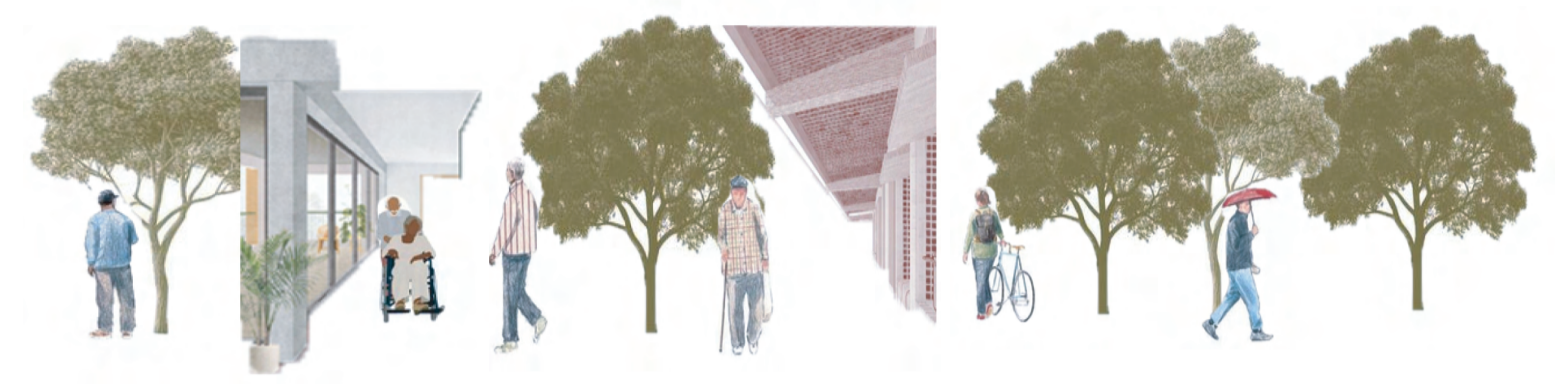


Brayford Wharf Life and wellness community centre

This project, focuses on the elderly community and individuals with chronic health conditions within the heart of Lincoln. Within Lincolnshire there is an aging population and a significant increase in health conditions across the county such as arthritis, diabetes, and respiratory conditions, thus the need for a inclusive communal space. Offering accessible leisure facilities, opportunities for learning and development whilst also being in a therapeutic environment. The incorporation of landscape design that encourages movement and connection to nature through the use of external balconies and garden rooftop walkway. Bringing together multigenerational individuals with chronic health conditions and the elderly, allowing people who experience similar health conditions, mobility challenges and care needs to form a community in a safe accessible public building. Fostering mutual support, community and shared experience within the building design. This response not only to the site conditions on the Brayford Wharf but also promotes physical and mental activity, learning and interaction whilst considering a holistic approach in both the conceptual development through circulation walkways, encouraging movement and wellness but also through the use of landscape external space. Zones focused on therapeutic spaces through warm natural materials, daylighting and a comfortable climate allows for a more accessible space, not only through widen corridors, level surfaces and lift blocks but breaking cognitive and health barriers. The circulation strategy not only emphasises circulation loops within nature but also promotes daily activity and slow movement, this is beneficial for individual individuals with Low mobility and arthritis whilst also experiencing nature through the use of green corridors and the external garden roof rooftop.

Client requirements from a community centre



Primary Users		Secondary Users
Chronic health conditions	Elderly	General Public
Primary occupant	Primary occupant	Passive occupant
Age: 0-65	Age: 65+	Age: 16-65
People with chronic health conditions will be provided a space to help and cope with their condition. With Addition support for physical activities, life support and mentally beneficial programmes.	People over 65+ will have a community space for meaningful interaction whilst promoting physical fitness both internally and externally.	Located in the heart of Lincoln with links to transportation and on the brayford wharf natural curiosity will lead to secondary users to utilise the externally space that both directly and indirectly interacts with the building.

25% of Lincolnshires population is over 65+

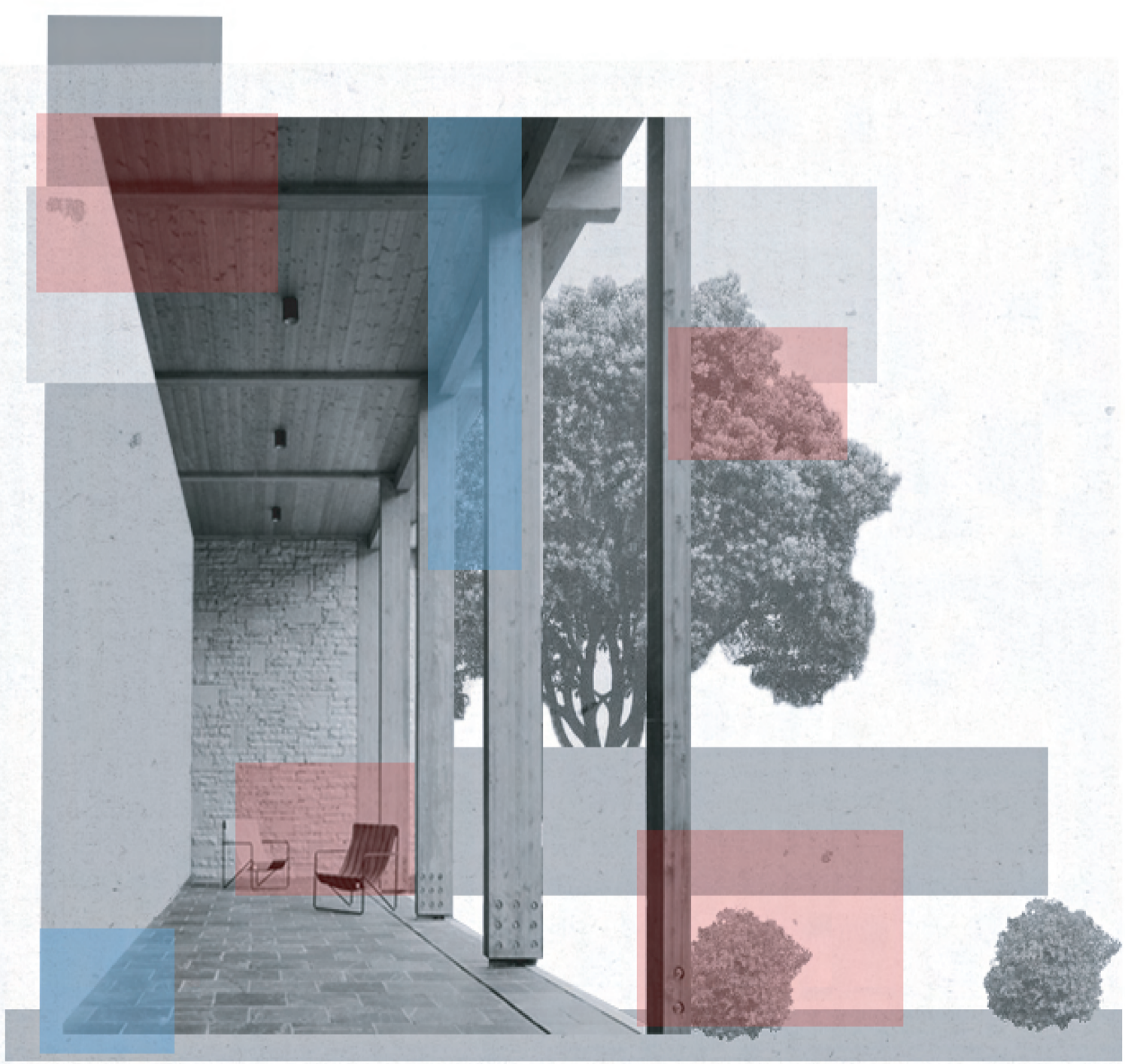
The Lincolnshire integrated care board found in a NHS report inequality health care facilities in rural and coastal areas

1 in 20 report poor health in Lincoln

Mobility issues such as Musculoskeletal conditions has some of the high rates in Lincolnshire.

Support carers and families Carers often report burnout, overwhelming stress and isolation.

Around 15.8% of adults (16+) are estimated to have common mental disorders in Lincolnshire



Starting the concept with a collage of how the space should intend to feel in the external space.



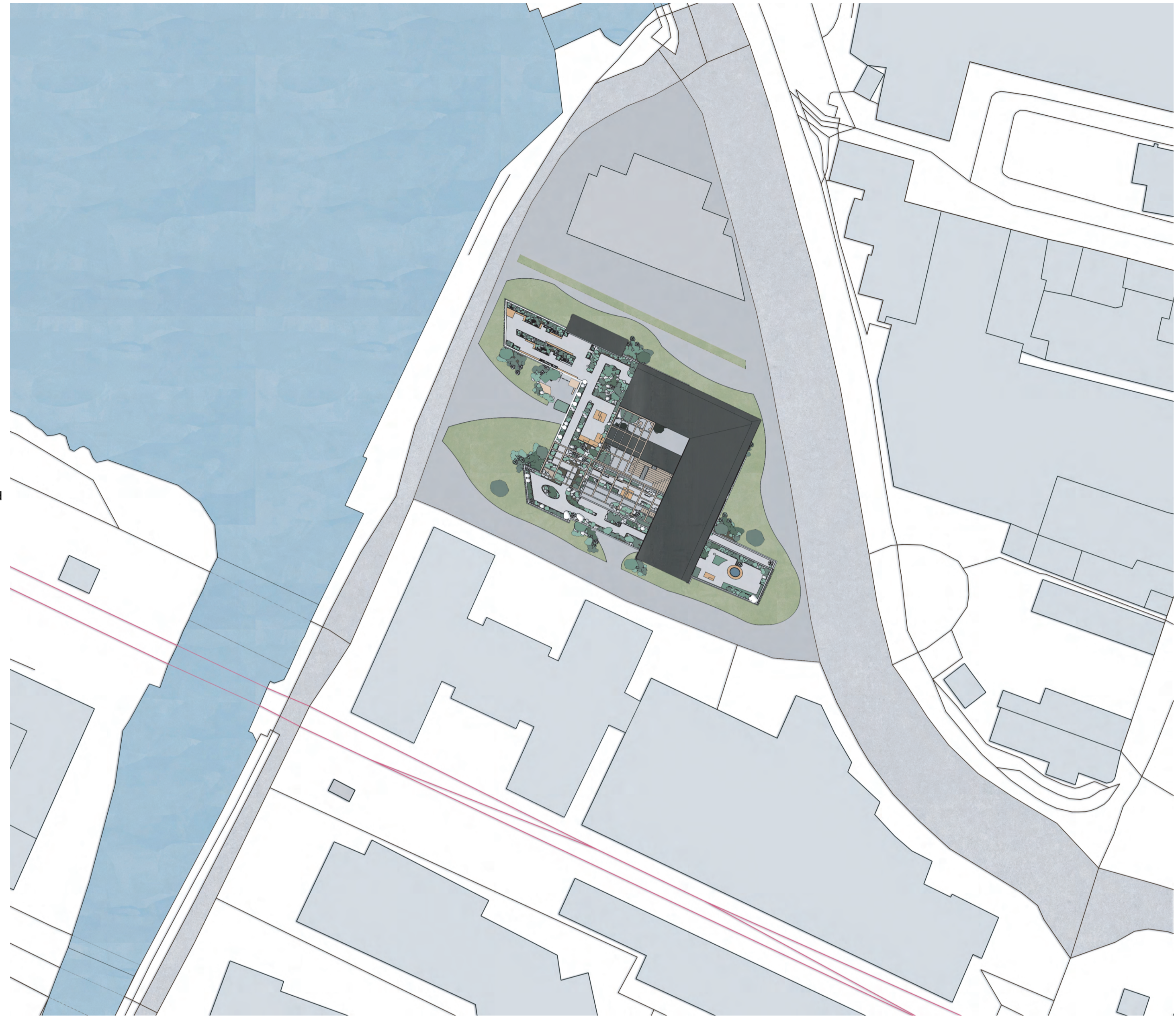
Atrium
This space stretched over three floors allows for a communal resting space within the continuous walking loops internally. Focused on natural materials and vegetation that are known to reduce stress, high blood pressure and psychological strain within the elderly users. With integrated seating, games and a café this space is not only accessible for all users but also allows for thoughtful moments for them to sit and rest within a community. The orientation of the building not only allows the atrium to gain above adequate day light which is crucial within communal spaces but also has south westerly wind paths allowing for passive ventilation of fresh air within such a large space. This impacts the users as individuals with respiratory issues, asthma, and psychological stress with natural fresh air that regulates the internal climate whilst also improving circadian rhythms due to daylight. Thus this space does not only improve the user's intergenerational social interaction but also helps to maintain and improve their health.



West Facade
The building looks onto the Brayford wharf, whilst having strong links into Lincoln city centre and the university of Lincoln. This makes this site easy to access for all users both within Lincoln and Lincolnshire due to train links, bus routes and car parks. Focused on circulation loops and nature both externally and internally this building also tries to mitigate potential site risks, with permeable paving surrounding the building reducing surface flooding and also reducing heat island effect for the surrounding areas. With the courtyard of the building protecting the area from high wind created on the Brayford wharf this allows a space for all activities in a controlled area.

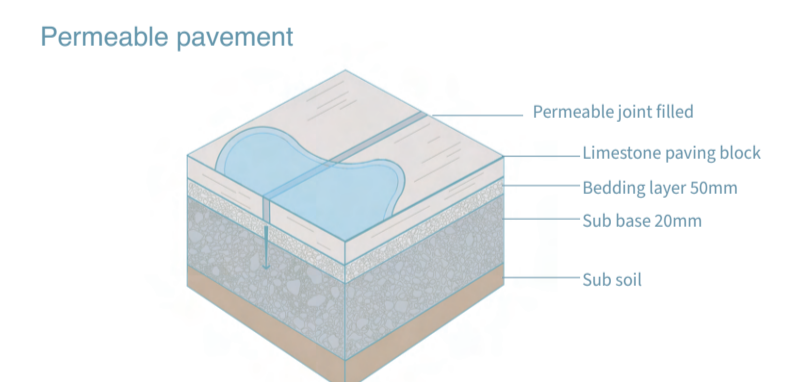


Pool
A communal pool that is beneficial for the elderly and individuals with chronic health conditions, with a closely located chemical and plant room that houses the MVHR ventilation unit, taking in hot stale damp air within the pool and sauna room. This mitigates the risk of mould building up. With the internal walls being made of natural materials like tadelakt plaster that is hydrophobic when in contact with olive oil and lime Stone tiles these natural elements create a warm space reducing psychological stress and creating an environment for users that reduces issues with respiratory conditions. With specialised equipment such as buoyancy/ floatation devices, resistance tools and support aids helps individuals with mobility issues within a pool environment, which is known to be a low impact sport on joints. With classes, such as aquatic physiotherapy, aqua mobility and gentle aqua while also having hours open for recreational use for all users to exercise and relax within the pool.



Site 1:200

The proposed site is located in Lincoln's Brayford Wharf, on Brayford Wharf east street to the west of the building, south of the building is Brayford street and to the east is Wigford way. Main roads shown in light textured grey, surrounding building in light grey, the Brayford Wharf in textured blue and the building pavement in dark grey. This site shows how the rooftop walkway garden increase biodiversity within the sites location. With pedestrian walkways connecting the university of Lincoln campus to Lincoln city centre. The landscaping merges the boundary between the building and the public paving through unique boundary lines as this is a public building for the community the building should be integrated within the streetscape without creating harsh boundary lines.



Precedence

Centre for Health, Copenhagen, Denmark
Community based health centre focus prevention, rehabilitation, lifestyle improvement. The Centre for Health treats lifestyle diseases such as type 2 diabetes and heart disease.

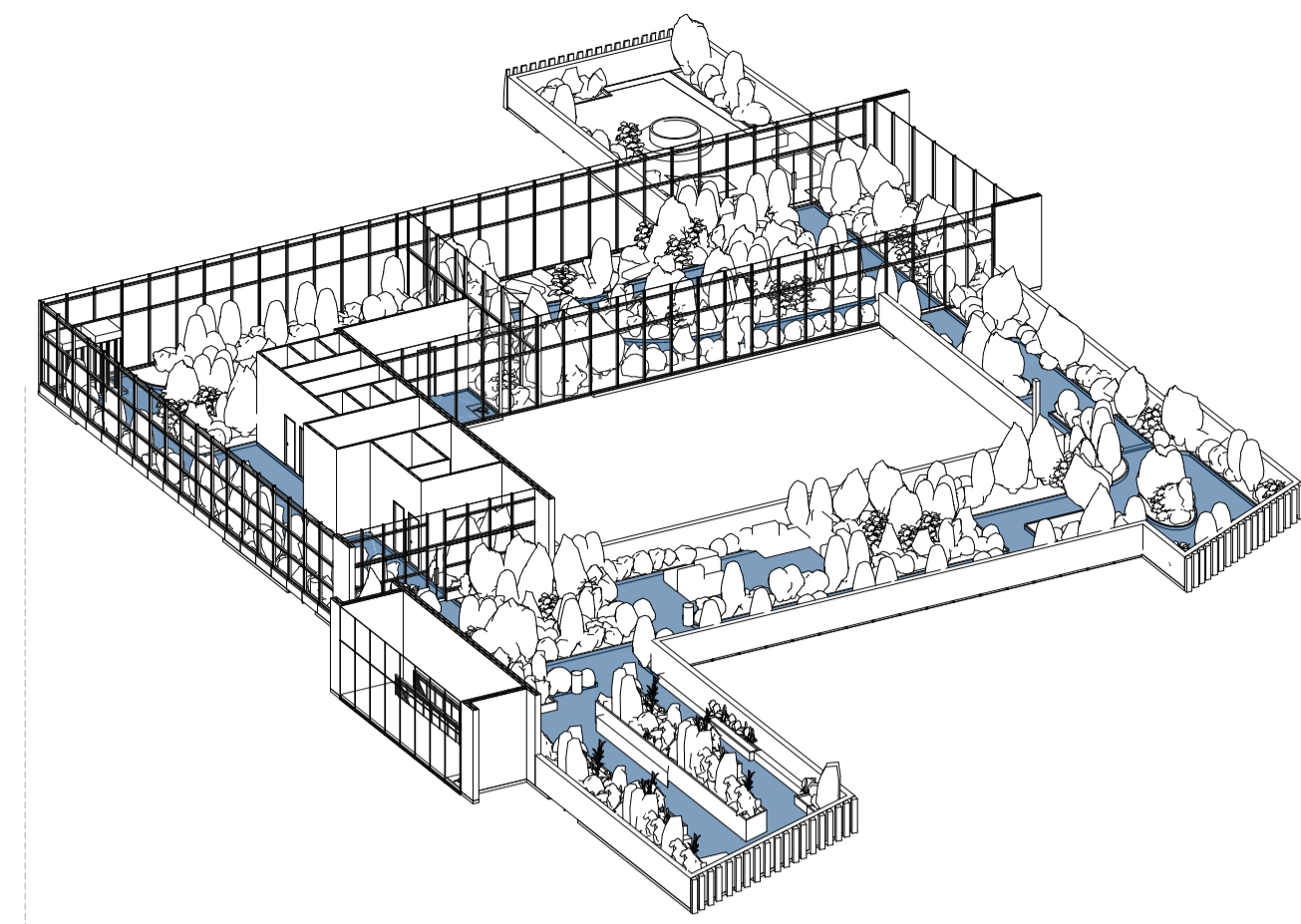
SOCSCO Rehabilitaion Centre, Malacca, Malaysia
The SOCSCO rehabilitation centre id designed around a primary spine, a path that links a cluster of buildings creating a unique structure focused on rehabilitation and well being. A national rehabilitation centre for injures and physical disabilities. Recovery through physical rehab, therapy and vocational reintegration. SOCSCO rehabilitaio centre connects nature and recovery with shaded walkways, water features, walking loops and integrated seating. Applying this to the project by utilising movement patterns and nature, with walking loops, sensory gardens and shaded walkways.

Circulation Development

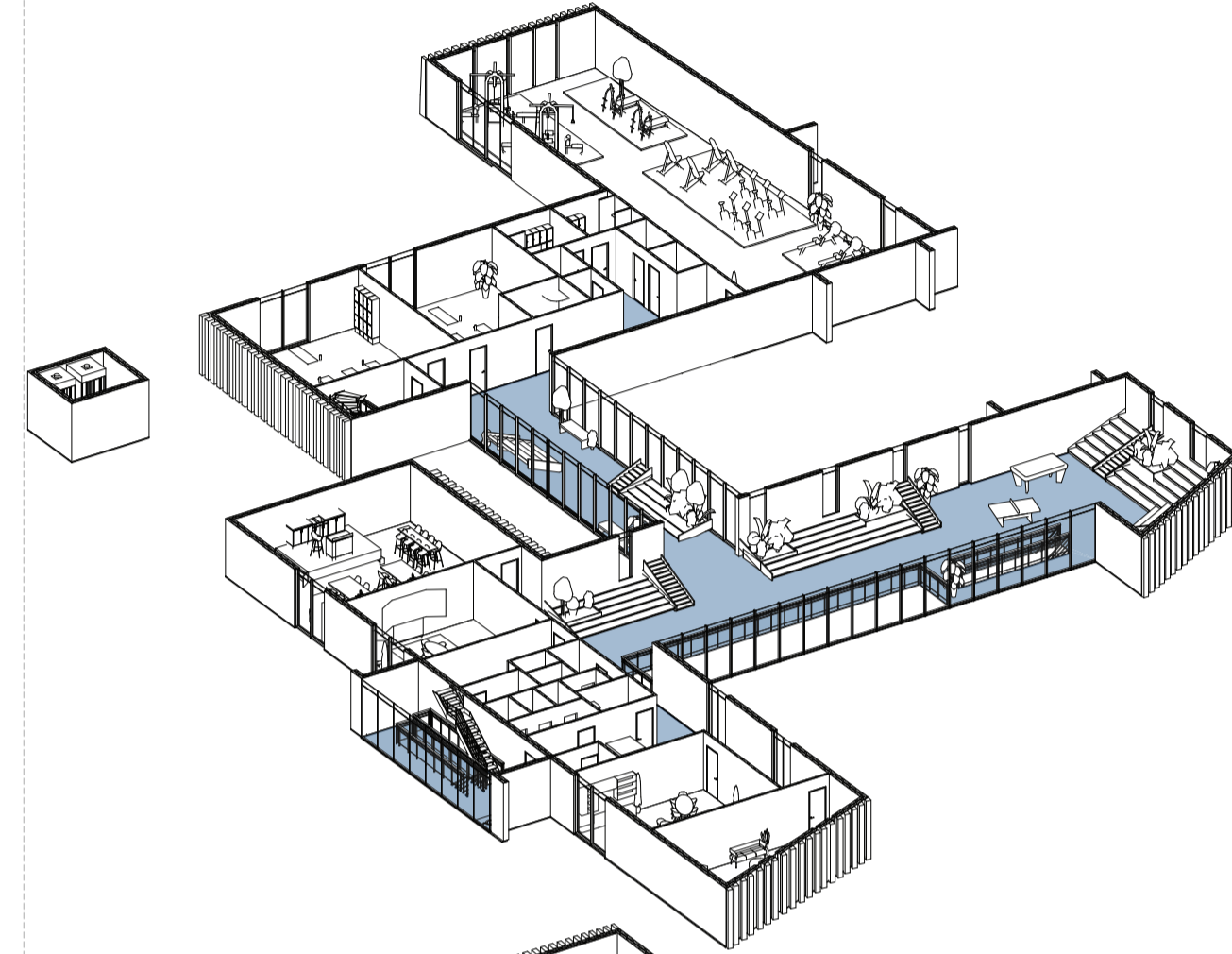
The Rotterdam rooftop walkway is an example of a good circulation system.

The khoo teck puat hospstil is a great prenteced for an intergrated walkway system.

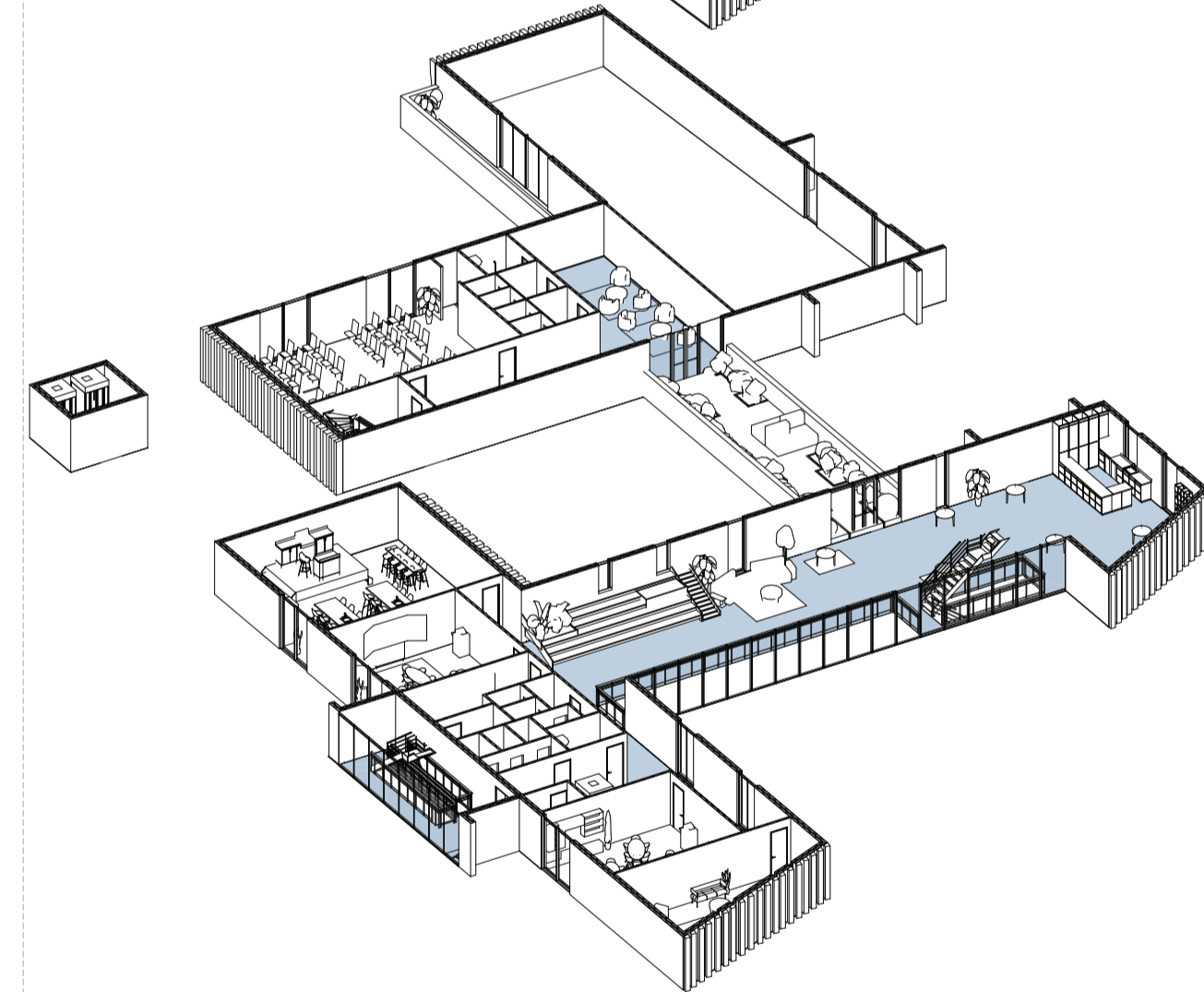
A circulation system from the massing and forming work to created a movement pattern that promotes walking.



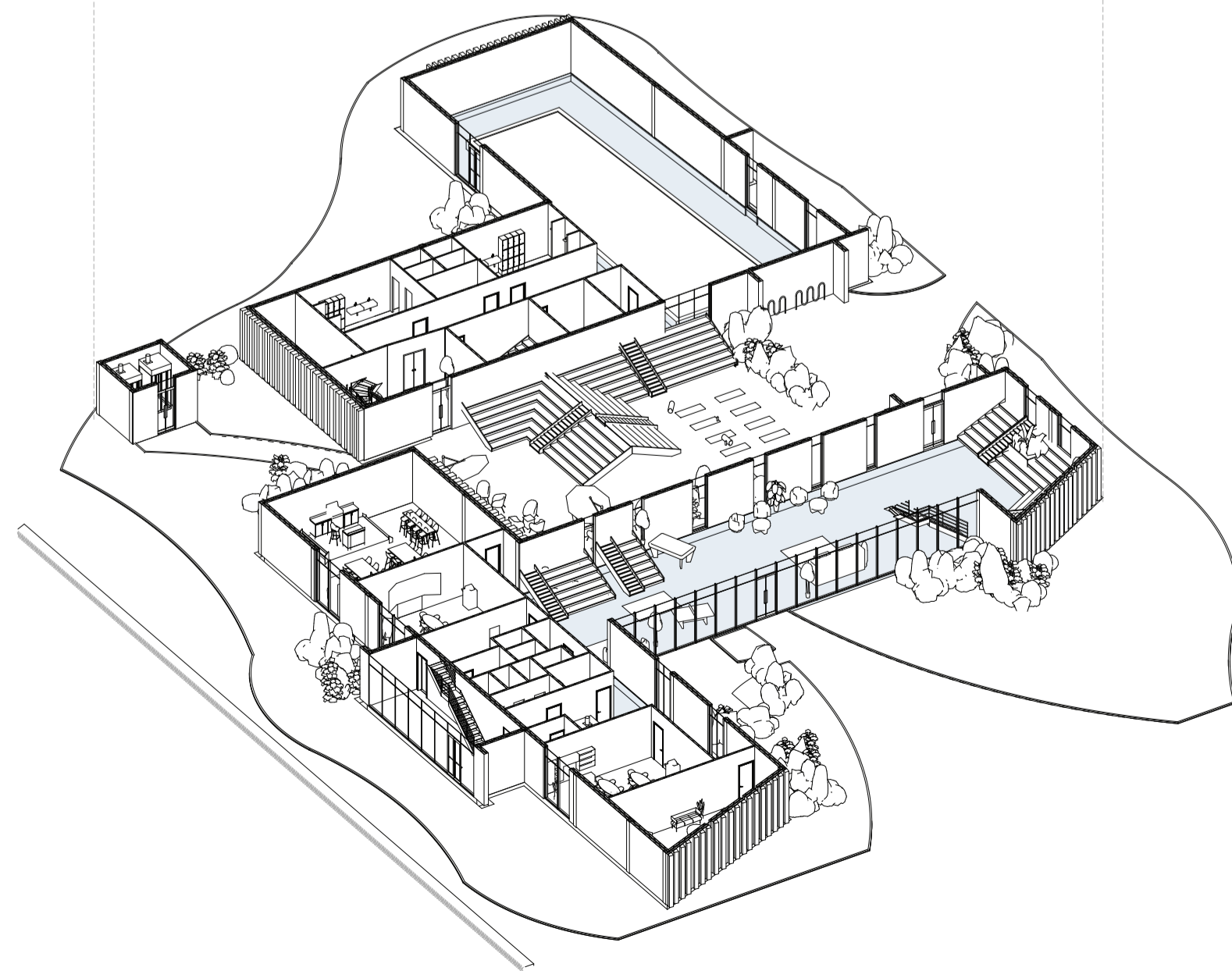
- 04**
- 1-Green Walking path
 - 2-Vegatable Garden
 - 3-Quiet Sensory Garden
 - 4-WC
 - 5-Plant Room
 - 6-Storage Room



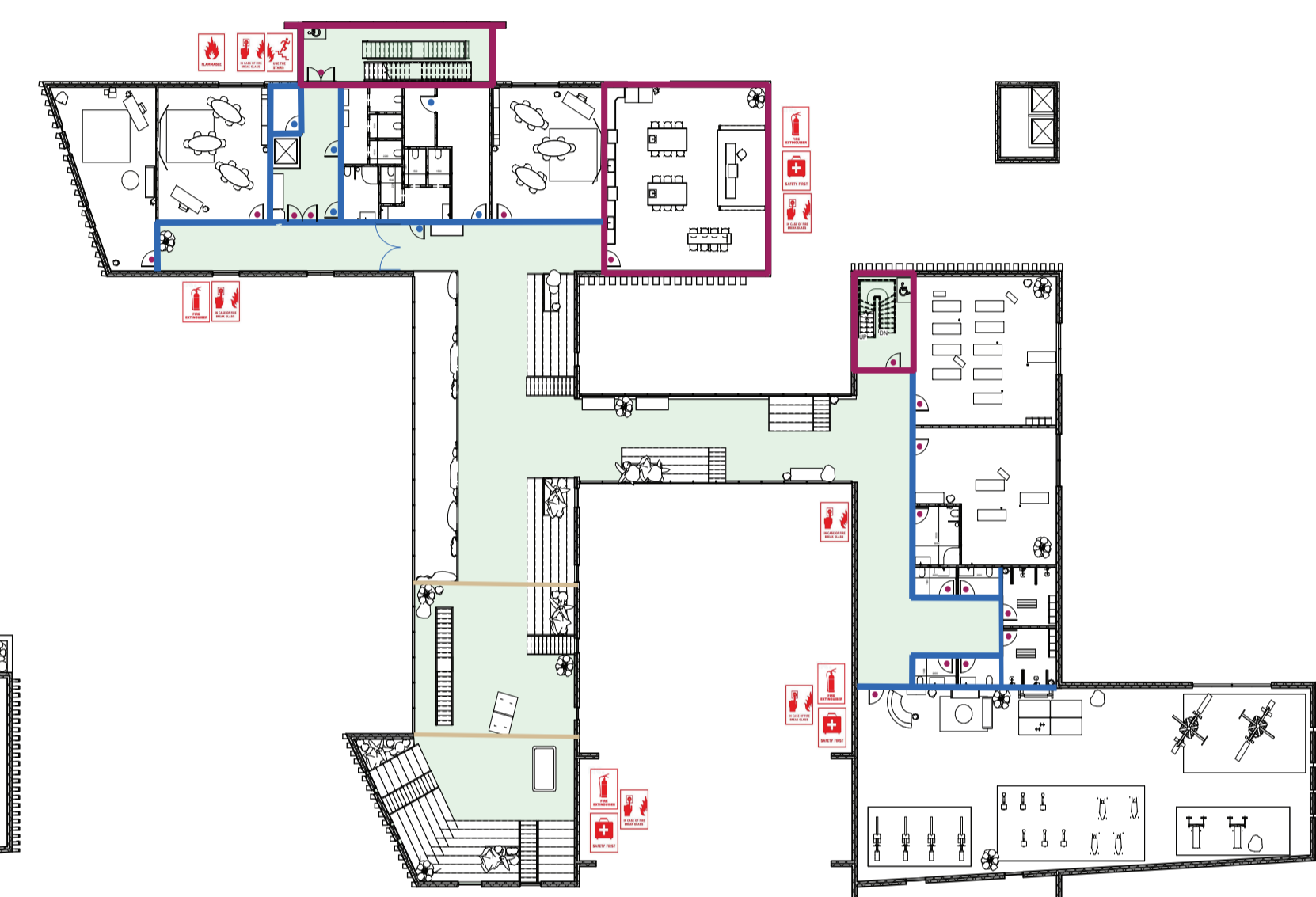
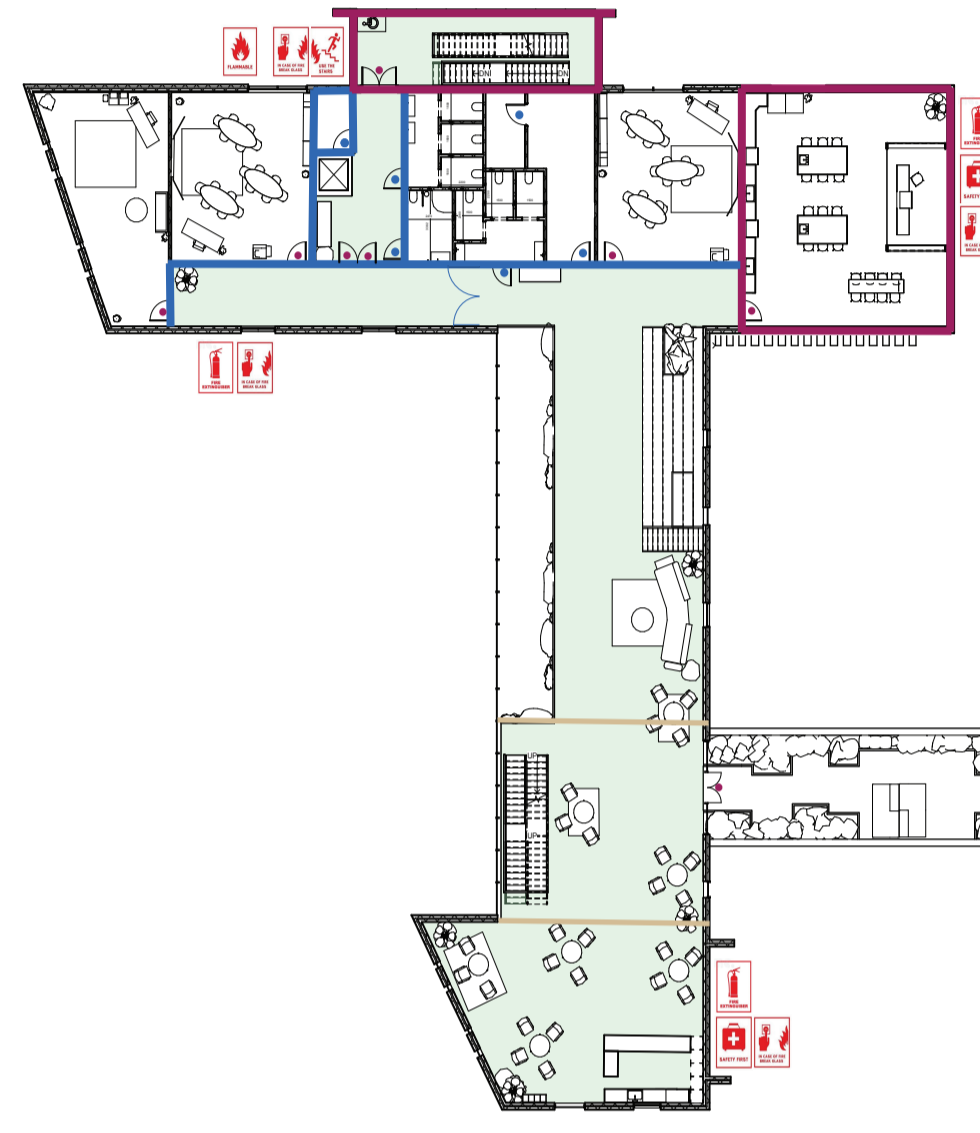
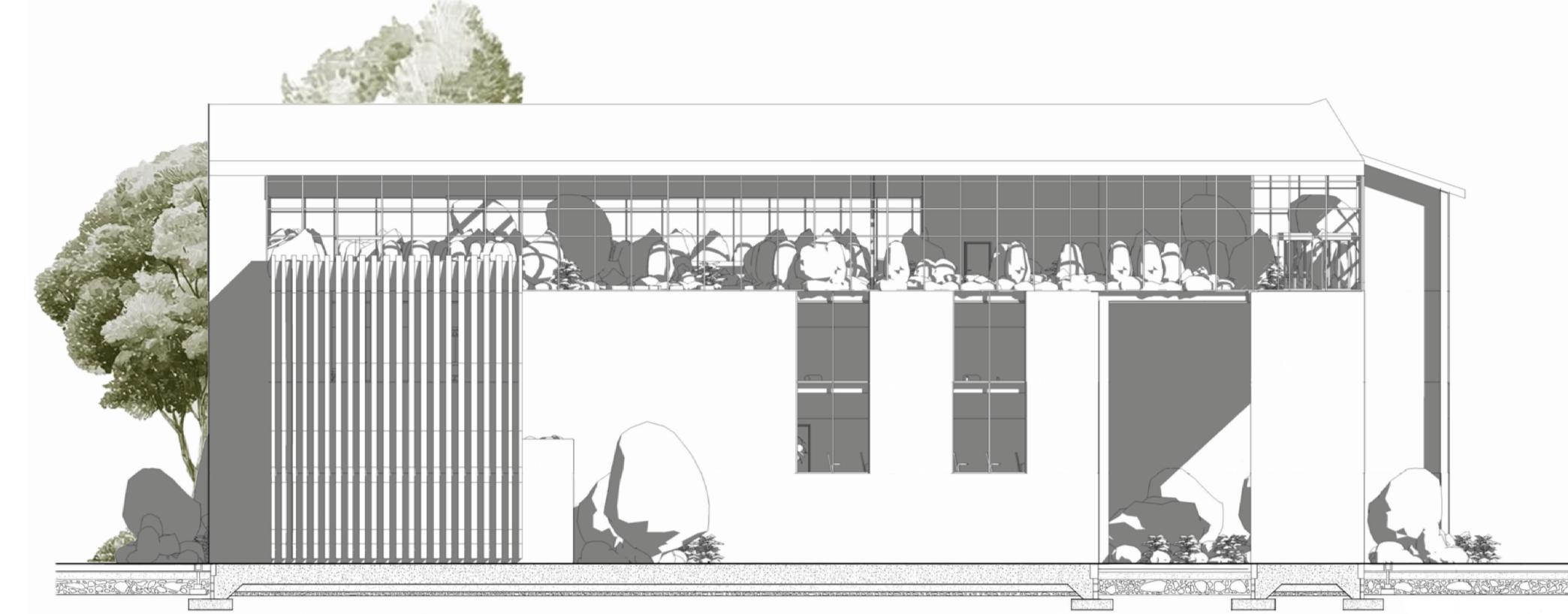
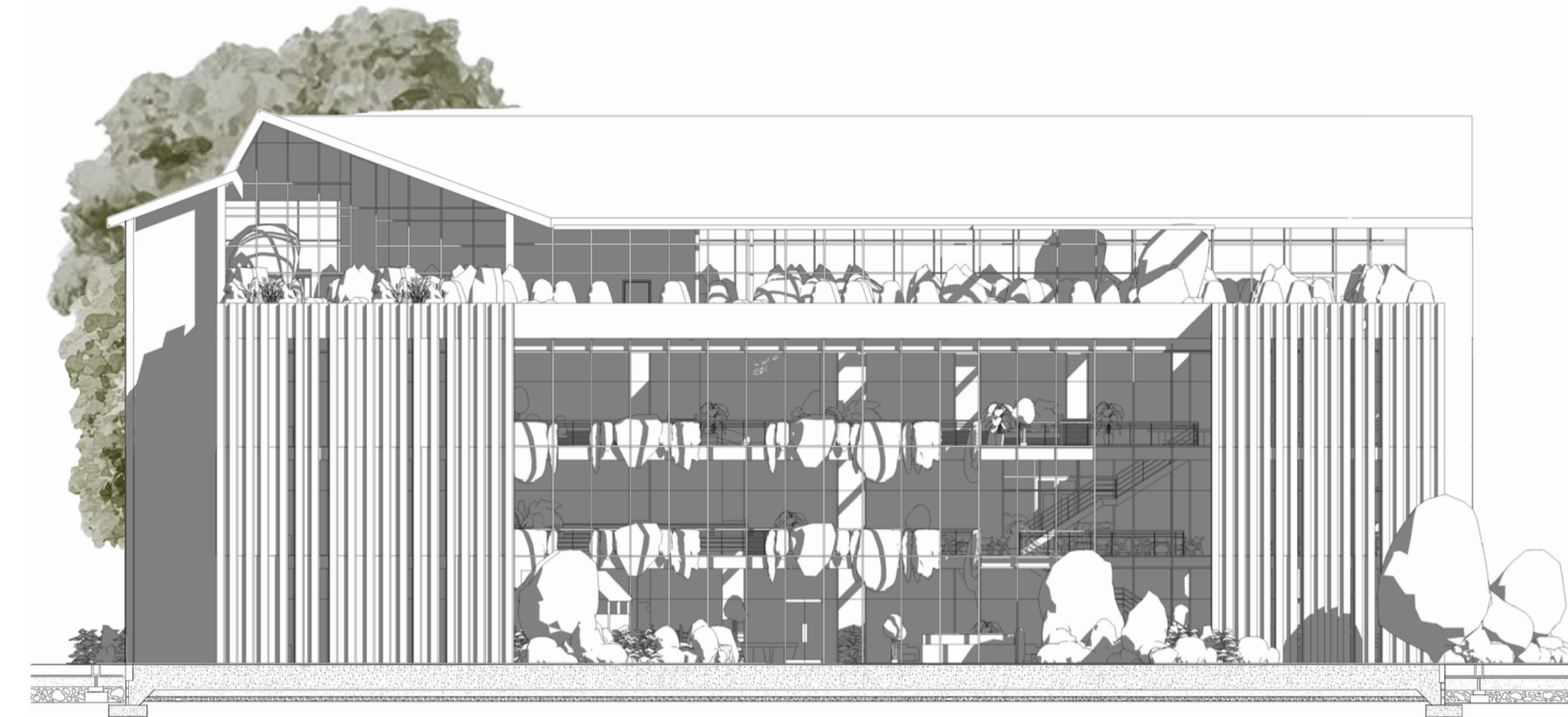
- 03**
- 1-Gym
 - 2-Changing
 - 3-Rooms
 - 4-Studio
 - 5-Classrooms
 - 6-Cooking classrooms
 - 7-Physical therapy Room
 - 8-Atrium
 - 9-WC
 - 10-Lifts
 - 11-Fire escape
 - 12-Storage Room



- 02**
- 1-Atrium
 - 2-WC
 - 3-Lecture Room
 - 4-Classrooms
 - 5-Cooking Classroom
 - 6-Physical therapy Room
 - 7-Lifts
 - 8-Fire escape
 - 9-External Balcony
 - 10-Storage Room



- 01**
- 1-Atrium
 - 2-Classroom
 - 3-Cooking Classroom
 - 4-Physical therapy Room
 - 5-WC
 - 6-Lifts
 - 7-Fire escape
 - 8-Pool
 - 9-Changing Rooms
 - 10-Sauna Rooms
 - 11-Reception
 - 12-Plant Room
 - 13-Courtyard
 - 14-Storage Room



Fire Doors		Fire fighting equipment	
●	FD30 self closing with smoke seal	🔥	Fire extinguisher
●	FD60 self closing with smoke seal	🔥	Fire extinguisher
Fire rated walls and curtain		🔥	Automatic sprinkler system
—	Deployable fire curtain	🔥	Fire blanket
—	60 min fire-rated wall	🔥	Robust suppression hood
—	30 min fire-rated wall	Evacuation and message	
Detection and alarm system		🚪	Evacuation route
🔊	Hozer alarm with sound/visible light	👤	Assembly point
🔊	Heat detectors	🚪	Door with electromagnetic wall/floor holders
🔊	Custom message-directors	🚪	Use stair sign
🔊	Addressable fire alarm panel	Elevator and communication	
🔊	Fire alarm break-glass call point	🚪	Refuge point with communication
Health and safety		🚪	Personal emergency evacuation sign
🚪	Flammable sign	🚪	Emergency light
🚪	First aid kit	🚪	Fire action notice
		🚪	Main isolation switches

Building regulations part B, volume 2, staircase width must be adequate in evacuating the building safely. Regulations state that the primary staircase minimum width of 1000mm, With the staircase width being determined on the capacity of the building and the number of stories as shown in the table below taken from document B (HM Government, 2010).

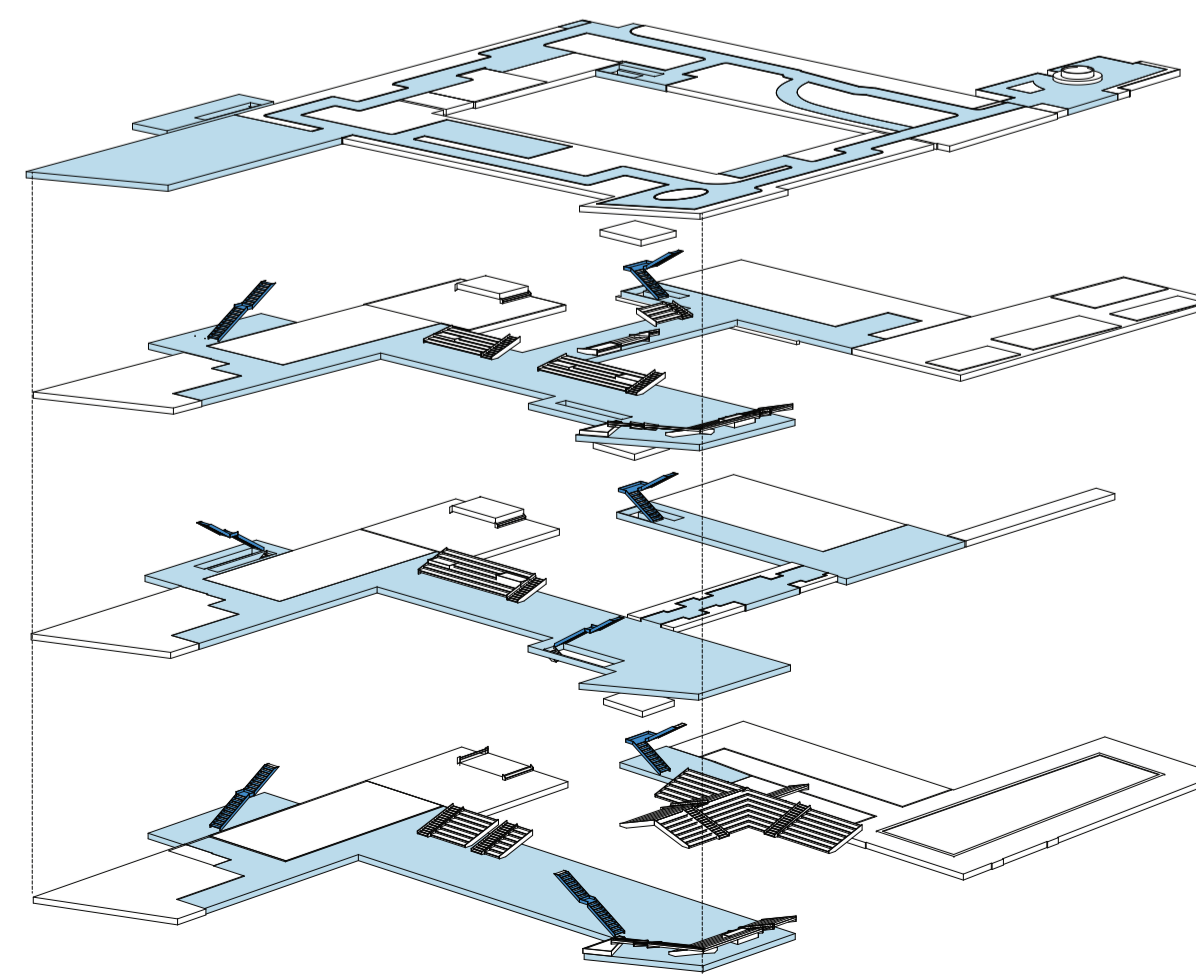
The proposed building has four stories with less than 270 people per floor allowed, with a staircase width of 1000mm, as well as:
 -Continuous handrails, noise and stripes that comply with helping aid users with limited mobility during emergency evacuation.

-A refuge point allows individuals with mobility issues to use a two way communication system and be in a safe space to wait for assistance during an evacuation. This is vital for the proposed building as many users have mobility issues.

-170mm rise and 250mm ongoing for each staircase in compliance with part k of building regulations. This was selected as it creates ease for the elderly and other users getting up and down the stairs.

Circulation

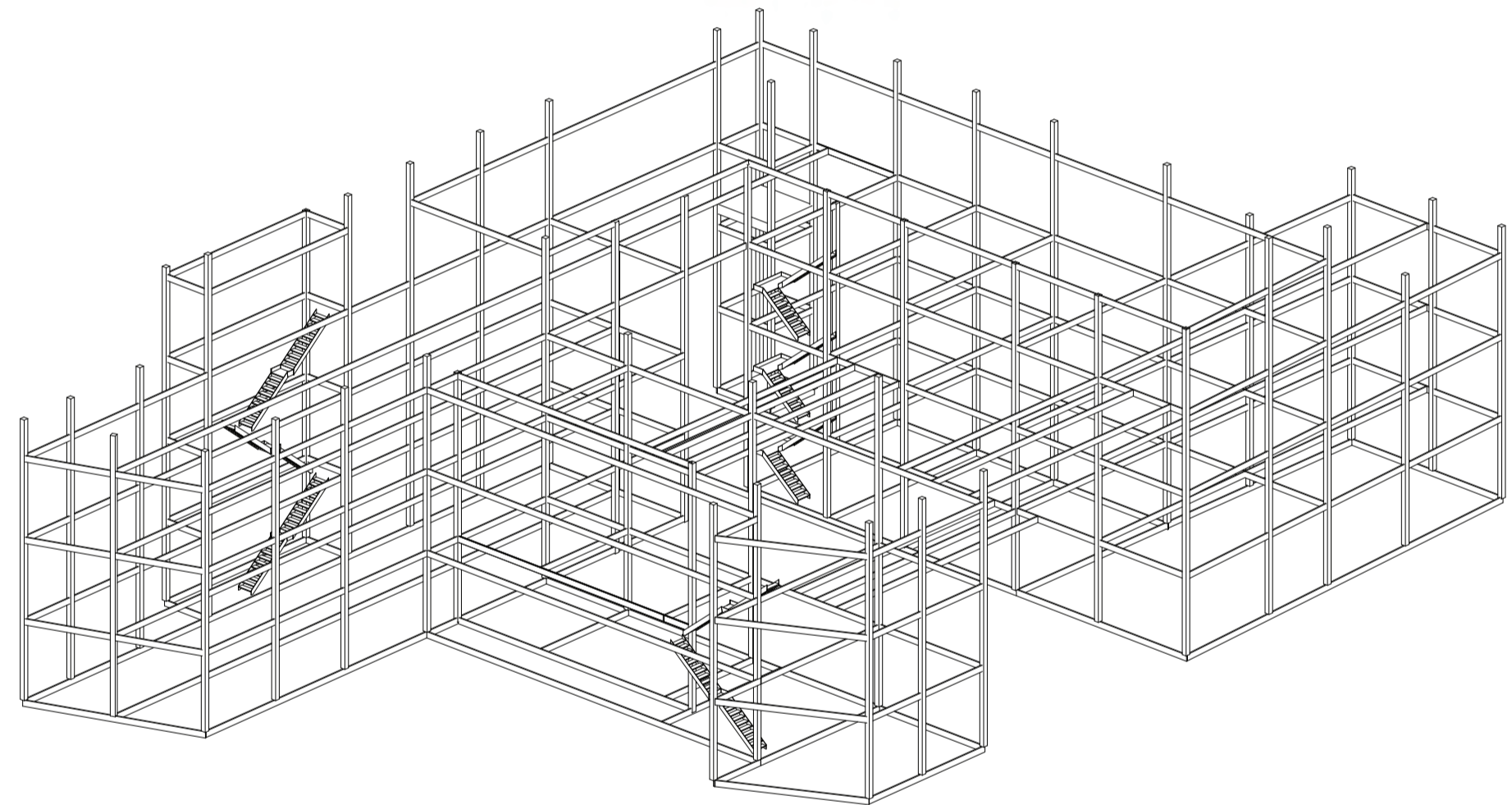
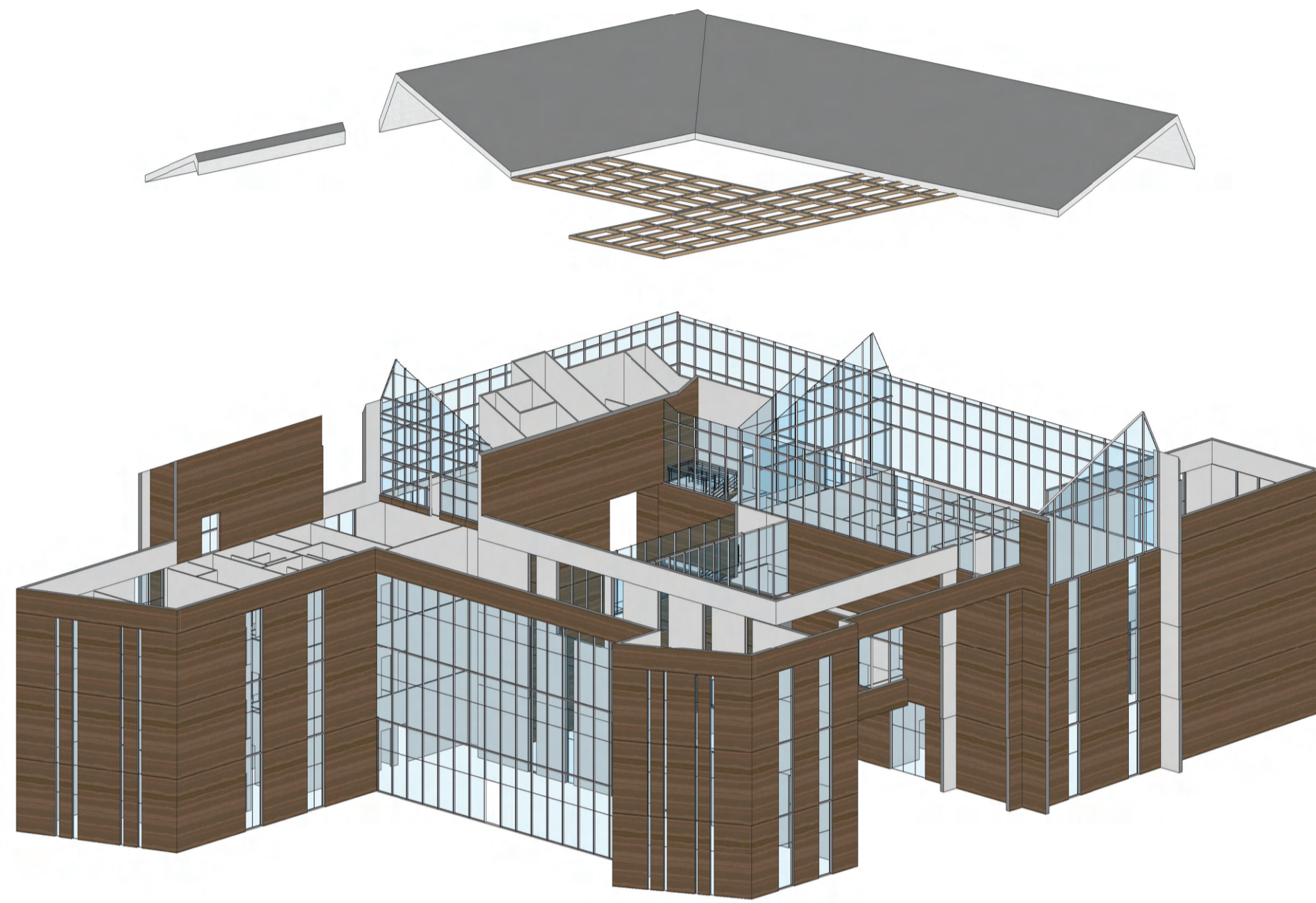
The primary therapeutic instrument of this community centre is circulation and is not merely a secondary consideration. Movement through the building is the treatment. Highlighted in blue are the primary routes within each floor horizontally, while vertically the staircase connects each floor. The circulation system is three dimensional, forming a continuous walking loop from the ground floor to the roof top greenhouse. With purposeful movement that is gently encouraged through the biophilic environment. This approach was informed by precedents including Rotterdam roof top walkway and SOCSO rehabilitation centre.



Exploded Axonometric Structure

A glulam (glued laminated timber) frame for primary loadbearing, with cross laminated timber (CLT) providing the horizontal floor and ceiling bearing were chosen for this project. With steel connection plates that will facilitate the load transfer, these were chosen for both their structural strength as well as the sustainability of their embodied carbon. This structure meets performance requirements of a multi used building and the goals for the UK Net-zero building standards PAS 2080:2023.

The core structural columns and beams being glulam, glulam was both a structural and sustainable choice created through bonding multiple layers of softwood timber with adhesive and applying intense pressure. This forms a cohesive strength spanning through the beam/column this strength is comparable to steel. Glulam carries approximately 50-80kgCo2 per Cubic meter within the life cycle, whereas steel carries 1,780kgCo2 per tonne, with a reduction of over 95% by mass. The impact of this choice is important as for a four-storey building of this scale, substituting a steel frame for glulam reduces the upfront embodied carbon approximately 350-500kgCo2 per tonne of gross internal area to 150-250kgCo2 per Cubic meter of glulam (IstructE, 2020).

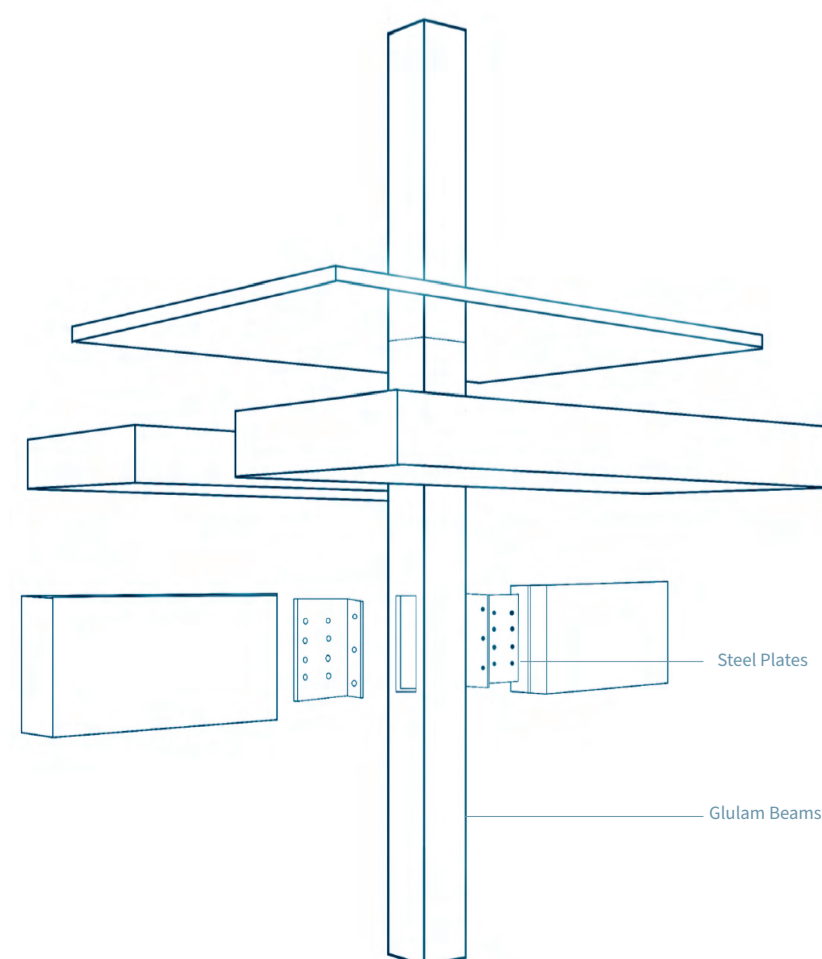


This shows the glulam superstructure, double glazing and external limestone plaster wall.

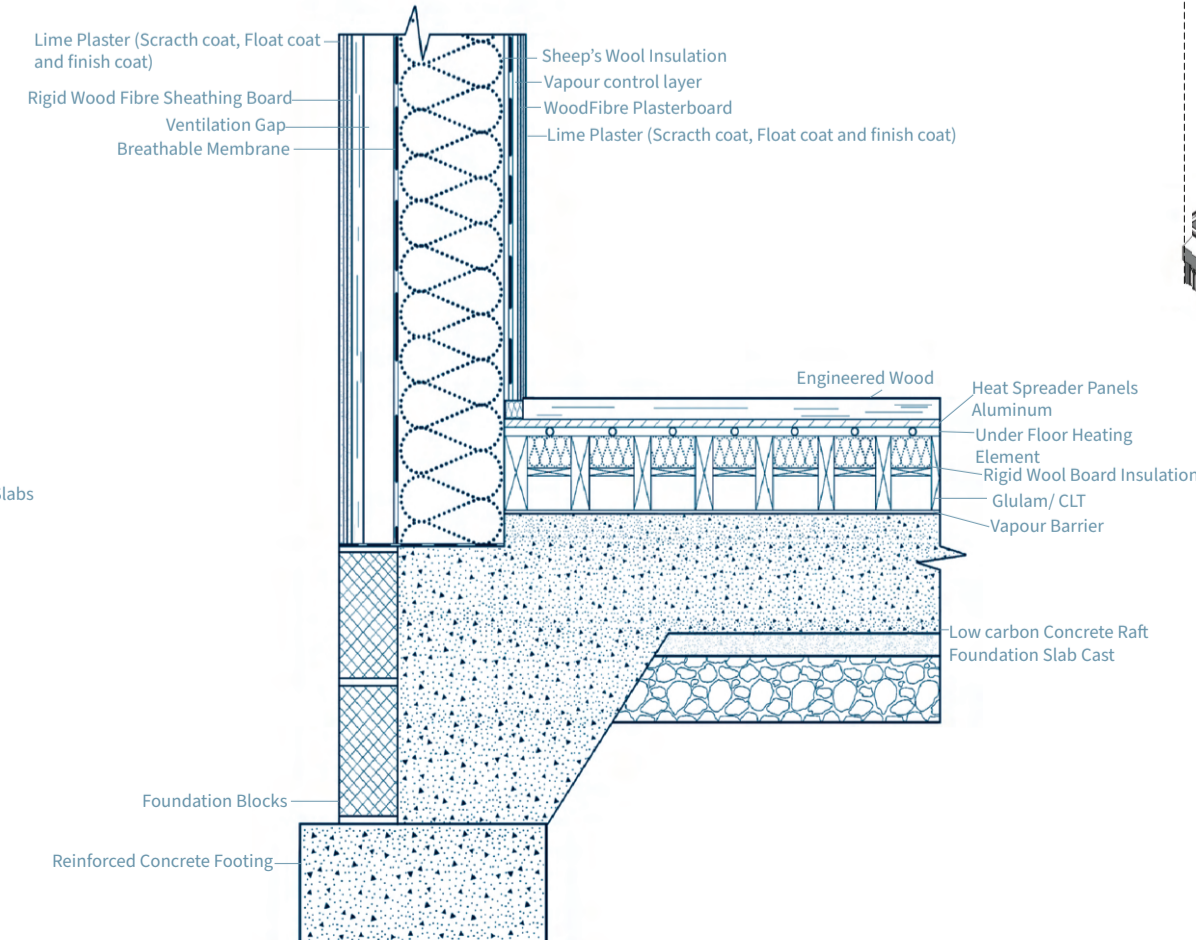
This locks the carbon of the building's structure on day one of construction and this is irreversible once buildings are constructed. Thus, this is the single highest impact carbon decision in the project. This has an impact as the glulam biogenetic nature means that the structure acts as a long-term carbon store during the growth period and continues to lock that carbon into the frame. This makes the structural choice an active contribution to the UK's net zero goal rather than alternatives, as well as the use of the natural and warm material allowing for better air quality compared to other alternatives such as steel, contributing to the quality of life that the users will experience.

Structural details

Beams and Columns



Foundation



Local material

Locality source materials reduce carbon output in transportation, this is classified as module A4 and RICS whole lifecycle assessment framework. Thus high volume materials such as structural concrete aggregate and installation account for 5 to 15% of embodied carbon (Istructure, 2020).



Glulam and Timber

FSC certified timber from Lincolnshire and Nottinghamshire having a 50 mile radius.

Limestone Plaster

Lincolnshire limestone clay and factories within Lincolnshire. With a 40 to 45 mile radius from site.

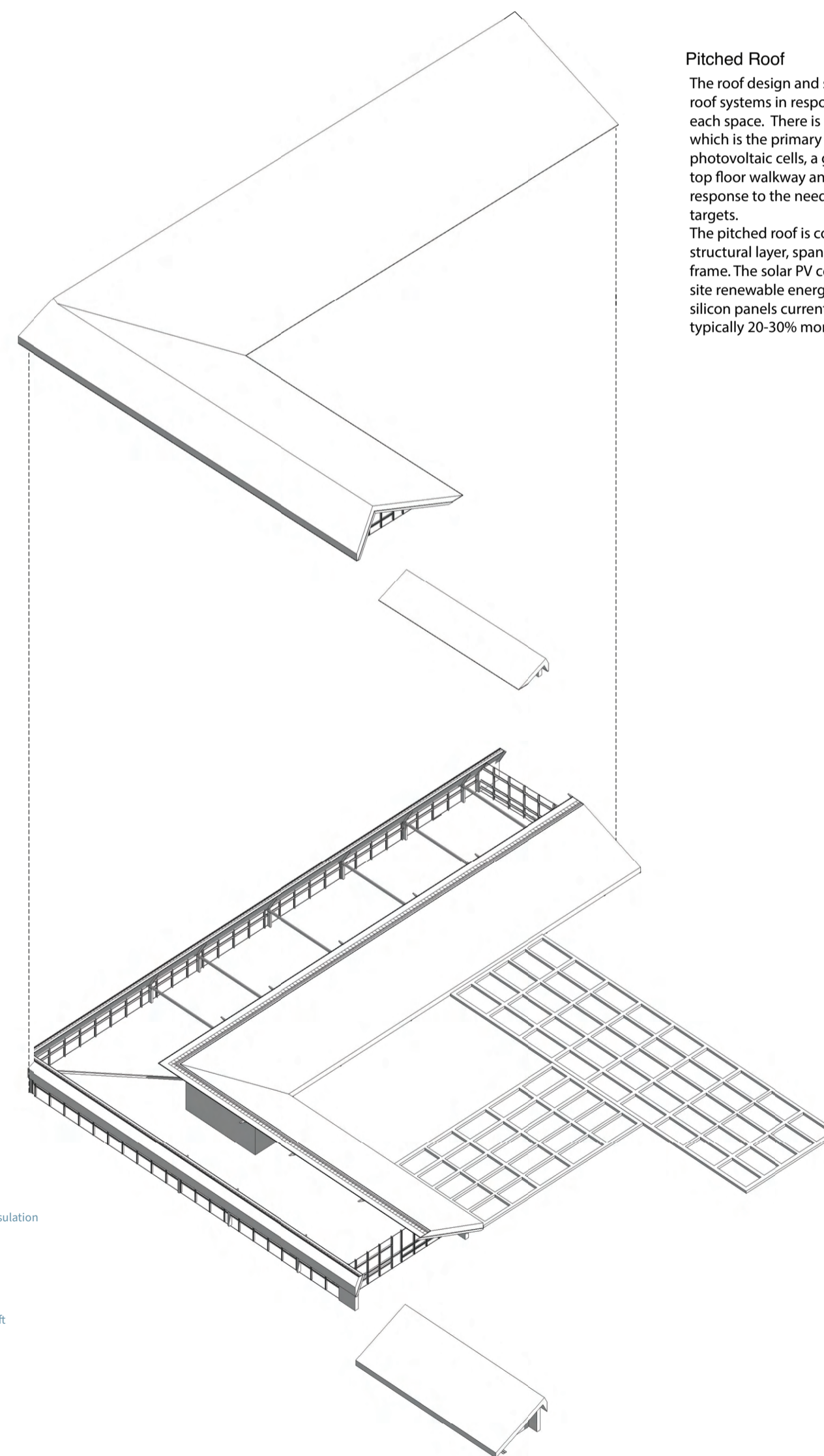
Rigid Wool board Insulation

Wool shows from Lincolnshire farmers, with a 40 to 45 mile radius.

GGBS Concrete

GGBS from Scunthorpe steel Works, which is around 25 miles from site.

Exploded Axonometric Roofplan



Pitched Roof

The roof design and structure for this project is multiple roof systems in response to the needs and function of each space. There is three roof types, pitched roof of which is the primary roof form and support of photovoltaic cells, a green roof system for the external top floor walkway and a flat roof system. Each system response to the needs and meets operational energy targets.

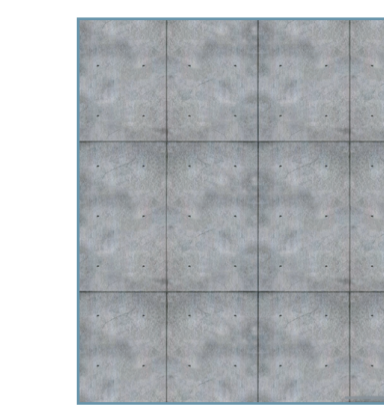
The pitched roof is constructed from Glulam beams as a structural layer, spanning the roof meeting the Glulam frame. The solar PV cells are the primary strategy of on site renewable energy generation. Monocrystalline silicon panels currently achieves commercial efficiency typically 20-30% more than others.

External Shading

External Shading for a courtyard and external garden walkway, this creates passive cooling and a comfortable climate zone. This can reduce heat stress, UV exposure, allowing safe outdoor movement without overheating. This encourages gentle physical activity whilst supporting users with cardiovascular issues, respiratory issues and mobility.

Materiality

The Material choice for this project lasts the buildings life cycle and therefore the choice determines the building's structural capacity, durability and embodied carbon, whilst also affecting thermal massing, indoor environmental quality and aesthetics. Within the UK net zero strategy, goals materials should reduce the carbon locked into the buildings (RIBA, 2022; UKGBC, 2021). For this project, the responsibility of the materials must also support the health of users with chronic health conditions such as compromised immune systems, respiratory issues and cardiovascular vulnerability. The material strategy of this project was also influenced through natural materials and locally sourced.



GGBS Concrete Substructure

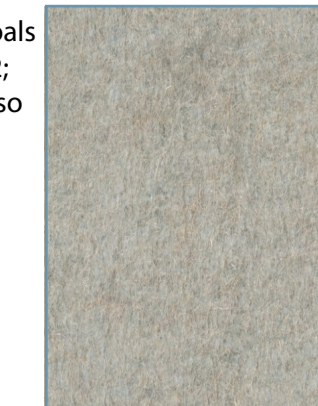
- High Thermal Mass
- Reduces Temperature Fluctuation
- Creates a comfortable climate environment.
- Beneficial for the Elderly.



Limestone Tile

Flooring with the pool, Sunna and changing rooms/WC

- Hygienic
- Easy to Maintain
- Beneficial for compromised immune systems.
- Non-slip
- Waterproof



Recycled Aluminium Roofing sheet

- Light Weight, Durable, corrosion-resistant
- Long term weather protection
- Reflective properties reduce overheating
- Creates a stable indoor temperature, which is beneficial for the elderly and young children.

Rigid Wool board Insulation

Insulation

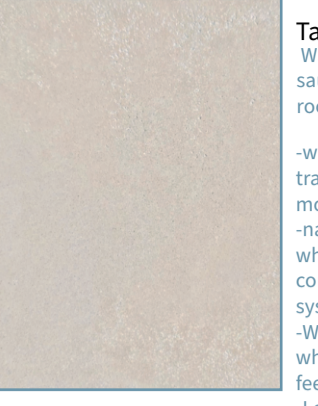
- Natural, Breathable and regulates indoor humidity
- Reduces condensation and mould growth
- Improves air quality
- Provides acoustic insulation
- Beneficial for the elderly people with respiratory issues.



Tadelakt

Wall within the pool, sauna, and changing rooms/WCs

- waterproof, prevents trapped moisture and mould
- naturally, anti-microbial which is essential for compromised immune system systems
- Warm tactile service which reduces clinical feeling
- Low embodied carbon compared to ceramic tile



Limestone plaster

external and internal plastering

- Hygroscopic (Regulates indoor humidity)
- Beneficial for users with respiratory conditions.

Glulam and Timber

Primary structure and protruding facade element

- Structural Strength
- Timber environments are linked with reducing stress and lowering heart rate
- Beneficial for usage with mental health issues and heart problems.



Glass

Double glazing

- Maximise access to natural daylight
- Support circadian rhythms
- Improve sleep quality and mood
- Reduces stress
- Beneficial for users with cognitive impairments and the elderly.

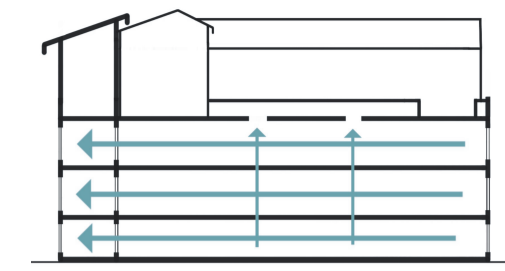


Vegetation

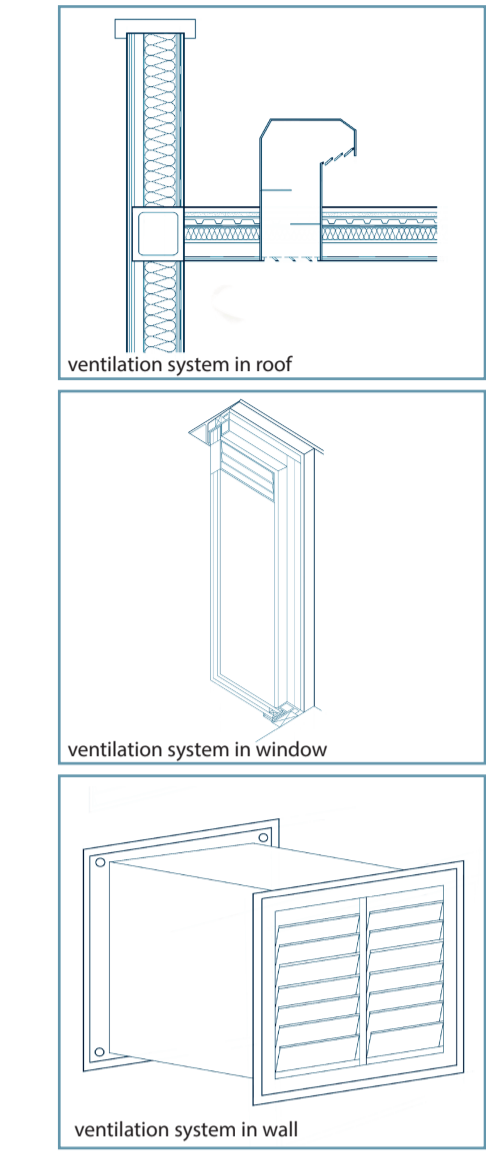
- Improves Air Quality
- Reduces stress, lowers blood pressure, supports cognitive functions
- Beneficial for the elderly and people with chronic health conditions.
- native plants and vegetation



sustainability

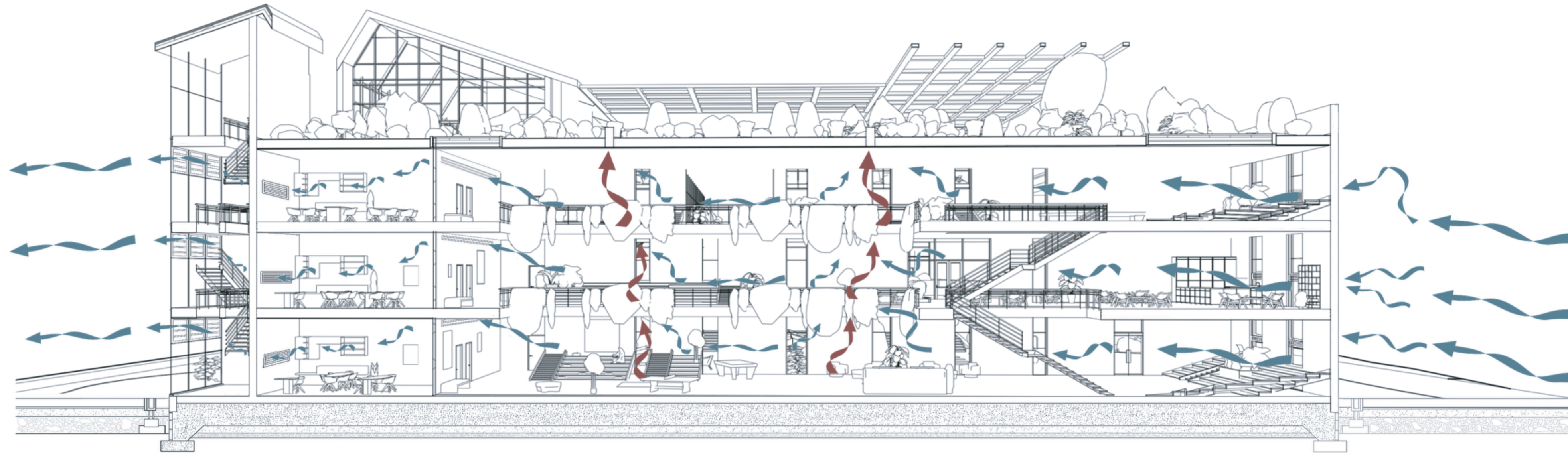


1. ventilation

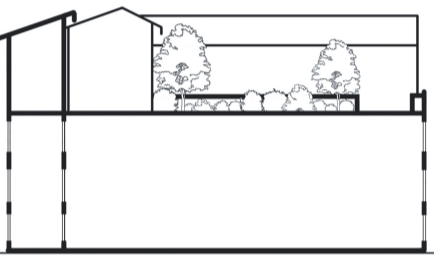


Mechanical ventilation

Mechanical ventilation maintains sufficient air quality in thermal comfort, with rooms with high moisture content such as kitchen spaces, bathrooms, and plant rooms. With the use of mechanical ventilation with heat recovery (MVHR) units that obstruct warm air and pass it through a heat exchanger before moving it to the exterior, they recover 70 to 90% of the heat energy that could be lost through conventional ventilation. The impact of 70 to 90% of heat recovery is it for every 1KWH of heat that otherwise be expelled within the exhaust air, 0.7-0.9KWH is returned to the incoming fresh air supply. With the heating system over the summer months, this would reduce the supplementary heat energy required for ventilation by 30 to 40% compared to extraction systems, which saves significant operational carbon for the pool, WCs and kitchen classrooms spaces. This saves not only the operational energy but also delivers a practical ventilation system for these spaces.



Passive ventilation is a primary passive ventilation method, horizontal airflow passing through the section of the building, through the prevailing south westerly winds in Lincoln that admit fresh and cool air. This is a self-regulative airflow system in occupied zones, leading to reduced energy input. Cross ventilation can deliver air exchange rates of 5-15 per hour under moderate winds, of which exceeds the minimum 0.5-1.0 changes per hour under the health under building regulations approved document F. The use of cross ventilation as the primary ventilation system rather than using mechanical ventilation is that the system has no energy demands during the hours when the wind is sufficient, of which Lincoln waterfront is the majority of the occupied hours as a building is south westerly facing. This reduces ventilation energy from the operational carbon. Accounting entirely for these periods contributes to the net zero target. The impact of cross ventilation that operates without mechanical assistance during operational hours means it reduces 30% of total energy consumption. When this is compared to 60 year life cycle, this is an energy saving systems with from single design decision. For the buildings primary users, the natural cross ventilation benefits them with airflow rate that responds naturally and automatically increasing when the spaces are full and heat generation is at its highest, thus delivering the best air quality without mechanical intervention for users.

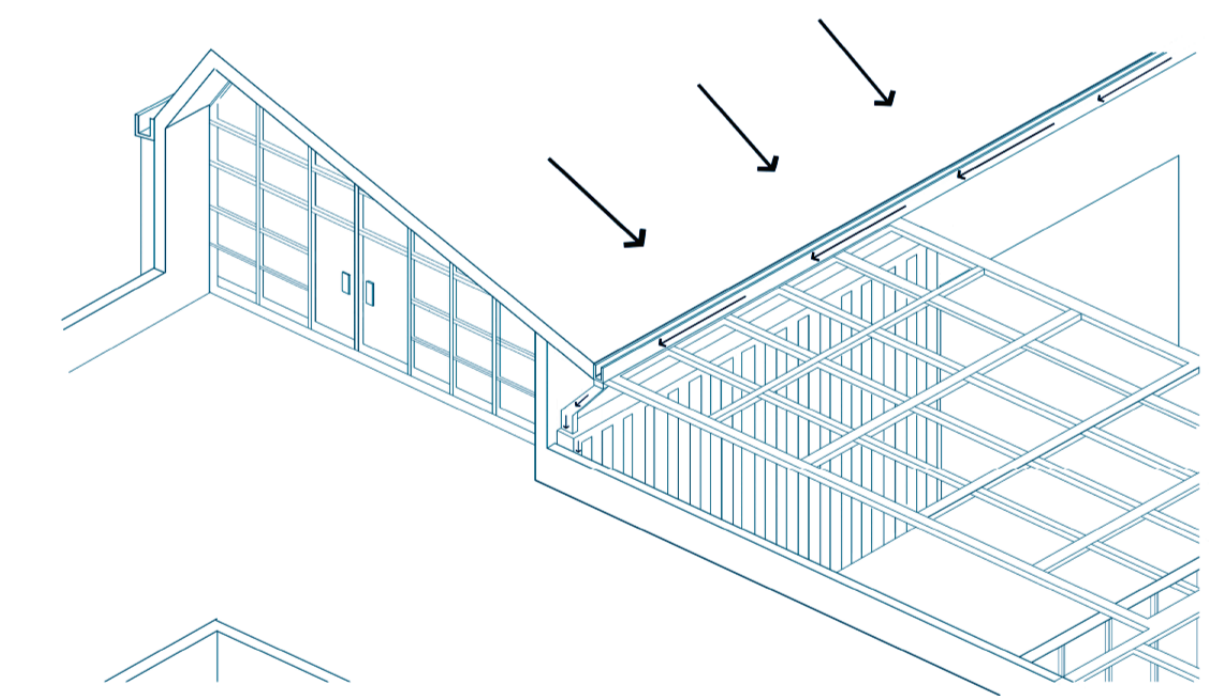


2. Roof Systems

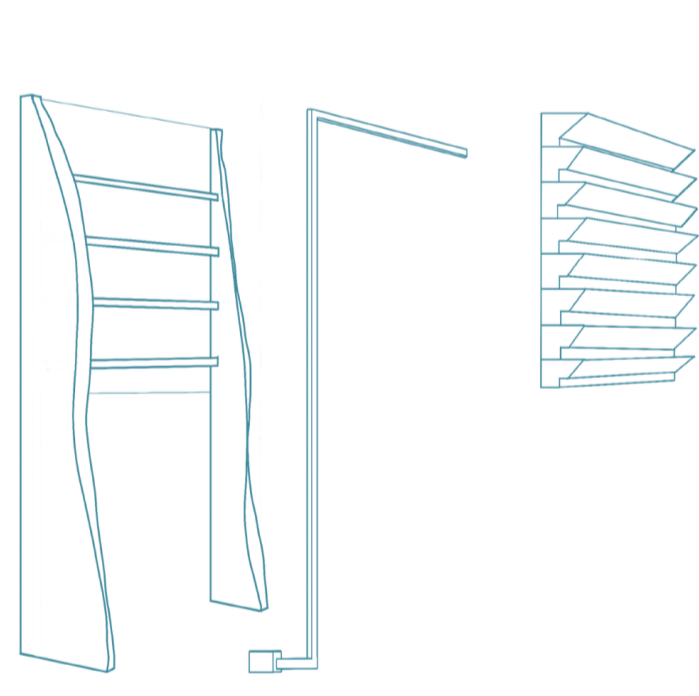
The use of vegetation throughout the facade and on the exterior garden walkway reduces surface temperature and reduces CO2.

The rainwater harvesting systems collect rainwater across the pitched roof with the arrows indicating the direction of the water flowing across the roof service towards the collection gutters and the concealed downpipe. The total catchment area for this roof is measured through Lincolnshire's rainfall and the area of the roof. With Lincoln's annual rainfall of 600 mm and the area of the pitched roof being 660 m², the roof area of this building generates an annual harvest that is compatible with the rainwater harvesting design mythology to meet the buildings non-portable water demands such as for the toilet flushing mechanisms, irrigation systems and surface cleaning throughout the year (CIBSE, 2015). The pitch roof is optimal due to the water naturally running off the down slope through the use of gravity, with the capacity to carry peak flow in a 1-in-100 year rainfall event with a 40% climate change allowance in accordance with BS EN 13056-3:2000.

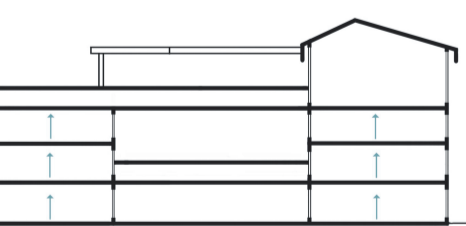
Rainwater harvesting system



Irrigation system



The gutters are supported by glulam rafter rails with aluminium, ensuring corrosion resistance and a design life of 40+ years. The harvested rainwater is stored in an underground system that is then distributed back up into the roof garden, facade integration system and WC, running from the storage systems through the building services riser to the roof level, connecting to the drip irrigation network within the green roof growing substrate and drip services within a facade. The pump is powered by solar PV cells, ensuring that the energy cost of the water distributed is met from the on-site renewable supplier compared to the grid. This is consistent with the building's net zero operational carbon strategy, with the distribution system controlled by a soil moisture sensor network embedded in the roof garden at multiple locations across the roof.

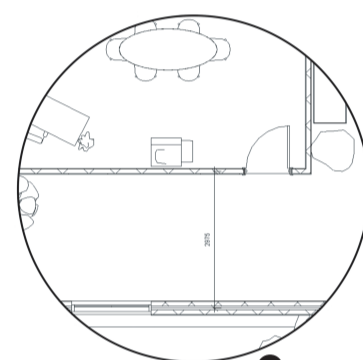
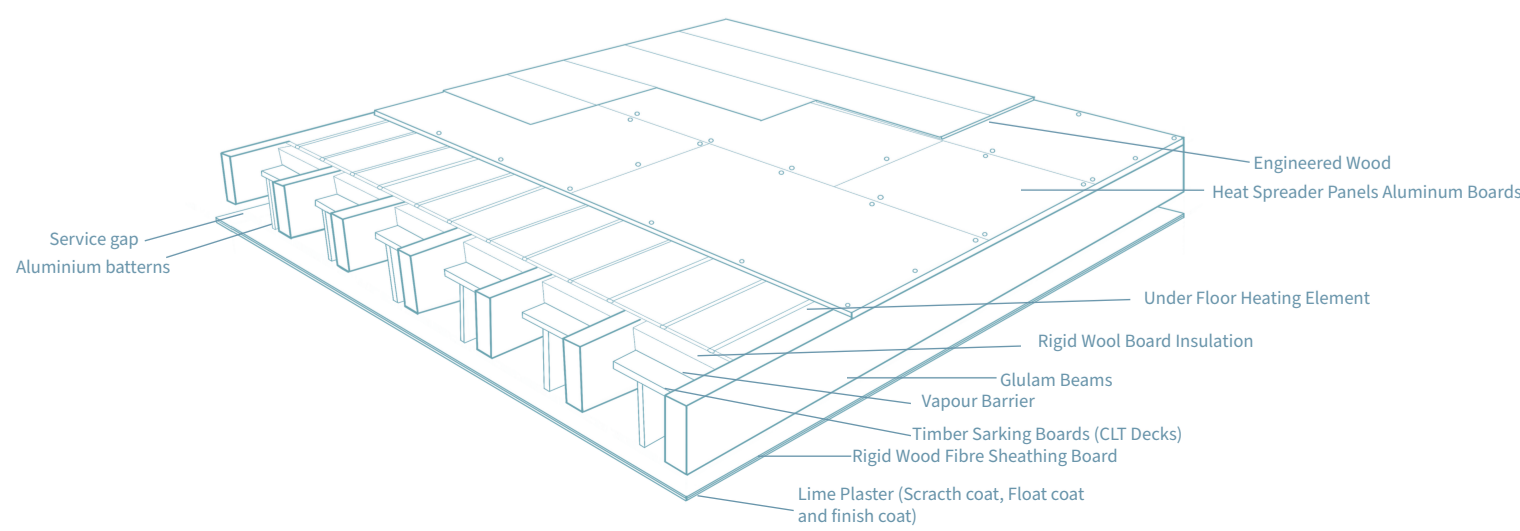


3. underfloor heating/cooling

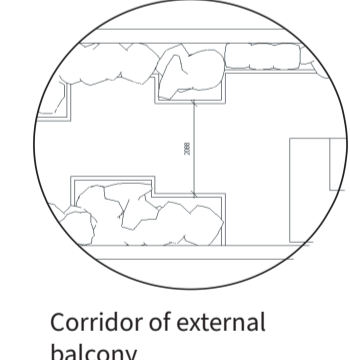
Hydronic underfloor heating and cooling system (UFHC) is a mechanical thermal system, it is embedded into the floor. The system is a Temperature controlled, 35° to 45° heating and 16° to 18° cooling, water network supplied by a water source heat pump. This is an energy efficient system compared to radiator systems.

A closed loop pipework connects to the heat pump unit in the Brayford wharf, extracting low-grade thermal energy from the water. A thermodynamic refrigerant cycle compresses this energy to raise it to a usable heating temperature. In the summer cycle this reverses under the buildings excess heat is rejected back into the water, providing cooling without any mechanical systems. These two systems of underfloor heating/cooling and a water source heat pump require one another to operate efficiently. With the use of the water source heat pump delivering four times more heat per unit energy than gas, with the zero direct combustion emissions. With a lifespan of 20 to 25 years with no combustion components needing to be replaced.

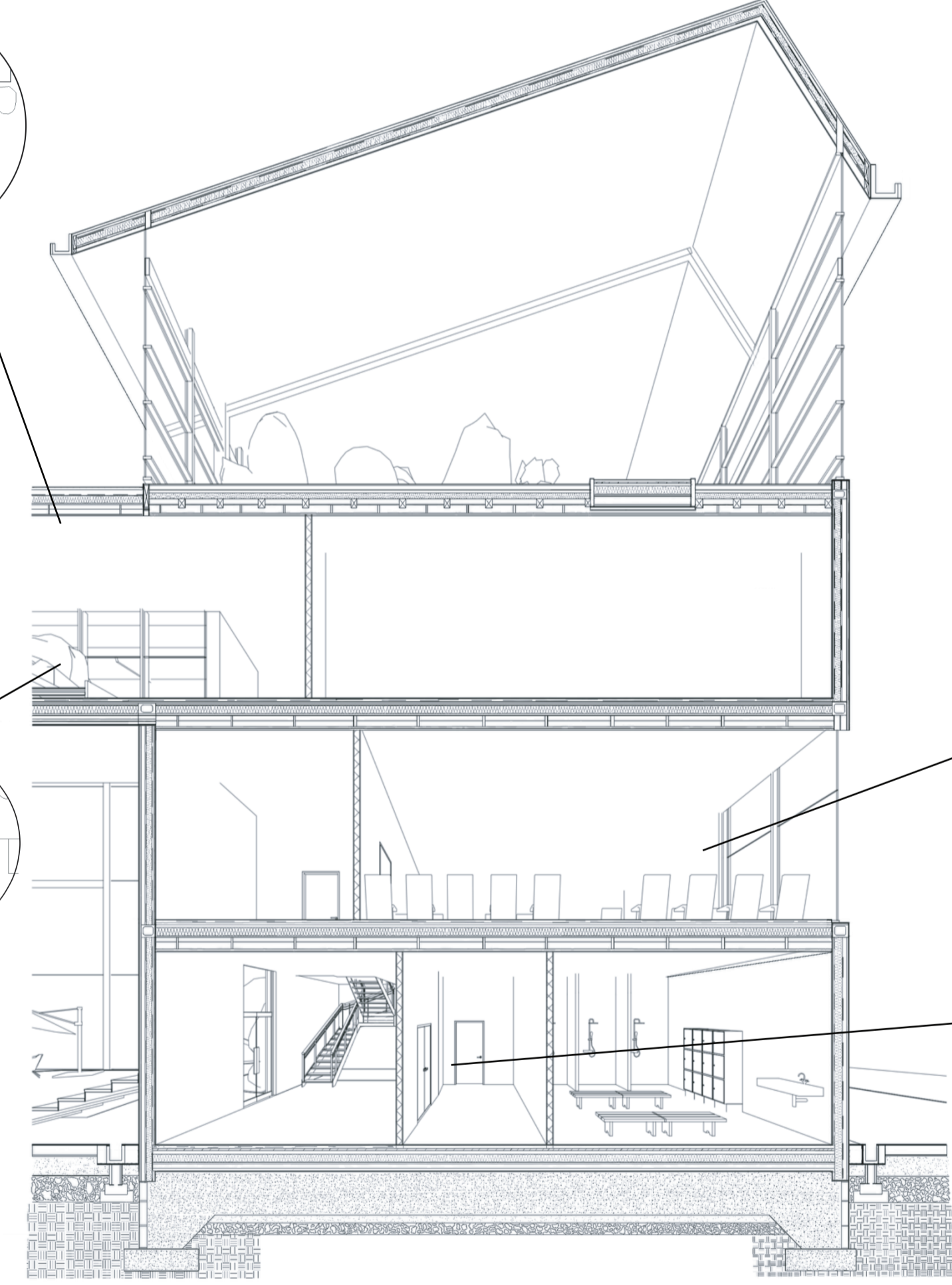
Hydronic underfloor heating detail



Corridor of classrooms



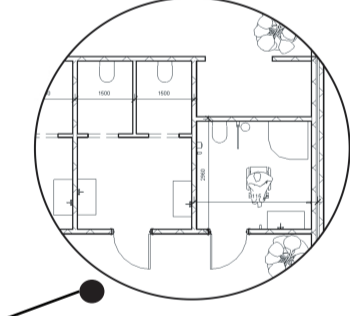
Corridor of external balcony



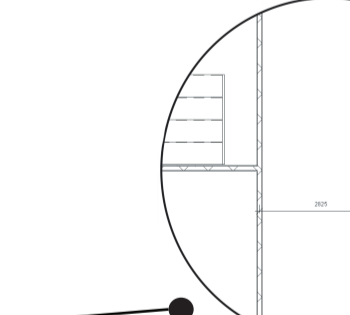
Part M

As the site is located on the Brayford wharf waterfront which is a Level surface this is an advantage to the usage of the building as it means no ramps are required. With entrance clearance of 1100 mm opening, a flush threshold and automatic doors, this creates an ease of accessibility for all users. With each internal story being level excluding the lift and stair blocks this creates a design suited for the elderly and individuals with chronic health conditions as it decreases chances of losing balance due to uneven surfaces. As this design is based on continuous walking loops corridors require minimum Of 1800 mm clearance width.

WC/ Disabled WC



Corridor of ground floor



Acoustic Condition

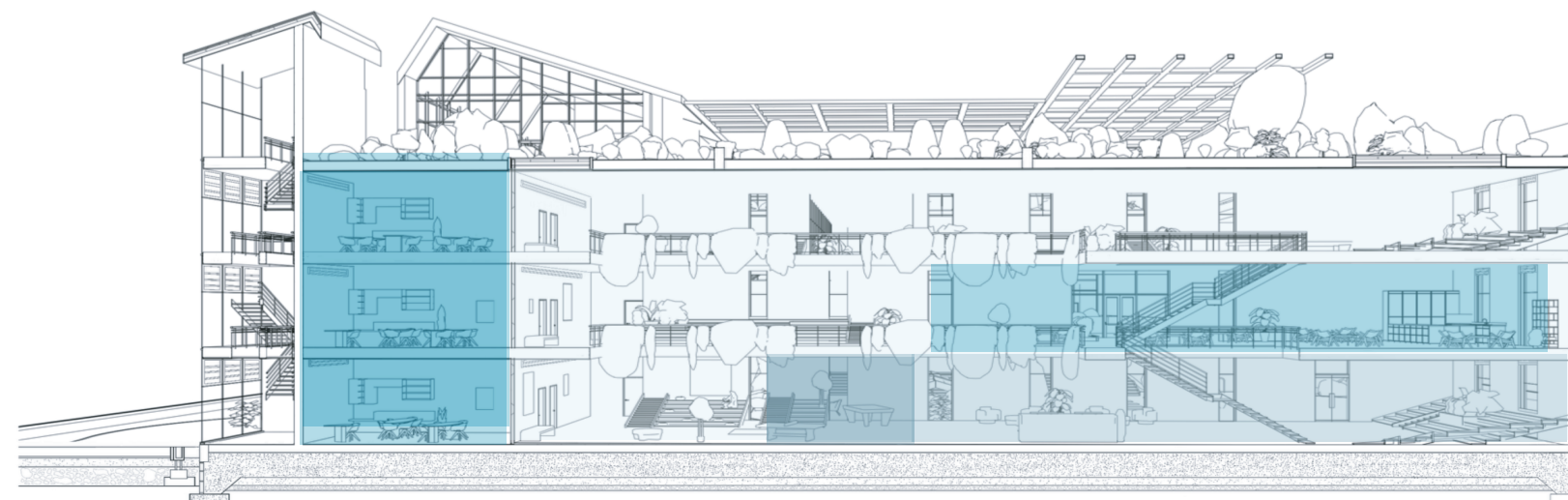
Acoustic principles

Absorption vs isolation: Absorption from materials such as wood and timber reduces reverberations within rooms. With isolation using solid core doors and resistant layers presents sound from transmitting between rooms. Both of these are important as worn by itself does not work as well.

Flanking transmission: Sound travels via the building structure, with CLT decks carrying impact noise, whilst resilient acoustic aluminium boards, that also work with the heating element, and full height walls break the flanking path.

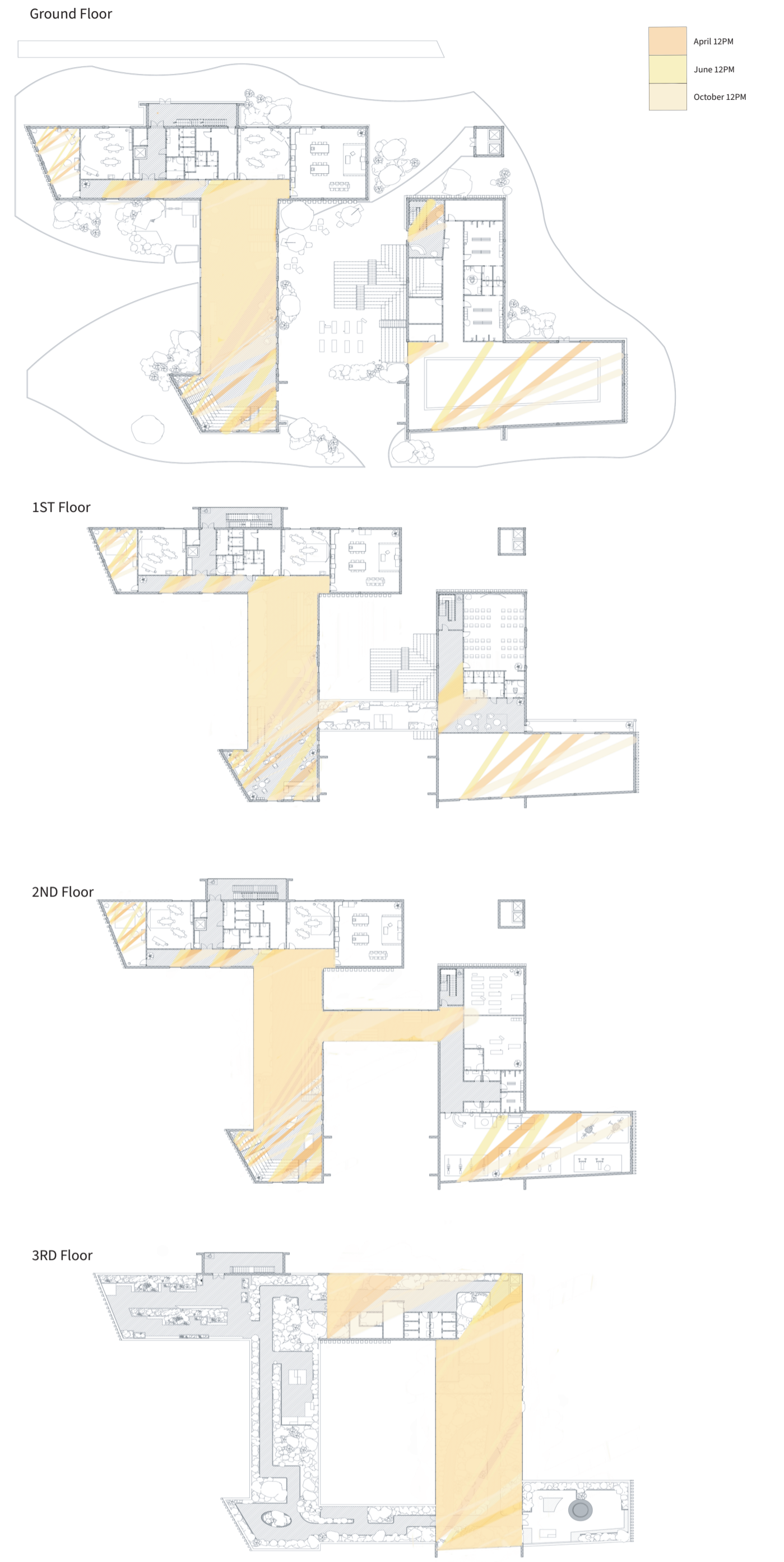
Materials: The material choices such as sheep wool insulation, CLT and tadelakt provide both thermal and acoustic performance in contrast to other materials such as concrete slabs instead of CLT decks of which would reduce both acoustic performance and increase weight.

Health informed design: use it with chronic health conditions can be sensitive to noise and this can cause psychological stress. With mechanical ventilation noise (MVHR units) must be with an all of 35 or lower for the therapeutic design brief.



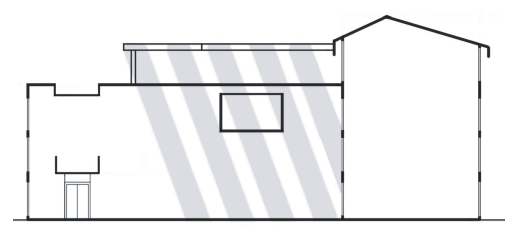
Lighting Condition

Designed to receive direct or reflective daylight, this allows users of the building natural light within occupied hours. Spaces that require diffused glare free light for tasks that require visual concentration on North facing such as the therapy room, classroom and cooking classroom. A solar glare can be intrusive in a learning environment and for individuals with visual impairment. With communal spaces such as the atrium, pool, gym and greenhouse being south facing this allows for generous natural light and solar heating. This allows for these large open spaces to be well lit and passively heated without the need for the use of the electrical systems.



Natural light can be insufficient during evening and night hours, with artificial lighting systems being activated during these times. All artificial lighting throughout the building is specifically LED technology, with LED illuminations meeting specifications for the buildings net zero operational carbon. The colour temperature of the LED lamp is critical for the building's users, with cool white LED (4000-6500K) is a spectrum of blue wavelength that suppresses melatonin production and promotes alertness. This is beneficial in daylight time activity space such as the gym, therapy room and circulation corridor as it benefits from higher alertness and visual activity. With the use of warm white LEDs (2700-3000K) emitting a spectrum of reduced blue wavelength that works best in transitional spaces to create a calm environment, of which is appropriate for relaxation in community spaces and evening hours. A human scented lighting control system that will be automatic and adjustable, mimicking the natural progression from cool morning daylight to warm evening lights.

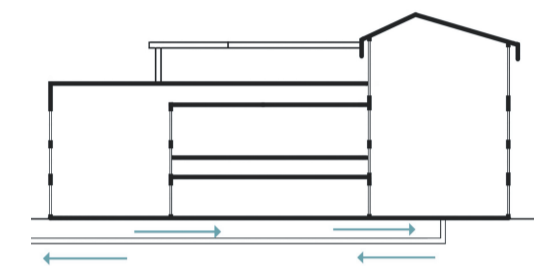
Acoustic zoning into room types		
<p>Gym- 0.8 to 1.2s RT</p> <p>Problem: The impact sound from the use of equipment.</p> <p>Rubber acoustic flooring mats to compress under impact, absorbing the shock before it travels. Reducing sound waves and vibration into the buildings frame.</p> <p>Wall installation reduces reverberation from music and equipment keeping the RT below 1.2s which is comfortable for exercising.</p>	<p>Pool- 1.5 to 2.0s RT</p> <p>Problem: Limestone tiles and water cause a natural reverberation</p> <p>Tadelakt walls absorb mid frequency sounds.</p> <p>A pool has requires more acoustic insulation due to users interacting with the pool and the large space.</p>	<p>Sauna- 0.3 to 0.5s RT</p> <p>Problem: smaller rooms risk the chance of echoing and humidity of the space rules out standard acoustic board.</p> <p>Timber seating absorb sound rather than reflecting it, naturally shortening reverberation it provides an appropriate noise level for this space</p> <p>Flutter echoes occur when two parallel surfaces bounce off each other, however the bench breaks this system.</p>
<p>Classrooms- 0.4 to 0.6s RT</p> <p>Problem: users with hearing difficulty rely on sound clarity therefore reverberations blur voices.</p> <p>No facing and far away from the street, these classrooms reduce external noise before even being treated for acoustic condition.</p> <p>Wood fibre board with limestone plaster and wool insulation creates a high absorption level of high and mid frequency sounds. This brings it down from 1.5s that is standard to 0.4-0.6s.</p>	<p>Atrium- 1.8 to 2.0s RT</p> <p>Problem: The large void and glazing creates reverberations and risks booming echoes.</p> <p>Vegetation as an acoustic diffuser, as irregular leaf surfaces scatter sound rather than reflecting it can absorb up to 0.32-0.5 of mid frequencies.</p> <p>Higher RT is acceptable in this space as it is circulatory and social area, some reverberations create a sense of liveliness in community, it is acceptable under 2s.</p>	<p>Therapy room- 0.4 to 0.6s RT</p> <p>Problem: The impact sound from equipment and private conversations.</p> <p>Wood installation reduces flanking transmission, this allows conversations to be audible to public spaces.</p> <p>Solid core timber doors with a rating of 40 dB reduces clear audible sounds whilst acoustic door seals close the air gap</p>



A lightweight external shading canopy, covers the courtyard and external walkway areas. Constructed with Glulam beams, the canopy provides protection from solar glare, UV rays and reduces heat stress whilst allowing the space to be comfortable for all year round use. Through solar angle analysis influence the design of the shading canopy, while still allowing natural sunlight to reach the building during the winter season. This passive design aligns with guidance from CIBSE guide A (CIBSE,2015), this reduces the need for mechanical heating and cooling interventions. This is compliant with GIBSE guide A.

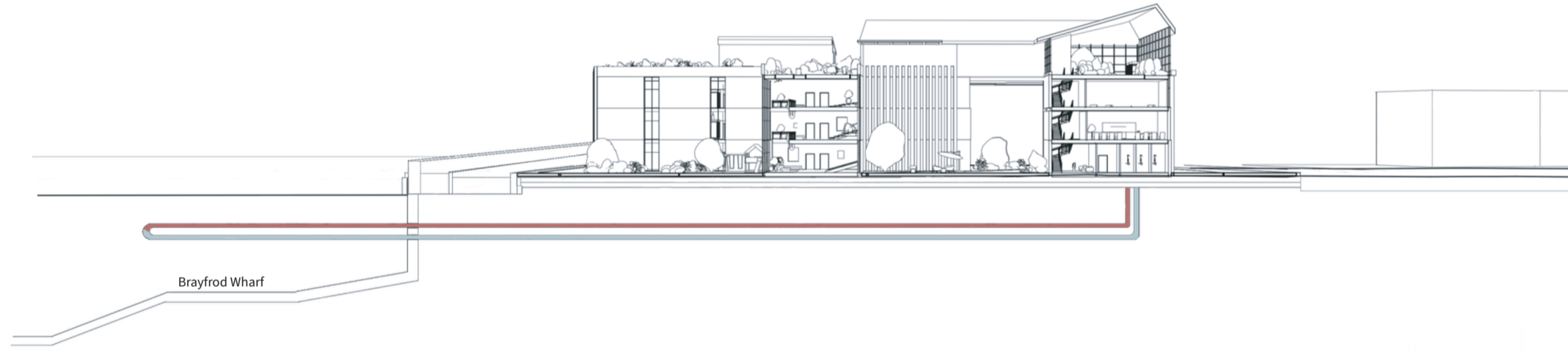
4. Shading

The average amount of sunlight during these times

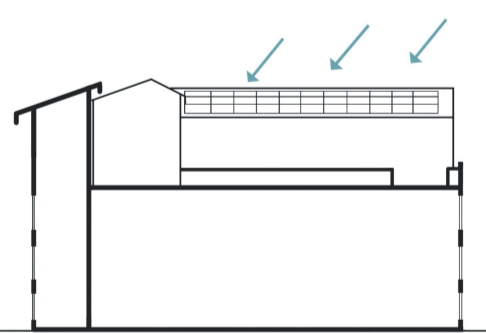
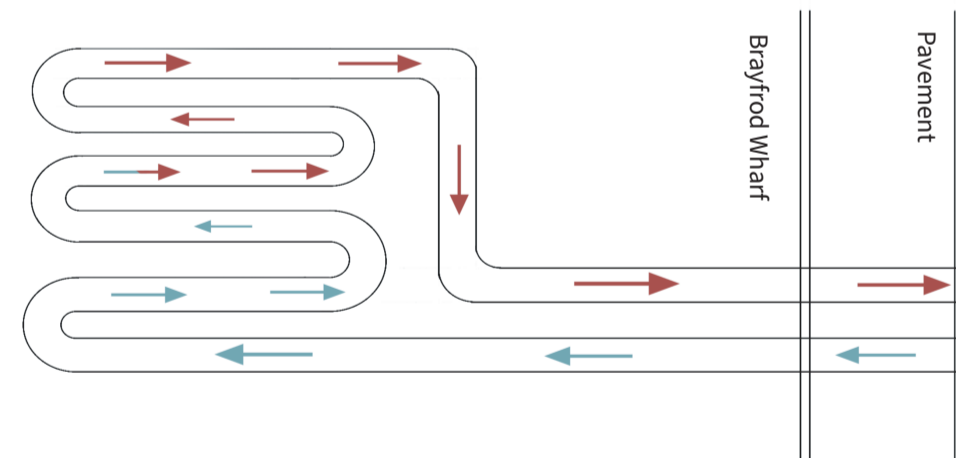


5. Water source heat pump

The primary source of water/cooling is a water source heat pump, making a net zero operational carbon system. The water source heat pump is a closed loop pipework that connects the heat pump in the Brayford wharf to the underground heating/cooling distribution system. Heat pumps operate through the use of thermodynamic refrigeration cycle, extracting low-grade thermal energy from the source and compressing it through refrigerant to raise the temperature. A water source heat pump energy consumption (Coefficient of performance) achieves 3.0-6.9 COP and 3.5-5.0 COP, this means it delivers 3.5 to 5 units of heat for every unit of electricity that is consumed. When that electricity is supplied by the building solar PV rays, it helps to mitigate the operational carbon, reducing the net zero carbon cost. In contrast, gas boilers deliver the same heat at 90% efficiency, producing 215 kg of CO2 per KWH of heat, which over a 60 year life cycle means the heat pump eliminates the equivalent of hundreds of tonnes in operational carbon.

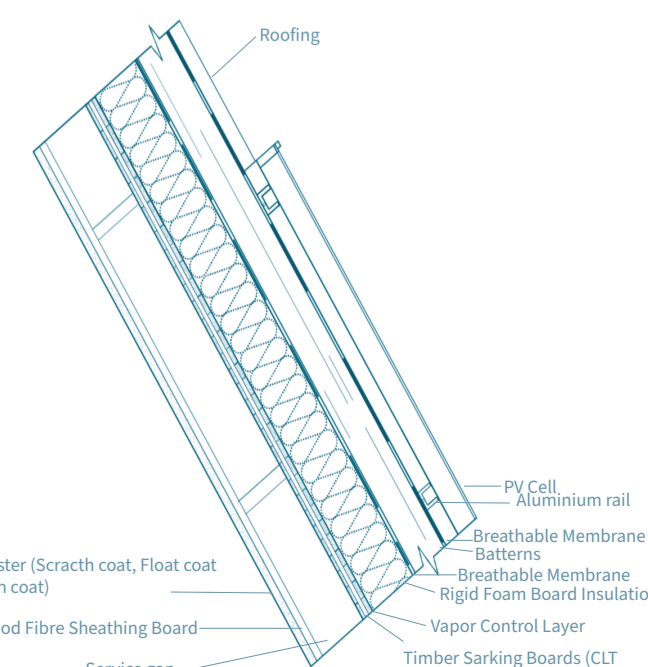
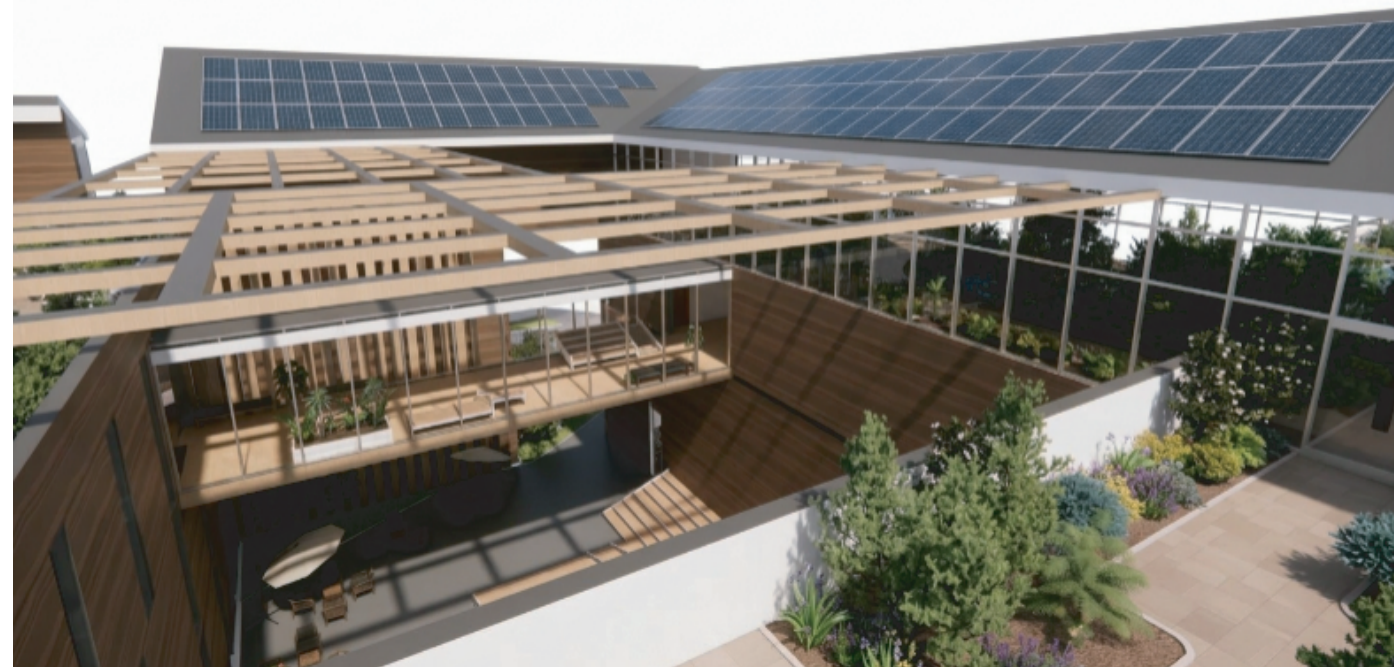


This means the performance level is four times better than conventional heating systems within the winter months. Within the winter months the hydronic underfloor heating/cooling systems require efficient and consistent temperatures of 35 to 45° and 16 to 18° for the summer. This is compliant with Approved document L. The positive impact of a water source heat pump allows for low carbon operational use due to the location of site having water access through the Brayford wharf, whilst also reducing energy operations due to the use of a PV cell system. This also benefits the users due to the link with the underfloor heating system that provide health benefits through reducing cold related joint stiffness and full risks whilst also contributing to the buildings net zero.



6. Photovoltaics cells

PV systems connected to battery storage allows energy to be generated during peak hours, discharging energy during low generation times. Both sustainability and economic incentive are high for the choice of PV systems due to surplus energy being exported/sold back to the grid. In a life cycle of PV cells energy payback is approximately 1.5 to 2.5 years within the UK. for the 25 to 30 year operational lifespan, the PV cells deliver a surplus of energy greater than the energy cost to manufacture. At the end of the PV cells life cycle, parts are a cycled in a scheme for silicon panels, allowing recovery of glass, aluminium and semi conductor materials. Thus the choice of a PV system was incredibly sustainable both for the proposed building and the entire life cycle. This is compliant with building regulation approved document L and MCS 001. The impact of PV cells for this building is both financially beneficial from the grid due to excess of generated electricity and the generating of electricity offset the buildings operational energy cost. This reduces the running cost of the community centre and keeps financial sustainability and accessibility to the Lincoln County Council and NHS.

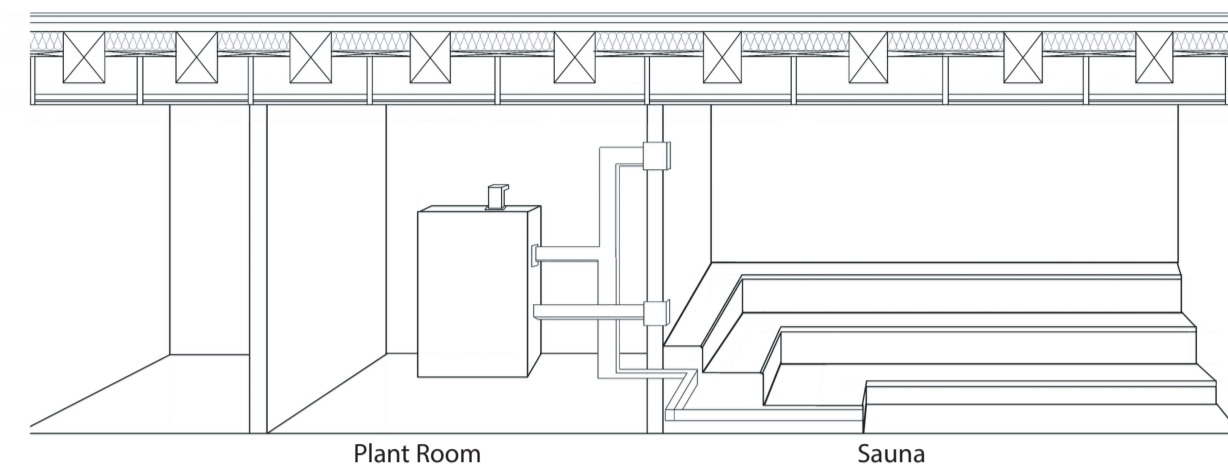


Sauna

Shown above is the ventilation relationship of the plant room and sauna, warm stale air is extracted with fresh air drawn in through the plant room's external wall by the MVHR unit. With the vents located at the lowest point of the bench and the highest point of the room to extract warm air, with a mid level vents fresh air at sitting height.

Acoustically the soft wooden benches geometrically absorb sound naturally achieving RT 0.3 to 0.5 without any additional acoustic treatment. Whilst also scattering reflections and preventing flutter echoes between the parallel walls.

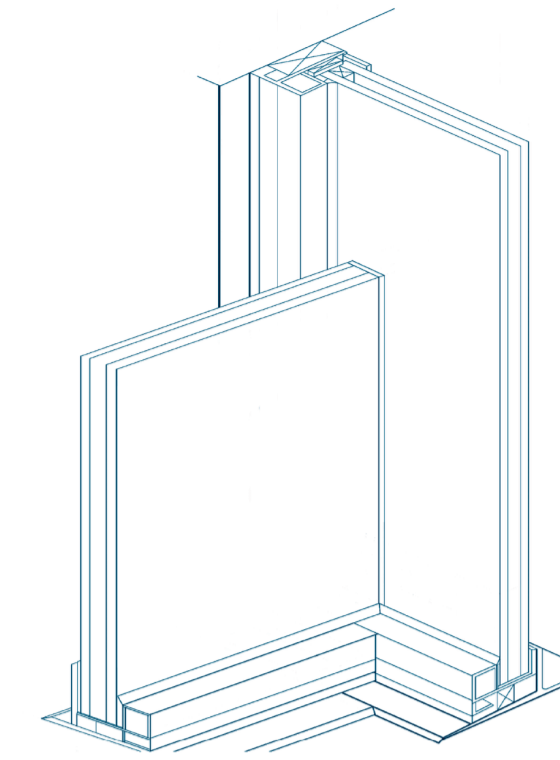
Sauna ventilation



Within the wall construction the use of moisture resistant acoustic membrane performs within a higher humidity space between 80 to 100°. With the lighting for the space shown in the render below at a temperature of 2700 K at a warm decibel, this adds a calming and meditative environment to the healing principles of the sauna space. Whilst creating a biophilic area through non-clinical surfaces such as lime plaster, timber benches and limestone tiles this is beneficial for individuals' anxiety, stress and cardiovascular conditions due to the calming nature of natural materials.

Tropical section of the greenhouse

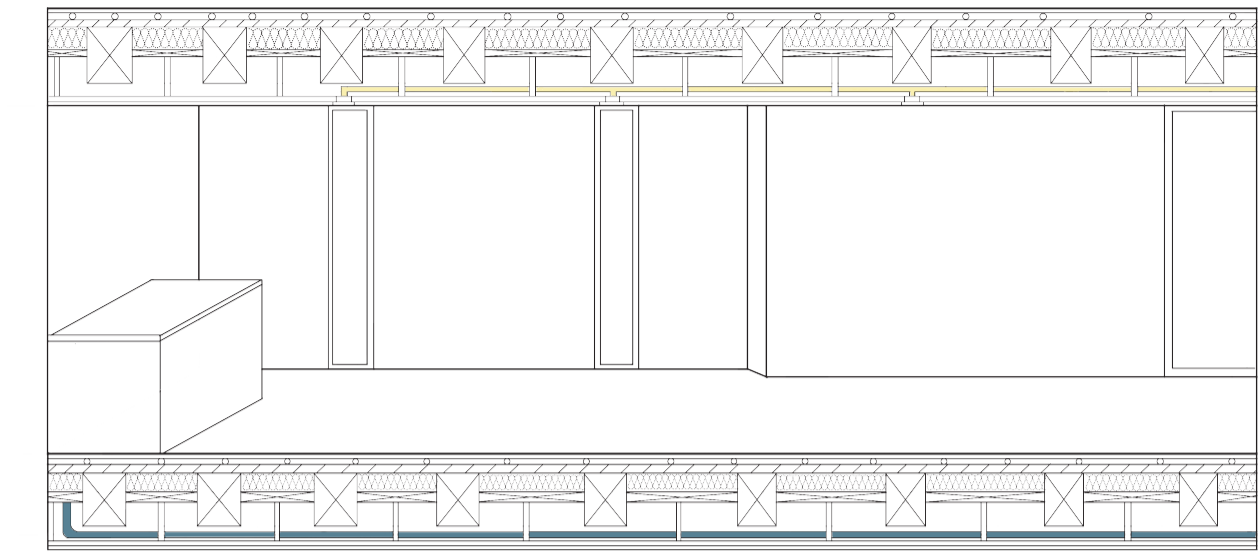
Above shows the window detail of the internal glass wall meeting the external glass wall within the greenhouse. With a frameless glass to glass at 90° joint, this was chosen due to the thermal performance with framed glass creating condensation at meeting points creating thermal weakness points, with the need to maintain a warm temperature for the plants survival.



This method creates an uninterrupted sight line with a lack of a frame and the idea of glazing to improve users health of circadian rhythms and daylight benefits as glass to glass corners maximize glazed area. While structurally glass to glass is viable as tough/laminated structural glass is strong enough in compression to carry corner load without a post, with provided silicon joints specifically at 10 to 15 mm width.

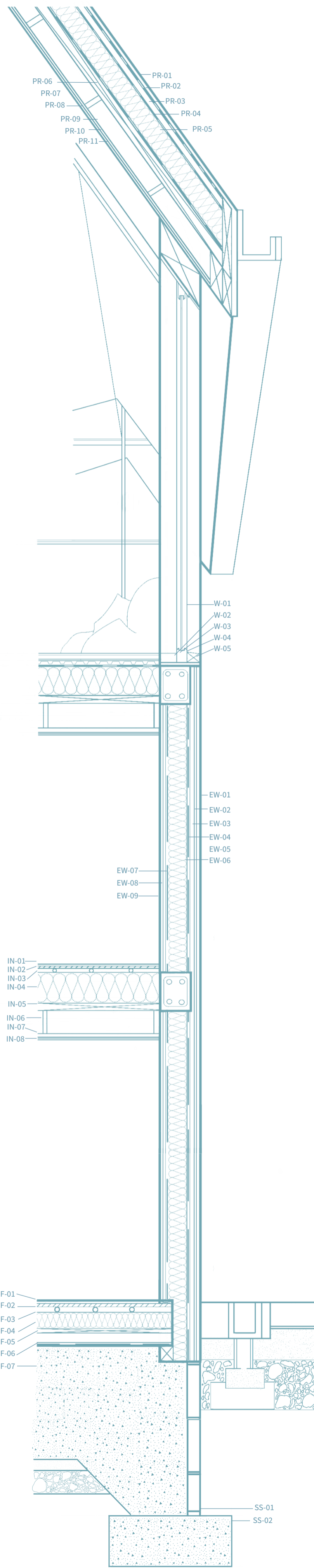
Atrium cafe

Above shows the use of the service gap within the café space in the atrium, including water services and electrical systems. Within the heating and lighting systems for the space as the café is both south and west facing receiving direct sunlight with a 43° June altitude and the use of warm LED lights as shown in the render of 2700 to 3000k to create a calm environment within the café due to the use of the atrium as a social communal space as well as daylight responsive that transition automatically.



While acoustically the use of vegetation as acoustic diffusers with soft natural materials is not only a part of the biophilic design but also reduces acoustic echoing within the large space. The café adds another gathering spot within the anchor of the building as it is an open well lit space that encourages not only slow movements but also social interaction.





Key

Pitched roof

Layer Ref.	Material	Thickness (mm)	Notes
PR-01	Aluminium roof sheet	3	
PR-02	Waterproof Membrane		
PR-03	Battens	38x50	Counter and tiling battens
PR-04	Breathable Membrane		
PR-05	Rigid wool Board Insulation		
PR-06	Timber Sarking Boards (CLT Decks)	50	
PR-07	Glulam Beams		
PR-08	Aluminium battens		Service cavity/racking
PR-09	Vapor Control Layer		
PR-10	Rigid Wood Fibre Sheathing Board	25	Scatch coat 8-12mm Float coat
PR-11	Interior Limestone Plaster	12-15	Finish coat 2-3mm

Windows

Layer Ref.	Material
W-01	Double Glazing unit
W-02	Fixed Wooden Frame
W-03	Thermal break
W-04	Weather seals/gaskets
W-05	Interal Wooden Sill

Internal Floor

Layer Ref.	Material	Thickness (mm)	Notes
IN-01	wooden Flooring	18	Finish layer
IN-02	Heat Spreader Panels Aluminum Boards		
IN-03	Under Floor Heating Element	3	UFH distribution
IN-04	Rigid wool Board Insulation	150	
IN-05	Strutural SubFloor		
IN-06	Vapour control layer/ aluminium battens		Service cavity/racking
IN-07	Rigid Wood Fibre Sheathing Board	25	Scatch coat 8-12mm Float coat
IN-08	Interior Limestone Plaster	12-15	Finish coat 2-3mm

Exterior wall

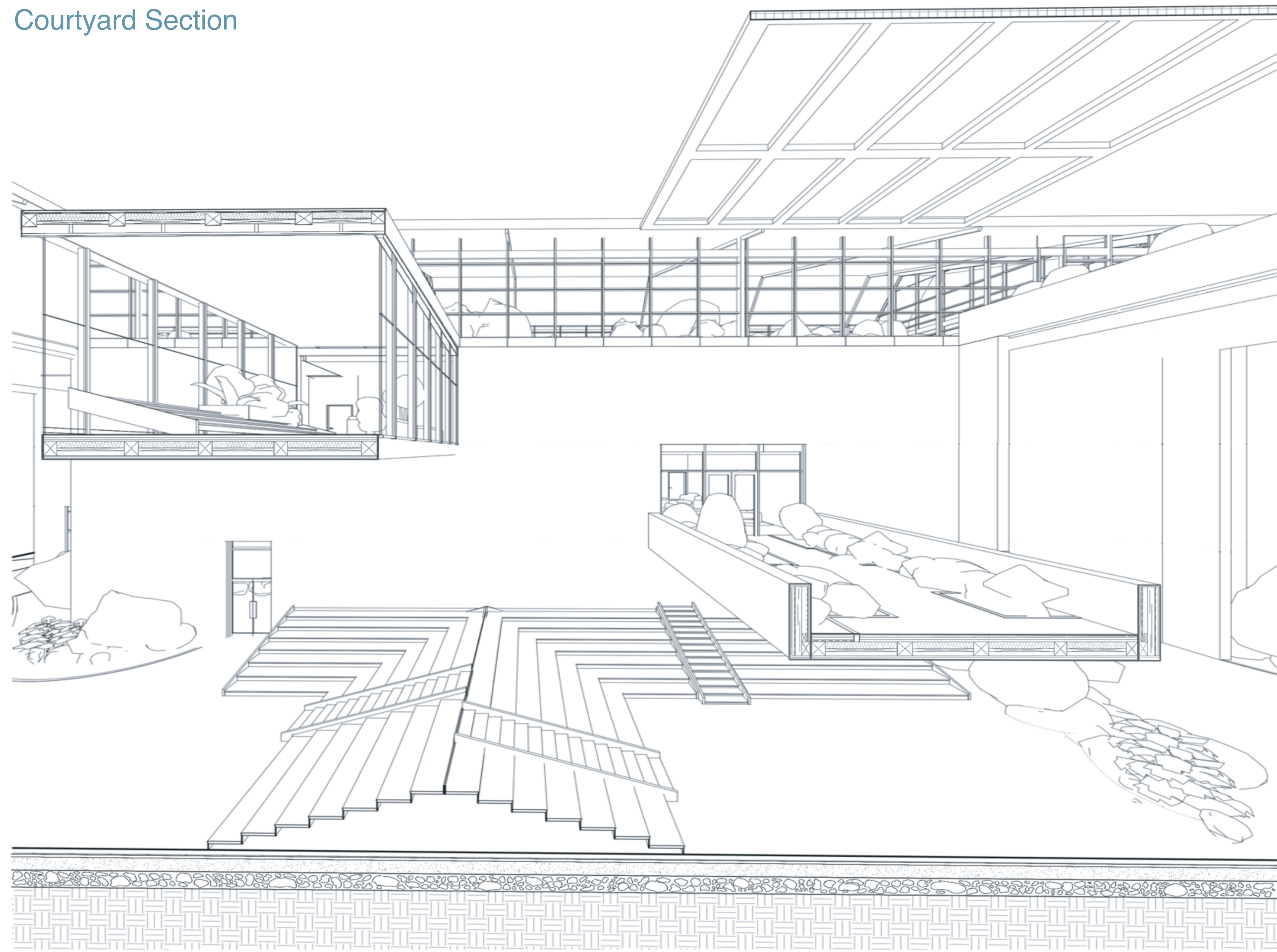
Layer Ref.	Material	Thickness (mm)	Notes
EW-01	Exterior Limestone Plaster	12-15	Scatch coat 8-12mm Float coat
EW-02	Rigid Wood Fibre Sheathing Board	25	Finish coat 2-3mm
EW-03	Ventilation Gap		
EW-04	Breathable Membrane		
EW-05	Glulam Beams		
EW-06	Sheep's Wool Insulation	240	
EW-07	Vapour control layer		
EW-08	Rigid Wood Fibre Sheathing Board	25	Scatch coat 8-12mm Float coat
EW-09	Interior Limestone Plaster	12-15	Finish coat 2-3mm

Ground Floor

Layer Ref.	Material	Thickness (mm)	Notes
GF-01	wooden Flooring	3	Finish layer
GF-02	Heat Spreader Panels Aluminum Boards		
GF-03	Under Floor Heating Element	18	UFH distribution
GF-04	Rigid wool Board Insulation	150	
GF-05	Strutural SubFloor		
GF-06	Vapour Barrier		
GF-07	Low carbon Concrete R Foundation Slab Cast		

Sub Structure

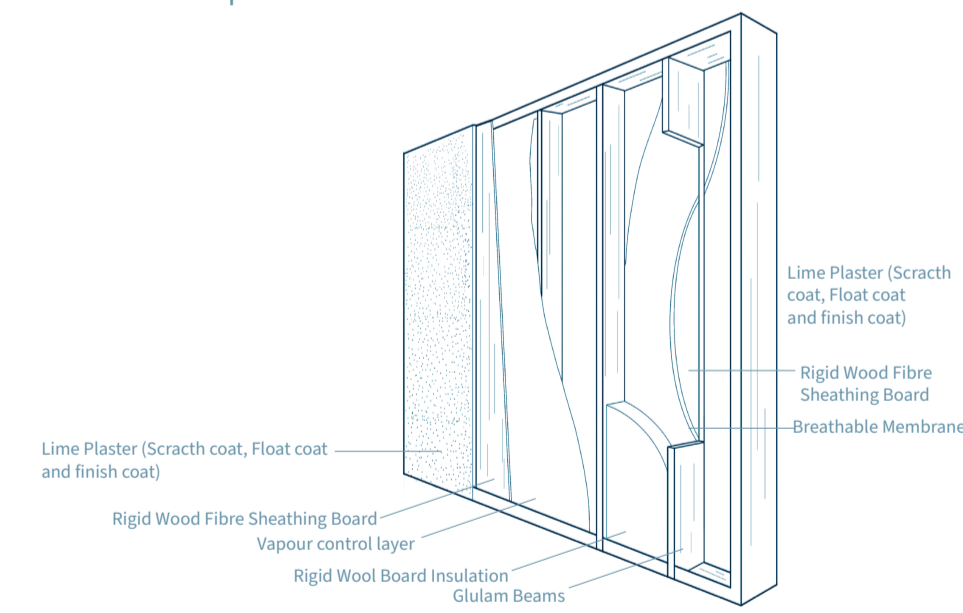
Layer Ref.	Material
SS-01	Foundation Blocks
SS-02	Reinforced Low carbon Concrete Footing



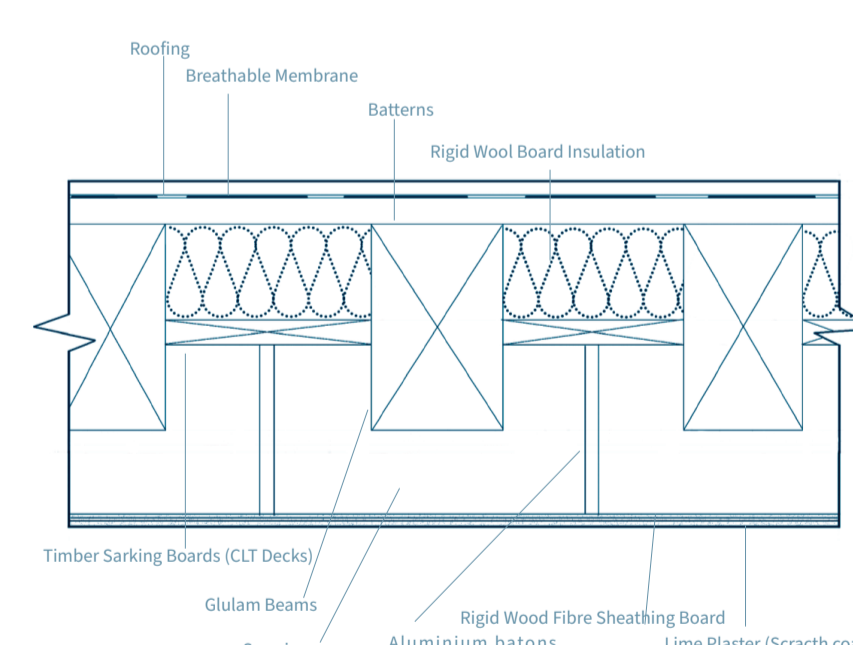
This drawing works as a construction detail and spatial argument, as the assembly of the building is an experience through continuous loops. Shown are the two connecting bridges technical built up through the use of glulam as a primary structure over the courtyard. With a glazed corridor filled with seating and vegetation that is transparent, reducing the mass within the courtyard space whilst also allowing for natural light to penetrate deeper into the building. Whilst the balcony connects the T-shaped and L-shaped building creating a transitional space from internal to external allowing for fresh air and natural daylight whilst being protected from the wind and solar. This also shows from the ground floor to the top floor each level has a connection between both buildings either through the courtyard, balcony, glazed bridge and rooftop garden.

Technical details

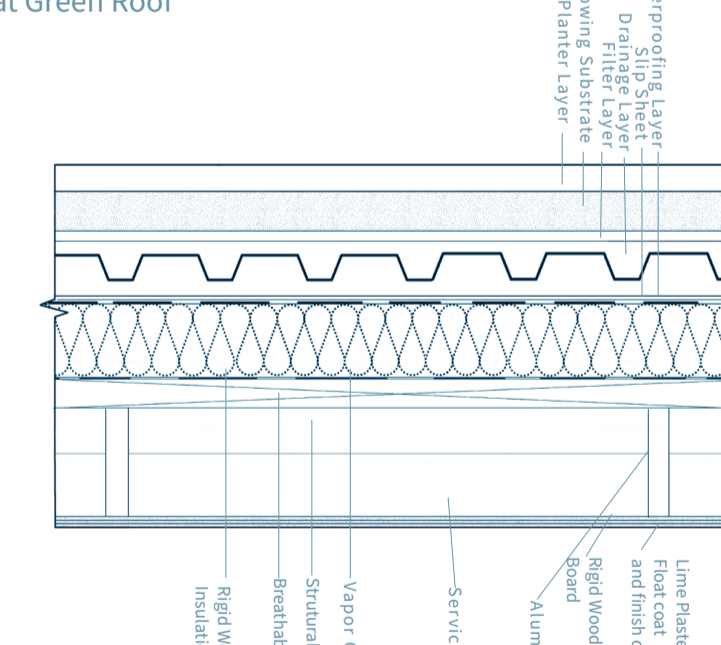
Limeplaster Wall



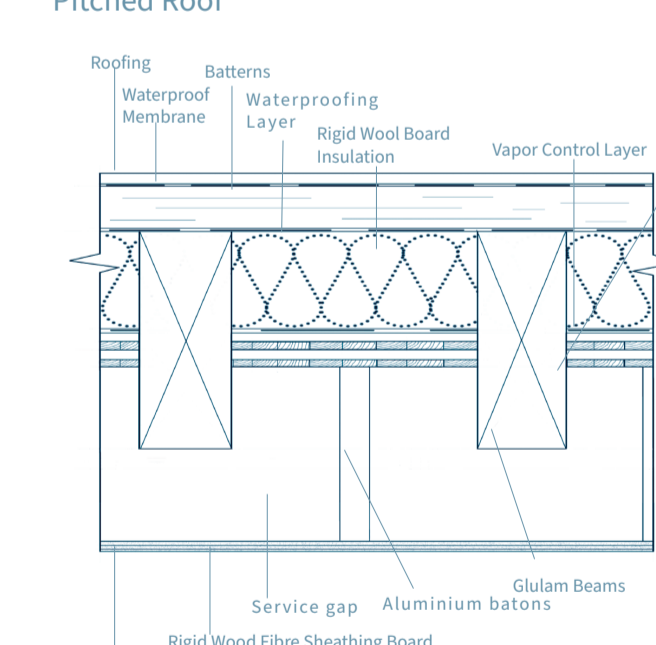
Flat Roof



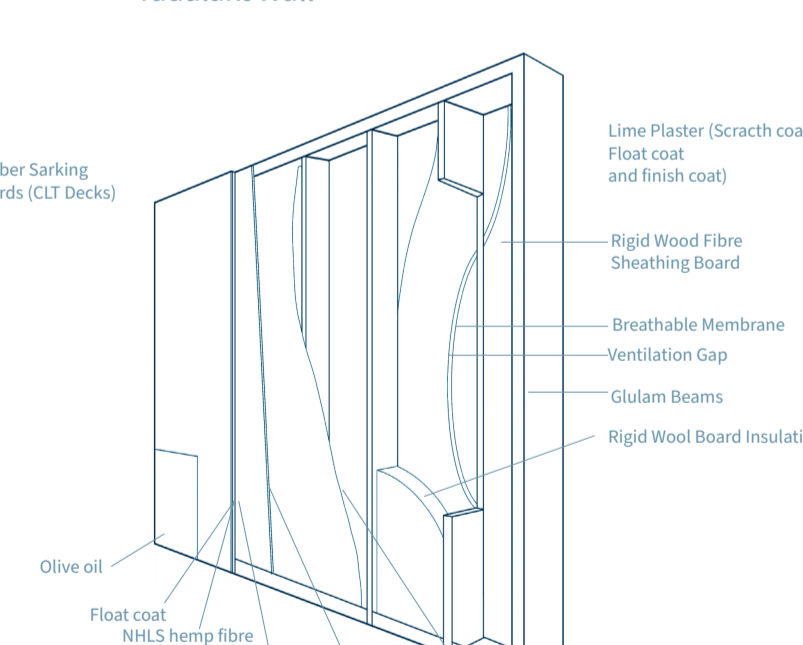
Flat Green Roof



Pitched Roof



Tadalakt Wall



Construction phase diagram

<p>Phase 1: Week 1-8 Groundworks & Foundation</p> <p>Foundation: Low carbon raft slabs distribute the Glulam Frame load, which works in reducing differential settlement on the Brayford wharf clay subsoil.</p> <p>Ground conditions: Holocone alluvial Play with PT patches, which has moderate bearing capacity this the choice of rafts Was picked over deep piles to avoid ground disturbances.</p> <p>Concrete specification: GGBS blended low carbon concrete has 100 to 150 kgCO2/m3in comparison to standard Portland cement which has 250 to 330 KgCO2/m3.</p> <p>Substructure services: underfloor heating hydronic pipes, drainage, water source heat pump ducts are cast into the slab within the stage.</p>	<p>Phase 2: Week 9-20 Primary structure- Glulam Beams</p> <p>Frame System: Glulam beam and columns are prefabricated offsite, then crane lifted into position. This reduces on-site labour and construction waste.</p> <p>Lateral stability: As the CLT Panels and beam/columns brace connection this means there is no masonry/concrete cause that are required, as the timber structure is self stabilising.</p> <p>CLT Floors: Cross laminated timber panels span between the Glulam beams add a 90° angle alternating layers, this distribute the lateral load to the core.</p> <p>Steel base plates: Glulam columns connect to the raft via a hot dip galvanised steel base plate. This elevates the timber of the low concrete slab thus prevent moisture contact (PAS 2028:2023).</p>
<p>Phase 3: Week 21-34 Building envelope</p> <p>Roof systems: Pitched roof over the greenhouse with Glulam beams and PV rails. Flat green roof for the external garden and a flat roof over the bridge/path of external garden.</p> <p>Glazing: Full height collision within the atrium, pool, gym and walkway. With overhanging roof shading canopy to control solar gain.</p> <p>Facade: vertical timber, the echoes the movement of the water. This is mounted with hot dip galvanised steel on the external wall.</p> <p>PV Installation: Monocrystalline silicon panels fixed onto the pitched roof rail system, allows for 20 to 30% of efficiency rate with silicon being recycled at the end of its life.</p>	<p>Phase 4: Week 33-52 Fit-out, M&E & Landscaping</p> <p>MVHR units: Mechanical ventilation with heat recovery is installed within classrooms, cooking rooms, bathrooms, pool and plant rooms which leads to 70 to 90% of heat recovery.</p> <p>Internal Finishes: flooring, limestone tiles, lime plaster, acoustic wool insulation panels within therapeutic rooms, classrooms and atrium spaces, et cetera. Both natural and biophilic materials.</p> <p>Underfloor heating: Hydronic UFHC is connected to the water source heat pump with approximate temperatures of 35 to 45° for heating and 16 to 18° for cooling.</p> <p>Landscaping and Walkways: External covered walkway with planters, vegetable gardens, sensory gardens and the insulation of a rainwater harvesting tank that connects to the green roof drainage.</p>

Buildings Lifecycle

