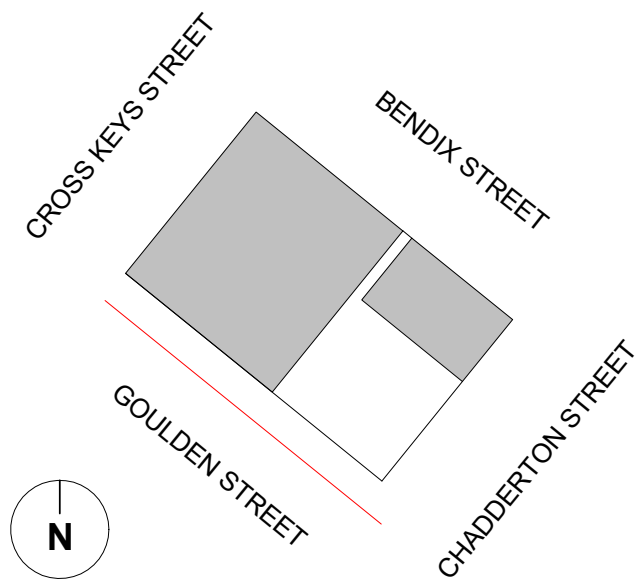
CROSS KEYS STREET

CHADDERTON STREET

GOULDEN STREET

- Item to be demolished
- Item to be infilled to match existing brickwork/stonework





- 1 Brickwork – light grey/ buff. Mortar colour to provide slight contrast with brick, bucket handle joints.
- 1a Brickwork, as item 1. Recessed 20mm from front face of adjacent brick
- 1b Brickwork, as item 1. Ventilation air brick
- 2 Brickwork – light brown/ buff. Mortar colour to provide slight contrast with brick, bucket handle joints.
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- 3a Brickwork, as item 3. Recessed 20mm from front face of adjacent brick.
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- 4 Aluminium cladding panel, powder coated colour and finish to match window frames. All fixings to be concealed.
- 5 Aluminium window with clear glazing and powder coated frames. Bi-folding opening as indicated on drawings. 50mm profiles to all mullions and transoms. Colour bronze.
- 6 Aluminium fixed window with clear glazing and powder coated frames. 50mm profiles to all mullions and transoms. Colour bronze.
- 7 Aluminium window system with clear glazing comprising fixed window pane and one side hung opening panel. 50mm profiles to all mullions and transoms. Fixed aluminium panel to front face of opening panel to provide purge ventilation. Panel and framing powder coated. Colour TBC
Refer to detail drawings.
- 8 Aluminium skylight with clear glazing and powder coated frames. CONFIRM FIXED OR OPERABLE. Colour bronze
- 9 Aluminium curtain wall system with clear glazing and powder coated frames to match windows. 50mm profiles to all mullions and transoms.
- 10 CONFIRM WINDOW OR OPENING. Fixed window/ opening complete with aluminium sill profile to reveal. Profile & colour to match window & sill.
- 11 External metal door, powder coated. Colour and finish to match window frames. Fully louvred where indicated on drawings.
- 12 Metal standing seam roofing. Colour to match window frames. CONFIRM FINISH OR SYSTEM?
- 13 Aluminium parapet capping, powder coated colour and finish to match window frames.
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- F Existing Columns to be retained and made good.



0 1m 2 3 4 5 6 7 8 9 10m
SCALE BAR 1:100



7 Constance Street
Knott Mill
Manchester
M15 4JQ
Tel: +44 (0)161 870 1152
www.timgroomarchitects.com

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Rev	Description	Date
P2	Planning Submission	30.09.19

Client
Mulbury City

Project
Goulden Street

Title
Goulden Street Elevation

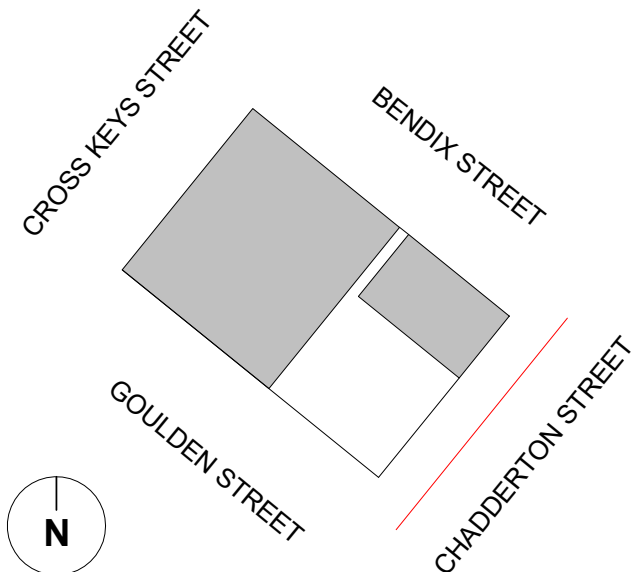
Status
Planning

Project number	Date
0321	30/09/19

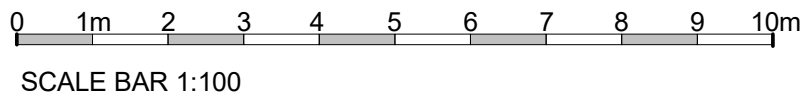
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Scale	Revision
As indicated@A1	P2

Drawing No.
0321-TGA-XX-XX-DR-A-0501



- 1 Brickwork – light grey/ buff. Mortar colour to provide slight contrast with brick, bucket handle joints.
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Rev	Description	Date
P2	Planning Submission	30.09.19

Client
Mulbury City

Project
Goulden Street

Title
Chadderton Street
Elevation
Status
Planning

Project number
0321

Date
30/09/19

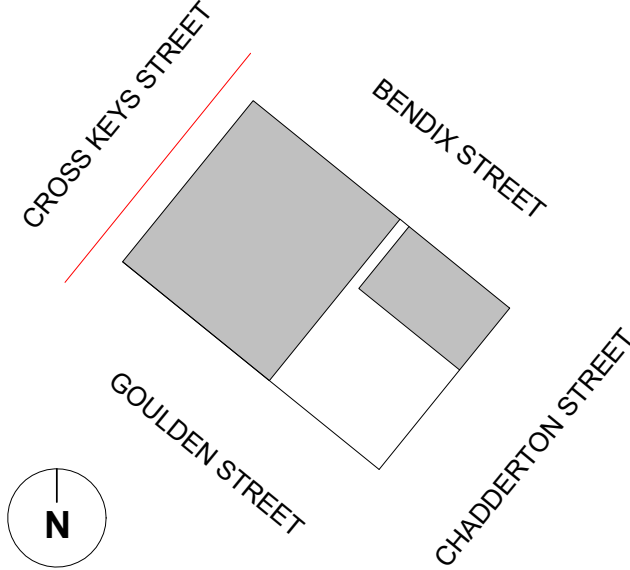
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Checked by
AB

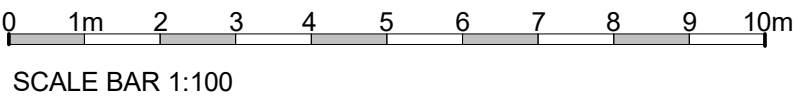
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Revision
P2

Drawing No.
0321-TGA-XX-XX-DR-A-0502



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TIM
GROOM
ARCHITECTS

7 Constance Street
Knott Mill
Manchester
M15 4JQ
Tel: +44 (0)161 870 1152
www.timgroomarchitects.com

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Rev	Description	Date
P2	Planning Submission	30.09.19

Client
Mulbury City

Project
Goulden Street

Title
Cross Keys Street Elevation

Status
Planning

Project number
0321

Date
30/09/19

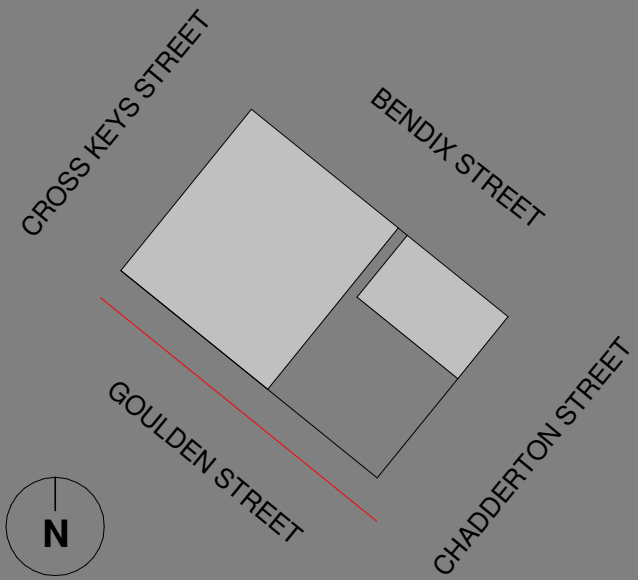
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Scale
As indicated@A1

Revision
P2

Drawing No.
0321-TGA-XX-XX-DR-A-0503



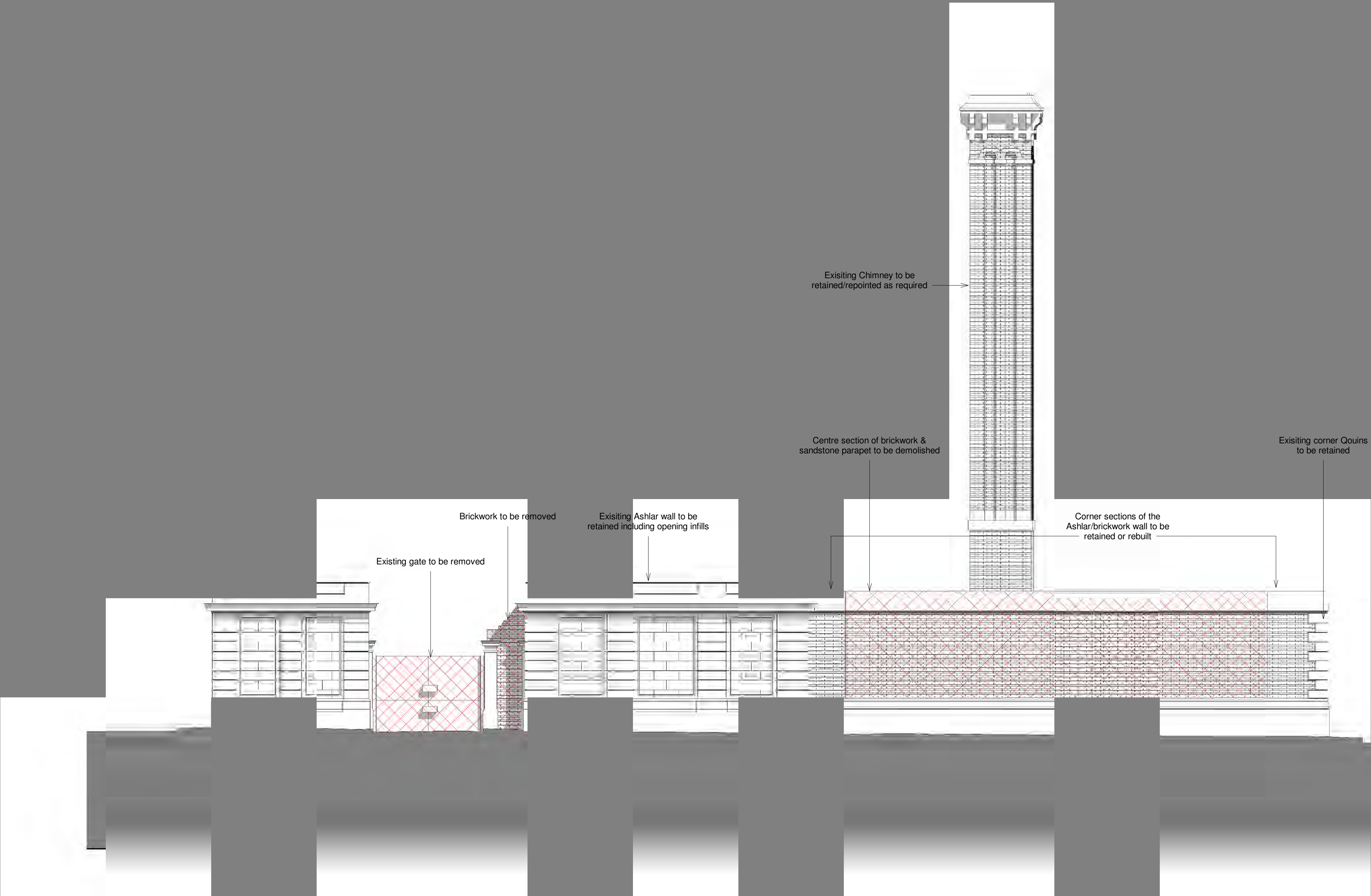
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M15 4JQ

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Rev.	Description	Date
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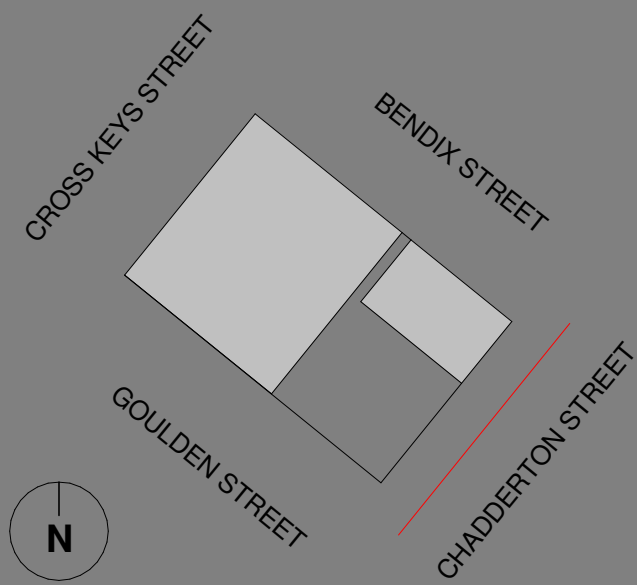


- Item to be demolished
- Item to be infilled to match existing brickwork/stonework

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SCALE BAR 1:100

Client:	Mulbury City
Project:	Gouden Street
Title:	Demolition Gouden Street Elevation
Status:	Information
Project number:	0321
Date:	01/03/19
Drawn by:	Author
Checked by:	Checker
Scale:	As indicated@A1
Drawing No.	0321-TGA-XX-XX-DR-A-0516
Revision:	

04/01/2019 11:52:50



7 Constance Street

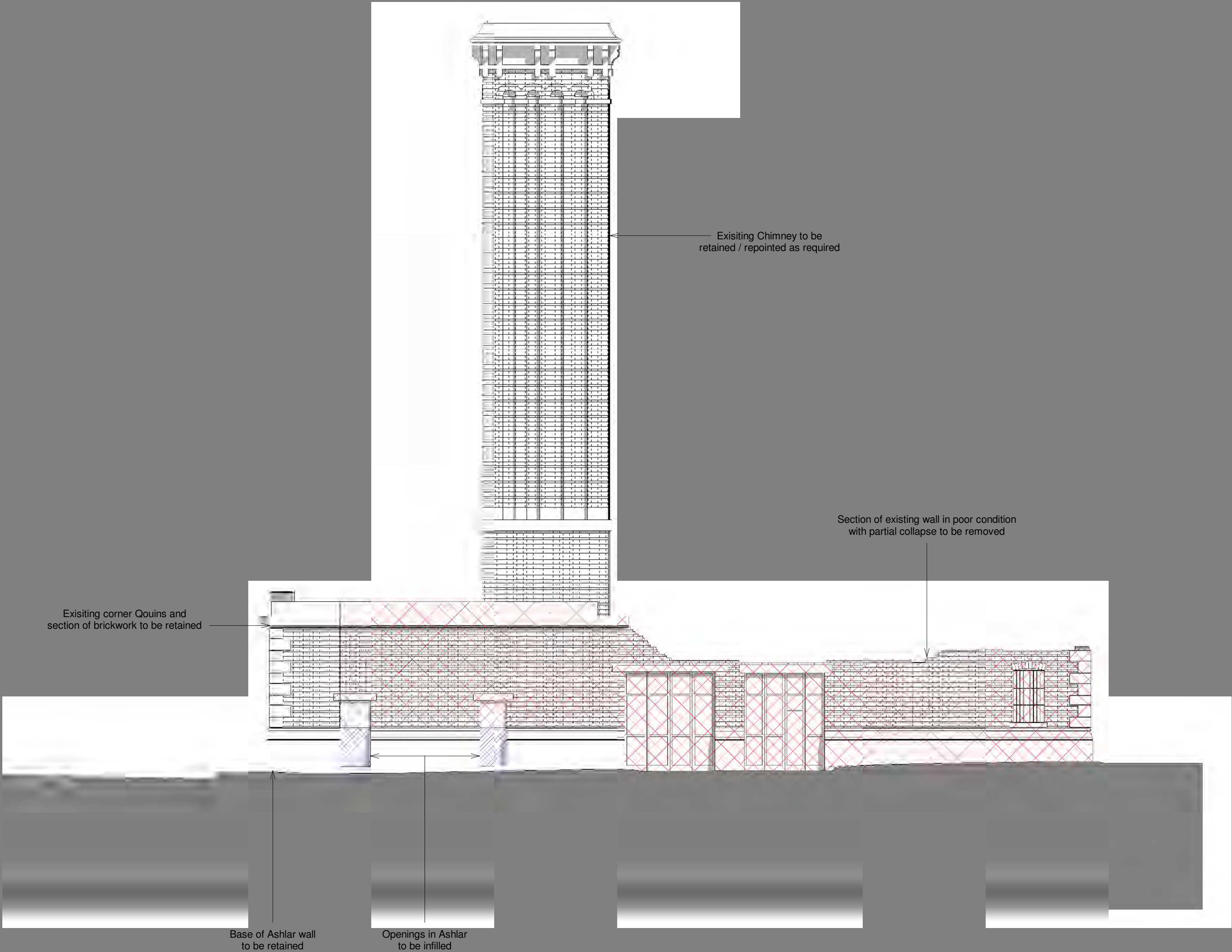
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Manchester
M15 4JQ

Tel: +44 (0)161 870 1152
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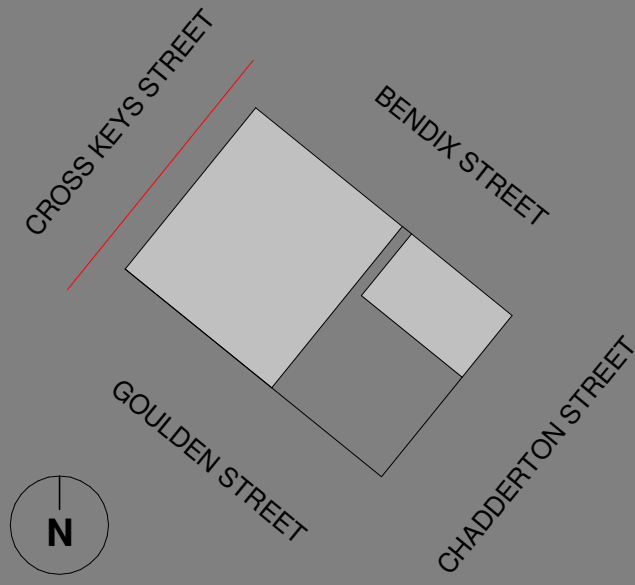


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-  Item to be infilled to match existing brickwork/stonework

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Project:	Goulden Street
Title:	Demolition Chadderton Street Elevation
Status:	Information
Project number:	0321
Date:	01/03/19
Drawn by:	Author
Checked by:	Checker
Scale:	As indicated@A1
Drawing No:	0321-TGA-XX-XX-DR-A-0516
Revision:	

04/01/2019 11:55:12

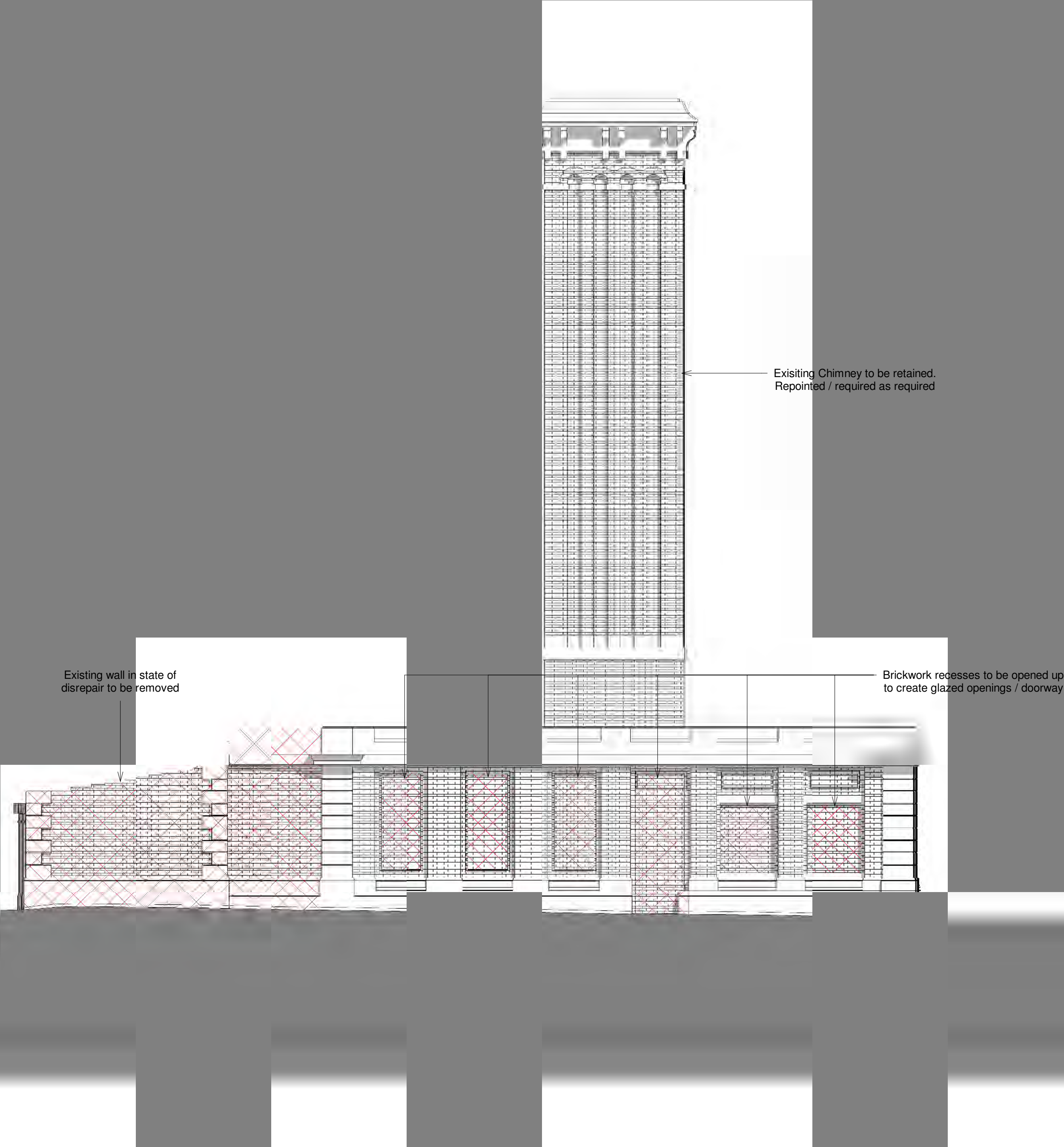


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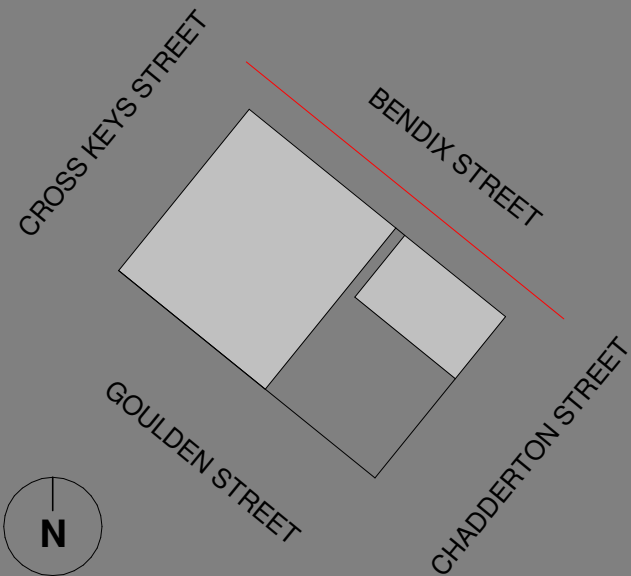


-  Item to be demolished
-  Item to be infilled to match existing brickwork/stonework

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Project:	Goulden Street
Title:	Demolition Cross Keys Street Elevation
Status:	Information
Project number:	0321
Date:	01/03/19
Drawn by:	Author
Checked by:	Checker
Scale:	As indicated@A1
Drawing No.	0321-TGA-XX-XX-DR.A-0517
Revision:	

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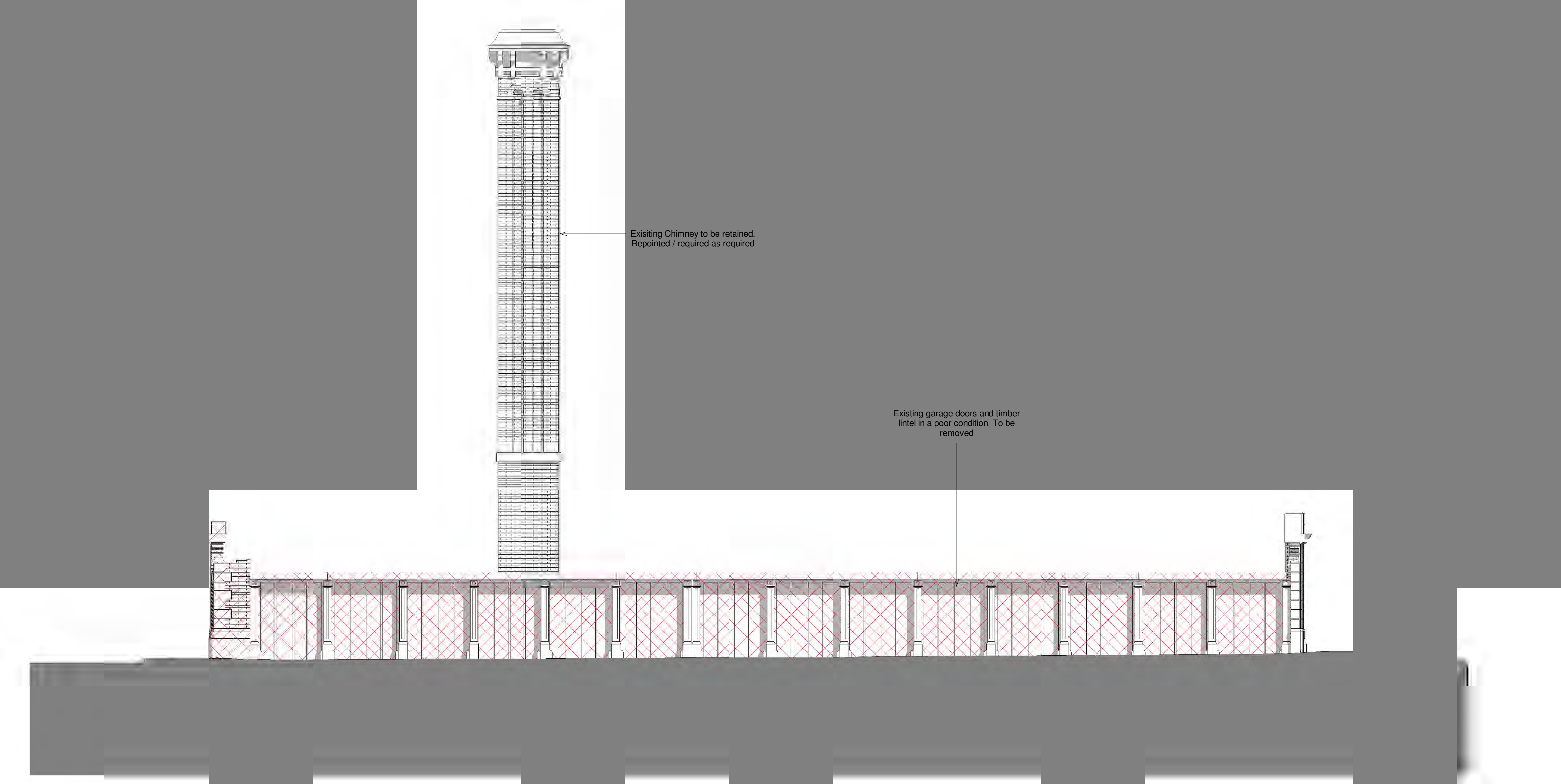


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-  Item to be demolished
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0 1m 2 3 4 5 6 7 8 9 10m
SCALE BAR 1:100

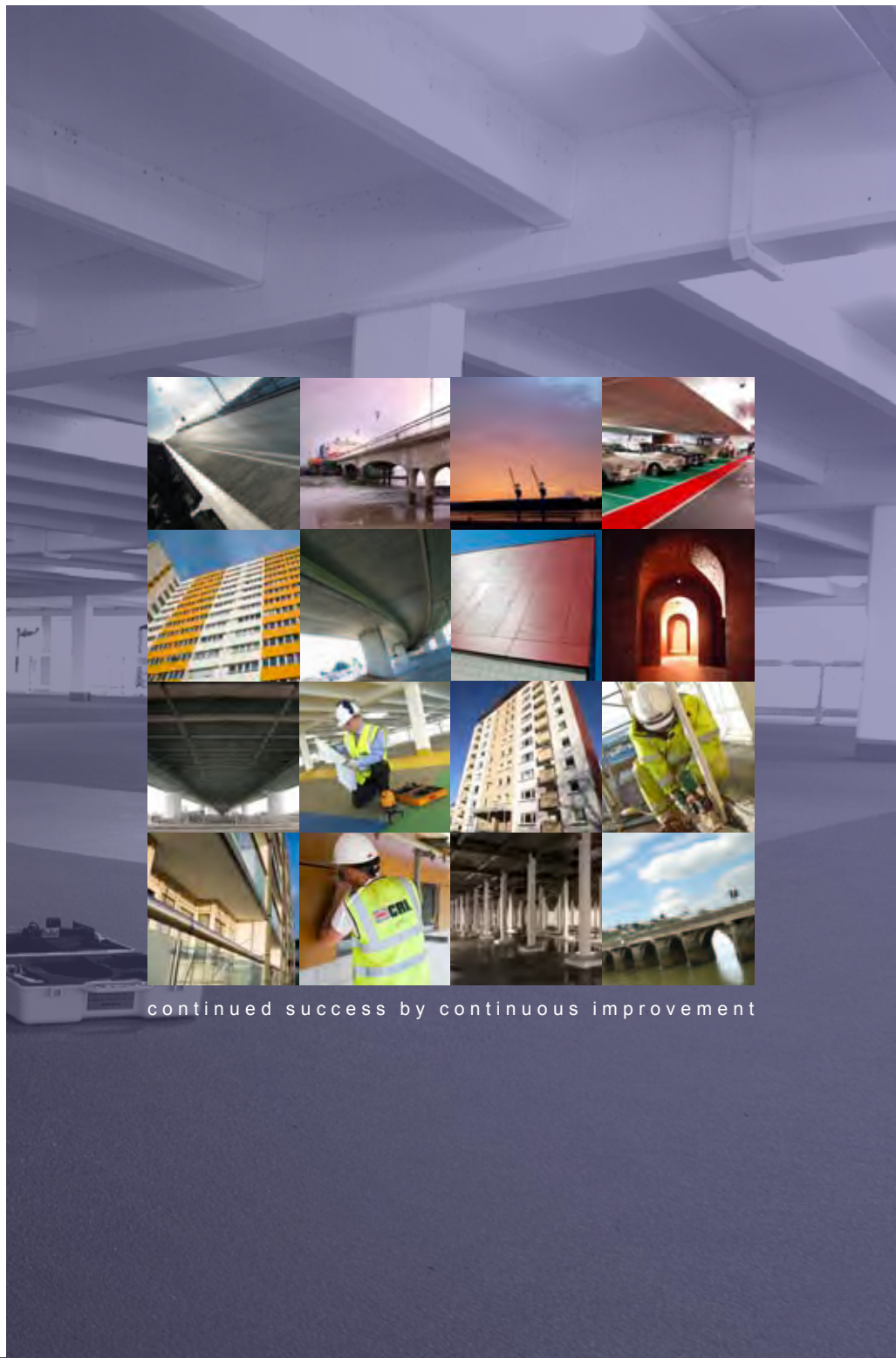
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Project:	Goulden Street
Title:	Demolition Bendix Street Elevation
Status:	Information
Project number:	0321
Date:	01/03/19
Drawn by:	Author
Checked by:	Checker
Scale:	As indicated@A1
Drawing No.	0321-TGA-XX-XX-DR-A-0518
Revision:	

04/01/2019 11:55:25

4.0 Appendix B CRL Chimney Report & Intrusive Survey



CONDITION ASSESSMENT OF GOULDEN STREET CHIMNEY FOR SCOTT HUGHES DESIGN



continued success by continuous improvement



Report SUR183512

Cont'd...

**CONDITION ASSESSMENT
OF
GOULDEN STREET CHIMNEY
FOR
SCOTT HUGHES DESIGN**



Report SUR183512

Cont'd...

CONTRACT DETAILS			
Contract No.:	SUR183512		
Site:	The Former Police Station Chimney Goulden Street Manchester M4 5EZ		
Customer:	c/o Mulbury Homes (Goulden Street) Limited Scott Hughes Design The Flint Glass Works 64 Jersey Street Manchester Greater Manchester M4 6JW For the attention of: Mr Kris Clark		
FOR CRL SURVEYS			
Documentation Authored By:	Simon Bladon BSc., MSc. CRL Surveys General Manager		
Report Prepared By:	Grzegorz Nowakowski Area Manager	Signed:	
Checked / Approved By:	Nigel Pierce BEng(Hons) Assistant Survey Manager	Signed:	
REPORT DETAILS			
This Report Comprises:	14 pages of text Appendix A (5 Pages) Appendix B (5 Pages) Appendix C (9 Pages)	Issue Record	
		Date	Revision
		7 th September 2018 28 th September 2018	Draft Final
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Goulden Street Chimney

Cont'd...

CONTENTS

1	REPORT REVISIONS RECORDS	5
2	INTRODUCTION	6
2.1	REFERENCES	6
2.2	GENERAL BACKGROUND	6
3	'SITE' DETAILS	7
4	PROCEDURES	8
4.1	TERMS OF REFERENCE.....	8
4.2	GENERAL DEFECTS AND DILAPIDATIONS	8
4.3	MASONRY STRUCTURAL DETAILS	8
4.3.1	<i>Unit Strengths</i>	8
4.3.2	<i>Mortar Bedding</i>	8
4.4	STRUCTURAL FORM	9
5	INVESTIGATION RESULTS.....	10
5.1	GENERAL.....	10
5.2	GENERAL DEFECTS AND DILAPIDATIONS	10
5.3	MASONRY STRUCTURAL DETAILS	13
5.3.1	<i>Unit Strengths</i>	13
5.3.2	<i>Mortar Bedding</i>	13
5.4	STRUCTURAL FORM	13
6	REMARKS.....	14
APPENDIX A: DETAILED VISUAL INSPECTION RESULTS		
(5 PAGES).....		
APPENDIX B: DETAILED CONSTRUCTION FORM RESULTS		
(5 PAGES).....		
APPENDIX C: LABORATORY ANALYSIS AND TEST REPORT.....		
(9 PAGES).....		
END OF REPORT		

1 REPORT REVISIONS RECORDS

[illegible]



2 INTRODUCTION

2.1 REFERENCES

CRL Surveys Proposals and Quotation Letter Ref: ESUR1630647/TB/tb dated 22nd July 2018

CRL Surveys Revised Quotation Ref: ESUR1630647 Rev1 dated 16th May 2018

Email with Instructions from Mr Kris Clark (Scott Hughes Design) to Mr Simon Bladon (CRL Surveys) on 4th July 2018

2.2 GENERAL BACKGROUND

CRL Surveys were asked by Mr Kris Clark of Scott Hughes Design acting at the direction of Mulbury Homes (Goulden Street) Limited to carry out a condition survey of the former police station chimney at Goulden Street in Manchester.

We were particularly asked to carry out a full visual inspection of the structure, remove brick samples for compressive strength and prepare mortar samples for 'Mix Composition'. We were also asked to establish the structural form of the chimney.

Our Technicians attended site on 22nd August 2018 and their findings are detailed as follows.

3 'SITE' DETAILS

The former Victorian fire and police station on Goulden Street in Manchester was constructed in 1872 and Grade II listed in 1992. The building suffered major fire damage in November 2002 when being used as a fireworks store, during the national fire service strike. After demolition to make safe, the remaining structures consisted of the perimeter walls / columns and the main brick chimney.



A



B

Plate T1: Aerial (A) and general (B) view of the chimney. Image (A) courtesy of Google.

4 PROCEDURES

4.1 TERMS OF REFERENCE

Dimensional measurement is undertaken as an inherent part of many of the following activities and although all dimensions recorded should be taken as 'approximate', every effort has been made to ensure the precision and accuracy of the approximations.

All dimensional measurements less than, 'nominally', 300mm, e.g. where checking reinforcement bar diameters, measuring depths of drilling (dust samples), measuring depths of carbonation, or measuring small defects etc., were measured using calibrated steel rules, manufactured to EU Class I. Where steel rules would not fit, e.g. within small breakouts etc., engineers dividers were employed, with dimensions transferred from a calibrated steel rule manufactured to EU Class I. Such measurements were generally rounded to the nearest whole mm.

All dimensional measurements greater than, 'nominally', 300mm, e.g. where measuring larger defect sizes or structural dimensions, were undertaken using measuring tapes manufactured to EU Class I.¹ We again generally rounded such measurements to the nearest whole mm.

NB: The condition of the steel rules, measuring tapes, and engineer's dividers were checked prior to every shift / measurement and only used if in good condition, i.e. the ends / edges / points were straight, sharp and undamaged, with the gradations / values / markings clearly legible.

4.2 GENERAL DEFECTS AND DILAPIDATIONS

The structure was subjected to, as far as practicable, a full close-quarters visual inspection following the procedure described within Concrete Repairs Limited (CRL Surveys), Documented In-house Procedure CRLS STP01.

This procedure is covered by Concrete Repairs Limited (CRL Surveys) UKAS Accreditation, UKAS Ref: 2728. For further details please visit www.ukas.org.



4.3 MASONRY STRUCTURAL DETAILS

4.3.1 Unit Strengths

4.3.1.1 Sampling

A 'Set' of brick samples, each comprising specimens of similar 'sound' bricks from similar locations, were carefully removed from the structure using small hand-held tools.

Each brick specimen was uniquely referenced and sealed into a plastic Sample bag, with its sampling location recorded.

4.3.1.2 Testing

Each brick specimen was submitted to a UKAS Accredited Laboratory for compressive strength testing in general accordance with BS3921².

BS3921 requires that each 'test' should be carried out using a 'set' of 10No. bricks.

4.3.2 Mortar Bedding

¹ Proprietary steel 'pocket' tapes were not used due to potential inaccuracies with the loose fixing and / or deterioration of the end 'hooks'.

² BS3921: 1985, "Specification for Clay Bricks".



4.3.2.1 Sampling

Samples of mortar were prepared in accordance with BS 4551³, in particular Sub-clause 5.3⁴.

Samples were sealed into individually, uniquely labelled, plastic Sample bags, with the sampling location recorded.

4.3.2.2 Analysis

The samples were then submitted to a UKAS Accredited Laboratory for preparation and chemical analysis, for the calculation of mortar mix proportions, in general accordance with BS 4551.

4.4 STRUCTURAL FORM

The form of construction was investigated using non-destructive direct / indirect measurements aided by various fibre-optical borescopes / endoscopes inserted through existing holes. Due to the chimney being Grade II listed intrusive techniques were not used.

³ BS 4551, "Mortar – Methods of test for mortar – Chemical analysis and physical testing"

⁴ Clause 5, "Sampling", Sub-Clause 5.3, "Hardened mortars"

5 INVESTIGATION RESULTS

5.1 GENERAL

The detailed results of our investigations have been prepared as various drawings which have been presented within **Appendix A** and **Appendix B**, with a copy of the Laboratory Analysis Report included as **Appendix C**.

The investigation results are discussed, in summary, below.

NB: The provision of the following summary should not be considered to nullify the requirement for the owners of, or those responsible for the ongoing design and repair or maintenance of this structure to review and understand the detailed results. CRL Surveys accept no liability for misunderstandings, or knock-on effects, including costs, arising from the sole reliance on the following summary. CRL Surveys remain committed to this project and, as far as practicable, on hand to expand or clarify any points of uncertainty.

5.2 GENERAL DEFECTS AND DILAPIDATIONS

Please Note: The following photographs were prepared to illustrate the typical types of defects encountered, rather than to be a representation of the overall condition of the structures concerned, i.e. in this context the 'good' were not photographed, and the impression given may therefore be unduly pessimistic.



A



B

Plate T2: The cast iron and concrete elements at the top of the chimney were found to be displaced.



Plate T3: The steel frame supporting the slabs to the top of the chimney was extensively corroded.



Plate T4: The decorative grilles were also very badly corroded.



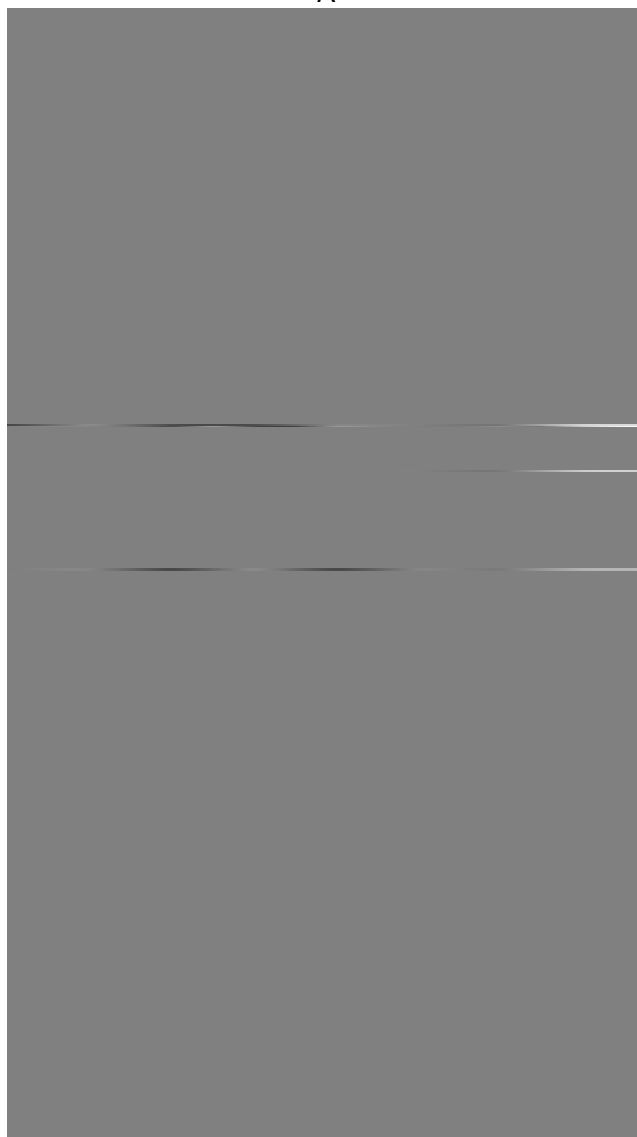
Plate T5: Spalled top corner of a stone sill.



Plate T6: Displaced supporting corbels.



A



B

Plate T7: The mortar pointing and brickwork was found to be in a very poor condition throughout the structure.

5.3 MASONRY STRUCTURAL DETAILS

5.3.1 Unit Strengths

The brickwork units' strength ranged between 9.5 N/mm² and 25 N/mm² with an average of 21.0 N/mm².

5.3.2 Mortar Bedding

The mortar sample S1 was found to comprise a Portland cement and sand mix and was found to be richer than any Designation given in BS 4551:2005 + A2:2013. The sulphate content of the sample was found to be at a normal level. The other three mortar samples were found to comprise semi-hydraulic lime and sand mixes. Mortar sample S4 was also found to contain 9.8% by weight coal or ash in the aggregate.

5.4 STRUCTURAL FORM

The top part of the chimney (approximately 15m high) comprised of two brickwork flues with a number of voids surrounding the flues. Limited information was established on the construction of the lower portion, approximately 8.6m high. We envisage that the voids did not extend to the lower part. The thickness of the external brickwork wall, measured at the existing opening, was found to be approximately 950mm.



Report SUR183512

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6 REMARKS

This report concludes the programme of investigation works requested to date.

Goulden Street Chimney

Cont'd...

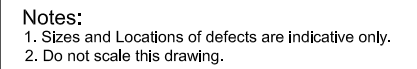


Report SUR183512

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APPENDIX A: DETAILED VISUAL INSPECTION RESULTS

(5 PAGES)



Revision	By	Date	Description
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Client:
Mulbury Homes (Goulden Street) Limited
c/o
Scott Hughes Design

Project Title: _____

Goulden Street
Chimney

Drawing Title:

Kay Plan

Drawn By: LC Date: Aug 2018

Checked By: GN Date: Aug 2018

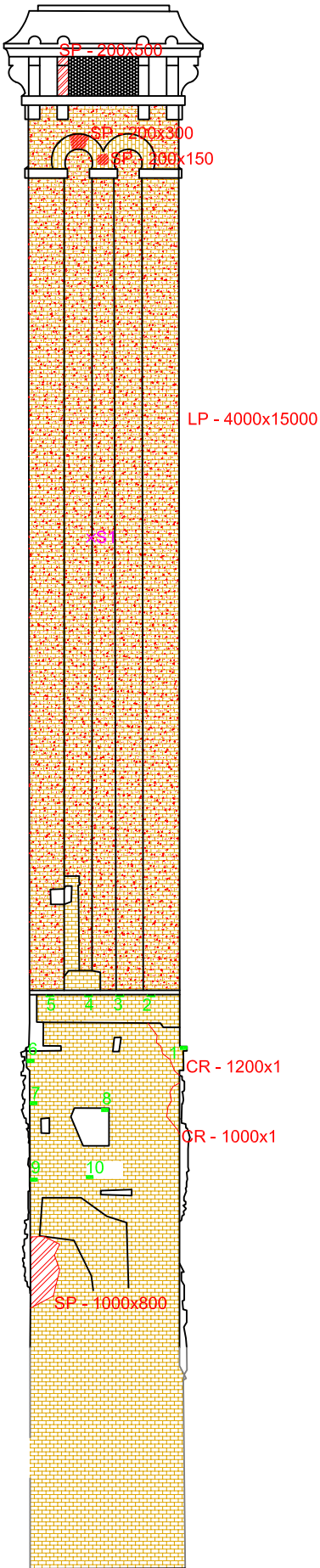
Approved By: GN Date: Aug 2018

Drawing Number:	Revision
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SUR183511/01	0
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Dwg Scale: NTS Dwg Status: Final

DO NOT SCALE



Notes:
1. Sizes and Locations of defects are indicative only.
2. Do not scale this drawing.

VISUAL INSPECTION LEGEND

	Spalled Brickwork (SP)
	Surface Erosion (SE)
	Crack (CK)
	Loose Pointing (LP)
	Poor Pointing (PP)
	Defect Reference Number
	Brick or Mortar Samples
	Mortar Samples Locations

Revision	By	Date	Description
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PORTLAND HOUSE
BRITANNIA ROAD
CHESTERFIELD
DERBYSHIRE
S40 2TZ
T: 01 546 544 900
F: 01 246 525 974
E: mail@concrete-repairs.co.uk
W: www.concrete-repairs.co.uk

Client:
Mulbury Homes (Goulden Street) Limited
c/o
Scott Hughes Design

Project Title:

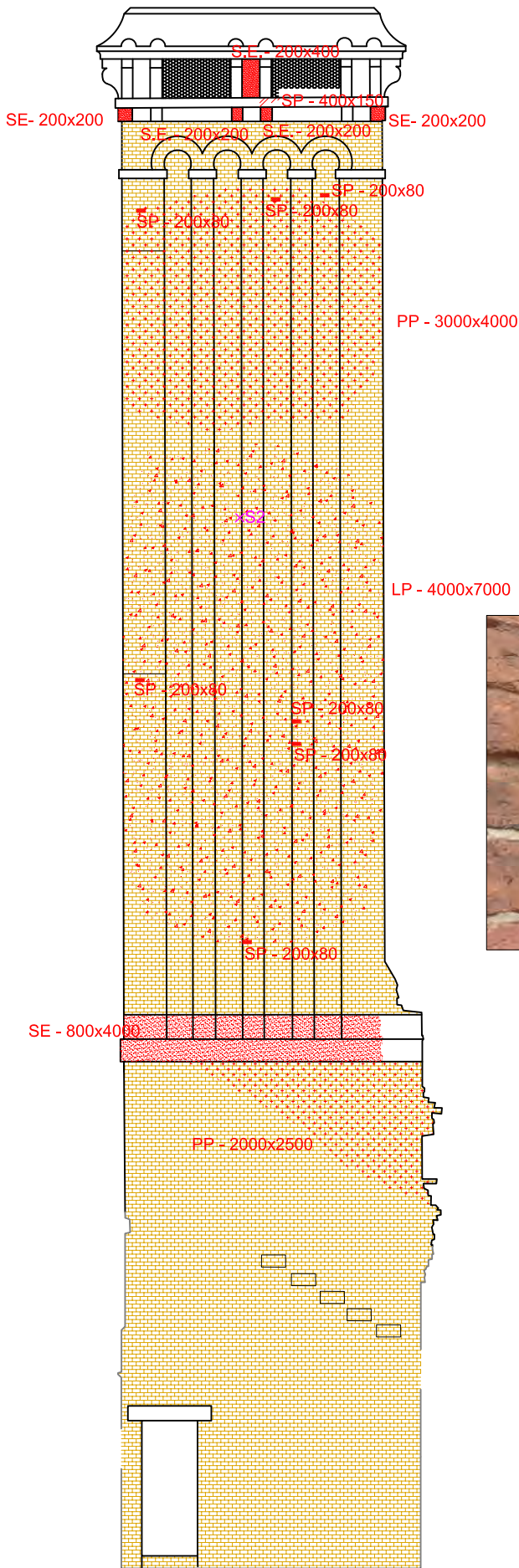
Goulden Street
Chimney

Drawing Title:

Elevation A

Drawn By: LC	Date: Aug 2018
Checked By: GN	Date: Aug 2018
Approved By: GN	Date: Aug 2018
Drawing Number: SUR183511/02	Revision 0
Dwg Scale: NTS	Dwg Status: Final

DO NOT SCALE



Notes:
1. Sizes and Locations of defects are indicative only.
2. Do not scale this drawing.

VISUAL INSPECTION LEGEND	
	Spalled Brickwork (SP)
	Surface Erosion (SE)
	Crack (CK)
	Loose Pointing (LP)
	Poor Pointing (PP)
	Defect Reference Number
	Brickwork Samples
	Mortar Samples Locations

Revision	By	Date	Description
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PORTLAND HOUSE
BRITANNIA ROAD
CHESTERFIELD
DERBYSHIRE
S40 2TZ
T: 01 546 544 900
F: 01 246 525 974
E: mail@concrete-repairs.co.uk
W: www.concrete-repairs.co.uk

Client:
Mulbury Homes (Goulden Street) Limited
c/o
Scott Hughes Design

Project Title:
Goulden Street
Chimney

Drawing Title:
Elevation B

Drawn By: LC Date: Aug 2018

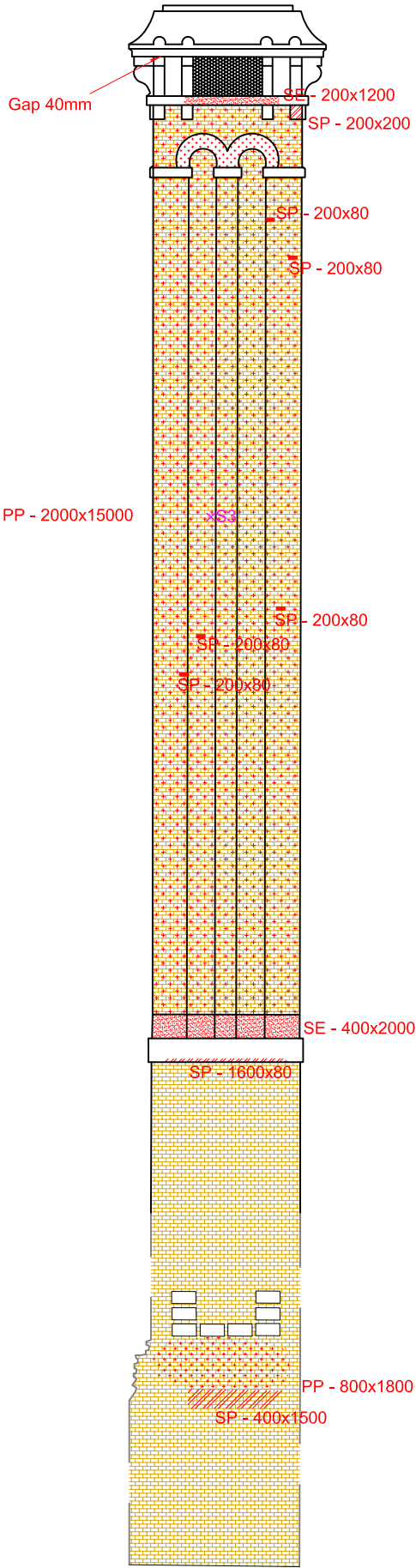
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Approved By: GN Date: Aug 2018

Drawing Number: SUR183511/03	Revision -
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Dwg Scale: NTS Dwg Status: Final

DO NOT SCALE



Notes:
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	Surface Erosion (SE)
	Crack (CK)
	Loose Pointing (LP)
	Poor Pointing (PP)
	Defect Reference Number
	Brickwork Samples
	Mortal Samples Locations

Revision	By	Date	Description
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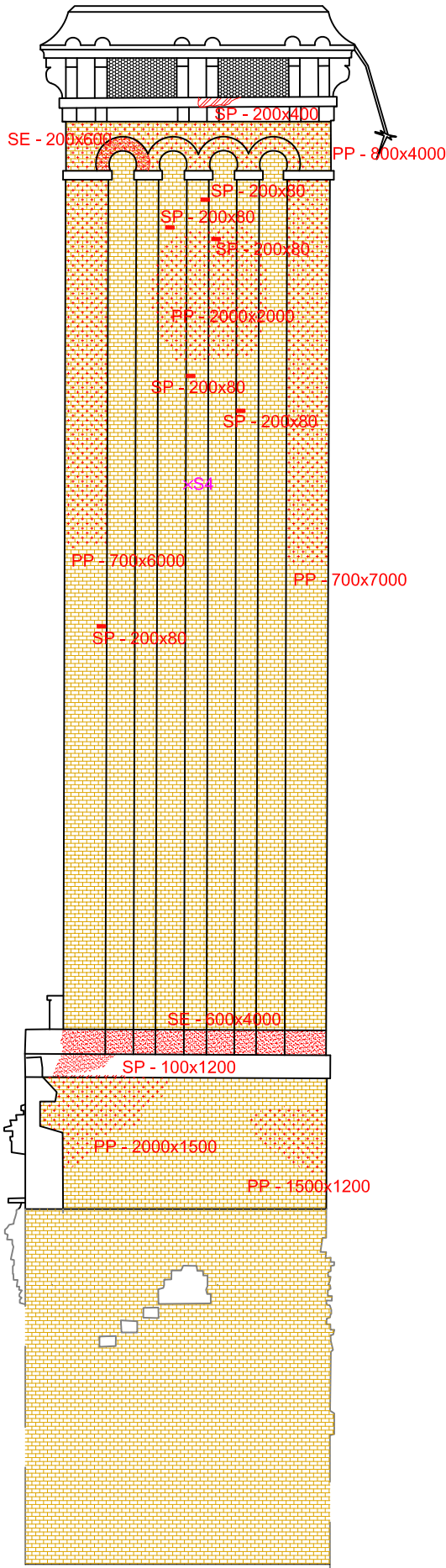
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Mulbury Homes (Goulden Street) Limited
c/o
Scott Hughes Design

Project Title:
Goulden Street
Chimney

Drawing Title:
Elevation C

Drawn By: LC	Date: Aug 2018
Checked By: GN	Date: Aug 2018
Approved By: GN	Date: Aug 2018
Drawing Number: SUR183511/04	Revision: 0
Dwg Scale: NTS	Dwg Status: Final

DO NOT SCALE



Notes:
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- Surface Erosion (SE)
- Crack (CK)
- Loose Pointing (LP)
- Poor Pointing (PP)
- 131 Defect Reference Number
- Brick ork Samples
- S1 Mortal Samples Locations

Revision	By	Date	Description
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Client:
Mulbury Homes (Goulden Street) Limited
c/o
Scott Hughes Design

Project Title:
Goulden Street
Chimney

Drawing Title:
Elevation D

Drawn By: LC	Date: Aug 2018
Checked By: GN	Date: Aug 2018
Approved By: GN	Date: Aug 2018
Drawing Number: SUR183511/05	Revision: 0
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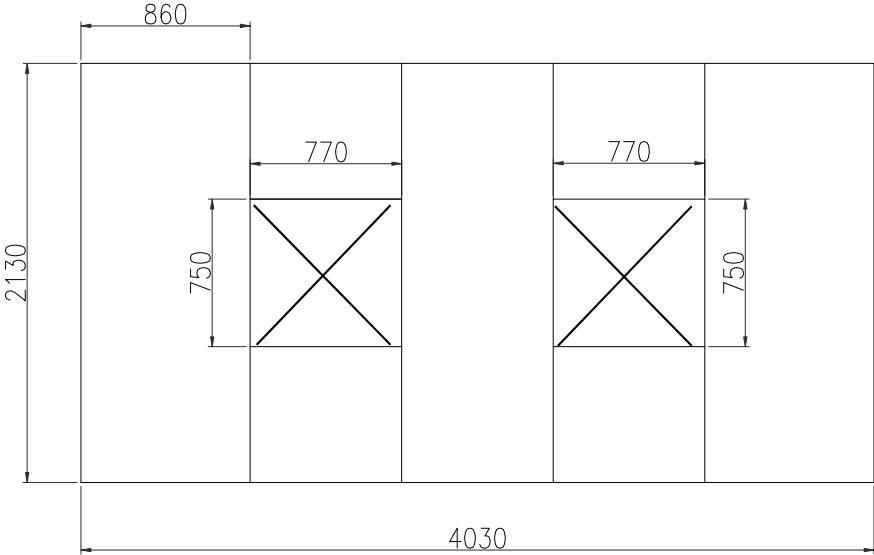


Report SUR183512

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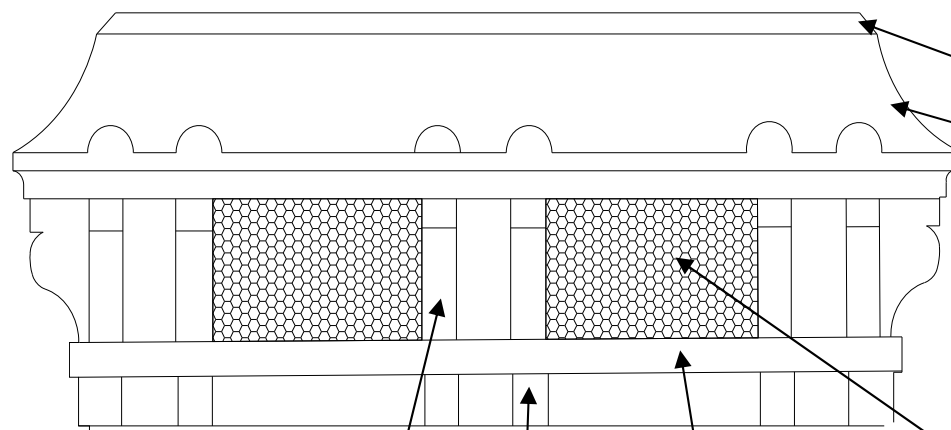
APPENDIX B: DETAILED CONSTRUCTION FORM RESULTS

(5 PAGES)

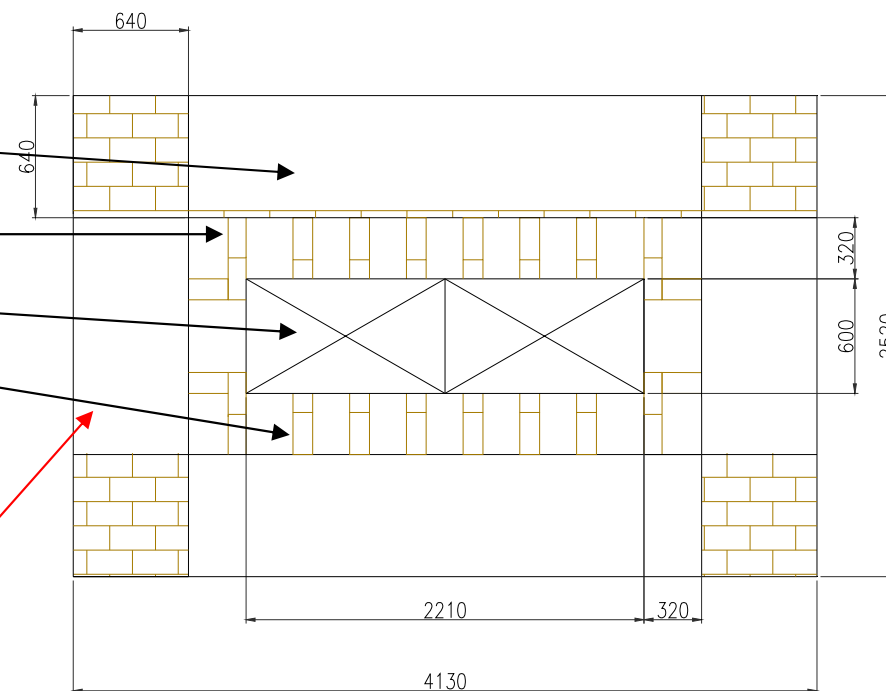


General view from top

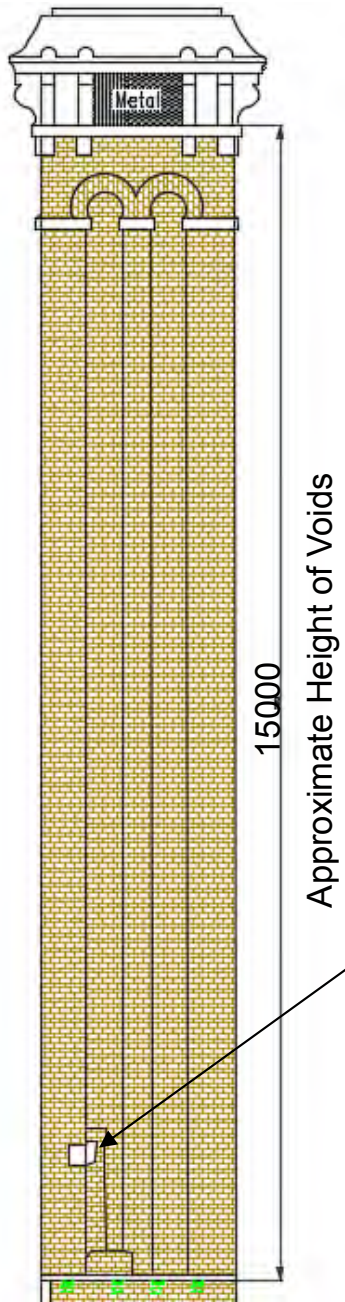
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Goulden Street Chimney	Structural Form	Aug 2018	SUR183512	LC	



SITE	DETAILS	DATE	CONTRACT NO.	INITIALS	
Goulden Street Chimney	Structural Form	Aug 2018	SUR183512	LC	

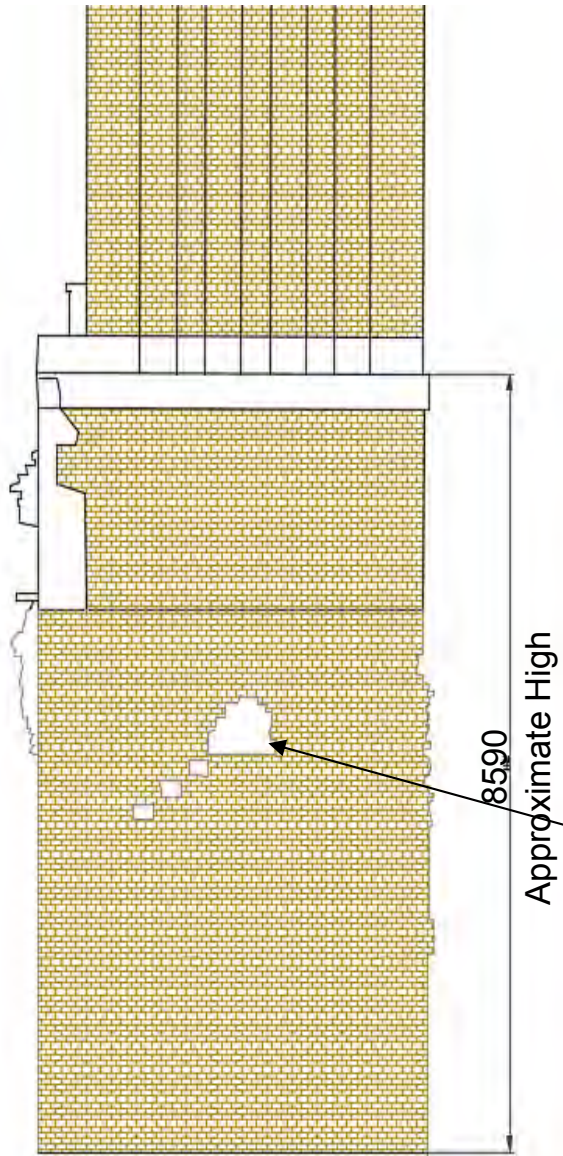


SITE	DETAILS	DATE	CONTRACT NO.	INITIALS	
Goulden Street Chimney	Structural Form	Aug 2018	SUR183512	LC	 CRL SURVEYS Structural and building assessment



Voids Visible through an Opening

SITE	DETAILS	DATE	CONTRACT NO.	INITIALS
Goulden Street Chimney	Structural Form	Aug 2018	SUR183512	LC



Voids not Visible above an Opening



Approximate wall thickness 950mm

SITE	DETAILS	DATE	CONTRACT NO.	INITIALS
Goulden Street Chimney	Structural Form	Aug 2018	SUR183512	LC



Report SUR183512

Cont'd...

APPENDIX C: LABORATORY ANALYSIS AND TEST REPORT

(9 PAGES)

Goulden Street Chimney

Cont'd...

SANDBERG

REPORT 61654/C/72

THE FORMER POLICE STATION CHIMNEY

**ANALYSIS OF BRICKS AND MORTAR
SAMPLES**

Sandberg LLP
5 Carpenters Place
Clapham High Street
London SW4 7TD

Tel: 020 7565 7000
Fax: 020 7565 7101
email: mail@sandberg.co.uk
web: www.sandberg.co.uk

SANDBERG
CONSULTING ENGINEERS
INVESTIGATION INSPECTION
MATERIALS TESTING

Sandberg LLP
5 Carpenters Place
London SW4 7TD

Tel: 020 7565 7000
Fax: 020 7565 7101
email: clapham@sandberg.co.uk
web: www.sandberg.co.uk

REPORT 61654/C/72

THE FORMER POLICE STATION CHIMNEY

ANALYSIS OF BRICKS AND MORTAR SAMPLES

Concrete Repairs Limited
Portland House
Britannia Road
Chesterfield
S40 2TZ

This report comprises
3 pages of text
Table 1 of 2 sheets
Table 2 of 1 sheet

For the attention of Mr Greg Nowakowski

19 September 2018

Partners: N C D Sandberg S C Clarke D J Ellis P Tate A A Willmott R A Rogerson
M A Eden J D French C Morgan G S Mayers G C S Moor J Fagan J H Dell
Senior Associates: R D Easthope I M Hudson S R P Morris M I Ingle M Faliva R A Lucas A L Pitman D A Kinnersley
Associates: D Hunt J Carmichael Y N P Guellil A T Hollyman J Glen Dr W R Newby K J Green Dr S E Tulip J Gallagher

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CONSULTING ENGINEERS

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Sandberg LLP
5 Carpenters Place
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THE FORMER POLICE STATION CHIMNEY

ANALYSIS OF BRICKS AND MORTAR SAMPLES

Reference: Order Number 000473 SUR183512 dated 23 August 2018.

1. INTRODUCTION

Four mortar samples, taken by yourselves from the above project, were received in our laboratories on 29 August 2018.

We were asked to carry out analysis to determine the mix composition and proportions of the mortar samples.

Ten brick samples were received at the same time for compressive strength testing.

2. SAMPLE DETAILS

Details of the samples are given in the results tables.

3. ANALYSIS METHOD AND RESULTS

3.1 Determination of Mix Proportions

The mortar samples were prepared and analysed using documented in-house methods based on BS 4551:2005 + A2:2013 "Methods of test for mortar".

As examination of the analysis data indicated that the mix for sample C97119 (S1) consisted of Portland cement and sand, the mix proportions were calculated on this assumption, following the directions given in Table 3 of BS 4551.

As examination of the other three mortar samples indicated that the mixes comprised semi-hydraulic lime and sand, the mix proportions were calculated on this assumption, following documented in-house methods.

The cement content for sample C97119 (S1) was calculated from the acid soluble calcium content making the assumptions shown in the analysis Table. Since the result was outside the categories listed in Table 4 of BS 4551, the approximate volume proportions were calculated assuming the average bulk densities of the constituents which are given in BS 4551.

The lime contents were calculated from the acid soluble calcium contents making the assumptions shown in the analysis Tables. The approximate volume proportions were calculated using typical bulk densities for the constituents as indicated in the analysis tables.

Details of the analysis are given in Table 1 of this report, including details of the assumptions made in the calculations. The mix proportions are summarized below:

Sample Reference	Client Reference	Mix Type	Mix proportions by volume	Designation from BS 4551 : 2005
C97119	S1	Portland cement : sand	1 : 2.1	-*

-* Richer than any Designation given in 4551:2005 + A2:2013.

Sample Reference	Client Reference	Mix Type	Mix proportions by weight	Mix proportions by volume
C97120	S2	Semi-hydraulic lime : sand	1 : 2.8	1 : 1.1
C97121	S3	Semi-hydraulic lime : sand	1 : 3.0	1 : 1.2
C97122	S4	Semi-hydraulic lime : sand	1 : 5.7	1 : 2.3

3.2 Compressive Strength of Brick Samples

The ten brick samples were capped with high alumina cement mortar and used to determine compressive strength in accordance with BS EN 3921:1985.

The test results are given in Table 2.

4. REMARKS

The mortar sample C97119 (S1) was found to comprise a Portland cement and sand mix and was found to be richer than any Designation given in BS 4551:2005 + A2:2013.

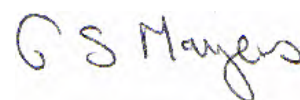
The sulphate content of the sample was found to be at a normal level.

The other three mortar samples were found to comprise semi-hydraulic lime and sand mixes.

Mortar sample C97122 (S4) was also found to contain 9.8% by weight coal or ash in the aggregate.

Concrete Repairs Limited
Portland House
Britannia Road
Chesterfield
S40 2TZ

for Sandberg LLP



G S Mayers
Department Manager
19 September 2018

For the attention of Mr Greg Nowakowski

Materials, samples and test specimens are retained for a period of 2 months from the issue of the final report.

Tests reported on sheets not bearing the UKAS mark in this report/certificate are not included in the UKAS accreditation schedule for this laboratory.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

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61654/C/72

Table/Sheet

1/1 of 2

Date of Test

14-17/09/18

MORTAR - CHEMICAL ANALYSIS
DETERMINATION OF MIX PROPORTIONS
 Documented In-house Methods 34.1(*) and BS 4551:2005+A2:2013

Sandberg Reference	C97119			
Client Reference	S1			
Details	Mortar			
CHEMICAL ANALYSIS				
		% by mass		
Insoluble Residue	58.72			
Soluble Silica, SiO ₂ *	6.42			
Acid soluble Alumina, Al ₂ O ₃ *	1.68			
Acid soluble Iron, Fe ₂ O ₃ *	0.84			
Acid soluble Calcium, CaO	16.48			
Acid soluble Magnesium, MgO	1.62			
Acid soluble Sulphate, SO ₃	0.86			
Loss on Ignition	13.01			
Total	99.63			

Calculated Mix Proportions				
Composition to nearest 0.5%	% by mass of dry mass			
Portland cement : sand				
Portland cement	29.5			
Sand	70.5			
Calculated volume	1 : 2.1			
Mortar Designation From Table 4, BS4551 : 2005	.*			
Sulphate % by mass of cement	4.0			

.*Richer than any Designation given in 4551:2005 + A2:2013.

Assumptions used in calculations	SiO ₂ %	CaO %	bulk density kg/m ³	material type
Sand	0.2	0.0	1675	Siliceous
Portland cement	20.5	64.5	1450	OPC

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61654/C/72

Table/Sheet

1/2 of 2

Date of Test

14-17/09/18

MORTAR - CHEMICAL ANALYSIS
DETERMINATION OF MIX PROPORTIONS
 Documented In-house Methods 34.1(*) and BS 4551:2005+A2:2013

Sandberg Reference	C97120	C97121	C97122	
Client Reference	S2	S3	S4	
Details	mortar	mortar	mortar	
CHEMICAL ANALYSIS				
	% by mass			
Insoluble Residue	65.31	67.35	79.46	
Soluble Silica, SiO ₂ *	1.04	1.03	1.54	
Acid soluble Alumina, Al ₂ O ₃ *	0.36	0.40	0.61	
Acid soluble Iron, Fe ₂ O ₃ *	0.26	0.28	0.89	
Acid soluble Calcium, CaO	14.73	14.21	9.17	
Acid soluble Magnesium, MgO	1.42	1.38	0.20	
Acid soluble Sulphate, SO ₃	1.10	1.21	2.59	
Loss on Ignition	15.31	13.89	5.42	
Combustible material			(9.83)	
Total	99.53	99.75	99.88	

Calculated Mix Proportions				
Composition to nearest 0.5%	% by mass of dry mass			
Semi-hydraulic lime : sand				
Lime	26.5	25.0	15.0	
Sand	73.5	75.0	85.0	
Calculated volume proportions	1 : 1.1	1 : 1.2	1 : 2.3	
Remarks	Feebly hydraulic	Feebly hydraulic	Feebly hydraulic	

Assumptions used in calculations	SiO ₂ %	CaO %	bulk density kg/m ³	material type
Sand	-	0.0	1400	siliceous
Semi-hydraulic lime	-	62.0	575	Semi- hydraulic

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61654/C/72

Table/Sheet

2/1 of 1

Date of Test

3/9/2018

BRICK TEST RESULTS
COMPRESSIVE STRENGTH
 BS 3921:1985, Appendix D(s/s)¹

Sandberg Sample Reference	C97109-18
Client Sample Reference	The Former Police Station Chimney
Type:	Used clay solid
Mean strength of mortar used to fill frogs at test, days, N/mm²	-

Sandberg Specimen Reference	Client Specimen Reference	Surface Area mm²	Maximum Failing Load kN	Compressive Strength² N/mm²
7386	-	23100	470	20.3
7387	-	23400	594	25.4
7388	-	23296	425	18.2
7389	-	24168	249	10.3
7390	-	24640	742	30.1
7391	-	22800	768	33.7
7392	-	25850	246	9.5
7393	-	23088	446	19.3
7394	-	22680	432	19.0
7395	-	25080	610	24.3
			Average	21.0

¹ BS 3921:1985 has been withdrawn and replaced by parts of BS EN 771 and BS EN 772 series. However for the purposes of testing reclaimed bricks we have continued to use BS 3921 methods.

² To the nearest 0.1 N/mm²

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Where our involvement consists exclusively of testing samples, the results and our conclusions relate only to the samples tested.



Report SUR183512

Cont'd...

END OF REPORT

Goulden Street Chimney

Cont'd...

LONDON & SOUTH EAST

Cathite House
23a Willow Lane
Mitcham, Surrey
CR4 4TU
020 8288 4848
london@concrete-repairs.co.uk

SCOTLAND

Carron House
16 Winchester Avenue
Denny, Falkirk
FK6 6QE
01324 821 400
falkirk@concrete-repairs.co.uk

NORTH EAST & MIDLANDS

Portland House
Britannia Road
Chesterfield
S40 2TZ
01246 544 900
chesterfield@concrete-repairs.co.uk

NORTH WEST & NORTH WALES

Chadwick House
Birchwood Park
Warrington
WA3 6AE
01925 574060
warrington@concrete-repairs.co.uk

SOUTH WEST & SOUTH WALES

The Old Boiler House
Burnett Business Park
Gypsy Lane, Keynsham
Bristol, BS31 2ED
0117 986 8088
bristol@concrete-repairs.co.uk

CRL EMIRATES

PO Box 72568
Abu Dhabi
United Arab Emirates
+971 5 0566 8537
mail@crleirates.ae
www.crleirates.ae



www.crlsurveys.co.uk

