

Design & Access Statement PSDS Withington Library Manchester City Council

February 2025

Withington Library
410 Wilmslow Road
Withington
Manchester
M20 3BD

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1.0 Introduction

This Design & Access Statement has been prepared by Drees & Sommer UK Ltd on behalf of Manchester City Council, to support the planning and listed building consent application submissions for works associated with decarbonisation comprising the following:

- i. Replacement of the existing gas boilers with Air Source Heat Pumps (ASHP)*
- ii. Upgrade BMS*
- iii. Replacement of the existing timber sash single glazed windows with new heritage timber sash double glazed windows*
- iv. Refurbishment of the existing single glazed steel windows and installation of secondary glazing to the internal face.*

The information provided in this report is specific to Withington Library in order to clearly demonstrate the work content and any impact on the building which is situated in a conservation area.

The potential impact of the proposed works on the Grade II Listed Building is discussed in further detail in the accompanying Heritage Statement. This document has been prepared in accordance with the requirements of DCLG Circular 01/2006 and the CABE Publication Guidance "Design and Access Statements".

The report considers:

- Scope of Works
- Methods of Construction
- Impact on Building Structure, Fabric and Finishes
- Outline Specifications

Instructions

Client

Manchester City Council
Town Hall
182 Sefton Street
Manchester M60 2LA

Property Discussed in this Report

Withington Library
410 Wilmslow Road
Withington
Manchester M20 3BD

Lead Consultant/Designer

Drees & Sommer UK Ltd
1.06 South Harrington Building
182 Sefton Street
Liverpool L3 4BQ

2.0 Background

2.1 Project Need

Manchester City Council (MCC) is committed to becoming a more sustainable organisation, with a key component to achieving this being the decarbonisation of their corporate estate. The council has targeted Net Zero Carbon status by 2038.

Surveys have been undertaken of the building stock, a number of potential decarbonisation measures were reviewed which prioritised the use of the energy hierarchy model to initially look to reduce energy demand and improve efficiency, followed by installing low or zero carbon solutions including renewable energy before finally looking to offset remaining emissions.

Various mechanical and electrical upgrades have been proposed for MCC buildings which include installation of roof mounted solar PV, replacing gas boilers with Air Source Heat Pumps, replacement LED lighting etc. in conjunction with Building Fabric Improvements comprising upgrading roof coverings, installation of cavity wall insulation and replacement windows and doors.

2.2 Existing Site

Withington library houses was constructed in 1927. The building features an open plan library space with several meeting rooms as well as a staff office and basement plant room. The building is a generally a single storey structure with a raised double height entrance atrium. The building is constructed with standard load bearing brick solid wall construction with areas of decorative stonework throughout the buildings external walls. Load bearing walls and internal columns support a concrete flat roof structure which is covered with an insulated mineral felt build up and features multiple rooflights of varying size, shape and type. The building features single glazed timber sash windows at ground floor level, with level windows in the double height space with single glazed leaded glazed steel framed and direct masonry fixed windows.

Withington library currently utilise 196,237 kWh of natural gas and 24,931 kWh of electricity per annum. All of the natural gas usage on site is used for space heating.

There have been several upgrades to the building since its original construction including recovering flat roofs with rigid insulation in 2018, and replacing many of the original single-glazed rooflights windows with aluminium framed double-glazed rooflights in 2018.

This report provides a route to Net Zero for Withington Library with harm minimised and avoided where possible.

3.0 The Development

3.1 Outline Scope of Works

The proposed development will provide a positive contribution to decarbonising the existing buildings which includes the following works:

1. Removal of existing gas boilers as indicated on drawing 3388-CWC-XX-B1-DR-M-5602. Installation of high temperature Air Source Heat Pump (ASHP) to the roof of the building (refer to image 01), with associated pipework connections as indicated on drawing 3388-CWC-XX-EX-DR-M-5004.



Image 01: Withington Library ASHP Roof Reference Plan

2. Existing single glazed timber sash windows to ground floor level (refer to image 02), are to be removed and replaced with new equivalent double glazed timber sash windows with improved draughtproofing and seals. Proposed elevations showing new windows are included within drawing 24615.104.



Image 02: Withington Library Existing Timber Sash Windows

3. Existing steel framed and direct fixed single glazed leaded lights to high level (refer to image 03), are to be refurbished with leaded lights to be straightened and steel frames to be stripped back and repaired. Aluminium framed secondary glazing in a triple panel arrangement is to be installed to fill the existing window reveals. Proposed elevations showing existing are included within drawing 24615.104, with details of the secondary glazing shown in drawing 24615.114.



Image 03: Withington Library Existing Steel Framed Windows

4. Associated works for access and maintenance requirements for the ASHP and high level windows, including mansafe system to the main roof area, and fixed ladder to the yard external walls areas (refer to image 04), all as detailed on drawings 3388-CWC-XX-EX-DR-M-5004-T4, DWG24615.104 and DWG24615.107 respectively. A mansafe system is to be provided to the lower roof at the front elevation of the property as to allow for maintenance

and cleaning of the higher level windows to this roof, no access ladder is to be provided for this with it to be accessed via scaffold or MEWP when required.

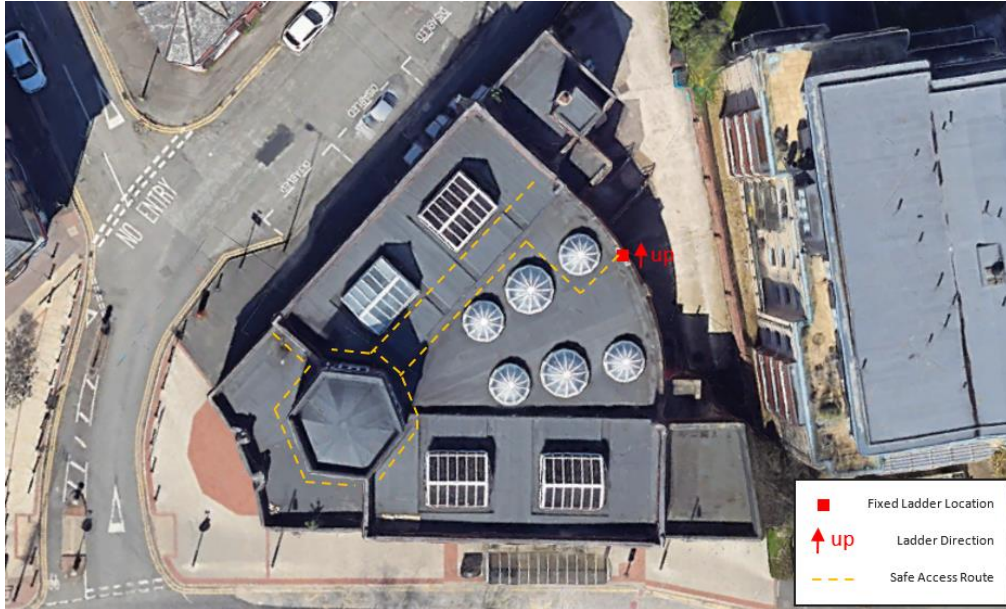


Image 04: Withington Library Roof Access

3.2 Method Statement for ASHP's

ASHP's are to be installed externally to a discrete location to the roof. The ASHP's will mostly be covered by the buildings parapet wall which will limit the visual impact of their installation when viewed from ground level. The ASHP are to be located on "Bigfoot" feet as to prevent intrusive works and to limit the impact on the structure. For ASHP locations refer to drawing 3388-CWC-XX-EX-DR-M-5004.

Pipework will penetrate the roof of the Plant room at two points, with a maximum clearance opening of 150mmØ as indicated in drawing 3388-CWC-XX-B1-DR-M-5602 and 3388-CWC-XX-EX-DR-M-5004. A cable tray opening would also be required with largest size 150mm wide as detailed in drawing 3388-CWC-XX-ZZ-DR-E-6001. Please also refer to the photos in Appendix 'B' providing reference to the roof locations.

Existing gas boilers will be removed from the Plant Room. No additional internal upgrades are proposed with existing pipework infrastructure and heat emitters being retained.

3.3 Method Statement for Windows

The Existing windows are to be replaced to repair elements which are currently in poor condition and improve the thermal performance of the building.

To the ground floor the building features timber hardwood sash windows with Georgian window bars and single glazing throughout. Windows are of various sizes throughout the building. The existing windows are in poor condition with rotten cills noted to windows throughout. These existing windows

are to be replaced with new sapele hardwood timber sash windows with Georgian window bars, draughtproofing and heritage double glazing. This will provide new good condition windows, while also significantly improving the U-Value of the windows to 1.4 W/m²k, and maintaining the existing aesthetic appearance.

To the Higher level windows the building features steel leaded single glazed Crittall windows and direct fixed glazing directly into the existing stone work. The existing windows are in poor condition with corrosion noted to most steel frames, and water ingress damage noted to the surrounding internal plaster work.

Existing windows are to be repaired with existing glazing and frames to be removed and refurbished off site. Steel frames are to be fully stripped with all corrosion treated and damaged sections of steel replaced prior to decoration and re-installation. All hinges and ironmongery to be repaired where possible or replaced with equivalent matching items. Leaded glazing is to be straightened with any cracked or damaged glazing sections being replaced with matching glass. Following repairs of the frames and glazing, both are to be re-installed on site in their original locations. This should extend the lifespan of the windows, improve the condition and prevent further damage to the building via water ingress.

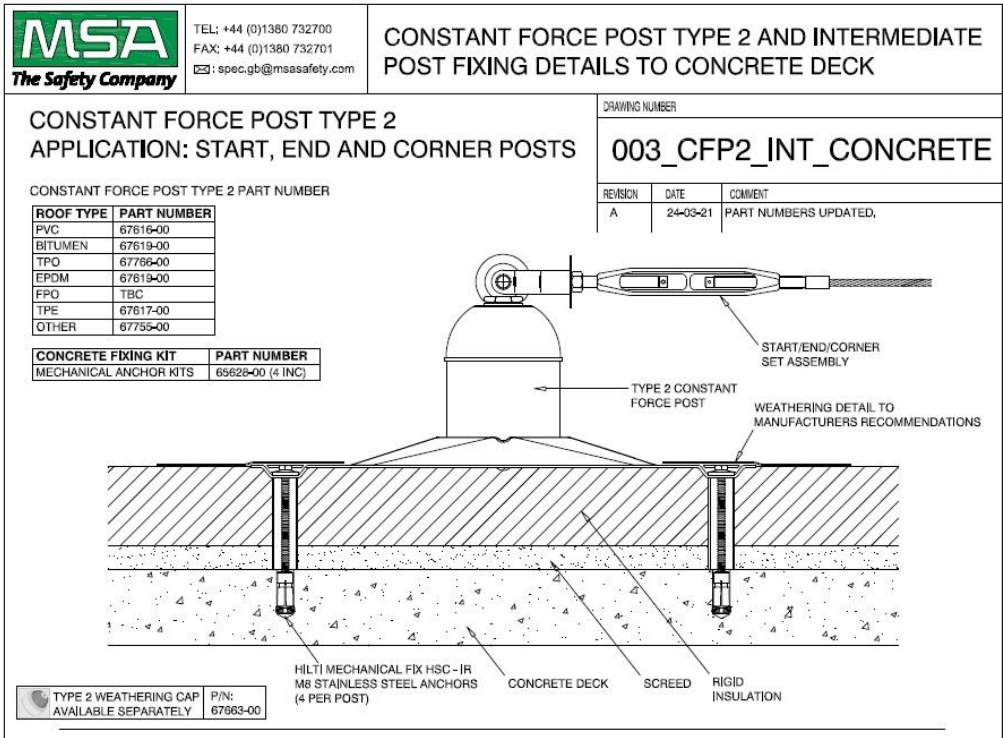
Aluminium framed secondary glazing is to be in a three panel horizontal sliding glazing arrangement to match the existing high level window layout. This will increase the thermal performance of the existing windows while having limited impact on the appearance.

3.4 Method Statement for ASHP Access

3.4.1 Mansafe System

The Library are predominantly flat with varying levels. Some areas of roof feature an existing parapet, however as the height of the parapet does not meet the 1100mm height as outlined in Building Regulations Part K, additional edge protection or fall restraint will be required. Installation of ASHP panels would require safe method of maintenance and fall protection.

A constant force type mansafe system would need to be installed above the Library roofs as to allow access to the ASHP locations, with posts secured to the roof structure with mechanical steel anchor fixings as detailed in image 05.



The ladders and overrail system would need to be secured to external walls and parapets with mechanical steel anchor fixings as detailed in image 06. Please also refer to the photos in Appendix 'B' providing reference to the wall locations.

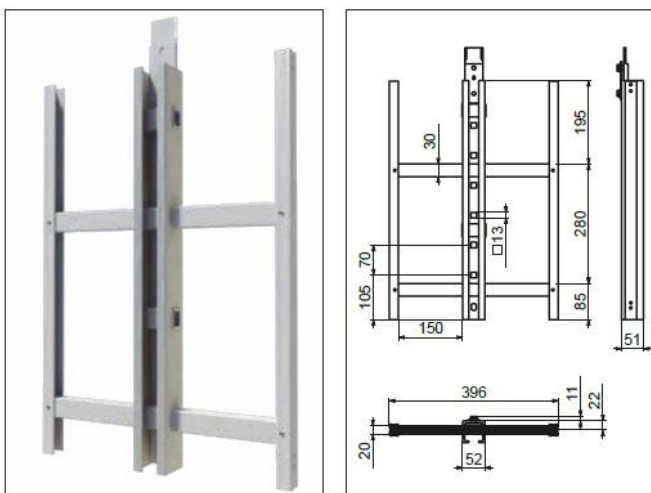
Twin ladder

- With side rails
- Profile 5 x 51 mm
- With connector
- Mounting distance: recommended 1,400 mm - max. 2,240 mm
- The bracket is mounted to the ladder through the rectangular cut-outs in the back of the guide rail or through the guide rail catch bar
- Max. section length 4,480 mm
- Rung distance 80 mm
- Step width per side 150 mm

Material: Anodised aluminium

Weight: 3.5 kg/m

Part no. ZAL-<ladder length in mm>



Set of connectors

- To connect twin ladders
- Complete with all mounting elements
- Included in the delivery of each twin ladder
- Must be used when an existing twin ladder is cut and reconnected

Material: Anodised aluminium

Weight: 0.25 kg/each

Part no. 21876

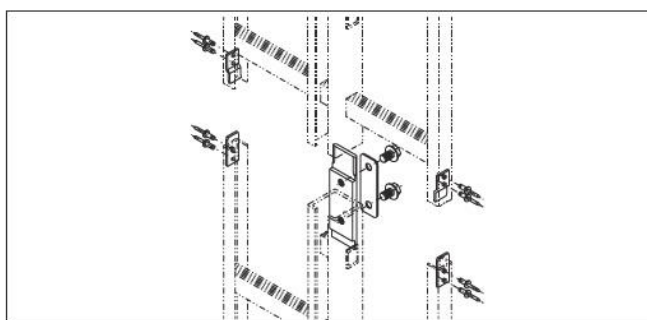


Image 07: Crematorium Vertical Ladder Fixing Detail

4.0 Building Fabric /Finishes and Structural Considerations

4.1 Roof Structure and Coverings

The flat roof coverings have been recently replaced in 2018 and the as-built information has been reviewed to obtain the material build-up, that would assist with the appraisal of roof structure in determining the feasibility of installing ASHP to the library Roof. No sign of water ingress was discovered and as such it is safe to assume that the roof covering is in good condition throughout.

Existing bituminous membrane roof coverings were confirmed to be in good condition and sufficiently insulated as indicated within the as-built information provided within Appendix 'C'.

Structural Engineers Frederick G Markland Associates were also instructed to undertake inspection and appraisal of the roof structure and supporting framework to determine additional load associated

with installation of the ASHP's would not compromise the weathertightness and structural integrity of the existing building.

FG Markland's assessment and report ref /date concluded the construction of the roof decks would have sufficient capacity to support the additional weight imposed by the ASHP system, refer to Appendix 'D'.

4.2 ASHP Support & Fixings

The ASHP's and substituent framework, cable trays and pipework would be mounted on rubber Big Foot feet and would not require any fixings to penetrate the roof covering or structure.

The additional weight of the proposed ASHP's will continue to be assessed by the Structural Engineer as the design progresses to ensure that the additional weight imposed causes no detriment to the existing structure or roof coverings.

4.3 Mansafe System & Fixings

Mansafe system is proposed to be installed above the library's roof, with posts secured to the concrete roof structure with mechanical steel anchor fixings. Pull-out testing would need to be undertaken prior to installation to ensure the roof structure is suitable for the required resistance loadings.

The additional weight of the proposed mansafe system will continue to be assessed by the Structural Engineer as the design progresses to ensure that the additional weight imposed causes no detriment to the existing structure or roof coverings.

4.4 Access Ladder & Fixings

Vertical fixed ladders are proposed to be installed at a single location to provide unrestricted access to the library roof for maintaining the ASHP. The ladder and overrail would be secured to external walls and parapets with mechanical steel anchor fixings. Pull-out testing would need to be undertaken prior to installation to ensure wall structures are suitable for the required resistance loadings.

The additional weight of the fixed ladders will continue to be assessed by the Structural Engineer as the design progresses to ensure that the additional weight imposed causes no detriment to the existing wall structures.

The means of fixing ladders to the existing structure will also be checked by a specialist to ensure that a sufficient quantity of fixings are installed to allow the weight of operatives using the ladder to be adequately supported and not damage the building fabric.

4.5 Heating Infrastructure

The forming of holes to allow distribution routes through external walls and pipework /cable duct entry points will first be assessed by a Structural Engineer to ensure there is no structural impact to the existing building wall structures.

The means of fixing to the existing structure will also be checked by a specialist to ensure that sufficient quantity of fixings are installed to support the weight of new pipework and cabling.

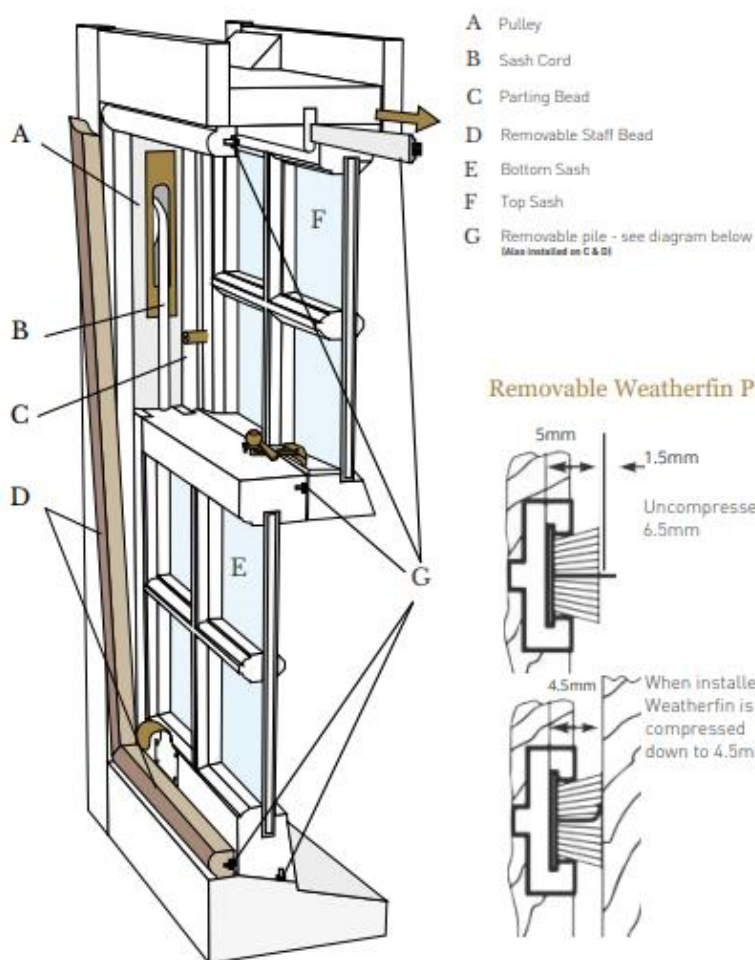
ASHP pipework and cable duct protrusions through walls and rooves will be sealed with a suitable weatherproof sealing compound.

5.0 Specifications

5.1 Windows

Ventrolla sapele hardwood timber double glazed sash windows are proposed to replace the existing timber single glazed sash windows. The new windows will achieve a new U-Value of 1.4 W/m²K as detailed below.

A Ventrolla Renovated Window



Sash Removal System

[SRS] is discreetly mounted in the side of the sash, allowing safe and easy removal of both the upper and lower sashes, to therefore give free access to the window box frame, and is not visible either internally or externally during the normal operation of the sash window.



Close up of the brake itself unengaged and free to move



Close up of brake in it's engaged state

www.ventrolla.co.uk

0800 0277 454

9

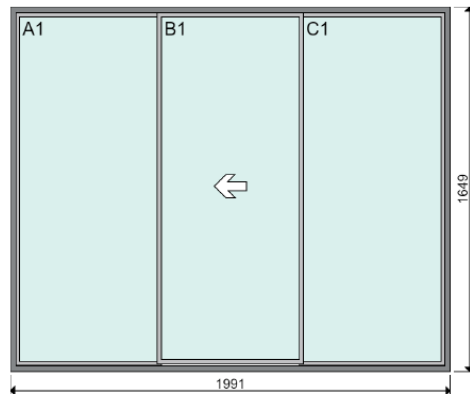
Heritage Unit 4-6-4 - The overall thickness is 14 mm.

Centre pane U value for unit incorporating 4mm Super Low 'E'- 6mm superspacer argon filled cavity- 4mm Clear Float= U Value of 2.0 W/m²K

Centre pane U value for unit incorporating 4mm Super Low 'E'- 6mm superspacer krypton filled cavity- 4mm Clear Float= U Value of 1.4 W/m²K

5.2 Secondary Glazing

Secondary glazing is to be installed to the existing window reveals with Ventrolla Horizontal Sliding Secondary Glazing with aluminium frames and toughened glazing as detailed below.



Supply & Install a complete new Secondary Glazing (Secondary Glazing Horizontal sliding range) in Aluminium

Moulding

Ovolo

Single Glazing - Yorkshire

6mm K Tough

Paint / Finish

Internal: Final Finish RAL 9003 Signal White, External: Final Finish RAL 9003

Signal White, Cill: Final Finish RAL 9003 Signal White

Ironmongery

N/A

Notes

Panel width to match split of item 27

Horizontal Slider

Slim, Versatile & Stylish

Arguably the most popular product in the entire range, our horizontal sliding units offer a sleek, slimline design aesthetic with minimal sight lines.

Whether it's for a period property, listed building or city centre apartment, our horizontal sliders seamlessly blend to their surroundings and provide extensive thermal and acoustic benefits, without even the slightest compromise on style.

Available in 2, 3, 4 and 5 panel configurations, horizontal sliding units can be used to treat even the largest of glass expanses, with brass rollers as standard to ensure effortless sliding along the frame.

Other Key Features:

- Removable panels for ease of cleaning.
- Integrated lock for superior aesthetics.
- Up to 10.8mm glazing available.
- Colour coded hardware available.
- Trickle ventilation available.
- Restrictors available.

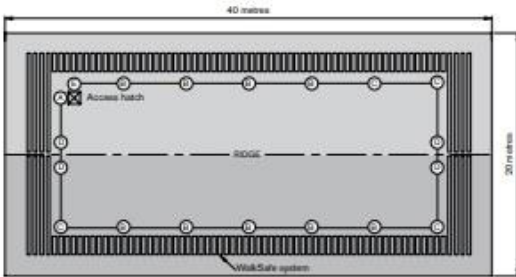
5.3 Mansafe System

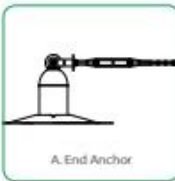
A constant force type mansafe system would need to be installed above the library roofs to provide safe access for installation and maintenance of the ASHP as detailed below.

Latchways Fall Protection

Constant Force post: System design

A typical roof layout for a perimeter system is illustrated identifying the different system components. Posts must not be spaced more than 10 m apart. Designers should try to ensure that access to all areas is achieved without the requirement for PPE (Personal Protective Equipment) adjustment. MSA provides a bespoke Latchways system design service for your project requirements.
Email: spec@latchways.com for more information.





A. End Anchor



B. Intermediate Anchor



C. Corner Anchor



D. Variable Anchor



E. End Anchor

System components

The following components complete the system allowing hands-free operation. Latchways components are manufactured in marine-grade stainless steel and are individually numbered to allow complete traceability. Inspection and maintenance are required annually.

Transfasteners

The user, wearing a full body harness and energy-absorbing lanyard, is continuously attached to the system with a Transfastener™, which rotates allowing it to pass through the intermediate cable supports. For systems on inclines over 15° a Climblatch device is required instead of the Transfastener.





Turnbuckle assembly
The turnbuckle assembly provides a cable termination and method of tensioning the system. The integral indicator disc will spin when the correct tension is reached.



Swage & Clevis
The swage and clevis unit provides the method of terminating the cable at the opposite end of the system to the turnbuckle assembly.



90° Corner bracket
This one-piece corner bracket attached to an intermediate post provides an angle change of 90° within the system.



Variable bracket
This bracket attaches to an intermediate post and provides an angle change of between 0 and 80° both in the horizontal and the vertical plane.



D Ring & Hanger
The D ring and hanger form an intermediate cable support. The cable is threaded through the hanger allowing the Transfastener to travel the length of the system without disconnecting.



5.4 Fixed Ladders

Vertical fixed ladders would need to be installed at various locations to provide unrestricted access to maintain ASHP on the Library Roof as detailed below.

Söll PivotLoc foldable ladder system

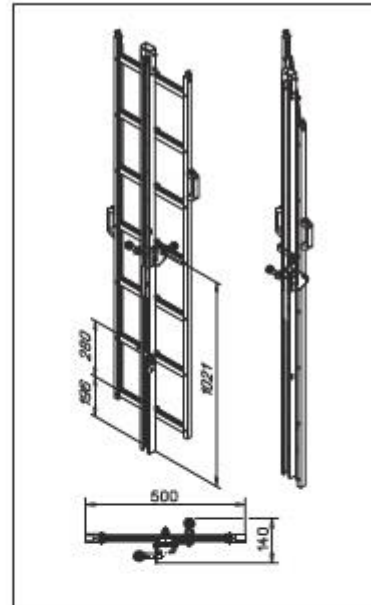
Design principle:

The ladders can be opened or folded closed. When the ladder is closed, it has a slim and unobtrusive profile. When open, the result is a high-quality ladder with Miller® fall protection. The foldable ladder system prevents unauthorised use of the system.

Söll PivotLoc, 1st ladder section:

- Profile 5 x 33 mm
- With arresting device, end-stop, recess, connector and side handles
- Mounting distance: Recommended 1,400 mm – max. 1,680 mm
- The brackets must be fixed on the pivot points of the rungs
- Max. section length 4,480 mm
- Rung distance 80 mm
- The system also includes a stainless steel clamp that is used to insert a padlock

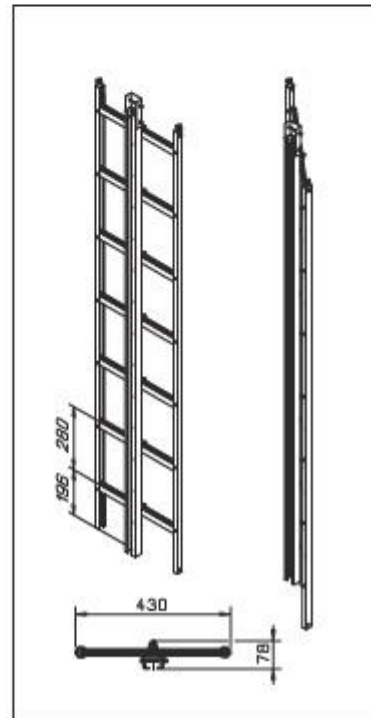
Material: Anodised aluminium
Weight: Approx. 4.0 kg/m
Part no. ZALKLAPP-<ladder length in mm>-A



Söll PivotLoc, extension section:

- Profile 5 x 33 mm
- With connector
- Recommended mounting distance: 1,400 mm – max. 1,680 mm
- The brackets must be fixed on the pivot points of the rungs
- Manufacturing length max. 4,480 mm
- Rung distance 80 mm

Material: Anodised aluminium
Weight: 4.0 kg/m
Part no. ZALKLAPP-<ladder length in mm>



Safety Ladders: Aluminium Curve Over Rail Top Extension for PivotLoc Ladders

Curve over rail Top Extension

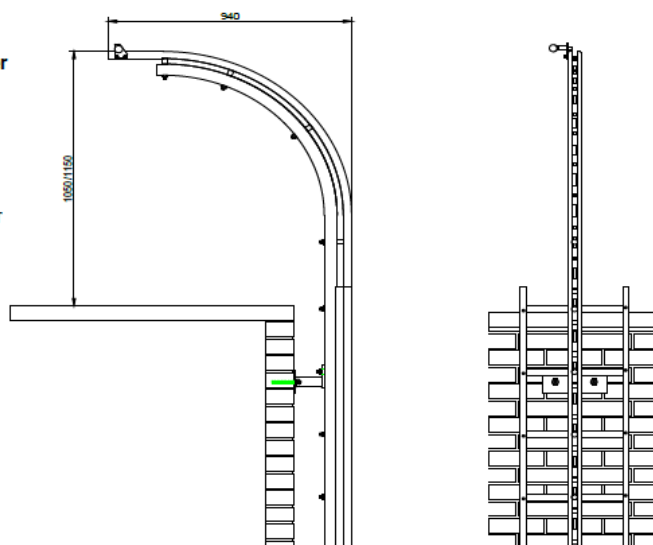
Guide rail with 90° bend allows transfer from vertical to horizontal direction, without the need to penetrate the roof.

To be used only with fall arrester Body Control I or Söll-Fall arresters, which have been included into the delivery programme after March 2003.

Length of guide rail: 1870 mm.

Supplied complete with curve over rail, 50x50x4 SHS (including bolts and spacers) and end stop.

Anodised Aluminium
Part No. ZALK-COR-EXT-SAL



6.0 Accessibility

6.1 Air Source Heat Pumps

To ensure safe access is provided to roof areas for maintaining the ASHP on a 6 month cycle, vertical fixed ladders are proposed with built-in fall protection. On accessing roof areas mansafe systems would be available to safely access the working areas.



7.0 Conditions of Use of this Report

This report is to be regarded as confidential to and for the sole use of the recipient. Consequently, no responsibility is accepted to any third party in respect of its contents in whole or in part

APPENDIX A

Drawing Schedule

DRAWING REGISTER

Drawing Owner	Status	Drawing No.	Title	Rev No.
Crookes & Walker	Planning	3388-CWC-XX-EX-DR-M-5004	PROPOSED EXTERNAL SERVICES	T04
Crookes & Walker	Planning	3388-CWC-XX-B1-DR-M-5602	PROPOSED PLANTROOM LAYOUT	T01
Crookes & Walker	Planning	3388-CWC-XX-ZZ-DR-E-6001	GROUND FLOOR SMALL POWER	T02
Drees & Sommer	Planning	24615.104	Proposed Elevations	A
Drees & Sommer	Planning	24615.107	Proposed Roof Plan	A
Drees & Sommer	Planning	24615.114	Secondary Glazing Details	-

APPENDIX B

Photographic Schedule



Image 01 – Ladder Access Location Nr.1



Image 03 – Roof Area to Receive ASHP Nr.1



Image 04 – – Roof Area to Receive ASHP Nr.2



Image 05 – Roof Area to Receive ASHP Nr.3

APPENDIX C

Roof Covering As-Built Information

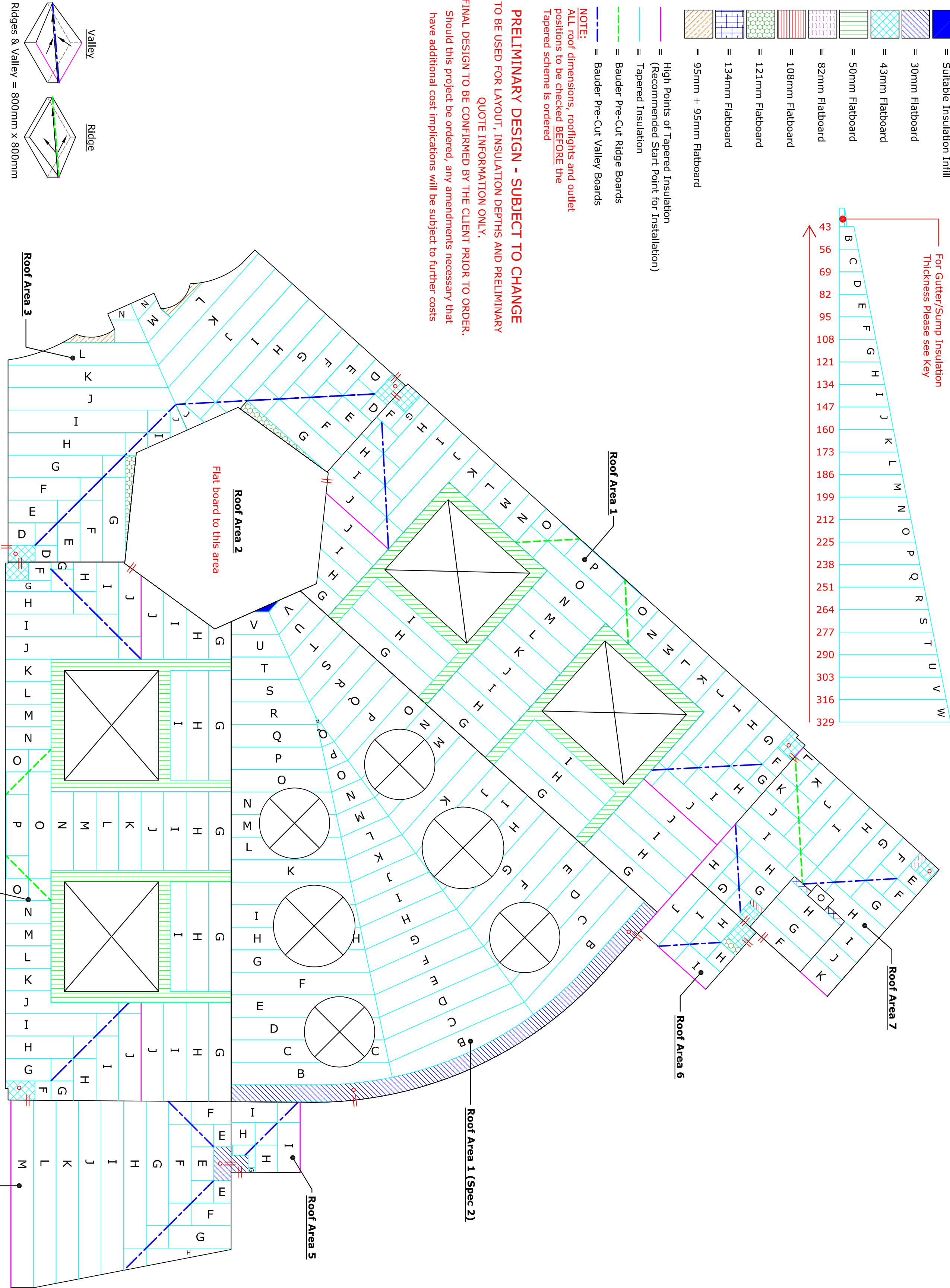
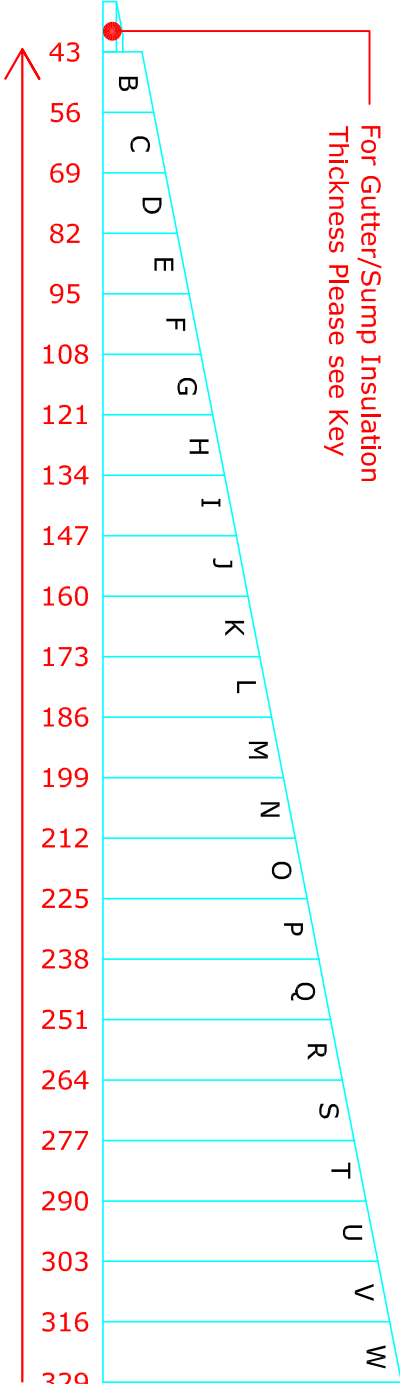
Key:

-  = Suitable Insulation Infill
-  = 30mm Flatboard
-  = 43mm Flatboard
-  = 50mm Flatboard
-  = 82mm Flatboard
-  = 108mm Flatboard
-  = 121mm Flatboard
-  = 134mm Flatboard
-  = 95mm + 95mm Flatboard

-  = High Points of Tapered Insulation (Recommended Start Point for Installation)
 -  = Tapered Insulation
 -  = Bauder Pre-Cut Ridge Boards
 -  = Bauder Pre-Cut Valley Boards
- NOTE:**
ALL roof dimensions, rooflights and outlet positions to be checked BEFORE the Tapered scheme is ordered

PRELIMINARY DESIGN - SUBJECT TO CHANGE
TO BE USED FOR LAYOUT, INSULATION DEPTHS AND PRELIMINARY QUOTE INFORMATION ONLY.

FINAL DESIGN TO BE CONFIRMED BY THE CLIENT PRIOR TO ORDER.
Should this project be ordered, any amendments necessary that have additional cost implications will be subject to further costs



Roof Name Area:	Deck Type	Minimum U' Value	Average U' Value	Approximate Net Roof Area (m²)	Total Insulation Required Inc Waste (m²)
Roof Area 01	Concrete	0.71 W/m² K	0.18 W/m² K	388.04	436.80
Roof Area 03	Concrete	0.57 W/m² K	0.18 W/m² K	80.37	95.04
Roof Area 04	Concrete	0.71 W/m² K	0.18 W/m² K	47.13	53.76
Roof Area 05	Concrete	0.71 W/m² K	0.18 W/m² K	6.17	8.64
Roof Area 06	Concrete	0.57 W/m² K	0.18 W/m² K	8.39	10.88
Roof Area 07	Concrete	0.57 W/m² K	0.18 W/m² K	38.64	45.76

NOTE REGARDING U-VALUES

The individual roof areas achieve the Average 'U' Values stated in the table. These U-Values are calculated according to BS EN ISO 6946:2007(E) Annex 'C'.

INSTALLATION NOTES:

1. This drawing assumes a level deck unless otherwise stated. BAUDER tapered systems are designed for installation on level decks.
2. BAUDER LTD recommend that this scheme should be installed starting from the thickest boards, so that in the event of discrepancies in roof size, the flatboard areas can be modified accordingly.
3. Boards to be close butted and staggered. Upstands to perimeters, rooflights, tank houses etc, to be raised where necessary to incorporate the thickness of the insulation.
4. Mitre Boards are available in all falls. They are denoted on this plan by an "R" or a "V" to signify Ridge and Valley. The corner of the board marked "R" or "V" is where the high point of the board should be located.
5. Please note that all offcuts of tapered insulation boards over 300mm should be used within the scheme. These are not deemed as waste boards by Bauder.

NOTES:

Although this tapered insulation scheme is designed to help shed water from the roof, we cannot guarantee that ponding will be totally eliminated.

Please note that ponding water may occur around the flatboard gutter area due to a lack of cross falls. However this is not detrimental to the Bauder system

All Dimensions, positions of Rooflights and Outlets are to be checked on site BEFORE the tapered scheme is ordered.

Rev	Date	Description	Drawn By



UK OFFICE
Bauder Limited
70 Lansdeer Road, Ipswich,
Suffolk IP3 0DH,
England.
Tel: +44 (0)1473 257671
Fax: +44 (0)1473 230761
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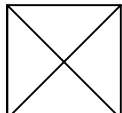
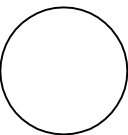
IRELAND OFFICE
Bauder Limited
O'Duffy Centre, Cross Lane,
Carrickmacross, Co. Monaghan,
Ireland.
Tel: +353 (0)42 9692 333
Fax: +353 (0)42 9692 839
Email: technical@bauder.ie
bauder.ie

Contractor to be responsible for checking this scheme against architects drawings/site requirements and to advise Bauder immediately of any discrepancies. Orders placed against this drawing reference assume approval of this scheme. Any materials required over and above the quantities given, will be charged accordingly.

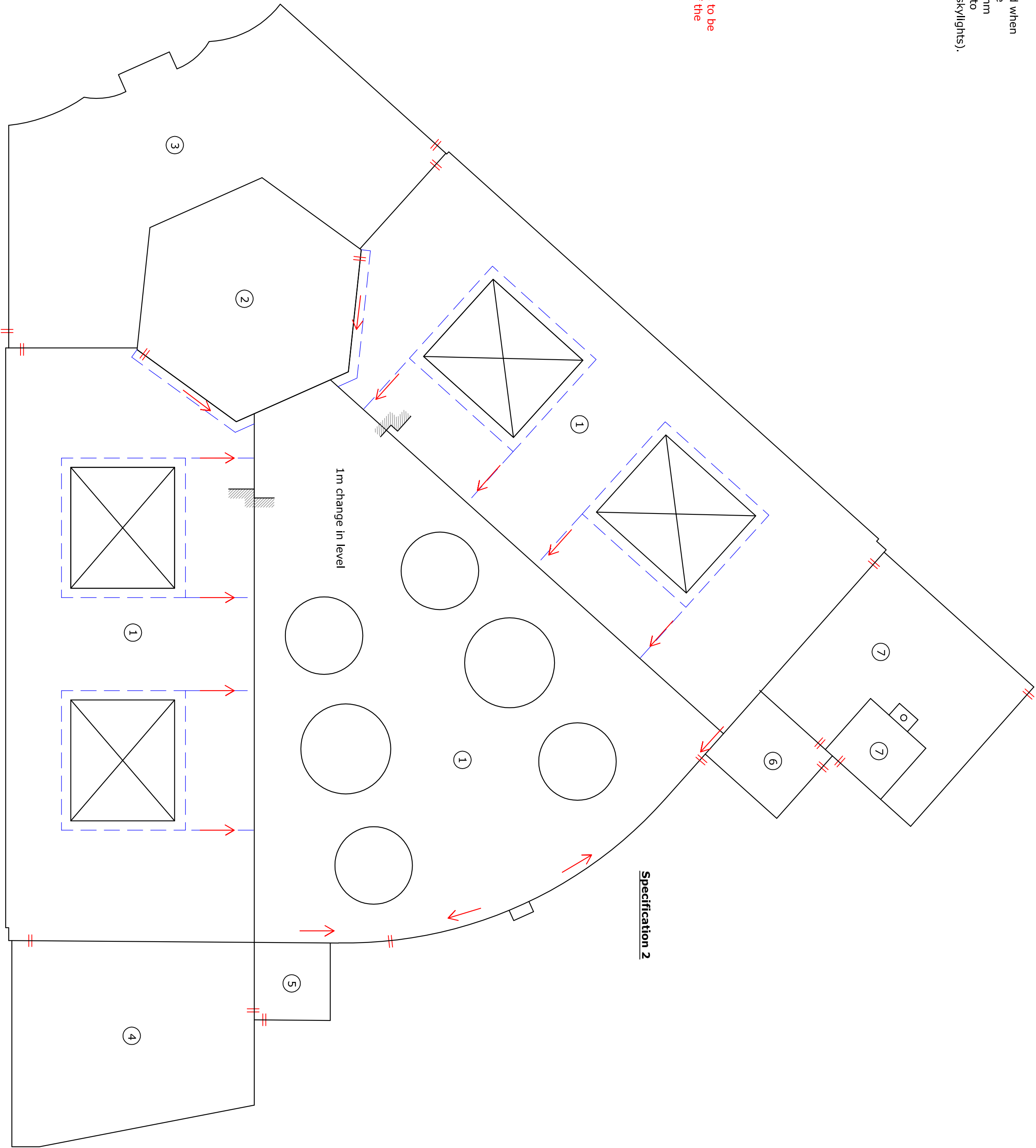
Contract Name:
Withington Library
Wilmslow Road, MANCHESTER
M20 3BN

STANDARD TAPER SCHEME			
Contract No:	B173320		
Drawing No:	B173320_LTT-001_Sheet 2 of 2		
Designed to Drawing No:	Bauder Survey		
Scale:	1:100 @ A2		
Drawn By:	JD	Date:	20.11.2017

Key:

-  = Direction of water in gutter
-  = Internal Gutter retained when new round skylights are installed, minimum 50mm insulated (low upstand to window of rectangular skylights).
-  = Skylights to remain
-  = Skylight to be replaced
-  = Chute
-  = Roof Number
-  = Chimney

NOTE:
ALL dimensions and outlet positions to be checked PRIOR to the installation of the Bauder systems.



Notes:

All Dimensions, positions of Rooflights and Outlets are to be checked on site. Dimensions are shown in mm and are approximate ONLY. These should not be used for pricing purposes as Bauder cannot be held responsible for the accuracy of them.

Rev	Date	Description	Drawn By



UK OFFICE
Bauder Limited
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Contractor to be responsible for checking this scheme against architects drawings/site requirements and to advise Bauder immediately of any discrepancies. Orders placed against this drawing reference assume approval of this scheme. Any materials required over and above the quantities given, will be charged accordingly.

Contract Name:
Withington Library
Wilmslow Road, MANCHESTER
M20 3BN

ROOF PLAN			
Contract No:	B173320		
Drawing No:	B173320_RP-001	Sheet 2 of 2	
Designed to Drawing No:	Bauder Survey		
Scale:	1:100 @ A2		
Drawn By:	JD	Date:	16.11.2017

APPENDIX D

Structural Report



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Structural Report

Manchester City Council Decarbonisation.

Withington Library – Roof Appraisal

Prepared by

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Prepared for

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Withington Library – Roof Appraisal

Brief

Frederick G Markland Associates have been instructed to undertake a site inspection to determine the existing roof structure and prepare an appraisal relating to the feasibility of supporting air source heat pumps (ASHP) on the existing flat roof construction.

Site Address

Withington Library
410 Wilmslow Road
Withington
Manchester
M20 3BD

Inspection Date

The inspection was carried out on 28th November 2024.

Observations

Withington Library is a single storey building with flat roofs at varying heights across the footprint of the building. The soffit of the flat roof appears to consist of a plaster finish applied directly to a concrete surface. An arrangement of beam down stands were noted to support the flat roof deck, with 270mm wide x 270mm deep secondary beams spanning between 250mm wide x 390mm deep primary beams. At the stepped junction between flat roof heights, primary beams span between what appear to be masonry piers, approximately 1000mm long x 500mm wide. A line of primary beams bisecting the central, lower flat roof was noted to span between 255mm x 255mm square columns which appeared to consist of concrete. The structural members noted appeared to be consistent with a reinforced concrete construction.

A longitudinal crack was noted along a vertical face of one of the secondary beams adjacent to the junction where the flat roof level changes.

The flat roof finish consists of a Bauder warm roof build up, with a bitumen capping sheet. Details of the warm roof installation from 2017 have been provided by the client.

Measurements taken during the survey indicate a total roof build up depth of circa 400mm. The warm roof build up information provided indicates an average depth of 120mm. On the assumption that the original build up consisted of an asphalt covering over a screed laid to falls, it is assumed that the concrete deck is 200mm thick.

Proposals

A number of potential decarbonisation measures have been identified on behalf of the client to attain the client's target of achieving Net Zero Carbon status by 2038.

One of the measures identified across a number of properties within the client's corporate estate include the installation of ASHPs. At Withington Library, it has been identified that the preferred location for the proposed ASHP units are on the flat roof, in accordance with Crookes Walker Consulting drawing No. 3388-CWC-XX-EX-DR-M-5004.

The existing permanent loadings will be assessed in conjunction with both the original design variable loading, applicable at the time of construction for this building, along with current design

variable loading, to determine whether the existing roof structure has sufficient capacity to support the proposed ASHP.

The proposed ASHP units weigh 140kg, in conjunction with an assumed weight of 100kg for the acoustic enclosure over one unit. Based on each unit having two “feet”, a point load of 1.2kN at approximately 600mm centres has been adopted for the purposes of this appraisal. This should be confirmed upon receipt of detailed proposals from the ASHP & enclosure supplier/installer.

Loading

Permanent loading

The existing dead loading can be considered as follows:

- Concrete deck	5.00
- Asphalt & screed	1.67
- 120mm insulation	0.10
- Bauder warm roof	0.12
- Services	0.10
- Plaster finish	<u>0.15</u>
	7.14 kN/m²
 - Typical point load from ASHP + enclosure	 1.20 kN

Variable loading

Withington Library was constructed in 1927. In this time period, imposed loadings were typically specified by the architect to suit the proposed function of the floor/roof. A few advisory documents would have been available at the time, with prescribed imposed loadings for flat roofs ranging from 2.5 kN/m² to 0.75 kN/m².

For the purposes of this appraisal, the design imposed loading will be considered as follows.

- Roof variable load	0.75 kN/m²
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Current British Standards (UK NA to BS EN 1991-1-1:2002) prescribe an imposed loading of **0.60 kN/m²** for access for maintenance only.

Snow loading

The site-specific snow loading can be considered as follows:

In accordance with EN 1991-1-3:2003 and UK national annex NA to BS EN 1991-1-3:2003

Altitude, A =	39m
Zone number, Z =	3
Density of snow, γ =	2.00 kN/m ³
Characteristic snow load, s_k =	$((0.15 + (0.1 \times Z + 0.05)) + ((A - 100) / 525)) = 0.38 \text{ kN/m}^2$

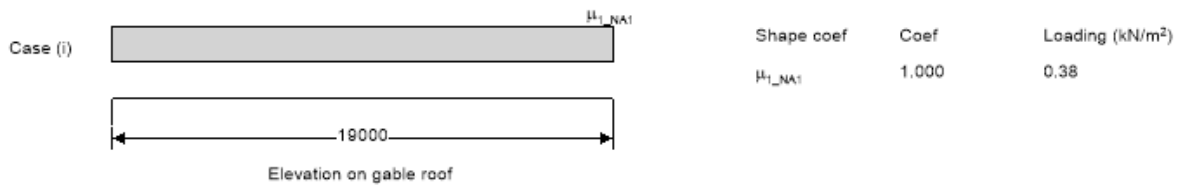
Roof type:	Flat
Width of roof	b = 19m

Shape coefficients:

Shape coefficient roof (Table UK NA.1)	$\mu_{1_a_NA1} =$	1.00
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Loadcase 1 (Table UK NA.1)

Snow loading,	$s_1 \times \mu_{1_a_NA1} =$	0.38 kN/m²
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Wind loading

Type of roof	Flat
Length of building	L = 27000 mm
Width of building	W = 19000 mm
Height to eaves	H = 3000 mm

Basic values

Location	Manchester
Wind speed velocity (Figure NA.1)	$v_{b,map} = 22.5 \text{ m/s}$
Distance to shore	$L_{shore} = 52.00 \text{ km}$
Altitude above sea level	$A_{alt} = 39.0 \text{ m}$
Altitude factor	$C_{alt} = A_{alt}/1 \text{ m} \times 0.001 + 1 = 1.039$
Fundamental basic wind velocity	$v_{b,0} = v_{b,map} \times C_{alt} = 23.4 \text{ m/s}$
Direction factor	$C_{dir} = 1.00$
Season factor	$C_{season} = 1.00$
Shape parameter K	$K = 0.2$
Exponent n	$n = 0.5$
Air density	$\rho = 1.226 \text{ kg/m}^3$
Probability factor	$C_{prob} = 1.00$
Basic wind velocity (Exp. 4.1)	$v_b = C_{dir} \times C_{season} \times v_{b,0} \times C_{prob} = 23.4 \text{ m/s}$
Reference mean velocity pressure	$q_b = 0.5 \times \rho \times v_b^2 = 0.335 \text{ kN/m}^2$

Wind0 Loadcase:

Exposure factor (Figure NA.7)	$C_e = 1.72$
Exposure correction factor (Figure NA.8)	$C_{e,T} = 0.72$
Peak velocity pressure	$q_p = C_e \times C_{e,T} \times q_b = 0.42 \text{ kN/m}^2$

Consider Roof Zones H & I:

Zone H = $(C_{pe} - C_{pi}) \times q_p =$	-0.32 kN/m²
Zone I = $(C_{pe} - C_{pi}) \times q_p =$	0.19 kN/m²

Wind90 Loadcase:

Exposure factor (Figure NA.7)	$C_e = 1.72$
Exposure correction factor (Figure NA.8)	$C_{e,T} = 0.72$
Peak velocity pressure	$q_p = C_e \times C_{e,T} \times q_b = 0.42 \text{ kN/m}^2$

Consider Roof Zones H & I:

Zone H = $(C_{pe} - C_{pi}) \times q_p = (-0.86 - (0.2)) \times 0.53 =$	-0.33 kN/m²
Zone I = $(C_{pe} - C_{pi}) \times q_p = (-0.83 - (0.2)) \times 0.53 =$	0.19 kN/m²

Discussion

The variable loading calculations indicate that the most onerous variable loadcase can be attributed to access for maintenance and indicates a 0.15 kN/m^2 reduction from the assumed original design loading.

Without specific details of the reinforcement within the reinforced concrete structural elements, a detailed calculation appraisal of the capacity of the structural elements is not possible. For the purposes of this report, a comparison of loadings will be considered on the basis of utilising the “spare” load capacity derived from the difference between the original design imposed loading of 0.75 kN/m^2 , and the current prescribed design imposed loading of 0.6 kN/m^2 .

Roof deck

The proposed ASHP layout, as shown on drawing No. 3388-CWC-XX-EX-DR-M-5004, indicates a line of 6No. ASHP units and acoustic enclosures positioned adjacent to the existing line of primary beams spanning between masonry piers. Any additional loading applied to the roof deck adjacent and parallel to a substantial line of support is considered unlikely to significantly affect the structural performance of the deck.

Secondary beams

The additional loading due to the ASHP units will be distributed to the secondary beams via the deck to a location relatively close to the end of the secondary beam spans. Therefore, it is considered unlikely that the additional loading will have a significant effect on the bending moment developed within the beam. However, there will be an increased shear force developed at the support location adjacent to the proposed ASHP units.

Considering a secondary beam spanning approximately 7.3m and supporting 3.8m of roof deck, in conjunction with the reduced variable design loading, an approximation of “redundant” shear capacity can be calculated:

$$\text{“Redundant” shear} = 0.15 \times 3.8 \times 7.3 \times 0.5 = 2.08 \text{ kN}$$

On the basis of approximately 2No. ASHP units within one 3.8m roof bay, positioned approximately 600mm from the secondary beam support location:

$$\text{Shear due to ASHP} = (2 \times 1.2) \times [(7.3 - 0.6)/7.3] = 2.20 \text{ kN}$$

The net increase in shear is therefore 0.12 kN, and is considered negligible.

Primary beams

The additional loading due to the ASHP units will be distributed to the primary beams from the secondary beam end reactions, applied as point loads. As such, the above figures indicate an increase of 0.12 kN due to the secondary beam end reaction point loads, and is considered negligible.

Conclusions

In summary, it is considered highly likely that the existing roof structure has sufficient capacity to support the proposed ASHP units.

It is proposed that the ASHP units should be located adjacent to the primary beam line spanning between the internal masonry piers to mitigate the impact of the additional loading on the behaviour of the secondary beams, as indicated below:

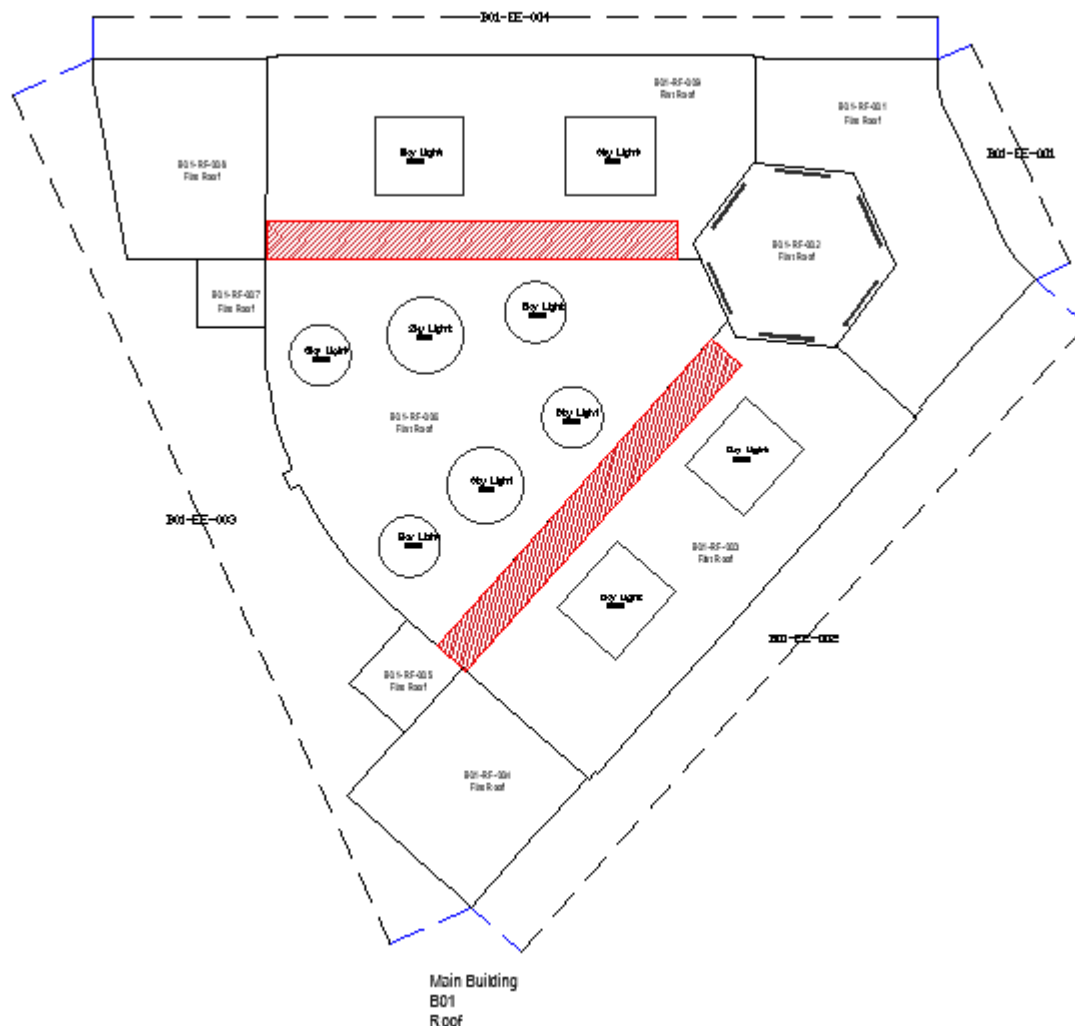


Fig. 1: Proposed areas to position ASHP units

A big-foot system should be considered to reduce the localised pressure exerted at each foot location. In addition, a big-foot system would enable the support locations to be set out appropriately to miss the existing gutter lines present on the flat roof.

While outside the scope of our appointment, a crack was noted within one of the secondary beams. The above initial appraisal is based on the existing concrete and reinforcement being in good condition, so it is recommended that a detailed condition survey is undertaken and suitable remedial works identified. In the instance of the crack observed during the survey, it is considered likely that some corrosion of the reinforcement has occurred. Any cracked or loose concrete should be locally broken out and corroded reinforcement de-rusted and treated. On the basis that the reinforcement has not suffered significant section loss, a concrete patch repair can be applied.

Report Prepared by:

A handwritten signature in black ink, appearing to read 'Ben Clelland', with a long horizontal stroke extending to the right.

Ben Clelland
BSc (Hons)
Structural Engineer