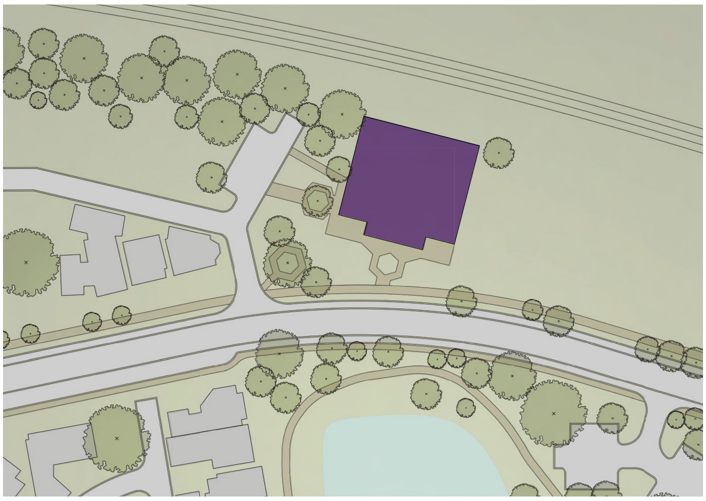
FLEETWOOD

.hive

15 YELVERTON DRIVE
WOODBRIDGE
WA 6056

DESIGN VALIDATION REPORT
+
SUPPORTING CALCULATIONS

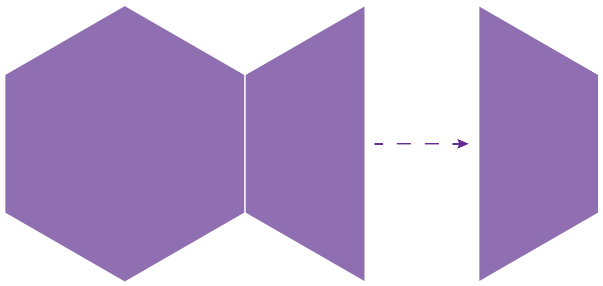


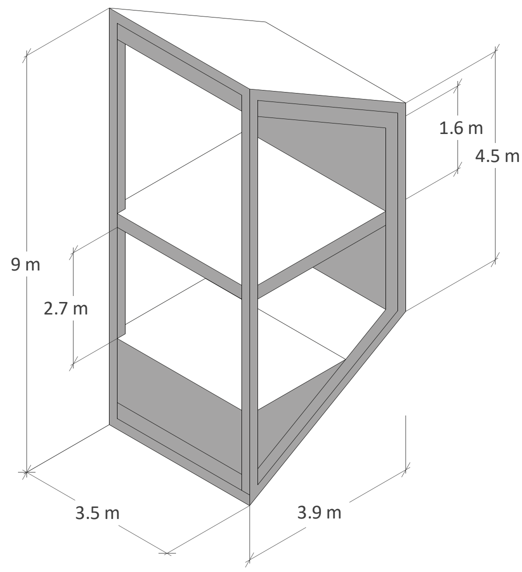
SITE HISTORY & CONTEXT

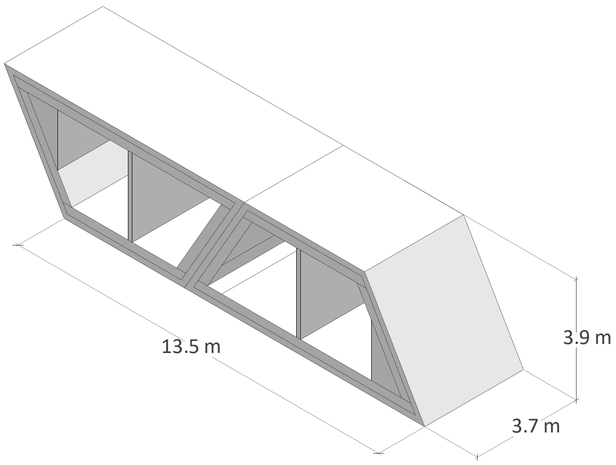
Midland has always been the guts of Perth, always changing but never fearful of the future. Serving as the foundation for the city, providing what was needed to grow and become a modern society. And though the rail workshops closed in 1994, the community of Midland had continued to develop on strong principles of hard work and innovation, with Midland High winning the innovation award 4 years running this year.

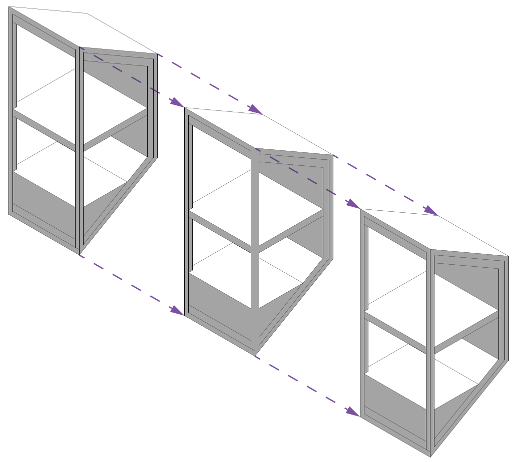
It must be said however, that Midland isn't just important to Perth, but to the first peoples who lived there, with artifacts dating to 40 thousand years ago, and Corroborees still happening in 1907. The area would have been a common camp site for the Noongar during the summer seasons, camping by the Helena River and receiving nourishment from its flow.

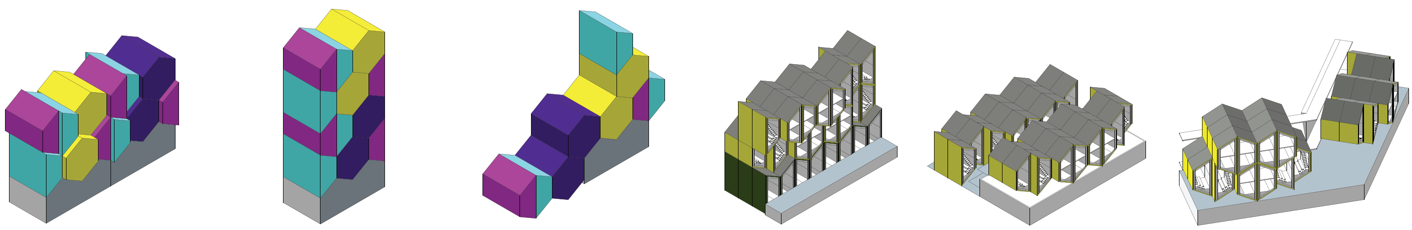
The site chosen for this project is 15 Yelverton Drive, situated at the heart of the Old Rail Workshops. It directly relates to Hebe Park and the Coal Dam Lake; once used as dumping grounds for the coal that fuelled the Old Trains. Remnants of the old track remain as features of Coal Dam Park. This site was chosen due to its historical richness in both European and Aboriginal cultures. There was a strong desire to introduce a larger demographic variety within site amongst the team to encourage stronger bonds among the community. The prolific site allowed more emphasis to be placed on communal relations and support.









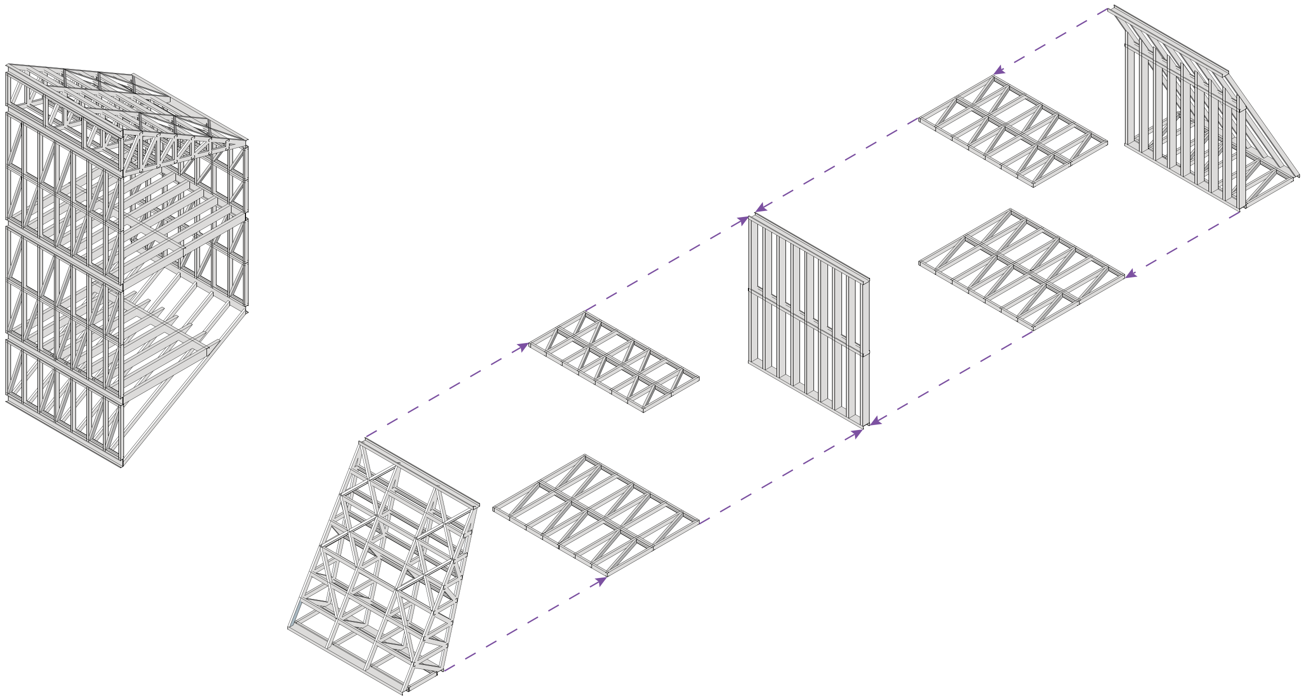


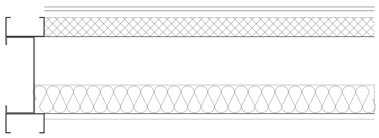
MODULE DESIGN

The design is inspired by bees and their relationship with the first peoples of Australia, who prized honey for their medicinal value. We adapted the hexagon shape of bee cells, playing on the dichotomy of visual aesthetics and the natural stability of the shape. We defined the parameters of each module to fit on a truck without the need for pilot vehicles to reduce imposing restrictions on the community and save on the economic and environmental costs.

Our goal is to create something that can be scalable, to work both as standalone units and as medium density residential complexes. This goal was created to allow these units to be used by everyone, establishing a new mode of living that would be economically viable to prolong the use and maintenance of these structures.

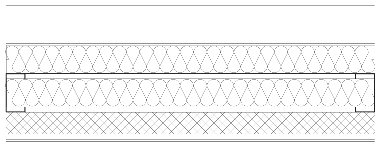
The honeycomb shape gave us something very interesting to play with, and with more time, we could possibly go on and on refining and changing things because of the shape's versatility. The shape allowed us to expand in 3 dimensions and allowed for some very interesting unit arrangements.





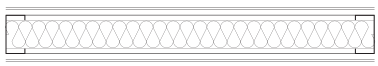
- FLOOR SYSTEM
SCALE 1 : 20

10mm HEAVY DUTY CORK TILE FLOORING
18mm MAGNESIUM OXIDE BOARD
50mm DURRAPANEL C50/R0.62 STRAWPANEL
75mm R2 EARTHWOOL
15mm FIRE RATED GYPSUM



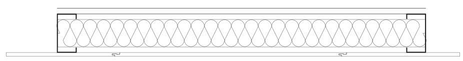
- EXTERNAL WALL SYSTEM
SCALE 1 : 20

120 mm ALUCABOND CLADDING SYSTEM
5mm WATER PROOF MEMBRANE
75mm R2 EARTHWOOL
102mm CEE SECTION w/ 90mm R2.5 EARTHWOOL
58mm DURRAPANEL C58/R0.72 STRAWPANEL
15mm FIRE RATED GYPSUM
5mm CORK TILES



- INTERNAL WALL SYSTEM (DRY)
SCALE 1 : 20

5mm CORK TILES
15mm FIRE RATED GYPSUM
102mm CEE SECTION w/ 90mm R2.5 EARTHWOOL
15mm FIRE RATED GYPSUM
5mm CORK TILES

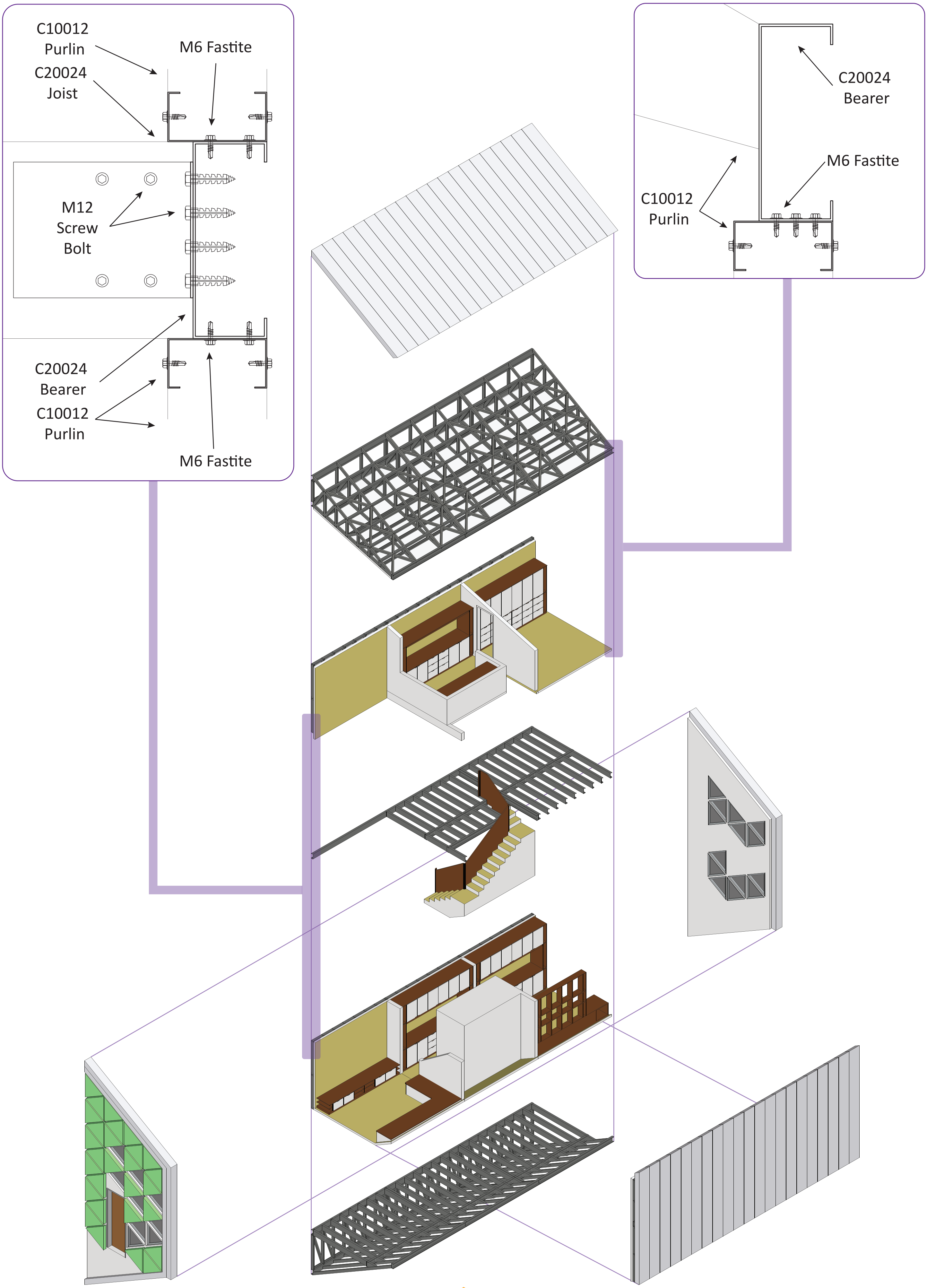


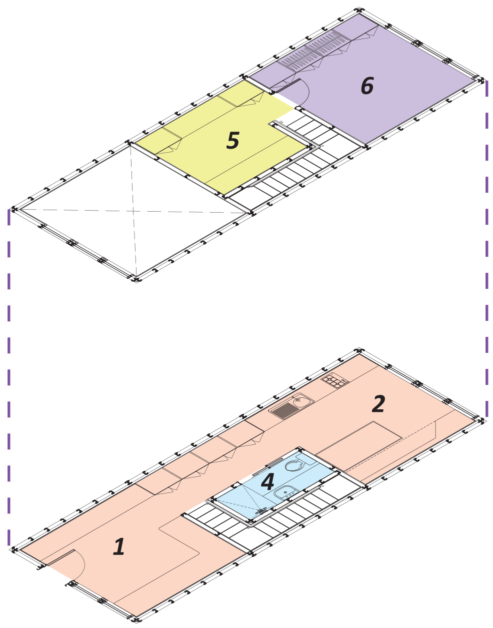
- INTERNAL WALL SYSTEM (WET)
SCALE 1 : 20

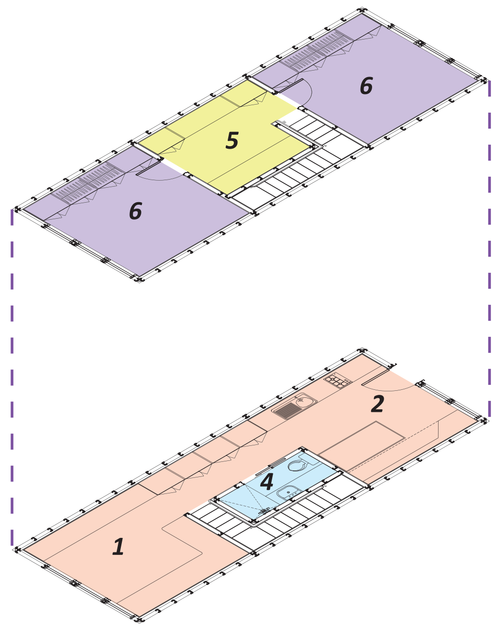
15mm FIRE RATED GYPSUM
102mm CEE SECTION w/ 90mm
R2.5 EARTHWOOL
10mm FIBO AQUALOCK WALL PANEL

MATERIAL SELECTION

We decided to use cold-formed steel for the structural system of this project, boasting the usual strengths of steel while having a significantly lower carbon footprint to manufacture. Each half-hexagon module would be made up of seven pieces as depicted above. Lightweight and fire resistant, Alucobond was chosen as the exterior cladding for its clean finish, colour availability and swift installation process. Due to the site bordering the train line, a composite system was decided upon for the insulation of the building. All external walls would have an additional layer of strawboard, utilising an agricultural biproduct that boasts strong acoustic insulating properties. Fire-resistant boards have been used within the walls, floors and ceiling creating fire compartments, mitigating the expansion of any accidental fires. Cork has been applied to the walls and floors of the dry areas of each units providing a natural finish to the project.

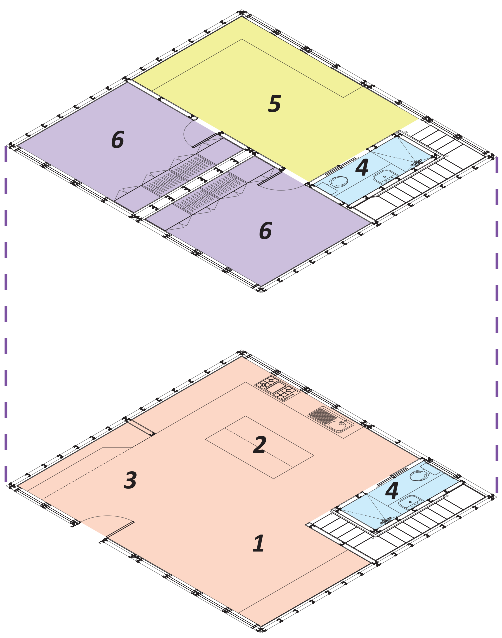

C10012
Purlin
M6 Fastite
C20024
Joist
M12
Screw
Bolt
C20024
Bearer
C10012
Purlin
M6 Fastite
C20024
Bearer
M6 Fastite
C10012
Purlin

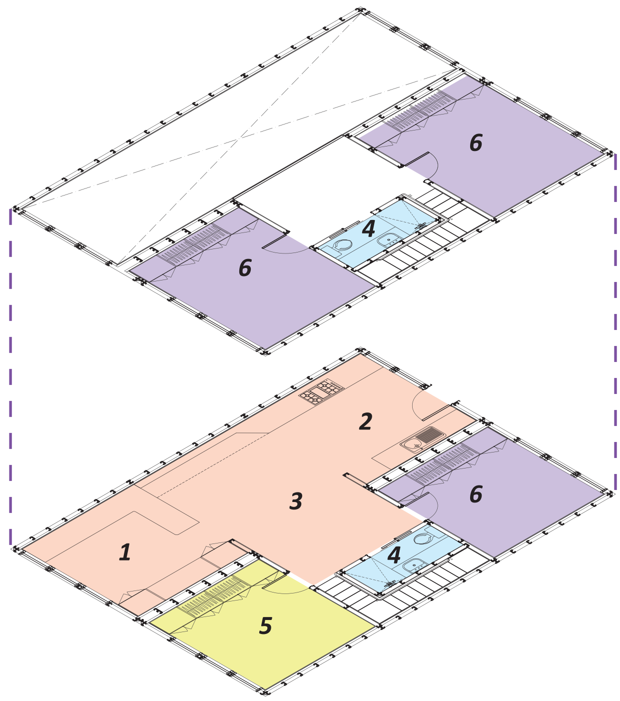




TYPE A		AREA sqm
1 BED 1 BATH		
1	LIVING	*11.85*
2	KITCHEN	*11.85*
	DINING	
4	WC	*2.78*
5	STUDY	*11.85*
6	BEDROOM	*11.85*
	TOTAL AREA	*59.25*

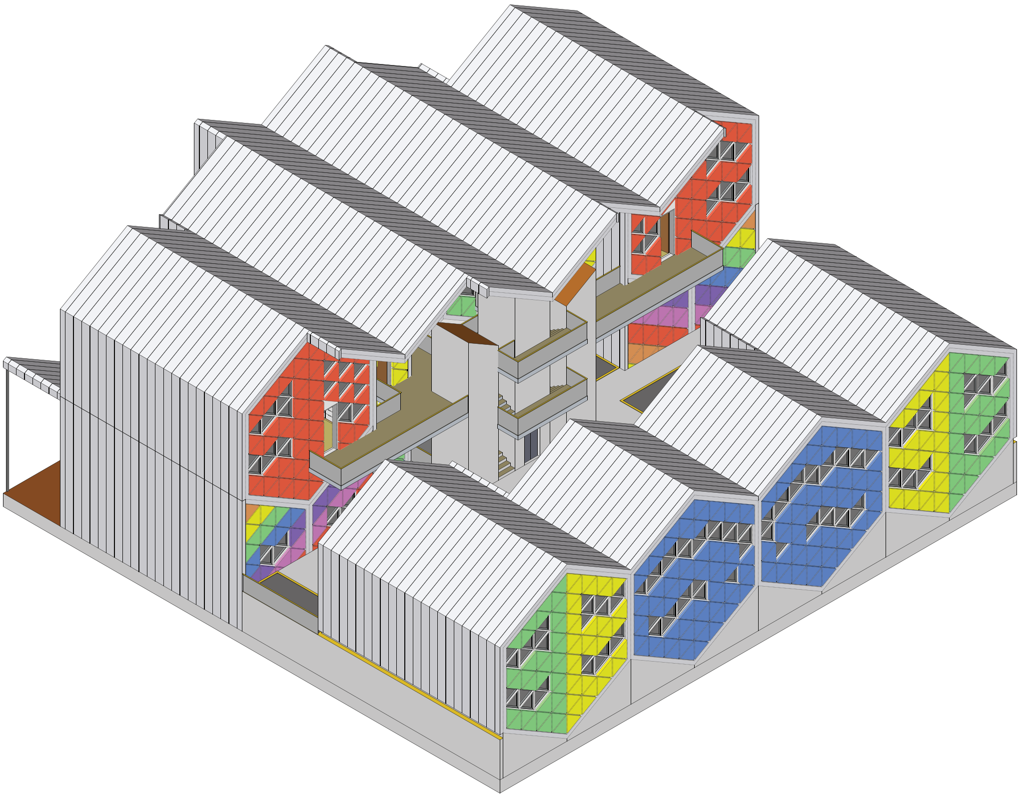
TYPE B		AREA sqm
2 BED 1 BATH		
1	LIVING	*11.85*
2	KITCHEN	*11.85*
	DINING	
4	WC	*2.78*
5	STUDY	*11.85*
6	BEDROOM	*11.85*
	TOTAL AREA	*71.1*

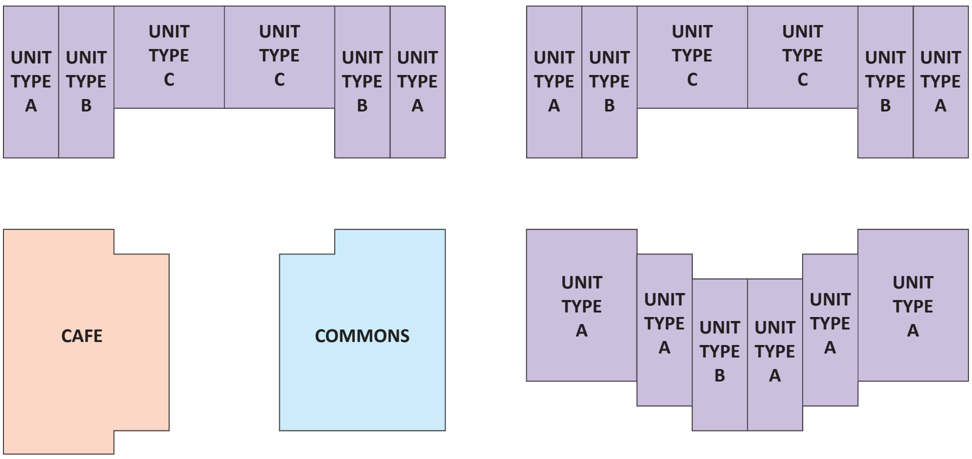




TYPE C		AREA sqm
2 BED 2 BATH		
1	LIVING	*12.45*
2	KITCHEN	*18.15*
3	DINING	*12.45*
4	WC	*2.78*
5	STUDY	*18.15*
6	BEDROOM	*11.85*
	TOTAL AREA	*101.75*

TYPE D		AREA sqm
3 BED 2 BATH		
1	LIVING	*11.85*
2	KITCHEN	*11.85*
3	DINING	*18.16*
4	WC	*2.78*
5	STUDY	*11.85*
6	BEDROOM	*11.85*
	TOTAL AREA	*120.00*





DESIGN PHILOSOPHY

Of equal importance of the modules is the arrangement of space and how the project works together. The most important aspect of the Hive is belonging, the kind of belonging that is only provided by stability, stability in privacy, community, and livelihood. Each unit is arranged and stacked according to the needs of the project. With this in mind, the project is divided into three parts, all equal in the workings of the project much like the division of honeybee hierachy which depend on each other to function.

The Café, situated in the eastern side of the project, relates to the adjacent parks and serves as a point of reference for the Community of Midland to relate to the project. The Café serves as a space where residents can be trained with real skills for the outside, regardless of education, and where the community of Midland as a whole can come and support the project. The Café will be run as a cooperative, where profits will be reinvested in the community living there at the Hive, buying books, paying bills and maintenance.

The Commons serves as a gathering place for the residents of the Hive, to grow together, sharing and learning from one another. The Commons emphasises the communal aspect of the Hive, where residents can come together to grow and become who they believe they should be. There are spaces for entertainment, nourishment, education and community, hopefully providing a place where broken individuals can be supported and loved as they trek their way into wholeness.

The Colony, named after the family unit of honeybees, is meant to provide private living quarters for all residents of the hive. Each individual unit is meant as a space to recharge and be at peace.

CAFE

1	ALFRESCO
2	DINING AREA
3	BARRISTA
4	KITCHEN

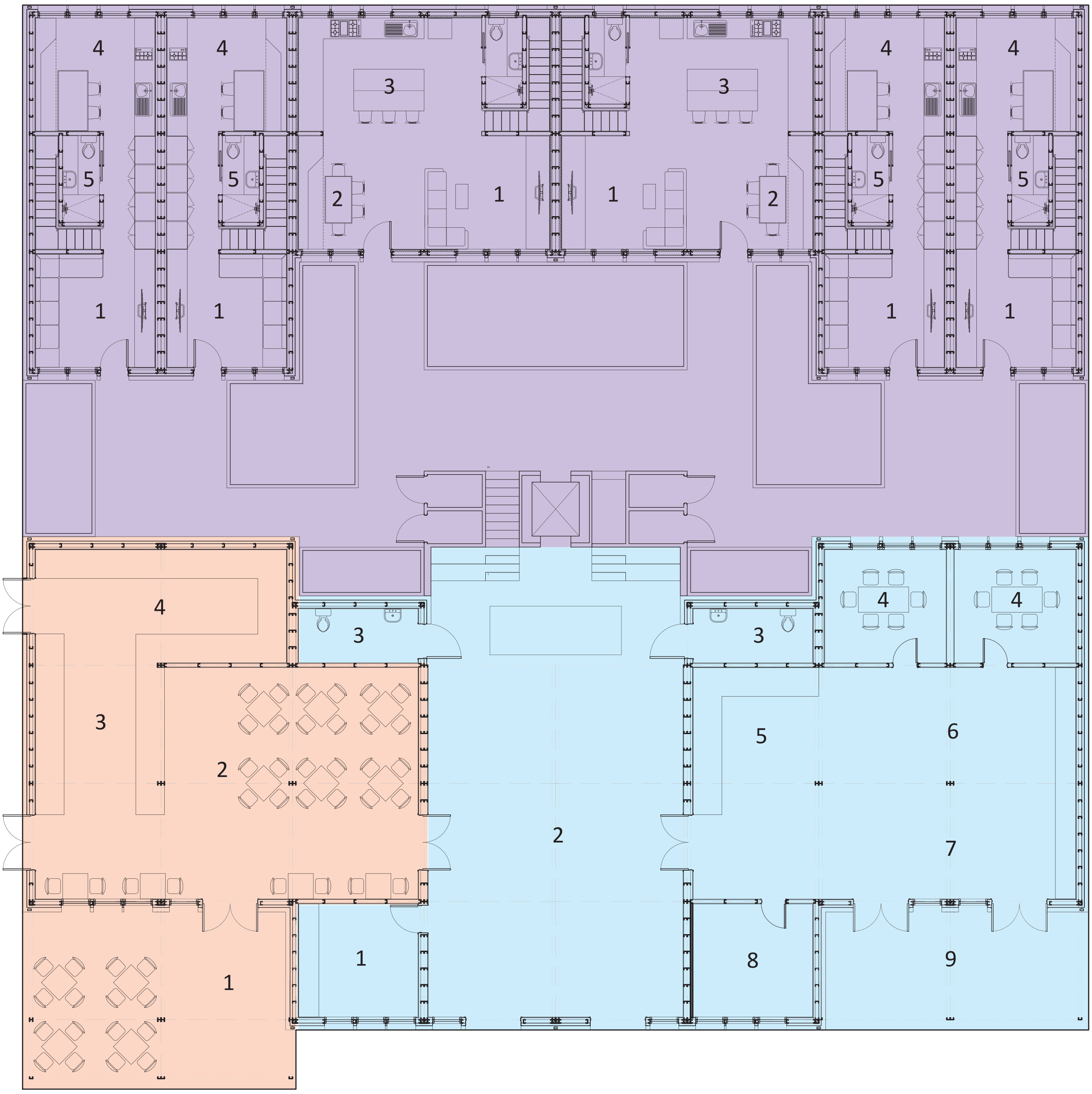
COMMONS

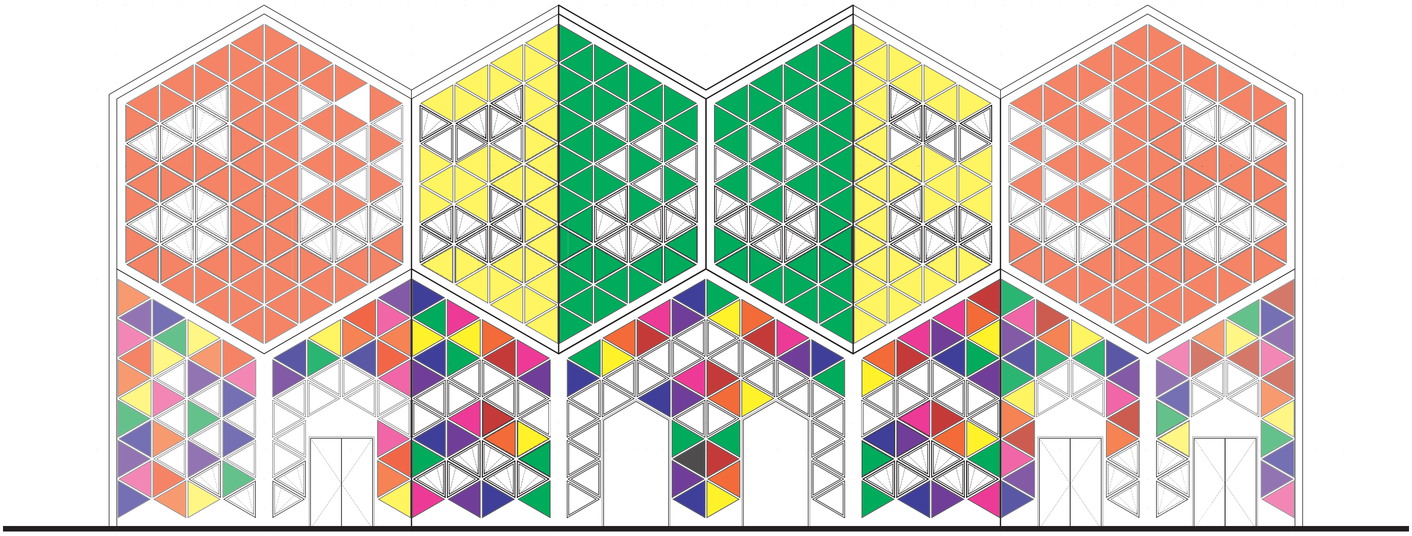
1	ADMINISTRATION
2	PLAZA
3	ACCESSIBLE WC
4	STUDY
5	KITCHEN
6	DINING
7	LIVING
8	LAUNDRY
9	ALFRESCO

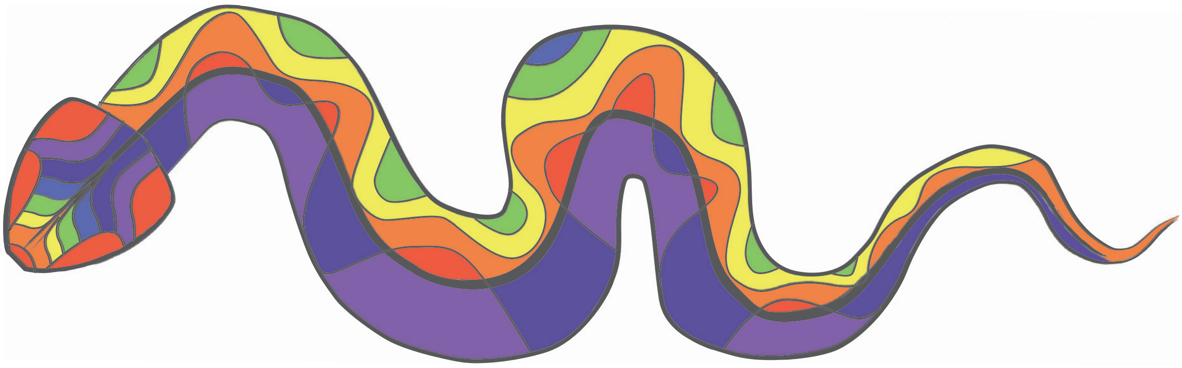
COLONY

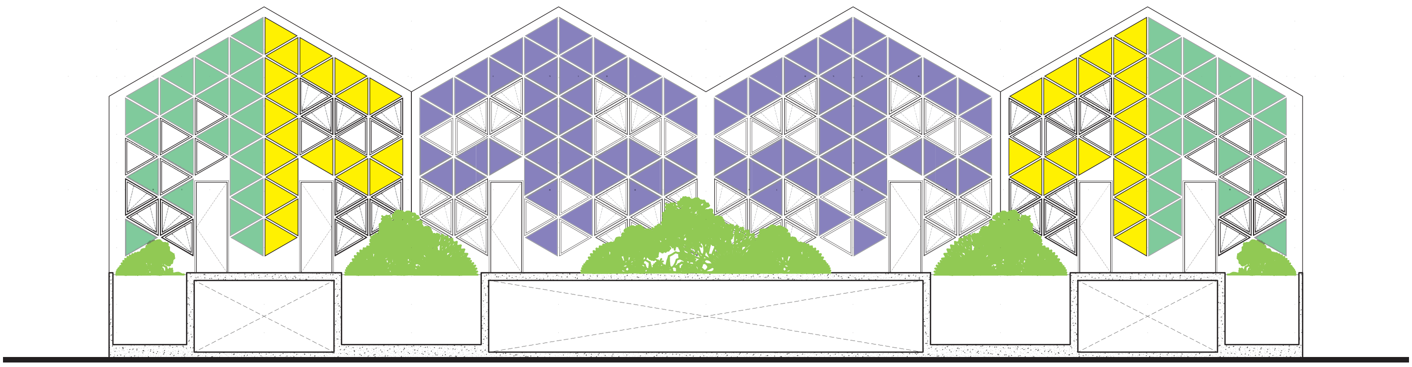
1	LIVING
2	DINING
3	KITCHEN
4	KITCHEN DINING
5	BATHROOM
6	STUDY
7	BEDROOM

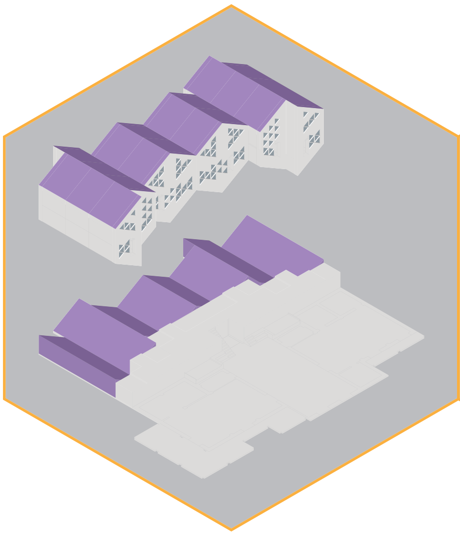
LEVEL 0

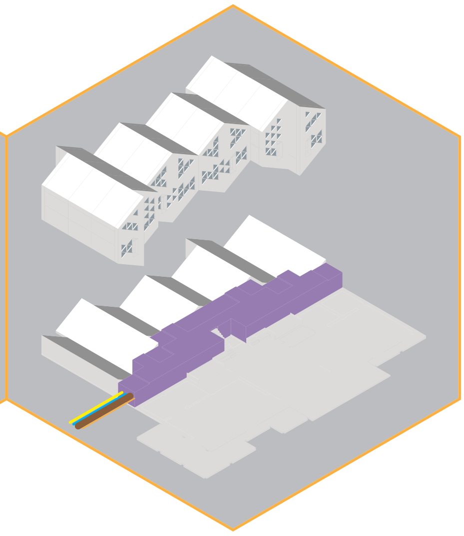










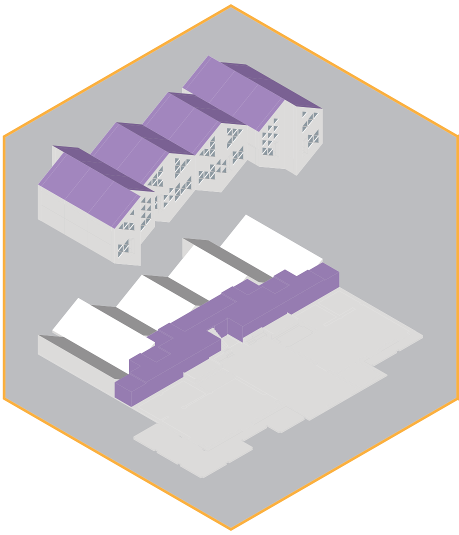


SOLAR PV & BATTERY ARRAY
Commonplace in the Net Zero Strategies of many buildings are the Photovoltaic Cells placed on the roof. The cells face East and West, contrary to usual practice of having it face North. This allows energy to be generated at varying times throughout the day, hopefully alleviating the issue with energy loads experienced by the grid due to over collection at midday. The Photovoltaic Cells feed into a Battery Array situated in the Service Modules below the northern row of the Colony which

INTERNAL FITTINGS
To reduce water usage for cleaning, all taps and showers will be fitted with Mist nozzles while all water-based appliances are to be waterwise.

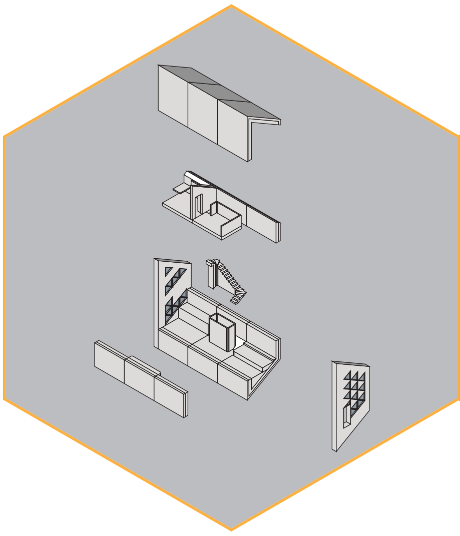
Electrical appliances should have integrated inverters to reduce electrical consumption and overall dead weight. Fibreoptic with LED backup lighting will be used to draw in daylight into the project, only using electricity when absolutely necessary.

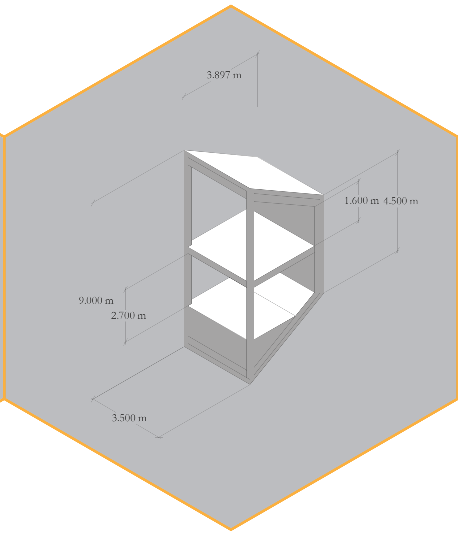
SERVICES
The utility services will be channelled through the west side of the site directly into the middle of the Hive. Water mains will feed into a small water tank which will then be distributed amongst the different units. Electrical mains will used as a backup system for the Solar PV and will feed into the batteries when solar energy dries up for the time being. This strategy allows the battery array to mitigate any damage to systems should there be a general power outage.

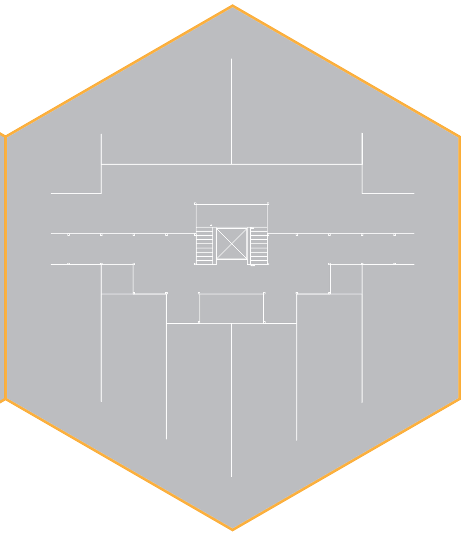


RW COLLECTION TANK
Rainwater is collected from the roofing system and delivered to a storage tank below the central corridor and is to be used for flushing and plant care.

OPENINGS
To reduce heat loss in the project, all external openings will utilise a minimum of double-glazed windows and solid core doors.







FLOOR AREA REQUIREMENTS

Type	Size	Requirements
A	59m2	47m2
B	71m2	67m2
C	102m2	70m2
D	120m2	93m2

Balconies have thus far not been provided to encourage residents to get to know each other in the more public areas of the project.

CEILING HEIGHT REQUIREMENTS

Ceiling Heights match the reqirements of 2.4m for Non-Habitable Rooms and 2.7m Habitable Rooms as well as a minimum of 1.5m minimum height for Attic Rooms.

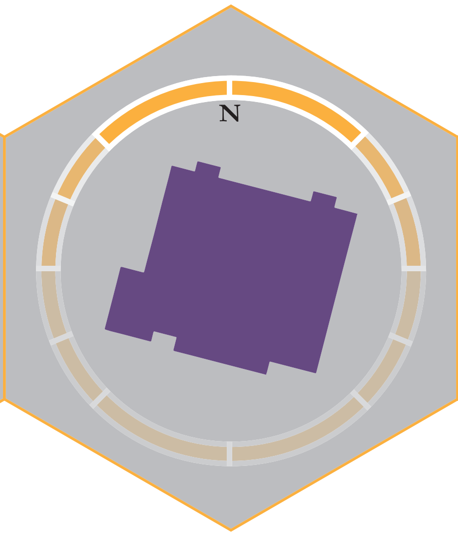
Ceiling Height for restaurant/café has been matched at 3.3m

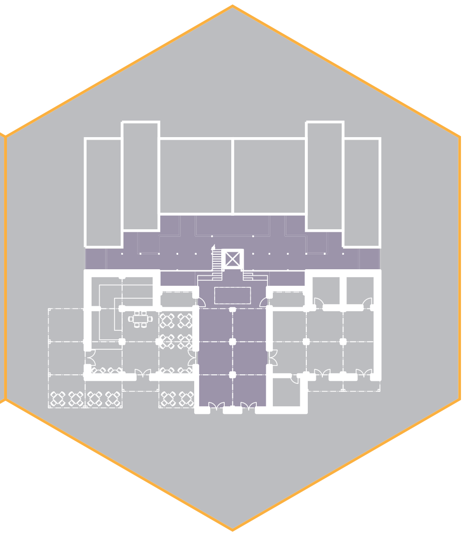
STAIR REQUIREMENTS

Stair requirements at 600mm for internal circulation and 1000mm for central and fire escape stairs with maximum of 18 risers before each landing.

CORRIDOR WIDTH

Corridor width of 1500mm has been matched along with window gap of 1500mm.





SETBACK COMPLIANCE

Setbacks comply with the MRA for Yelverton Drive

PEDESTRIAN ENTRY AND ACCESS

Highly identifiable Pedestrian Entry and Access provided on the South Façade.

SOLAR ACCESS

Most major openings sit in the acceptable range for solar access.

OPEN SPACE REQUIREMENTS

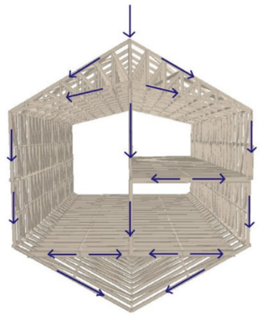
Communal Open Space requirements of 6m2 per dwelling exceeded at 130m2, or 10m2 per dwelling.

ENGINEERING ANALYSIS

The structural planning for the cold-formed steel structure is based on engineering knowledge as shown in figure below. The load bearing walls are designed in cold-formed steel frames and the roof is designed to be scissors truss. Loads considered are roof loads, wind loads, imposed and permanent loads.

LOAD TRANSFER

TRUSS SYSTEM
WALL FRAMES UPPER FLOOR
FLOOR JOIST
BEARER BEAM
UPPER FLOOR
WALL FRAMES LOWER FLOOR
FLOOR JOIST
PAD FOOTING



STRUCTURAL DESIGN

STRUCTURE	MATERIALS
Roof Cladding	Custom Orb 0.48 BMT
Purlin	Cold-formed Steel C10012
Truss	Cold-formed Steel C10012
Wall Frame	Cold-formed Steel C10012
Flooring Joist & Bearer	Cold-formed Steel C20024
Stairs	Cold-formed Steel C10012
Column	125x125x4 SHS
Exterior/ Interior Load Bearing Wall	9mm Fibre Cement Weatherboards + 15mm Fire Resistant Gypsum Board
Interior Wall Partition. Non-load Bearing	15mm Fire Guard Plasterboard on both sides of cold formed steel frame
Flooring	18mm Magnesium Oxide Board
Stairs, Corridors & Lift Core	Concrete

INTRA-CONNECTION DESIGN

<table>
<tr><th>STRUCTURAL MEMBERS</th><th>CONNECTIONS</th><th>REFERENCES</th></tr>
<tr><td>Roof truss to wall frame</td><td rowspan="3">M6 Fastite (Flat head, 17mm,PP, BMT 0.95)</td><td rowspan="3">FRAMECAD Fastening Solution for Cold Formed Steel

http://nebula.wsimg.com/0e855b7fb6ca2a10d9cc159431092f2f?AccessKeyId=25F1265C92698680223B&disposition=0&alloworigin=1</td></tr>
<tr><td>Load Bearing Wall Frame Studs connection</td></tr>
<tr><td>Truss system</td></tr>
<tr><td>Bearer to floor joist</td><td rowspan="2">M12 Screw Bolts</td><td rowspan="2">Powers, Blue-Tip Screw Bolt

https://www.westcoastfasteners.com.au/pdf/Powers_Blue_Tip_Screw_Bolts.pdf</td></tr>
<tr><td>Fix down for load bearing wall frame</td></tr>
</table>

SUMMARY OF DESIGN CAPACITY FOR LOAD BEARING WALL

CAPACITY	VALUE	COMMENT
Design tensile force, Nt*	26.2kN	Obtained from STAAD PRO CONNECT design analysis
Design compression force, Nc*	45kN	
Design bending moment, M*	1.932kNm	
Design shear force, V*	20.3kN	
Tension, ΦtNt	87.5kN	>Nt*= (∴Satisfied)
Compression, Nynet	91kN	>Nc* (∴Satisfied)
Nominal member capacity for local buckling, Ncl	50.3kN	Ncl ≤ Nynet ∴Compression members do not yield
Nominal section moment capacity, ΦMs	3.033kNm	>M* (∴Satisfied)
Moment causing initial yield, My	4.24kNm	
Elastic lateral-torsional buckling moment, Mo	17kNm	Mo > 2.78My ∴ Mbe=My
Nominal member capacity for lateral-torsional buckling, Mbe	4.24kNm	>M* (∴Satisfied)
Nominal member capacity for local buckling, Mbl	3.35kNm	>M* (∴Satisfied)
Nominal shear capacity of the web, ΦVv	33.03kN	>V* (∴Satisfied)
Combined bending and shear, $\left(\frac{M^*}{\phi bMs}\right)^2 + \left(\frac{V^*}{\phi vVv}\right)^2$	0.78	≤1.0 ∴M* and V* are satisfied

SUMMARY OF DESIGN CAPACITY FOR FLOOR JOIST

CAPACITY	VALUE	COMMENT
Design tensile force, Nt*	73.4kN	Obtained from STAAD PRO CONNECT design analysis
Design compression force, Nc*	73.4kN	
Design bending moment, M*	15.64kNm	
Design shear force, V*	21.71kN	
Tension, ΦtNt	318kN	>Nt*= (∴Satisfied)
Compression, Nynet	389.7kN	>Nc* (∴Satisfied)
Nominal member capacity for local buckling, Ncl	384kN	Ncl ≤ Nynet ∴Compression members do not yield
Nominal section moment capacity, ΦMs	19.24kNm	>M* (∴Satisfied)
Moment causing initial yield, My	25.2kNm	
Elastic lateral-torsional buckling moment, Mo	1271kNm	Mo > 2.78My ∴ Mbe=My
Nominal member capacity for lateral-torsional buckling, Mbe	25.2kNm	>M* (∴Satisfied)
Nominal member capacity for local buckling, Mbl	24.9kNm	>M* (∴Satisfied)
Nominal shear capacity of the web, ΦVv	118.35kN	>V* (∴Satisfied)
Combined bending and shear, $\left(\frac{M*}{\phi bMs}\right)^2+\left(\frac{V*}{\phi vVv}\right)^2$	0.69	≤1.0 ∴M* and V* are satisfied

SUMMARY OF DESIGN CAPACITY FOR FLOOR BEARER

CAPACITY	VALUE	COMMENT
Design tensile force, Nt*	40.9kN	Obtained from STAAD PRO CONNECT design analysis
Design compression force, Nc*	12.4kN	
Design bending moment, M*	13.1kN	
Design shear force, V*	72.4kN	
Tension, ΦtNt	332kN	>Nt*= (∴Satisfied)
Compression, Nynet	406.8kN	>Nc* (∴Satisfied)
Nominal member capacity for local buckling, Ncl	337.9kN	Ncl ≤ Nynet ∴Compression members do not yield
Nominal section moment capacity, ΦMs	19.24kNm	>M* (∴Satisfied)
Moment causing initial yield, My	25.2kNm	
Elastic lateral-torsional buckling moment, Mo	739.2kNm	Mo > 2.78My ∴ Mbe=My
Nominal member capacity for lateral-torsional buckling, Mbe	25.2kNm	>M* (∴Satisfied)
Nominal member capacity for local buckling, Mbl	24.9kNm	>M* (∴Satisfied)
Nominal shear capacity of the web, ΦVv	118.35kN	>V* (∴Satisfied)
Combined bending and shear, $\left(\frac{M*}{\phi bMs}\right)^2+\left(\frac{V*}{\phi vVv}\right)^2$	0.84	≤1.0 ∴M* and V* are satisfied

SUMMARY OF DESIGN CAPACITY COLUMN

CAPACITY	VALUE	COMMENT
Design tensile force, Nt*	39.5kN	Obtained from STAAD PRO CONNECT design analysis
Design bending moment about z-axis, Mz*	4.152kNm	
Design shear force, V*	0.062kN	
Design bending moment, M*	1.67kNm	Calculation
Tension, ΦtNt	592kN	>Nt*= (∴Satisfied)
Nominal member moment capacity, ΦMb	25.2kNm	>M* (∴Satisfied)
Nominal section moment capacity, ΦMs	24.84kNm	>M* (∴Satisfied)
Nominal moment section capacity, ΦMz	20.8kNm	>Mz* (∴Satisfied)
Nominal shear capacity, ΦVw	94.5kN	$\frac{dp}{tw} \leq \frac{82}{\sqrt{\frac{fy}{250}}}$ ∴ ΦVv=ΦVu=ΦVw
Nominal shear capacity of the web, ΦVv	94.5kN	0.6ΦVv>V* (∴Satisfied) ∴ Shear and bending interaction ok.

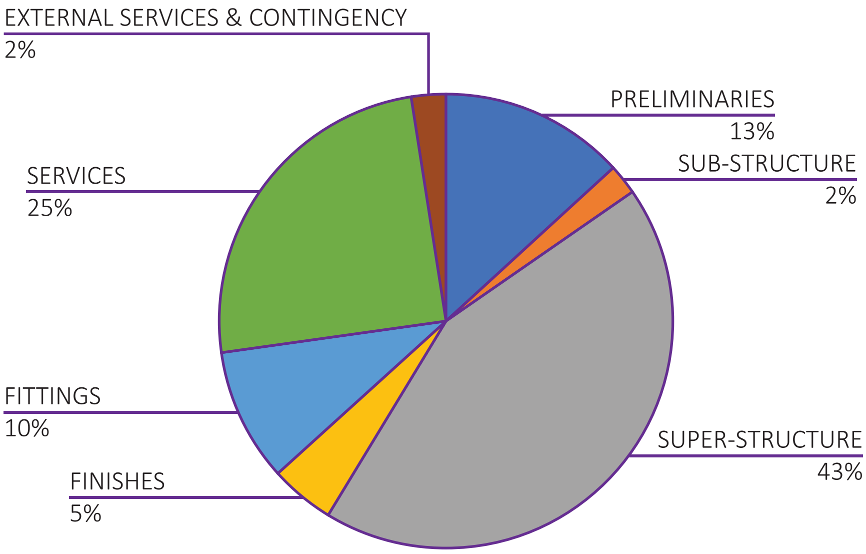
SUMMARY OF DESIGN CAPACITY FOR STAIRCASE

CAPACITY	VALUE	COMMENT
Design shear force, V*	0.241kN	Calculation
Design bending moment, M*	0.0075kNm	
Tension, ΦtNt	592kN	>Nt*= (∴Satisfied)
Nominal member moment capacity, ΦMb	18.7kNm	>M* (∴Satisfied)
Moment causing initial yield, My	27kNm	
Elastic lateral-torsional buckling moment, Mo	10267.2kNm	Mo > 2.78My ∴ Mbe=My
Nominal member capacity for lateral-torsional buckling, Mbe	27kNm	>M* (∴Satisfied)
Nominal section moment capacity, ΦMs	24.3kNm	>M* (∴Satisfied)
Nominal shear capacity of the web, ΦVv	23.5kN	>V* (∴Satisfied)

COST

Preliminary Estimated Cost

Total preliminary estimated cost = $2.879 million ± 30 % = $2.015 million- $3.743 million



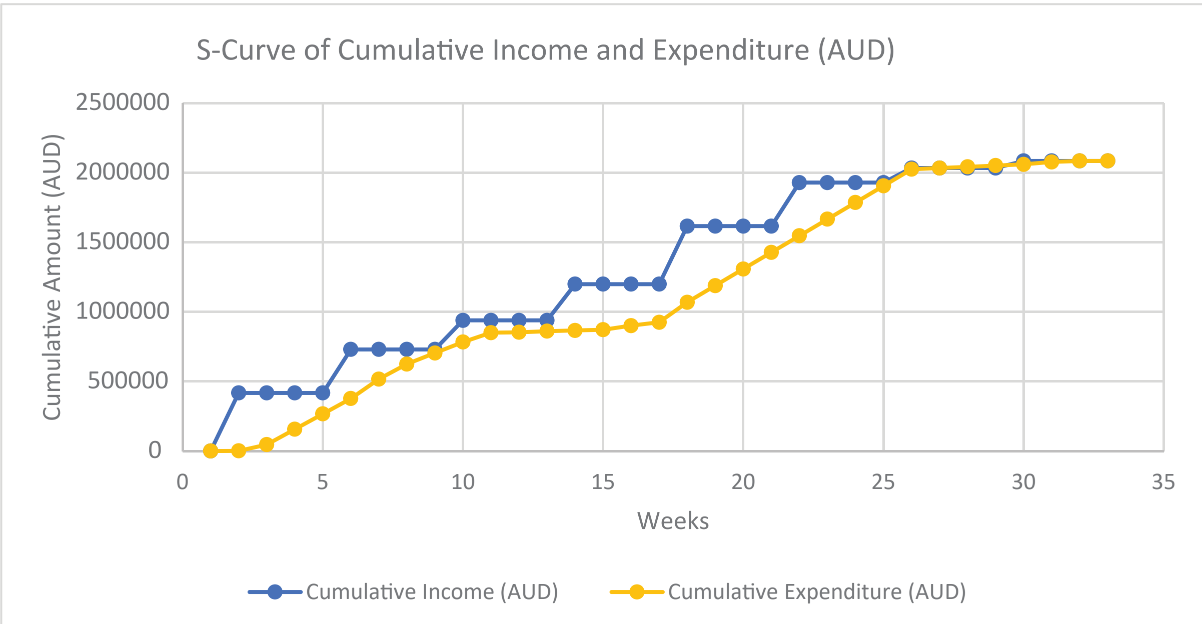
Final Estimated Cost

Total cost for this project is AUD 2,084,707.73 inclusive of 10% G.S.T. Calculations can be provided upon request. The unit rate for all the materials is taken from Rawlinson's Australian Construction Handbook 2022 and SPON'S Architects' and Builders' Price Book 2020. The rates taken from Rawlinson excludes the Goods and Services Tax (G.S.T) and includes the Builders' head office overheads and profit at the following rates:

- Preliminaries, Transportation Systems and Base Material Prices: 0.0%
- Electrical and Mechanical Services: 2.5%
- All other trades and services: 5.0%

The overall markup of this project is 10%, which contains the general overhead, profit and contingency. The overhead is included in the rate stated in Rawlinson's. A fixed profit of 5% and 5% of contingency for greenfield work are taken into account during the calculation of unit rate.

As labour rates differs based on the type of work, therefore, the latest salary rates for each occupation are taken from (Talent.com, 2022) and listed down in Appendix B.



Based on the plotted combined S-Curve graph, the curve for cumulative income is higher than the cumulative expenditure curve, showing that the overall income for this project is sufficient to cover the expenses. The financial costs for this project will not be an issue because all expenses are guaranteed.

TABULATION OF CUMULATIVE INCOME AND EXPENDITURE

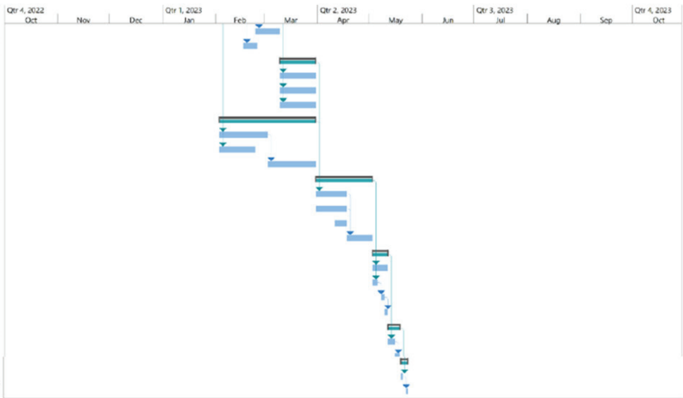
Week	Payment (AUD)	Cumulative Income (AUD)	Expenditure (AUD)	Cumulative Expenditure (AUD)	Net Balance (AUD)	Remarks
1	0	0	517.00	517.00	(517.00)	Interim Valuation 1
2	416,941.55	416,941.55	517.00	1,034.00	415,907.55	20% payment
3		416,941.55	44,425.39	45,459.39	371,482.16	
4		416,941.55	110,376.67	155,836.06	261,105.49	
5		416,941.55	110,376.67	266,212.73	150,728.82	Interim Valuation 2
6	312,706.16	729,647.71	110,376.67	376,589.40	353,058.31	15% payment
7		729,647.71	139,718.38	516,307.78	213,339.93	
8		729,647.71	108,349.47	624,657.25	104,990.46	
9		729,647.71	79,007.75	703,665.00	25,982.71	Interim Valuation 3
10	208,470.77	938,118.48	79,007.75	782,672.75	155,445.73	10% payment
11		938,118.48	67,234.94	849,907.69	88,210.79	
12		938,118.48	2,772.00	852,679.69	85,438.79	
13		938,118.48	7,982.27	860,661.96	77,456.52	Interim Valuation 4
14	260,588.47	1,198,706.94	5,210.28	865,872.24	332,834.70	12.5% payment
15		1,198,706.94	5,210.28	871,082.52	327,624.42	
16		1,198,706.94	29,410.27	900,492.79	298,214.15	
17		1,198,706.94	24,200.00	924,692.79	274,014.15	Interim Valuation 5
18	416,941.55	1,615,648.49	143,647.66	1,068,340.45	547,308.04	20% payment
19		1,615,648.49	119,447.66	1,187,788.11	427,860.38	
20		1,615,648.49	119,447.66	1,307,235.77	308,412.72	
21		1,615,648.49	119,447.66	1,426,683.43	188,965.06	Interim Valuation 6
22	312,706.16	1,928,354.65	119,447.66	1,546,131.09	382,223.56	15% payment
23		1,928,354.65	119,447.66	1,665,578.75	262,775.90	
24		1,928,354.65	119,447.66	1,785,026.41	143,328.24	
25		1,928,354.65	119,447.66	1,904,474.07	23,880.58	Interim Valuation 7
26	104,235.39	2,032,590.04	119,447.66	2,023,921.73	8,668.31	5% payment
27		2,032,590.04	8,857.20	2,032,778.93	(188.89)	
28		2,032,590.04	8,857.20	2,041,636.13	(9,046.09)	
29		2,032,590.04	8,857.20	2,050,493.33	(17,903.29)	Interim Valuation 8
30	52,117.69	2,084,707.73	8,857.20	2,059,350.53	25,357.20	2.5% payment
31		2,084,707.73	17,107.20	2,076,457.73	8,250.00	
32		2,084,707.73	8,250.00	2,084,707.73	-	
33		2,084,707.73	-	2,084,707.73	-	

PROJECT SCHEDULE

GANNT Chart

The project will commence on 3rd of October 2022 and is expected to be completed on 22nd May 2023. The estimated duration of the project is 159 days, excluding weekends and public holidays.

ID		Task Mode	Task Name	Duration	Start	Finish	Predecessors
0			**Yelverton Drive Modular Construction**	**159 days**	**Mon 3/10/22**	**Mon 22/5/23**	
1			**Site Investigation**	**5 days**	**Mon 3/10/22**	**Fri 7/10/22**	
2			Preliminary Investigation	2 days	Mon 3/10/22	Tue 4/10/22	
3			Detailed Site Investigation	2 days	Wed 5/10/22	Thu 6/10/22	2
4			Supplementary investigation and construction control	1 day	Fri 7/10/22	Fri 7/10/22	3
5			**Site Clearance**	**7 days**	**Mon 10/10/22**	**Tue 18/10/22**	
6			Clearance of Vegetation	3 days	Mon 10/10/22	Wed 12/10/22	4
7			Disposal of unwanted soil	2 days	Thu 13/10/22	Fri 14/10/22	6
8			Disposal of waste materials and rubbish	2 days	Mon 17/10/22	Tue 18/10/22	7
9			**Construction of footing on site**	**20 days**	**Wed 19/10/22**	**Tue 15/11/22**	
10			Installation of reinforcement steel	10 days	Wed 19/10/22	Tue 1/11/22	5
11			Site inspection	2 days	Wed 2/11/22	Thu 3/11/22	10
12			Concreting	6 days	Fri 4/11/22	Fri 11/11/22	11
13			Remove formwork and curing	2 days	Mon 14/11/22	Tue 15/11/22	12
14			**Construction of triangular shape**	**7 days**	**Wed 16/11/22**	**Thu 24/11/22**	
15			Installation of reinforcement steel	3 days	Wed 16/11/22	Fri 18/11/22	9
16			Site inspection	1 day	Fri 18/11/22	Fri 18/11/22	
17			Concreting	3 days	Mon 21/11/22	Wed 23/11/22	16
18			Remove formwork and curing	1 day	Thu 24/11/22	Thu 24/11/22	17
19			**Preparation of prefab materials**	**10 days**	**Mon 10/10/22**	**Fri 21/10/22**	
20			Cold-formed steel	6 days	Mon 10/10/22	Mon 17/10/22	1
21			Connections	4 days	Tue 18/10/22	Fri 21/10/22	20
22			**Construction of modules in the factory**	**40 days**	**Mon 24/10/22**	**Fri 16/12/22**	
23			Install roof truss	20 days	Mon 24/10/22	Fri 18/11/22	19
24			Install External Wall frame	20 days	Mon 24/10/22	Fri 18/11/22	19
25			Install Internal Wall Frame	10 days	Mon 24/10/22	Fri 4/11/22	19
26			Install Floor joist and bearer	15 days	Mon 24/10/22	Fri 11/11/22	19
27			Assemble into section	15 days	Mon 21/11/22	Fri 9/12/22	26,23,24,25
28			Install lifting connection	3 days	Mon 12/12/22	Wed 14/12/22	27
29			Inspection	2 days	Thu 15/12/22	Fri 16/12/22	28
30			**Delivery**	**6 days**	**Mon 19/12/22**	**Tue 27/12/22**	
31			Delivery by 2 sections each trip	6 days	Mon 19/12/22	Tue 27/12/22	22
32			**Installation of modules on site**	**14 days**	**Wed 28/12/22**	**Wed 18/1/23**	
33			Installation of modules in front row	6 days	Wed 28/12/22	Thu 5/1/23	14,30
34			Installation of modules in back row	6 days	Mon 9/1/23	Mon 16/1/23	33
35			Uninstall lifting connections	12 days	Wed 28/12/22	Mon 16/1/23	
36			Inspection	2 days	Tue 17/1/23	Wed 18/1/23	33,34,35
37			**M&E Installation**	**10 days**	**Thu 19/1/23**	**Thu 2/2/23**	
38			Electrical System	6 days	Thu 19/1/23	Fri 27/1/23	32
39			Air Condition System	4 days	Mon 30/1/23	Thu 2/2/23	38
40			Water Reticulation System	5 days	Thu 19/1/23	Wed 25/1/23	32
41			**Installation of cladding, openings and solar panel**	**25 days**	**Fri 3/2/23**	**Thu 9/3/23**	
42			Roof cladding	10 days	Fri 3/2/23	Thu 16/2/23	37
43			Floor cladding	15 days	Fri 3/2/23	Thu 23/2/23	37
44			Wall cladding	15 days	Fri 3/2/23	Thu 23/2/23	37
45			Doors	10 days	Fri 24/2/23	Thu 9/3/23	44
46			Windows	10 days	Fri 24/2/23	Thu 9/3/23	44
47			Solar Panel	6 days	Fri 17/2/23	Fri 24/2/23	42
48			**Interior Design**	**15 days**	**Fri 10/3/23**	**Thu 30/3/23**	
49			Room	15 days	Fri 10/3/23	Thu 30/3/23	41
50			Toilet	15 days	Fri 10/3/23	Thu 30/3/23	41
51			Kitchen	15 days	Fri 10/3/23	Thu 30/3/23	41
52			**Construction of Exterior Superstructure**	**40 days**	**Fri 3/2/23**	**Thu 30/3/23**	
53			Exterior suspended slab	20 days	Fri 3/2/23	Thu 2/3/23	37
54			Lift core wall	15 days	Fri 3/2/23	Thu 23/2/23	37
55			Concrete stairs	20 days	Fri 3/3/23	Thu 30/3/23	53
56			**Construction of External Works**	**20 days**	**Fri 31/3/23**	**Tue 2/5/23**	
57			Sewerage system	10 days	Fri 31/3/23	Mon 17/4/23	48,52
58			Drainage	10 days	Fri 31/3/23	Mon 17/4/23	
59			Water Reticulation system	5 days	Tue 11/4/23	Mon 17/4/23	
60			Landscaping	10 days	Tue 18/4/23	Tue 2/5/23	57,58
61			**Site Clean Up**	**7 days**	**Wed 3/5/23**	**Thu 11/5/23**	
62			Housekeeping	7 days	Wed 3/5/23	Thu 11/5/23	56
63			Remove temporary structures	3 days	Wed 3/5/23	Fri 5/5/23	56
64			Remove Equipment and Machineries	2 days	Mon 8/5/23	Tue 9/5/23	63
65			Waste Management	2 days	Wed 10/5/23	Thu 11/5/23	64
66			**Final Acceptance**	**5 days**	**Fri 12/5/23**	**Thu 18/5/23**	
67			Perform testing and commisionning of M&E Services	2 days	Fri 12/5/23	Mon 15/5/23	61
68			Perform final walk-through inspection	3 days	Tue 16/5/23	Thu 18/5/23	67
69			**Completion and Handover**	**2 days**	**Fri 19/5/23**	**Mon 22/5/23**	
70			Completion	1 day	Fri 19/5/23	Fri 19/5/23	66
71			Handover to client	1 day	Mon 22/5/23	Mon 22/5/23	70



BCA COMPLIANCE
SECTION A: GOVERNING EQUIREMENTS
PART A6: Building Classification

A6.1 Class 1 Buildings
A Class 1 building includes one or more of the following sub-classifications:
(1) Class 1a is one or more buildings, which together form a single dwelling including the following:
a. A detached house.
b. One of a group of two or more attached dwellings, each being a building, separated by a fire-resisting wall, including a row house, terrace house, town house or villa unit.
(2) Class 1b is one or more buildings which together constitute—
a. a boarding house, guest house, hostel or the like that—
i. a boarding house, guest house, hostel or the like that—
ii. have a total area of all floors not more than 300 m2 (measured over the enclosing walls of the building or buildings); or
b. four or more single dwellings located on one allotment and used for short-term holiday accommodation.

A6.2 Class 2 Buildings
(1) A Class 2 building is a building containing two or more sole-occupancy units.
(2) Each sole-occupancy unit in a Class 2 building must be a separate dwelling.

A6.6 Class 6 Buildings
A Class 6 building is a shop or other building used for the sale of goods by retail or the supply of services direct to the public, including—
(1) an eating room, café, restaurant, milk or soft-drink bar; or
(2) a dining room, bar area that is not an assembly building, shop or kiosk part of a hotel or motel; or
(3) a hairdresser's or barber's shop, public laundry, or undertaker's establishment; or
(4) market or sale room, showroom, or service station.

Definition of 'sole occupancy unit':
Sole-occupancy unit means a room or other part of a building for occupation by one or joint owner, lessee, tenant, or other occupier to the exclusion of any other owner, lessee, tenant, or other occupier and includes—
a. a dwelling; or
b. a room or suite of rooms in a Class 3 building which includes sleeping facilities; or
c. a room or suite of associated rooms in a Class 5, 6, 7, 8 or 9 building; or
d. a room or suite of associated rooms in a Class 9c building, which includes sleeping facilities and any area for the exclusive use of a resident.

SECTION B: STRUCTURE
Perhaps the most important foundation to any architectural project is structure. A building needs to be designed to remain stable and not damaged, sustaining its integrity through contextual actions such as climate conditions of wind and storm, human occupancy and use as well as ground conditions of soil types and porosity. This section ensures that buildings and structures do not cause harm or damage to people or property.

As the project is deemed to sit at a prime location in the Midland Area, our vision for the project is the capacity to be either removed or expanded and influences the structural design of the project.
The footing system used within the project is pad footing of considerable size to accommodate the water table and expansion abilities of the project.

The structure has been designed to withstand all permanent actions (dead loads), imposed actions (occupancy and use), and wind action for A1 regions like Midland, Perth. Refer to engineer's report for full calculations. The structure takes advantage of cold formed steel, keeping the strength and lightweight features of steel while having a considerably smaller carbon footprint.

15mm fire resistant plasterboards line the walls and ceilings of the project, while the floor is lined with 18mm magnesium oxide boards, ensuring these areas have a 90-minute fire rating, keeping any fire from raging and consuming the project and nearby properties.

SECTION C: FIRE RESISTANCE : this is an important section of the BCA. Please go through each section and comment on it and add sections that are relevant
CP2 Spread of fire
We have done the best in our power to mitigate the spread of fire within and between units by lining all walls, ceilings, and floors with fire resistant materials. Emergency equipment shall be provided in key locations for easy access and be replenished appropriately.

CP4 Safe Conditions for evacuations
All units in the project have a quick and direct link to the ingress and egress of the building to assist in the swift evacuation of inhabitants.

CP9 Fire Brigade Access
Access is provided to and around the building on all sides except the east in the event that a new structure is built on the empty lots to the east.

C1.1 Type of Construction Required
Based on the table provided in C1.1, we have stipulated that the type of construction required is A.
Rise in Storeys: 4
Class of Building: 1, 2, 6
Type of Construction: A

C1.2 Calculation in the Rise of Storeys:
The NCC defines in C1.2a the rise in storeys as the greatest number of storeys at any part of the external walls of the building and any storeys within the roof space. An additional clause is found in C1.2d(i) where a mezzanine is regarded as a storey in that part of the building in which it is situated if its floor area is more than 200m2 or more than 1/3 the floor area of the room, whichever is lesser.

In this project, we calculated the rise in storeys based on the lived areas of the building, which includes the mezzanine (since it leads to dwellings and is larger than 200m2), as well as the typical dwellings above the commons and café area.

C1.3 Buildings of Multiple classification
In buildings with multiple classifications, the highest construction type is required as stipulated in C1.3a. Since this building is a combination of 1, 2 and 6, the correct construction type is A, eventhough at one storey, a class 6 building would only require a C, but in conjunction with all other storeys, it must be A.

C1.4 Mixed Types of Construction
A building may be of mixed types of construction where it is separated in accordance with C2.7 Separation by firewalls and the type of construction is determined in accordance with C1.1 or C1.3. However, we have deemed it necessary for this project to use construction type A even if it may carry a larger construction cost to reduce any confusion and ensure the safety of inhabitants.

C1.5 Two Storey Class 2,3 or 9c buildings
C1.5 stipulates that a building having a rise in storeys of two may be type C construction if C1.5a and C1.5b are complied with. This does not affect this project due to the number of rises in storeys.

C1.6 Class 4 parts of building
There are no dwellings within the class 6 portion of the building, as such, this does not affect this project in any way.

C1.7 Open Spectator Stands and Indoor Sports Stadium
Not applicable for this project due to building use.

C1.8 Lightweight Construction
Lightweight construction means construction which incorporates or comprises—
a. sheet or board material, plaster, render, sprayed application, or other material similarly susceptible to damage by impact, pressure or abrasion; or
b. concrete and concrete products containing pumice, perlite, vermiculite, or other soft material similarly susceptible to damage by impact, pressure or abrasion; or
c. masonry having a width of less than 70 mm.

A vast majority of this project consists of elements that fit within the definition of lightweight construction due to it modular and movable nature. The plaster boards and magnesium oxide boards used within this project have an FRL and comply with Specification C1.8.

C1.9 Non-Combustible Building Elements
The façade covering, framing and insulation that are incorporated into external and common walls are non-combustible. Refer to the wall details for further information.

C2.6 Vertical Separation of Openings in external walls
Windows between storeys are separated by a spandrel at 1100mm in height, in accordance with the 900mm as stipulated and is part of a panel wall that has a FRL of not less than 60/60/60, with any gaps packed with non-combustible material.

C2.7 Separation by fire walls
All fire walls have been designed to be constructed in accordance with specification C1.1 and is deemed to satisfy provisions of sections C, D and E.

C2.10 Separation of lift shafts
The lift shaft is separated from the rest of the building by enclosure of the shaft with walls that have the relevant FRL prescribed by Specification C1.1 as the project is deemed to be of Type A construction and connects three storeys of the building.

C3.11 Bounding Construction: Class 2 and 3 buildings and Class 4 parts
All entrance doorways into dwellings are fire protected doors, ensuring that access to the public corridors and the required exit remain safe for use.

SECTION D: ACCESS AND EGRESS :
D1 : Provision for escape
D1.2 Number of Exits required
The project is not under requirements for more than one exit due to:
- All dwellings either open up to the public lobby or are directly connected to an exit that opens up to an open space
- The building does not have an effective height of 25m

D1.3 When Fire Isolated stairways and ramps are required
The required exit does not need to be fire isolated as it does not serve more than 3 consecutive storeys of Class 2 buildings according to D1.3a(i).

D1.4 Exit travel distances
Unfortunately, the project does not fully comply with D1.4a(i)(a) in which the entrance doorway from any sole occupancy unit must be not more than 6m from an exit, where currently two units exceed this number and sits at 9m. Future iterations of the design need to accommodate this by either adding a new exit or by moving the units over to a different location.

D1.6 Dimensions of exits and paths of travel to exits
All paths have an unobstructed height no less than 2m and have a minimum width of 1m.

D1.9 Travel by non-fire-isolated stairways or ramps
The distance between the furthest doorway of a room and the point of egress to a road does not exceed 60m in accordance with D1.9b(ii).

D1.10 Discharge from exits
The required exit that leads to an open space has a width of 1m.

D2 : Construction of Exits
D2.3 Non-fire-isolated stairways and ramps
Main supporting element of the stairs is constructed out of reinforced concrete while the steps uses C25019 cold form steel that needs to be checked against the standard of steel in no less than 6mm thick.

D2.13 Goings and Risers

Within the project, the stairway with the highest numbers of risers is 14, below the maximum of 18 between landings. The going depth is 250mm and riser height of 150mm, which matches the minimum of 550mm with the equation of 2R+G. The surface of the stairway is to be specified by the engineers to have a slip resistance in accordance with table D2.14 when tested in accordance with AS 4586.
There is no gap between the threads, passing the test for 125mm sphere.

D2.16 Barriers to prevent falls

Barriers have been provided at all fall hazards

D2.17 Handrails

Handrails have been provided along at least one side of each flight at a fixed height of 900mm in accordance with the minimum 865mm.

D2.20 Swinging Doors

No doors encroach on the required width of any landings, stairways, ramps or passageways and does not impede the path or direction of egress.

D3 : Access for people with a disability

D3.1 General building access requirements

Two units have been designed to accommodate access for people with disability, providing living quarters and facilities for hygiene at the entry level in accordance with table D3.1 and is served by accessible compliant lift.

D3.3 Parts of buildings to be accessible

Access is provided to all common and public areas of the project and an accessible compliant lift allows access to other areas.

D3.6 Signage

Braille and tactile signage to identify each sanitary facility, exit and level.

SECTION F: HEALTH AND AMENITY

Room heights can ultimately define the way a room is used. Typically, the higher the ceiling height goes, the lighter a room feels. Various codes define ceiling heights for various types of rooms. In the BCA, F3.1a defines the ceiling height of habitable room as 2.4m, however, in the R-codes, it is defined in section 4.3 of volume 2 as 2.7m.

As architects, it is important to focus on ceiling heights as it could very well affect the well-being of a building's occupants. Ultimately, as architects, everything we design should have a purpose, to manipulate or encourage better and healthier living for the betterment of others. In this project, there are bedrooms that are not entirely up to the NCC but it is to the R codes.

For example, the bedrooms have a raked ceiling that starts at 1656mm and ends at 2638mm. It does not reach the BCA's standard in F3.1a(iv)A of not less than 2200mm for at least two thirds of the floor area. There is a dichotomy there, lower ceiling heights mean that there is less air, easier to warm up, but its easier to start having air toxicity. Therefore, the design provides quite a large portion of windows to allow for proper ventilation, which leads us to our next point, ventilation.

Ventilation holds the key to good health. In our research, pleasant scents encourage healthier habits, better focus, and relaxation. The introduction of south facing living rooms were meant to encourage occupants to open their windows and let natural scents enter the apartments from the nearby Hebe and Coal Dam Parks. Good ventilation also allows occupants to expel contaminated air, reducing the harmful effects these contaminants may carry as outlined in FP4.5. However, it can be difficult to dispose of contaminated air if occupants require warmth in the colder months.

F4.1a states that all habitable rooms must be provided with natural light. Daylight is important as a source of light and warmth. Daylight also helps regulate sleep cycle which have come under assault in recent years with better artificial lighting solutions and the increase reliance on electronic tools. As architects, it is imperative that daylight be provided, encouraging hobbies and entertainment not reliant on artificial lighting like reading or painting.

SECTION J: ENERGY EFFICIENCY

In a time where society is becoming more aware of the effects of pollution on climate change, we must do what we can to rely on renewable energy and more natural ways to function. We need to be more efficient on how we heat and cool our buildings, reducing any impact we could have on the environment. The NCC stipulates in J1.5 and J1.6 that all walls, floors, and glazing must adhere to a minimum standard or thermal resistance and must be verified by a specialist. Personally, it seems like the minimum requirements are quite low for Zone 5, where Perth is situated.

With the climate crisis looming over our shoulders, as architects we need to help the world build better. The concept of Passivhaus has been around for some time and advocates for buildings to become more climate conscious by using better materials and reducing the need for heating and cooling to begin with.