Fleetwood Challenge Cup 2023

Report

North Elevation

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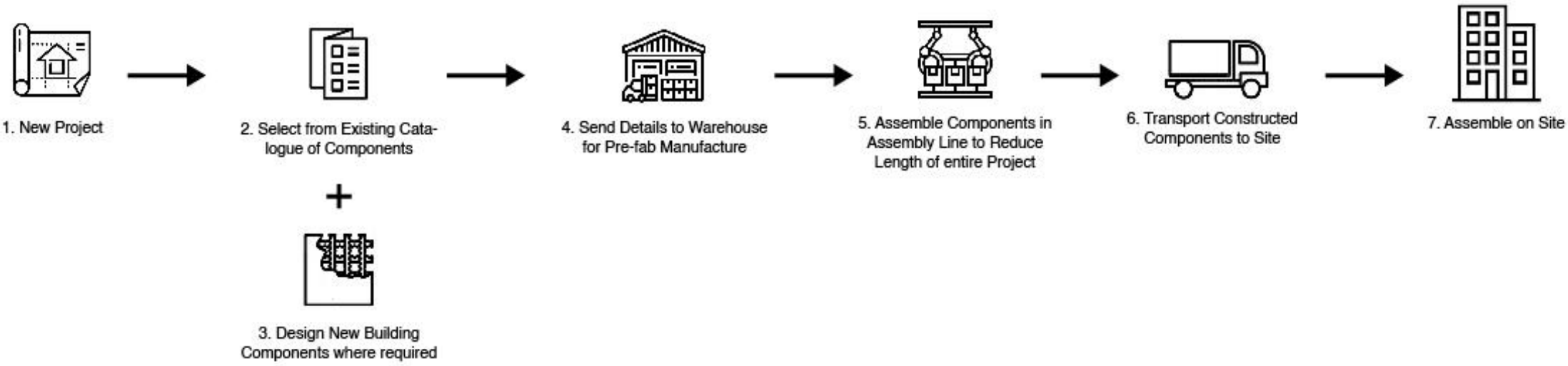
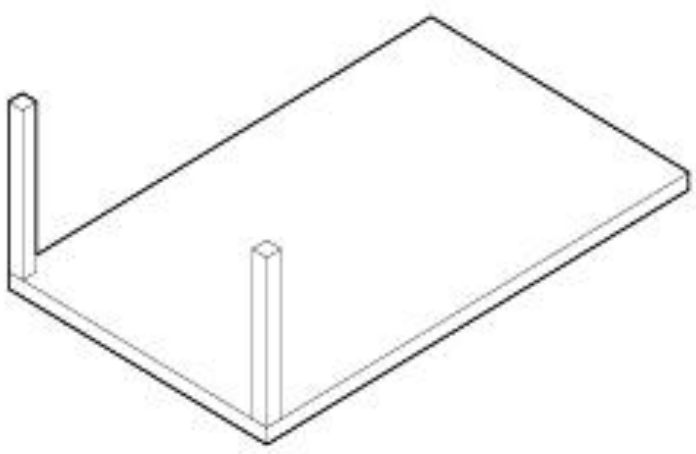
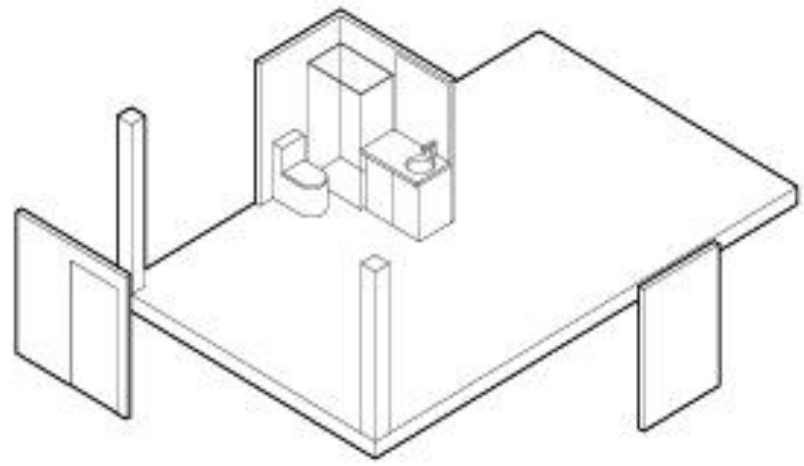
Pre-fab Concept Idea

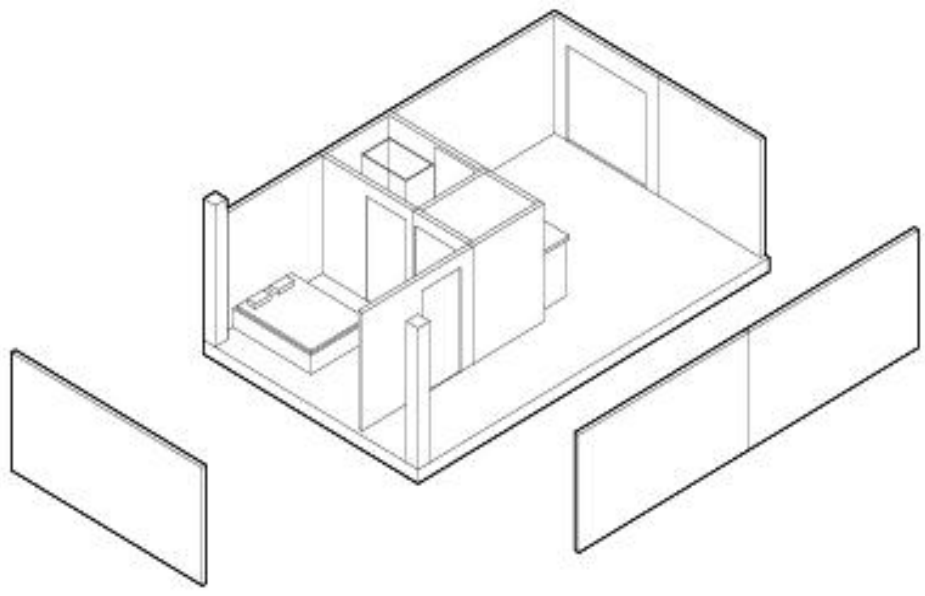




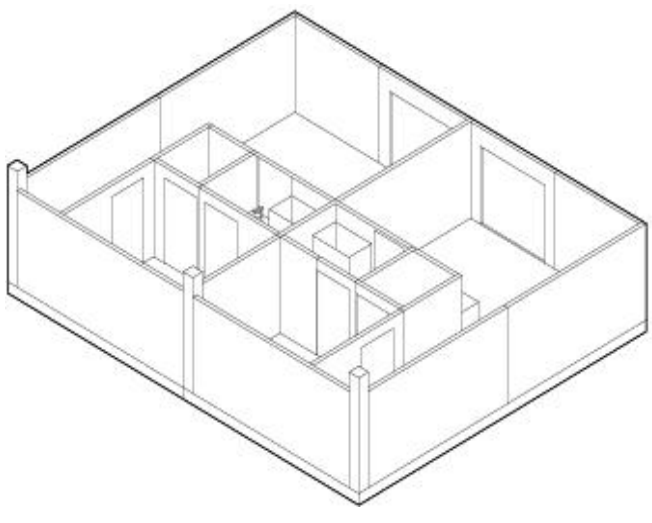
1. On Site Structural Columns and Floor



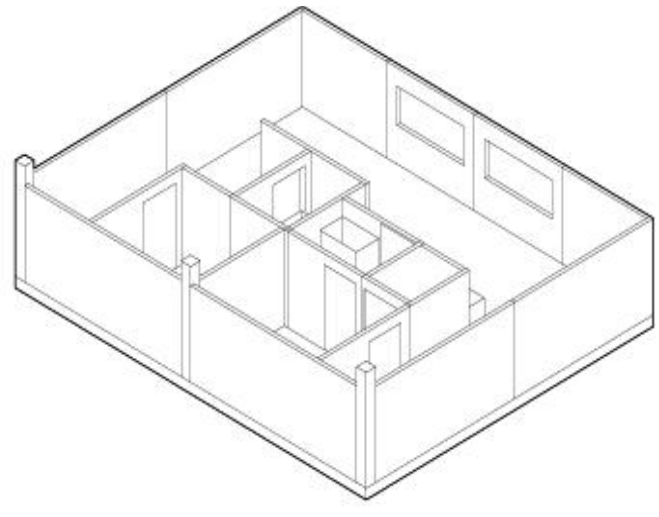
2. Pre-Fab Volumetric Bathrooms installed



3. 2D Pre-Fab Walls installed

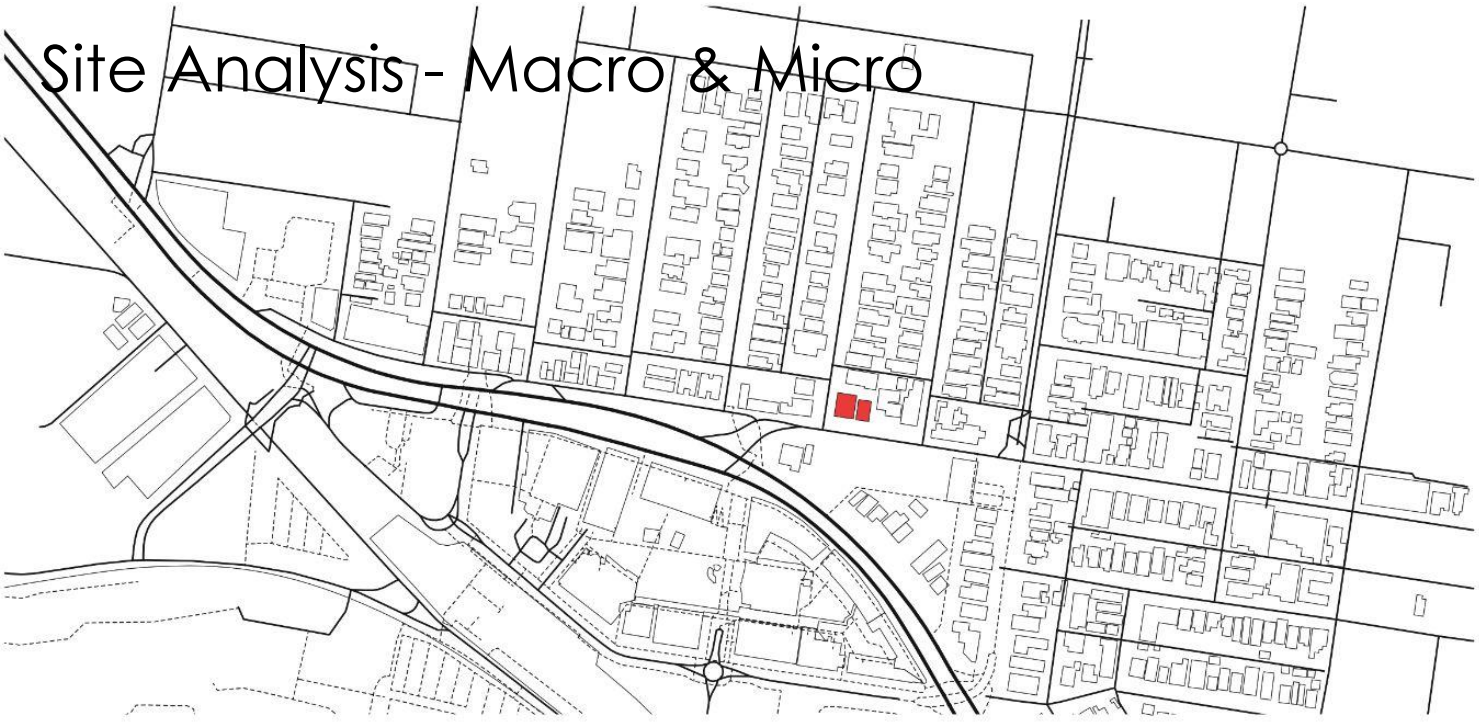


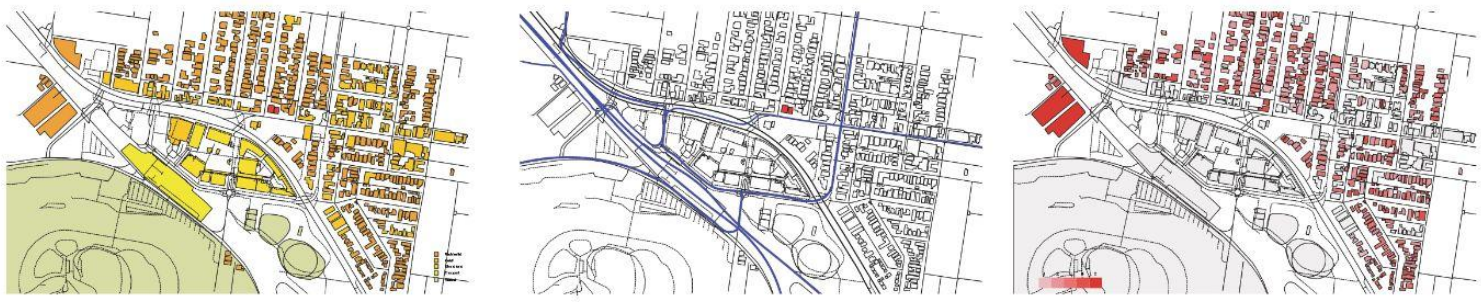
4. Multiply and Customize for Client

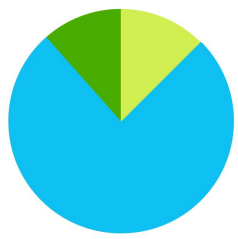


5. Disassemble and Re-Organise

Site Analysis - Macro & Micro

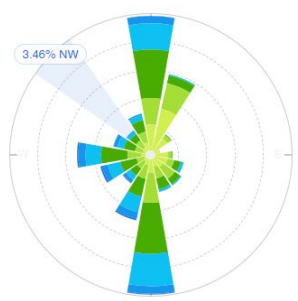






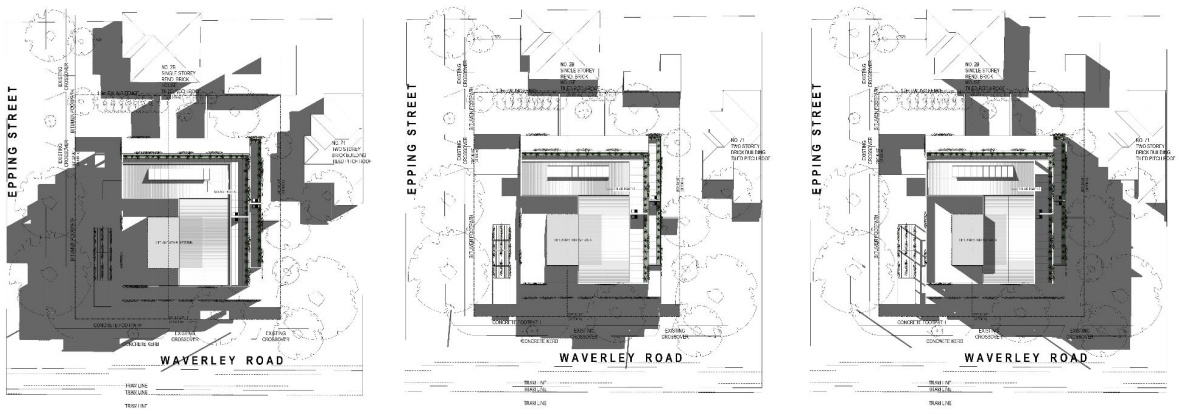
2.5
People per household

41
Median Age

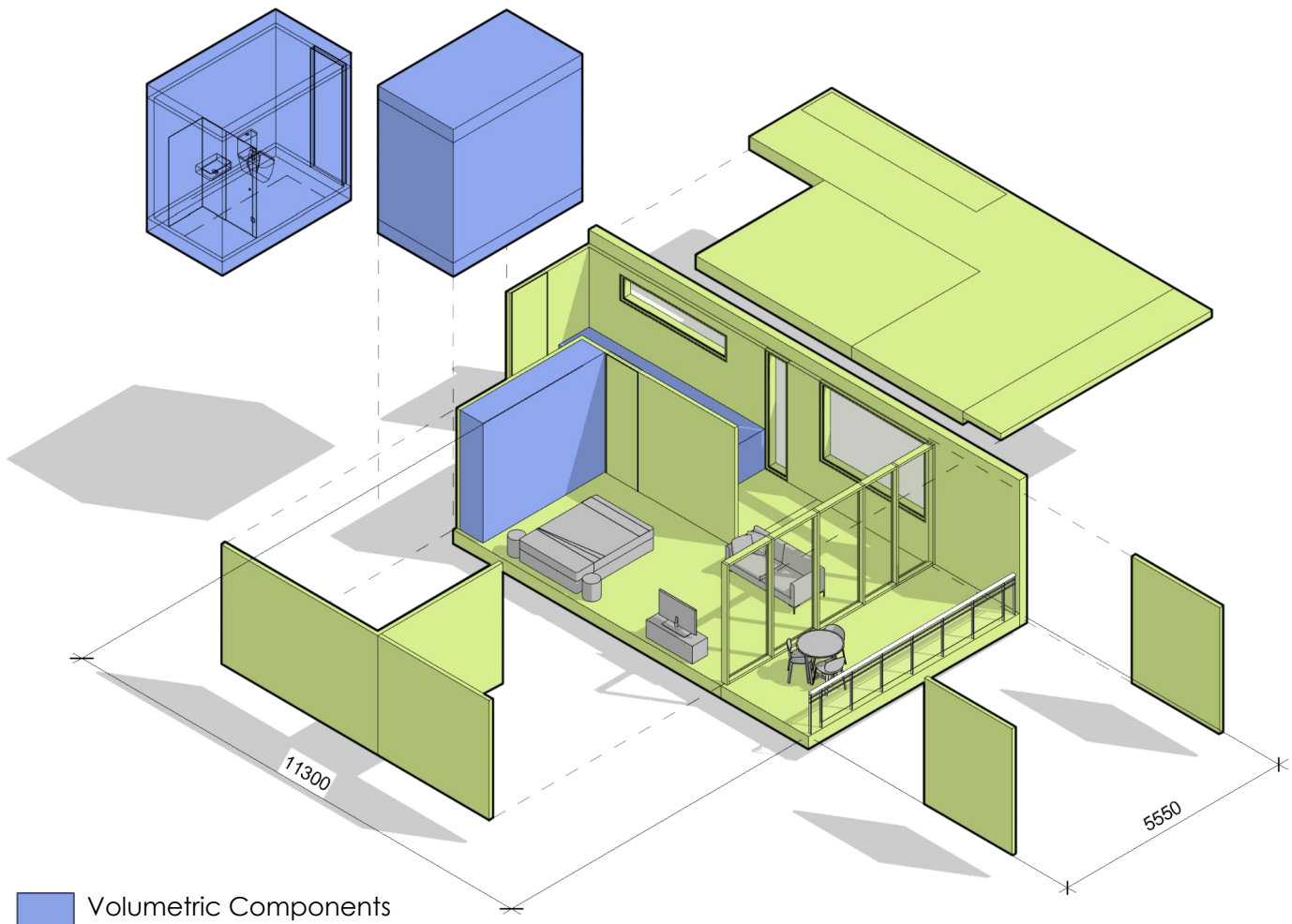


Site Analysis

We conducted a site analysis at a macro Malvern East scale to determine the type of user we want to target our building towards. In conjunction with some statistics of the site we used maps looking at typology, transport and density of the surrounding site to determine that the best user group for our project would be higher end home buyers looking for ownership.



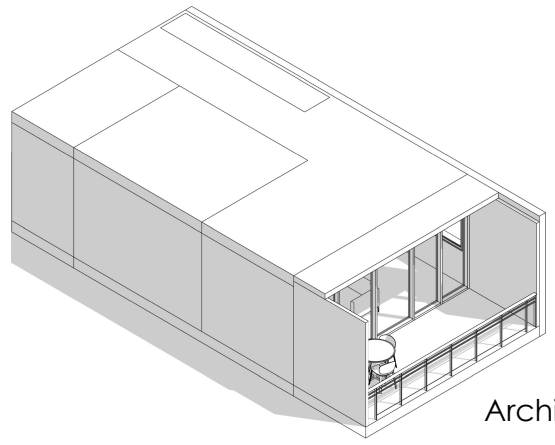
Modular Design Example: 1-Bedroom Components Schedule



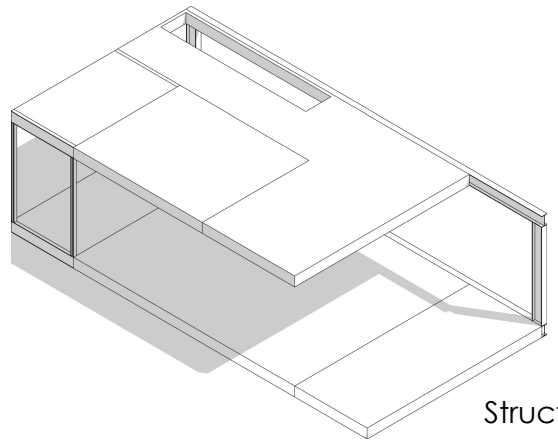
Volumetric Components

Panelised Components

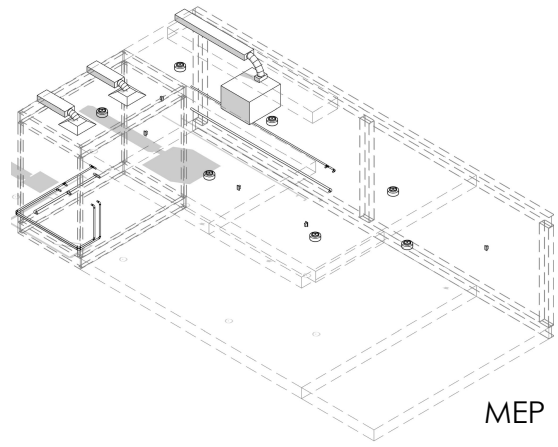
Independent Components



Architectural



Structural



MEP

Volumetric Bathroom for 1-Bedroom Apartment (1.8m by 3.2m)

Select this clean and modern volumetric bathroom product for a budget friendly yet luxuious addition to your 1-Bedroom apartment. Structure, plumbing, cabling, ductwork and all relevant fixtures are all pre-installed and ready for easy installation into your project. This product also comes in a variety of material palettes, wall-to-wall connection types, as well as a generous selection of joinery options. Below are some standard sub-components.

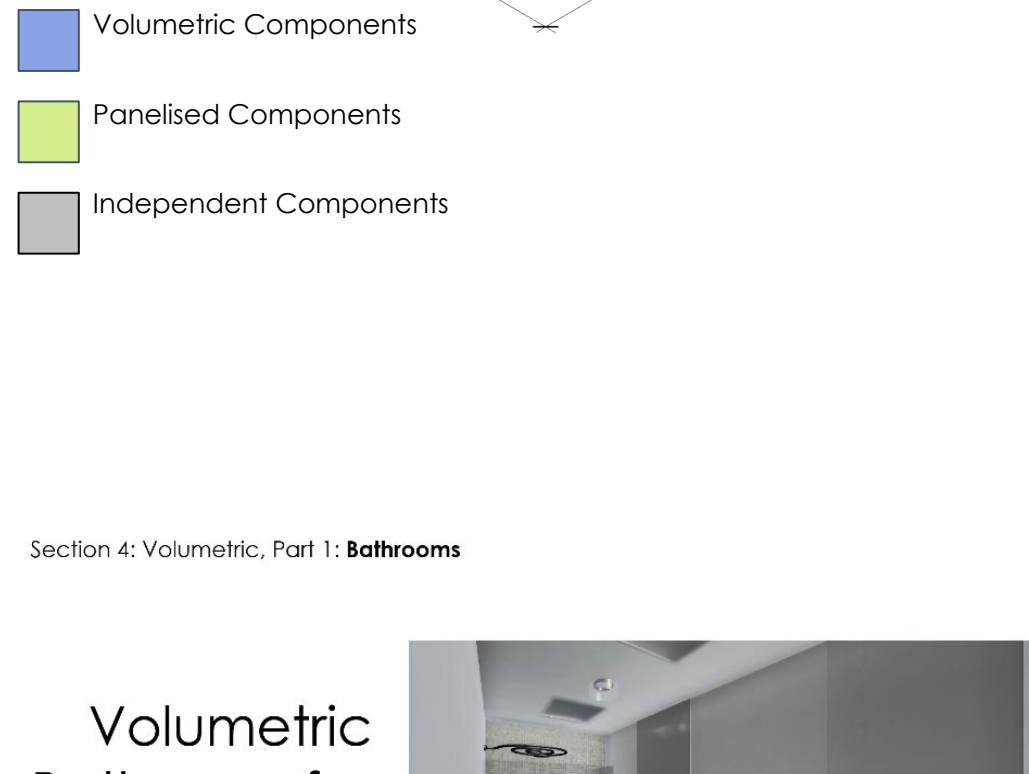
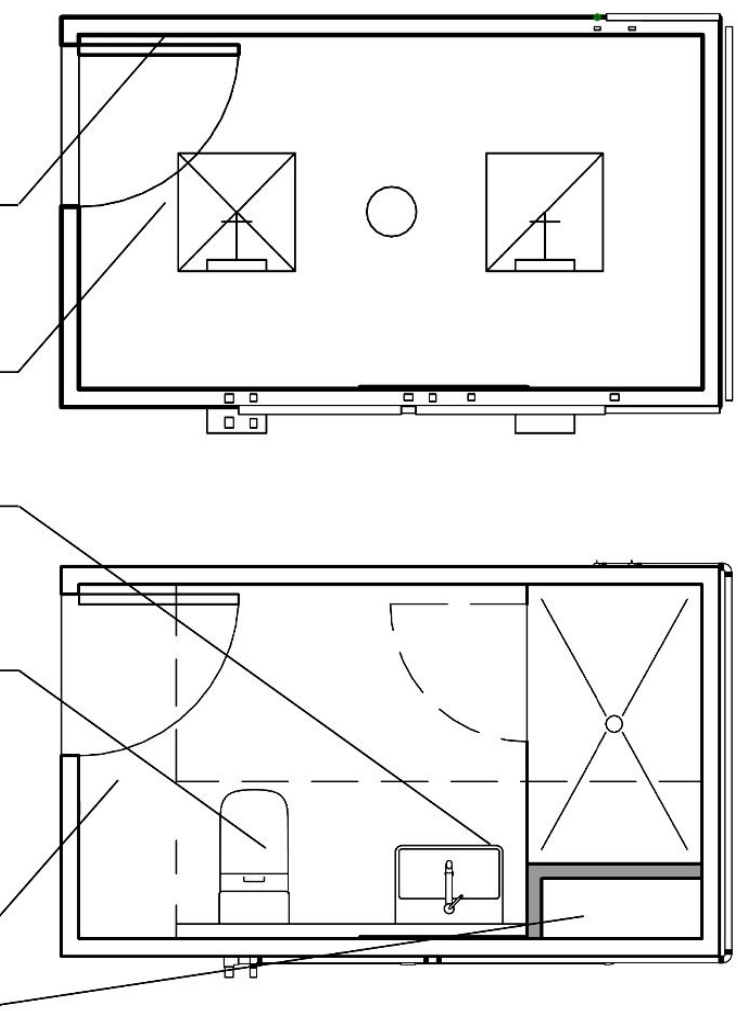


Figure. 1: 3D and Exploded Axonometric Displaying Component



Materials and Sustainability

Through the use of the Living Building Challenge, and Green Star, we are able to thoroughly assess, energy, water, materials, in making the most sustainable design we can, while maintaining the core task.

Water Assessment
An important factor for water usage, is water reuse. This would involve a catchment off the roof area, into a suitable water tank size. This could be an effective way to reduce water usage and wastage, as you could produce your own source of grey water for the building, from the building itself, and allow net positive water to be implemented.

Living Building Challenge
- Imperative I - 05 Responsible water usage.
- Imperative I - 06 Net Positive Water

Energy Assessment
Due to the nature of the building being residential, the energy usage will be dependent on the number of tenants, with therefore solar catchment is used, such as a battery wall with solar panels, it could power the building through green energy, avoiding the large cost factors, and carbon footprints the building will leave behind.

Living Building Challenge
- Imperative I - 07 Energy + Carbon Reduction
- Imperative I - 08 Net Positive Carbon

Green Star
- Code 19 Potable Water (10 Points)
- Code 20 Fire Protection Testing (2 Points)

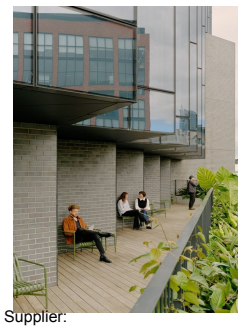
Materials Assessment
As the building will be primarily prefabricated, we aim to use locally source materials, from steel, concrete, timber and structural insulated panels. As they will be assembled off site, the amount of wastage will be heavily reduced and therefore avoid such a large carbon footprint.

Living Building Challenge
- Imperative I - 07 Energy + Carbon Reduction
- Imperative I - 08 Net Positive Carbon
- Imperative I - 12 Responsible materials
- Imperative I - 13 Red List
- Imperative I - 14 Responsible Sourcing
- Imperative I - 15 Living Economy Sourcing
- Imperative I - 16 Net Positive Waste

Green Star
- Code 15 Greenhouse Gas Emissions (23 Points)
- Code 16 Peak Electricity Demand (1 Points)

Green Star
- Code 21 Procurement and Purchasing (3 Points)
- Code 22 Waste From Operations (4 Points)
- Code 23 Waste From Refurbishment (3 Points)

Cladding Materials and Life Cycle



Brick Inlay:
It is a facade system which allows traditional precast concrete panels to be covered with a thin brick or tile, creating a unique facade system which is cheap, efficient, and still provides architectural grade facades.

(Based on industry sources, the average price for brick inlay panels in Australia can range from around $150 to $400 per square metre. Whereas a general estimate, the cost of building a brick wall in Australia can range from around $550 to $1,500 per square metre.)

Supplier:
Building 5, 650 Church Street
Cremorne VIC 3121

Disassembled

Resued	Recycled	Landfill
Salvage and reuse: If the precast concrete brick veneer is still in good condition, it can be salvaged and reused in other construction projects. This is an environmentally friendly option that can save money on materials and reduce waste.	Recycling: If the precast concrete brick veneer cannot be reused, it can be recycled. The concrete can be crushed and used as aggregate in road construction, for example. The bricks can also be recycled into new building materials.	Landfill: this would mean it has come to the end of its life cycle, and that the energy to produce the material has gone to waste, as well as the stored carbon. The material will sit, and not break down due to its chemical makeup.

Standing Seam, or Interlocking Metal Cladding
Standing seam cladding can be applied as wall facades and roof systems, allowing for a uniform look, they come in 1200mm panels, and have an easy install process.

Interlocking cladding can only be used for wall panels, as water pooling will seep through the seal. They too come in 1200mm wide panels, and have the same installation process.

As a general estimate, the cost of metal cladding in Australia can range from around $50 to $150 per square metre

Supplier:
712 Oakleigh VIC 3166

Disassembled

Resued	Recycled	Landfill
If the metal cladding is in a usable condition, it can be repurposed in other construction projects, which is a sustainable approach that reduces waste and saves money on material costs.	Metal cladding that is no longer in use can be recycled, where it can be melted and repurposed into various metal products. This method not only minimizes the amount of waste that would otherwise end up in landfills but also conserves natural resources through the reuse of extracted metals.	Landfill: this would mean it has come to the end of its life cycle, and that the energy to produce the material has gone to waste, as well as the stored carbon. The material will sit, and not break down due to its chemical makeup.

James Hardie Fiber Cement EasyLap Panel
This is a fibre cement sheet, which comes with a shiplap joint, on both of the sides, with these panels can be easily assembled and disassembled. They too come with a site applied textured paint, which is able to mimic wood, yet last much longer with no maintenance.

The cost of James Hardie Easy Lap panels can range from around $15 to $30 per square metre, making it a cheap material to use.

Disassembled

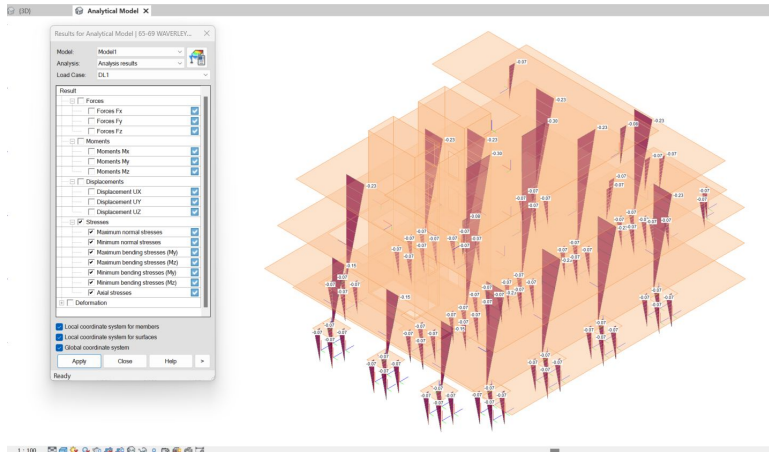
Resued	Landfill	Incineration
Fiber cement sheeting has the potential to be recycled into new building materials or alternative products by separating the cement and cellulose fibers. The resulting materials can be utilized to create new fiber cement sheets, as well as drainage pipes or landscaping materials.	Fiber cement sheeting can be disposed of in a landfill if recycling is not a feasible option or if the material is contaminated. However, it should be noted that this option is the least preferable as it occupies landfill space and contributes to environmental harm.	While fiber cement sheeting can be incinerated to produce energy and reduce landfill waste, it is not the most sustainable option due to the potential for harmful emissions. Therefore, it is recommended that recycling be prioritized, and the amount of waste sent to landfills

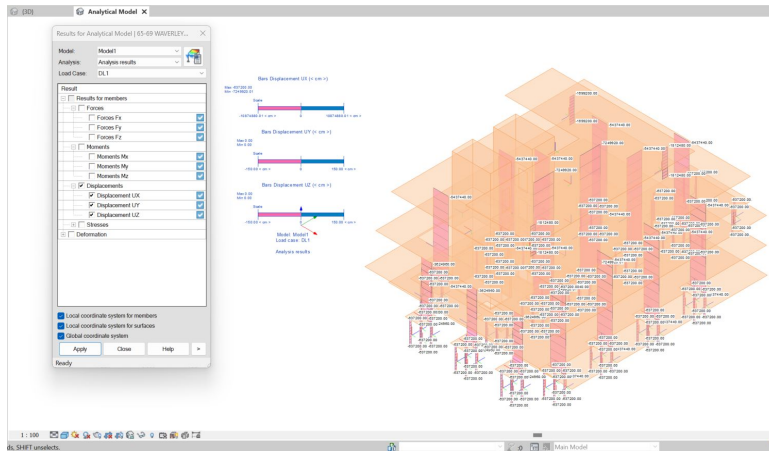
Structural Analysis

Agile Architecture

Future Uses

- Office Space
- Show Room
- Supermarket
- Multi Purpose Building
- Car Park
- Education Facility
- Medical Facility

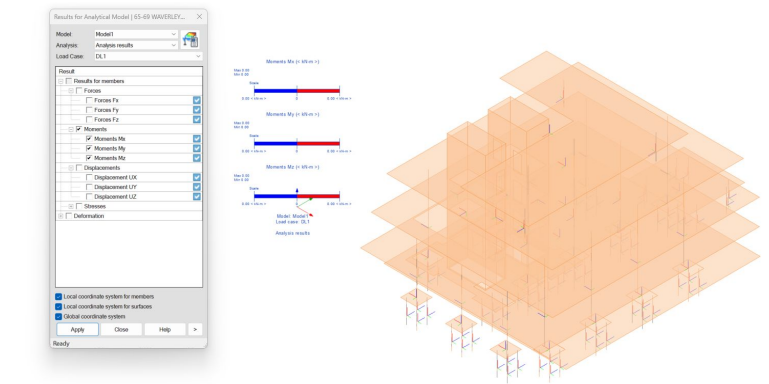


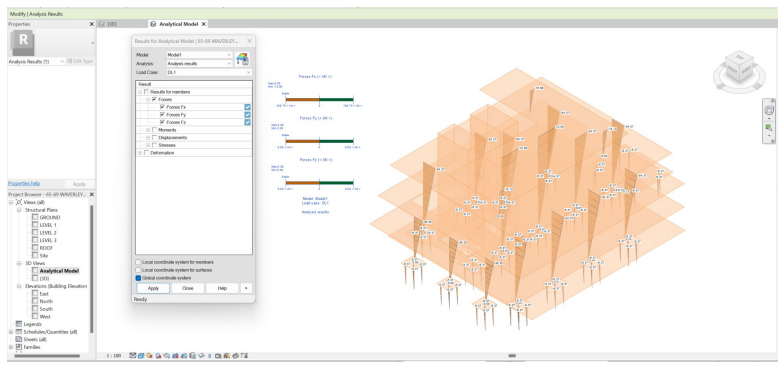


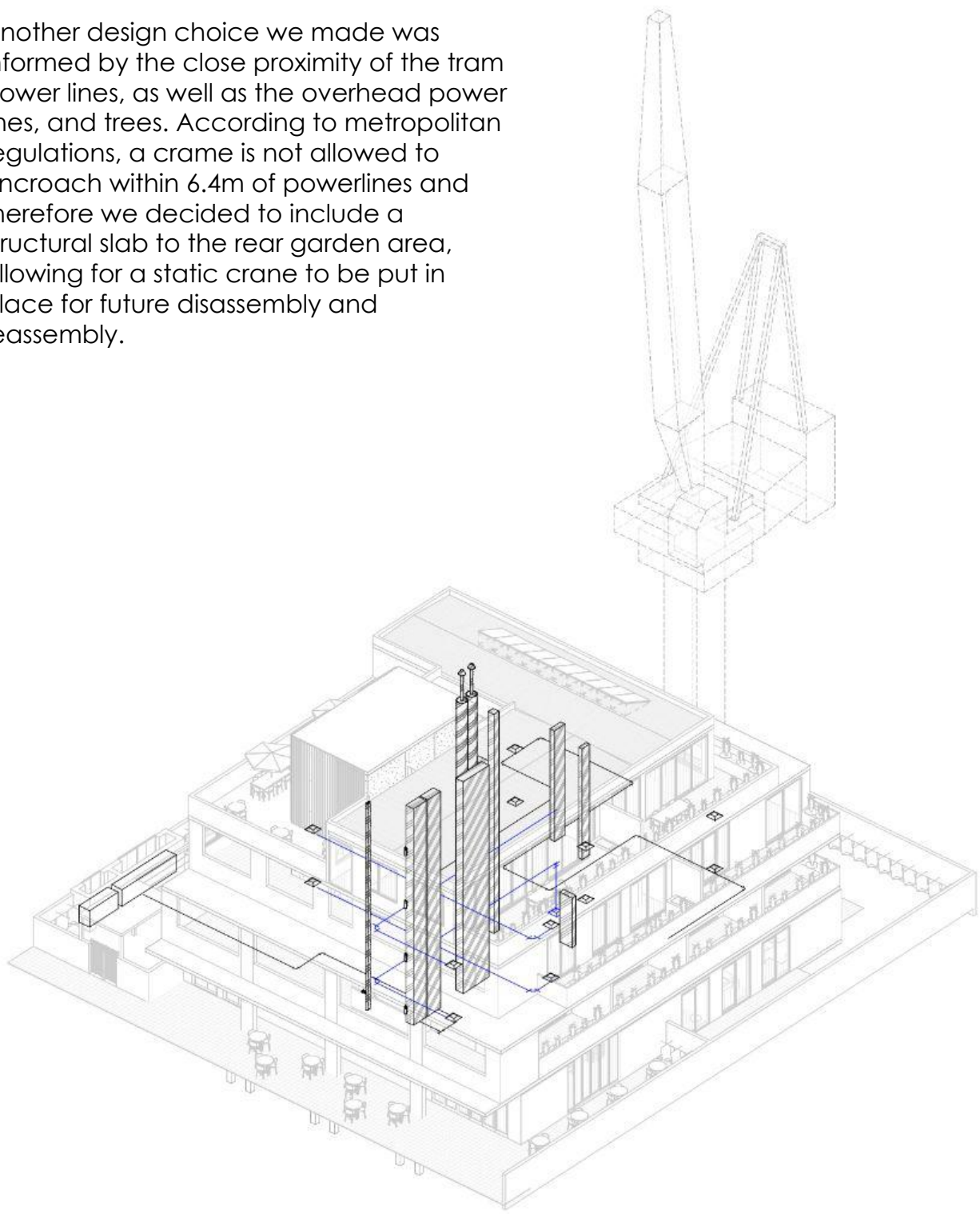
Structural Design Decisions

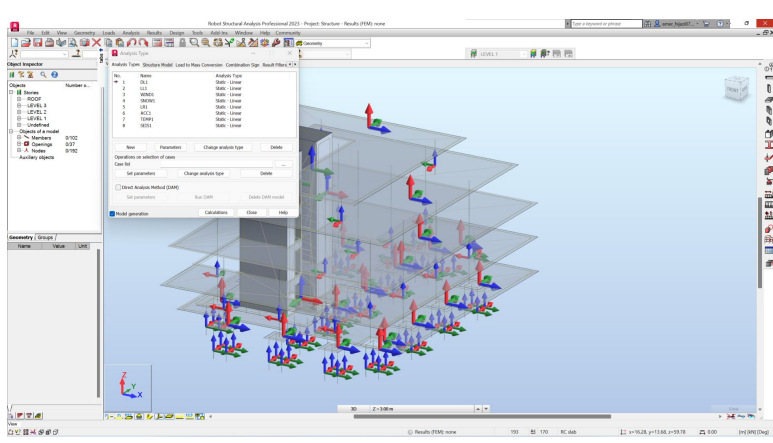
For the structure, we made defining decisions, which in our design, aims to create an agile and efficient building. These decisions entail, a column system which is offset from the exterior of the building. Through this, we aimed to avoid defining space through structure, allowing the building to be ankle to change use over its lifetime.

Another design choice we made was informed by the close proximity of the tram power lines, as well as the overhead power lines, and trees. According to metropolitan regulations, a crame is not allowed to encroach within 6.4m of powerlines and therefore we decided to include a structural slab to the rear garden area, allowing for a static crane to be put in place for future disassembly and reassembly.

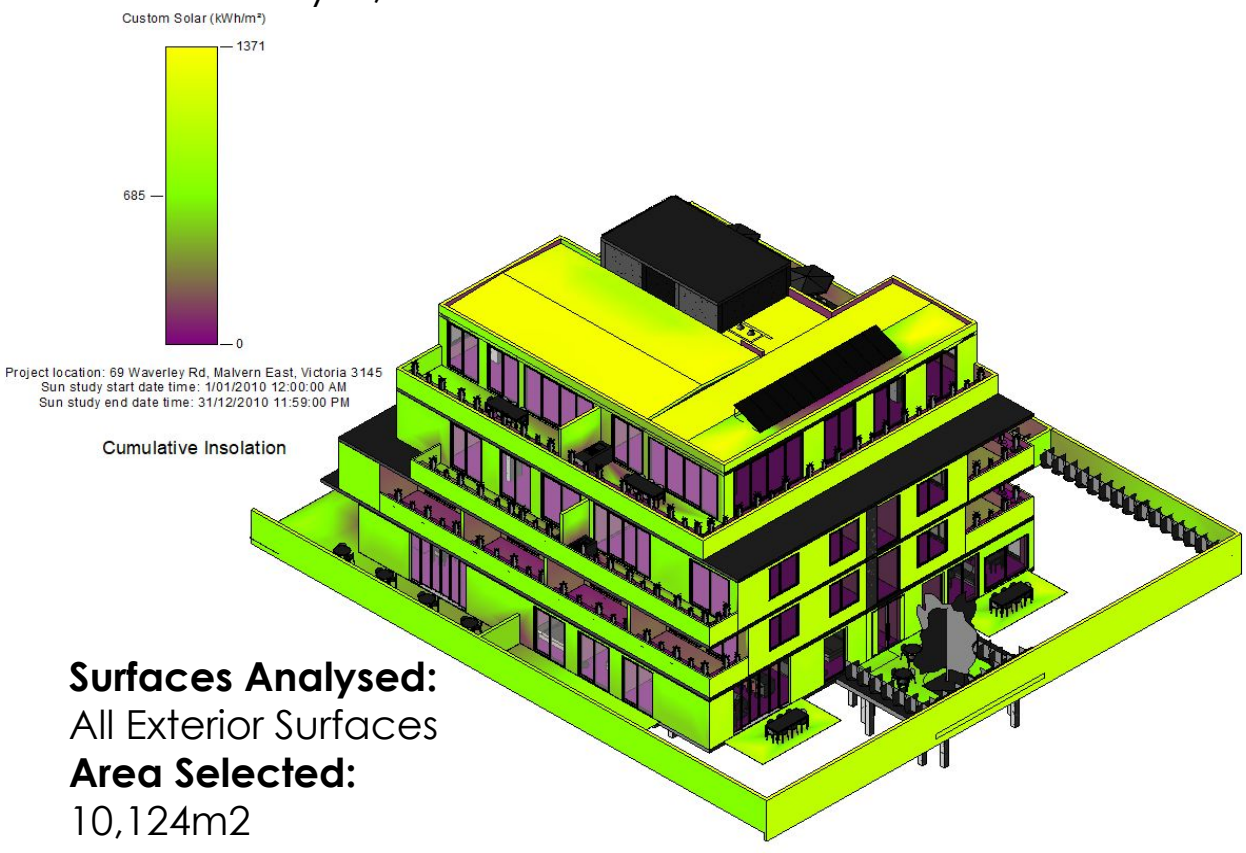








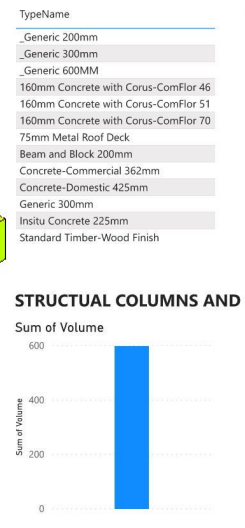
Structural Analysis, and MEP

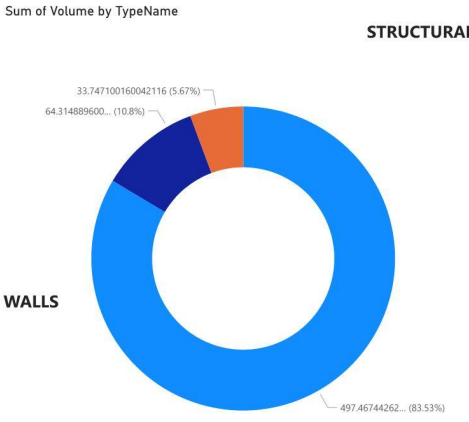


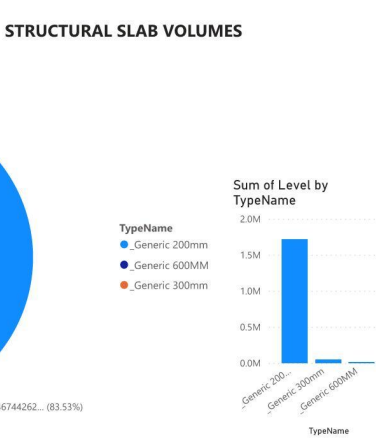
Surfaces Analysed:
All Exterior Surfaces
Area Selected:
10,124m2
Duration: 1/1 Sunrise - 31/12 Sunset
Type: Cumulative Insolation
Style: Solar Analysis

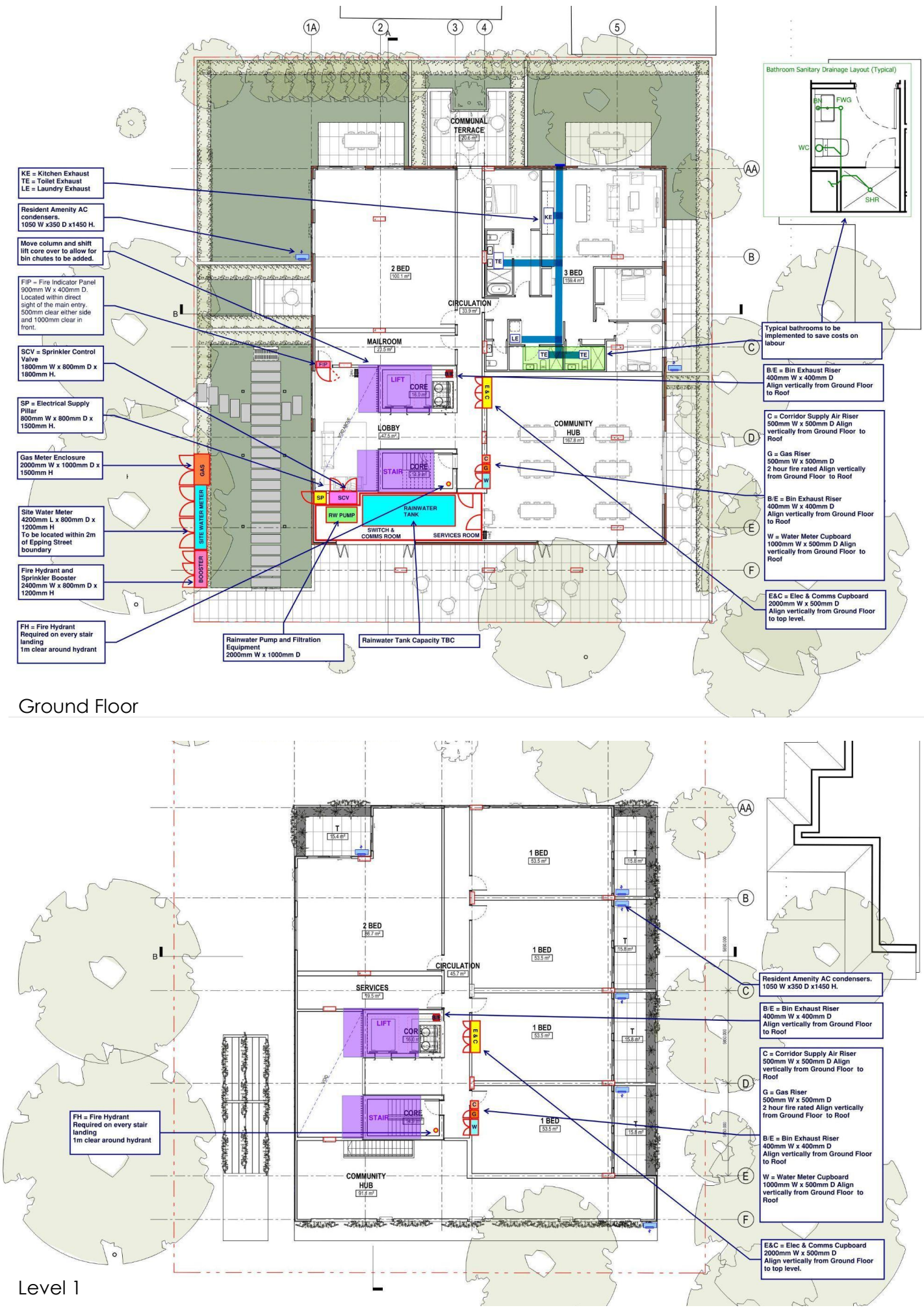
TypeName	Sum of Volume
	383.69
Total	**383.69**

TypeName
_Generic 200mm
_Generic 300mm
_Generic 600MM
160mm Concrete with Corus-ComFlor 46
160mm Concrete with Corus-ComFlor 51
160mm Concrete with Corus-ComFlor 70
75mm Metal Roof Deck
Beam and Block 200mm
Concrete-Commercial 362mm
Concrete-Domestic 425mm
Generic 300mm
Insitu Concrete 225mm
Standard Timber-Wood Finish





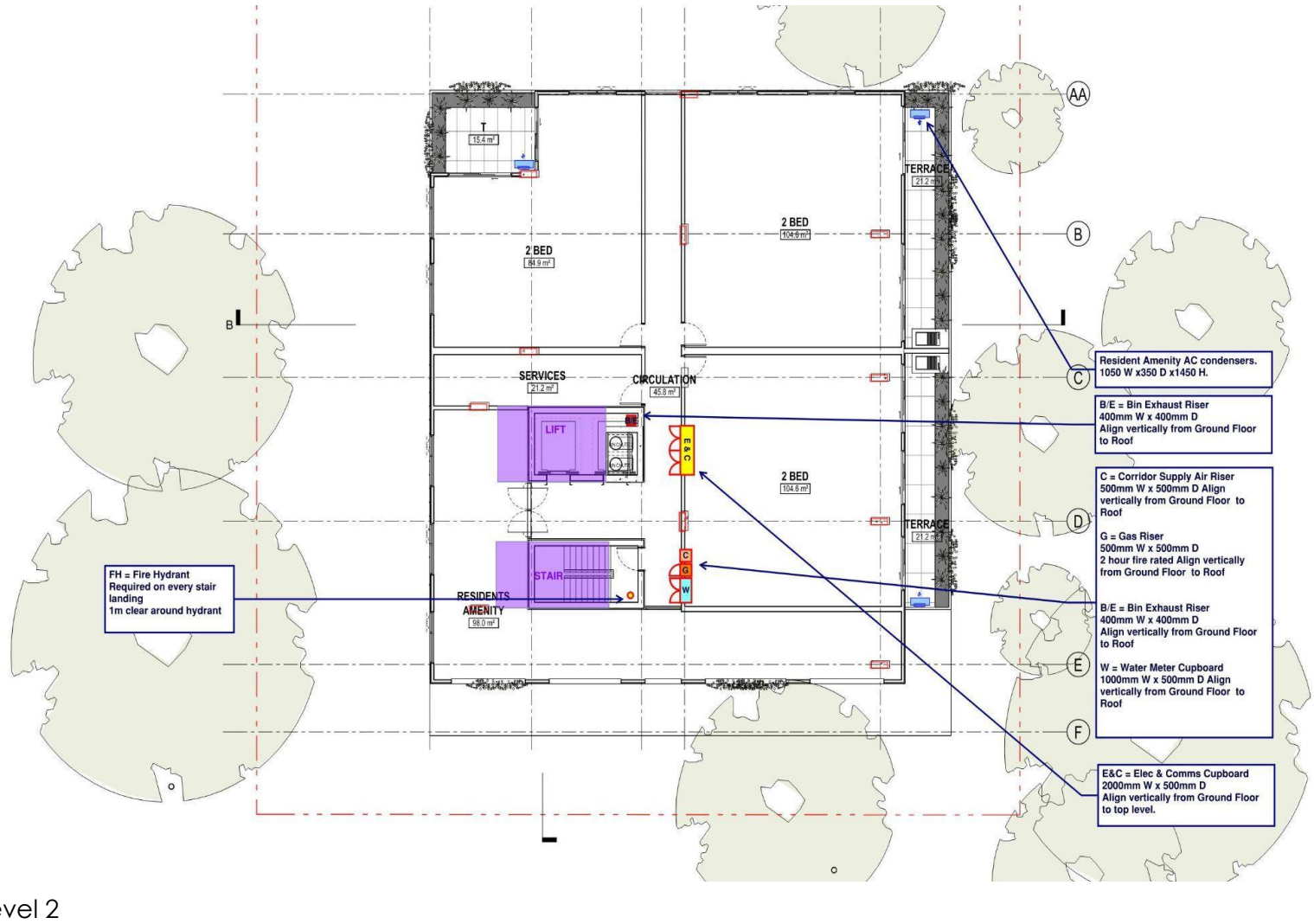




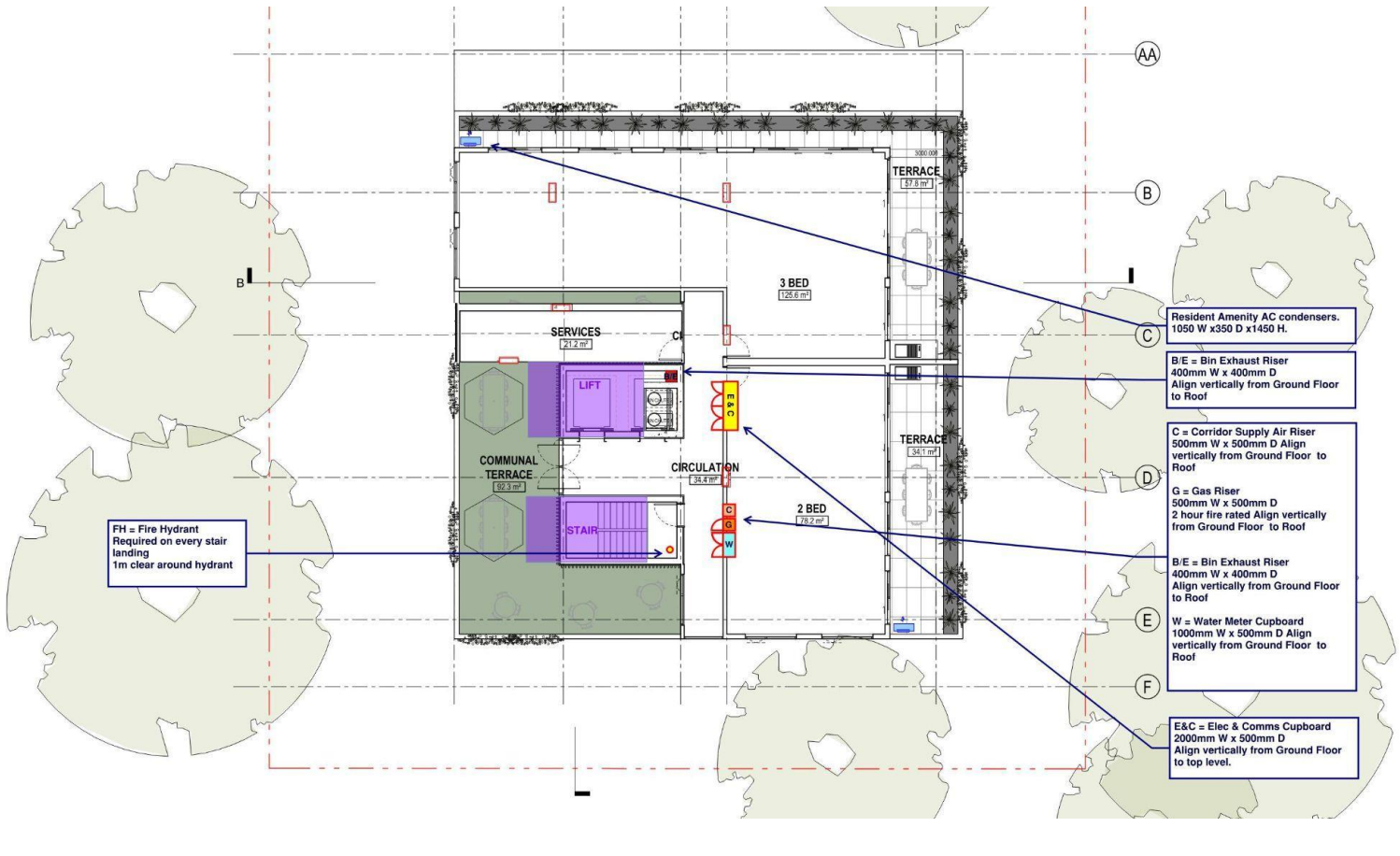
Ground Floor

Level 1

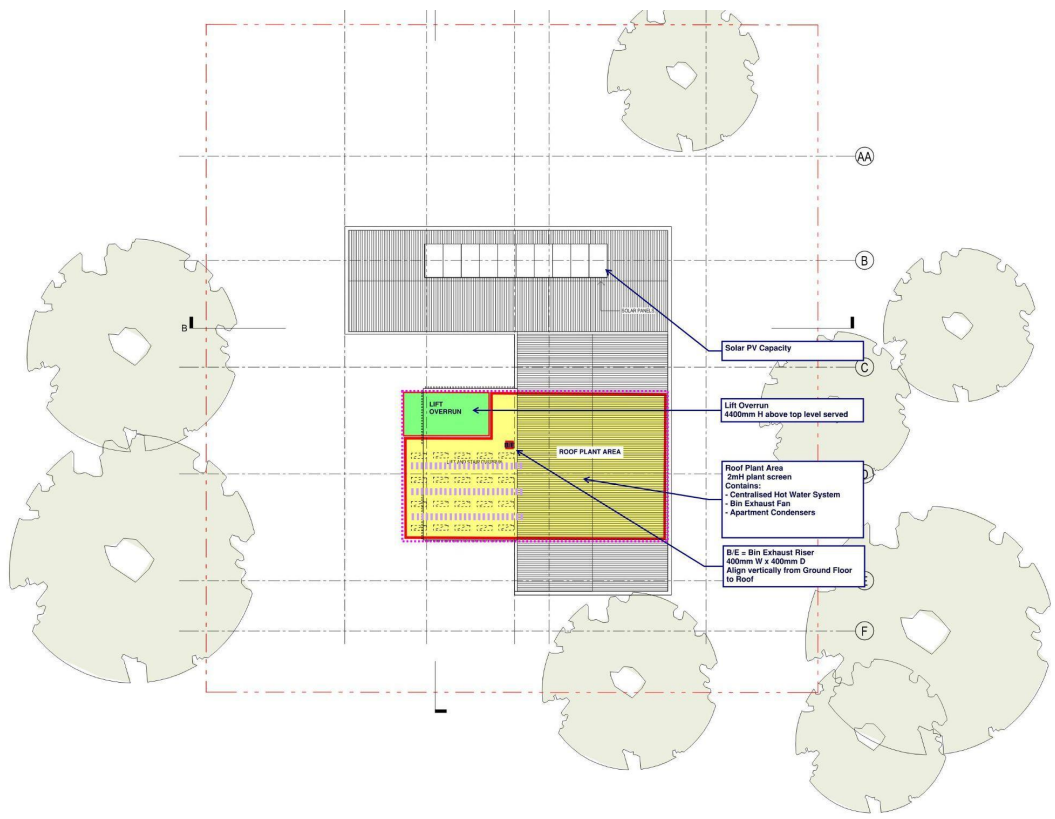
MEP



Level 2



Level 3



Roof

Costing Summary

The costing of the construction and assembly of the apartment building concluded, is informed by Rawlinsons cost guide 2022, as well as using averages from previous Prefab projects, and competition entries. While looking at previous projects, consideration about inflation was made, and prices were increased for a realistic summary. The cost is given in m2, as comparable to Rawlinsons, and other non prefabricated projects, giving insight into the pricing difference and benefits seen in the prefabrication industry.

Off Site Construction		Individual Apartment Cost		Onsite Construction (12% on top)	Transport to Site (5% on top)	Miscellaneous Inc GST	Total
1 Bed Apartment	$2,578/m2	$137,923.00	4 times unit type	$66,203.04	$27,584.60		
2 Bed Apartment							
86.7m2	$2,620/m2	$227,154.00		$27,258.48	$11,357.70	Engineering/Permits/Fees	
84.9m2	$2,620/m2	$222,438.00		$26,692.56	$11,121.90	Site Clearance	
104.6m2	$2,620/m2	$274,052.00	2 times unit type	$65,772.48	$27,405.20	Earth Works	
78.2m2	$2,620/m2	$204,884.00		$24,586.08	$10,244.20	Traffic Managment	
101.1m2	$2,620/m2	$264,882.00		$31,785.84	$13,244.10	Flatbed Truck (Standard Size) Bathroom Module Delivery	
3 Bed Apartment						Average Rental Cost Per SQM Per Annum in moorabbin	
125.6m2	$2,490/m2	$312,744.00		$37,529.28	$15,637.20		
159.4m2	$2,490/m2	$396,906.00		$47,628.72	$19,845.30		
Communal Spaces		$897,323.00					
Structure		$567,400.00					
Total Apartment cost		**$3,505,706.00**		**$233,994.96**	**$97,497.90**	**$125,505.88**	**$5,069,438.44**

The median unit price in Malvern East is $620,000 based on 157 sales in the past 12 months—that's a decrease of 14%. Buyer demand has decreased by 10% in the same period.

Bedrooms	Our construction price (Exc GST)	Median sale price	Sold
1 bedroom	$137,923.00	$297,500.00	36
2 bedrooms	$238,682.00	$629,330.00	80
3 bedrooms	$354,825.00	$1,116,750.00	38

Bedrooms	Expected Profit	Amount For Sale	Total Profit
1 bedroom	$159,577.00	4	$638,308.00
2 bedrooms	$390,648.00	6	$2,343,888.00
3 bedrooms	$761,925.00	2	$1,523,850.00

Scheduling


Project Lead
Project Start:
Display Week:
Design
Architectural Design
Engineering Feasibility
Finishing Architectural Design
Finishing Engineering Design
Documentation and Planning
Design Approvals
Utilities Plan
Construction Plan
Risk Management Plan
Safety Management Plan
Quality Management Plan
Traffic Management Plan
PROCUREMENT - Materials
Concrete
Steel
Fibre Cement Sheeting
Aluminium Cladding
Bonded Brickwork
Architectural Elements
Equipment
Crane
Trucks
Digger
Site Preparation
Fences
Site Clearing
Offset/Pier Alignment Mac
CONSTRUCTION - Groundwork
Site Grading
Excavation Layout
Diamond Pit Excavation
Footing Excavation
Service Excavation
Footings
Install Formwork
Install Reinforcement
Pour Concrete
Cure
Remove Formwork
Cure
Backfill
Services
Water
Electrical
Off-site Module Construction
2D Module Fabrication
2D Module Fabrication
On-site Assembly - Ground Floor
Lifting Into Place
Connecting Modules on Baseplates
Connecting Modules on Modules
Enclosure/Cladding
Second Floor
Lifting Into Place
Connecting Modules on Baseplates
Connecting Modules on Modules
Enclosure/Cladding
Third Floor
Lifting Into Place
Connecting Modules on Baseplates
Connecting Modules on Modules
Enclosure/Cladding
Fourth Floor
Lifting Into Place
Connecting Modules on Baseplates
Connecting Modules on Modules
Enclosure/Cladding