‘Ein Ty Ni’

Our House

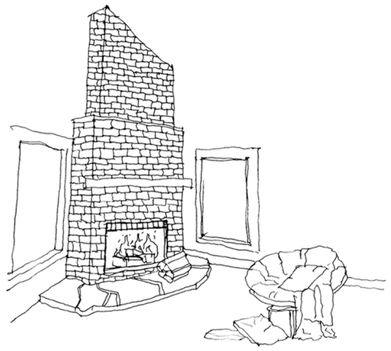
“Empowering a culture to go beyond building a building”

Molly Nash - Year 4
C1606967

AR4401 | Co-Production | Common Governance | Social Regeneration

Technical Design Proposal

Contents



Introduction

This project has been designed for the Caerau and Ely Sports Trust which is made up of 6 community members made up of entrepreneurs, councillors and everyday citizens yet we argue this. The client is the people of Caerau and Ely not just the chosen six, rather the thousands that live in the suburb. This architecture is a discipline of social purpose and through engaging with the social context, the proposal is rich in social value that empowers a culture that goes beyond building a building. The proposal and materials chosen throughout provide the community with a space they can build themselves and adapt as they grow and progress.

Local and civic amenities are located within 1 mile of the proposal and can be accesses on foot, car or local bus routes. The nearby settlement is truly suburban and lies within 3 miles of Cardiff city centre.

Key Spaces:

The Nest / Y Nyth - Community Hall

The nest aims to be the heart of the building and the heart of the community where voices can be heard and celebrations of local achievements take place. A highly flexible space which can serve the needs of the young, old and vulnerable; this would be the first phase of the project. A space to build social value and a testing ground for the programmes aimed to be introduce in tackling social challenges.

Cuddle Cupboard / Cwtch / Private Spaces For Discussion

A cwtch is an intimate space unique to the welsh vernacular, aspiring to design such spaces to discuss the challenges that people are facing - inspired by the solid stone and earth filled walls of the welsh vernacular. Utilising the welsh langauage in crafting a sense of place and identity - rooting the proposal in context.

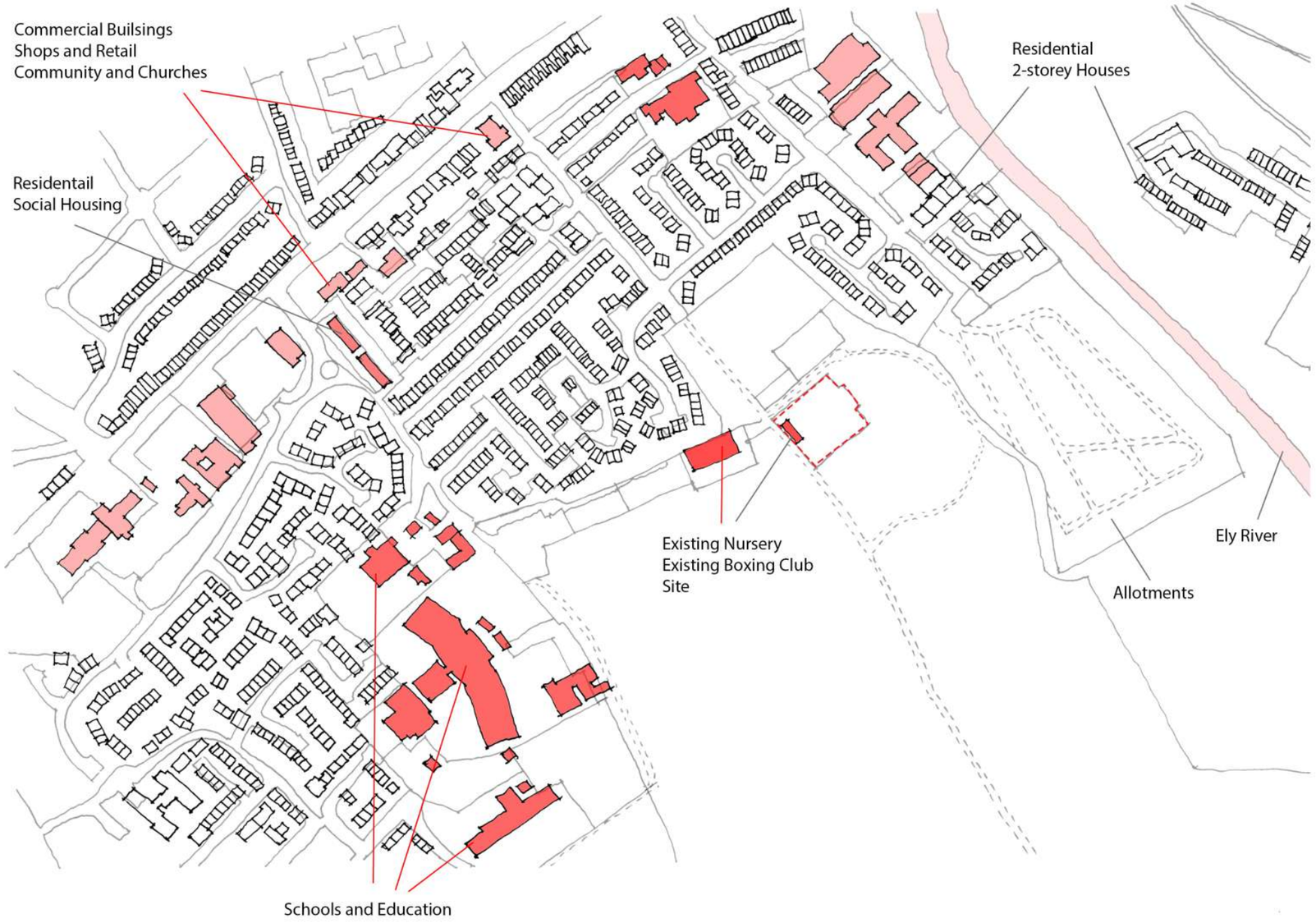
Community Cafe

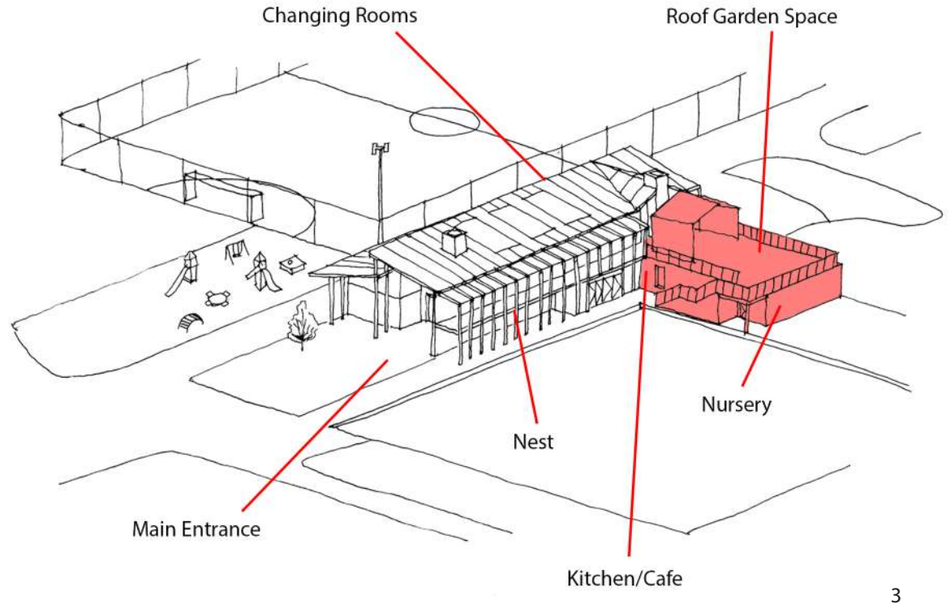
The community cafe is a space for gathering and social integration, where the young and the old can socialise side by side. A space of domestic function, modesty and warmth, creating a ground to build and sustain social relationships.

Nursery

The nursery is located strategically in order to provide connections to the allotments, the bowling green, the main nest space, kitchen and woordland area surrounding the site. The nursery is the focus of this report and will be explored in more detail.

Site and Context





Acoustics

Sound proofing between the nursery and cafe and kitchen spaces is vital to achieve comfortable environments in each.
Privacy and quiet areas must be achieved in the toilets and calmer building zones. Within the nursery/creche there should be quieter zones created by buffers and a clear distinction between public and private domain.
Different building zones are active at different times of the day which must be taken into consideration, for example, the cafe and nest will generate a lot of noise both during the daytime and outside working hours (early mornings and evenings). Therefore, the surrounding residential area should be taken into consideration when locating and orientating the noisier areas of the building. The choice of materials will directly impact the noise produced and contained.
When considering sound, the toilets should have a degree of sound proofing when located near/within public spaces.

Air Flow and Ventilation

The air quality will have a sizeable impact on the comfort of the building and the health of the users.
The building must be ventilated throughout the year and ventilation should be easily achieved (not purely through openings in the building's skin) which must ensure high air quality in order to create healthy working environments for children.

Construction

All works are to be carried out in a workmanlike manner. All materials and workmanship must comply with Regulation 7 of the Building Regulations, all relevant British Standards, European Standards, Agreement Certificates, Product Certification of Schemes (Kite Marks) etc. Products conforming to a European technical standard or harmonised European product should have a CE marking. Ground to be prepared for new works by removing all unsuitable material, vegetable matter and tree or shrub roots to a suitable depth to prevent future growth. Save as much vegetation as possible, avoid destruction. Seal up, cap off, disconnect and remove existing redundant services as necessary. Reasonable precautions must also be taken to avoid danger to health and safety caused by contaminants and ground gases e.g. landfill gases, radon, vapours etc on or in the ground covered, or to be covered by the building.
The building must provide shelter from the natural weather conditions on site and be secure and protect the users from external factors.
The building must provide appropriate conditions (including control) of filtering the weather.
The building materials should be UK sourced in order to maintain a low lead time.
At least 15% of each building should be made from recycled goods.
The construction of the buildings should celebrate the simple construction techniques of the existing boxing and existing nursery sheds, allowing the community to actively participate in the build.
The construction time should be kept to a minimum to minimise site impact and prefabricated parts should be used where possible. The building should develop over time and evolve as the comunity evolves.
The materials should be long-lasting and provide protection to the structure. They should also be cost effective.
Modular work where possible will aid in the community production concept as well as speed up construction time.
human environment.
The wall U-values must be equal to or less than 0.7 W/m2k. [non-domestic Requirements Handbook].
The floor U-values must be equal to or less than 0.7 W/m2k. [non-domestic Requirements Handbook].
The roof U-values must be equal to or less than 0.35 W/m2k. [non-domestic Requirements Handbook].

General Aesthetics

The building should be 'of place' as well as act as a clear beacon to locals and visitors. The building should invite the public in with an eye-catcing entrance and clear set boundaries for public and private domains (ensuring the safety of children in the nursery).
Exterior covered walkways (streets) must be of prime focus and provide accidental meetings spaces for the varying groups on site.
Interaction must be enabled through the public walkways at all times of the day.
Views of the Roman Villas and sporting fields, astro turfs and playgrounds should create points of climax across the site.
Buildings must create clear zones for specific activities and age groups.
Different users should be considered and the way in which they travel around the site must be taken into account when deciding upon a circulation strategy.

Heating and Cooling

Localised heating systems throughout the scheme will enable different rooms to be heated at different times of the day creating a personalised energy consumption across the whole scheme.
Rooms should accommodate the different users at different times. For example, the WI group using the nest on Thursday afternoons need adequate heating and cooling facilities for activities such as baking and afternoon teas. On the other hand, rooms used by children in particular must be able to be cooled quickly to avoid children overheating in the summer which may cause fainting and other health risks.
Care shall be taken to limit the occurrence of thermal bridging in the insulation layers caused by gaps within the thermal element, (i.e. around windows and door openings). Reasonable provision shall also be made to ensure the dwelling is constructed to minimise unwanted air leakage through the new building fabric.
Background ventilation - Controllable background ventilation via trickle vents to BS EN 13141-3 within the window frame to be provided to new habitable rooms at a rate of min 5000mm^2; and to kitchens, bathrooms, WCs and utility rooms at a rate of 2500mm^2 .
Purge ventilation - New windows/rooflights to have openable area in excess of 1/20th of their floor area, if the window opens more than 30° or 1/10th of their floor area if the window opens less than 30°

Lighting

The visual environment must be enhanced by natural and daylight lighting and both internal and external views. Child health must be taken into ccount when approaching a lighting strategy.
Direct sunlight in certain areas of the site should be controlled in order to ensure suitable working environments for varying activities.
The exterior walkway should be lit at night to create a safe walking space for those using the site in the dark.
Exterior lighting should be provided on site to increase saftey for all users.

Maintenance

The building should mostly be modular so parts should be easily replaceable. The community should be able to repair minor work and only require expert help for larger (less likely) incidents.
The buildings should last for 60 years.
The external cladding should be coated in a fire- and weatherproof coating.

Materials and Workmanship

All works are to be carried out in a workmanlike manner. All materials and workmanship must comply with Regulation 7 of the Building Regulations, all relevant British Standards, European Standards, Agreement Certificates, Product Certification of Schemes (Kite Marks) etc. Products conforming to a European technical standard or harmonised European product should have a CE marking.

Safety

There must be protection from fire, the building and its elements.
Circulation routes must be considered in the areas where cars, lorries, machines, cyclists and pedestrians (including children) interact and overlap on and around the site.
Hygiene needs to be considered within the kitchens that are closely located to the chilren's nursery and main nest.
Fire engines must be able to access the site in the event of an emergency.
Safe zones for children and disabled people should be considered when deciding upon fire assembly points and exits.
Provide emergency egress windows to any newly created first floor habitable rooms and ground floor inner rooms. Windows to have an unobstructed openable area that complies with:
- minimum height of 450mm and minimum width of 450mm.
- minimum area 0.33m^2.
- the bottom of the openable area should be not more than 1100mm above the floor.

The window should enable the person to reach a place free from danger from fire. All glazing in critical locations to be toughened or laminated safety glass to BS 6206, BS EN 14179 or BS EN ISO 12543-1 and Part K (Part N in Wales) of the current building regulations. i.e. within 1500mm above floor level in doors and side panels within 300mm of door opening and within 800mm above floor level in windows.
Mains operated linked smoke alarm detection system to BS EN 14604 and BS 5839-6:2019 to at least a Grade D category LD3 standard and to be mains powered with battery back up. Smoke alarms should be sited so that there is a smoke alarm in the circulation space on all levels/ storeys and within 7.5m of the door to every habitable room.
All balcony balustrades to be min 1.1m in height. Balustrades to be in toughened glass in accordance with Part K (Part N in Wales) of the Building Regulations and designed to resist the horizontal force given in BS 6180:2011.

Water and Drainage

The water that enters the sewers must not exceed the amount of water that currently (before construction) is drained from the site.
The use of permeable paving, suds and/or balancing ponds could be implemented along with a combination of blue and green roofs and balconies.
Rainwater should be collected and reused within the communal kitchens and toilets.
There must be a suitable installation for the provision of a wholesome water supply in accordance with Approved Document G.
Supply of cold water to comply with section 67 of the water industry act 1991 and the Water Supply Regulations 2000.
New rainwater goods to be new 110mm UPVC half round gutters taken and connected into 68mm dia UPVC downpipes. Rainwater taken to new soakaway, situated a min distance of 5.0m away from any building, via 110mm dia UPVC pipes surrounded in 150mm granular fill. Trench of soakaway to be provided slightly largely than designed depth after porosity test (if required) but just over 1m3 min from invert level of pipe. Provide suitable geotextile over the base and up the sides of the trench over 100mm level and compact bed of coarse sand.
Underground drainage to consist of 100mm diameter UPVC proprietary pipe work to give a 1:40 fall. Surround pipes in 100mm pea shingle. Provide 600mm suitable cover (900mm under drives).
Inspection chambers to have bolt down double sealed covers in buildings and be adequate for vehicle loads in driveways.

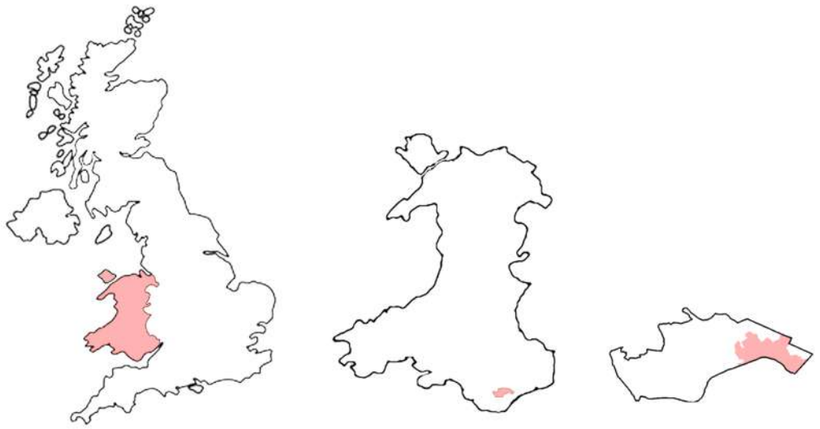
Lessons from the Site Analysis

1. Existing transport network: studying the transport network allowed the proposal to notice the necessity for more direct connections to the rest of the city (bus, trains, cycling paths).

1. Existing potential network: this land use map of the relevant locations shows how the community has already started addressing the needs of inhabitants with leisure & sports centres, care homes or even community centres. From speaking with the community, this is still not sufficient.

1. Connection between the existing networks: the opportunity of improving the transport network has been recognised by linking the existing interesting facilities. This will allow them to act almost as supporting locations or the site becomes the catalyst of community life - their "House". By improving these main arteries, this effect will radiate to the rest of the surroundings therefore decreasing existing vandalism and antisocial behaviours.

The microclimate of the site reaches 9 degrees celcius and falls to 1 degree celcius in winter months. During the summer, the average temperatures reach 20 degrees celcius and fall to 12 degrees celcius. There is a difference of 64mm of precipitation between the driest and wettest months. Chosen materials must consider local climate impact and furtureproofing/maintenance.



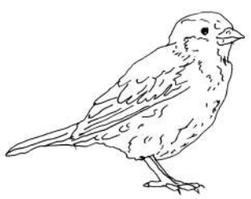
UK and Wales | Wales and Ely and Caerau | Ely and Caerau and Trelai

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	2.7	3.8	6	8.5	11.5	14.9	16.5	16.2	14	10.6	6.1	3.9
Min. Temperature (°C)	-0.2	1.1	2.5	4.9	7.3	10.5	12	11.6	9.7	6.8	3.1	1
Max. Temperature (°C)	5.7	6.5	9.5	12.1	15.8	19.3	21	20.8	18.3	14.4	9.2	6.8
Avg. Temperature (°F)	36.9	38.8	42.8	47.3	52.7	58.8	61.7	61.2	57.2	51.1	43.0	39.0
Min. Temperature (°F)	31.6	34.0	36.5	40.8	45.1	50.9	53.6	52.9	49.5	44.2	37.6	33.8
Max. Temperature (°F)	42.3	43.7	49.1	53.8	60.4	66.7	69.8	69.4	64.9	57.9	48.6	44.2
Precipitation / Rainfall (mm)	44	33	40	41	45	49	50	53	49	48	51	48

Landscape Analysis

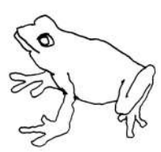
Proposal allowing introduction of Species:

House Sparrow



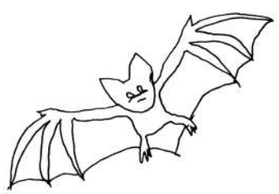
A house sparrows ideal habitat can be achieved through brown/green roofs enabling roof nesting. Nesting boxes should be positioned 2m above the ground at 1.5m apart and ideally face east, an opportunuity created by the sloed green nursery roof pointing east.

Frogs, Toads and Newts



Frogs, toads and newts thrive in ponds surroudned by tall herb plants. Nitrogen levels should be kept to a minimum and surrounding tree shade avoided. Toad crossing points enable children to be actively involved and the ponds ease tension on surface water soakaways.

Bats

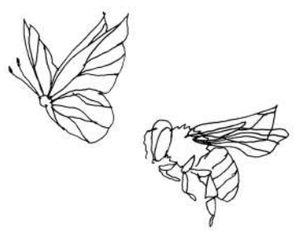


There has been a 70% decline in bats in the past 100 years. Bats are protected under EU/UK law. Avoid use of chemicals in roof timber frame and the provision of bat boxes in roofs and gardens should face south (south of nursery roof is undisturbed). Oak and beech trees are ideal.

Hedgehogs

Hedgehogs tend to avoid areas used by badgers and prefer to live in wildlife corners with pile of leaves and wood (provided in outdoor play spaces). Avoid netting for hedgehog and child safety. Ramps providing access to frog ponds allow freedom of movement for all (inclusive).

Butterflies and Bees



Butterflies and bees thrive in flower meadows, even up to 20 storeys high. Grouped plants with sequential flowering are vital and can be provided through seasonal gardens on the nursery roof. Leave some areas of grass uncut to benefit species and lower maintenance for locals.

Contextual Analysis

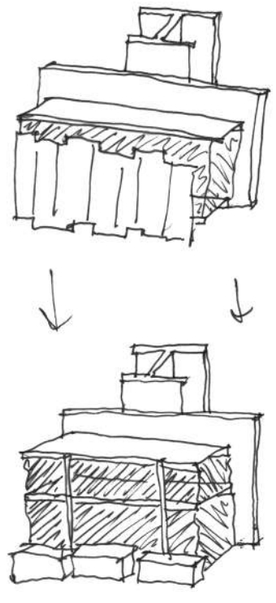
An on site mixted media sectional drawing has enabled an understanding of the site conditions and existing materiality. It led to further analysis of the existing Boxing Club.

The Boxing Club has been analysed structurally, in terms of materials and properties, construction techniques and conceptualised ideas of site representation.

Models and photographs have led to an understanding of material build-up and have informed the nature of the proposed. A strong heavy bottom half supports a more lightweight construction that have been assembled quicly on site for mixted use purposes, similar to that of an industrial shed.

Build-up of existing boxing club

1. I-Beam
2. Fire Resistant Plasterboard
3. Light Steel Frame
4. Insulation
5. Sheeting Board
6. Wall Ties
7. Brick Cladding



Section expressing textures on approach to site , cut through the car park and boxing club.

Sectional model of existing building near site 1:10. Based on Molly Nash's Year 3 Technology Report.

Boxing Club as site precedent study, material build-up.

Proposed material arrangement, heavy (sense of grounding) to support light (lifting the community up).

Proposed Textures on Site

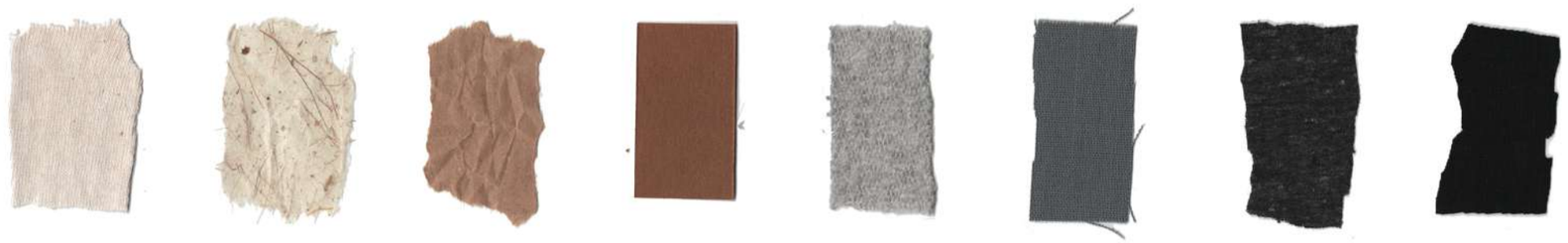
Experiential mapping through collage and development of site photographs has allowed for material progress evolving the proposal.

The existing site has a degree of social value. The proposal and vision aim to add to this through material representation and internal uses. The boxing club acts as the little immediate vernacular helping to inform the building in terms of materials and form. The wider regional context has also been a key influence in developing the building's material and tectonic language as it's place in Wales should be valued. Numerous welsh buildings are modest in form, appearance and structure. However, they are rich in life, valued socially and emotional, and highly animated internally.

The following images explore the addition of modest materials and traditional welsh textures to the site. They play upon ideas of verticality and light being supported by dark. The proposal aims to effortlessly represent the vast welsh heritage of the site through long-established surface finsihes and character.

Through the provision of both hard and soft textures, anti-social behaviour is lowered and community spirits are almost lifted towards the tree-scape.

St Fagans National Museum of Wales - https://museum.wales/stfagans/castle-and-gardens/



Introduction of a Green Roof:

Greenery in the City - Green sustainability Agenda

The main disadvantage of greenery in cities is that it needs year-round, continuous maintenance and care. Doing this is an on-going commitment and cost for the client for the entire lifespan of the building, particularly where the new landscape is not adopted by the Local Authority.

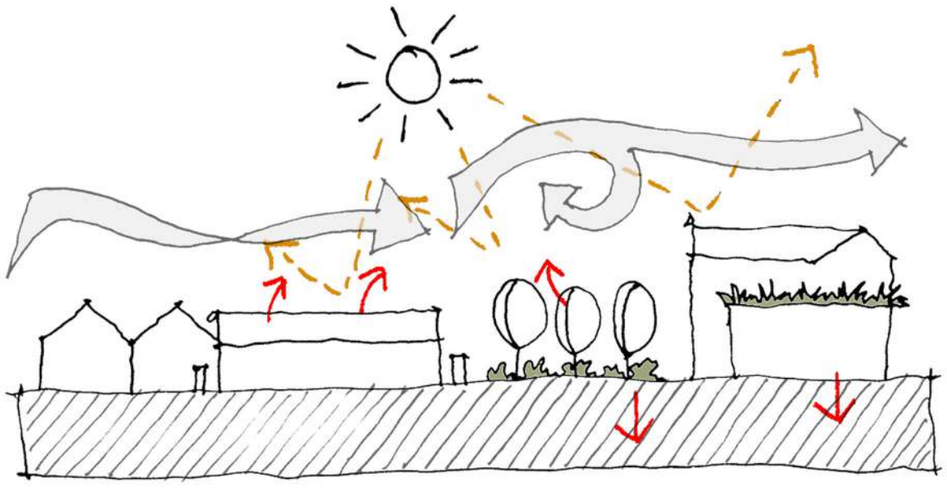
Temperatures

Urban areas are usually around 4–5°C warmer than the surrounding countryside. While this may be beneficial in the winter, in summer it may lead to overheating in buildings and exacerbate health issues. Reducing CO2 locally and globally benefits the environment as well as human health. Passive cooling measures are preferred instead of providing active cooling which would increase CO2 emissions.

During the daytime, soil evaporation and the shade from trees creates a 'park cool island' effect, with temperatures in parks 2–3°C lower than the surroundings. The larger the green space, the greater its tempering effect, although this effect can still be felt with spaces as small as 10 m diameter.

Vegetation

A 'cooler' city is one where light surfaces and vegetation are combined to create shade, reflect sunlight and provide cooling through evaporation. Urban vegetation, combined with light and reflective surfaces, can reduce surface temperatures by 10–20°C. There are also winter benefits if the vegetation is evergreen and sufficiently dense. The solar reflection coefficient, (or albedo), is the percentage of solar radiation reflected by a surface, using a scale of 0–1. As materials age, their albedo changes. The closer to 1 (or 100%), the better the surface is at reflecting the incident radiation and keeping surfaces cooler. However, reflected heat from some surfaces may be absorbed again by surrounding buildings and can cause damage to property. Providing a green roof and an overhang of green that spans into the vertical plane of the building improves the solar reflection coefficient.



Reduced solar absorption from vegetated surfaces (The Environmental Handbook Guidance)

Existing Boxing Club photograph, Molly Nash. Edit with green roof.
Material palet exploration. Dark and heavy against nature.

Key Observations of site and client comments

• All routes are walkable and cyclable.

• Inclusive design is high on the agenda, and constant natural surveillance is encouraged through high levels of glazing and accessibility.

• Large outdoor spaces provide ample opportunities for sporting clubs, fresh air, education and species/habitat developemnt.

• The trees and vegetation surrounding the site provide privacy and there are strong potential views across the park. The vegetation provides views to the existing fields and houses (as seen in the site photos).

• There are north light opportunities for comfortable daylight while the south is shaded by trees (seen in entrance photos). The northern light brings opportunity for lighting. Whereas, southern shade will provide possible heating difficulties fom a solar gain perspective.

• Existing materials can be seen throughout the site photographs. Brick and render is predominant in housing and school cladding due to cost and ease of construtcion.

Response To Observations

• Create a destination which has an inviting public realm and includes flexible indoor and outdoor spaces for community events.

• Creating a building which is simple in construction which can be phased to reduce up-front costs and the community can have a direct involvement in the building process.

• Create a building that enhances key views - through lifting the eyeline above ground level. Surveillance of the parkland is preferable and complete surveillance of the nursery is necessary.

• Co-producing a building that meets the needs of the diverse client groups, which include the on-site nursery, various sports clubs and community groups.

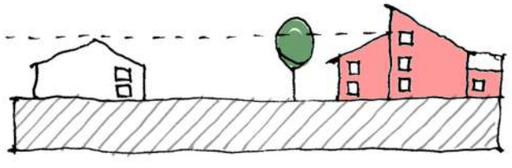
• Creating spaces which are filled with daylight, allowing for optimal learning environments.

• External spaces which are highly lit at night to reduce vandalism and anti-social behaviour.

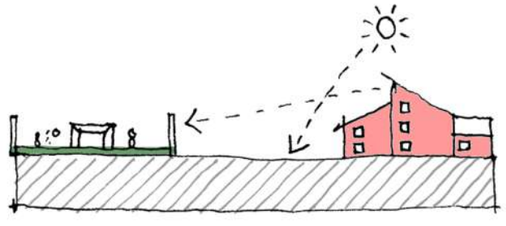
Developed from Stage 3 Group Document

Site and proposal relations

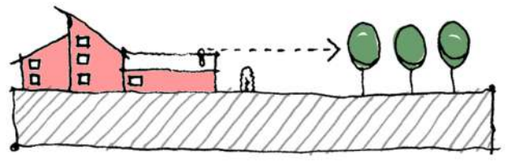
Relationship to 2-storey Existing Boxing Club



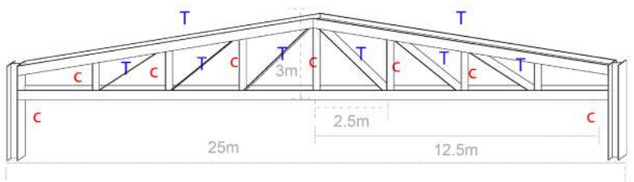
Relationship to Existing Astro Turf



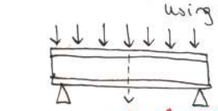
Relationship to Green Spaces



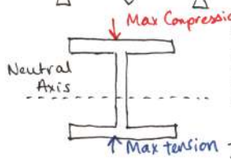
Analysis of the existing Boxing Club investigating structural propoerties of trusses and material impacts in order to develop a new timber truss system for the nursery proposal.



I-beam; handles a maximum bending load while using the least amount of material.

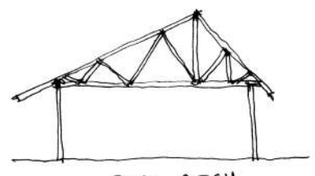


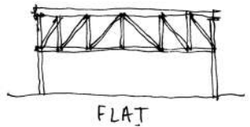
Max Deflection = $\frac{5WL^3}{384EI}$

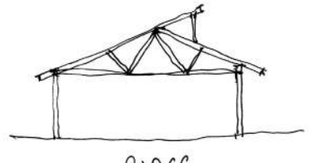


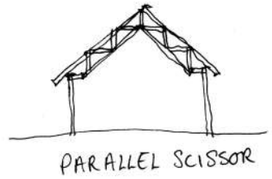
W = UDL (uniformly distributed load) (N/m)
L = Span (m)
E = Young's Modulus (N/m^2) [describes the stiffness of material]
I = Second Moment of Area

Larger area of material away from the neutral axis means larger second moment of area = stronger shape = smaller deflection.

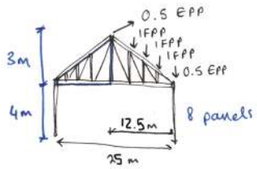








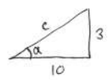
Dead Load Calculations of Existing Boxing Club Structure



Angle of roof truss (α)

$\tan\alpha = \frac{3}{10}$

$\alpha = 17°$ (rounded (1sf))



Length of c,

$3^2 + 10^2 = c^2$

$c = 10.44$ m

Half plan area = $12.5 \times 5 = 62.5\ m^2$

Half slope area = $10.44 \times 5 = 52.5\ m^2$

(1) weight of roofing material,
A.C.C sheet = 150 N/m^2 (on slope)
∴ weight of roof material = $150 \times 52.5 = 7875$ N

(2) weight of purlin,
weight = 120 N/m^2 (plan area)
∴ weight of purlin = $120 \times 62.5 = 7500$ N

(3) self weight of roof truss,
$\Rightarrow 10\left[\frac{span}{3} + 5\right] N/m^2$
$= 10\left[\frac{20}{3} + 5\right]$
$= 116.7$ (1dp) (on plan area)
∴ self weight of roof truss = $116.7 \times 62.5 = 7293.75$ N (1dp)

(4) weight of wind bracing,
12 N/m^2 assume on plan area
weight of wind bracing = $12 \times 62.5 = 750$ N

(5) Total dead load = (1) + (2) + (3) + (4)
$= 7875 + 7500 + 7293.75 + 750$
$= 23418.75$ N

⇒ one side of the roof truss = 4 panels
∴ dead load per panel point = $\frac{23418.75}{4} = 5854.69$ N

Live Load Calculations of Existing Boxing Club Structure

Live loads issued on purlins for > 10° slope. [existing slope = 17°]. = 0.75 kN/m²

$\Rightarrow 0.75 - (\alpha - 10°) \times 0.02$ kN/m²
$= 0.75 - (17 - 10) \times 0.02$
$= 0.75 - (7) \times 0.02$
$= 0.61 > 0.4$ kN/m²

∴ live load on roof truss = $\frac{2}{3}$ live load on purlins
$\Rightarrow \frac{2}{3} \times 610 = 406.67$ (plan area)

Total live load,
$406.67 \times 62.5 = 25416.88$

Live load on full panel point,
$\frac{25416.88}{4} = 6354.22$
$= 6.35$ kN [1kN = 1000 N]

Live load on end panel point,
$\frac{6354.22}{2} = 3.18$ kN


Model of Existing Boxing Shed Structure 1:100
(exploring truss strength and qualities to adapt in the proposal)

Green Roof Strategy

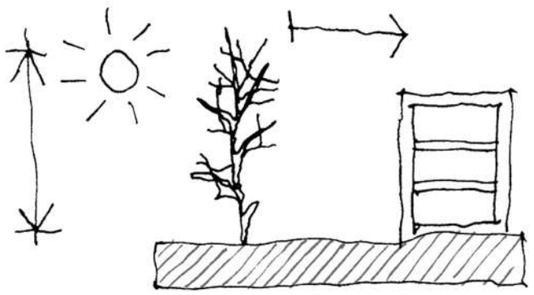
Evergreen vegetation can reduce wind speeds in winter. This minimises unwanted air-infiltration, particularly for badly insulated/non-airtight buildings. Allowing the greenery to almost engulf the nursery will improve heatloss coefficients and allow for cheaper running costs.

In summer, however, vegetation should not prevent natural ventilation which relies on wind speeds and air-infiltration through open windows. Year-round natural daylight and solar gain in winter should not be compromised. Therefore, allowing the green to trickle down one side of the nursery means that wind can still penetrate the building and enable natural ventilation.

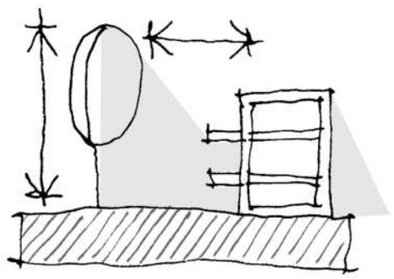
There is a clear correlation between the location of a dense, mostly evergreen, 'shelterbelt' and the reduction of space heating demand. This is because the vegetation barrier reduces wind speeds, minimising draughts and heat losses. This creates a more pleasant opening and welcome area to the nursery which is sheltered from the wind. The noise at the nursery entrance is also reduced.

Vegetation helps to screen noise but it is not a sufficient noise barrier on its own. This is particularly the case in winter when there are no leaves on deciduous plants. The presence of trees does have a psychological impact: they may visually screen the source of noise and distract from it with the sound of leaves in the wind.

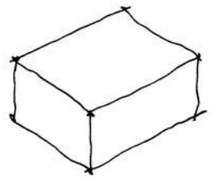
The rooftop garden space would benefit from native plant species as they support a diverse native wildlife. They provide food, shelter and nesting places for small mammals, amphibians, birds, butterflies, bees and other insects, all of which children in the nursery would nebefit from seeing and interacting with. The importance of local habitats and biodiversity is reflected by BREEAM, Code for Sustainable Homes, EcoHomes and LEED, which award credits for supporting local biodiversity habitats.



Summer Solar gain - 80% summer solar gain reduction

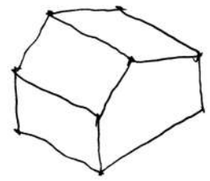


Winter Solar gain with deciduous vegetation - 30% winter solar gain reduction



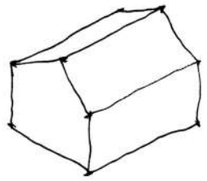
Flat roof:

- Host activities
- Viewing platform



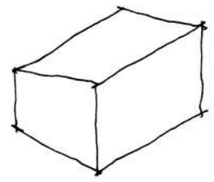
Pitched roof:

- Slope towards bowling green



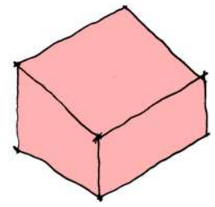
Pitched roof:

- Slope towards playing fiels
- Ideal south solar panels



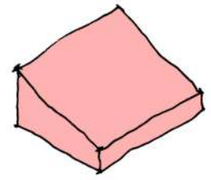
Sloped roof:

- Viewing platform
- Looks towards cafe



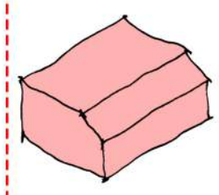
Sloped roof:

- Slope towards playing fields
- Solar gain



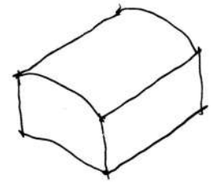
Deep sloped roof:

- Slope towards playing fiels
- Steep viewing
- Solar gain



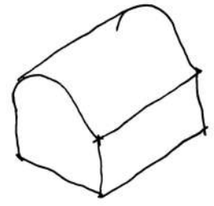
Combination roof:

- Viewing platform
- Sloped for solar gain and green spread



Curved roof:

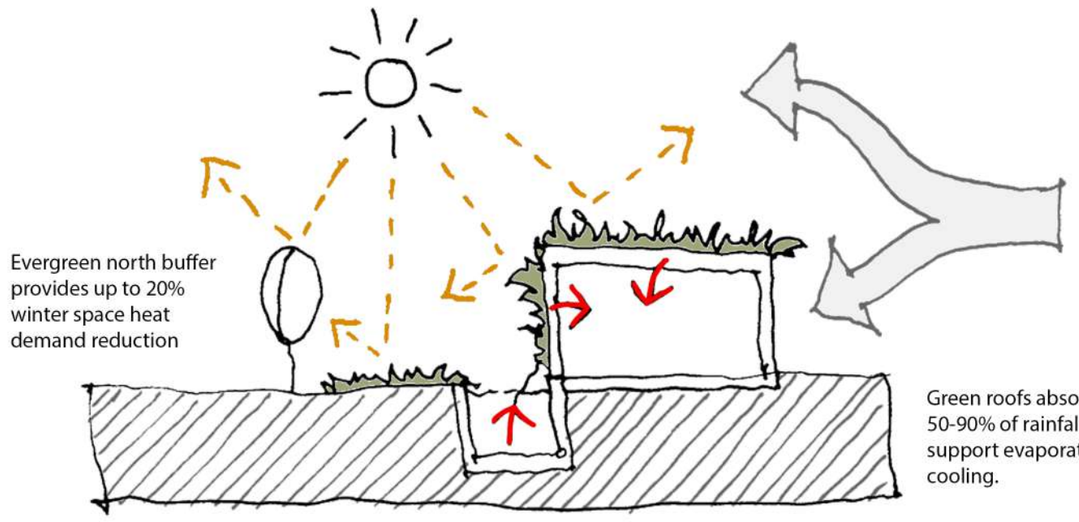
- No activity
- More complicated construction



Curved roof:

- No activity
- More complicated construction

Chosen roofscape to h0 use greenery and create space for external activity. A combination of flat roof and sloped creates the opportunity for increased water absorption, reduced heating requirements, natural shading and safe external play space. The combination roof ties in with and informs the child-scaled entrance along the 'rabbit hole' theme (discussed on subsequent pages.



Permeable paving only lowers surface temperatures when wet but can remain wet through vegetation planting and watering

Frame Concept and Structural Experimentation

An open framework/lattice of interwoven or intersecting pieces of wood create the main structural elements of the nursery. They are based upon the trellis that is normally made to support and diplay climbing plants and shrubs.

The truss supports the green roof whilst acting as an internal climbing frame for the nursery children and a means to display work.

Advantages of Truss Systems

The existing steel frame shed of the boxing club is made up of a series of I-beams and pratt-trusses. The precedents take similar truss concepts and attributes in timber.

The truss systems are pre-engineered buildings with many advantages as follows:

- Economical Construction
- Earth Quake Resistance
- Infinite Choices of Layout
- Unique Aesthetic Appeal
- Negligible Maintenance Cost
- Ease in Future Expansion
- Large and Clean Span
- Fast Construction Speed

The concept of the proposal adheres to the above criteria and allows for community and social expansion, while introducing a unique structural system to the site - something unique to Trelai community. The proposal can be quickly and cheaply built on site or prefabrecated off site and transported.

Learning Outcomes:

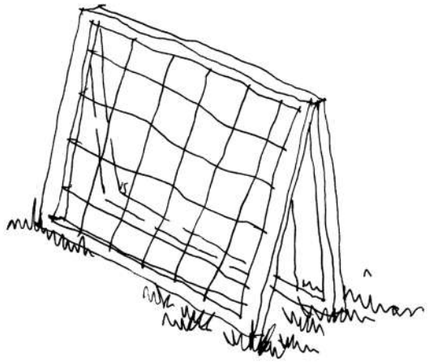
Splintering occured causing longer supporting beams to buckle

Well-supported truss slope was last to break, along with traditional flat roof truss structure. Triangular support is adequate here.

Smaller supporting webs showed signs of slintering under medium weight. Signs of compresion are clear.

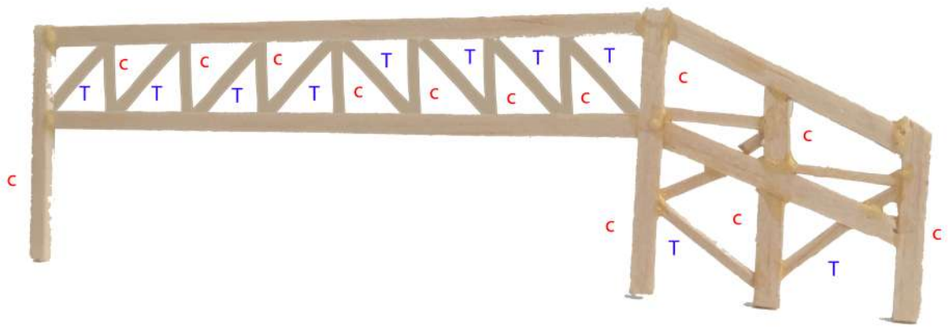
Truss coped well in terms of tensile testing as wood was not affected, but (simple glue) joints gave way.

Trellis Structure

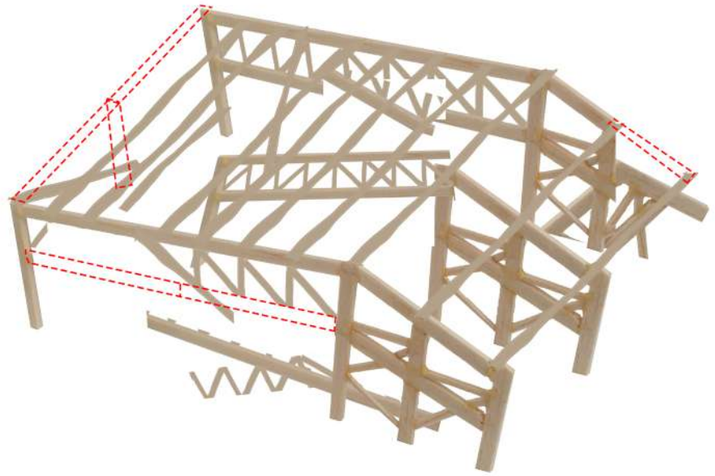


Proposed Combination Truss Model 1:30

Compression, C
Tension, T



Proposed Combination Truss Model 1:30 Loading Experiments



El Ganeno Horse Stables and Warehouse
Penafiel & Valdivieso Arquitectos, 2016

Cafeteria with Exposed Timber Truss
Niji Architects, 2013

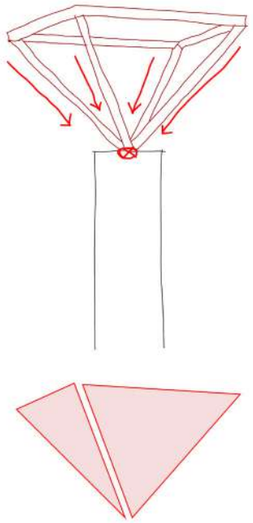
R.W. Kern Center's Minimalist Timber Structure
Bruner/Cott Architects, 2016

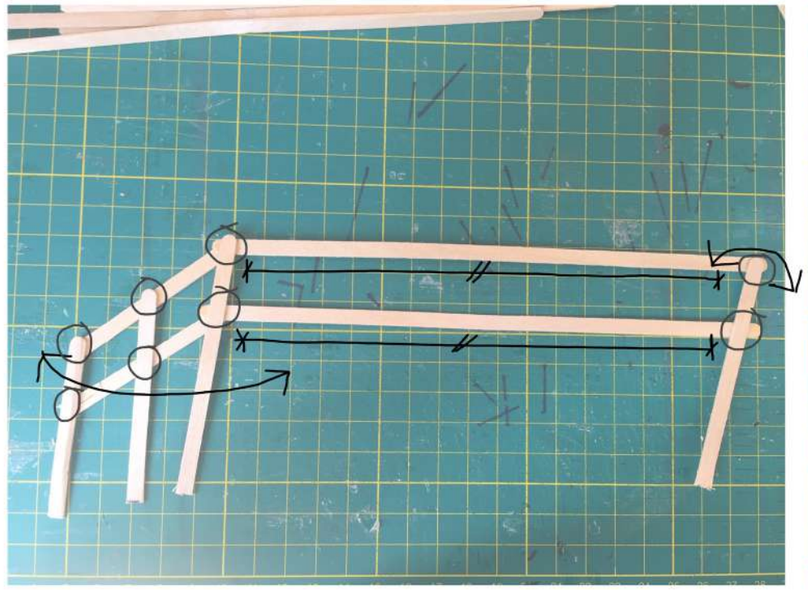
Truss Structural Experiments

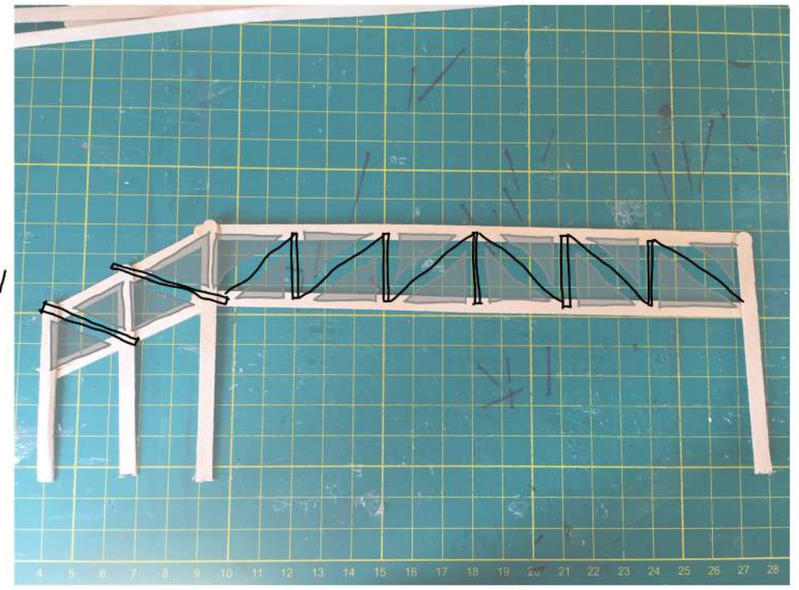
When exposed to pressure and weight the wood splinters before the joints break.

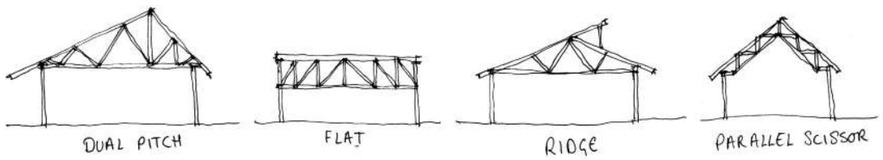
Single triangle truss testing carried out through modelling and sketch work. This type of truss is seen in a framed roof consisting of rafters and a ceiling joist. It is also seen in mechanical structures such as bicycles and aircraft, due to the stability of this triangular shape.

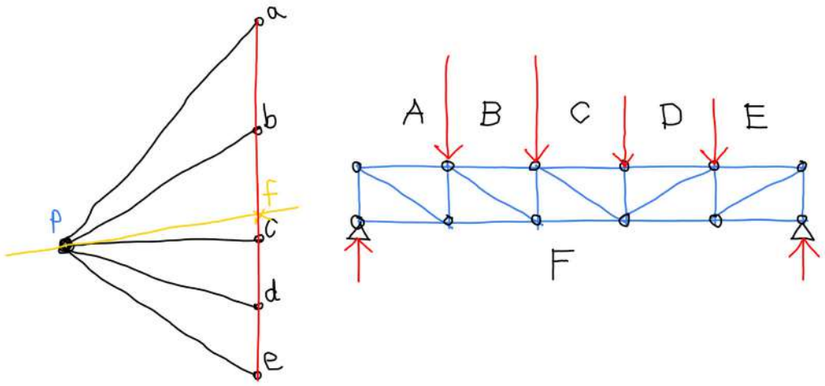
A simple/triangular truss can be constructed through a successive addition of pairs of members, that are each connected to two existing joints, forming a new joint. This uses trangles but does not require the final shape to consist of triangles. For example, the traditional diamond-shape bicycle frame utilises two conjoined triangles. A similar techniques has been adopted here to form a structurally sound building whilst allowing deisgn methods of play to be introduced internally.



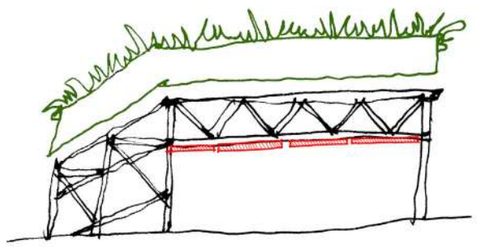


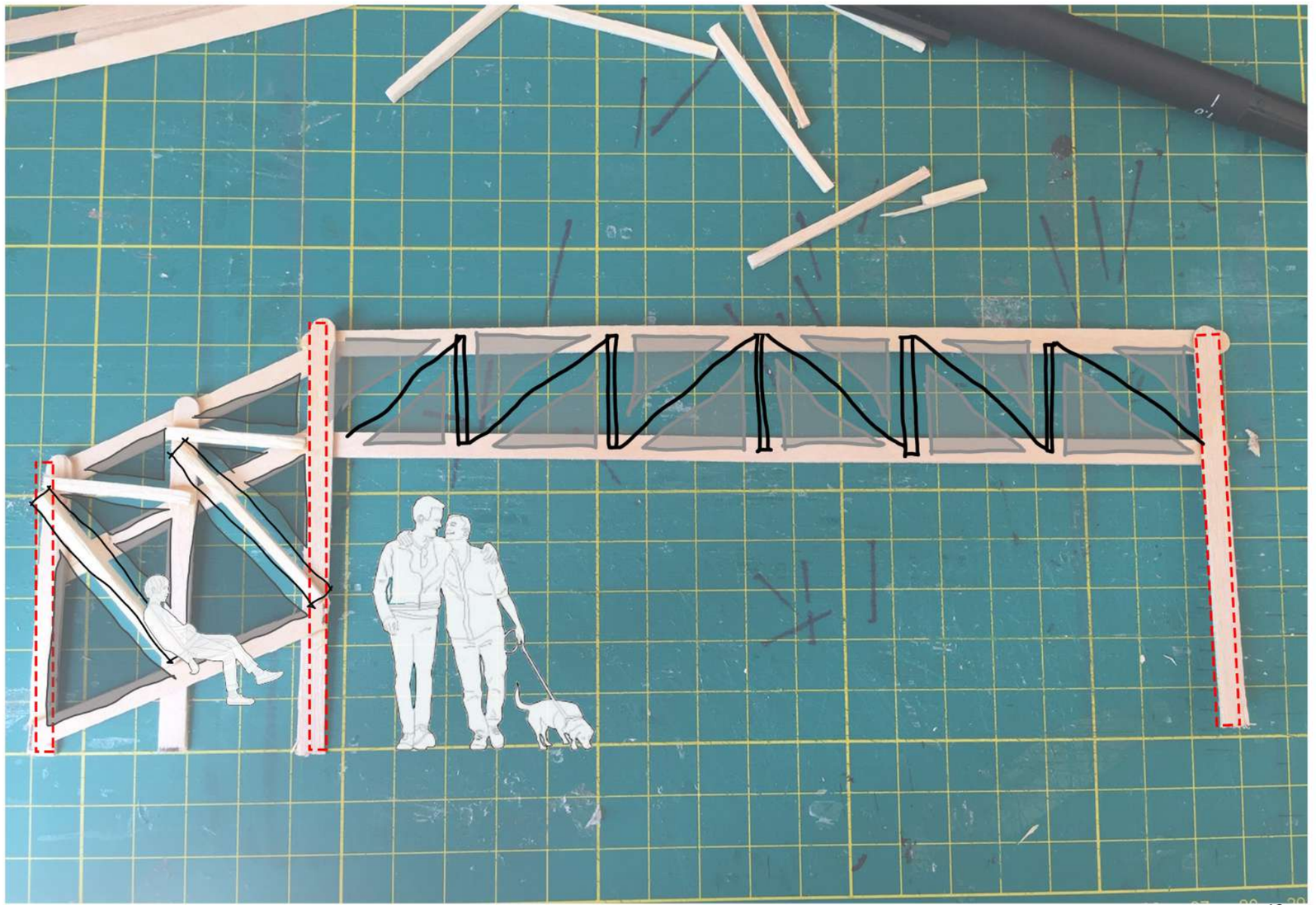






Forces and distribution - diagonal informing forces applied to verticals to decrease bending of horizontal elements. Equal distribution chosen in models.





Heating and Ventilation Strategy

Localised Heating System - Primary heated areas that will be occupied (Main Space, Kitchen, Toilets, Staff Room)

In the main corriodr space a mobile paraffin heater can be used since it is much more economical than electric heating systems and the space will not be used al of the time. Centralised management of heating with enhanced localised control of radiators allow significant energy savings (30%). Decentralized heating systems allow individual control of the temperature in different areas of a building as needed. This ensures that heating costs are kept to a minimum. These systems are often very practical in the context of large commercial spaces. When dealing with massive square footage, it can be financially impractical to keep the entire space heated to a consistent temperature.

Advantages of decentralized heating systems:

Easy and cheaper to install than centralised heating (can be installed when needed). Allows for easier individual control of separate spaces (cheaper in the long run) Can be more affordable when dealing with large spaces (different atmospheric zones for needs). Repairs only involve units in the spaces where the fault occurs (cheaper long term costings)

If temperature changes from 15 °C to 30 °C, the length of an LVL beam changes correspondingly:

10 000 mm –> 10 000 + (15 · 4.0 · 10-6 · 10 000) = 10 000.6 mm (which is a negligible amount).

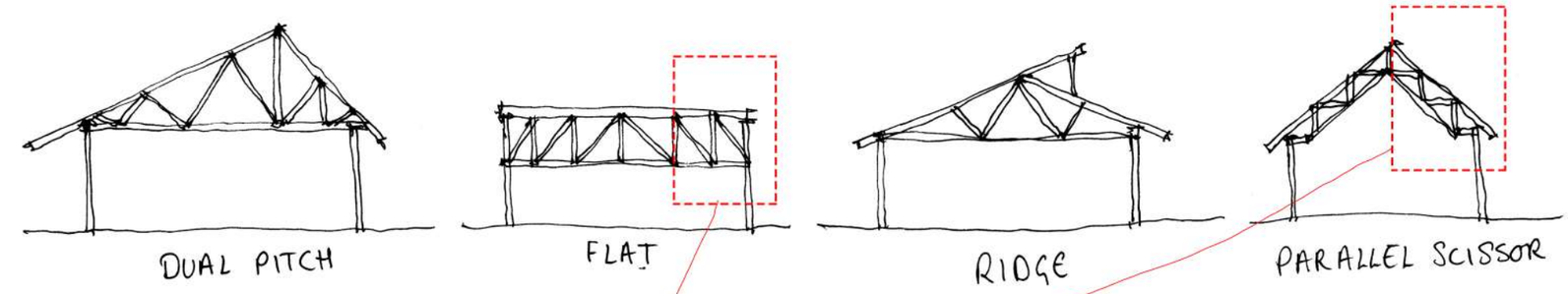
https://www.metsawood.com/global/Tools/MaterialArchive/MaterialArchive/kerto-manual-lvl-thermal-properties.pdf

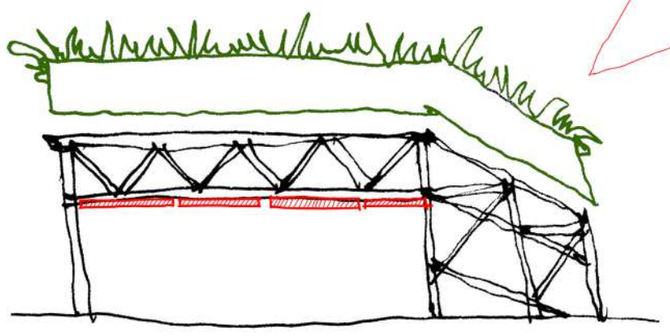
Heatloss Calculations
Standard 6.2, Non-Domestic Technical Handbook-

"communal parts of domestic buildings which will not be heated heat loss regualtions are limited"
[Source | Met Office UK]
Heatloss through any given element
= U-Value x Surface Area x Temp. Difference

When,
Interior Temperature (winter) = 18 degrees celcius
Interior Temperature (summer) = 22 degrees celcius
Exterior Temperature (winter) = 2 degree celcius
Exterior Temperature (summer) = 20 degrees celcius

For Nursery (2.d.p),
Roof (winter) Heatloss = [0.34 x 97.5 x 16] = 530.4 W/m2
Roof (summer) Heatloss = [0.34 x 97.5 x 2] = 66.3 W/m2
Wall (winter) Heatloss = [0.24 x 39 x 16] = 149.76 W/m2
Wall (summer) Heatloss = [0.24 x 39 x 2] = 18.72 W/m2
Floor (winter) Heatloss = [0.87 x 97.5 x 16] = 1357.2 W/m2
Floor (summer) Heatloss = [0.87 x 97.5 x 2] = 169.65 W/m2



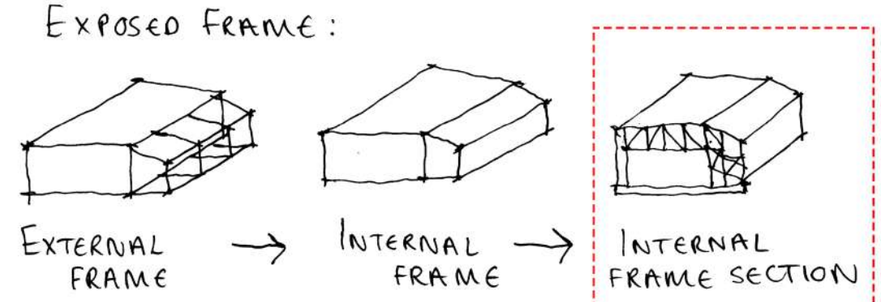


Exposed internal truss with green roof

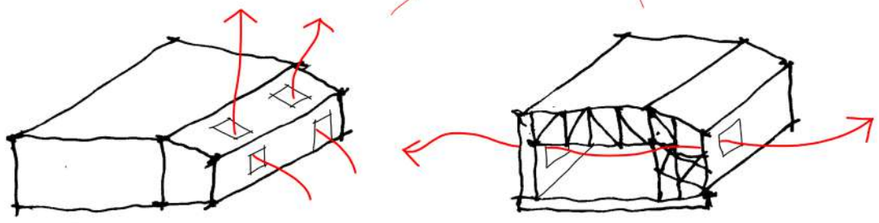
Reverberation Times
Added suspended acoustic mineral wall tiles to the ceiling in order to improve the reverberation time.

http://www.sengpielaudio.com/calculator-RT60Coeff.htm

Resonics recommends a reverbeation time of less than 1.5 seconds for good speech intelligibility in village halls. However, reverberation time in village halls is often around 4 seconds or more. When the proposed nursery is full, it is within the guidelines for good speech intelligibility (0.4) creating a non-stressful environment for children and visitors.



Building width is within 7m, so stack ventilation is not necessary, but roof lighting allows for improved internal lighting.



Ventilation

Natural stratification of rising warm air (stack effect) will be used by proposal with the prevailing wind pressure to draw air into, around and out of the building. Ventilation can fully be controlled by the occupants through adjustable windows. MVHR systems can be introduced between the exposed flanges and lower chords of the trusses. MVHR systems extract warm, damp air from the building and draw in fresh air from the outside. The fresh air is pre-warmed by the pumed interior air but does not come into contact with pollutants.

A lot of the natural light on site is determined by the trees. During the winter, the leaves shed, allowing more natural light into the scheme. The trees then offer a lot of natural shade in the summer which has health benefits for humans. Each individual unit propsed has openings punctured based on their location within the grid structure. Therefore, cross ventilation occurs more often than not. Openings in the internal walls also encourage natural ventilation and natural light throughout the proposal.

Structural Material Comparison

The Alternatives to CLT (StGE 3 Group Document Suggestion)

The use of engineered wood products is an essential component of nearly all wood-framed buildings. Structural composite lumber (SCL) is a term used to describe a family of engineered wood products created by layering wood veneers or strands and bonding them with moisture- resistant adhesives to form structural framing members such as beams, studs, and columns. SCL members provide numerous advantages over sawn conventional lumber, including higher strengths, dimensional stability, and resistance to moisture changes. SCL consists primarily of three products: Laminated Strand Lumber (LSL), Parallel Strand Lumber (PSL), and Laminated Veneer Lumber (LVL).

7/9

- [x] Aesthetics
- [x] Price
- [x] Strength

Laminated Strand Lumber (LSL)

LSL is manufactured from flaked wood strands and resembles oriented strand board (OSB) in appearance, though the strands are arranged parallel to the longitudinal axis of the member. LSL is typically less expensive than other engineered wood beams. Due its high allowable shear strength, LSL beams have capacity for larger penetrations than other engineered wood beam options. While not as strong as LVL or PSL beams, LSL is generally cheaper and are ideal for short spans.

5/9

- [x] Aesthetics
- [x] Price
- [x] Strength

Parallel Strand Lumber (PSL)

PSL is manufactured from veneers laid into long, parallel strands and bonded together. PSL beams are generally more expensive than glulam, LSL, or LVL beams. PSL beams can be stained or finished where an aesthetically pleasing exposed application is desired.

6/9

- [x] Aesthetics
- [x] Price
- [x] Strength

Laminated Veneer Lumber (LVL)

LVL is a commonly available engineered product that is manufactured similarly to PSL. Available sizes, strengths, and stiffnesses are similar to PSL but are generally cheaper, making it a commonly specified beam type. A benefit to LVL is that it can be fabricated in narrower beam widths (1 ½, 1 ¾"), and multiple plys can be nail-laminated together to form a larger beam. This is especially beneficial in retrofit options where lifting a wide, heavy beam into place is cumbersome or infeasible. LVL stud and columns are available as well from some manufacturers.

9/9

- [x] Aesthetics
- [x] Price
- [x] Strength

Glued Laminated Timber (Glulam)

Glulam is manufactured by face-bonding layers of kiln-dried timber members, typically 2×4 or 2×6 in size, together with waterproof adhesives to form timber section. Glulams are popular due to their engineered strength, versatility, availability, and cost. Manufacturing processes for glulams allow for members to be cambered, curved, and fabricated in unique shapes. Glulams have a long history of being used beautifully in exposed, large open areas such as vaulted ceilings, churches, theatres and a vast array of other public spaces.

7/9

- [x] Aesthetics
- [x] Price
- [x] Strength

Structure
truss comparison | forces | spans | loads

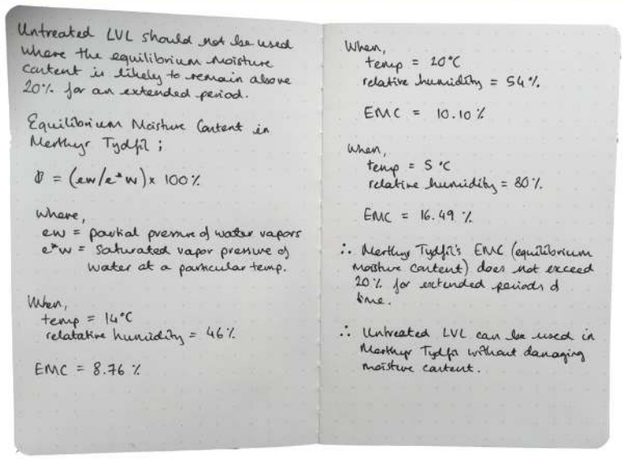
Chemical resistance

LVL (laminated veneer lumber) has an advantage over steel members when exposed to corrosive environments. Timber and wood products are able to withstand mild acid conditions and are more resistant to degradation. The behaviour of LVL in chemical environments depends upon a number of factors, including PH and temperature. Being located on an industrial estate increases the risk of chemical interaction. Wood essentially responds by either swelling (Category S), similar to moisture response, or by chemical degradation (Category D). Damage due to swelling is essentially reversible, but chemical degradation results in breakdown of the wood structure and is non-reversible. Category S agents include alcohol and other polar agents. These agents are most likely to occur on an industrial estate and swell dry wood causing a strength (and stiffness) loss proportional to the swelling.

Table reference Williamson T.G. 2002 APA Engineered Wood Handbook.

[1] Approximate moisture content of LVL at 21 degrees celcius.

Agent category	Chemical agent	Mode of attack	Damage - reversible or permanent	Severity - (loss of strength and/or stiffness)
Neutral	Non-polar liquids such as petroleum hydro-carbons	None	Negligible	Negligible
S (swelling)	Alcohol and other polar solvents	Swelling	Reversible	Proportional to volumetric swelling
D (degrading)	Inorganic acids	Hydrolysis of cellulose	Permanent	Slight to moderate
D	Organic acids such as: Formic, acetic, propi-onic and lactic acid	Hydrolysis of cellulose	Permanent	Slight (pH 3-6)
D	Alkalis such as: sodium, calcium and magne-sium hydroxide	De-lignification of wood and dissolving of hemicellulose	Permanent	Moderate (pH > 9.5) Severe (pH > 11)
D	Salts (considered as weak acids)	Hydrolysis of cellulose	Permanent	Slight



Treating LVL

To provide the longest service life of LVL it is recommended the LVL is painted with an exterior paint with a Light Reflectance Value (LRV) greater than 30%. Heat reduction exterior paints should be used where the desired colour is dark or has a LRV of less than 30%.

A hydrophobic surface must be aplied to the LVL that is exposed to the elements. This can be a transparent paint or oil which provides the wood with protection against rain and other liquids. Some treatments also allow the wood to breathe and water vapour to move freely (Kerto WeatherGuard®).

https://www.metsawood.com/global/Products/kerto/Pages/Kerto-WeatherGuard.aspx

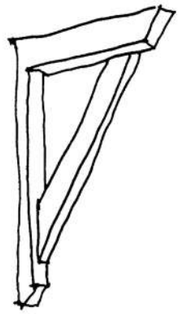
Joinery Exploration and Detailing. Axo at 1:50.

Timber construction details have been kept simple in order to celebrate the community and involve them in the main truss construction.

The design of the sandwich joint is simple and industrial, in keeping with the location and neighbouring industrial boxing club. The sandwich increases the cost due to an increased amount of timber required. However, the design and aesthetic considerations outweigh the cost in order to create a focal point of the build and to acknowledge the vast craftmanship the site has experienced in its vast Roman History.

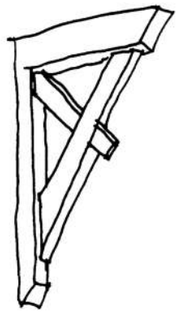
The structure requires minimal steel support, simply pins, in order to create a natural tree-like appearance and warm, human-feel (as opposed to harsh, cold steel plating throughout).

Other avenues have been explored, though the sandwich joint was chosen so that the building remains quick and easy to build on or off site. The craft and carpentry techniques can be taught and carried out by the community

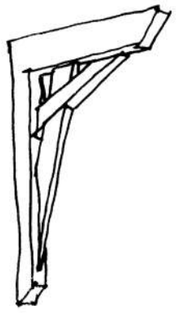


Traditional Bracket

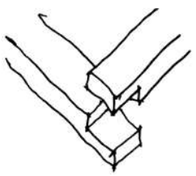
Curved Bracket



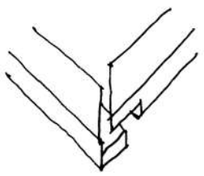
Tang Bracket



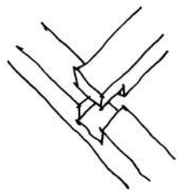
Cross Bracket



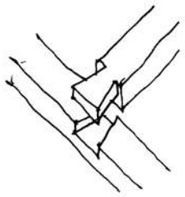
Half Lap Joint



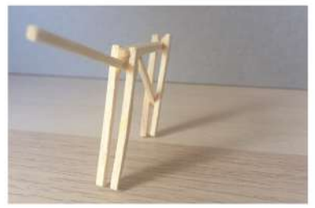
Mitred Half Lap Joint

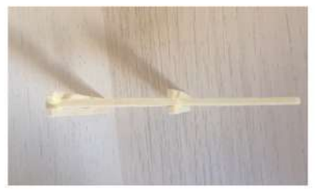


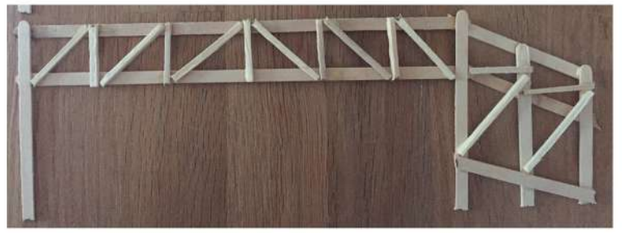
Cross Lap Joint

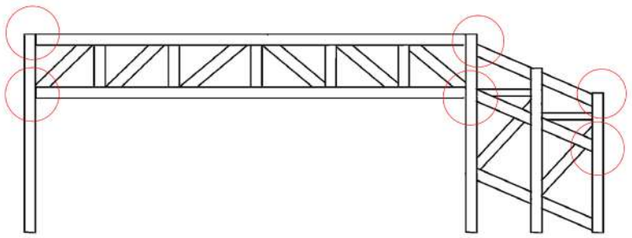


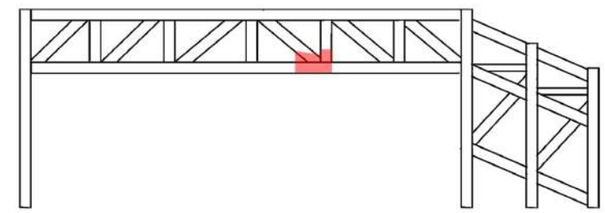
Dovetail Crossed Lap Joint



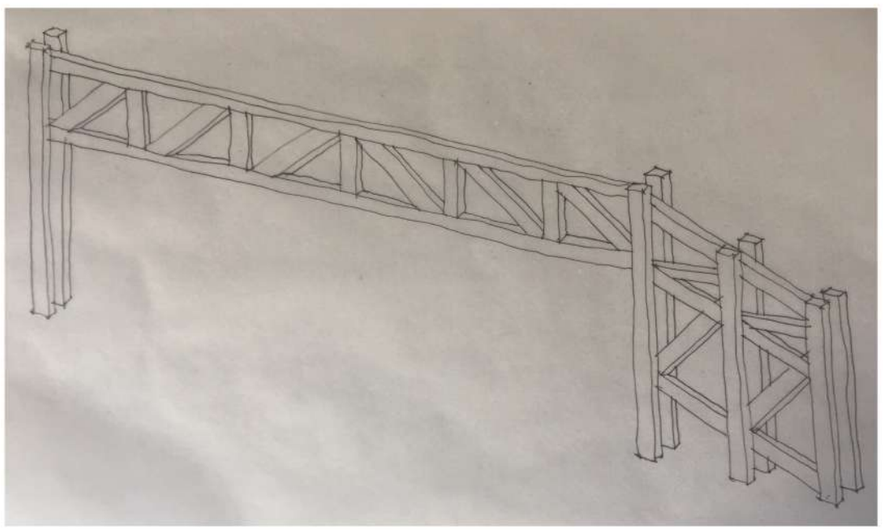








Metal Plate - Restrictive.
Can represent 'community' and 'togetherness' through a single strong metal bond.

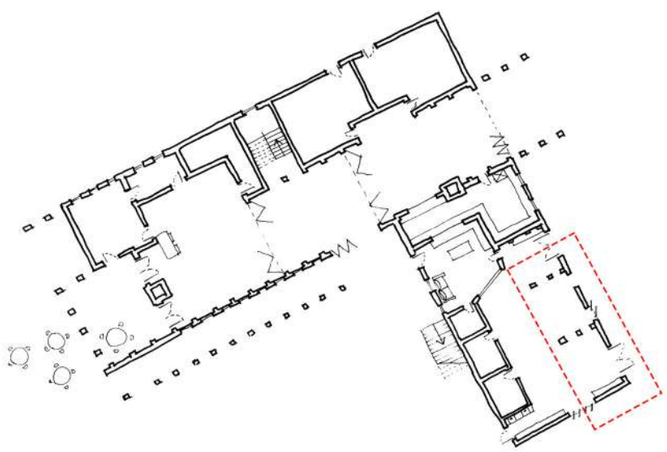


Concept sketch showing timber sandwiching ideas.
Sketch not to scale, developed beam thickness into model.

Truss Sandwich model 1:50.

Interior Model 1:20

Demonstrating internal atmosphere created by the interactive truss.



N

Laminated Veneer Lumber (LVL)

The grains of LVL all run in the same direction which makes it very stable. Due to its tensile strength, it holds up a lot of its own weight without sagging and makes it good for door | window headers, cantilevered roof supports etc. Its strength also gives it the ability to span long, open spaces, eliminating the need for posts.

LVL is commonly used in framing buildings. The finish of LVL is low quality as the glue line is often visible, but LVL can be sanded and painted or stained. LVL can replace regular lumber. It is most commonly used for flanges in timber I-beams and ply-webbed box beams. It takes less trees to make a lot lumber veneer than it does to make whole sawed lumber. Therefore, the environmental impact is lowered.

Reclaimed Timber

Reclaimed timber is locally sourced from Reclaimed Timber Merchants. It is used to externally clad the proposal and can be carried out by the community in the form of panels. The ageing feel and appearance of the wood can add a touch of history to the scheme and give the illusion of a longstanding role in the community, especially when combined with more modern furniture and objects.

Due to its history and past use, the timber is more than likely to have been exposed to hot and cold atmospheres and a wide range of elements for a significant period of time. As a result, it is fully dried out and has already performed all the expanding and contracting it is ever going to do, considerably reducing the risk of the wood splitting or warping in the future.

Slate Cladding - Replaced by vertical fins painted (blackboard paint)

Due to its natural properties, slate is only submitted to the processes of extraction and shaping. It requires no additional treatment, substantially reducing CO2 emissions into the atmosphere. When comparing natural slate to other materials, its results in terms of air pollution, water and energy consumption, are the lowest, even to terracotta, zinc and fibre cement.

Stone Cladding

The rough surface of the stone will deter vandals. Replicating the look of natural stone can be prohibitively expensive when using full-sized pieces. Stone tiles cost far less and deliver the exact same look; installation is less expensive too and can be carried out using the most basic tools and skills.Material transportation costs are also reduced. The stone cladding is common for internal uses that include fireplaces and floors.

Concrete Flooring

Concrete flooring is low-maintenance, durable and easy to care for. When properly sealed, concrete floors shrug off dirt, grit, stains, spills and hard impacts. Little sweeping is required to maintain the floors and mopping can keep them looking like new which makes it extremely easy for the community to maintain. Lots of people will be walking in and out with muddy shoes and sports equipment, so a surface that can be maintained quickly and simply is vital.

Component	Material	Thickness (d) (mm)	Thermal Conductivity Coefficient (k) W.m-1.K-1	Resistivity*
Roof	Exposed Timber Supports	10	0.19	0.05
	Interior Birch Faced Ply	20	0.6	0.13
	Sound Insulation Panels	N/A	N/A	N/A
	Timber Support Panel	N/A	N/A	N/A
	Steel Sheeting	10	201	0
	Thermal Insulation	50	0.16	0.42
	Waterproof Membrane	N/A	N/A	N/A
	Drainage Layer	N/A	N/A	N/A
	Root Barrier	N/A	N/A	N/A
	Growing Medium	150	0.16	0.83
	Vegetation	N/A	N/A	N/A

R-Value = d (m) / k
U-Value = 1 / Total Resistivity
= 1 / 1.43
= 0.6993007
= 0.70 W/m2K (2 d.p.)

0.7 does NOT comply with the non-domestic regulation of a maximum U-Value of 0.35. When 100mm increase in insulation and add concrete layer, U-Value = 0. 33 W/m2K (2 d.p)

Component	Material	Thickness (d) (mm)	Thermal Conductivity Coefficient (k) W.m-1.K-1	Resistivity*
Wall	Interior Birch Faced Plywood	20	0.16	0.13
	Plasterboard	10	0.19	0.05
	Timber	30	0.16	0.19
	Thermal Insulation	200	0.16	1.25
	Airtight Membrane	N/A	N/A	N/A
	LVL Battens	200	0.13	1.54
	Stone Tile Cladding	70	1.4	0.98

R-Value = d (m) / k
U-Value = 1 / Total Resistivity
= 1 / 4.14
= 0.24154589
= 0.24 W/m2K (2 d.p.)

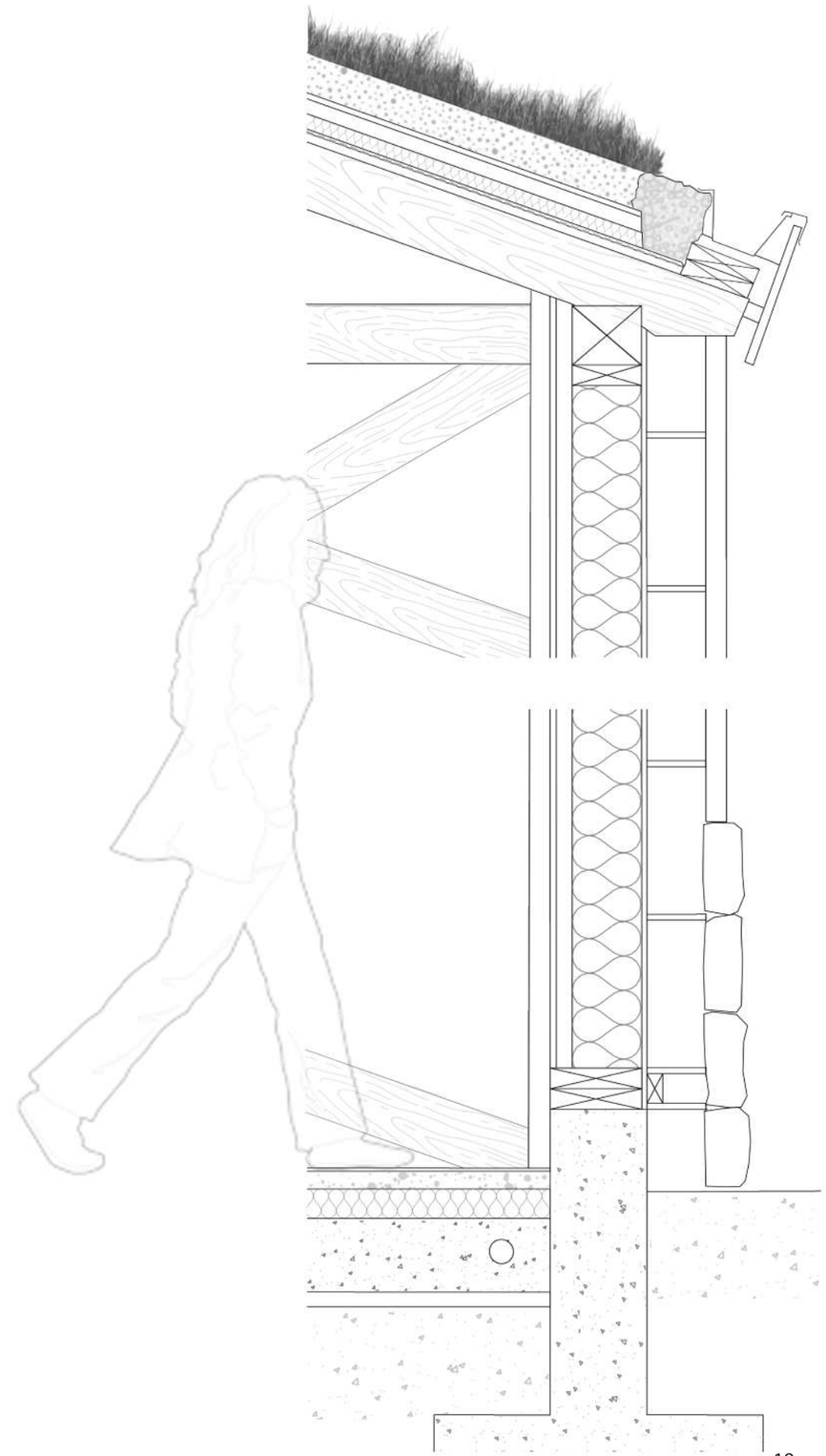
0.24 does comply with the non-domestic regulation of a maximum U-Value of 0.7.

Component	Material	Thickness (d) (mm)	Thermal Conductivity Coefficient (k) W.m-1.K-1	Resistivity*
Floor	Hardwood	20	0.19	0.05
	Screed	60	2.2	0.03
	Separating Layer (Fleece)	2	0.04	0.05
	Impact Sound Insulation	200	0.16	1.25
	Reinforced Concrete	250	0.8	0.31
	Lean Concrete	50	0.6	0.08

R-Value = d (m) / k
U-Value = 1 / Total Resistivity
= 1 / 1.15
= 0.86956522
= 0.87 W/m2K (2 d.p.)

0.87 does comply with the non-domestic regulation of a maximum U-Value of 0.7.

Section through Sloped Green Roof 1:20



Roof Structure and Uses

Roof Garden Allotments

The roof garden will create a space for the growth of produce used by the cafe/kitchen along with the nearby allotments. The produce can be used to make meals each day for the children in the nursery.

Connecting to Nature

The nursery children can be in charge of the growing process on the roof of their space. This offer opportunity for outdoor learning and learning through doing/making.

Attractive Outdoor Cafe

The cafe spills over onto the roof of the nursery. People can sit outside in the gardens amongst the produce sold in the cafe while watching their children play sports on the Roman Ruins fields.

Snow Loads on Flat Roof

Length = 13m, Width = 7.5m
Snow Depth (average for UK) = 25cm
Roof Pitch = 0/12 (flat)

Snow Load = 1217 - 1706 kg

Snow Loads of Sloped Roof Edge

Length = 13m, Width = 2.7m
Snow Depth (average for UK) = 25cm
Roof Pitch = 20 degrees

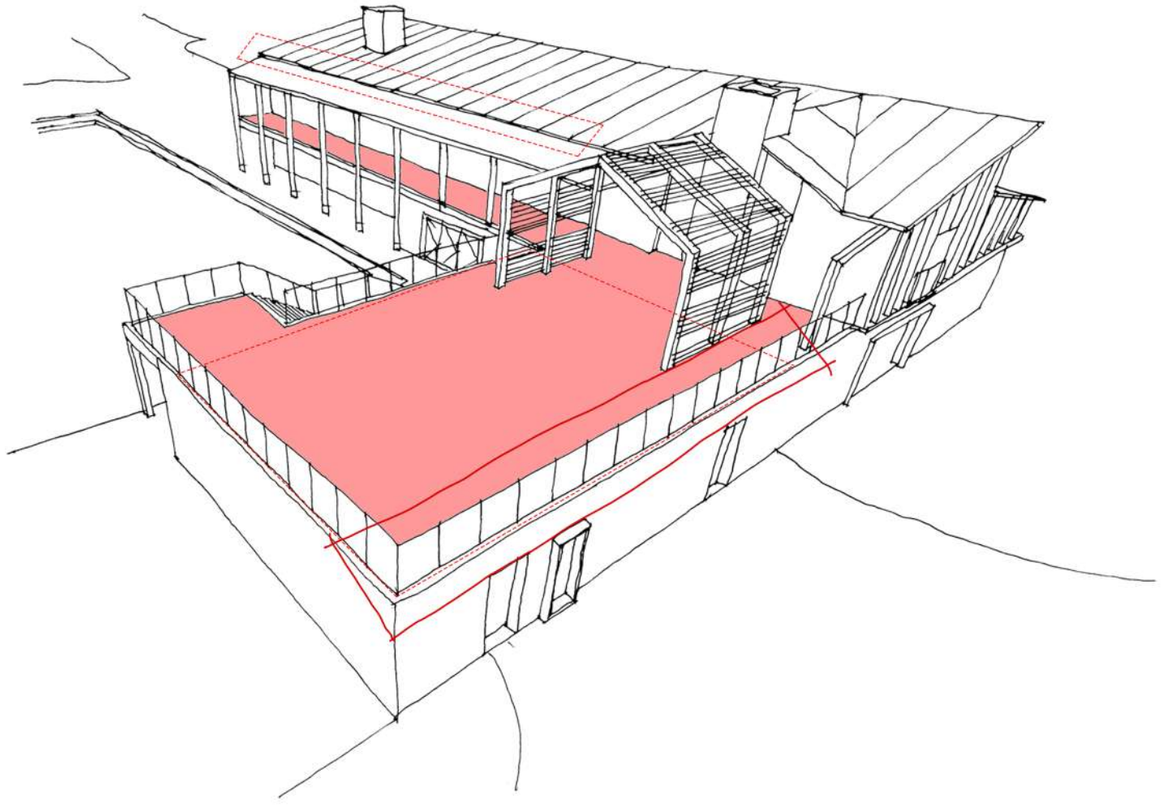
Snow Load = 462 - 647 kg

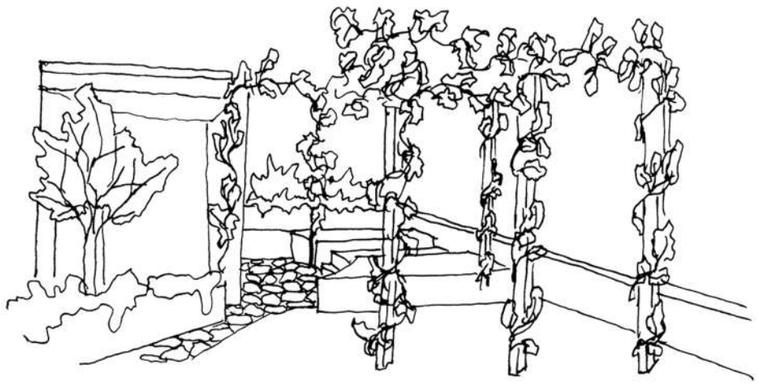
Maximum Snow Coverage = 28cm on warm roof

The Spruce. Getty Images.

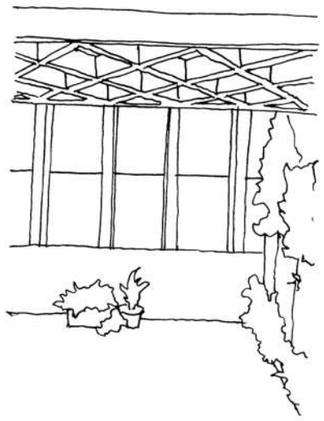
Royalty-free Stock Photo. DreamsTime.

RoofTop Cafe KeyWest.

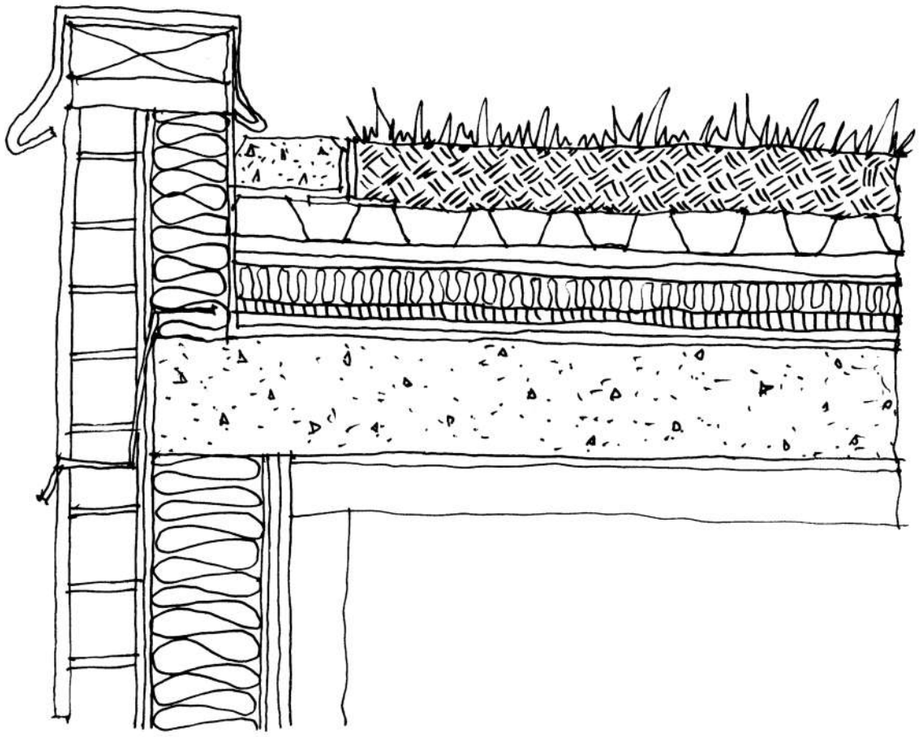




Roof terrace atmosphere with a series of seasonal gardens catering for bee and butterfly species and child development projects.



Trellis built by the children to house birds within the roofscape.



Landscape Grass

Landscape Topsoil

Plastic Guttering

Membrane

Innsulation

Vapour/Root Barrier

Roof Membrane

Lightweight Concrete

Interior Plasterboard Skimmed

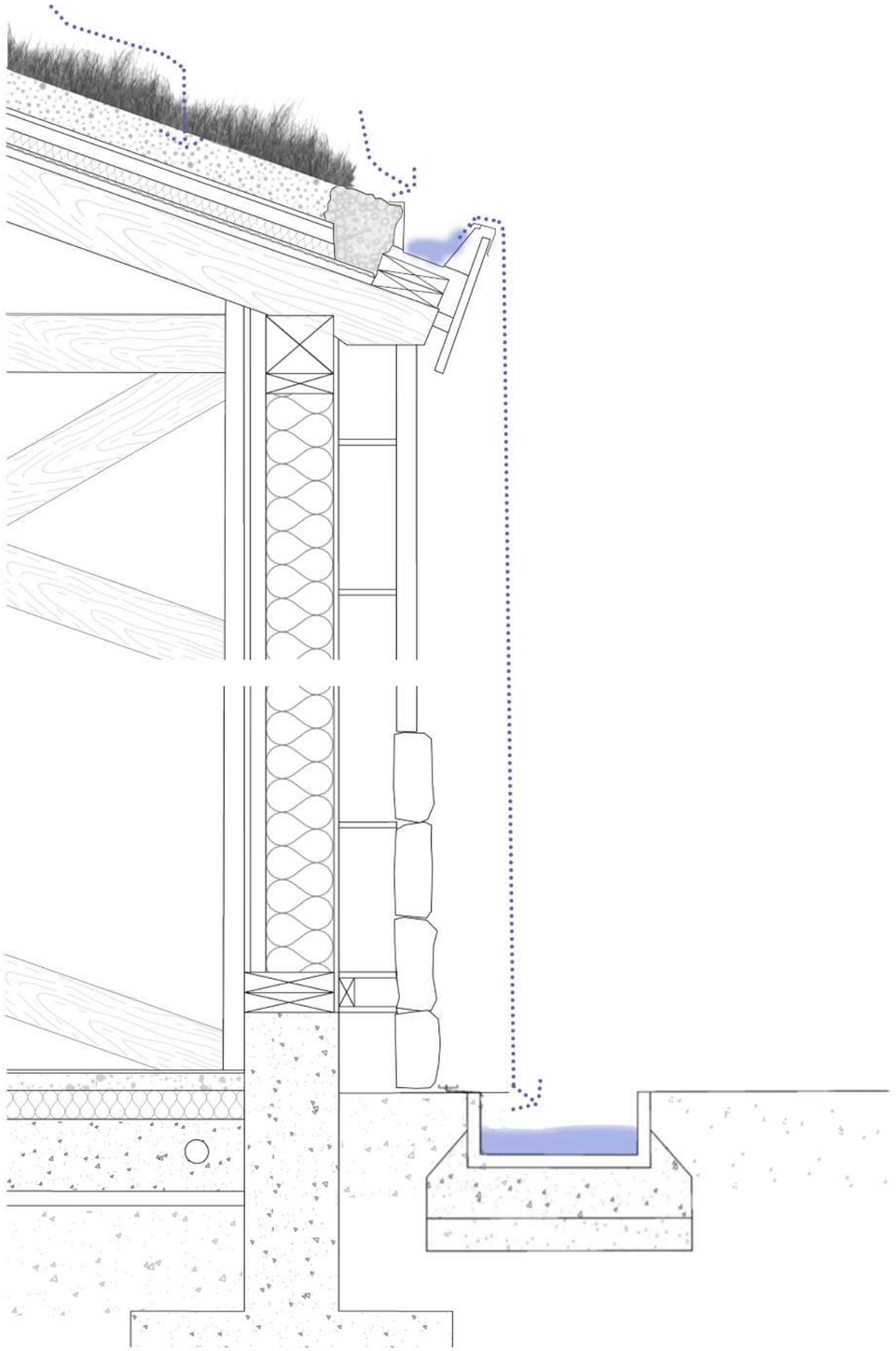
Exposed LVL Beams

Section through Sloped Green Roof 1:20

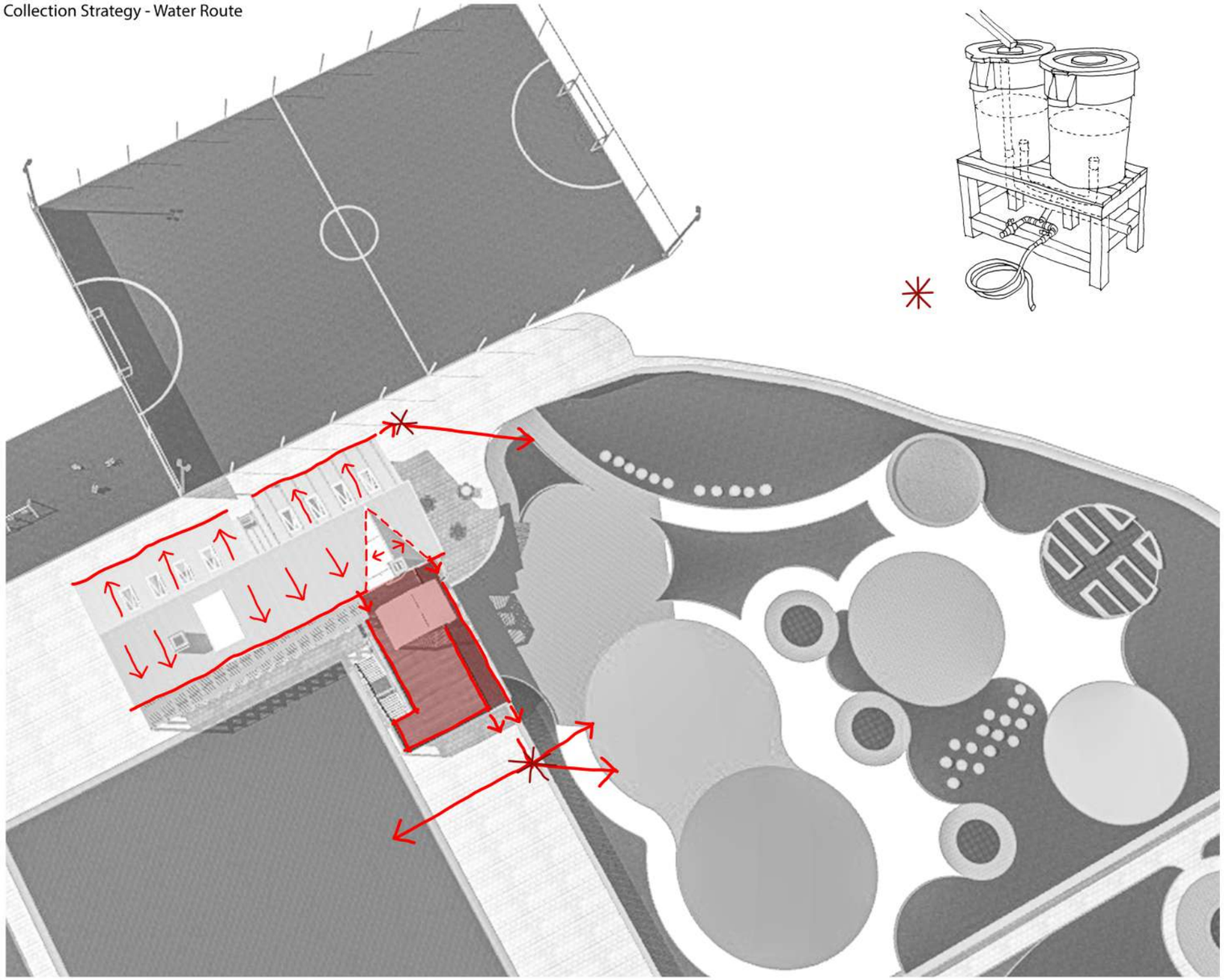
All surface water is collected in soakaways and plant watering barrels.

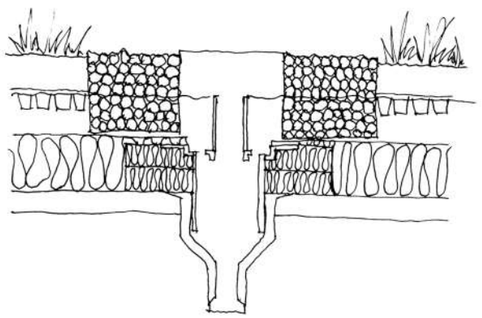
Water from the roofs is redirected to water suds or barrels accessible by children for plants and wldlife. The slow release suds have controlled water levels for human safety. The water then progresses from the suds to join the nearby River Taff.

Potential environmental hazards can be caused if litter is thrown in the suds (ample bins to be provided on site).

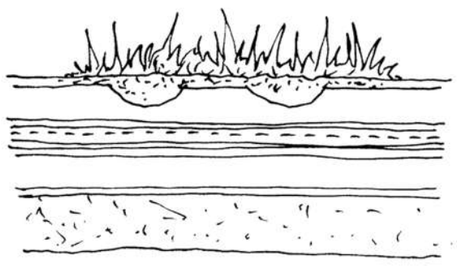


Water Collection Strategy - Water Route

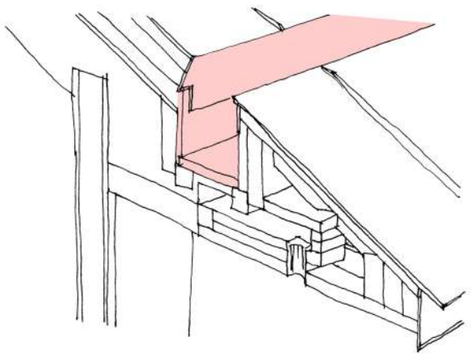




Blue Roof Investigation. Avoided due to mainentance and child safety when playing in the roof garden.



Green Roof Build-up including concrete and extra insulation to meet U-Value non-domestic requirements.



Gutter detail for the rest of the proposal. Overhanging zinc roof with upstands at 400 ctrs.

Site Phasing and Scheme Development

The building strargy aims to incorperate both skilled and unskilled labour where the collage 'A culture of co-production' aims to show how we can instill social value into the buidling through this approach.

The internal timber structure will be treated and not exposed to elements, therefore maintenence checks should be carried out between every 5-10 years. Much of this heavy load work will be carried out by specialist contractors.

The external cladding will be exposed to the elements. Using a clear treament will have the longest maintenence intervals which will be easy to repair and maintain.This is where the use of communal - unskilled labout can be utilised.

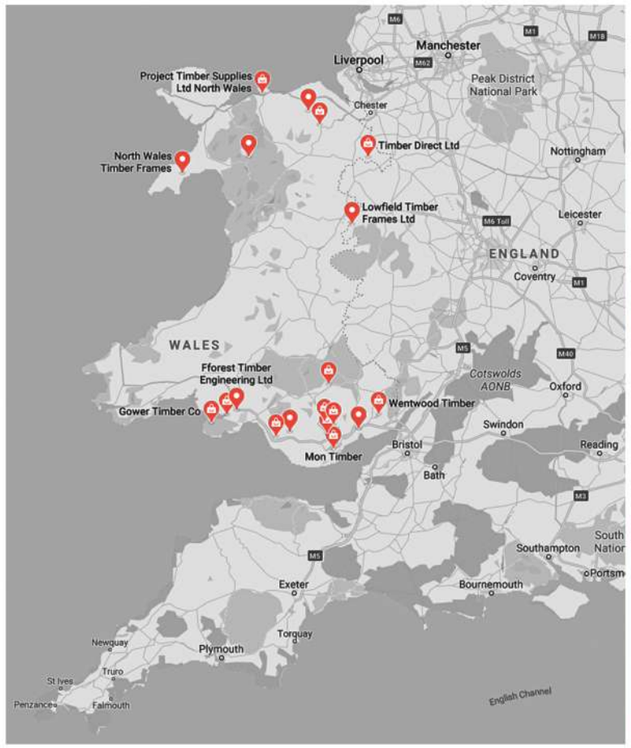
Phasing the Build:

The building itself will be a phased project where skilled workers and unskilled community members will work collaboratively in producing certain parts of the building.

• 2020: Piling, Piled Raft Foundation and all Future Proofing services will be incorporated to provide provision for future expansion. Primary structure will be built along with community hall, plant and temporary spaces.

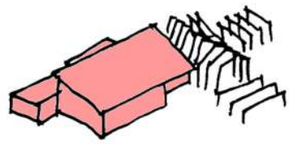
• 2021:Cafe, kitchen, well being and nursery spaces will be built.

• 2023: Future extension will be constructed for new use.

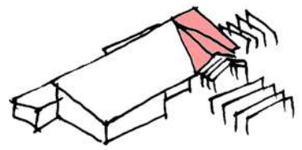


Locations of local timber manufactureers in Wales for the production of the timber frame

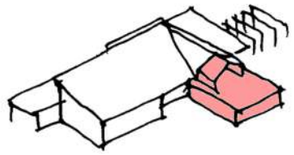
Building Phasing and Construction



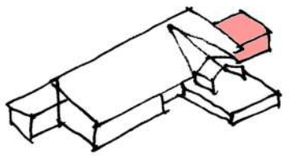
Phase 1, 2020: Communinty Hall, Plant Room, Kitchen



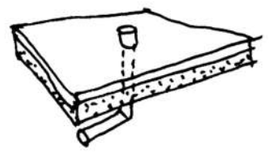
Phase 2, 2023: Health & WEllbeing Space, Unique Spaces



Phase 3, 2024: Community Cafe, Nursery and Gardens

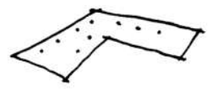


Phase 4, 2025: Future Expansion Implemented



SVP Location

Service Encasement

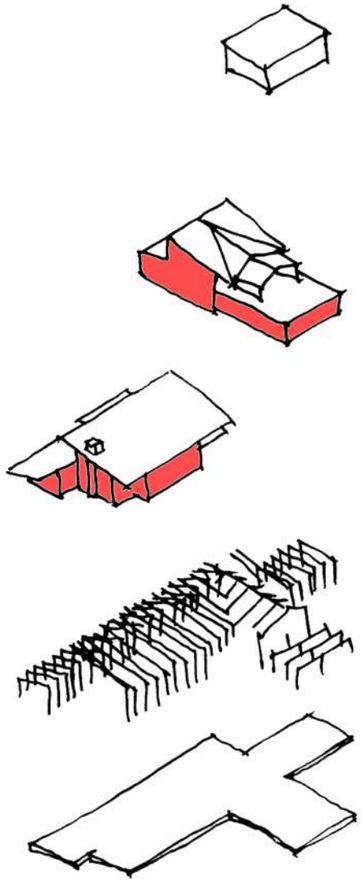


SVP Location

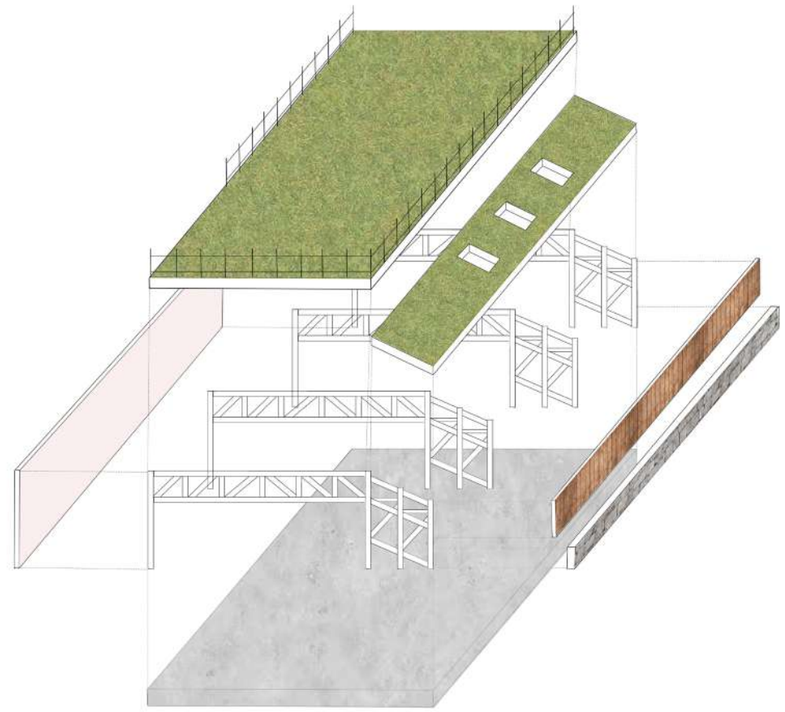
Access Hatches

Pile Foundations

Construction and Build-Up



Material and Structural Axo 1:50



Fire Safety Key Points

From Approved Document B,

Relevant Purpose Group = 3
Travel Distances for office scaled buildings,
One direction = 18m
More than one direction = 45m

Total number of staff = 365 (from introduction page)
Minimum of two exits are required for 365 people.

The long length corridor in the proposal has undergone compartmentation in the plan to fit the requirements.

Sprinkler systems are not needed since the building is under 18m tall and travel distrances are well within guides.

The minimum width of timber used as the superstructure for any building is 38mm. The proposed thicknesses of 0.04m (40mm) meets this regulation and, therefore, the maximum amount of time before the timber frame burns down is achieved.

Maximum Capacity of the Nest = 300 poeple.
[max. capacity of Nest = 300 people, 2 exits = 150 people per exit]
[max. capacity of Nursery = 30 people, 2 exits = 15 people per exit, children included]

Each exit is over 750mm wide providing enough space for 40 people to pass through per minute. It would take 7.5 minutes to evacuate the Nest and 0.75 minutes to evacuate the Nursery. Only one floor so access to dogs and disabled is available.

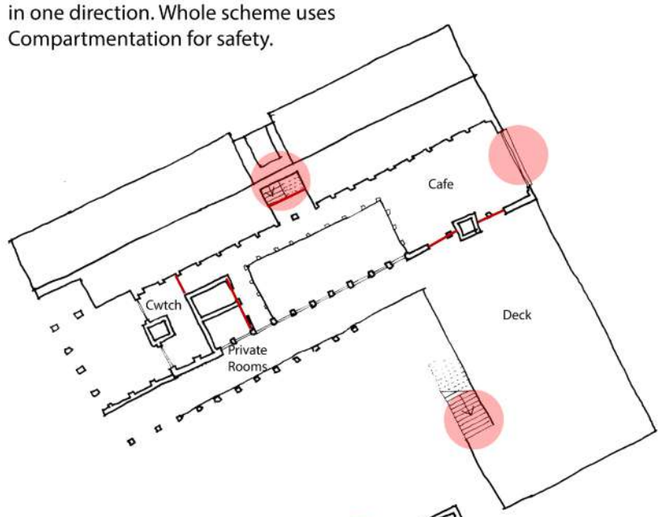
It has been suggested that green roofs and walls may constitute a fire hazard. In relation to fire performance, the general consensus is that as long as the green roof or wall is kept moist (which is the normal case in order to keep the roof alive) it is likely to be very resistant to

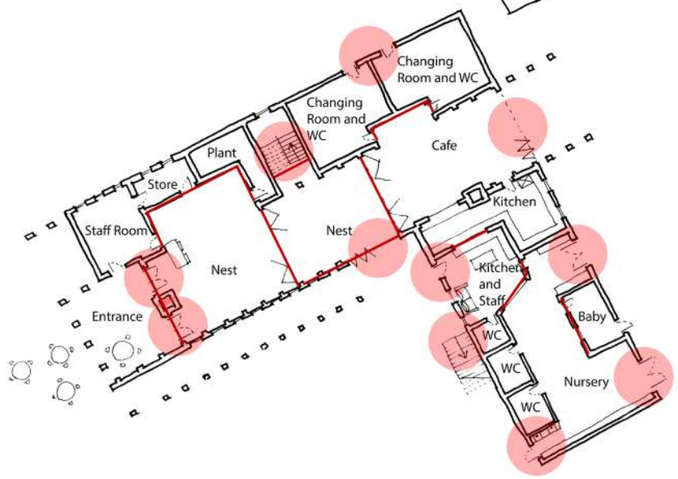
Based on a charring rate of 0.72 mm/min, the largest load bearing element of LVL (top chord) is expected to fail after [time of fire exposure x design charring rate] = 28 minutes.

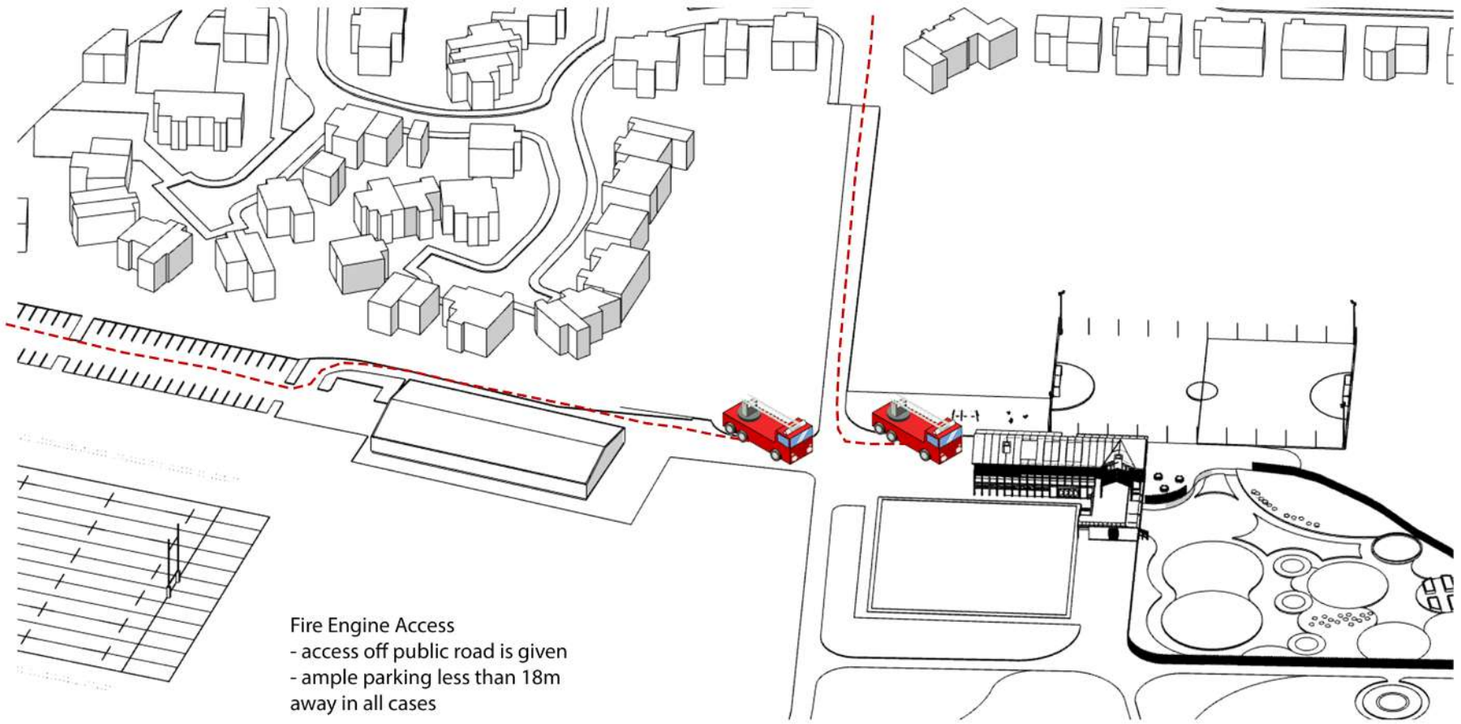
Flame spread timings [cource; Performance Panels] suggest that birch faced plywood has a flame spread rating of less than 25 when either treated or coated with a fire-retardant. When not treated, birch faced plywood's fire rating goes up to 200 which is permitted in rooms of most occupancies except hospital rooms. Therefore, untreated ply is suitable.

Concrete performs extremely well under heat and it has the highest fire resistance classification (class AI) under EN 13501-1:2007-A1:2009 [according to MPA the concrete centre]. It is a non-combustible material with a low rate of heat transfer. Concrete does not emit any toxic fumes when affected by fire and it as relatively poor thermal conductivity.

Exits Highlighted. All well within 18m in one direction. Whole scheme uses Compartmentation for safety.







Fire Engine Access
- access off public road is given
- ample parking less than 18m away in all cases

Child-Scaled entrance to the nursery

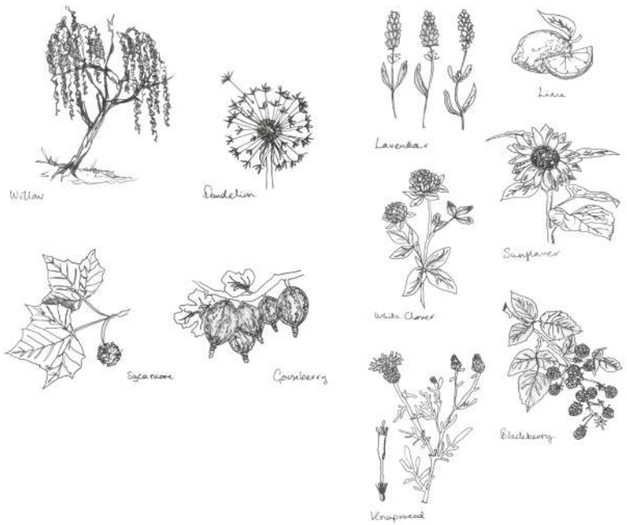
The benefits afforded by the green roof proposal have allowed for landscaped gardens housing wildlife, run by children. It has also allowed for the addition of further species.

The sloping green roof increases the green footprint and provides shading at the nursery drop-off point throughout the year, reflects sunlight and allows for cooling of the wider context through evaporation. This reduces surface temperatures and improves the materials lifespan by lowering natural damages.

The slope informs the nursery design and provides a child-scale entrance to the nursery that is protected by visual overlooking security from the green roof. The entrance is also protected from th wind by the greenery, reducing any unwanted ventilation. This causes lower running costs and heatloss is minimised. The vegetation creates a sound buffer between cafe activity and the nursery. The entrance created follows the children's tale of Alice in Wonderland: Down the Rabbit Hole. The habitats and nestling activity created on the green sloping roof allow for a burrow-like front door beneath that leads to an enchanting show of roots (timber trusses).

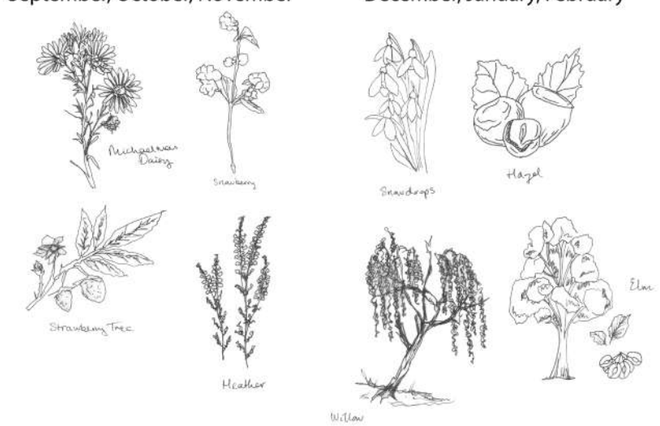
Seasonal Garden planting catered for aforementioned species:

March, April, May



June, July, August

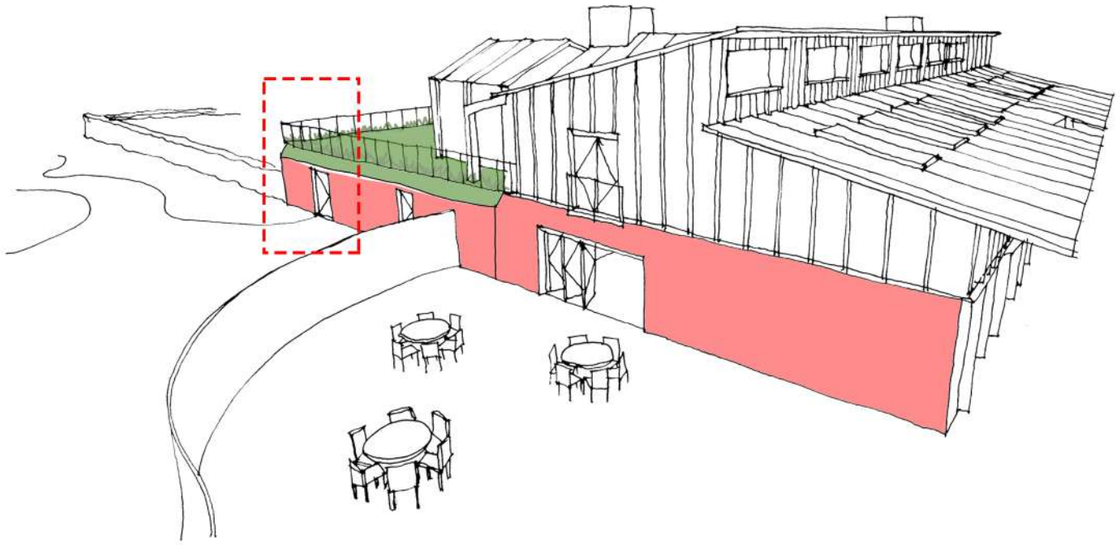
September, October, November

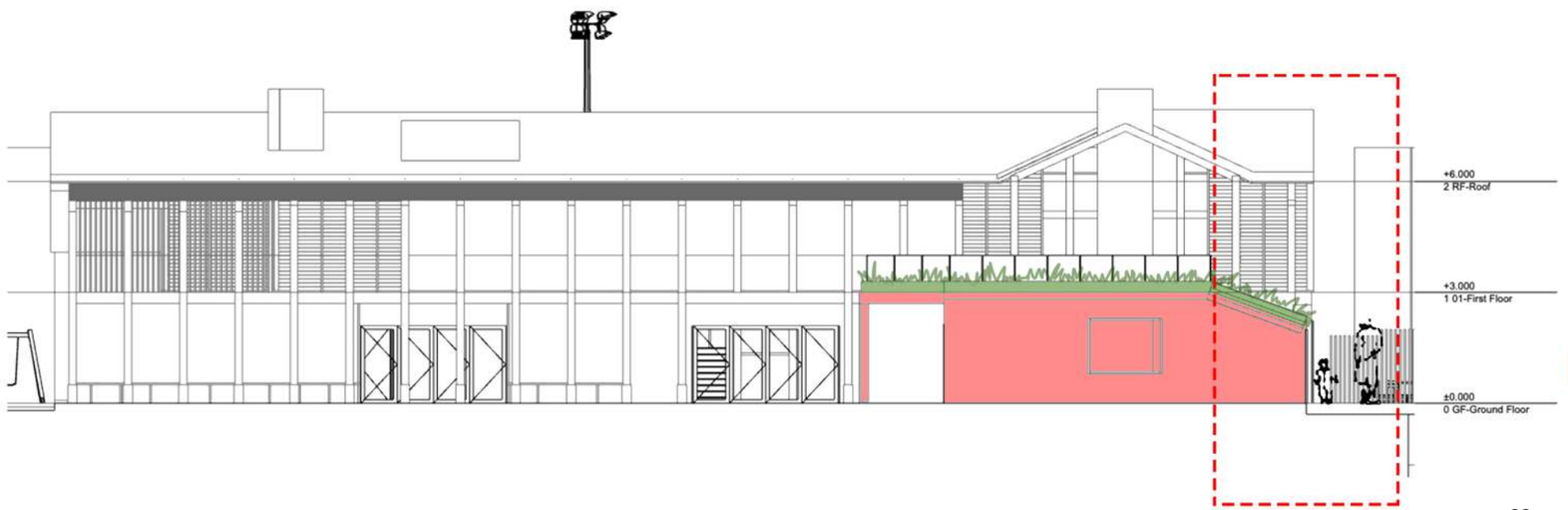


December, January, February

Entrance designed in line with Alice in Wonderland. A rabbit leads under the flowers andd grass to an adventure within. Alice Down the Rabbit Hole, 1951.
https://www.youtube.com/watch?v=XZ0UksWw2D8

Hole House, Christian Müller and Bjarne Mastenbroek. Photography: Michel Bonvin.





External cladding, Interaction and Shading

The following design concepts and explorations came from the existing Trelai Nursery's lack of play equipment and access to safe outdoor play space. The subsequent pages investigate what new forms of play could be incorporated for the children through various materials and textures.

Exterior cladding Texture Exploration

Soft timbers reaching towards the sky create a lighter looking build. The stronger, darker tones of the heavier stone and slate ground the building and solidify it into the landscape. The lower slates can be used by the children in the nursery to draw upon, keeping the lighter timber structure up in the trees.

There are numerous pros to exterior slate cladding:

Its extreme durability and long lifespan. It is complimentary to other materials such as concrete and timber and offers various finish options to suit applications and can therefore be used in a wide range of projects. The slates and stones provide a high level of insulation, which can therefore keep heating and cooling costs down.

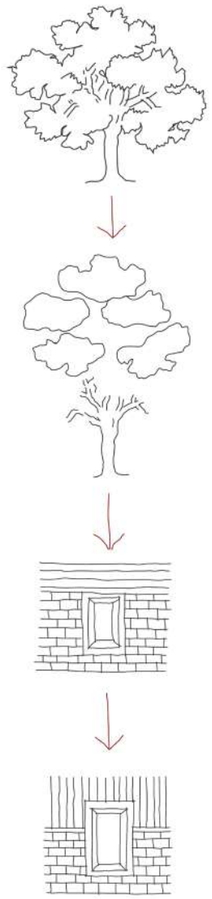
Slate is the perfect outdoor teaching instrument as it can be scratch and abrasion resistant and children can draw on the tiles, forming an outdoor classroom that parents can view during pick up and drop off times. Once installed the slates are easy to maintain long-term.

The cons of external slate cladding are as follows:

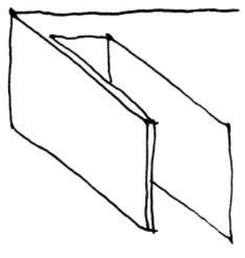
Depending on the application method, slate and stone can be labour intensive and time-consuming to install. This cladding will increase the cost of the overall building. Best installed by a professional rather than a DIY project, but it is possible to be carried out by the community.

Ways in which slate can be incorporated:

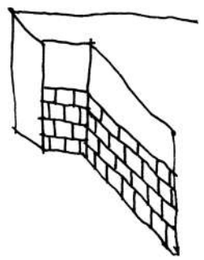
1. External cladding, moveable and built by the community, expensive.
2. Exterior corridor independent from structure, changeable by community and can evolve with teching needs, additional construction required.
3. Interactive shading panels coated in blackboard paint, decreased cost and less pressure on community upkeep.



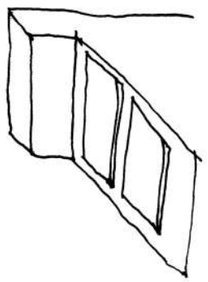
Jure Kotnik Architecture, kindergarten in Ljubljana, Slovenia.
Photography by Miran Kambic.



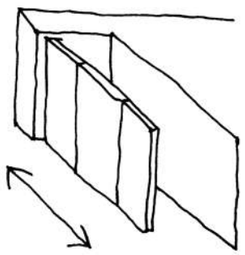
Solid exterior corridor



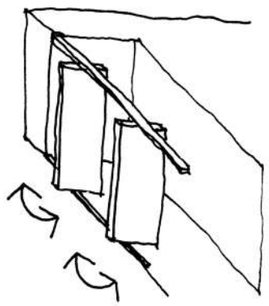
Wall Cladding



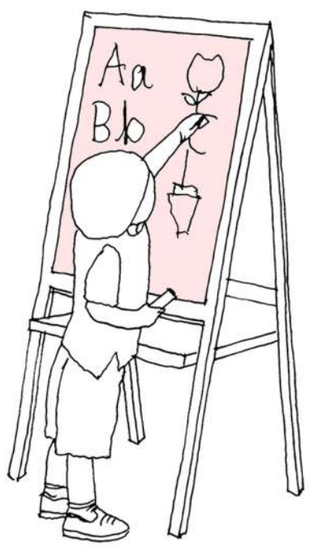
Cladding Panels

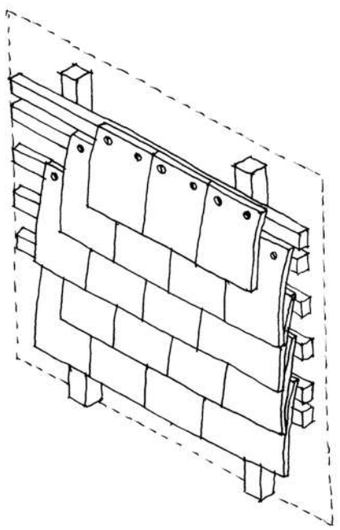


Slide-out Panels

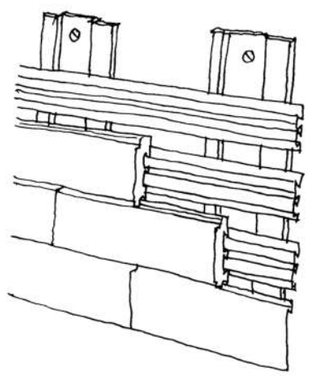


Rotating Panels

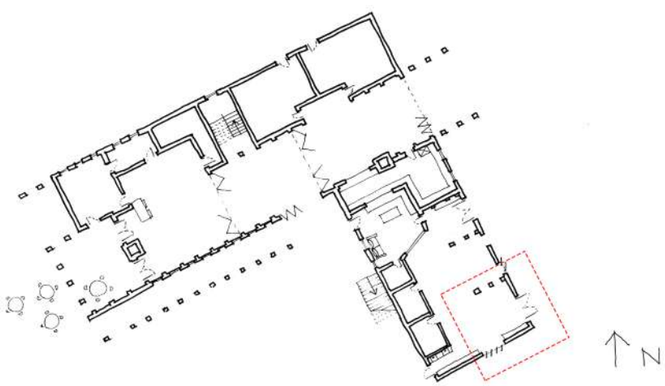




Mechanical Stone Cladding



Aluminium Backing



Chalkboard Panel Experiments

- External corridor panels.
- Slate types and textures.
- Scale.
- Frame and light massings.

Nursery lighting:

Daylight (not sun) = 500 LUX (lumens/m^2)
Area of nursery = 112.5 m^2
Amount of lumens needed,
112.5 x 500 = 56,250 lumens

405 lumen energy saving bulbs.
Number of bulbs needed,

$\frac{56,250}{405} = 138.8889$

= 139 bulbs
(internally)

Kitchen countertop lighting

Ambient lighting = 108 lux
Food prep lighting = 588 lux
Area of surfaces in the main hubs kitchen,
$(4 \times 0.6) + (2 \times 0.6) + (2 \times 0.6)$ = Area
Area = 4.8 m^2
$\therefore$ 4.8 m^2 x 588 = 2,822.4 lumens
$\therefore$ LED under cabinet lighting = 350 lumens
↳ $\frac{2,822.4}{350} = 8.064$

meaning 8 bulbs are required for the three kitchen countertops.

Direct average outside daylight in the summer is around 10,000 foot candles.
10,000 foot candles = 10,000 lumens per ft^2.

$\therefore$ Bulbs are not required during daylight hours in the summer.

Exterior Walkway lighting

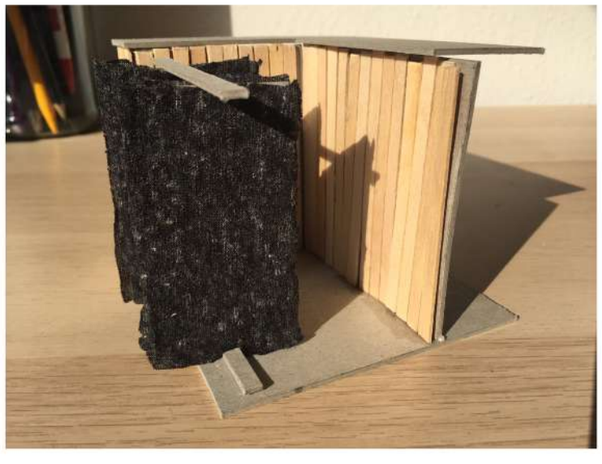
Daylight (not sun) = 200 LUX (lumen/m^2)
Area of walkway = 160 m^2
Amount of lumens needed, =
160 x 200 = 32,000 lumens
700 lumens in outdoor lights,

$\frac{32,000}{700} = 45.714$

= 46 bulbs needed

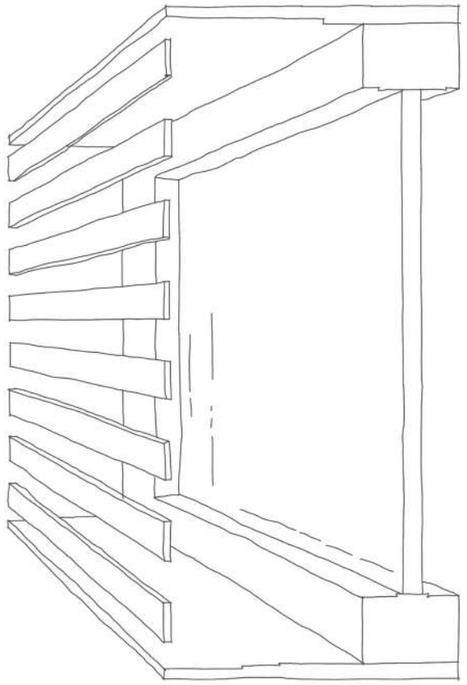
Distance between bulbs along walkway,

$\frac{46}{40}$ = 1.15m between each bulb

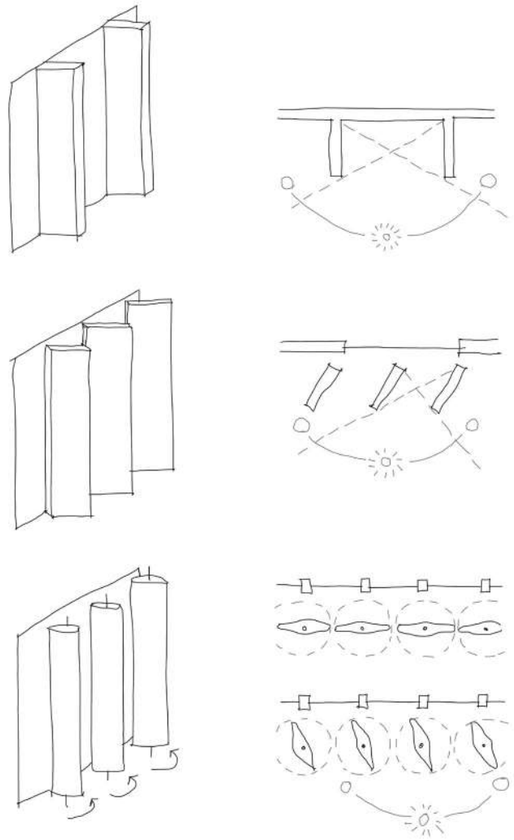


Vertical Fin arrangement for child education and building shading.

Lighting model 1:50

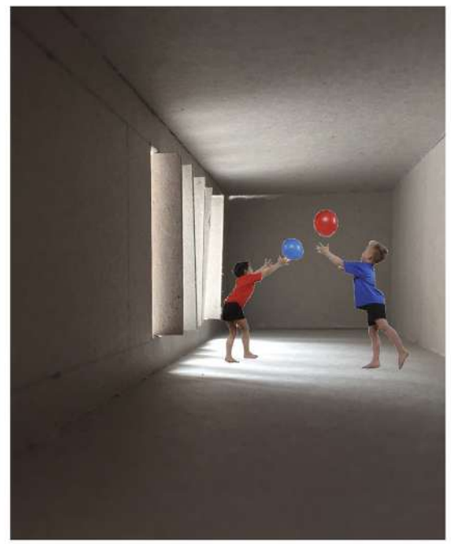


Horizontal louvres and shutters (sliding or rotating) combined with a horizontal overhang can be used on south facades, and can provide up to 90-95% solar gain reduction.



Dance sessions with changing lighting.

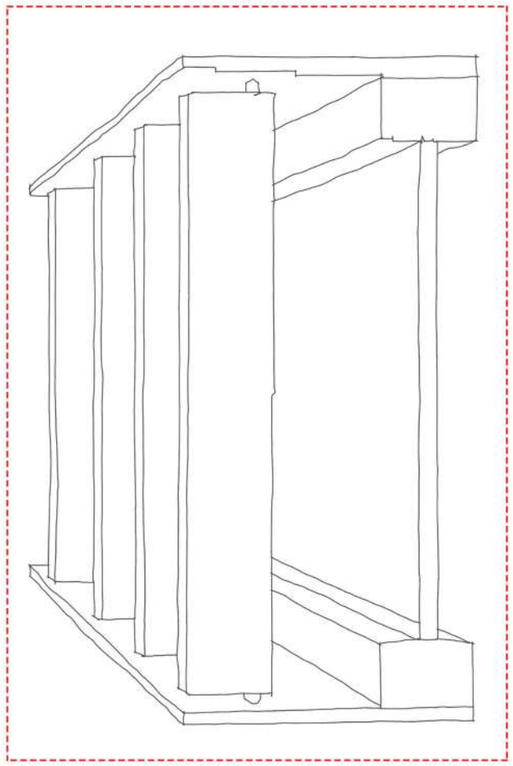
Reading corners and quiet determined by light.



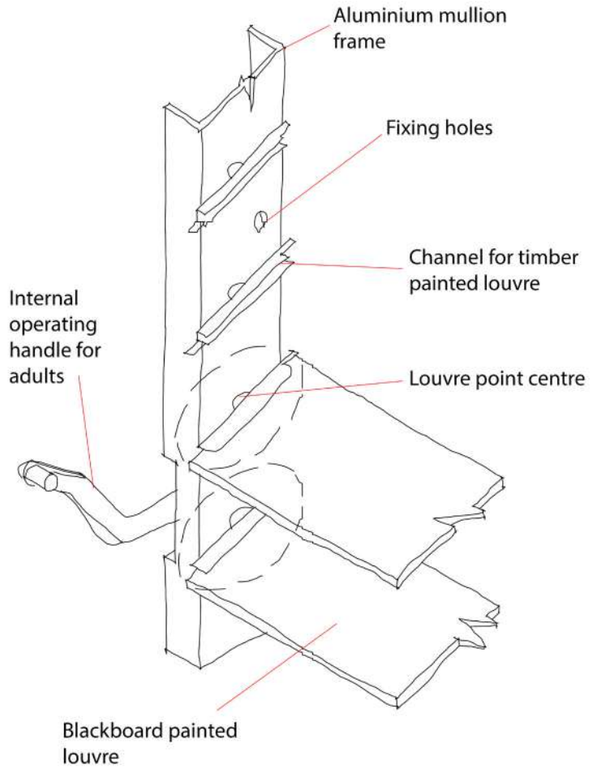
Natural lighting to enhance child development.

Shadow education and light pryzms.

London Mews manual vertical fins. D Raw Development.



Vertical fins (adjustable or fixed) combine with a horizontal overhang are best suited for east and west facades. Measures can provide up to 85-90% solar gain reduction.



Interior Model 1:20

The model is demonstrating the blurred lines between internal and external spaces and how light and structure inform play and educational spaces.

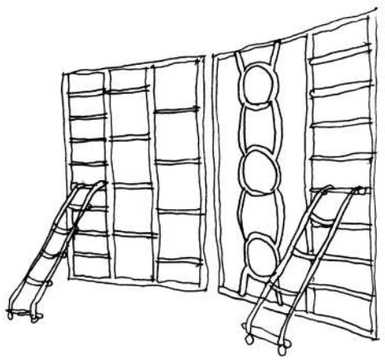
Soft timbers reaching towards the sky create a lighter looking build. The stronger, darker tones of the heavier stone and slate ground the building and solidify it into the landscape. The lower stones and slate-look (external blackboard painted) fins/louvers can be used by the children in the nursery to draw upon, keeping the lighter timber structure up in the trees. The dark paint attracts a degree of solar warmth while providig an interactive surface that can be spun around to show work off to parents, teachers, etc.

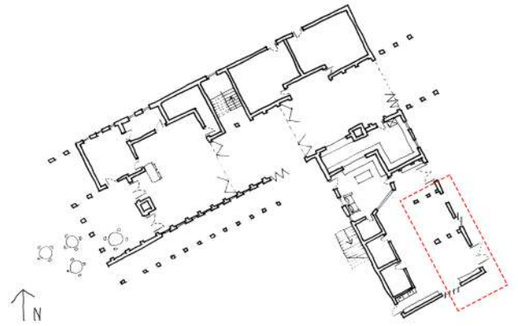
The interactive truss acts as a play space for the children internally while they can draw on both the inside and outside of the building through the use of the moveable shading fins.

This completely switches up the traditional ideas of "inside" and "outside". The aim is to draw play in and extend teaching facilities out into the fresh air through the materials chosen.

Educational Spaces breaking outdoors to roof garden and interactive blackboard louvers. Natural education and increased health through outdoor learning.

Creative outdoor play spaces introduced internally through the building's exposed structure. Education through doing, making use of the timber structure and dnacing forest-like lighting.





Design in Practice

Technical Proposal

Molly Nash

Cardiff University
Prifysgol Caerdydd

Technological Influences:

The above report concentrates on the nursery and children's space within the proposal. The scheme is highly influenced by technology, particularly regarding the site's surrounding nature and the community's great interest in the outdoors. In the Stage 3 Design document, it is specified that the proposal will be built by the community, for the community. The proposal develops overtime as the community and wider context advances and changes, and the uses of the building fluctuate based upon future requirements and desires.
Vegetation has played a key role in the development of the technical proposal. In order to create a 'cooler' city providing benefits to the site and surrounding buildings, light surfaces and vegetation have been combined to create shade, reflect sunlight and provide cooling through evaporation. The vegetation has been introduced at this technical stage in order to lower urban carbon dioxide levels in a polluted city, such as Cardiff. Reducing the carbon dioxide levels locally massively benefits the environment and public health. Urban vegetation is vital in providing comfortable environments for users both internally and externally. For example, when combined with light and reflective surfaces, vegetation can reduce surface temperatures by up to twenty degrees Celsius.

The proposed roof scape has been designed with a vegetation strategy at the forefront. The structural design has been influenced by the form of the roof, and a truss has been designed and developed throughout this report. The timber structure supporting a green roof allows a breakout space for the café, along with a safe and secure outdoor play area for the nursery children throughout the day. This rooftop garden space has been designed with specific plant species in mind (see report) to create and enhance local habitats and biodiversity in line with BREEAM specifications. Allowing the greenery to almost engulf the nursery roof and spill over to a slope created by the truss, improves heat loss coefficients and allows for overall cheaper running costs of the build. The slope also creates a bank in the sky for parents to sit on with a coffee from the café while they watch their children on match days.

The truss itself has been developed in order to structurally support the green roof, while allowing the community to become actively involved in the build through basic carpentry techniques. The trusses are exposed and utilised internally to create an interior playground in the nursery. The interactive truss can be climbed, sat upon and used to display children's work. When combined with the mechanically controlled windows within the sloped green roof that provide stack effect ventilation throughout the nursery, ample light is cast through the nursery and dances between the trusses as the day evolves.

Overall, the developed nursery aims to blur the line between interior and exterior. The goal has been to draw play in and extend learning outside and the designed truss and green roof have been instrumental in allowing this design concept to come to fruition.