

# MANCHESTER SCHOOL OF ARCHITECTURE

Rossendale Digital CIC is a group of tech entrepreneurs who want to turn Bacup Christ Church, a historic building from 1854, into an active digital hub for the local community. Our aim as a team is to tackle the digital skills gap in Rossendale and the space will offer hands-on training in areas like coding, web development and 3D printing alongside office and event spaces. We want to support startups, freelancers and local residents and this project will allow us to train up to 1,700 people a year and provide workspaces for up to 60 people.



ALTAR-NATIVE

## Team Members

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Cayden Kai Shen Kuan  
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Roshni Patel  
Tre-Kwan Mchpherson  
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Visit [msa.ac.uk](http://msa.ac.uk) for more information

## Team

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## Collaborators

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The project is at Rossendale Digital Bacup Campus. Most people will just call it 'The Bacup Campus', The Rossendale Digital Hub/Centre or Rossendale's Digital and Tech Community's Hub. The goal is to create a dedicated space where local digital talent can work, learn, meet, collaborate and build things that move the local economy forward.

Our aim as a team is to tackle the digital skills gap in Rossendale and the space will offer hands-on training in areas like coding, web development and 3D printing alongside office and event spaces. We want to support startups, freelancers and local residents and this project will allow us to train up to 1,700 people a year and provide workspaces for up to 60 people

# Introduction

## ALTAR-NATIVE

The project unfolded across four months from February to May 2026, with each phase building directly on the findings of the last. The team's process was shaped from the outset by three constraints stated explicitly by the client: budgets are tight, the heritage of the building must be retained as far as possible, and damp is a known risk given the hygroscopic nature of the stone.

In February, the team developed competing poster designs and a project website to establish a shared identity and communicate the scheme to external audiences. Two distinct visual approaches were explored — one foregrounding the architectural character of the church, one foregrounding the digital-technology metaphor of the circuit board — before the final green-ground isometric illustration was agreed as the project's public face.

March was devoted to the site visit: the team spent time in the building recording thermal and humidity data at eight measurement points, photographing the windows, walls, roof structure, and floor finishes in detail, and meeting with the client to align on the brief. The visit confirmed that the building is structurally sound and spatially generous, but thermally challenging, with the single-glazed windows and uninsulated walls as the dominant sources of heat loss.

April focused on analysis: solar radiation modelling, psychrometric analysis, internal temperature mapping, and the development of a physical model of the church to test spatial ideas at scale. The thermal survey data was processed and visualised as a colour-coded floor plan, which became the primary tool for communicating upgrade priorities to the client.

May brought the design proposals together: wall insulation specifications, underfloor heating layout, stained glass window construction details, cold bridge mitigation at the roof ridge, and three internal layout options. These are presented here as a cohesive body of technical work — evidence-based, budget-conscious, and grounded in the specific character of Bacup Christ Church.

# Introduction

## Site Appraisal + Heritage Statement

The project operates at the intersection of heritage preservation and environmental engineering, addressing the inherent conflict between the thermal inefficiency of nineteenth-century construction and the stringent requirements of modern UK building regulations. Traditional ecclesiastical structures like Bacup Christ Church were designed for short-term occupancy and natural ventilation rather than the sustained, high-performance climate control required by a digital workforce. Consequently, the primary technical objective involves a rigorous analysis of ventilation and thermal bridge mitigation to ensure the building can function as a productive, comfortable environment without losing its architectural soul.

We have committed to upholding the spirit of the original planning proposal, ensuring that our technical interventions remain secondary to the established design aesthetic. This necessitates a sophisticated approach to internal insulation where we apply high-performance materials to the interior face of the masonry. By selecting breathable, moisture-regulating insulation, we can significantly lower the U-values

of the massive stone walls while protecting the fabric from the risks of dampness and rot. This ensures that the building remains a healthy environment for both its new occupants and the historic timber and stone components that define its character.

Furthermore, the integration of mechanical systems is handled with extreme sensitivity to the listed status of the church. We are trialing a range of efficient mechanical heating methods, such as air-source heat pumps or localized radiant heating, to identify the most sustainable way to maintain a steady operating temperature within the vast volume of the nave.

These mechanical solutions are paired with passive ventilation strategies that utilize the building's existing geometry to facilitate airflow. By treating the church as a living, breathing entity, we are creating a thermally viable workspace that meets the high expectations of digital office users while ensuring that every modern addition is discreetly tucked away from the public eye, effectively future-proofing the structure for its new life in the Rossendale economy.

The first stage of technical analysis was a detailed site visit, during which the team deployed data loggers at eight measurement points across the ground floor plan to record internal temperature and relative humidity simultaneously.

This thermal survey provided an empirical foundation for all subsequent design decisions, moving the project from speculation to evidence-based proposals. The results were illuminating. Despite the relatively small footprint of the church, a clear pattern of thermal variation emerged. The building remains consistently cool throughout, with internal temperatures ranging from 16°C at the perimeter and upper-edge zones to 17°C in the more protected, enclosed areas of the nave and chancel.

This 1°C differential, while modest in absolute terms, is diagnostic: it reveals that the principal source of heat loss is the perimeter envelope — the walls, windows, and exposed roof junction — rather than any deficiency in the heating system itself.

The highest-priority zones for intervention are the upper north and west edges of the plan (P5 and P6), where exposed masonry and single-glazed windows create persistent cold bridges. Humidity readings at these points reached 55–58%, the highest in the building, confirming that moisture accumulation is already occurring at the wall surfaces.

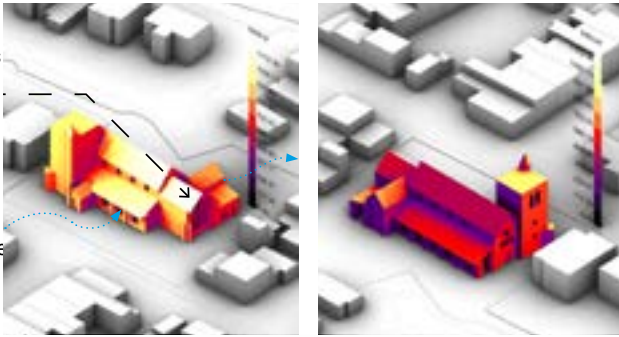


Image Top:  
Client Engagement

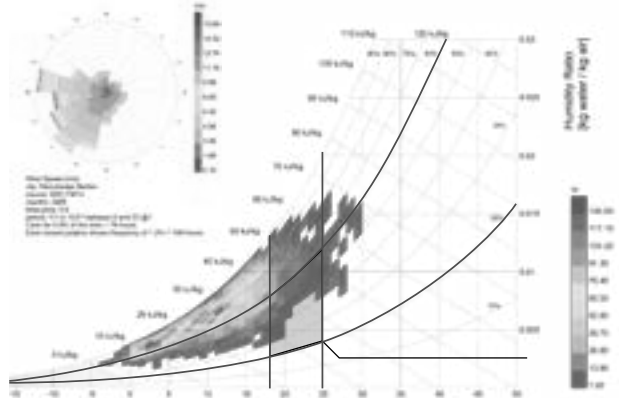
Image Middle:  
Building Performance  
Monitoring

Image Bottom:  
ALTAR-NATIVE Site Survey  
+ Appraisal

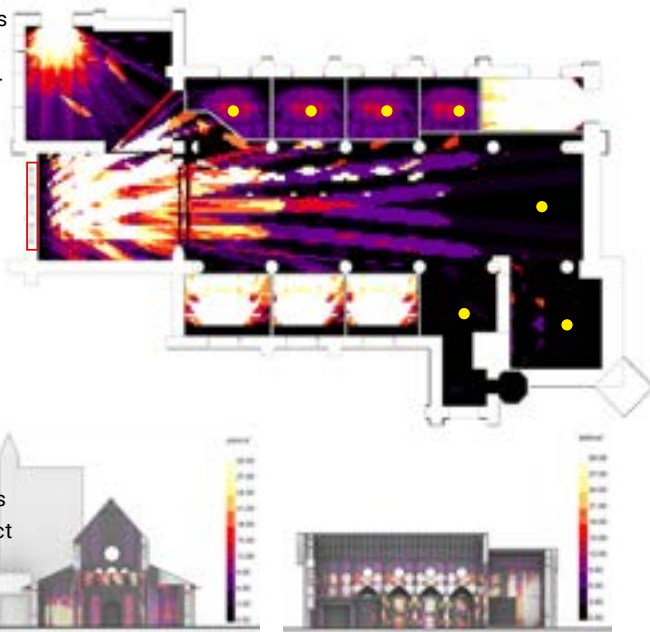
To understand the building's passive thermal potential, the first team undertook a solar radiation analysis plotted against a distribution chart representing the local outdoor climate. The results confirmed that Manchester's climate sits predominantly outside the indoor thermal comfort zone without active heating or cooling intervention – a finding that reinforces the urgency of improving the building's passive envelope performance. The solar analysis reveals a pronounced asymmetry in radiation across the building's surfaces.



The south-facing roof plane receives the strongest solar exposure throughout the year and represents the greatest opportunity for passive solar gain – though the single-layer slate and existing roof construction currently offer minimal resistance to heat loss. In contrast, the north-facing elevations receive significantly less radiation and require correspondingly greater insulation provision to prevent heat loss through the wall fabric.

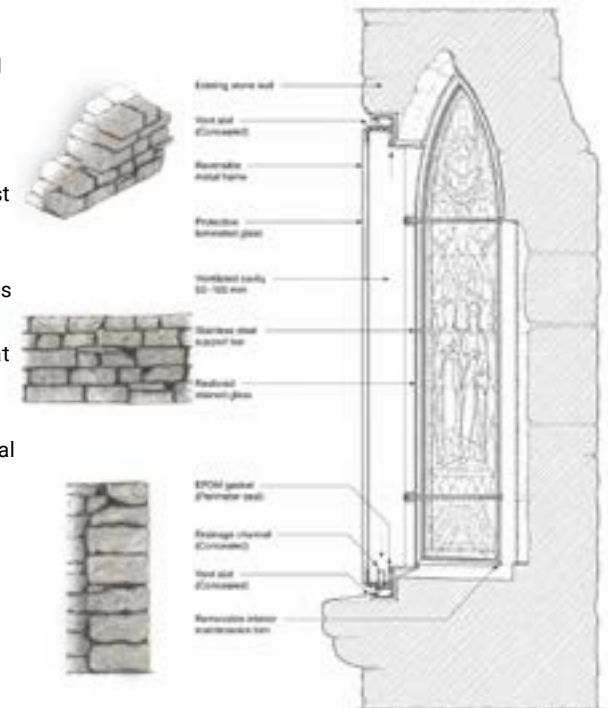


Internally, a daylight analysis of the floor plan confirms that large portions of the nave receive insufficient natural light to meet the reference illuminance levels required for office work. This is particularly acute in the entrance area on the east side, where the nave is deepest and most shaded. The west-facing full-height windows admit a substantial quantity of direct solar radiation during afternoon hours, which creates glare risk and localised overheating at the glazed



surface – further evidence that the windows require both upgraded thermal performance and considered shading provision.

Third, The limestone walls of Bacup Christ Church present one of the most technically demanding challenges of the project. The stone is highly hygroscopic – it absorbs and releases moisture continuously in response to ambient humidity – which means that any insulation strategy must allow the wall to 'breathe' if it is to avoid trapping moisture and causing internal condensation or timber rot.



A conventional approach of covering the interior face with impermeable rigid insulation boards was rejected on both conservation and building physics grounds: the listed status of the building means the exterior stone face must remain exposed, and covering it internally with a vapour-closed material would simply relocate the dew point to within the wall construction.

The proposed lighting strategy responds to these findings by identifying supplementary artificial lighting zones in the areas of lowest daylight factor, while avoiding additional heat loads in the zones already subject to solar gain. Lighting positions are mapped across both the nave cross-section and the longitudinal section to ensure even distribution at desk level without compromising the visual character of the historic interior.



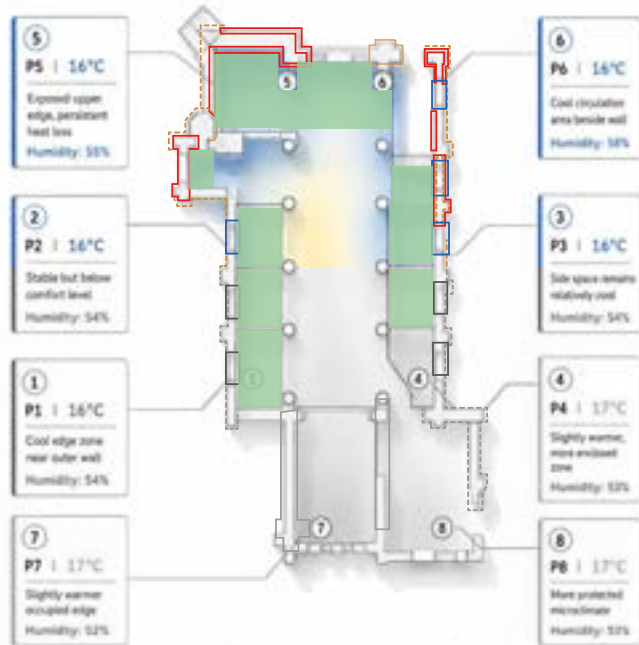
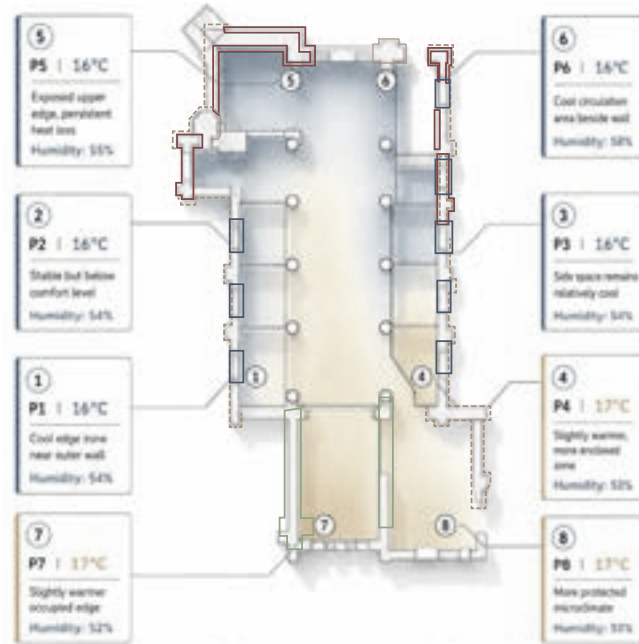
The thermal survey data collected during the March site visit was translated into a spatial upgrade map, allowing the team to prioritise environmental interventions across the ground floor plan in a way that is both evidence-based and budget-conscious. Rather than treating the building as a single thermal unit requiring uniform improvement, the strategy targets investment where it will deliver the greatest impact on occupant comfort and energy efficiency.

The perimeter of the building – particularly the upper north and west edges at points P5 and P6 – is designated high priority. These zones recorded the lowest temperatures at 16°C and the highest humidity readings of 55–58%, confirming persistent heat loss through the exposed masonry and single-glazed windows.

The wall insulation and window upgrade proposals are concentrated here first. The aisle spaces running along either side of the nave are identified as medium priority, stable in temperature but consistently below comfort level. The more enclosed zones of the chancel and lower nave, where P7 and P8 recorded slightly warmer temperatures of 17°C and lower humidity, are lower priority and can be monitored before further investment is committed.

**Upgrade priority**

- HIGH PRIORITY
- - - MEDIUM PRIORITY
- LOW PRIORITY / MONITOR
- WINDOW UPGRADE PRIORITY



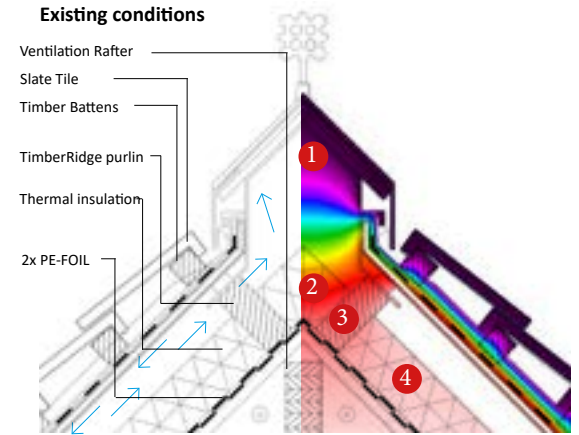
■ Areas of church to be implemented

A thermal bridge analysis of the existing roof ridge detail identified four compounding weaknesses in the current construction. The out-dated build up of the ridge concentrates bridging and creates a zone of significant heat loss at the apex of the roof.

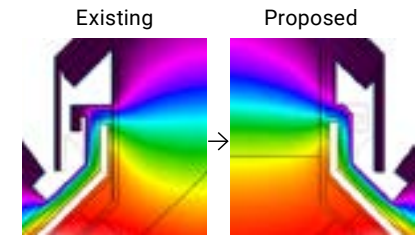
As such, the integrity of interior insulation is eroded at the ridge junction, structural elements penetrate the insulation layer without adequate thermal breaks, and the overall insulation thickness is insufficient to achieve the thermal resistance required for a comfortable working environment.

The proposed roof improvements address each of these issues systematically: ensuring continuous PE-Foil vapour control across the ridge junction, improving airtightness at all timber penetrations and junctions using airtight tape, and increasing the overall thickness of the insulation layer.

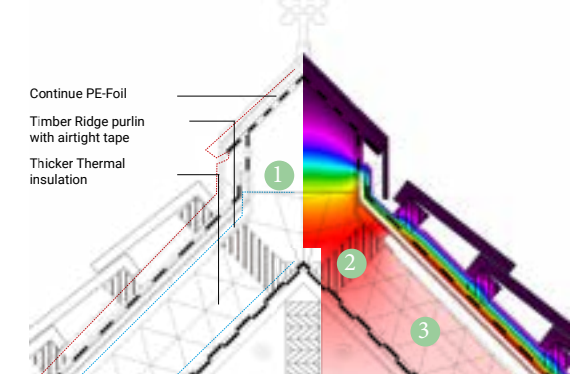
The before-and-after thermal comparison shows a marked improvement in the isotherm distribution at the ridge, with the cold zone significantly reduced in both area and severity.



1. Complex ridge geometry - The geometry concentrates heat flow and disorients isotherms
2. Discountuous insulation at the ridge - Insulation is interrupted at the ridge junction
3. Structural elements penetrating insulation
4. Insufficient insulation thickness - Limited insulation depth results in lower thermal resistance



**Proposed Roof Improvements**



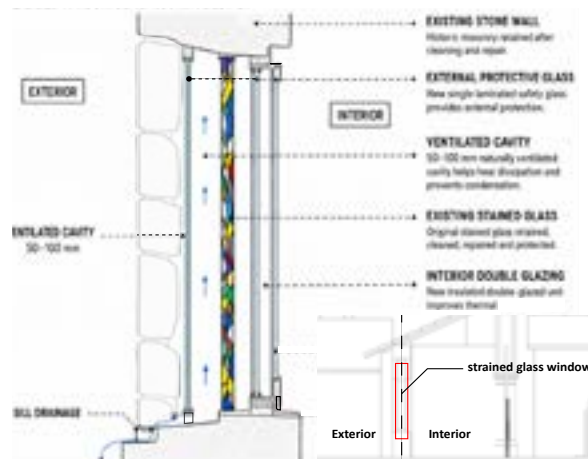
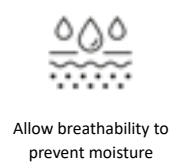
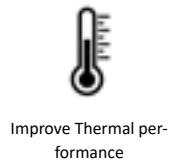
1. Ensure Continuity of the PE-Foil Especially at the ridge junction
2. Improve airtightness at timber penetrations and junctions Using airtight tape
3. Increasing the Thickness of the Existing Insulation Layer

Our technical strategy is guided by three principles drawn directly from the client brief; committing first to the use of breathable, moisture-regulating materials wherever insulation is introduced to the interior face of the masonry.

The stone walls of the church are hygroscopic – they absorb and release moisture as the humidity of the air fluctuates. Sealing them with impermeable insulation boards risk trapping moisture within the wall, accelerating erosion of both the stonework and the historic timber elements. Instead, we have specified a natural hydraulic lime render combined with a cork insulation aggregate, a combination that significantly improves thermal resistance while allowing the wall to continue breathing.

Through the cost effective heritage sensitive process of 'Repointing', expert sculptors (pictured) restore the original character of the masonry wall, by sanding and excavating a shallow indent of the mortar from the brick.

Second, we have recognised that the building's stained glass windows, currently boarded with metal security sheets, represent its most significant thermal weak point. Our window upgrade strategy retains the historic stained glass in situ, repaired and cleaned, while introducing an external laminated safety glass panel and an interior double-glazed unit, with a naturally ventilated cavity between the two to prevent condensation.



Second, we have approached the integration of mechanical systems with sensitivity to the listed status of the building.

A conventional HVAC system would be energetically inefficient in a space with such high ceilings and difficult to install unobtrusively within a listed interior. HVAC would also risk a significantly greater maintenance and operational cost in order to control the climate of the entire building; as opposed to isolating insulation and convention with, passive thermal bridging into secondary and tertiary programmes.

Our preferred solution is a hydronic (water based) underfloor heating system.

A wet screed system using 16mm PEX-C water pipes – which sits entirely below the existing stone floor finish allows targeted zone-by-zone control across the nave, chancel, and office areas.

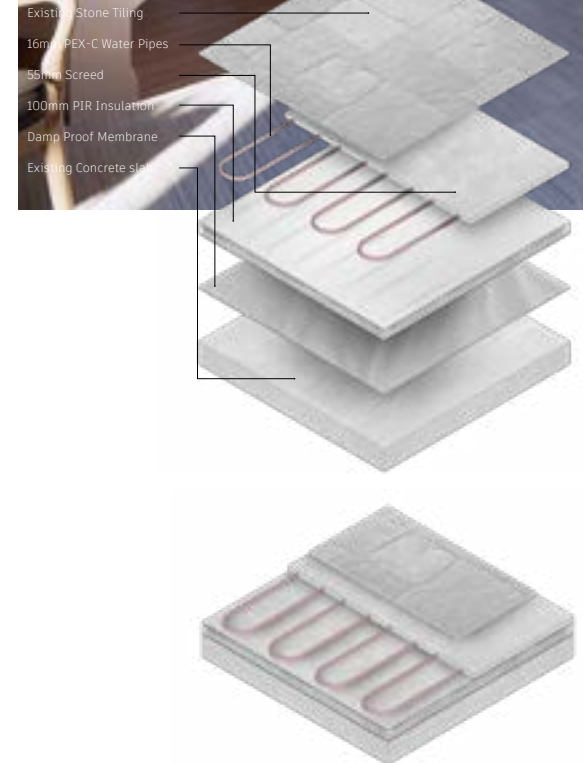


Image Top:  
Visualisation - Design  
Option 1 Central Nave

Three distinct layout options were developed as design alternatives for the converted interior, each representing a different balance between commercial viability, community focus, and environmental strategy.

Option 01 takes the approved planning application as its starting point, maximising net-saleable floor area through a series of enclosed private office rooms inserted within the nave aisles. Insulation and heating provision is concentrated around the office pods, which receive the greatest environmental investment and deliver the strongest return on that investment through occupancy. This option offers the most straightforward commercial case and the lowest risk of planning objection, but it prioritises private occupation over community access to the main body of the church.

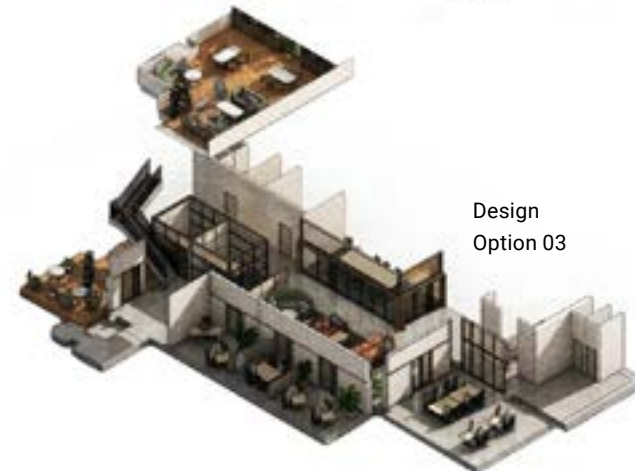
Option 03 is the most community-oriented and the least commercially driven. The mezzanine level is opened into an administrative and reception space rather than subdivided into offices, reducing the net-saleable area significantly but creating a more generous and welcoming entrance experience. This is also the cheapest mechanical design option, with simple zoning and lower system complexity, making it the most appropriate if the client's budget constraints tighten further during delivery.



Design Option 01



Design Option 02



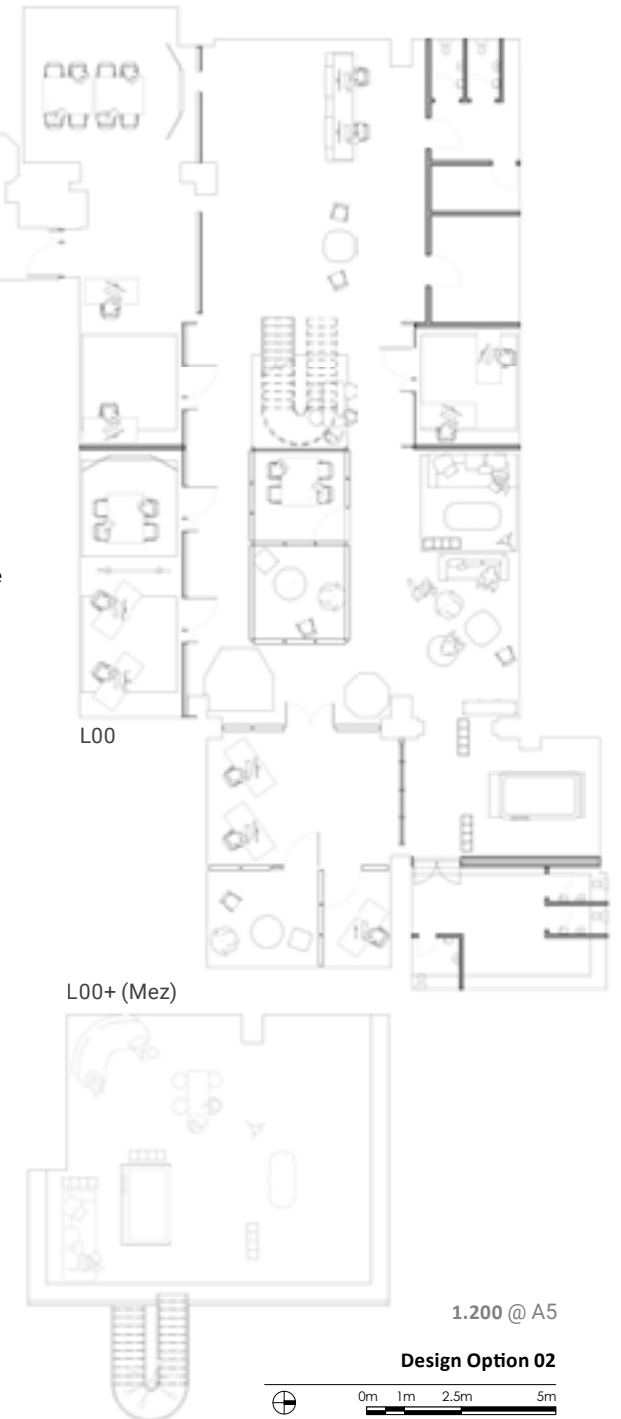
Design Option 03

The three options are presented not as competing proposals but as a design conversation with the client – each carries a different set of priorities, costs, and community outcomes, and the final decision rests with Rossendale Digital CIC.

As such, in reviving the original planning application, we sought to provide the client with design options that not only modernise the scheme - but each champion their principles of increased local economic output, heritage and character, and community integration and interdependency.

Design Option 2 puts forward a more radical architectural proposition: a central ornamental staircase celebrating the full verticality of the nave becomes the organising element of the scheme, with modular co-working cubicles arranged on either side.

This configuration champions a dynamic, collaborative working culture and makes the most powerful spatial statement – the drama of the church interior is experienced by everyone, not just those in office rooms with views of the windows. The heating and insulation strategy is targeted at the occupied cubicle zones at mid-nave, with the full-height central space free to regulate itself throughout seasons.

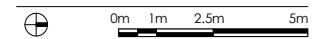


L00

L00+ (Mez)

1:200 @ A5

Design Option 02



# Reflection

The project demonstrated the complexity of adapting a nineteenth-century ecclesiastical building for contemporary occupation while retaining the material and spatial qualities that define its historic character. Rather than treating sustainability as a process of applying standardised technical upgrades, the work required a detailed understanding of the building's environmental behaviour, construction methods, and patterns of deterioration.

Through thermal surveys, humidity mapping, daylight analysis, and material research, the team developed an evidence-based understanding of how the church performs across different environmental conditions. The findings revealed that many of the building's limitations were directly connected to its original construction: hygroscopic limestone walls, single-glazed stained glass windows, minimal insulation, and a large internal volume designed for intermittent rather than continuous occupation.

A key challenge throughout the project was balancing environmental performance with conservation sensitivity. Proposed interventions therefore focused on reversible and breathable systems that could improve thermal comfort without compromising the long-term health

of the building fabric. Strategies such as cork-lime internal insulation, targeted window upgrades, thermal bridge mitigation at roof junctions, and zoned underfloor heating were developed not as isolated technical solutions, but as part of a wider approach to adaptive reuse that prioritised material compatibility and long-term maintenance.

The collaboration with Rossendale Digital CIC also reinforced the importance of designing within practical and financial constraints. Discussions around phasing, operational costs, and commercial viability shifted the project away from speculative architectural gestures towards realistic and deliverable proposals. The development of multiple layout options further demonstrated how environmental, social, and economic priorities can produce very different spatial outcomes within the same existing structure.

Ultimately, the project highlighted adaptive reuse as a process of negotiation between heritage, performance, and occupation, where architectural decisions must respond equally to technical evidence, community use, and the continued preservation of the existing building.

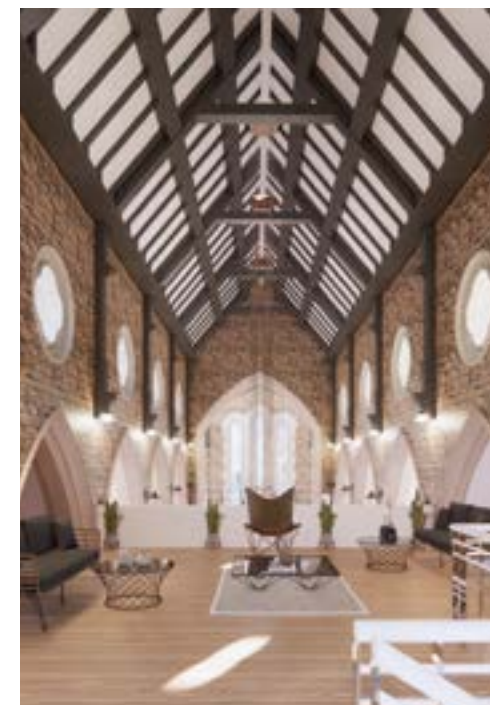
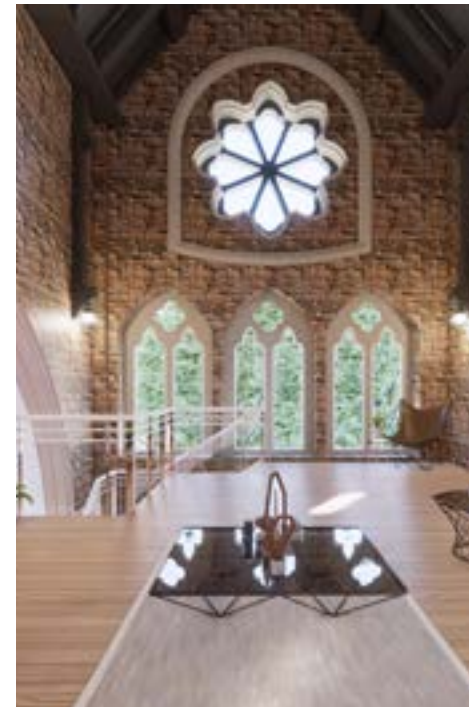


Image Top-Left:  
Visualisation - Design  
Option 2 Upper Ground  
Mezzanine West

Image Top-Right:  
Visualisation - Design  
Option 2 Meeting Room

Image Bottom-Left:  
Visualisation - Entrance +  
Reception Area

Image Bottom-Right:  
Visualisation - Design  
Option 2 Upper Ground  
Mezzanine East (Nave)

## ABOUT

Each year the MSA LIVE programme unites Masters Architecture year 1, Masters of Architecture & Adaptive Resuse students, BA foundation and year 1 and Masters Landscape Architecture 1 in mixed-year teams to undertake live projects with external partners to create social impact.

## LIVE PROJECTS

All MSA LIVE projects are live. A live project is where an educational organisation and an external partner develop a brief, timescale, and outcome for their mutual benefit.

## SOCIAL IMPACT

All MSA LIVE projects are for community benefit or have social impact. Social impact is the effect an organization's actions have on the well-being of a community. Our agendas are set by our external collaborators.

## EXTERNAL PARTNERS

MSA LIVE projects work with many organisations: charities, community groups, social enterprises, community interest companies, researchers, practitioners and educators.

## STUDENT-LED

Our MSA students take the lead in the project conception, brief development, delivery and co-ordination of a small project. The projects are celebrated in presentations at the end of the academic year. .

## KNOWLEDGE TRANSFER

Working in teams within and across year groups and courses; MSA students participate in peer to peer learning. In addition, collaborators, participants and students engage in the transfer of tangible and intellectual property, expertise, learning and skills.

## LARGE SCALE

This year approximately 400 students from 5 cohorts in MSA have worked on 34 projects with partners.

## QUESTIONS

For questions about MSA LIVE please contact the MSA LIVE team, Emily & Julie:

**[e.crompton@mmu.ac.uk](mailto:e.crompton@mmu.ac.uk) and [j.fitzpatrick@mmu.ac.uk](mailto:j.fitzpatrick@mmu.ac.uk)**

## BLOG

[live.msa.ac.uk/2026](http://live.msa.ac.uk/2026)

## SOCIAL

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[www.msa.ac.uk](http://www.msa.ac.uk)