



Design Note: Fabric Strategy for DAS input

Project:	Reading Town Hall
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1 Introduction

This design note has been prepared to support the Design and Access Statement (DAS) accompanying the Listed Building Consent application for roof fabric works at Reading Town Hall. The document sets out the existing performance and proposed fabric specification for the building's roofs to enhance the performance, with particular regard to heritage sensitivity, material compatibility, and moisture movement.

Constructed in phases between 1786 and 1897, Reading Town Hall is a Grade II listed building of considerable architectural and civic importance.

The purpose of this note is to define an appropriate fabric specification for the repair, renewal, and upgrade of the roof elements, ensuring that works are consistent with conservation best practice and the statutory duty to preserve the building's special architectural and historic interest. The approach prioritises retention and repair of historic fabric wherever feasible or upgrades using compatible materials, and the careful integration of discreet performance improvements where these can be achieved without harm to significance.

The recommendations are informed by an understanding of the building's construction history, material characteristics, and statutory context, and are intended to provide a clear and robust justification for the proposed works within the DAS.

Where information was limited, conservative assumptions have been applied regarding material thicknesses. Thermal conductivity values have been sourced from product datasheets, IESVE database and Passivhaus thermal conductivity database to ensure consistency and reliability of the calculations.

2 Detailed U-values Calculations

U-value assessments have been conducted in accordance with the methodologies outlined in BS EN ISO 6946:2017 and BR443 (2019).

For constructions incorporating an externally ventilated layer, all components located beyond this ventilated layer have been excluded from the thermal performance calculations, in line with standard practice.

Table 2-1 Roof U values - Existing and Proposed

Roof Element	Existing U-value	Proposed U-value	Improvement %
Roof 7	0.385	0.217	44%
Roof 8	0.402	0.202	49%
Roof 8 Flat	1.058	0.397 0.423 0.577	63% 60% 54%
Roof 8 Glazed	5.200	1.20	80%
Roof 9	0.385	0.217	44%
Roof 10	0.385	0.217	44%
Roof 11 Flat	0.297	0.318 0.309	-7% -6%
Roof 11 Glazed	5.200	1.00	80%
Roof 12	-	-	-
Roof 13 Glazed	1.8	1.20	33%
Roof 14	0.356	0.444 0.477	-24% -26%
Roof 15	0.356	0.444 0.477	-24% -26%
Roof 16	0.377	0.206	45%
Roof 17	0.377	0.206	45%
Roof 18	0.385	0.217	44%
Roof 19	1.257	0.156	88%



Roof 20	1.499	0.300 0.271	80% 82%
Roof 21	1.337	0.260	80%
Roof 22	1.257	0.404	68%
Roof 23	-	-	-

2.1 Existing Roof Overview

The existing roof construction typically comprises traditional pitched or loft-level build-ups, and in some areas flat roof constructions. Pitched roofs are generally uninsulated at rafter level or incorporate limited mineral wool insulation at ceiling/joist level only. Flat roof areas, where present, include rigid PIR-based insulation; however, installation quality and continuity vary and are not always aligned with modern performance standards. Across roof types, insulation is often inconsistently installed, with evidence of displacement, compression, gaps, and localised degradation, reducing effective in-situ thermal resistance compared to nominal values.

From a building physics perspective, ceiling-level and flat roof build-ups frequently lack a clearly defined vapour control layer and do not provide a reliable, continuous airtightness line. In pitched roofs, the absence of a robust VCL allows warm, moisture-laden air to migrate into cold roof voids via air leakage and vapour diffusion. In flat roofs, discontinuities in VCL placement or sealing can similarly permit vapour ingress into the build-up, increasing the risk of interstitial condensation, particularly where impermeable layers such as PIR insulation or roof membranes are present.

Poorly fitted mineral wool and discontinuous PIR insulation compromise thermal continuity and introduce thermal bypass pathways. Gaps at joist edges, board interfaces, service penetrations, upstands, and perimeter junctions enable uncontrolled air movement through or around the insulation layer. Consequently, the overall roof assemblies are likely to perform significantly below current regulatory expectations, characterised by elevated fabric heat loss, limited airtightness, and reduced hygrothermal robustness across both pitched and flat roof typologies.

2.2 General Guidance

2.2.1 Airtightness

All roof upgrades must maintain a continuous airtight layer to limit convective heat loss and prevent moisture ingress into the roof construction. The primary airtightness layer may be provided by a vapour control layer, an integrated airtight board, or proprietary system membranes, depending on the roof type. Continuity of the air barrier must be achieved across all junctions, including perimeter walls, upstands, ridges, verges, penetrations, and roof-to-wall interfaces.

2.2.2 Taping and Sealing

All laps, joints, penetrations, and interfaces between membranes, boards, and insulation layers must be sealed using compatible proprietary tapes, sealants, or adhesives as recommended by the system manufacturer. Particular attention is required at service penetrations, loft hatches, skylights, and abutments to prevent air leakage or moisture



ingress. Tape and sealant selection must ensure long-term adhesion and compatibility with surrounding materials.

2.2.3 Thermal Bridging

Measures must be taken to minimise thermal bridging at all structural junctions and interfaces. This includes:

- Installing continuous insulation over joists or rafters where feasible to reduce cold bridging through timber elements.
- Aligning insulation layers at junctions with walls, parapets, and other adjacent constructions.
- Using thermally broken glazing frames where rooflights, lanterns, or windows are incorporated.
- Avoiding compression or gaps in insulation that could compromise effective thermal resistance.

By applying these standard detailing principles across all roof types, the upgraded roofs will achieve consistent thermal performance, reduce condensation risk, and maintain the integrity of the building envelope.

2.2.4 Ventilation Requirements

Table 2-2 Minimum free area of openings for loft-space ventilation

Pitch	Underlay	Low-level vents location (e.g. eaves), mm ² /m	Comments
10° - 15°	High resistance	25000	
>15° and <75°	High resistance	10000	
10° to <75°	Low resistance	7000	This is applicable for this project

Comments:

- Length (m) is always the longest horizontal dimension of the roof
- Recommend seeking manufacturer's guidance
- For Warm pitched roof 25mm ventilation void to provided.

2.3 Roof 7 Pitched Clay Tile

Existing U-value:

Figure 2-1 Roof 7 Existing U-value

Description of building assembly						Assembly no.	
RF07 - Existing U-value						01ud	
Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement $[W/(m^2K)]$			
Area section 1	λ $[W/(mK)]$	Area section 2 (optional)	λ $[W/(mK)]$	Area section 3 (optional)	λ $[W/(mK)]$	Thickness [mm]	
Plaster	0.600					13	
Rockwool Flexi	0.050	Timber Joists	0.130			140	
Plywood	0.130					20	
Percentage of sec. 1:	83%	Percentage of sec. 2:	17.4%	Percentage of sec. 3:			
Heat transmission resistance coefficients						Total thickness [cm]:	
Interior R_{si} :						17.3	
Exterior R_{se} :						U-value $[W/(m^2K)]$: 0.385	

Upgrade Proposal:

The proposed upgrade introduces 140 mm mineral wool insulation between the joists, supplemented by an additional 60 mm continuous layer above the joists to reduce thermal bridging and improve overall thermal continuity. The over-joist layer is intended to minimise cold bridging through timber elements and enhance the effective U-value of the roof assembly.

Proposed U-value:

Figure 2-2 Roof 7 Proposed U-value

Description of building assembly						Assembly no.	
RF07						01ud	
Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement $[W/(m^2K)]$			
Area section 1	λ $[W/(mK)]$	Area section 2 (optional)	λ $[W/(mK)]$	Area section 3 (optional)	λ $[W/(mK)]$	Thickness [mm]	
Plaster	0.600					13	
Rockwool Flexi	0.035	Timber Joists	0.130			140	
Rockwool Flexi	0.038					50	
Plywood	0.130					20	
Percentage of sec. 1:	83%	Percentage of sec. 2:	17.4%	Percentage of sec. 3:			
Heat transmission resistance coefficients						Total thickness [cm]:	
Interior R_{si} :						22.3	
Exterior R_{se} :						U-value $[W/(m^2K)]$: 0.217	

Product Specification:

Figure 2-3 Product Performance Specification

Description	Performance (Pitched Clay Tile)	Comments
Roof Type	Cold Roof	Insulation in between the joists and on top of joists
Insulation	Thermal Conductivity ≤ 0.035 (between joists) / ≤ 0.038 (above joists)	Rockwool Flexi or equivalent mineral wool product.
AVCL	Vapour Resistance (Humidity Variable) Sd 0.25 - >25m	Intello Plus or equivalent intelligent membrane
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes, Chipboard, Hard plastics, MDF, Metal, OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	Pro Clima Tescon Vana equivalent airtight adhesive tape
Breather Membrane	-	Not required for this buildup

2.4 Roof 8 Pitched Clay Tile / Flat Roof / Pitched Glazed

Existing U-value:

Figure 2-4 Roof 7 Pitched Clay Tile Existing U-value

Description of building assembly						Assembly no.	
RF8 - Tiled Roof Existing U-value						02ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement [W/(m²K)]			

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Plaster	0.600					13
Rockwool Flexi	0.055	Timber Joists	0.130			140
Plywood	0.130					20
Percentage of sec. 1:	84%	Percentage of sec. 2:	16.0%	Percentage of sec. 3:		

Heat transmission resistance coefficients		Total thickness [cm]:	17.3
Interior R_{si} :	0.10 m²K/W	U-value [W/(m²K)]:	0.402
Exterior R_{se} :	0.10 m²K/W		

Figure 2-5 Roof 7 Flat Roof Existing U-value

Description of building assembly						Assembly no.	
RF8 - Flat Roof Existing U-value						03ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air		U-value supplement [W/(m²K)]			

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Plaster	0.600					13
Unventilated Cavity	0.920	Timber Joists	0.130			140
Unventilated Cavity	0.370	Timber Joists	0.130			140
Plywoodboard decking	0.130					22
Percentage of sec. 1:	84%	Percentage of sec. 2:	16.0%	Percentage of sec. 3:		

Heat transmission resistance coefficients		Total thickness [cm]:	31.5
Interior R_{si} :	0.10 m²K/W	U-value [W/(m²K)]:	1.058
Exterior R_{se} :	0.04 m²K/W		

Upgrade Proposal:

The proposed upgrade to the pitched clay tile roof consists of installing 140 mm mineral wool insulation between the joists, supplemented by an additional 60 mm mineral wool layer above the joists to improve overall thermal performance. The over-joist insulation layer is intended to reduce thermal bridging through the timber structure and enhance thermal continuity across the roof plane, thereby improving the effective U-value of the assembly.

The flat roof upgrade strategy proposes the addition of either 60 mm mineral wool insulation or 50 mm foam glass insulation as part of a proprietary system such as those provided by Bauder or IKO. These systems are typically designed as fully integrated warm roof build-ups, with insulation, waterproofing membrane, and ancillary components tested and certified to perform as a complete assembly.

An alternative option of incorporating 30 mm mineral wool insulation has been investigated; however, this thickness does not currently form part of a standard proprietary system. Its use would therefore require formal consultation with the selected manufacturer to confirm suitability, warranty compliance, and integration within their certified roof build-up. Any deviation from a tested system must be reviewed to ensure that thermal performance, condensation risk, wind uplift resistance, and waterproofing integrity are not compromised.

Detailing should align with the chosen manufacturer's specification to ensure the roof performs as a coherent system from thermal, structural, and hygrothermal perspectives.

As part of the overall thermal improvement strategy, existing rooflights is to be replaced with a new double-glazed, thermally broken system. The proposed units will incorporate double glazing sealed within frames featuring thermal breaks to significantly reduce conductive heat loss through the frame elements. This upgrade will improve the overall U-value of the glazed elements, reduce cold surface temperatures, and mitigate the risk of surface condensation. Installation must ensure airtight integration with the surrounding construction. Perimeter junctions between frames and structural openings should be sealed using appropriate airtightness tapes, membranes, and insulation infill to maintain continuity of the air barrier and prevent moisture ingress.

Proposed U-value:

Figure 2-6 Roof 8 Pitched Clat Tile Proposed U-value

Description of building assembly						Assembly no.	
RF08 - Tiled Roof Proposed U-value						02ud	

Orientation of building assembly (or R _{si})		1-Roof		Interior insulation?			
Adjacent to (or R _{se})		3-Ventilated		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plaster	0.600					13	
Rockwool Flexi	0.035	Timber Joists	0.130			140	
Rockwool Flexi	0.038					60	
Plywood	0.130					20	
Percentage of sec. 1:	84%	Percentage of sec. 2:	16.0%	Percentage of sec. 3:			

Heat transmission resistance coefficients		Total thickness [cm]:	23.3
Interior R _{si} :	0.10 m²K/W	U-value [W/(m²K)]:	0.202
Exterior R _{se} :	0.10 m²K/W		

Figure 2-7 Roof 8 Flat Roof Proposed U-value Option 1

Description of building assembly						Assembly no.	
RF08 - Flat Roof Proposed U-value						03ud	

Orientation of building assembly (or R _{si})		1-Roof		Interior insulation?			
Adjacent to (or R _{se})		1-Outdoor air		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plaster	0.600					13	
Unventilated Cavity	0.920	Timber Joists	0.130			140	
Unventilated Cavity	0.370	Timber Joists	0.130			140	
Plywoodboard decking	0.130					22	
Bauder Rockwool	0.039					60	
Percentage of sec. 1:	84%	Percentage of sec. 2:	16.0%	Percentage of sec. 3:			

Heat transmission resistance coefficients				Total thickness [cm]:		37.5	
Interior R _{si} :	0.10	m²K/W		U-value [W/(m²K)]:		0.397	
Exterior R _{se} :	0.04	m²K/W					

Figure 2-8 Roof 8 Flat Roof Proposed U-value Option 2

Description of building assembly						Assembly no.	
RF08 - Flat Roof Proposed U-value						03ud	

Orientation of building assembly (or R _{si})		1-Roof		Interior insulation?			
Adjacent to (or R _{se})		1-Outdoor air		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plaster	0.600					13	
Unventilated Cavity	0.920	Timber Joists	0.130			140	
Unventilated Cavity	0.370	Timber Joists	0.130			140	
Plywoodboard decking	0.130					22	
Bauder Foamglass	0.036					50	
Percentage of sec. 1:	84%	Percentage of sec. 2:	16.0%	Percentage of sec. 3:			

Heat transmission resistance coefficients				Total thickness [cm]:		36.5	
Interior R _{si} :	0.10	m²K/W		U-value [W/(m²K)]:		0.423	
Exterior R _{se} :	0.04	m²K/W					

Figure 2-9 Roof 8 Flat Roof Proposed U-value Option 3

Description of building assembly						Assembly no.	
RF08 - Flat Roof Proposed U-value						03ud	
Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plaster	0.600					13	
Unventilated Cavity	0.920	Timber Joists	0.130			140	
Unventilated Cavity	0.370	Timber Joists	0.130			140	
Plywoodboard decking	0.130					22	
Rockwool 30mm	0.039					30	
Percentage of sec. 1:	84%	Percentage of sec. 2:	16.0%	Percentage of sec. 3:			

Heat transmission resistance coefficients

Interior R_{si} :

0.10

m²K/W

Exterior R_{se} :

0.04

m²K/W

Total thickness [cm]:

34.5

U-value [W/(m²K)]:

0.577

Product Specification:

Figure 2-10 Product Performance Specification

Description	Performance (Pitched Clay Tile)	Comments
Roof Type	Cold Roof	Insulation in between the joists and on top of joists
Insulation	Thermal Conductivity ≤ 0.035 (between joists) / ≤ 0.038 (above joists)	Rockwool Flexi or equivalent mineral wool product.
AVCL	Vapour Resistance (Humidity Variable) Sd 0.25 - >25m	Intello Plus or equivalent intelligent membrane
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes, Chipboard, Hard plastics, MDF, Metal, OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	Pro Clima Tescon Vana equivalent airtight adhesive tape
Breather Membrane	-	Not required for this buildup

Figure 2-11 Product Performance Specification

Description	Performance (Flat Roof)	Comments
Roof Type	Warm Roof	Insulation in between the joists and on top of joists
Insulation	Thermal Conductivity ≤ 0.039 (Mineral wool or rockwool) / ≤ 0.036 (foamglass)	Insulation provided by suppliers like Bauder or IKO. 30mm insulation – rockwool hardfix or similar product
AVCL	As per supplier specification	Bauder, IKO or equivalent
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes, Chipboard, Hard plastics, MDF, Metal,	Bauder, IKO or equivalent

	OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	
Breather Membrane	-	Not required for this buildup

Figure 2-12 Product Performance Specification

Description	Performance (Pitched Glazed)	Comments
Glazing	Overall window U – value ≤ 1.20 G-value - ≤ 0.40	Skyline System or equivalent double-glazed system with thermally broken frames.
Tapes	Waterproof solid acrylic and for use around windows and rooflights	Internal taping – Pro Clima Contega Solido SL or equivalent External taping – Pro Clima Contega Solido EXO or equivalent

2.5 Roof 9, Roof 10 and Roof 18

The upgrade strategy for Roofs 9, 10 and 18 will be identical to the proposed Roof 7 build-up and should therefore be implemented in accordance with the same thermal, airtightness, and moisture control principles.

2.6 Roof 11

Existing U-value:

Figure 2-13 Roof 11 Existing U-value

Description of building assembly						Assembly no.	
RF11 - Existing U-value						04ud	
Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Concrete	2.100	Timber Joists	0.130			80	
Timber board	0.130					30	
Existing PIR insulation	0.024					70	
Percentage of sec. 1:		83%	Percentage of sec. 2:		16.6%	Percentage of sec. 3:	

Heat transmission resistance coefficients			Total thickness [cm]: 18.0	
Interior R_{si} :	0.10	m²K/W		
Exterior R_{se} :	0.04	m²K/W	U-value [W/(m²K)]: 0.297	

Upgrade Proposal:

The proposed upgrade strategy for Roof 11 is to incorporate either 105 mm mineral wool insulation board or 100 mm foam glass insulation as part of a proprietary warm roof system, such as those provided by Bauder, IKO, or an equivalent approved manufacturer. The insulation is to be integrated within a fully tested and certified roof build-up to ensure compliance with thermal, structural, fire, and waterproofing performance requirements. The introduction of 105 mm mineral wool insulation board will enhance the overall thermal resistance of the roof assembly while also providing inherent fire resistance and acoustic benefits. Alternatively, 100 mm foam glass insulation offers high compressive strength and inherent vapour resistance, making it particularly suitable where increased moisture robustness or load-bearing capacity is required.

As part of the overall thermal improvement strategy, existing rooflights is to be replaced with a new double-glazed, thermally broken system. The proposed units will incorporate double glazing sealed within frames featuring thermal breaks to significantly reduce conductive heat loss through the frame elements. This upgrade will improve the overall U-value of the glazed elements, reduce cold surface temperatures, and mitigate the risk of surface condensation. Installation must ensure airtight integration with the surrounding construction. Perimeter junctions between frames and structural openings should be sealed using appropriate airtightness tapes, membranes, and insulation infill to maintain continuity of the air barrier and prevent moisture ingress. In addition to the primary roof insulation upgrade, it is proposed to install a high-performance insulation blanket, such as foil-faced aerogel or similar over the existing single-glazed ceiling areas. This intervention is intended to significantly improve the thermal performance of these otherwise weak elements within the envelope. The foil-faced layer will act to reduce radiant heat loss while also providing a blackout effect to the space below, thereby enhancing occupant comfort and environmental control. It is critical that comprehensive draughtproofing works are undertaken around the existing single-glazed panels. There is evidence of condensation forming around the perimeter of the glazing, which is likely attributable to cold bridging and uncontrolled air leakage at the interfaces. This can be mitigated by carefully sealing the glazing edges and applying robust taping from the top side to improve airtightness and reduce moisture-laden air infiltration.

Proposed U-value:

Figure 2-14 Roof 11 Proposed U-value Option 1

Description of building assembly						Assembly no.
RF11 - Proposed U-value						04ud
Orientation of building assembly (or R_{si})		1-Roof	Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air	U-value supplement [W/(m ² K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Concrete	2.100	Timber Joists	0.130			80
Timber board	0.130					30
Bauder Rockwool	0.039					105
Percentage of sec. 1:	83%	Percentage of sec. 2:	16.6%	Percentage of sec. 3:		
Heat transmission resistance coefficients						Total thickness [cm]: 21.5
Interior R_{si} :	0.10	m ² K/W		U-value [W/(m ² K)]: 0.318		
Exterior R_{se} :	0.04	m ² K/W				

Figure 2-15 Roof 11 Proposed U-value Option 2

Description of building assembly						Assembly no.	
RF11 - Proposed U-value						04ud	

Orientation of building assembly (or R_{se})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Concrete	2.100	Timber Joists	0.130			80	
Timber board	0.130					30	
Bauder Foamglass	0.036					100	
Percentage of sec. 1:	83%	Percentage of sec. 2:	16.6%	Percentage of sec. 3:			

Heat transmission resistance coefficients		Total thickness [cm]:	21.0
Interior R_{si} :	0.10 m²K/W	U-value [W/(m²K)]:	0.309
Exterior R_{se} :	0.04 m²K/W		

Product Specification:

Table 2-3 Product Performance Specification

Description	Performance (Flat Roof)	Comments
Roof Type	Warm Roof	
Insulation	Thermal Conductivity ≤ 0.039 (mineral wool) / ≤ 0.036 (foamglass)	Insulation provided by suppliers like Bauder or IKO or equivalent.
AVCL	As per supplier specification	Bauder, IKO or equivalent
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes, Chipboard, Hard plastics, MDF, Metal, OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	Bauder, IKO or equivalent
Breather Membrane	-	Not required for this buildup

Table 2-4 Product Performance Specification

Description	Performance (Pitched Glazed)	Comments
Glazing	Overall window U – value ≤ 1.20 G-value - ≤ 0.40	Skyline System or equivalent double-glazed system with thermally broken frames.
Tapes	Waterproof solid acrylic and for use around windows and rooflights	Internal taping – Pro Clima Contega Solido SL or equivalent External taping – Pro Clima Contega Solido EXO or equivalent

2.7 Roof 13

Upgrade Proposal:

Roof 13 comprises a glazed lantern structure. The proposed strategy is to replace the existing glazing system with a new double-glazed assembly incorporating thermally broken frames to enhance thermal performance and reduce heat loss.

Product Specification:

Table 2-5 Product Performance Specification

Description	Performance (Pitched Glazed)	Comments
Glazing	Overall window U – value ≤ 1.20 G-value - ≤ 0.40	Skyline System or equivalent double-glazed system with thermally broken frames.
Tapes	Waterproof solid acrylic and for use around windows and rooflights	Internal taping – Pro Clima Contega Solido SL or equivalent External taping – Pro Clima Contega Solido EXO or equivalent

2.8 Roof 14 and Roof 15

Existing U-value:

Figure 2-16 Roof 14 & Roof 15 Existing U-value

Description of building assembly						Assembly no.	
RF14 & RF15 Existing U-value						10ud	
Orientation of building assembly (or R_{si})		1-Roof	Interior insulation?				
Adjacent to (or R_{se})		1-Outdoor air	U-value supplement $[W/(m^2K)]$				
Area section 1	λ $[W/(mK)]$	Area section 2 (optional)	λ $[W/(mK)]$	Area section 3 (optional)	λ $[W/(mK)]$	Thickness $[mm]$	
Plasterboard	0.250					13	
Unventilated	1.700	Timber Joists	0.130			277	
Timber board	0.130					30	
Assumed PIR	0.024					50	
Percentage of sec. 1:	80%	Percentage of sec. 2:	19.7%	Percentage of sec. 3:			
Heat transmission resistance coefficients						Total thickness $[cm]$: 37.0	
Interior R_{si} :	0.10	m^2K/W					
Exterior R_{se} :	0.04	m^2K/W		U-value $[W/(m^2K)]$: 0.356			

Upgrade Proposal:

The proposed strategy for Roofs 14 and 15 is to introduce either 60 mm mineral wool insulation or 50 mm foam glass insulation as part of a proprietary warm roof system, such as those provided by Bauder, IKO, or an equivalent approved manufacturer. The insulation is to be incorporated within a fully certified roof build-up to ensure compatibility between insulation, vapour control (where required), waterproofing membrane, and ancillary components.

Proposed U-value:

Figure 2-17 Roof 14 & Roof 15 Proposed U-value Option 1

Description of building assembly						Assembly no.	
RF14 & RF15 Proposed U-value						10ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air		U-value supplement [W/(m ² K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plasterboard	0.250					13	
Unventilated	1.700	Timber Joists	0.130			277	
Timber board	0.130					30	
Bauder Rockwool	0.039					60	
Percentage of sec. 1:	80%	Percentage of sec. 2:	19.7%	Percentage of sec. 3:			

Heat transmission resistance coefficients		Total thickness [cm]:	38.0
Interior R_{si} :	0.10 m ² K/W	U-value [W/(m ² K)]:	0.444
Exterior R_{se} :	0.04 m ² K/W		

Figure 2-18 Roof 14 & Roof 15 Proposed U-value Option 2

Description of building assembly						Assembly no.	
RF14 & RF15 Proposed U-value						10ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air		U-value supplement [W/(m ² K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plasterboard	0.250					13	
Unventilated	1.700	Timber Joists	0.130			277	
Timber board	0.130					30	
Bauder Foamglass	0.036					50	
Percentage of sec. 1:	80%	Percentage of sec. 2:	19.7%	Percentage of sec. 3:			

Heat transmission resistance coefficients		Total thickness [cm]:	37.0
Interior R_{si} :	0.10 m ² K/W	U-value [W/(m ² K)]:	0.477
Exterior R_{se} :	0.04 m ² K/W		

Product Specification:

Figure 2-19 Product Performance Specification

Description	Performance (Flat Roof)	Comments
Roof Type	Warm Roof	
Insulation	Thermal Conductivity ≤ 0.039 (mineral wool) / ≤ 0.036 (foamglass)	Insulation provided by suppliers like Bauder or IKO or equivalent.
AVCL	As per supplier specification	Bauder, IKO or equivalent
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes,	Bauder, IKO or equivalent



	Chipboard, Hard plastics, MDF, Metal, OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	
Breather Membrane	-	Not required for this buildup

2.9 Roof 16 and Roof 17

Existing U-value:

Figure 2-20 Roof 16 & Roof 17 Existing U-value

Description of building assembly						Assembly no.	
RF16 and Roof 17 Existing U-value						05ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plasterboard	0.250					13	
PIR Insulation	0.025					25	
Uninsulated	0.860	Timber Joists	0.130			140	
PIR Insulation	0.025					25	
Plywood board	0.130					20	
Percentage of sec. 1:	80%	Percentage of sec. 2:	19.7%	Percentage of sec. 3:			

Heat transmission resistance coefficients		Total thickness [cm]:		22.3	
Interior R_{si} :	0.10	m²K/W			
Exterior R_{se} :	0.10	m²K/W			
		U-value [W/(m²K)]:		0.377	

Upgrade Proposal:

Roofs 16 and 17 comprise pitched slate roof constructions. The proposed upgrade strategy is to install 140 mm mineral wool insulation between the rafters, supplemented by an additional 60 mm mineral wool layer positioned above the rafters to enhance overall thermal performance and reduce thermal bridging through the timber structure.

A vapour control layer is to be installed on the warm side of the insulation to manage vapour diffusion from the occupied space into the roof build-up and to reduce the risk of interstitial condensation. This layer will also function as the primary airtightness barrier, limiting convective heat loss and restricting moisture ingress into the construction.

On the cold side of the insulation, a breather membrane is to be provided beneath the slate covering. This breather membrane will allow the controlled escape of water vapour while providing secondary weather protection against wind-driven rain and water ingress. The combination of a warm-side VCL and cold-side breathable membrane ensures appropriate hygrothermal balance within the roof construction.

Proposed U-value:

Figure 2-21 Roof 16 & Roof 17 Proposed U-value

Description of building assembly						Assembly no.	
RF16 and Roof 17 Proposed U-value						06ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plasterboard	0.250					13	
Mineral Wool	0.036	Timber Joists	0.130			140	
Mineral Wool	0.036					60	
Plywood board	0.130					20	
Percentage of sec. 1:		80%	Percentage of sec. 2:		19.7%	Percentage of sec. 3:	

Heat transmission resistance coefficients		Total thickness [cm]:		23.3	
Interior R_{si} :	0.10	m^2K/W			
Exterior R_{se} :	0.10	m^2K/W			
			U-value [W/(m²K)]:		0.206

Product Specification:

Table 2-6 Product Performance Specification

Description	Performance (Pitched Slate)	Comments
Roof Type	Warm Roof	Insulation in between the rafters and on top of rafters
Insulation	Thermal Conductivity ≤ 0.036 (between joists) / ≤ 0.036 (above joists)	Rockwool Flexi or equivalent mineral wool product.
AVCL	Vapour Resistance (Humidity Variable) Sd 0.25 - >25m	Intello Plus or equivalent intelligent membrane
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes, Chipboard, Hard plastics, MDF, Metal, OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	Interior: Pro Clima Tescon Vana equivalent airtight adhesive tape Exterior: Pro Pro Clima Contega Solido Exo or equivalent airtight weatherproofing adhesive tape
Breather Membrane	Temperature resistance - -40 °C to 100 °C Fire rated membrane – B-s2 or better (fire consultant to provide advice) Water resistance – W1	Tyvek Fire rated membrane or similar product

2.10 Roof 19

Existing U-value:

Figure 2-22 Roof 19 Existing U-value

Description of building assembly						Assembly no.	
RF19 - Existing U-value						11ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement $[W/(m^2K)]$			

Area section 1	λ $[W/(mK)]$	Area section 2 (optional)	λ $[W/(mK)]$	Area section 3 (optional)	λ $[W/(mK)]$	Thickness [mm]
Plasterboard	0.250					15
Uninsulated cavity	1.410	Timber	0.130			230
Uninsulated cavity	0.780			Steel frame	50.000	127
Timber boards	0.130					22
Percentage of sec. 1:	80%	Percentage of sec. 2:	19.0%	Percentage of sec. 3:	1.0%	

Heat transmission resistance coefficients		Total thickness [cm]:		39.4	
Interior R_{si} :	0.10				
Exterior R_{se} :	0.10				
		U-value $[W/(m^2K)]$:		1.257	

Upgrade Proposal:

The proposed strategy for Roof 19 is to insulate at ceiling level by replacing the existing timber board lining with an integrated airtightness and vapour control layer (VCL) board, and installing 200 mm mineral wool insulation above at loft level.

The replacement board will act as both the internal ceiling finish substrate and the primary airtightness layer, incorporating an integral VCL to control vapour diffusion from the occupied space into the cold roof void. This approach is intended to significantly reduce uncontrolled air leakage and limit moisture migration into the insulation layer, thereby reducing the risk of interstitial condensation within the roof space.

Proposed U-value:

Figure 2-23 Roof 19 Proposed U-value

Description of building assembly						Assembly no.	
RF19 - Proposed U-value						12ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement [$W/(m^2K)$]			
Area section 1	λ [$W/(mK)$]	Area section 2 (optional)	λ [$W/(mK)$]	Area section 3 (optional)	λ [$W/(mK)$]	Thickness [mm]	
Plasterboard	0.250					15	
Uninsulated cavity	1.410	Timber	0.130			230	
Uninsulated cavity	0.780			Steel frame	50.000	127	
Airtightness board (Smartply)	0.130					18	
Mineral wool	0.036					200	
Percentage of sec. 1:	80%	Percentage of sec. 2:	19.0%	Percentage of sec. 3:	1.0%		

Heat transmission resistance coefficients		Total thickness [cm]:	59.0
Interior R_{si} :	0.10 m^2K/W	U-value [$W/(m^2K)$]:	0.156
Exterior R_{se} :	0.10 m^2K/W		

Product Specification:

Figure 2-24 Product Performance Specification

Description	Performance (Pitched Clay Tile)	Comments
Roof Type	Cold Roof	
Insulation	Thermal Conductivity ≤ 0.036	Rockwool Flexi or equivalent mineral wool product.
AVCL	AVCL integrated airtightness board	Smartply or equivalent product
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes, Chipboard, Hard plastics, MDF, Metal, OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	Interior: Pro Klima Tescon Vana equivalent airtight adhesive tape
Breather Membrane	-	Not required for this buildup

2.11 Roof 20

Existing U-value:

Figure 2-25 Roof 20 Existing U-value

Description of building assembly						Assembly no.	
RF20 Existing U-value						07ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement [W/(m ² K)]			

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Plasterboard	0.250					15
Unventilated cavity	1.890	timber joists	0.130			308
Plywood	0.130					20
Percentage of sec. 1:	76%	Percentage of sec. 2:	23.8%	Percentage of sec. 3:		

Heat transmission resistance coefficients		Total thickness [cm]:	34.3
Interior R_{si} :	0.10 m ² K/W	U-value [W/(m ² K)]:	1.499
Exterior R_{se} :	0.10 m ² K/W		

Upgrade Proposal:

The proposed upgrade strategy for Roof 20 is to incorporate either 105 mm mineral wool insulation board or 100 mm foam glass insulation as part of a proprietary warm roof system, such as those provided by Bauder, IKO, or an equivalent approved manufacturer. The insulation is to be integrated within a fully tested and certified roof build-up to ensure compliance with thermal, structural, fire, and waterproofing performance requirements.

Proposed U-value:

Figure 2-26 Roof 20 Proposed U-value Option 1

Description of building assembly						Assembly no.	
RF20 Proposed U-value						07ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement [W/(m ² K)]			

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Plasterboard	0.250					15
Unventilated cavity	1.890	timber joists	0.130			308
Plywood	0.130					20
Bauder Rockwool	0.039					100
Percentage of sec. 1:	76%	Percentage of sec. 2:	23.8%	Percentage of sec. 3:		

Heat transmission resistance coefficients		Total thickness [cm]:	44.3
Interior R_{si} :	0.10 m ² K/W	U-value [W/(m ² K)]:	0.300
Exterior R_{se} :	0.10 m ² K/W		

Figure 2-27 Roof 20 Proposed U-value Option 2

Description of building assembly						Assembly no.	
RF20 Proposed U-value						07ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		3-Ventilated		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plasterboard	0.250					15	
Unventilated cavity	1.890	timber joists	0.130			308	
Plywood	0.130					20	
Bauder Foamglass	0.036					105	
Percentage of sec. 1:	76%	Percentage of sec. 2:	23.8%	Percentage of sec. 3:			

Heat transmission resistance coefficients		Total thickness [cm]:		44.8	
Interior R_{si} :	0.10	m²K/W			
Exterior R_{se} :	0.10	m²K/W			
			U-value [W/(m²K)]:		0.271

Product Specification:

Table 2-7 Product Performance Specification

Description	Performance (Flat Roof)	Comments
Roof Type	Warm Roof	
Insulation	Thermal Conductivity ≤ 0.039 (mineral wool) / ≤ 0.036 (foamglass)	Insulation provided by suppliers like Bauder or IKO or equivalent.
AVCL	As per supplier specification	Bauder, IKO or equivalent
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes, Chipboard, Hard plastics, MDF, Metal, OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	Bauder, IKO or equivalent
Breather Membrane	-	Not required for this buildup

2.12 Roof 21

Existing U-value:

Figure 2-28 Roof 21 Existing U-value

Description of building assembly						Assembly no.	
RF21 - Proposed U-value						08ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plasterboard	0.250					25	
Unventilated Cavity	1.140	Timber Joists	0.130			185	
Unventilated Cavity	0.490	Timber Joists	1.130			80	
Plywood	0.130					20	
Percentage of sec. 1:	88%	Percentage of sec. 2:	12.5%	Percentage of sec. 3:			

Heat transmission resistance coefficients		Total thickness [cm]:		31.0	
Interior R_{si} :	0.10 m²K/W				
Exterior R_{se} :	0.04 m²K/W	U-value [W/(m²K)]:		1.337	

Upgrade Proposal:

The proposed upgrade strategy for Roof 21 is to install 120 mm mineral wool insulation on top of the new roof deck as part of a proprietary warm roof system, such as those provided by Bauder, IKO, or an equivalent approved manufacturer. The insulation is to be integrated within a fully tested and certified roof build-up to ensure compatibility between insulation, vapour control, waterproofing membrane, and ancillary components.

Proposed U-value:

Figure 2-29 Roof 21 Proposed U-value

Description of building assembly						Assembly no.	
RF21 - Proposed U-value						08ud	

Orientation of building assembly (or R_{si})		1-Roof		Interior insulation?			
Adjacent to (or R_{se})		1-Outdoor air		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Plasterboard	0.250					25	
Unventilated Cavity	1.140	Timber Joists	0.130			185	
Unventilated Cavity	0.490	Timber Joists	1.130			80	
Plywood	0.130					20	
Bauder Rockwool	0.039					120	
Percentage of sec. 1:	88%	Percentage of sec. 2:	12.5%	Percentage of sec. 3:			

Heat transmission resistance coefficients		Total thickness [cm]:		43.0	
Interior R_{si} :	0.10 m²K/W				
Exterior R_{se} :	0.04 m²K/W	U-value [W/(m²K)]:		0.260	



Product Specification:

Table 2-8 Product Performance Specification

Description	Performance (Flat Roof)	Comments
Roof Type	Warm Roof	
Insulation	Thermal Conductivity ≤ 0.039 (mineral wool)	Insulation provided by suppliers like Bauder or IKO or equivalent.
AVCL	As per supplier specification	Bauder, IKO or equivalent
Tapes	Permanently sticks to Aluminium, Aluminium / foil membranes, Chipboard, Hard plastics, MDF, Metal, OSB, PE, PA, PP, PET and foil membranes, Painted timber, Plywood, Smooth planed timber.	Bauder, IKO or equivalent
Breather Membrane	-	Not required for this buildup

2.13 Roof 22

The upgrade strategy for Roofs 22 will be similar to the proposed Roof 19 strategy (except insulation thickness to be 60mm instead of 200mm) and should therefore be implemented in accordance with the same airtightness, and moisture control principles.

2.14 Roof 23 (No upgrades)