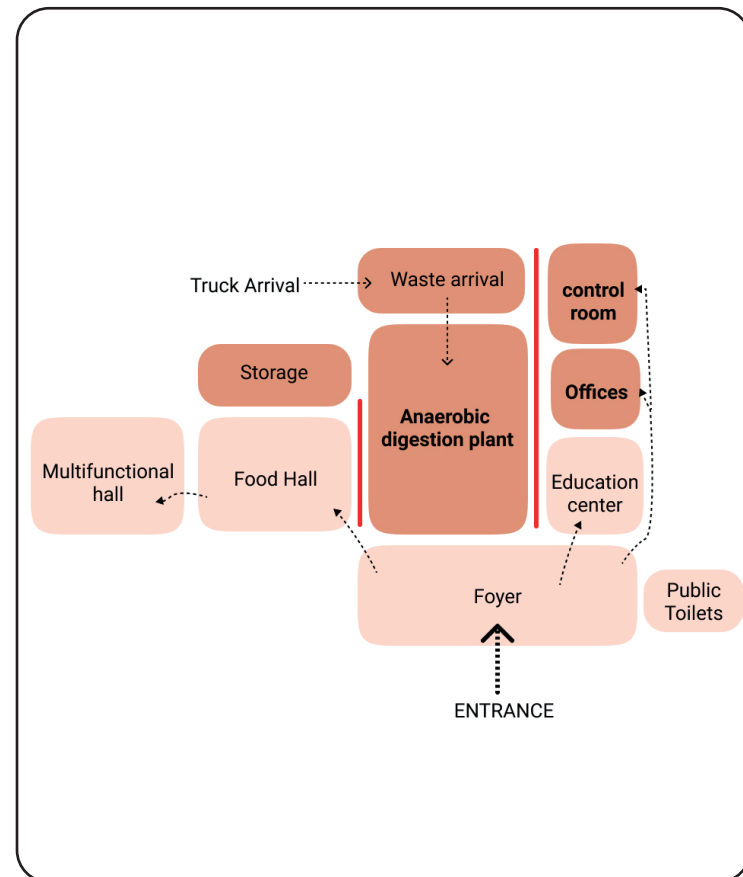


PART A- Architectural & Sustainability Strategies

A1:Technological & Typological Considerations

THE BRIEF

My brief is to build a food recycling plant (Anaerobic digestion plant) also know as biogas plant, as well as a leisure and social community hub including spaces such as the food hall, education space and multi-purpose hall.



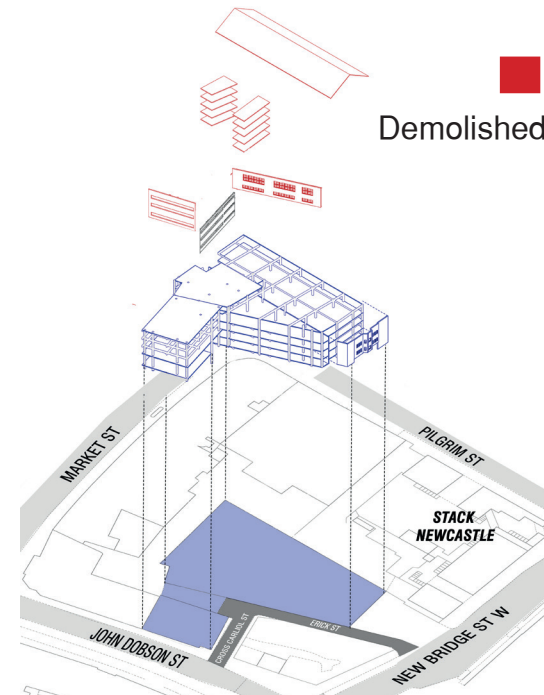
Typological Requirements & Considerations For the Project Brief

- Listed Buildings Carliol House, Market street East
- Acoustics (Multi-purpose Hall) (zoning)
- Views
- Connection of the recycle plant to the city centre & Venue
- Retaining Existing Green space on-site
- Wheelchair access
- Glare control in offices, control and education space
- Thermal comfort- Proper ventilation in the food hall will benefit in the elimination of smoke and unwanted smell
- Food Flow
- Smell management due to waste trucks arriving on-site
- Visibility between the sitting and cooking areas
- Air Circulation

Structural Considerations

Approach- Adaptive reuse and renovation

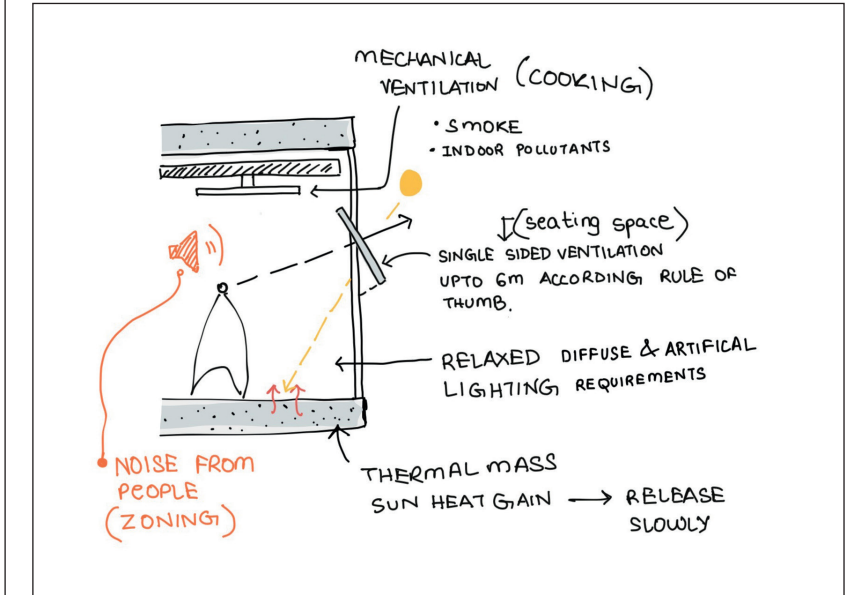
The strategy will be to maintain the current floor slabs and make the necessary cutbacks, as well as repair and resurface the concrete frame structure and slabs.



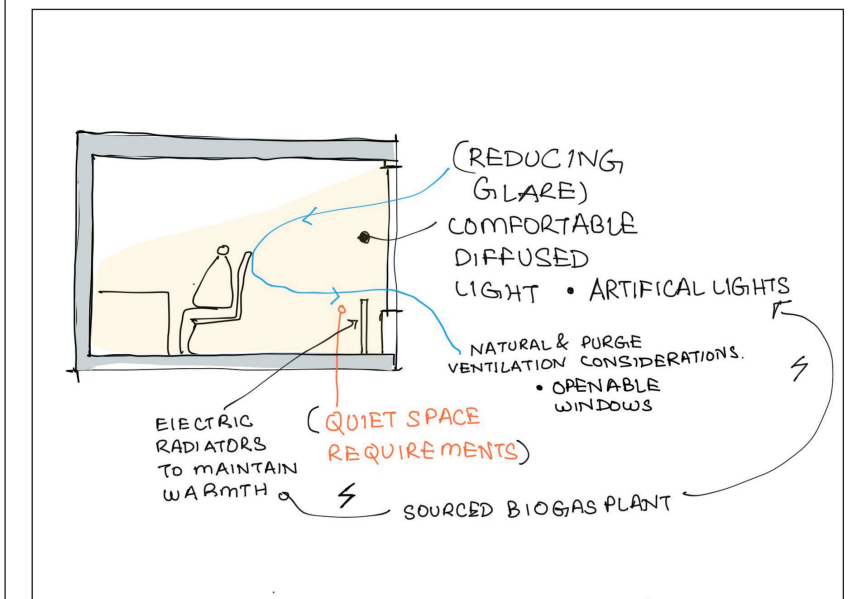
Demolition of existing steel frame roof structure. Demolition of ramp
The gap between the floors will be filled with reinforced concrete, and the spaces will be divided into public, semi-public, and private areas as a result. Demolition of existing east facade and cladding it with modern materials.

Environmental considerations

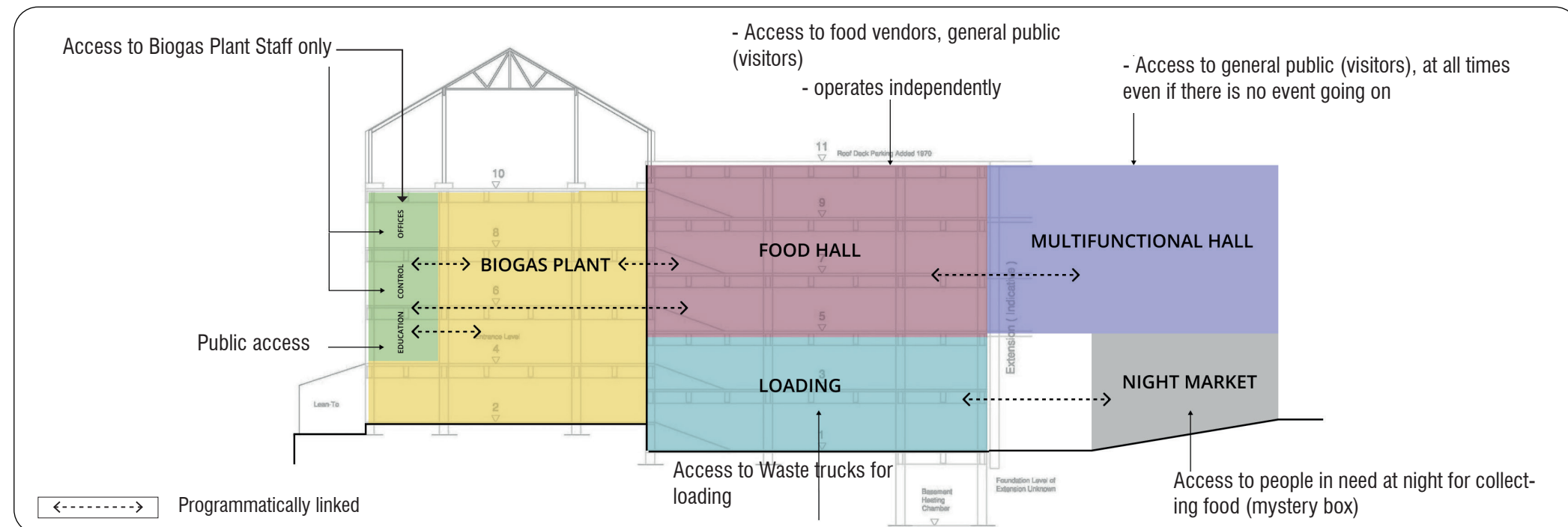
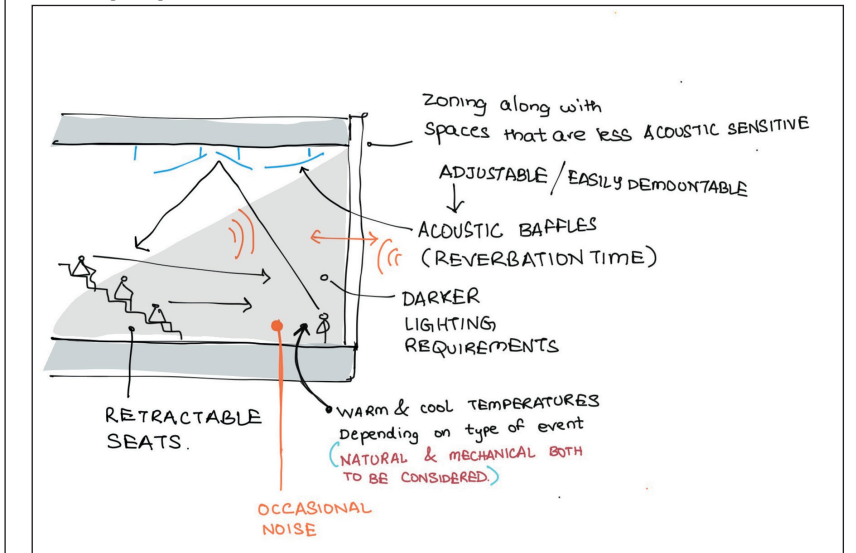
Food Hall



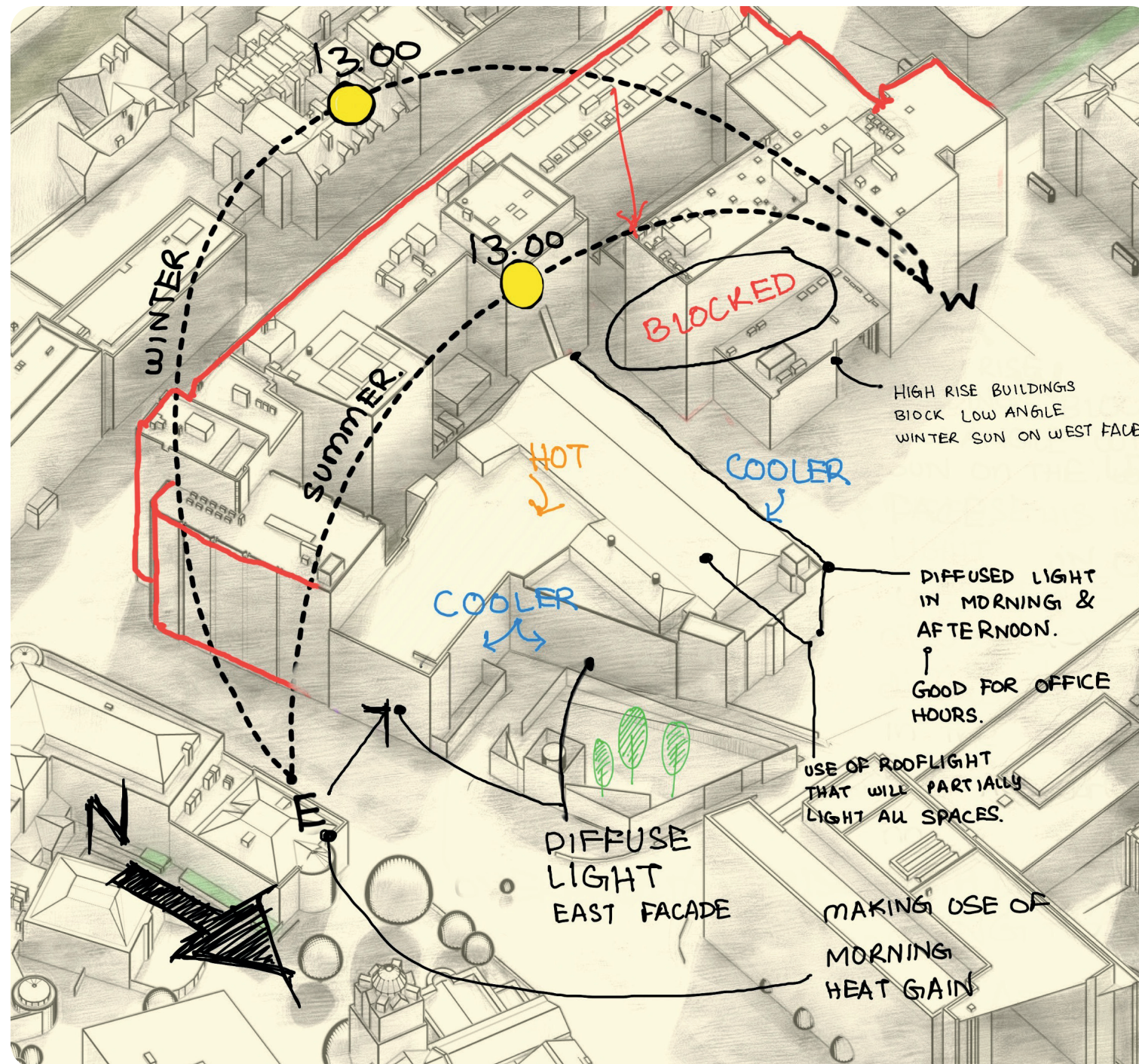
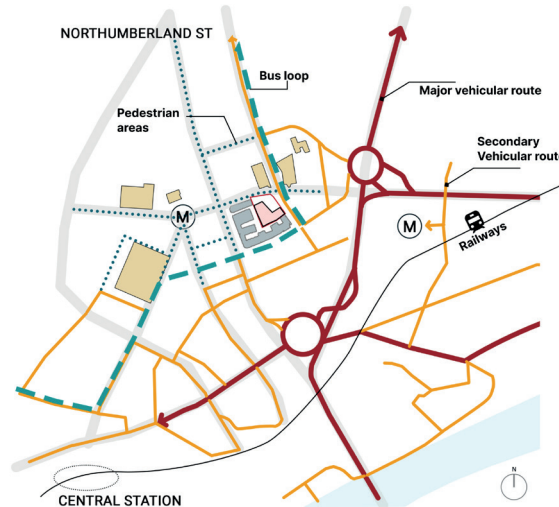
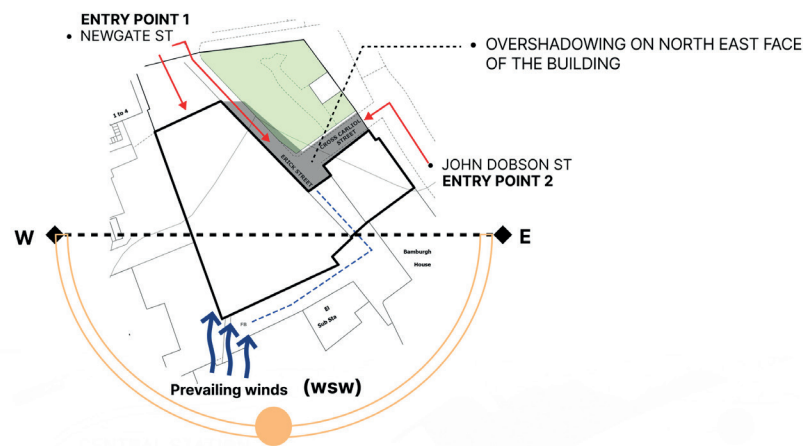
Offices, Control Room



Multi-purpose Hall



A2: Site Analysis

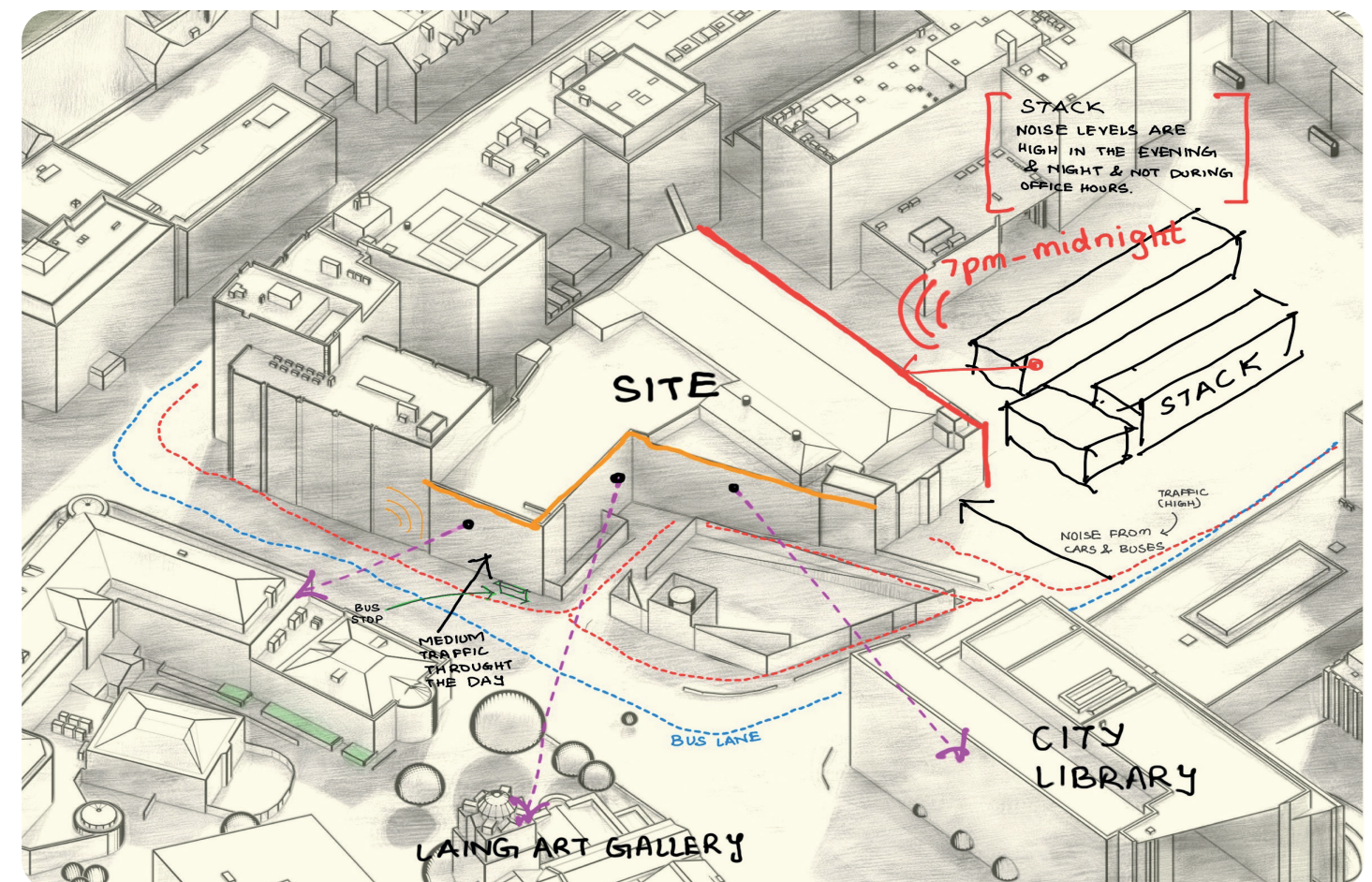


- S**
1. GOOD TRANSPORT LINKS- BUSES, METRO
 2. GREENSPACE WITHIN THE SPACE
 3. GOOD PEDESTRIAN ACCESS TO SITE
 4. USEABLE EXISTING BUILDING
 5. GOOD VIEWS
 6. WIND SPEEDS ARE BLOCKED BY THE EXISTING STRUCTURES BEHIND DEX GARAGE (WIND DIRECTION WSW)

- W**
1. HIGH TRAFFIC AREA
 2. OVERSHADOWING ON NORTH EAST FACE OF THE BUILDING
 3. VENTILATION SHAFT MAJOR VIEW OBSTRUCTER
 4. VERY COMPACT AND VERY CLOSE TO BUILDINGS BEHIND IT
 5. FOOT PRINT IS VERY LOW EVEN AFTER HAVING GOOD DEVELOPMENT AROUND THE SITE
 6. CREATING A NEW IMPROVED BUILT AROUND THE SITE IS A CHALLENGE BECAUSE OF HAVING A EXISTING BUILDING CREATES LIMITATIONS

- O**
1. GIVING THE HISTORICAL FACADE A MODERN TOUCH
 2. MAKING USE OF NORTH LIGHT IDEAL FOR SPACES LIKE OFFICES, EXHIBITIONS.
 3. CREATION OF NEW KEY CORNER AND PUBLIC REALM TO INCREASE FOOTFALL THROUGH THE SITE
 4. BUS LINKS ON JOHN DOBSON, NEWBRIDGE ST PROVIDE OPPORTUNITY TO CREATE A NEW ARRIVAL POINT
 5. CHANGING THE LOOK OF THE EXISTING FACADE TO MAKE IT MORE APPEALING AND CREATING INTEREST

- T**
1. RISK OF FLOODING IN FUTURE IS HIGH BECAUSE OF THE SLOPING TERRAIN OF THE SITE.
 2. GETTING PEOPLE INTO THE SITE FROM THE NORTHUMBERLAND, GREY, MARKET ST.
 3. CREATING A PUBLIC VENUE TO INTEREST PEOPLE IS VERY DIFFICULT AS THERE A LOT OF VENUES AROUND WHICH CREATE COMPETITION



A3: Environmental Brief and strategies

Self Sustaining Approach

The energy from the biogas plant will be used to supply electricity to the public venue, as well as to power the radiators and lighting appliances, making the building very sustainable in terms of lighting heating and making it a self-sustaining system. And also the biogas plant uses the energy that is generated in its own operations.

BREEAM: Energy

- Installation of renewables

RIBA (Nonresidential):

Operational energy from Biogas plant waste to energy- < 0.35kWh/m²/yr

BREEAM: Sound

- Internal indoor ambient noise levels
- Sound insulation
- Reverberation

BREEAM: Thermal Comfort is very important in a space like food hall as there heat gains from inside and outside factors and keeping the space cool and warm is very important in both summers and winters

BREEAM: Daylighting

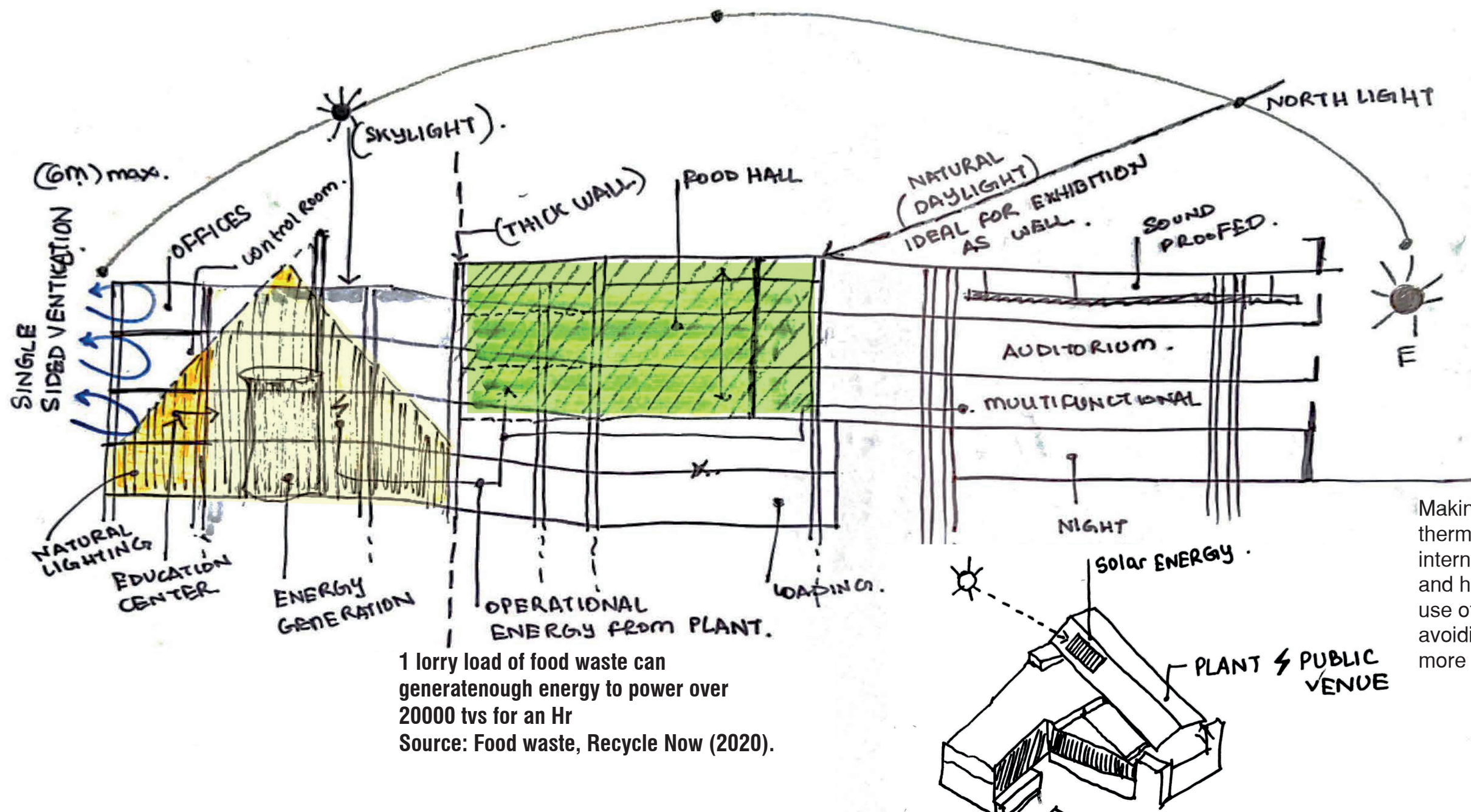
- Increased daylight factors appropriate to building type;
- a glare-control strategy in place that does not conflict with the lighting controls (avoiding higher energy use);
- a compliant view out from workstation positions.

WELL: Nourishment

- Nutrition Education
- Food Preparation-facilities for storage and preparation of food
- Nutritional Transparency
- Food Production - provides a permanent and accessible space for food production within 800 m [0.5 mi] of the project boundary

BREEAM: Waste

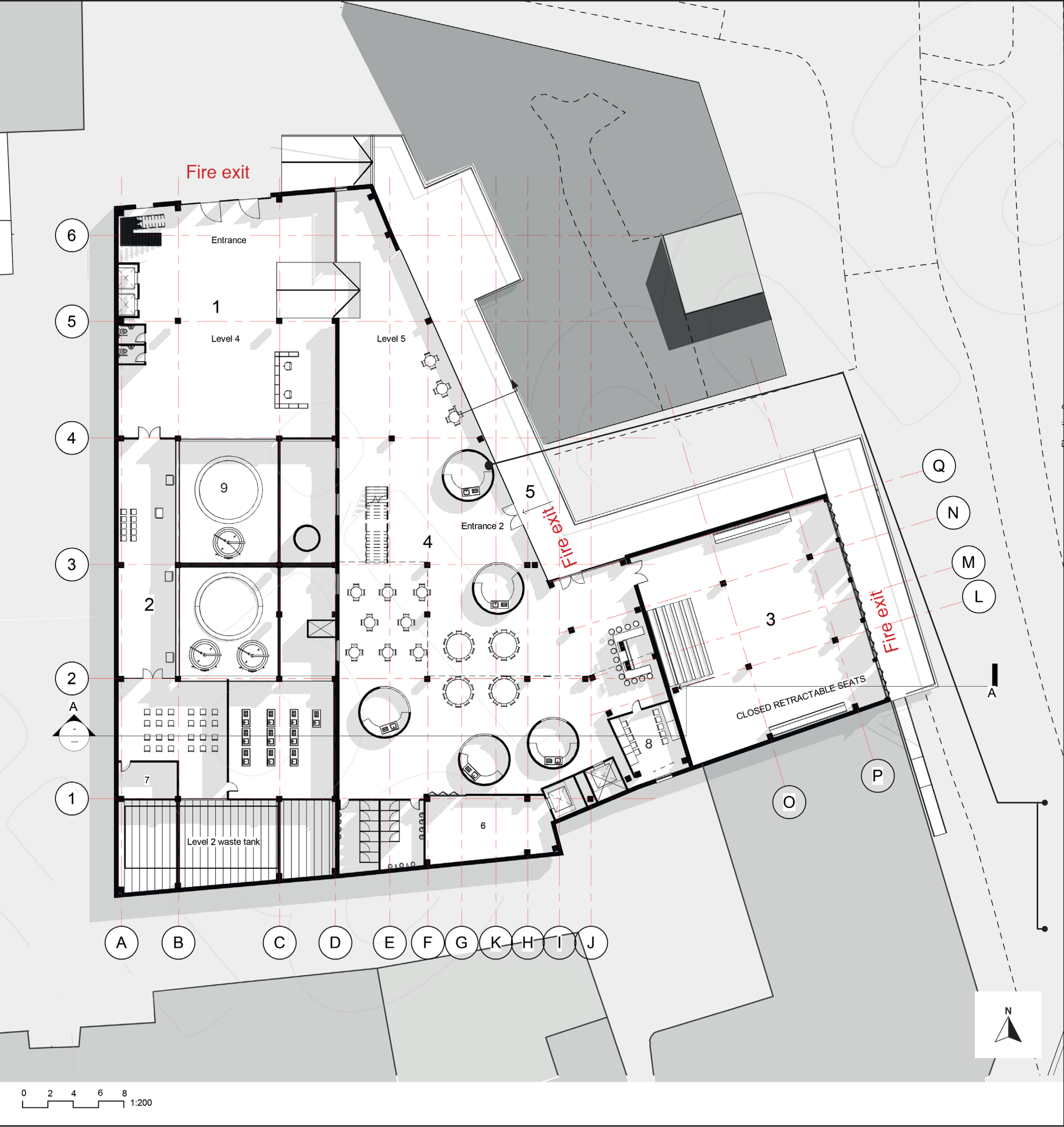
Referring to CIBSE recommended comfort Criteria for specific applications in my scheme



Justification Statement

-These are the most relevant criterias for my scheme as my goal for the recycling facility is to promote less food waste, provide education, and use the plant's energy for the public venue. Also, because there is very little sun exposure to the site, the consideration daylighting thermal comfort makes more sense, and noise factors are very important because the plant and venue are located in the heart of the city centre.

A4: General arrangement ground Floor plan 1:200



KEY

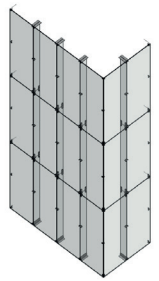
- 1- Foyer
- 2- Education and training centre
- 3- Multifunctional Auditorium
- 4- Food Hall with flexible food stalls
- 5- External steel structure Platform linked to Food Hall and Auditorium space
- 6- Storage for temporary stalls and auditorium equipments
- 7- Storage for education and training space
- 8- Green room
- 9- Biogas Plant

Wall envelope west and south elevation

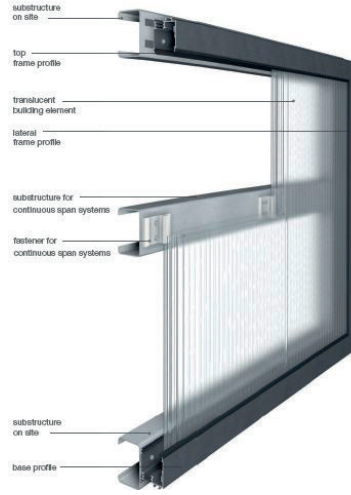


Envelope on East elevation

Pilkington Planar



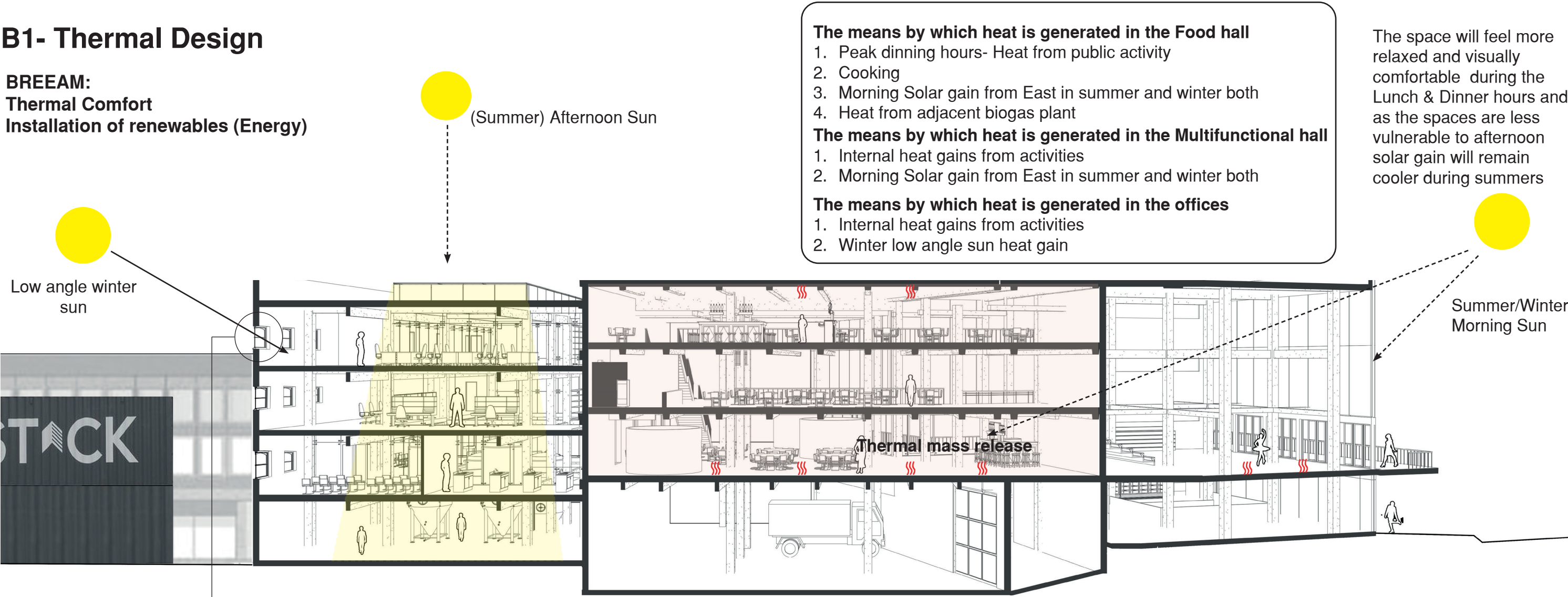
Rodeca translucent facades and roofs



PART B- Environmental Design

B1- Thermal Design

BREEAM:
Thermal Comfort
Installation of renewables (Energy)



Summer Strategy for office, control and education space

Office hours 9am-5pm

The spaces in the summer are much cooler during work hours because of west facing and also because of high rise building blocking the sun and creating cool environment
Opening of windows in summers & light clothing

Winter strategy for office, control and education space

The spaces will use electric radiators to keep itself warm during office hours. The heat is stored by the exposed 300 mm thermal mass floor and for that reason night time ventilation to be considered.

Summer Strategy for Food Hall & Multifunctional Hall

-Heat absorbed by the thermal mass floor (300mm exposed reinforced concrete) and slowly released throughout the day; to balance this heat absorption, air conditioning powered by renewable energy will be used, and entrance doors will be left open; as there is no harsh sun due to overshadowing on the east facade, cool breeze will keep the inside temperature cool, balancing the inside temperature so that the summer operational temperature is maintained **19-21 degrees Celsius**. (CIBSE GUIDE A)

Winter strategy For Food Hall & Multifunctional Hall

- Heat absorbed by the thermal mass floor in the morning by the sun,public, cooking during breakfast hour (300mm exposed reinforced concrete)
- Slowly released throughout the day from the thermal mass floor during afternoon hours when there is no direct solar gain only diffuse daylight
- Cladding material used is **Rodeca** Translucent building element (60mm crystal polycarbonate sheets onto substructure for facade support) U value- 0.75 W/m2K which has good insulation property helping to store much of the heat inside and also has 45% approx daylight transmission.
- **electric radiators** (*Waste to renewable energy*) will be utilised to keep the food hall warm, and separate air handling systems that push out fresh warm air will be installed. Winter operational temperature of **21-23 degrees Celsius** to be maintained. (CIBSE GUIDE A)
- These strategies are also applicable to multifunctional hall also

Summer and winter operative temperatures in accordance with CIBSE Environmental Guide A (Butcher and Craig, 2016)

	Summer	Winter
Food Hall cafeteria	19-21	21-25
Kitchen	15-18	18-25
Multi-purpose Hall	21-23	23-25
Changing room/Dressing room	21-23	22-25
Foyers	13-20	21-25
Offices	21-23	22-25

U VALUES & Thermal mass

WALL:
West and south Wall- Concrete cavity wall with insulation 0.19W/m2K
East walls
Polycarbonate facade- 0.75 W/m2K

Floor:
High Thermal mass floor 300mm with 40mm insulation and 70mm screed

Roof:
300mm Concrete flat slab with 90mm insulation and roofing membrane on top 0.26W/m2K

B2: Visual Comfort and Lighting Design

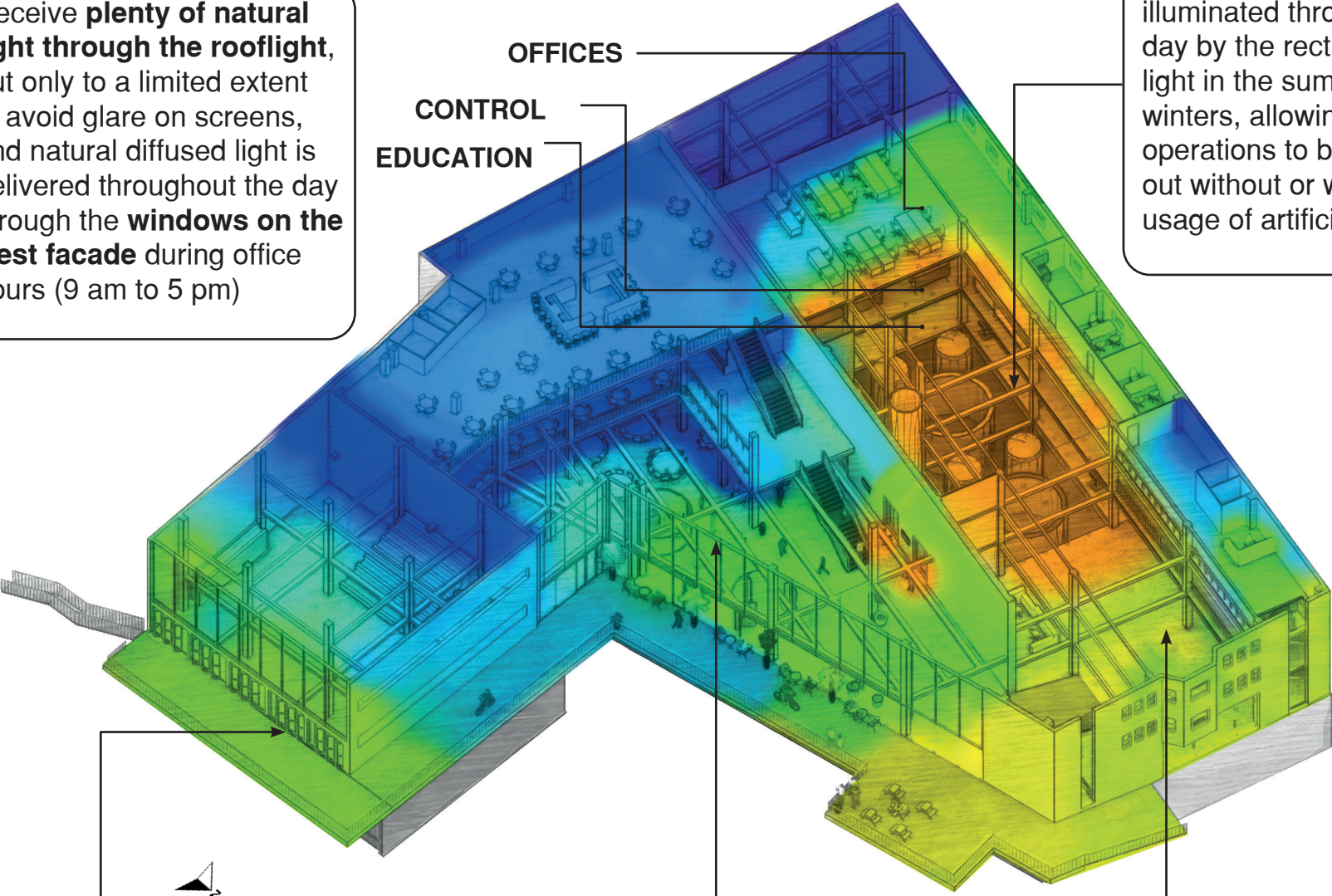
DAYLIGHT INTENSITY DIAGRAM

The office, control, and education areas

Receive **plenty of natural light through the rooflight**, but only to a limited extent to avoid glare on screens, and natural diffused light is delivered throughout the day through the **windows on the west facade** during office hours (9 am to 5 pm)

BIOGAS PLANT

The Biogas Plant is naturally illuminated throughout the day by the rectangular roof light in the summers and winters, allowing the plant's operations to be carried out without or with minimal usage of artificial lighting.



MULTIPURPOSE HALL

The Multifunctional Hall receives natural diffuse light **facing east** throughout the day due to its occasionally occupied character and also darker room requirements, and the materials selected to maximise the light include polycarbonate facade and Oak frame sliding doors with insulated glass in between.

Artificial lighting in night sourced by the reserve from biogas plant making it a renewable source of energy

3 FLOORS OF FOOD HALL

The food hall's natural light is increased with the use of insulating polycarbonate and glass facade, and because there is no direct solar gain during the afternoon hours that is Lunch Hours, the light that is transmitted inside the area is a softer diffused light, creating a comfortable atmosphere. The upper floors are of the food hall receive minimum lighting and use artificial lights to maintain the relaxed lighting conditions

FOYER

Combination of plenty of natural light from the rooflight and diffused light from windows on the north facade create a very comfortable environment in the foyer



BREEAM: Daylighting

- The site being surrounded by high rise buildings receives very less sunlight
- The daylighting in the building is increased with the help of polycarbonate facade and rooflight.

Artificial Light:



Borde CCT Pendant

Foyer, Food Hall

These lights will be hung from the exposed concrete beams and will maintain the original aesthetic of the Dex car park.



Ecophon Dot

Offices, control room and education space

RECOMMENDATIONS

Recommended maintained illuminance levels (Lux) in accordance with CIBSE Environmental Design Guide (Butcher and Craig, 2016)

- Food Hall- Night Club,public house, cafeteria - 200 lux
- Food preparation and cooking -500 lux
- Multi-purpose Hall- 300 lux
- Changing room/Dressing room - 300 lux
- Foyers- 200 Lux
- Offices
 - Staff offices with computers -300 lux

B3: Acoustic performance and design

BREEAM: Sound

- Internal indoor ambient noise levels
- Sound insulation
- Reverberation

Noise Criterion CIBSE guide A recommendations : Noise rating (NR) (Butcher and Craig, 2016)
Foyers- 40 NR
Food hall- 35-40 NR
Multipurpose hall- 40 NR
Offices- 30 NR
Factory- 50-65

NOISE LEVELS



Public Private Plant Foyer

S W E N

Acoustic glass panels will be used for visibility towards the biogas plant and also to reduce the impact of noise from the plant into office and education spaces

ZONING

The noise levels inside the space is balanced by placing the less acoustic sensitive areas on the east side and most sensitive on the west in middle is the Plant which has sounds coming from it's operation which is fine for the control room and education training as it's related to the biogas plant

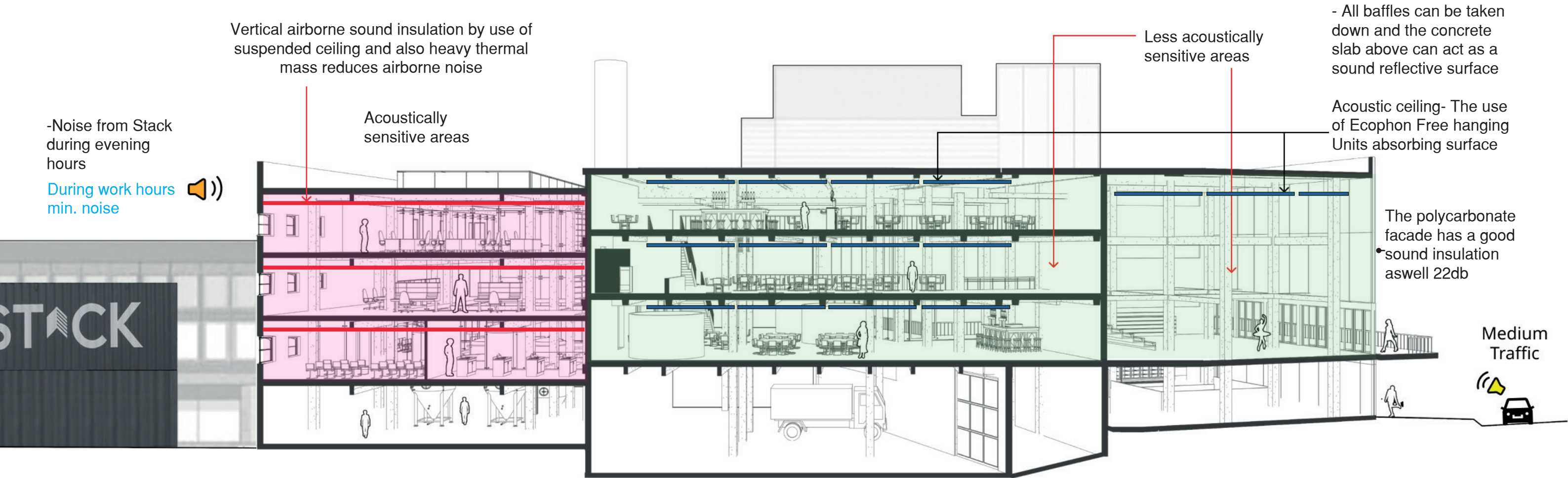
The offices are placed on the top floor so as to reduce the noise and also visibility towards the biogas plant is achieved through acoustic glass panels spanning between the existing concrete frame

Pilkington Optifloat™ 3-8 mm
Noise reduction interlayer Typically 0.76 mm

(Glass Systems, n.d.)

Ecophon Solo Baffle White frost: 1200x200mm

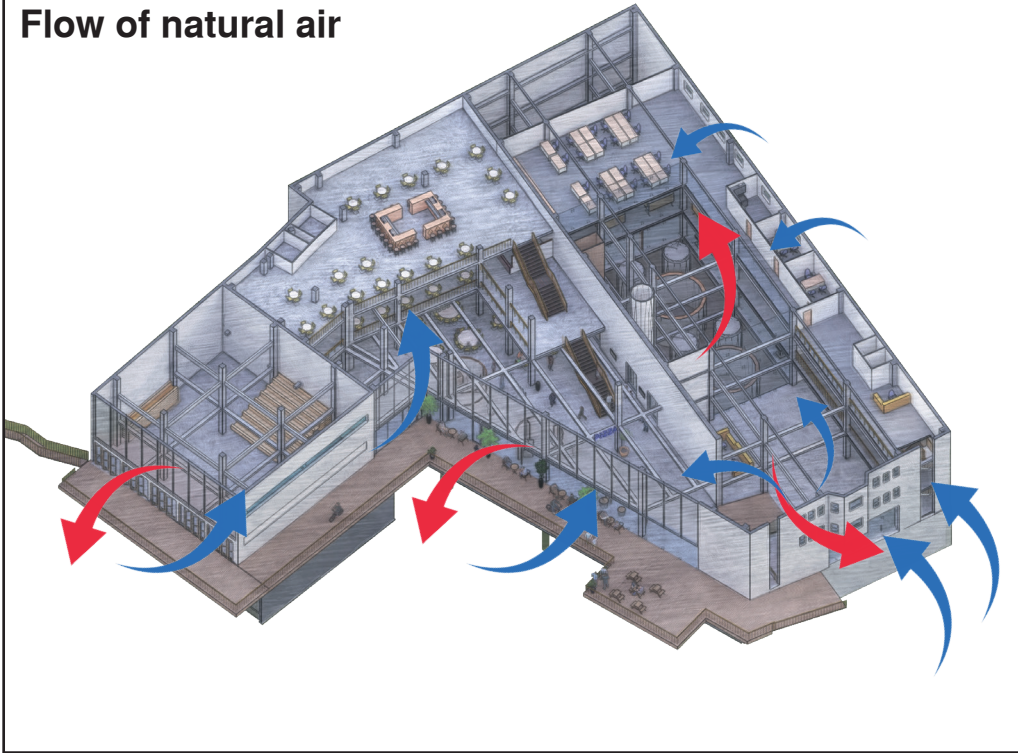
(Sound insulation, 2022)



B4: Ventilation and Air handling

Typical Air Changes per hour:
Food hall- 12-15
Multifunctional Hall- 8-15
Biogas plant- 10-15
Offices & control room- 4-6
Education centre - 4-12

Flow of natural air



Glass lid AOV fully opened for smoke ventilation.
(automatic-opening-vents,2022).



OFFICE, CONTROL, EDUCATION

- Mechanical and natural means to maintain fresh air inside office control and education space
- Night time ventilation from windows for heat absorbed by thermal mass floor
- The openable windows remove stale air and allow fresh air inside both in summers and winter
- Open windows provide Single sided natural ventilation up to 6m

Biogas Plant

- The openable roof light removes any indoor pollutants and hot air of biogas plant and keeps the Biogas plant cool but mechanical ventilation is also provided to extract warm air out of the space because of the heavy operations

Food Hall

- Openable doors in ground floor of food hall space allow fresh air throughout the winter and summers up-to 6m
- The space requires mechanical ventilation to draw stale air and pollutants out because of the cooking activities and internal gains from people during peak hours

Mechanical Ventilation by Halton (Food Hall Commercial Kitchen Ventilation Design Solutions, 2020)

Makeup Air

Air exhaust

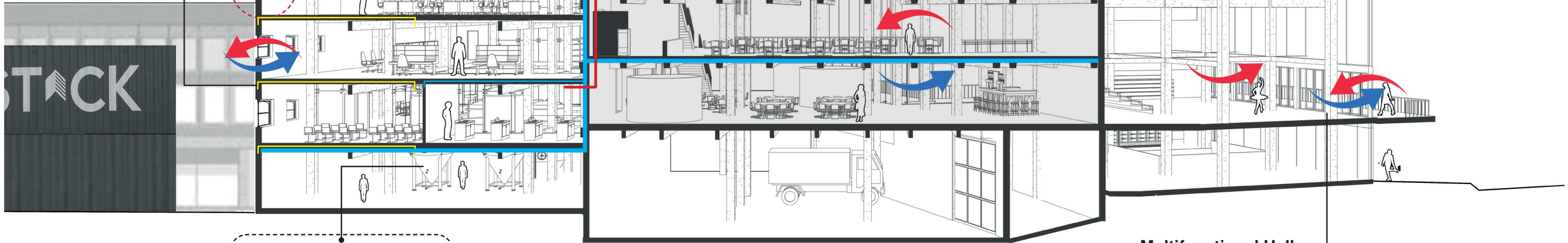
Also the ventilation gap in the facade removes moisture keep the space dry

Air exhaust

Use of Heat recovery system can also be appropriate so as to keep the spaces warm in winter through ducting

Multifunctional Hall

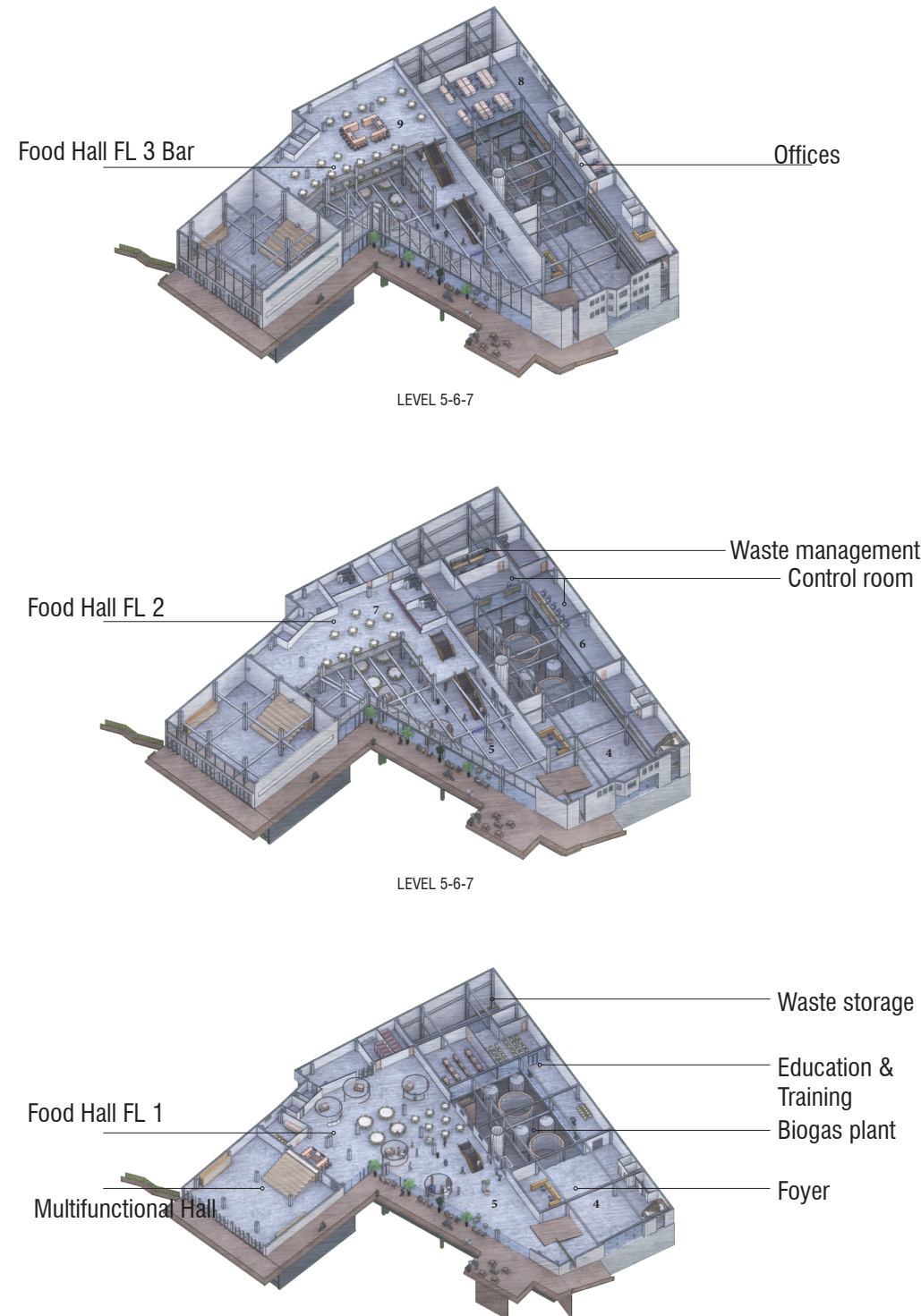
- The openable door remove stale air through the day in summer and winter
- Night time ventilation for the heat absorbed by thermal mass floor is elemented through mechanical ventilation because of security reason.



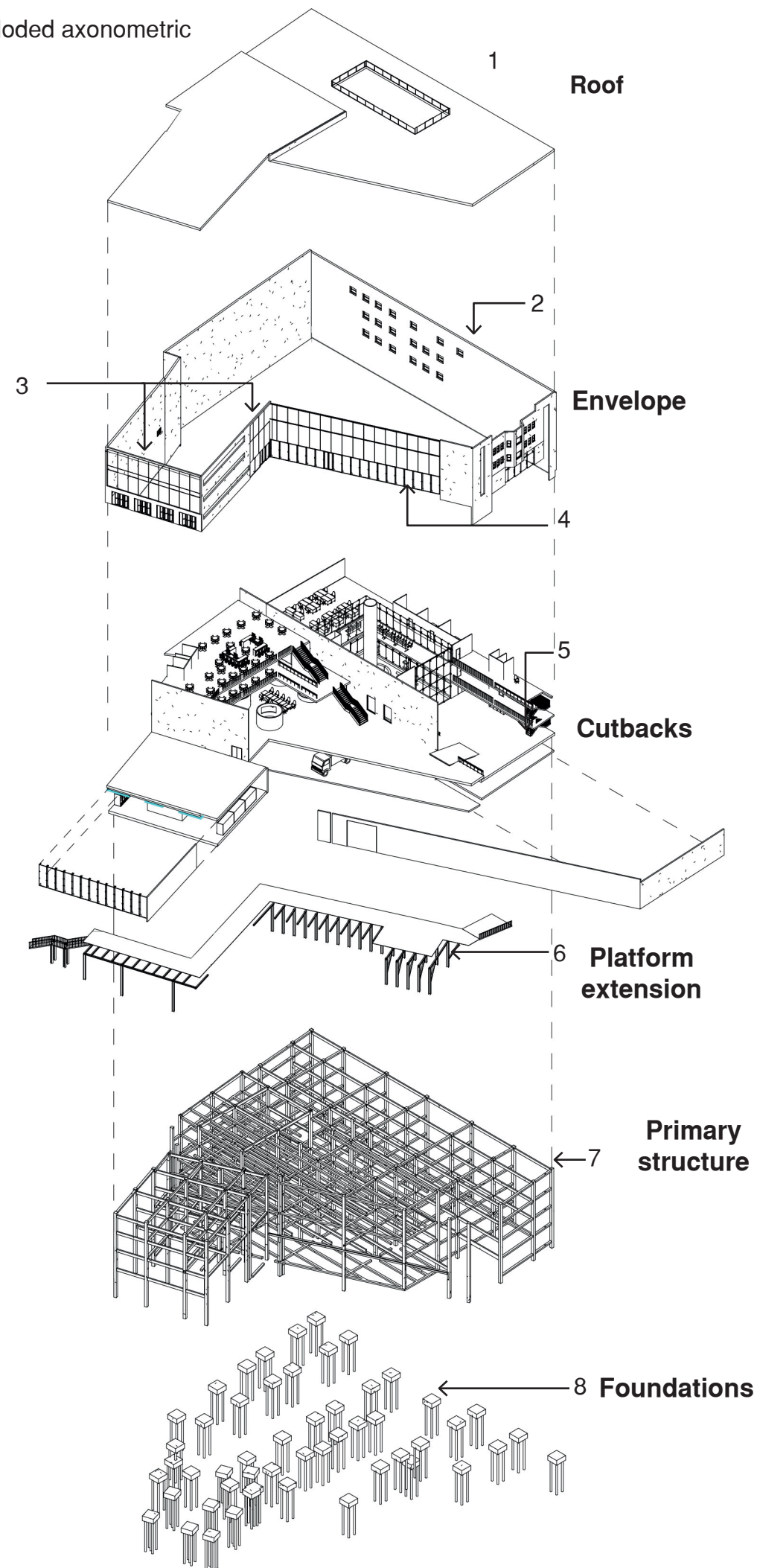
PART C- Structure and Envelope

C1: Primary Structure and Exploded Axonometric

General arrangement axonometric



Exploded axonometric

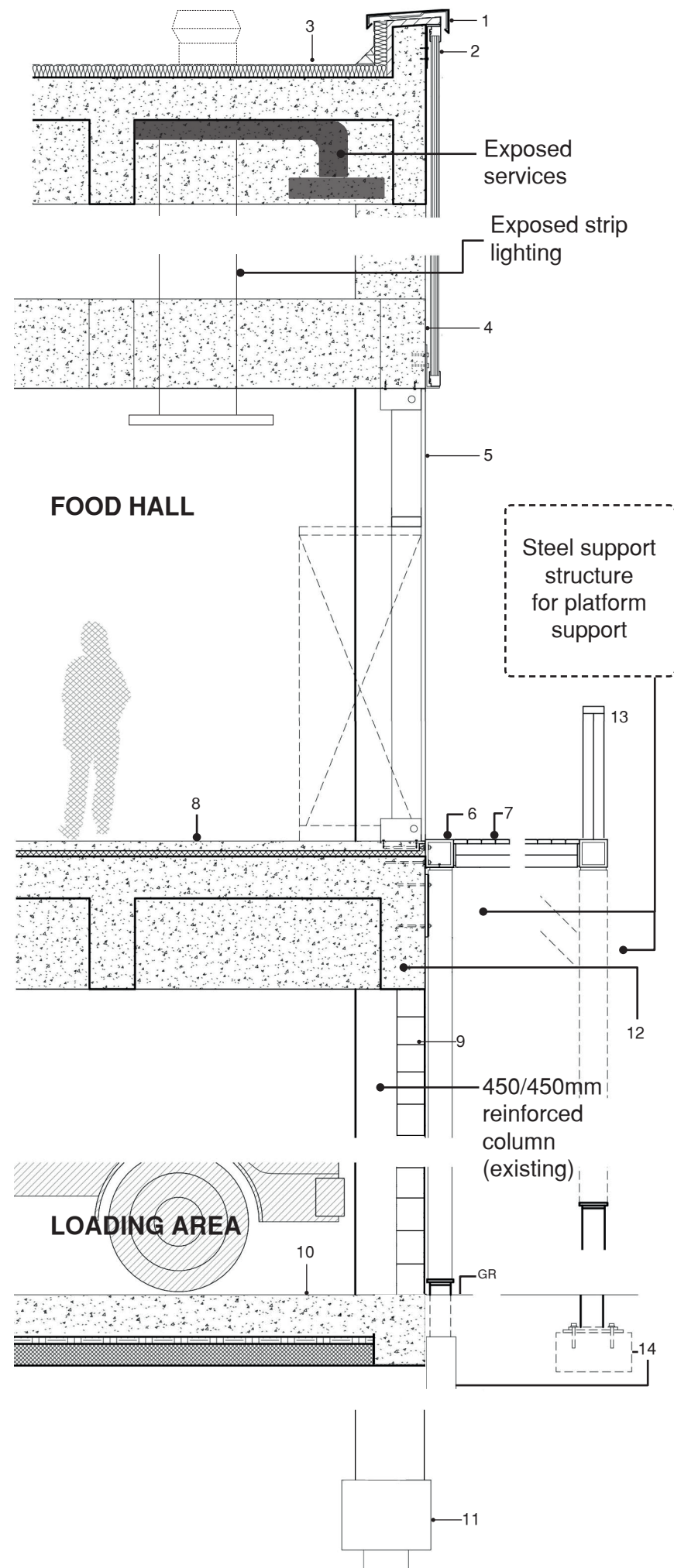


- The primary reinforced concrete is fully retained
- The new cladding materials are Rodeca translucent polycarbonate cladding, Pilkington glass mullion system, concrete cavity wall
- The slabs are cut to grid from inside to create double triple height spaces
- The ramps of the existing structure is removed and the gap is filled
- The roof slab is cut in between and roof-light is created with aluminium mullions and integration of velux Glass lid Automatic Opening Vent
- A platform is created with the use of steel skeleton structure that is connected to the existing fabric
- The approach was to use less but very sustainable materials and do very less of the demolish from outside
- The front facade is retained and painted

KEY

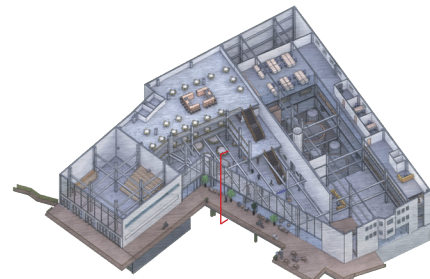
- 1 Existing Concrete flat roof with roof-light in between
Dead load
- 2 External wall build-up on west and south
22mm White Render, Beige, Smooth
215 mm Concrete hollow masonry
90mm Insulation
12mm Plaster
- 3 Lightweight Polycarbonate facade on east
- 4 Glass mullion glazing system on east
- 5 Existing reinforced concrete slabs (cutbacks) live loads supported by concrete frame
- 6 Steel structure
Wooden Planks on top
- 7 Primary concrete reinforced frame structure (Retained) provides good fire safety
- 8 Pile foundations

C2: Envelope construction 1:20



Polycarbonate

Fully recyclable
Embodied energy of plastic- 45,000 kWh/tonne whereas by using the recycled polycarbonate reduces embodied energy



Scale 1:20 section/part elevation

- 1 Aluminium Coping (Graphite black) Clip
20mm Marine Ply, breather membrane
90mm Rigid thermal insulation (**Rockwool** HARDROCK Multi-Fix)
- 2 **RODECA** Polycarbonate cladding 60mm (Crystal) with Rodeca Frame (Graphite black)
30mm ventilation gap
- 3 Fully Adhered single ply non-bitumous roofing membrane
90mm rigid insulation
Breather membrane
300mm existing concrete slab
- 4 Exposed concrete retained frame primary and secondary beam and no slab on top (slab removed and beams kept)
- 5 **Pilkington Planar** insulated glass units with glass mullion system 200/19mm rectangular glass mullion
- 6 20/20/5mm coated steel SHS
- 7 100/30 mm whitewood spruce timber planks
- 8 70mm Polished concrete screed
40 mm **Rockwool** rigid insulation
300mm existing reinforced concrete slab
- 9 200mm thick Concrete masonry wall, paint finish
- 10 300mm existing reinforced concrete slab ground bearing
- 11 Pile foundation
- 12 600/300 existing reinforced concrete beam
- 13 160/40mm wooden handrail
- 14 Concrete individual footing support for steel structure

BDR Bureau (Sandra Barclay et al., 2020)

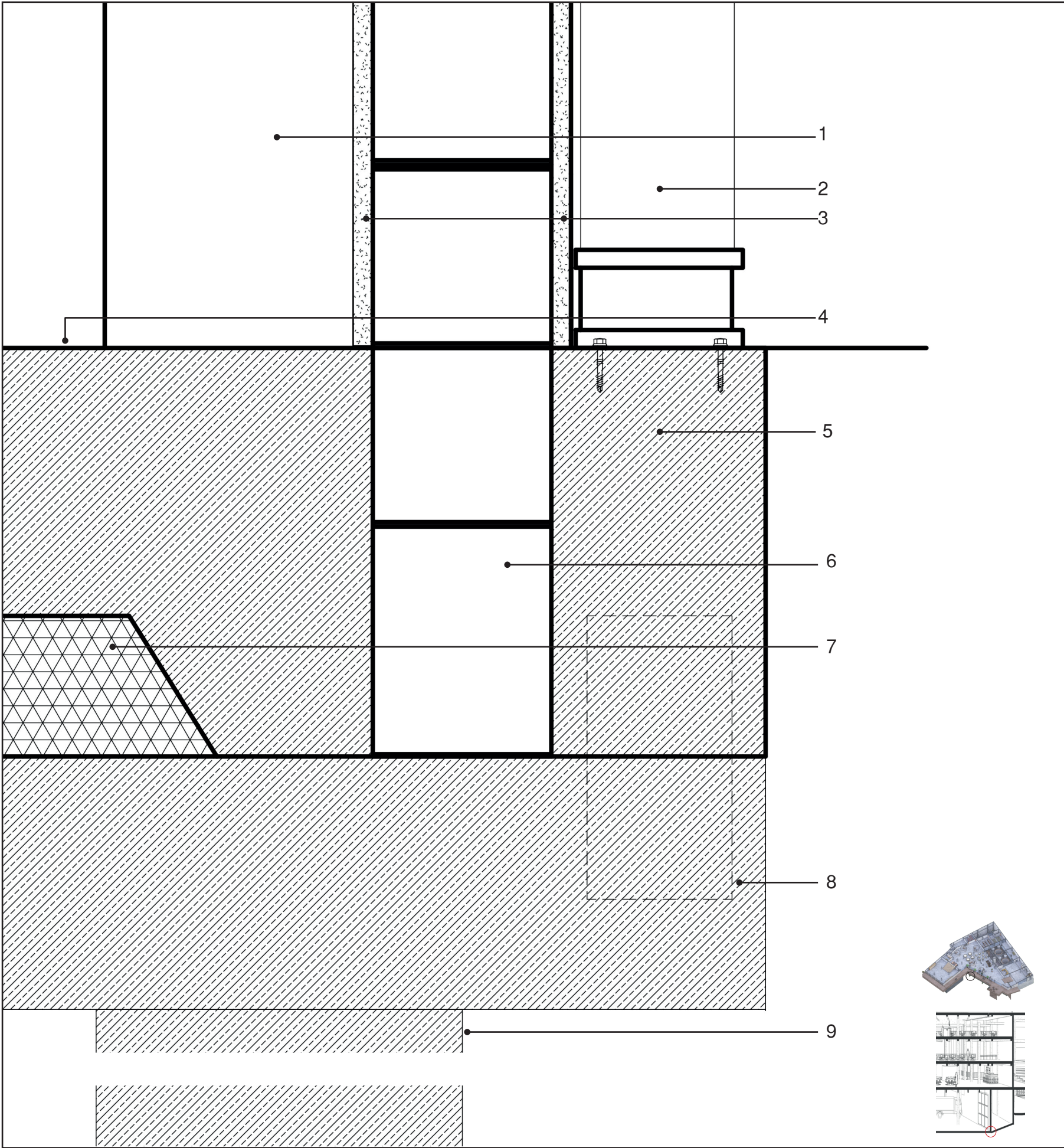


Heiler Geiger Architects build a new daycare center in Memmingen (Geiger et al., 2021)

The following precedent building is wrapped with 100% recycled polycarbonate

The following precedents form a steel structure extension that connects with existing fabric
A similar strategy is adopted in my design. A steel beam and column structure is employed to support the newly constructed platform, which links to the existing and forms a blend of old and modern light elements that contrast the heavy concrete frame.

C3: Ground floor / external wall detail 1:5



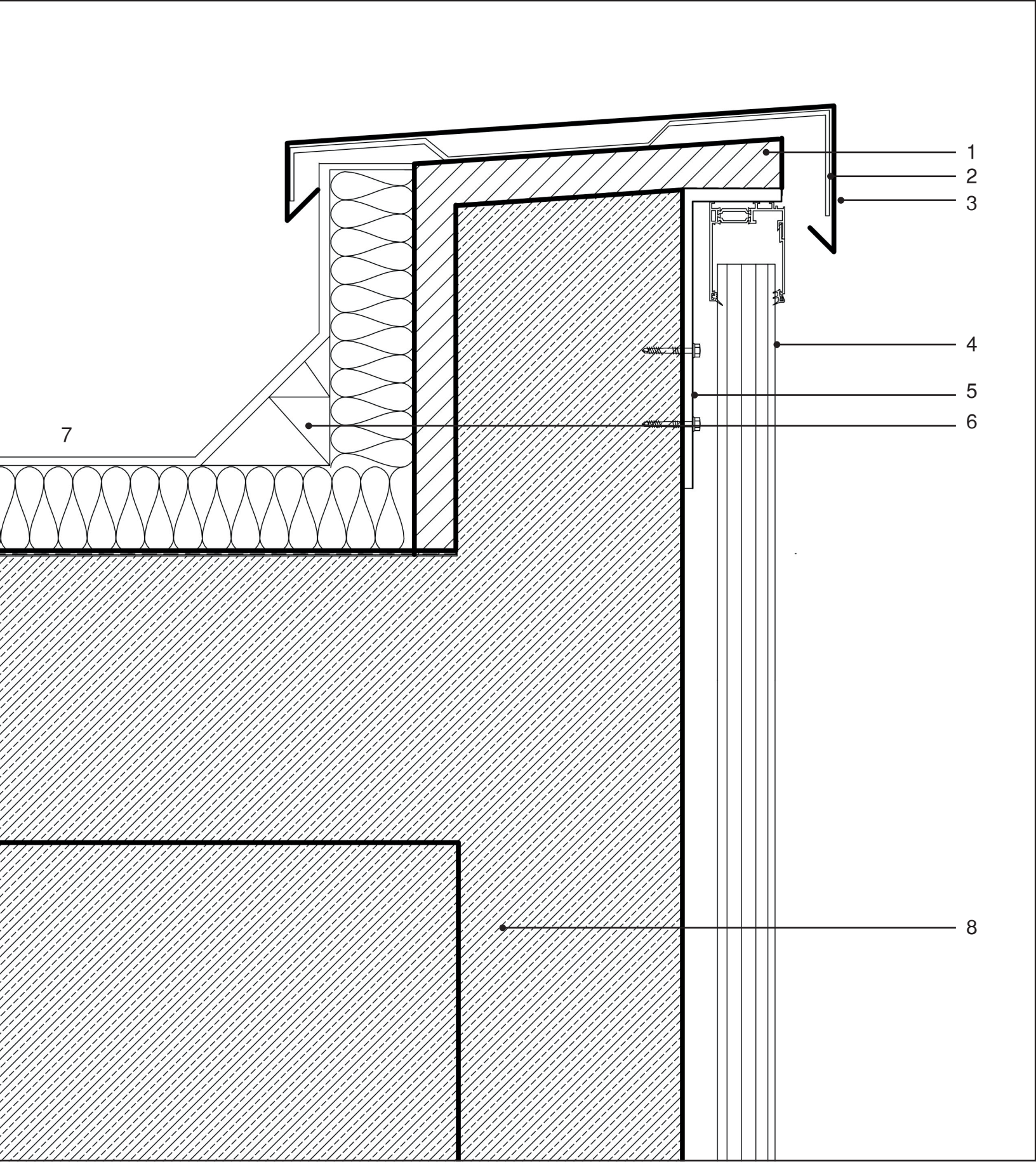
The external wall on the floor 1 and 2 are solid concrete masonry walls as it is only for the use of loading and unloading of waste that arrives.

Also the steel columns of the extended platform is supported by individual concrete footing from the ground

As the external wall is not visible to the general public and is only for the purpose of the factory trucks to come in it is not cladded with additional materials making less use of the materials.

- 1 Existing concrete frame column 450/450mm
- 2 Vertical Hollow steel column support for extended Ramp
- 3 22mm concrete render finish,white
- 4 300mm concrete slab ground bearing (no insulation as it is a Truck park and loading area)
- 5 Steel column fixed to 500/200mm reinforced concrete pad
- 6 support
- 7 200mm thick Concrete masonry wall with 10mm mortar in between
- 8 150 mm Gravel to makeup the hardcore layer
- 9 Reinforced Concrete footing (existing)
- 9 Reinforced Concrete piles (existing)

C4: Wall to Roof Junction 1:5



The project's approach was to reuse as much of the existing fabric as possible in order to extend the lifespan of the structure. The existing concrete roof structure is insulated on top with a fully adhered roofing membrane. The roof previously supported a live load with car parking on the roof; in my case, the roof will have no load

The ventilation gap between the concrete frame and the polycarbonate facade helps element the moisture and keeps the space dry

- 1 20mm marine ply, breather membrane
- 2 Clip
- 3 Aluminium coping
- 4 **RODECA** polycarbonate cladding 60mm (Crystal) with Rodeca powder coated aluminium frame (Graphite black)
30mm ventilation gap
- 5 Screws fixed to Rodeca frame through L angle bracket
- 6 Rigid Insulation
- 7 Fully Adhered single ply non-bitumous roofing membrane
90mm **Rockwool** rigid insulation
Breather membrane
300mm existing reinforced concrete slab
- 8 Existing concrete beam 600/230mm

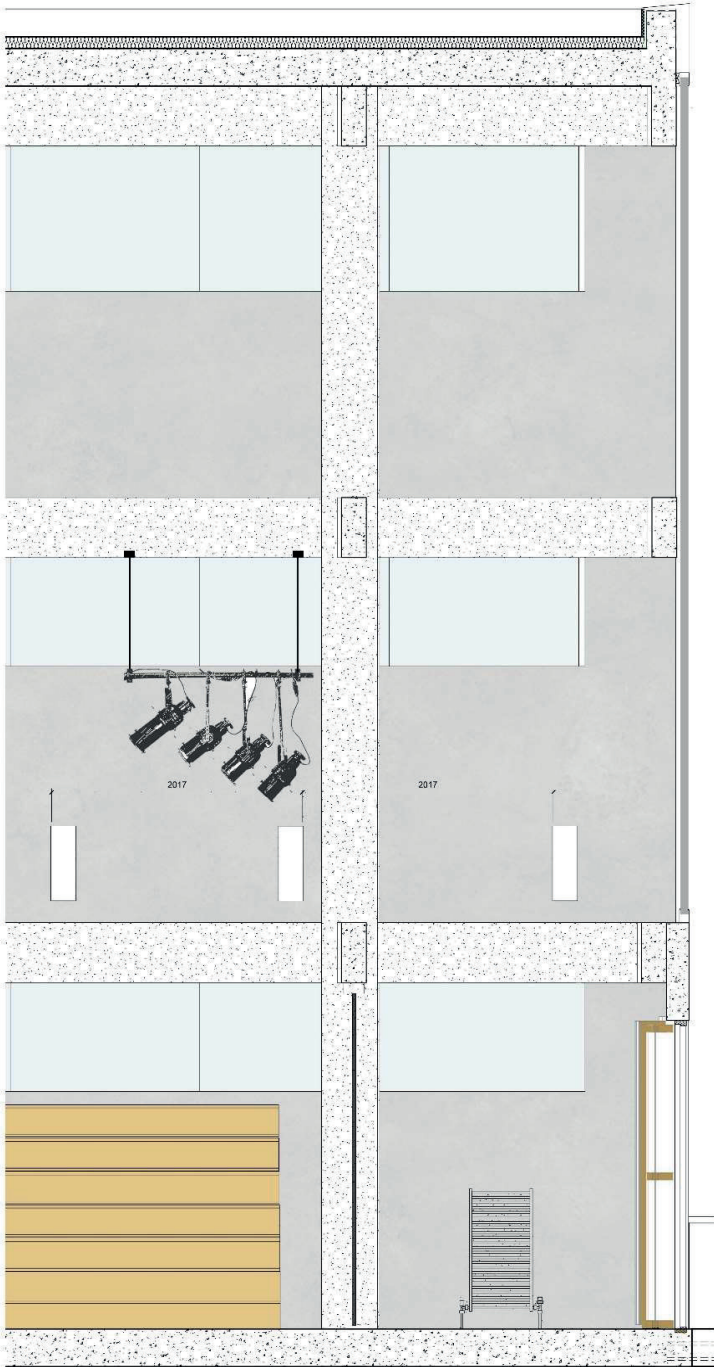
PART D- Internal Fit out and Services

Type	Description
Detection (Y)	Smoke detection placed on wall

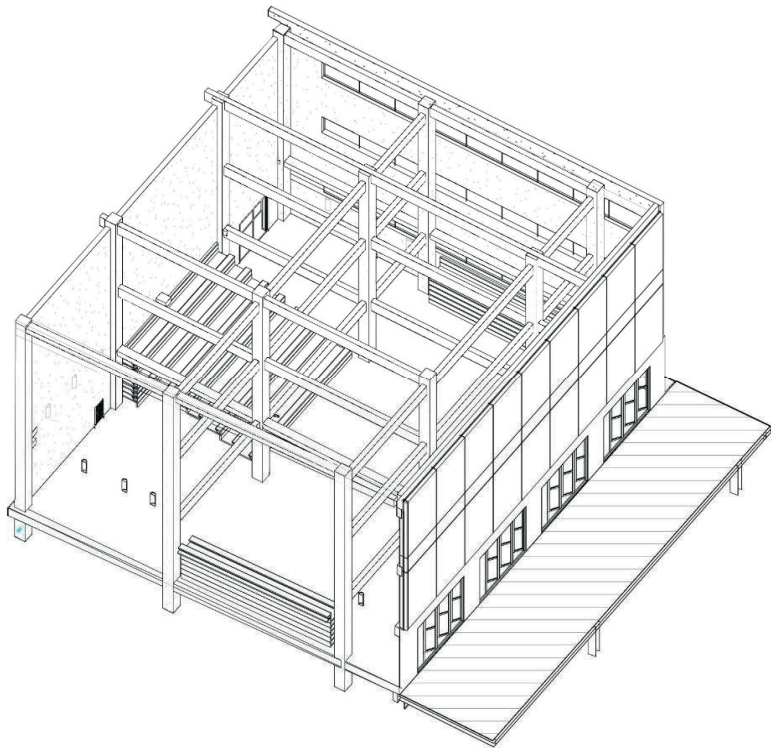
D1: Room data sheet

Notes

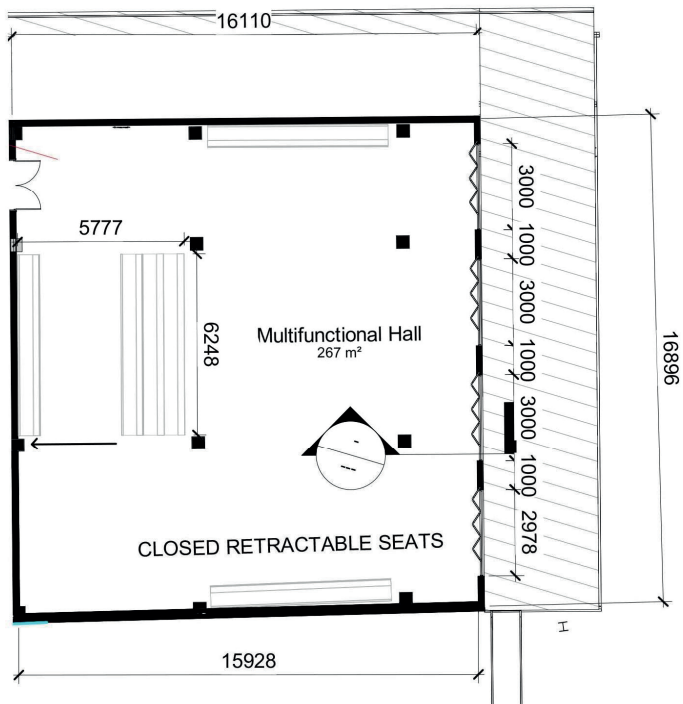
1:20



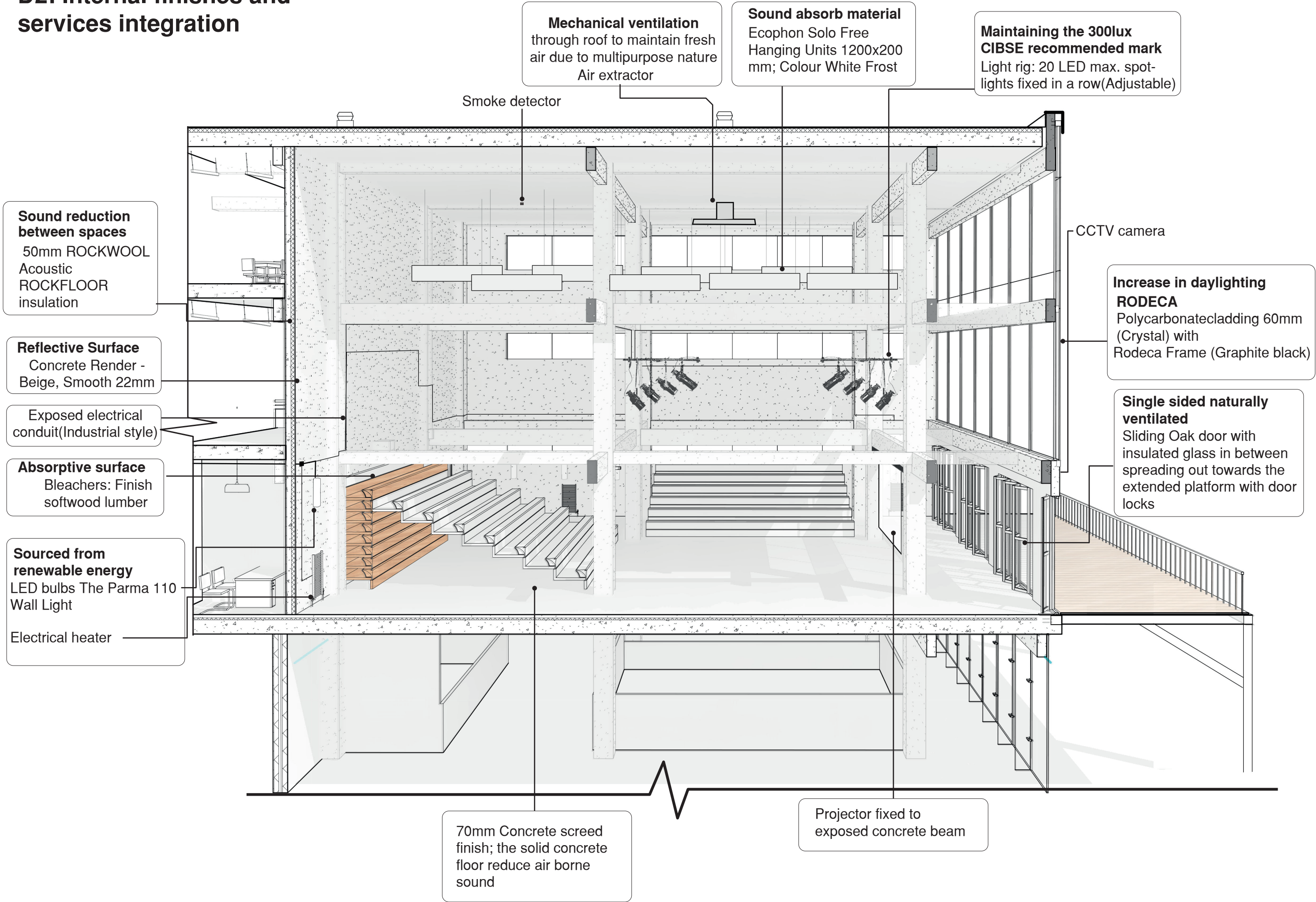
1:500



1:200



D2: Internal finishes and services integration



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