THE FLEETWOOD CHALLENGE REPORT.

2023

CONCEPT DESIGN VALIDATION REPORT.
SOCIAL CONTEXT & PRECEDENTS

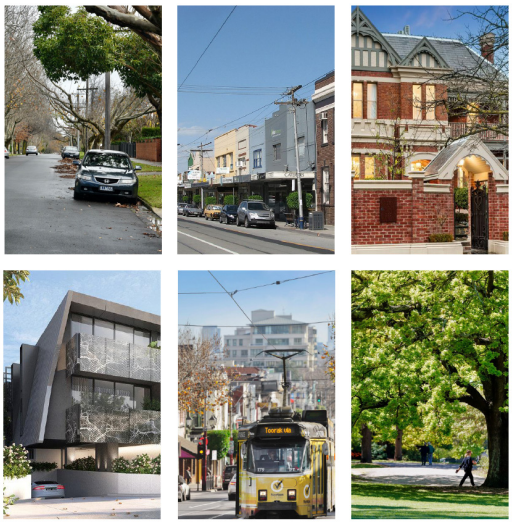
MALVERN EAST, VICTORIA.

Malvern East is a suburb in Melbourne, Victoria, Australia, 13 km south-east of Melbourne's Central Business District, located within the City of Stonnington local government area. Malvern East recorded a population of 22,296.
Malvern East is bounded to the north by Wattletree Road and Gardiners Creek, to the east by Warrigal Road, to the south by the Princes Highway (Dandenong Road) and to the west by Tooronga Road.
It is most famous for the Chadstone Shopping Centre, the largest shopping centre in the southern hemisphere, and the largest by total lettable space under one roof.
In recent times, what was once a relatively small suburb was extended to incorporate parts of neighboring Chadstone. Based on its easterly proximity to Malvern, the expansion and redefinition of Malvern East was driven in the 1990s by resident groups eager to 'reclaim' their address from being identified with the Chadstone Shopping Centre, which had been massively expanded since its original construction. However, the Chadstone Shopping Centre shares the 'Malvern East' address and postcode.

[FIGURE 1] Site Diagram

[FIGURE 2] Site Noise amd Sun Diagram

Site Identity



Various images of Malvern East.

Perimeter: 214m

Area: 1,225 sq m

Exterior images of the site.

PRECEDENTS

JUF NIENKE WOODEN MODULES

-Dual Access, well ventilated
-Prefabricated units
-Shared courtyard
-Dismantling and reuse later in the future
-Almost entirely built from timber, Contributing to a better climate

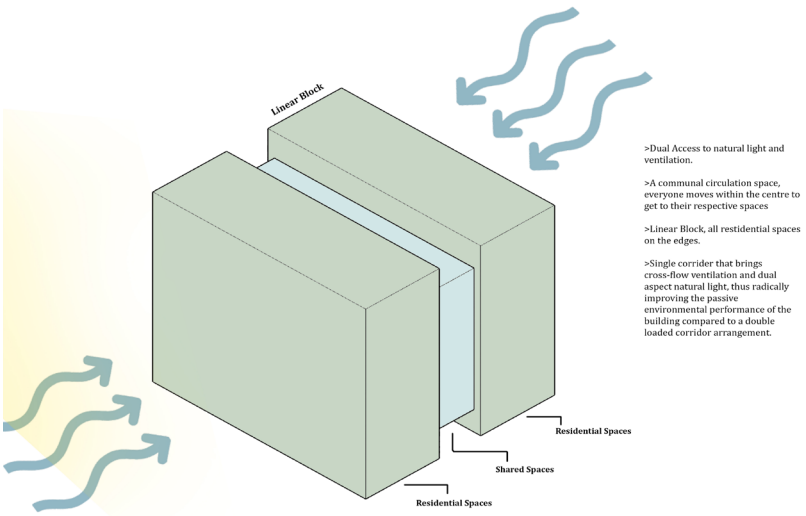
Exterior of Juf Nienke Wooden Modules.

WAHNREGAL APARTMENTS BY FAR.

-Precast concrete slaps
-Wide Rooms
-No interior walls
-TT-concrete beams

Exterior of Wohnregal Apartments.

CONCEPT DESIGN VALIDATION REPORT.
CONCEPT.



[FIGURE 3] Massing Concept Diagram

INITIAL CONCEPT

The basic massing of the design will be a linear block. With residential spaces on the sides with a circulation space in the middle, and a semi-public space on the ground floor. This ensures there is dual access for all occupants and makes the most of the site. Giving everyone ample ventilation and sunlight making spaces higher quality and more livable.
An important aspect of the project is ensuring that the design is high and detail and is far above the standard of living for an apartment.

FIVE CONCEPTS

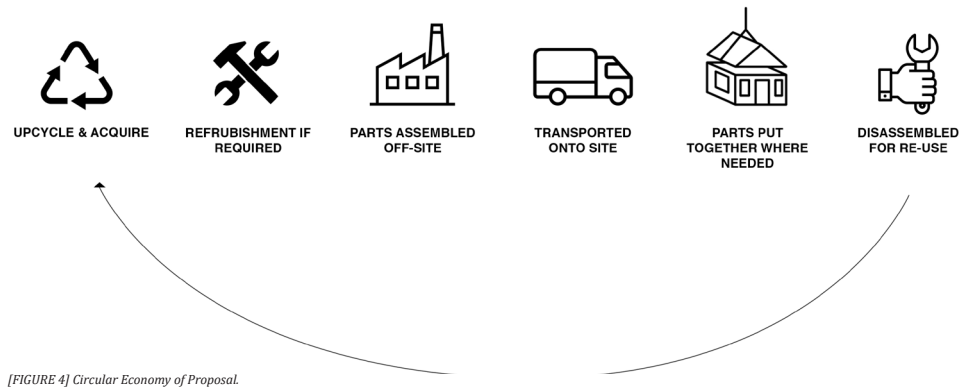
>Circular economy
A closed-loop system with little waste and resource wastage is the goal of the circular economy design idea. To keep resources in use for as long as feasible, items in a circular economy are made to be readily dismantled, repaired, and recycled at the end of their useful lives. Here are a few ways that design may incorporate the ideas of the circular economy.

>Design for disassembly
Products should be made to be easily disassembled so that materials may be easily separated and recovered at the end of their useful lives. Using modular designs, standardising fasteners and connections, and staying away from glue and other permanent connecting techniques are a few examples of how to do this.

>Use recycled or renewable materials
Materials that are recyclable, renewable, or constructed of recycled material should be used in the design of products. This can involve the use of renewable and biodegradable materials like bamboo or cork as well as recycled polymers or metals.

>Extend product lifespan
Products should be built using materials and building techniques that can resist wear and tear and be intended for durability. Using top-notch materials, planning for repairability, and developing goods that can be improved or modified over time are a few examples of how to do this.

>Design for multiple life cycles
Products should be made with the capacity to be dismantled, repaired, or updated as necessary, with the goal of being utilised for numerous life cycles. Designing items that are easily adaptable to new purposes or reused at the end of their useful lives is one way to achieve this.



[FIGURE 4] Circular Economy of Proposal.

CIRCULAR ECONOMY

In a circular economy approach, the architect should start a project not with an abstract design concept, but with a rigorous, detailed review of the existing site and its assets. They should actively seek to reuse, refurbish and re-purpose materials and structures where possible.
The aim of the design is create an immersive public and private space to maximise waste and optimise space. The design seeks to showcase the extents recycled materials can go using prefabrication, through the use of a tactically and throughout architecture. This in turn will demonstrate the benefits of up cycling and recycling and the positive impact it has on the environment. Up cycling will reduce the need for excessive production and labor, the production and mining of material are greatly responsible for the CO2 emissions in the industrial sector. The design will attempt to showcase the many ways of using prefabrication as a method of coupling the create space, along with designing functional and suitable living spaces that is tailored to the target individuals and the site.

DESIGN INNOVATION - GRENNERY

The inclusion of various green spaces in the structure is addressed throughout the design phase.

-Cost effective: In the long run, constructing a green building is thought to be the most economical option. In the long run, constructing a green building is thought to be the most economical option.

-Temperature regulation: Investment in green buildings makes sense given the yearly rise in temperature because they greatly aid in temperature regulation. Additionally, the flora induces wetness around the building, creating a nice atmosphere.

-Improvement of overall health: It is abundantly obvious that green constructions help sustainability and the environment. They also offer a wide range of health advantages. Pollutant reduction in green buildings has a definite impact on people's health. Furthermore, this kind of building is meant to improve mental health.

-An improvement in living standards: The overall quality of life will improve due to green design. It maintains the balance between building and nature that traditional architecture lacks.

Example from Fieldwork's Kensington Project.

CONCEPT DESIGN VALIDATION REPORT.
THE MATERIALS.


CONCRETE


BRICK


TIMBER


STEEL


ZINC


GLASS

The selection of materials for this project plays a significant part since it not only helps to contribute to the creation of a structure that is favorable to the environment and the community, but it also helps to contribute to the preservation of the historic values that Malrvern East possesses. Brick, timber, and concrete were some of the primary materials that were chosen for this project.

USE OF UP CYCLED MATERIALS

'Up cycling' refers to the process of re-purposing a product, material, or waste by improving its quality and value beyond its initial form.
The project will utilsied purely recycled materials from the demolition of site and recycled materials. This will not only be cheaper it will also reduce the amount of emissions produced. Studies have shown that recycled building materials help to reduce the amount of energy that is consumed (and emissions produced) when building new structures. Researchers found that remaking building materials from recycled ones uses 10-25% less energy, compared to not using recycled materials. Along with this it also limits the waste as what would of been wasted from the original site will be utilsied within the design.

DEMOLISH FOR RECYCLING
60 Garden Rd, Clayton.
Eco group is a demolition company that avoids destroying and wasting materials but instead recycles and deconstructs materials.

ECO TIMBER GROUP
380 Victoria St, Richmond.
The concept of recycle and reuse was an important concept in the proposed design and EcoTimber provides recycled timber, naturally EcoTimber because the designated supplier for Timber

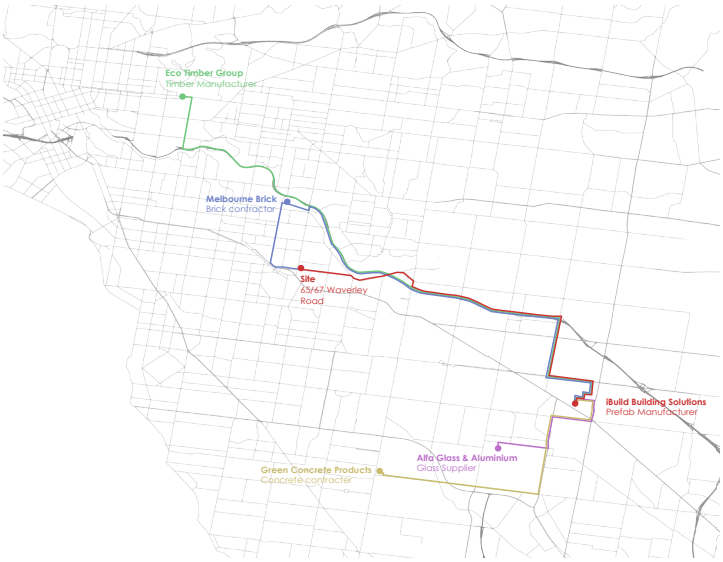
RECYCLED BRICK
330 Tooronga Rd, Glen Iris.
Heritage and preservation is key in the proposed design. As the original building consists of mainly bricks, up cycling these materials will be an environmentally conscious and economic decision.

ALFA GLASS & ALUMINIUM
219 Osborne Ave, Clayton South.
Alfa Glass supplies glass closest to the prefabrication manufacturer. They supply glass at a large scale which is essential in our proposed design as natural lighting is an important feature.

GREEN CONCRETE PROJECT
1 Kingston Rd, Heatherton.
This concrete supplier Provides sustainable concrete and is also close to the prefabrication manufacturer.

iBUILD BUILDING SOLUTIONS
5A Harnett Cl, Mulgrave.
This company specialised, modular buildings and steel structures which are highly regarded in the proposed design.

[FIGURE 5] Supplier Map

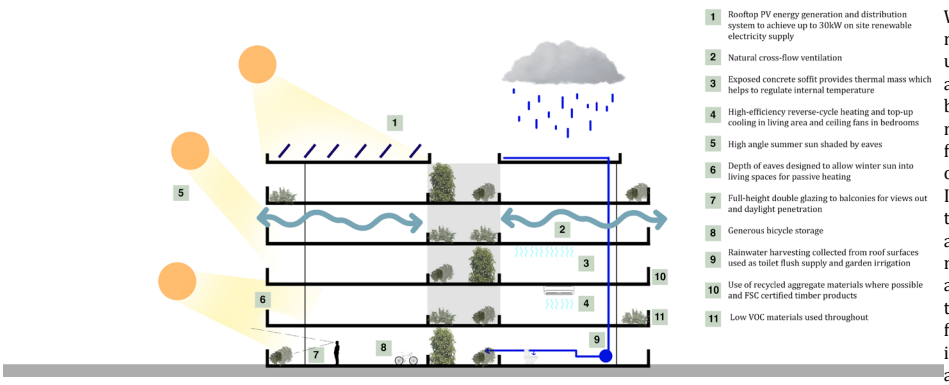


SUPPLIER MAP

As shown in the diagram, all suppliers and manufacturers are within a 20km radius, ensuring a reduction of transportation costs as well as reducing the carbon emissions of vehicles produced while in transit. This is essential as there will be multiple trips carrying modules and surfaces from the manufacturer to the site. Brick will be used from the original site therefore the old brick from site needs to be transported to the brick supplier for processing and upcycle to ensure that it would be able to be reused back on site. This is an environmentally friendly option to aim for a net zero energy design and by reusing old bricks it also decreases the environmental costs of manufacturing new brick and the demolition of old bricks. We also confirmed that our supplier and manufacturers are able to use recycled materials which will be a step closer to achieving 'net zero design'.

CONCEPT DESIGN VALIDATION REPORT.
DESIGN PHASE & DISASSEMBLY

[FIGURE 5] Net Zero Diagram



NET-ZERO DESIGN

We attempted to reach carbon neutrality, by using recycled material as well as enforcing the concept of upcycling materials towards the end of its life cycle. We also reduce the amount of carbon emission produced by transportation by ensuring that our supplier and manufacturer are within close proximity. We designed for adaptability, deconstruction and reuse which makes our building repurposable.

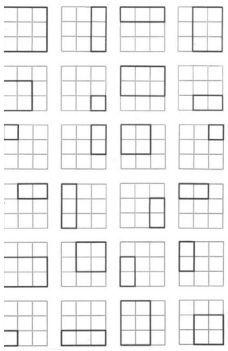
In addition to our focus on carbon neutrality, proximity to suppliers and manufacturers, and designing for adaptability and reuse, we also prioritize waste management and recycling initiatives. Our buildings are equipped with comprehensive recycling systems to effectively sort and recycle various waste streams, further reducing our environmental impact. By implementing these waste management practices, we aim to minimize landfill waste and promote the circular economy, contributing to a more sustainable and resource-efficient approach.

[FIGURE 6] Net Design

THE UNITS

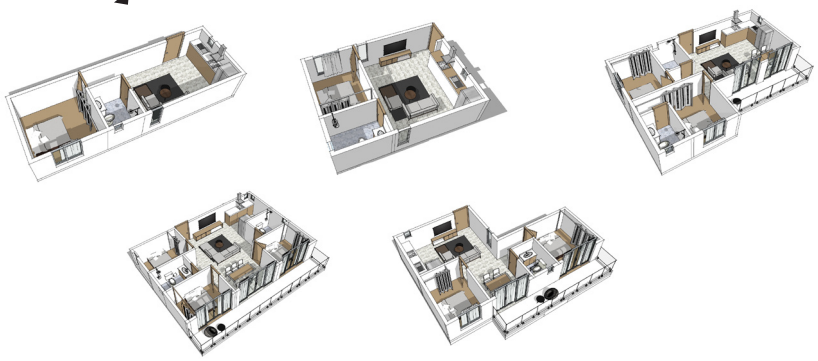
The following module is designed to cater to the following spaces:
>2 x Three Bedroom & Two Bathroom units ((125 x 2)= 250)
>2 x Two Bedroom & Two Bathroom units ((100 x 2) = 200)
>4 x Two Bedroom & Single Bathroom units ((75 x 4) = 300)
>4 x One Bedroom & Single Bathroom unit ((50 x 4) = 200)

GRID SYSTEM



Grid Diagram.

The image shows an example of how a 3x3 grid could be used to create multiple enclosures and its numerous combinations. This is most likely implemented in tall structures for ease in maintaining the structural and services line.

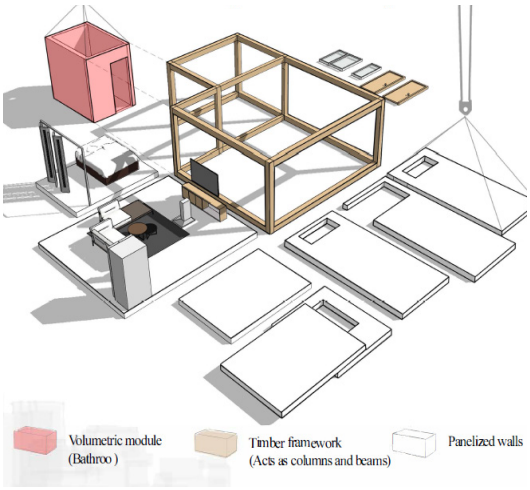


[FIGURE 7] Module Assembley

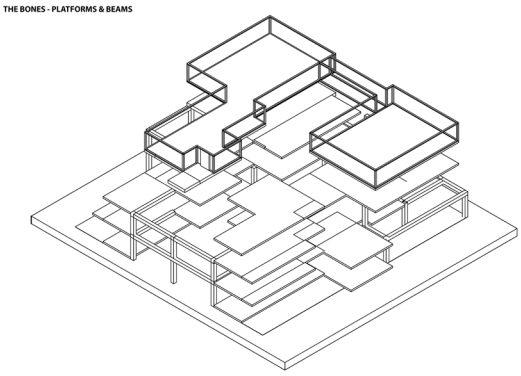
THE CONCEPT OF DISASSEMBLY.

Designing for disassembly is a key concept that was incorporated into the design concept. At the end of its life cycle, the building is to be deglazed, un-stacked, and disassembled. This could be achieved easily with basic handheld tools, with the idea that it can be disassembled by anyone. These parts are then to be organised and separated into materials category, transported to a factory to be up cycled and reused . There will be no waste and all energy that was used to make the material will be ultimately recovered. In the proposed project, timber flooring, steel structure and brick will be used the most as they are easily reused, refurbished and recycled.

By taking apart the original components of a product and reusing them allows for a circular economy to take shape. As shown in the diagram, the unit consists of timber frame work and volumetric bathroom modules which are manufactured off site and can be easily assembled on site. The structure would have been built prior to assembly and by using prefabrication it will only take 2 weeks for the whole building modules to be constructed. At the end of its life cycle it can easily be taken apart , upcycled and reused.



The structure beams and platform are also to be built off site so that the construction on site will be more efficient. This diagram also shows the simplicity of the design and that though the structure is fit in place, there can be many different variations of walls and volumetric modules can be assembled. The beams and platform are made from recycled timber.

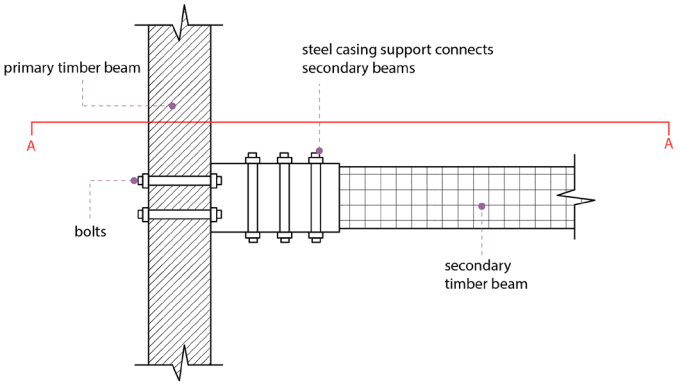


CONCEPT DESIGN VALIDATION REPORT.
DESIGNING FOR DISASSEMBLY.

MATERIAL CONNECTION

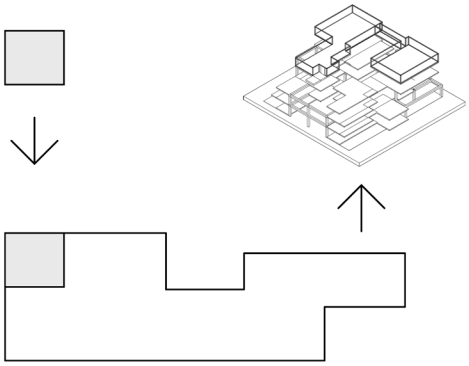
The decision to select steel connections for the modules was unanimous as steel-frame buildings are among the best candidates for reuse because of the versatility and durability of individual steel members. Regular steel takes almost double the amount of energy required to produce than recycled steel and by incorporating recycled steel into the design the same material can be used for centuries with its initial harvesting energy covered by its third or fourth recycled phase. In figure below shows the steel beam sections of the modules most likely used in communal areas as its partition is made of structural plastic allowing for openness and visibility in the public spaces. The skin acts as a filter that allows natural lighting and regulates temperature but keeps out UV light.

[FIGURE 8] Timber Connection Section



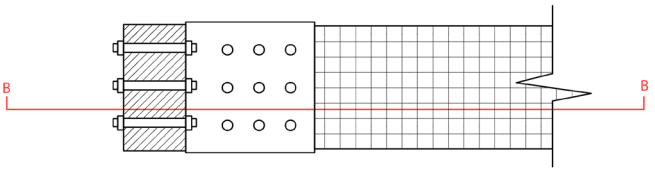
THE BONES - PLATFORMS & BEAMS

The structure's framework is made up of platforms and beams that are transported onto site into pieces and then assembled together. 4m x 4m platforms are transported onto to site and put together utilising a concrete joined timber frame and utilising the beams as structural to support the structure.



[FIGURE 9] Platform Connection Diagram

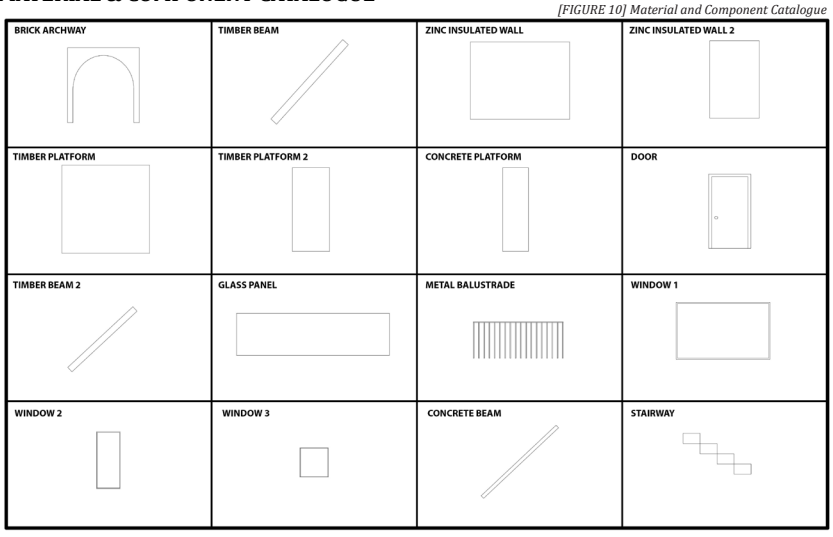
SECTION B-B
scale 1:10



SECTION A-A
scale 1:10

MATERIAL & COMPONENT CATALOGUE

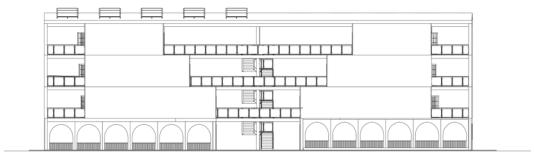
[FIGURE 10] Material and Component Catalogue



The above is a material and component catalogue with a total of 16 components. By having this 'IKEA' method of design allows for costs to be kept low as manufacturers only need to mass produce a smaller amount of components. This is also efficient in terms of time and cost for the construction, assembly and disassembly. The design will be very consistent in using just components from this catalogue. Towards the end of the life cycle of the building these same components can be reproduced to create another configuration version of the current building

MULTIPLE CONFIGURATION WITH COMPONENTS

The utilization of a material catalogue and keeping components minimal it allows for multiple configurations, this is good as it proves the concept of the components being very versatile along with when they are disassembled components can be used again.



Alternate Configuration Images.

CONCEPT DESIGN VALIDATION REPORT.
THE DESIGN.

ABOUT THE DESIGN.

The module is of two levels and the ground level being the area for the communal space and four single bedded units and the first floor holds four units and the second floor with four units with common amenities for the residents.

The design focuses on easy assembly and disassembly where the toilet area modules and lately the walls, fixtures and furniture align with the module. This saves a lot of on-site work where the toilet modulus are done ready and the brought to the site and then the walls are the only things to be fixed up on the site.
There will be no waste and all energy that was used to make the material will be ultimately recovered. In the proposed project, timber flooring, steel structure and brick will be used the most as they are easily reused, refurbished and recycled.

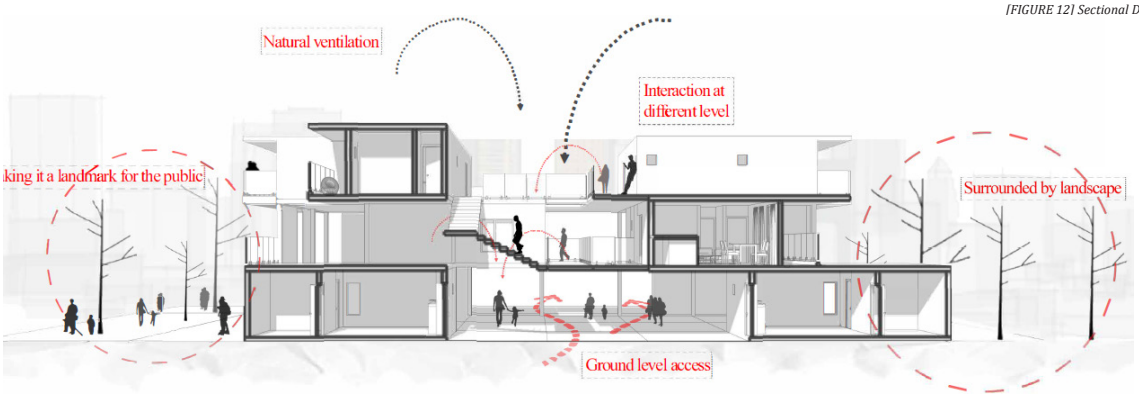
When designing for both DFA and DFD, it is important to consider factors such as material selection, part orientation, and ergonomic factors that can impact assembly and disassembly processes. By incorporating DFA and DFD principles into product design, manufacturers can reduce costs, improve product quality, and minimise environmental impacts.

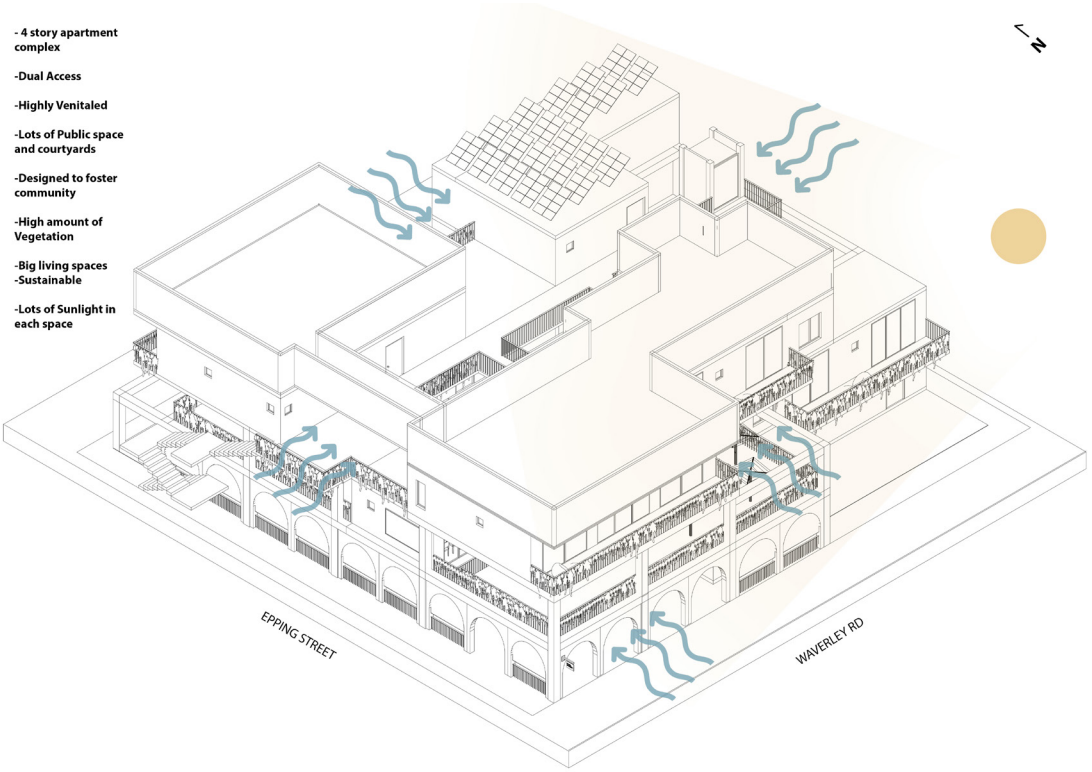
On the other hand, DFD involves designing products with ease of disassembly in mind, which can make it easier to recycle, repair, or dispose of products at the end of their life. Some key principles of DFD include designing products with modular components that can be easily removed and replaced, using standardised fasteners and connectors, and avoiding the use of adhesives or other permanent joining methods.

DFA entails creating items with ease of assembly in mind, which may lead to manufacturing processes that are quicker and more effective, with lower labour costs and better quality control. DFA's core concepts include minimising the amount of pieces, minimising the use of fasteners and other connecting techniques, and making sure that parts are simple to find and assemble.

The columns, floor with the ceiling plates are built on site and placed so that the rest all is modeled and made just to fit in. Since the whole layout deals with modularity it is easy to play around with the modules at any location as the floor and ceiling plates run to the whole span of the building. Every module could be disassembled and assembled to another location as its size just doubled up to other modules making it more easy.

[FIGURE 12] Sectional Diagram



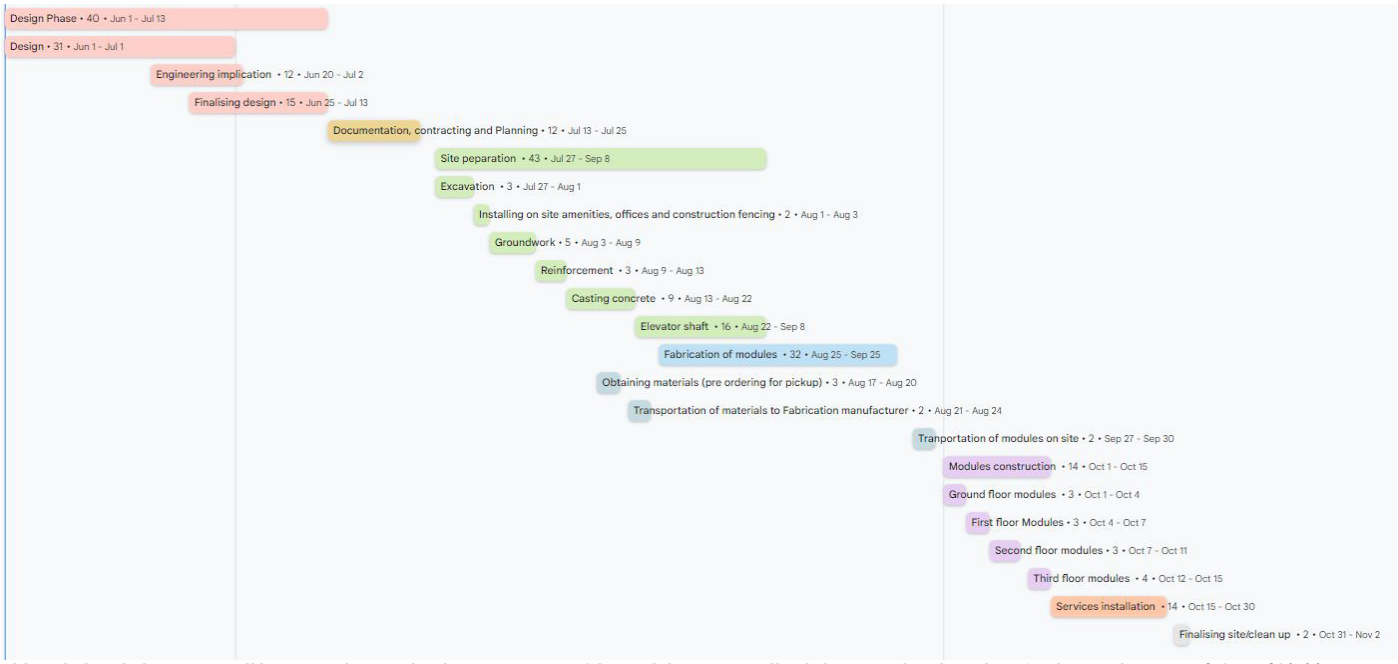


[FIGURE 12] Isometric Diagram

The space ensures openness and fosters a sense of community for the occupants. Utilising a very open space on the ground floor, with many courtyards and public spaces, with a lot of ventilation and sunlight through the dual linear block. All the spaces sit above the ground level space, with all the circulation happening within the centre of the site. With further balcony/courtyards space on the boundary of the spaces. The following renders are material studies and showcase how some of the recycled materials will be utilised within the project. The bricks in the ground floor are utilised from the demolition of the site and ensure to with-hold the character of the suburb.

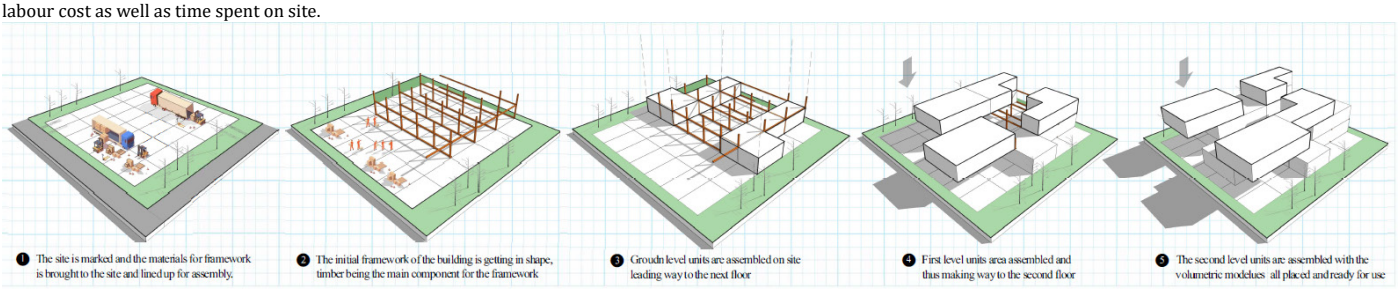
CONCEPT DESIGN VALIDATION REPORT.
LOGISTICS

PROJECT SCHEDULING



Although the whole process will last around 22 weeks, the construction of the modules on site will only last 2 weeks. This is beneficial to cut down labour cost as well as time spent on site.

[FIGURE 12] Scheduling Diagram



[FIGURE 13] Site Evolution Diagram

REGULATORY COMPLIANCE

- Due to our proposal being classified as both a Class 2 and Class 6 building, here are examples of changes in design made to exceed the 2019 NCC's minimum standards

STORY HEIGHTS
Each unit's floor-to-ceiling height is 3m, creating a more pleasant experience without a reduction in performance via HVAC/MEP

ACCESSIBILITY
The building consists of; two external staircases, one integral staircase, and two level-to-level staircases for ease of access/departure for fire precaution

KITCHEN FEATURES
Our proposal allows occupants the simple pleasures of preparing, cooking, and cleaning with the sanitary disposal of waste water

DESIGNING FOR ALL
For those less fortunate, the sole-occupancy units within the proposal are accessible without the extra hassle of stairs or the elevator - Which if necessary, is able to access all levels of the complex

SOUND TRANSMISSION
As the site is situated adjacent to public transport and a main road, acoustic insulation was introduced to prevent disturbances

RAILING HEIGHTS
In compliance with NCC's minimum standard of 845mm high railing, all railings total to a set height of 1m

LAUNDRY FEATURES
Our design features access to a laundry space that all residents can use, and the means for sanitary disposal of waste water

NATURAL LIGHTING
Occupants can enjoy mental and financial benefits by the vision of passive design engraved into fenestration and solar gain

ORGANISATION OF PROGRAM
In response to height limits, convenience, and privacy purposes, the Café/Study/ Sitting Space/Vege Market were sitated on ground level

[FIGURE 14] Regulatory Compliance

CONCEPT DESIGN VALIDATION REPORT.
COST

PROJECT SCHEDULING

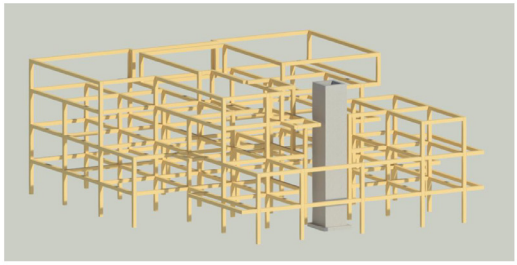
Structural Elements	Materials	Qty	Specifications	Rate	Cost	Upcycled? (Y/N)	House Gas Emissions (kgCO2e)	Subract reclaimed	Total energy embodied (kgCO2e)
Archway	Brick	22	2750 x 2645 x 27	$321.50	$11,462	Y	0.32 per m3	65%	17.3
Beam	CLT	74	400 x 400 x 5600	$194.4	$11,463	Y	645 per m3	-	557.92
Beam (Type 2)	CLT	166	255 x 150 x 150	$67.50	$11,464	Y	645 per m3	-	614.31
Beam (Type 3)	Concrete	12	3600 x 150 x 150	$71.40	$11,465	N	645 per m3	-	626.94
Insulated Zinc Wall	Zinc cladding, insulation, 18mm plywood	92	4000 x 2600 x 430	$363.99	$33,487	Y	5.5 per m3	-	1131.41
Insulated Zinc Wall (Type 2)	Zinc cladding, insulation, 18mm plywood	24	2000 x 2600 x 430	$181.5	$4,356	Y	5.5 per m3	-	295.15
Timber Platform (Type 2)	CLT	38	2000 x 2000 x 250	$360	$13,680	Y	645 per m3	75%	6,127.00
Concrete 32 MPa	Concrete	nil	nil	nil	-	N	416 per m3	-	-
Door	Timber	-	-	-	-	N	-	100%	0
Casement Window (Type 1)	Glass and Steel	22	1400 x 600 x 56	$220	$4840	Y	101 per m3	-	104.52
Casement Window (Type 2)	Glass and Steel	34	1400 x 1450 x 56	$220	$7480	Y	101 per m3	-	390.37
Casement Window (Type 3)	Glass and Steel	18	1100 x 2460 x 56	$220	$3960	Y	101 per m3	-	275.49
Stairway (In modules of 8 steps)	Timber	26	300 x 150 x 1500 Per step	$259.2	$6,739.2	Y	645 per m3	75%	283
Mesh Timber Framing	Timber + Steel Mesh	55	2500 x 2500 s 200	$258.30	$14,206.5	Y	645 per m3	75%	11085.93
TOTAL					**$185,772**				**21509.34**

Description	Unit	Qty	Rate	Total	Source
Preliminaries/ Site Preparation					
2week Temporary Fencing	m	89	$11.20	$996.8	Temporary Fencing Warehouse, Malvern East
Site Demolition/ Cleaning -2m(3) bin	sqm	820	$60	$49,200	EcoGroup, Clayton. Provides Eco-Friendly methods of Demolition. Ensuring materials are upcycled where possible
Site Office -3.6 x 3m	weeks	24	$64.62	$1,551	Carnegie Smart Hire, Carnegie
Amenities (Ablution Shed)	weeks	24	$34	$816	Carnegie Smart Hire, Carnegie
Preliminaries/ Site Preparation					
Backfilling, Levelling and Compaction (assuming 80% of site area is required)	sqm	1226	$3.55	$4,352.3	EcoGroup, Clayton.
Ground Slab -Assuming 32 MPa Concrete (200mm) is used -5% wastage	sqm	844.7	$102.60	$86,669.29	JMC Concrete, Malvern
Superstructure					
Finishing Works					
Landscaping -External site development -Overall Residential quality	sqm	275	$109.40	$30,085	Josh Norman Landscaping, Malvern
TOTAL				$4479070.39	
10% CONTINGENCY ALLOWANCE				~$447907	
10% GST				$447907	
FINAL TOTAL COST				$4926977.39	

Description	Unit	Rate	Total	Source
Transportation				
Labour (Manufacturing Labour, Installation Labour, Plumbing, Finishing Labour, Site Labour and Supervision and Project Management)	Contract	$11.20	$996.8	Temporary Fencing Warehouse, Malvern East
Assembly	sqm	$60	$49,200	EcoGroup, Clayton. Provides Eco-Friendly methods of Demolition. Ensuring materials are upcycled where possible
Transportation	L	$2	~$240	Wilby Transport, Carrum Downs
Crane and Equipment Rental	$/day	200	$1000	Clark Cranes, Thomastown
Storage and Staging	$/container/day	$3	$150	Container Hire
Material and Component Handling	Contract	1500	$7500	
Permits and Regulatory Compliance	$0.128 per dollar of cost of work	$0.128 per dollar of cost of work	$45,300.00	Municipality of the site- Stonnington Council
Quality Control	d	1250	$2500	Consultant agency
TOTAL			$106,886.80	
10% CONTINGENCY ALLOWANCE			$10,688.68	
10% GST			$10,688.68	
FINAL TOTAL COST			$128,264.16	

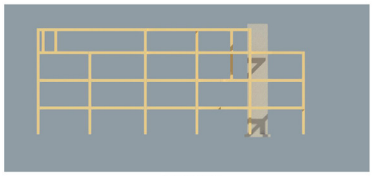
				$185,772
				$4926977.39
				$128,264.16
	ESTIMATED TOTAL PROJECT COST			**$5,241,013.55**

CONCEPT DESIGN VALIDATION REPORT.
STRUCTURAL ENGINEERING ANALYSIS

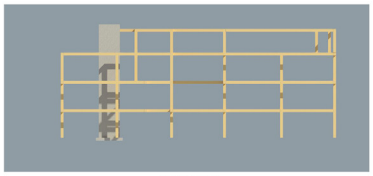


STRUCTURAL MODEL

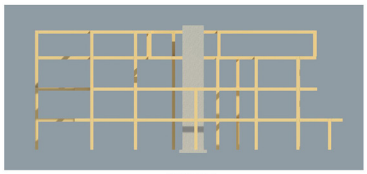
The structural design of this project embraces the strength and elegance of bones, utilizing 240 CLT timber beams and columns as the foundational framework. These elements securely hold the panelized kit-of-parts for each unit, streamlining assembly and significantly expediting on-site construction. By adopting this bone-like structural approach, the project benefits from enhanced efficiency and reduced labor costs. The CLT construction system, known for its lightweight and sustainable nature, contributes to the project's environmental consciousness. With its innovative design and integration of natural materials, this project stands as a testament to the possibilities of efficient, cost-effective, and eco-friendly construction practices.



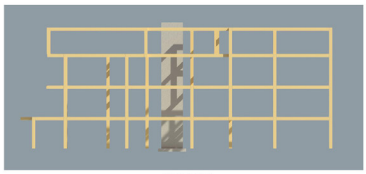
NORTH



SOUTH

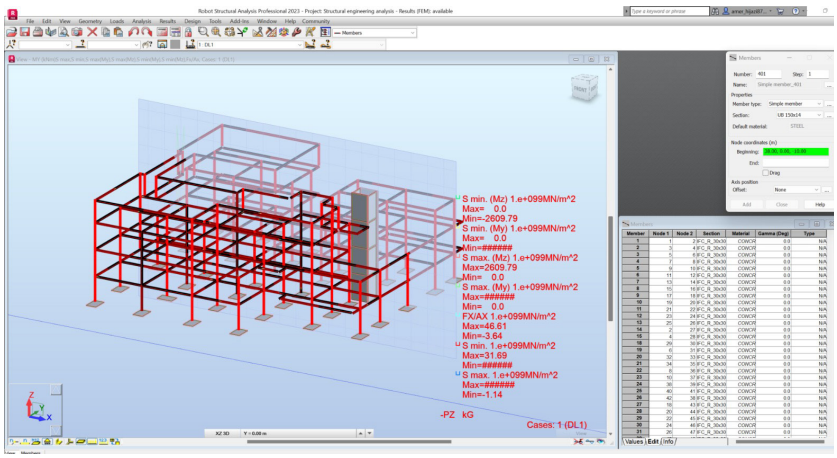


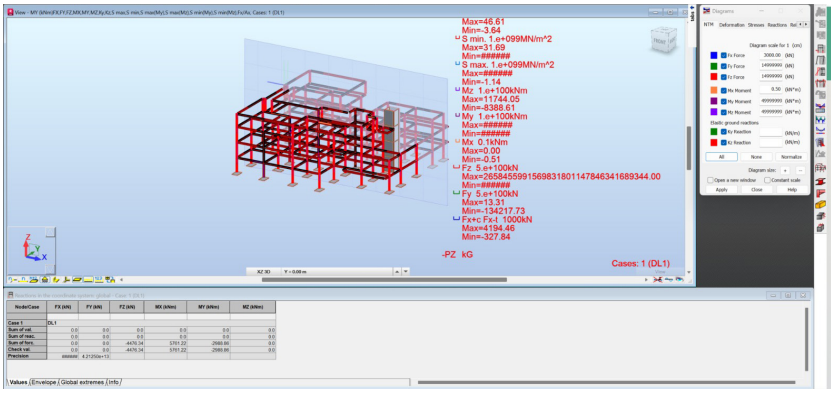
EAST

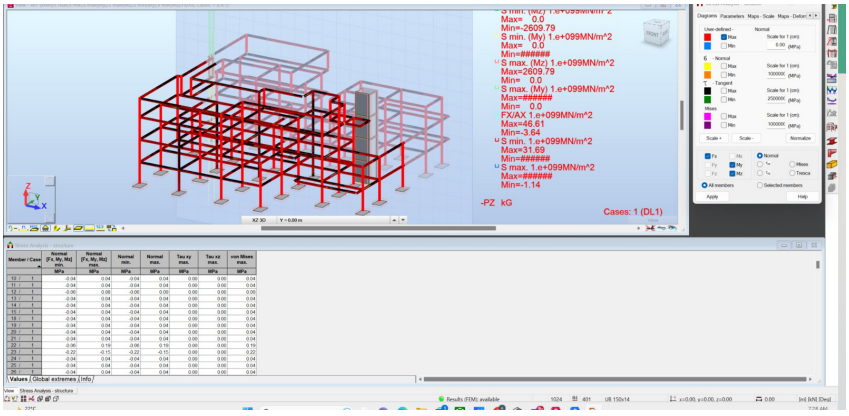


WEST

The striking resemblance to bones in the design of this structure is achieved through the strategic implementation of 240 CLT timber beams and columns. Acting as the backbone, these elements provide robust support for the panelized kit-of-parts, resulting in a simplified assembly process that drastically accelerates on-site construction. The utilization of CLT not only reduces labor costs but also underscores the project's commitment to sustainability, as timber is a renewable resource with lower carbon emissions compared to traditional building materials. This bone-like structural approach not only showcases ingenuity in design but also highlights the project's efficiency, affordability, and eco-consciousness.

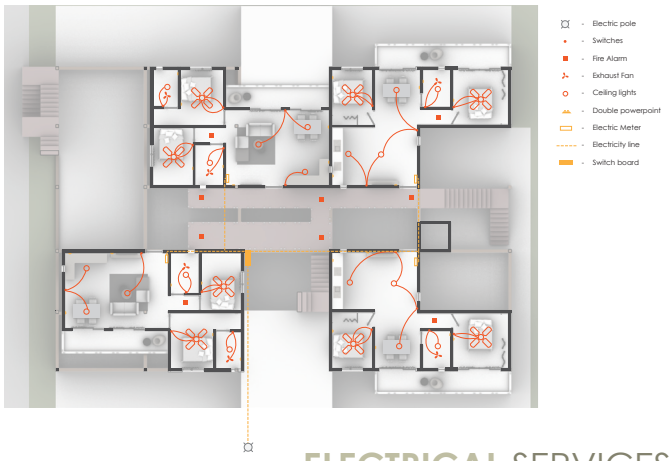






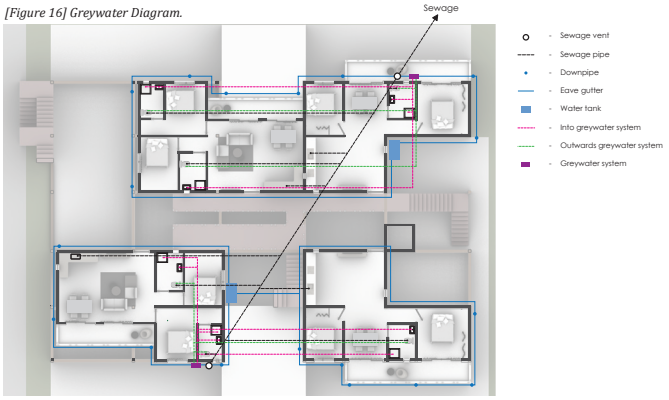
CONCEPT DESIGN VALIDATION REPORT.
SERVICES & RENDERS

[Figure 15] Electrical Diagram.

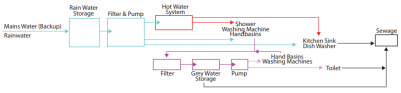


ELECTRICAL SERVICES

[Figure 16] Greywater Diagram.



GREYWATER SYSTEM



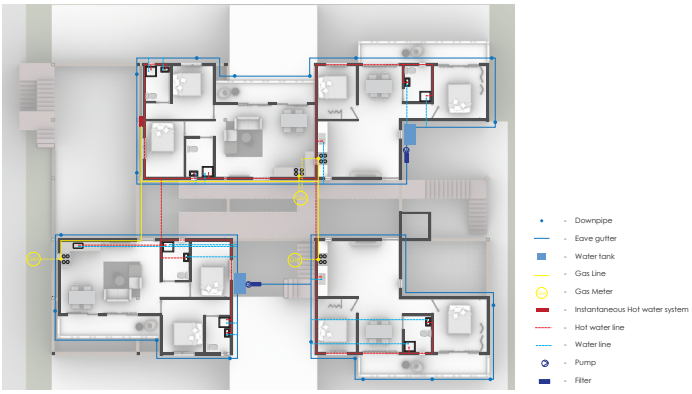
ELECTRICAL

After careful consideration, LEDs are to be used as it is more energy efficient. Compared to other light bulbs it lasts longer therefore being cheaper in the long run.
To increase ventilation within the bedrooms, ceiling fans are installed along with lights to save space and reduce the amount of wiring spread around the rooms. In bathrooms, an exhaust fan is placed to ventilate the space by taking out the odours and moisture outdoors.

GREY WATER SYSTEM

The grey water system is connected to multiple plumbing parts of the apartment. The grey water from the bathroom sink and shower is collected and then treated to be reused as toilet flush or basin. It could also be used to water the communal garden. The greywater line is not connected to the kitchen sink as food is to be handled with clean water. Every 24 hours, the excess grey water is to be sent into the sewerage so that bacteria does not grow in the system. The water tank collects the storm water and uses it as the main water source with the mains as a backup. With these water system installed this would ultimately reduce water wastage and the water bill.

GAS AND HOTWATER SERVICES



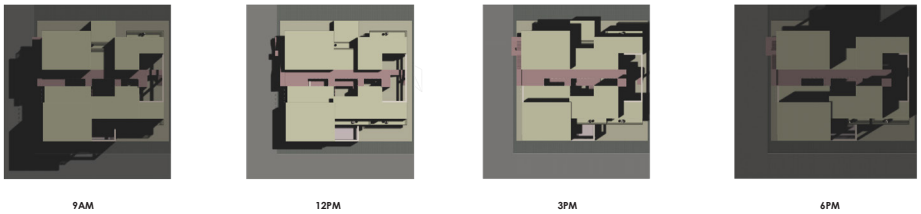
[Figure 17] Gas & Hotwater Diagram.

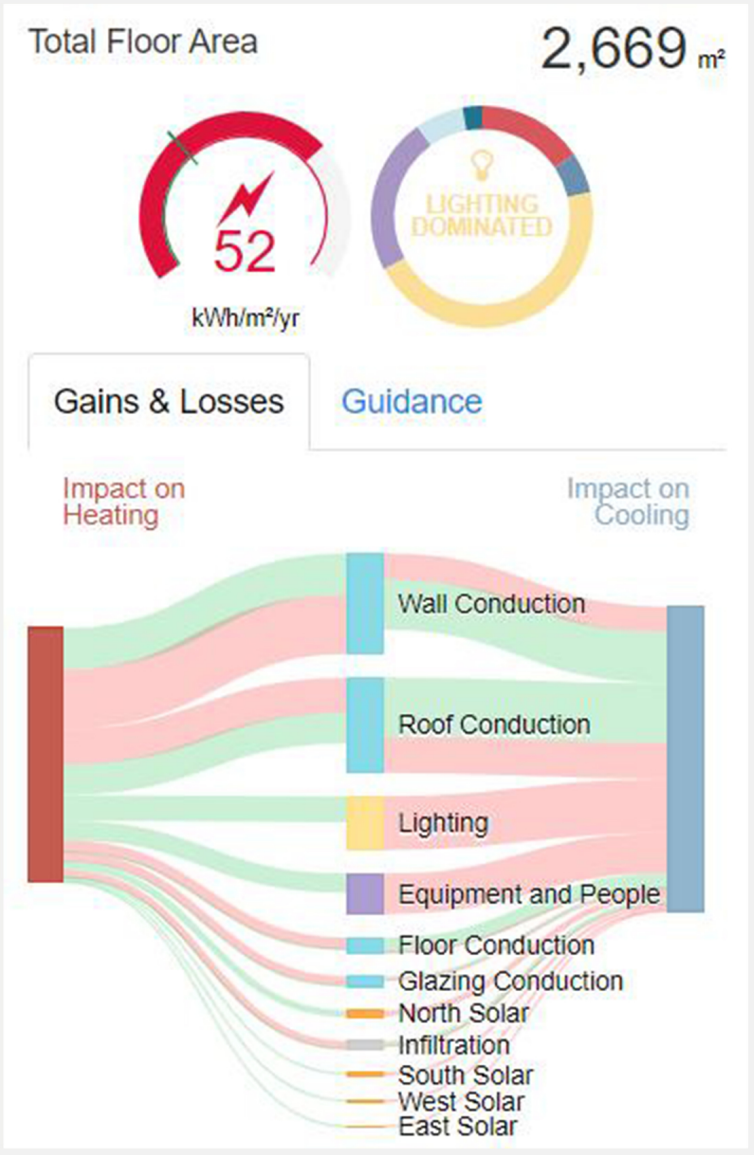
GAS AND HOT WATER SERVICES

The grey water system is connected to multiple plumbing parts of the apartment. The grey water from the bathroom sink and shower is collected and then treated to be reused as toilet flush or basin. It could also be used to water the communal garden. The greywater line is not connected to the kitchen sink as food is to be handled with clean water. Every 24 hours, the excess grey water is to be sent into the sewerage so that bacteria does not grow in the system. The water tank collects the storm water and uses it as the main water source with the mains as a backup. With these water system installed this would ultimately reduce water wastage and the water bill.

APPENDIX

SUN STUDY





ENERGY SEGMENTS

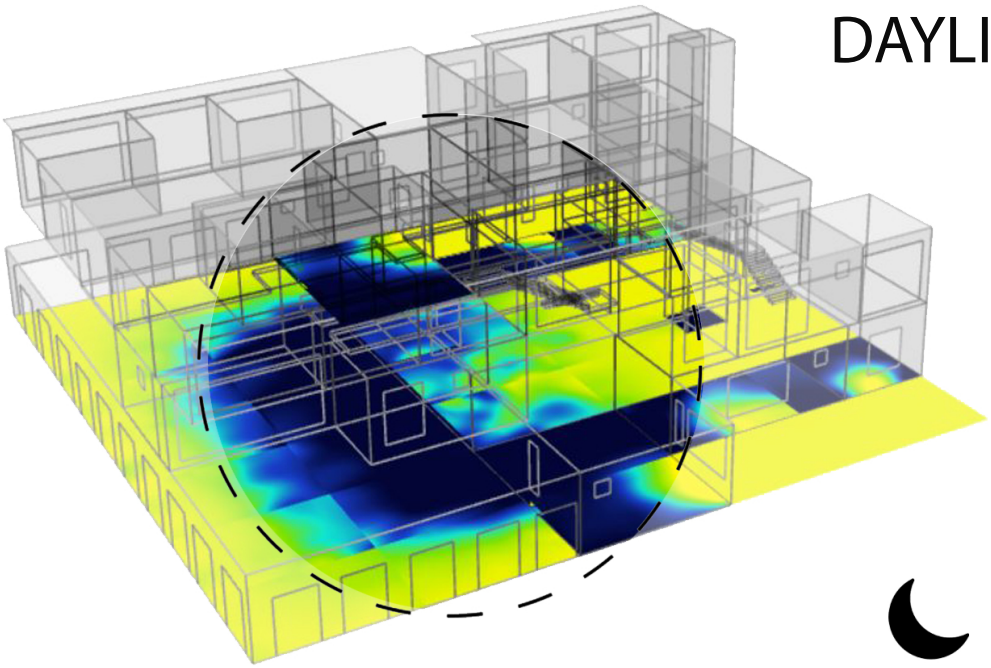
HEATING	16988
COOLING	6459
HEATING	16988
EQUIPMENT	25082
FANS	7718
PUMPS	3087

ENERGY USE INTENSITY kWh/yr

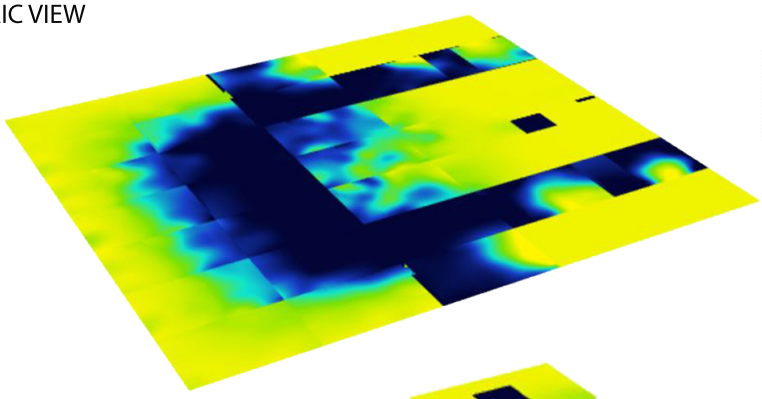
2030 CHALLENGE : 30

ACTUAL : 52

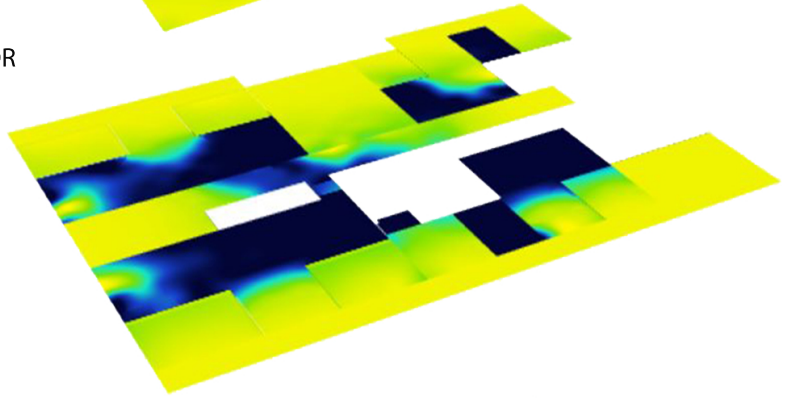
DAYLIGHTING



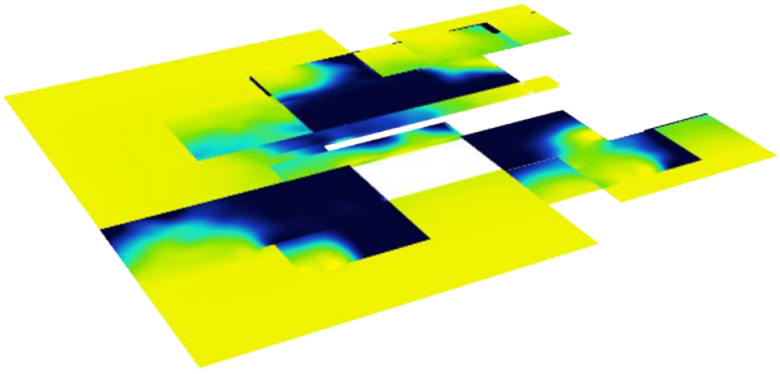
AXONOMETRIC VIEW



GROUND FLOOR



FIRST FLOOR



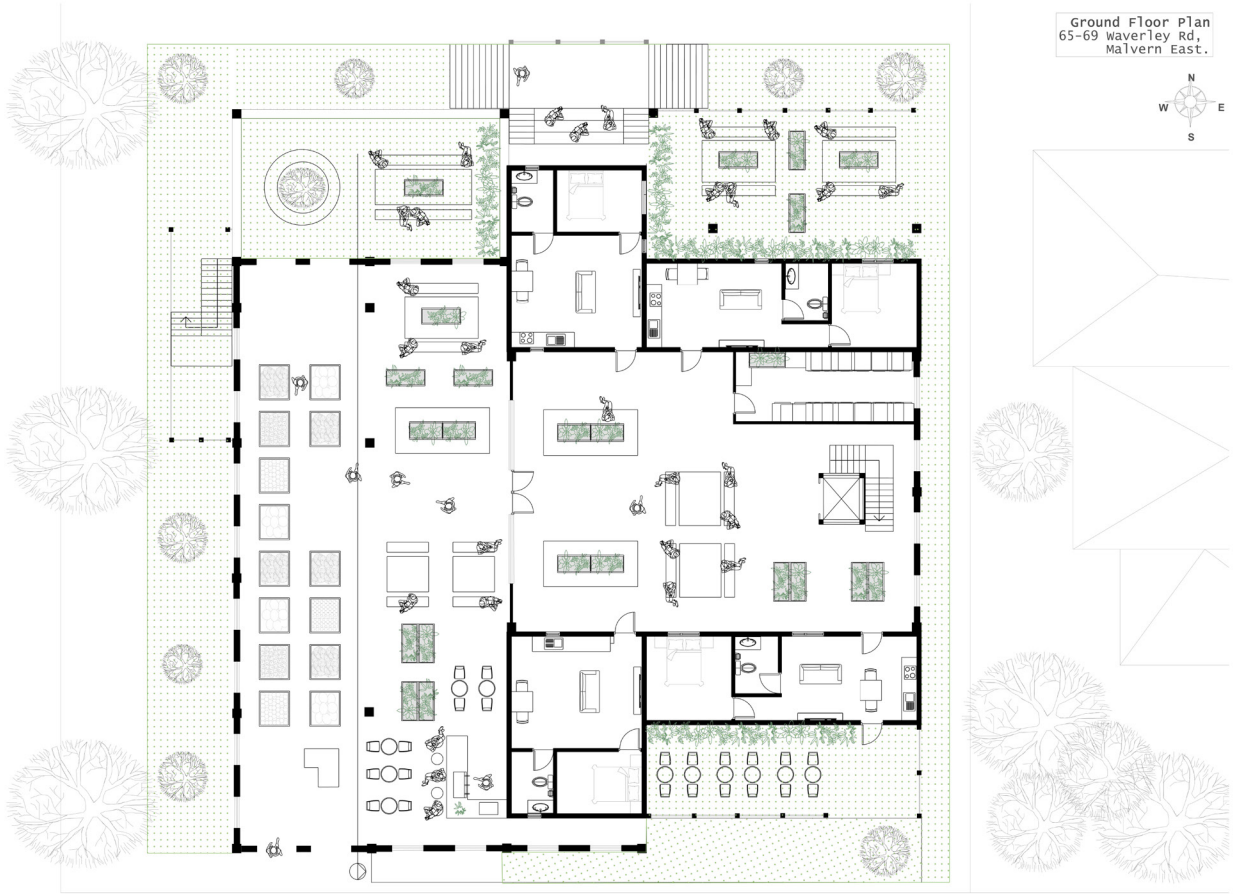
SECOND FLOOR

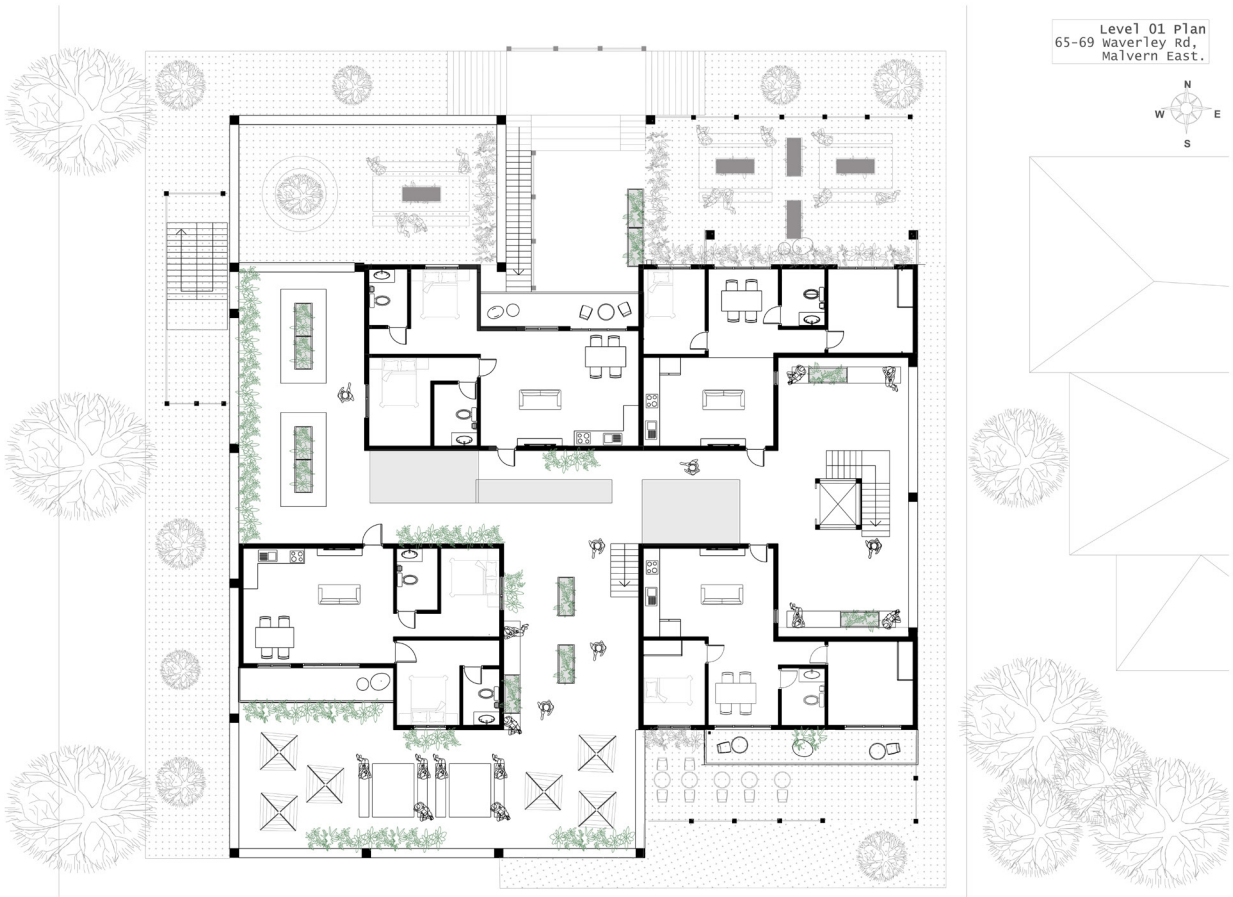
Underlit: 32

Well Lit : 35

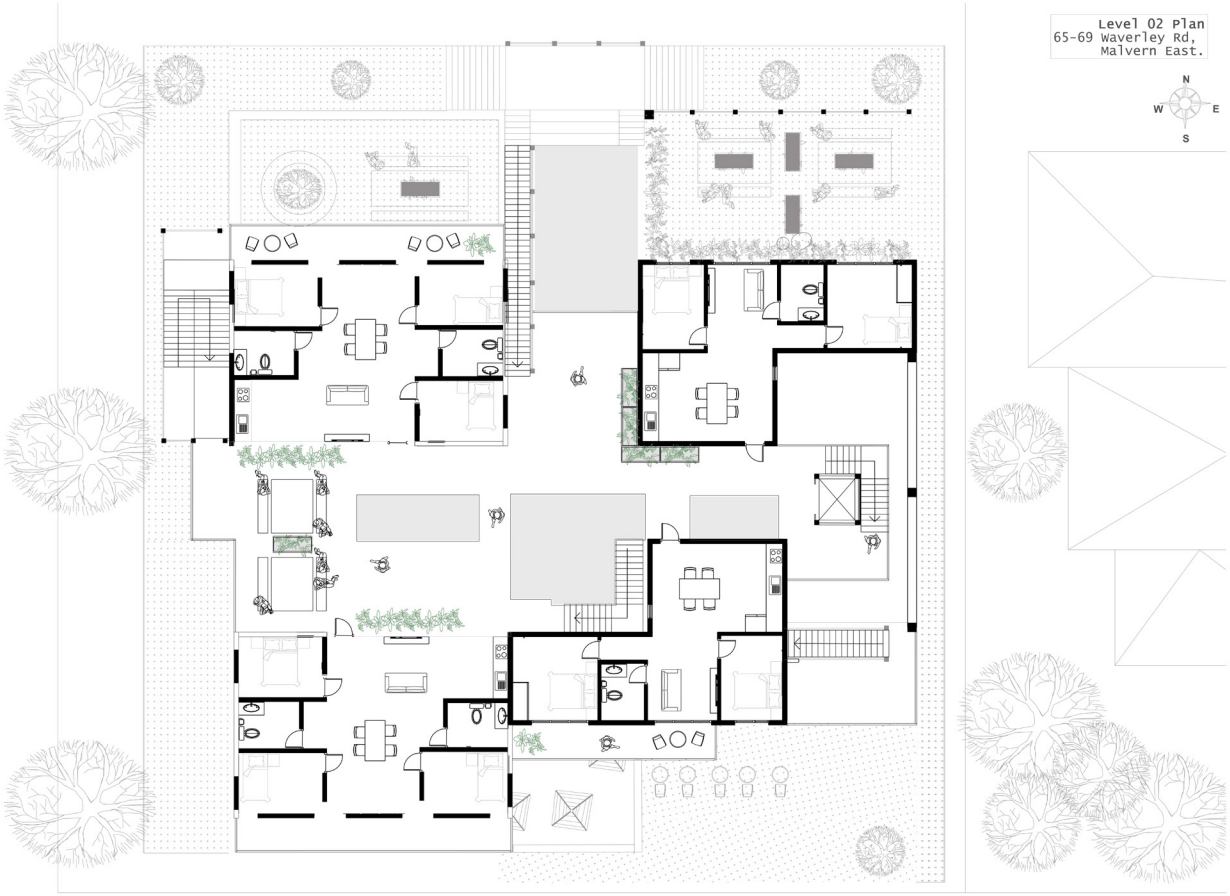
OverLIT : 33

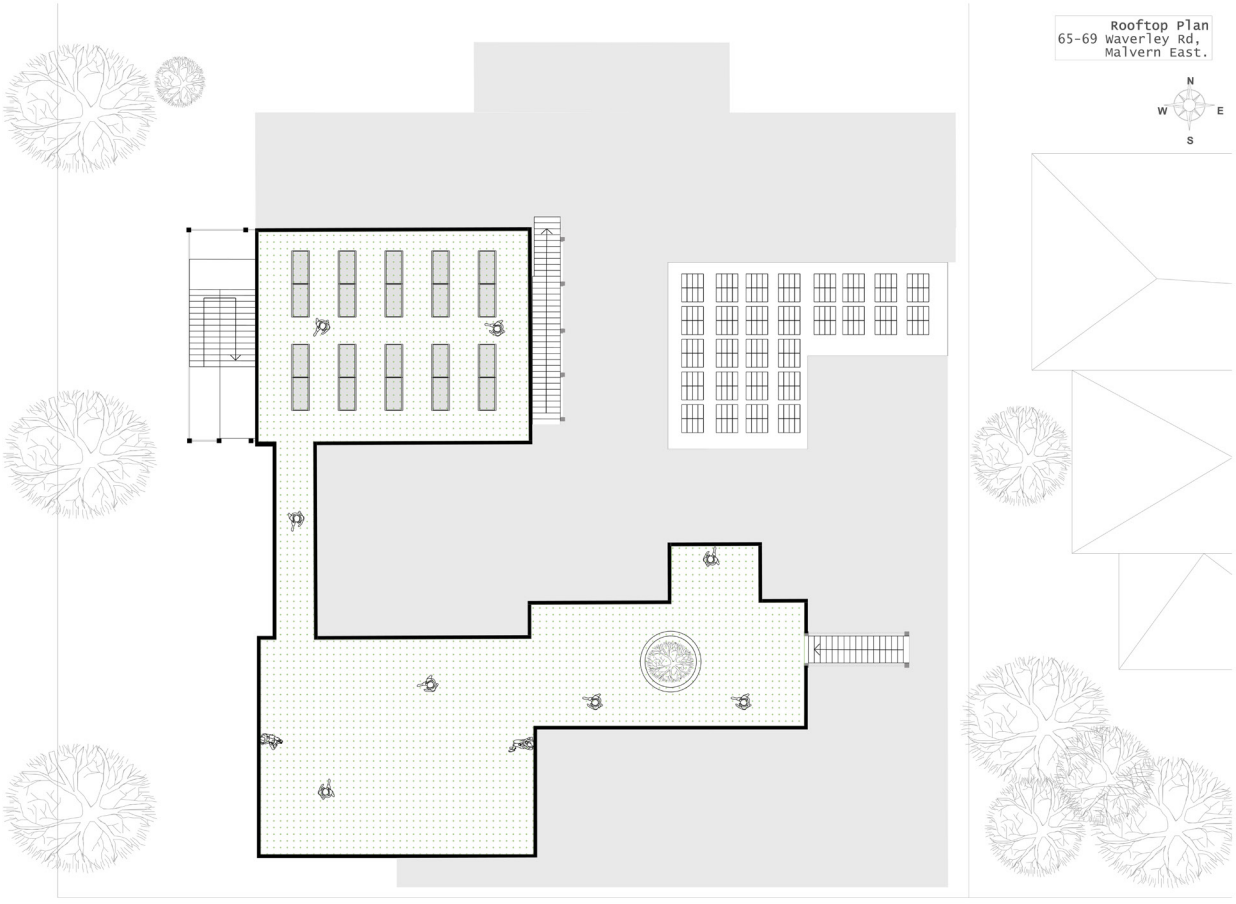
DRAWINGS


Ground Floor Plan
65-69 Waverley Rd,
Malvern East.
N
W
E
S

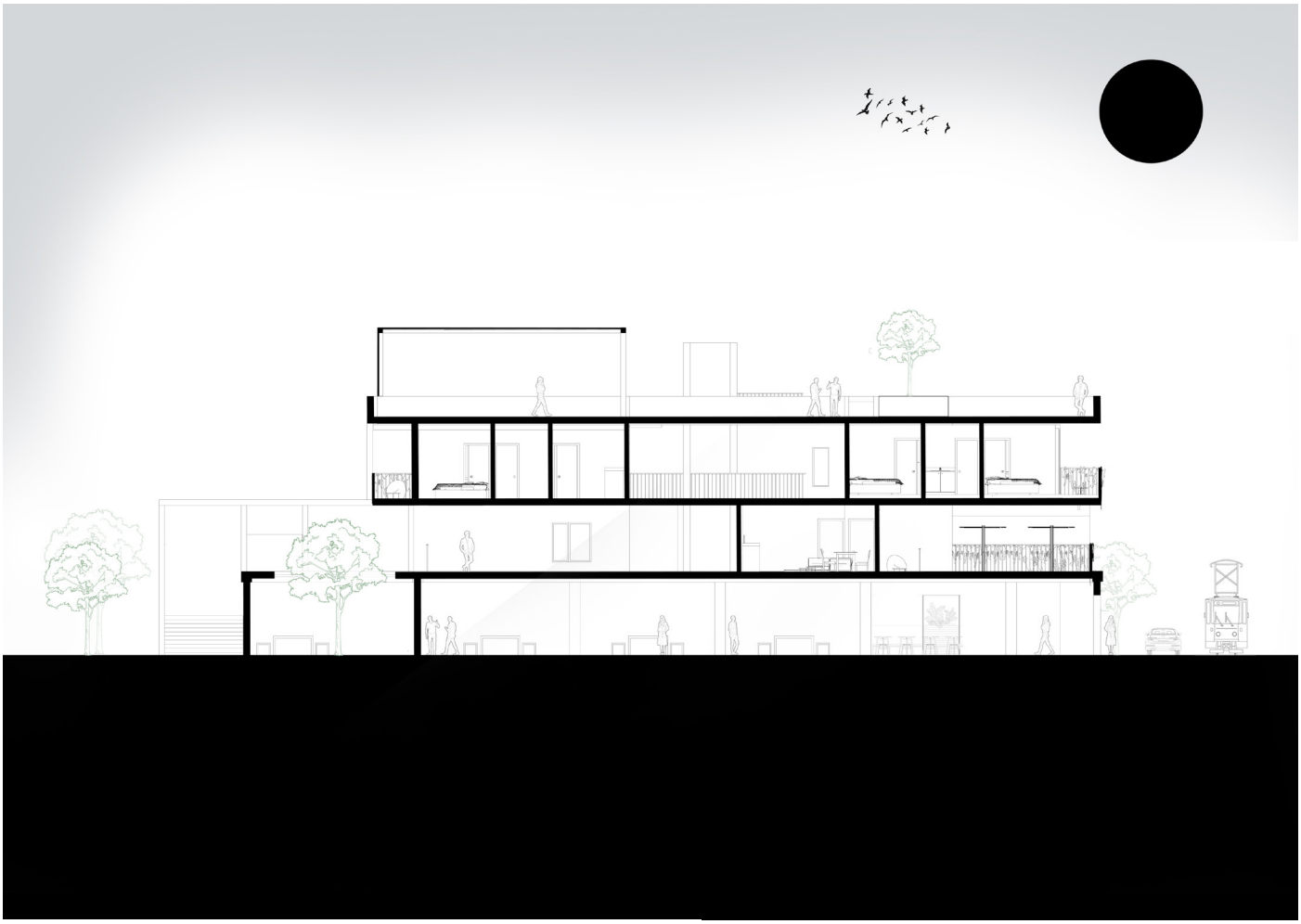

Level 01 Plan
65-69 Waverley Rd,
Malvern East.
N
W
E
S

DRAWINGS

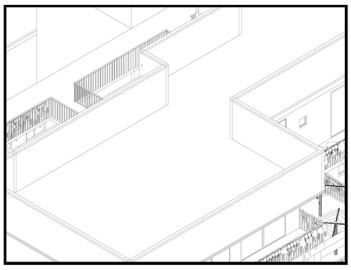

Level 02 Plan
65-69 Waverley Rd,
Malvern East.
N
W
E
S


Rooftop Plan
65-69 Waverley Rd,
Malvern East.
N
W
E
S

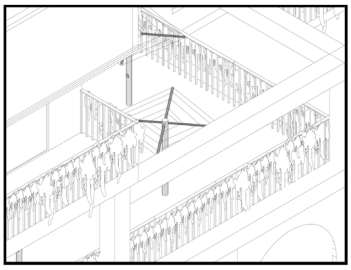
DRAWINGS & ADDITIONAL DIAGRAMS



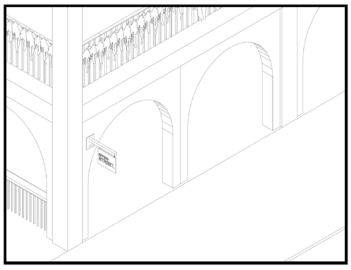
ROOFTOP TERRACE/COURTYARD



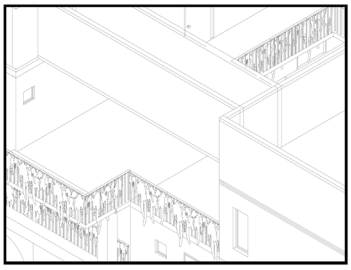
LAUNDRY TERRACE/WASHROOM



GROUND LEVEL PUBLIC SPACE & CAFE



RESIDENTIAL SHARED TERRACES



COURTYARDS.

Courtyard Diagram.

Very open spaces, allowing for very open and communal circulation. In ariel view we can see the spaces form voids which act as public and semi-public courtyards for the residents and the public.

VISUALISATIONS

VISUALISATIONS