building 4.0 crc

PROJECT #66: FUTURE OF CONSTRUCTION EDUCATION

ATTACHMENT 3: BUILDING 2050



MONASH University

MONASH ART DESIGN & ARCHITECTURE

Australian Government
Department of Industry, Science and Resources

Cooperative Research Centres Program

Project Name

TITLE:	BUILDING 2050: INDEX OF ADVANCED ARCHITECTURE RESEARCH AND PROJECTS Designing The Workforce And Workplace Of Future Construction
Conducted:	Semester 1, 2024
Instructors:	Chris Knapp, Jean-Paul Rollo
Edited, curated and collated by:	Jean-Paul Rollo, Chris Knapp and Blair Albrecht

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Introduction to Studio

Monash University M.A.D.A.
Advanced Architecture Project: 'BUILDING' 2050, Semester 1 2024
Instructors: Chris Knapp, PhD, and Jean-Paul Rollo, PhD

Studio Overview:

The 'Building' 2050 studio aimed to address the critical challenges faced by the building industry today, notably its significant contribution to climate change, as it accounts for approximately 39% of global carbon emissions. The construction sector is also grappling with various issues, including a shortage of skilled labour, rising housing costs, and corporate instability. These challenges have led to a crisis in the industry, emphasising the urgent need for transformative solutions. In collaboration with Building 4.0 CRC, it seeks to enact change through research initiatives designed to create a more digitalised, industrialised, and sustainable building environment. The studio conducted various speculative studies focusing on the state of Melbournes Fishermans Bend in the year 2050, during which carbon levels are projected to reach 685 ppm, and the city's population may soar to 8 million. Students will be tasked with designing a new building model called Constructions Through Advanced Manufacturing Precincts (C.A.M.P.) and developing the associated social, technical, and economic infrastructure necessary to support this vision. Additionally, the studio explored how housing production methods might evolve over the next 26 years and how this will, therefore, need to include a comprehensive investigation into the future construction workforce.

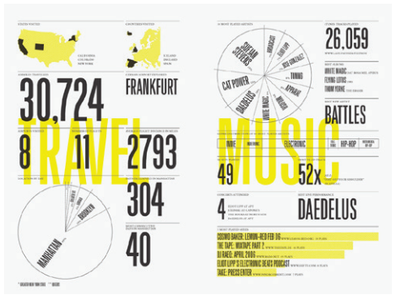
Studio Approach:

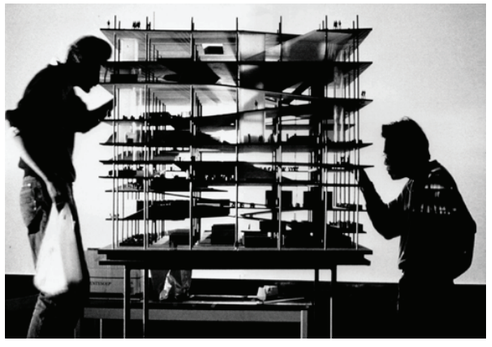
The 'Building' 2050 studio was linked to the activities and approach of Building 4.0 CRC, aiming to expedite the construction industry's transformation into a more sustainable and, technologically advanced and efficient domain. The 'four-point zero' concept aligns with the broader Industry 4.0 movement within the studio, highlighting the transformative impact of digital technologies on production processes and industry culture. Among the various research, this studio specifically ties to Project #66: Future of Construction Education. This initiative includes collaboration with Holmesglen Institute, alongside other academic institutions and industry stakeholders such as Lendlease and the Victorian Building Authority. The goal is to prototype the workforce and workplace of the future, leading to the development of a Bachelor of Future Construction program aimed at enrolling students by 2025.

Studio Focus:

The studio invited the students to immerse themselves in a conceptual future state of the building industry, stimulating discussions around the evolution of architectural practice. The dual focus of the studio included not only the creation of a spatial proposal for a manufacturing complex but also the examination and representation of the future construction workforce. This approach of prefabrication, which has been a topic of architectural interest for nearly a century but has seen limited adoption, is being revitalised as a potential solution to contemporary challenges, such as housing shortages and escalating costs. The studio will develop proposals for C.A.M.P, envisioned as essential infrastructure and community resources equipped with flexible programming options. An integral aspect of this initiative is understanding the future workforce, where approximately 300,000 construction jobs exist in Victoria today, but demand is expected to exceed supply. The current workforce is notably imbalanced, with only 11% female participation compared to 47% in other sectors. Furthermore, the rise of digital technologies necessitated a reevaluation of the skills and profiles needed in the construction field. Students will speculate on how emerging technologies might transform roles, challenge existing hierarchies, and create entirely new professional pathways within the industry.

Spread from The Feltron Annual Report, 2011
NIcholas Felton





Jussieu Library Model, OMA

Student List:

Blair Albrecht

Sara Amin

Saida Bakhsh

Marlow Brown

Jarrad Frahamer

Saraf Golpo

Chin Chang Hung

Rehila Hydari

Cho Woo Jin

James Kouskouras

Robin Deepthi Mahanthi

Meka Rakhmat

Claudia Sekulovski

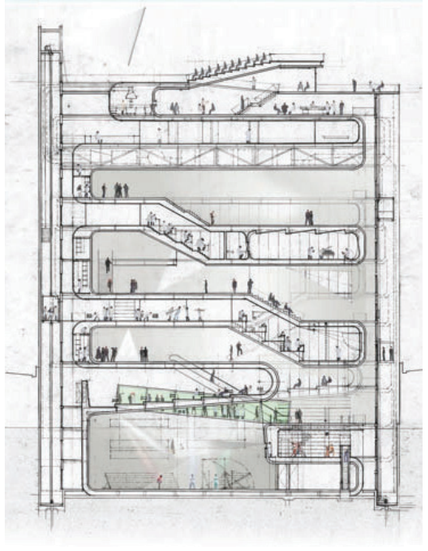
Makara So

Somana Sok

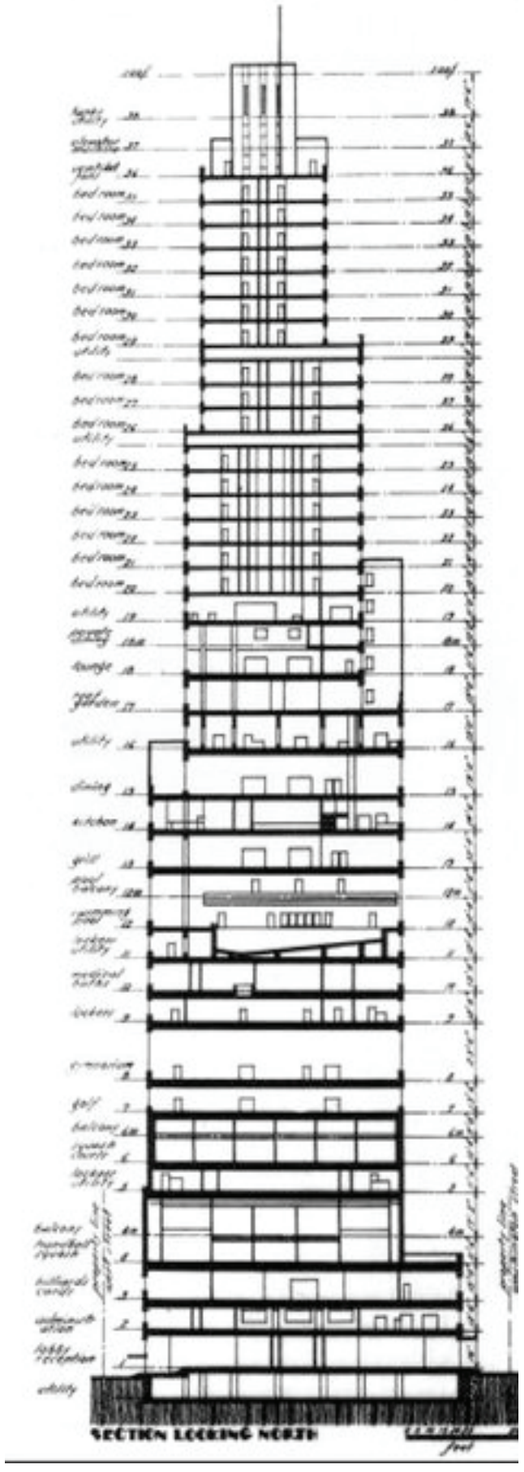
Trent van Elwoud

Su Wutt Yee

Tong Zhao



Eyebeam Atelier
Diller Scofidio + Renfro, 1999
New York

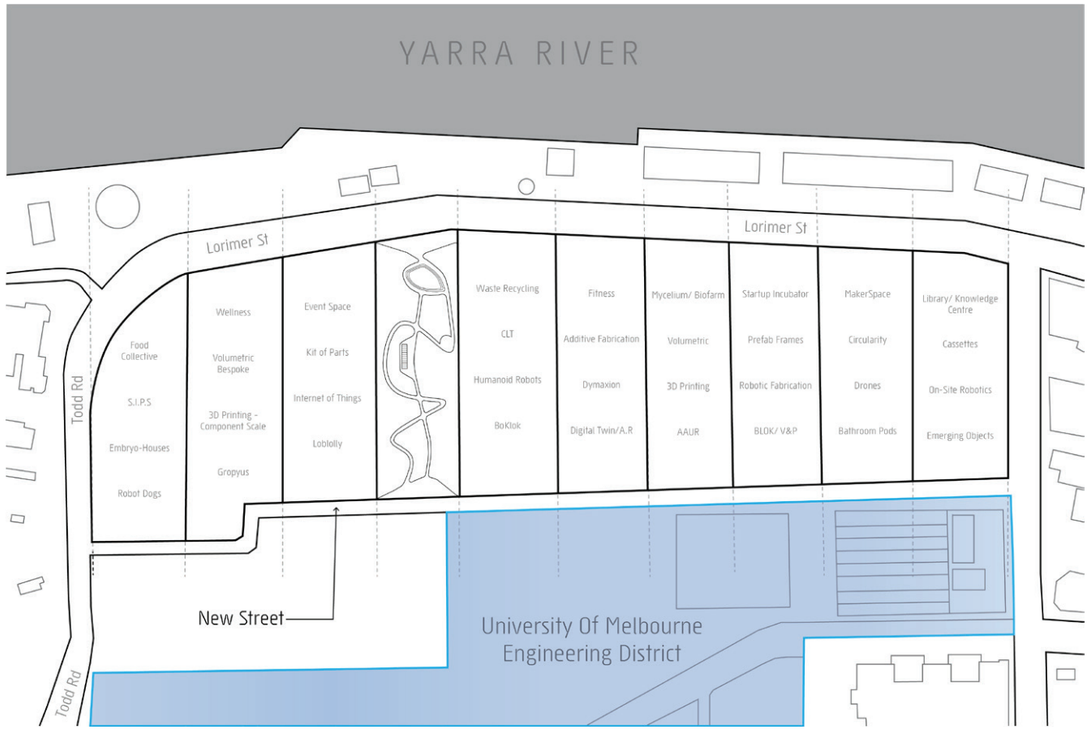


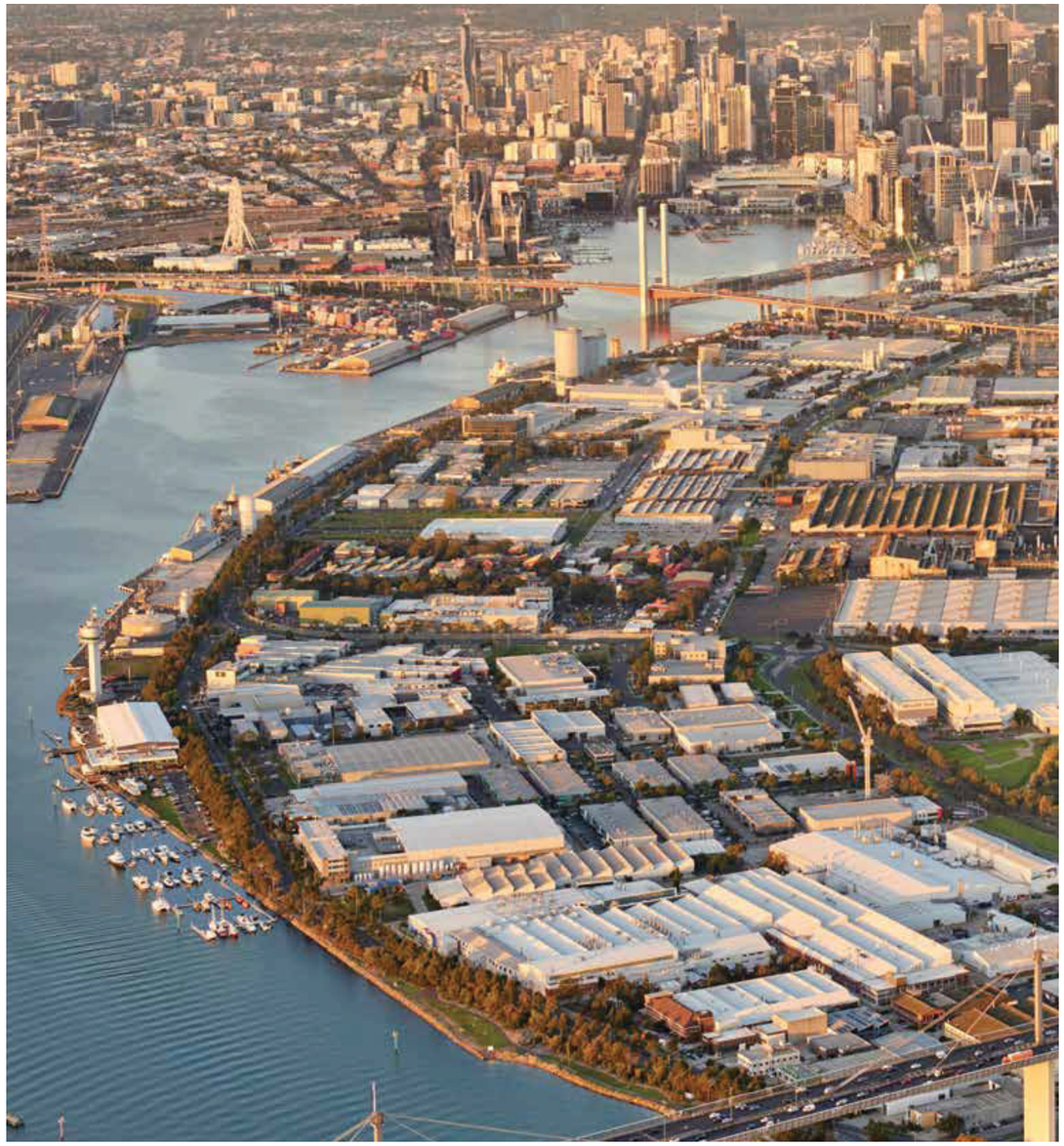
Downtown Athletic Club
Starret and Van Vleck, 1930
New York

Precinct Site Context
Fishermans Bend, Melbourne

Fisherman's Bend is a state significant development site on the south of the Yarra opposite the Docklands precinct and to the west of South Melbourne. This 480 hectare precinct has been envisioned for urban renewal, modernising what is currently a mix of brownfield and heavy industrial uses into a transformed district which balances innovative business, education and residential functions. It is anticipated 80,000 people will reside at Fisherman's Bend by 2050.

The site investigated by the studio is an approximately 35 hectare zone bounded by Lorimer Street, Caprice Avenue, and Salmon Street. The site has an existing mix of defence, former heavy manufacturing, logistics, data centres, and medium scale business. As per the focus of "Building" 2050, students were are asked to consider what the site will someday become. What will this territory, and larger precinct, be in terms of demographics, population density or architectural character? Will it be liveable, walkable, or entirely without cars, for example? Will any of today's buildings still exist in 26 years?





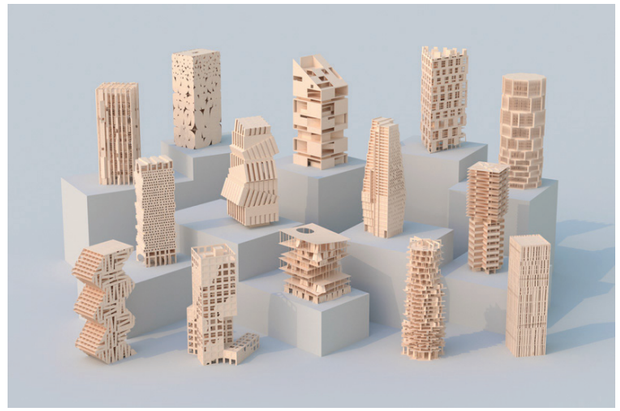
Design Scenario
Fishermans Bend Student Proposals

"The best way to predict the future is to design it"
- Buckminster Fuller

In the year 2050, the population of Melbourne has expanded from ~5 million inhabitants in 2024 to over 8 million. A growth boundary was placed around the city limits in 2030, leading to intense densification of the city and suburbs over the past 26 years. Housing in 2050 is now smaller and more efficiently built, with the average dwelling size at 120m2 (down from nearly 300m2 in previous decades). Yet, the 'housing crisis' that was articulated by politicians and news outlets has only continued to become more acute, with material scarcity, cost of living, available housing supply, and land availability all placing significant pressure on society. This is coupled with a global average temperature increase of 1.9C in the past two decades and atmospheric CO2 exceeding 650ppm, up from 420ppm just 26 years ago. Extreme weather events are the norm, and average daily high temperatures in Melbourne approach 50C from August to May annually. Sea levels have increased by 1m due to the disappearance of the northern ice cap and the collapse of significant Antarctic ice shelves. To mitigate this, the Victorian government implemented a sea wall and lock system to protect the city and Port of Melbourne from flooding and inundation.

The Victorian Govenment, building upon the transformation of Fishermans Bend in the years between 2020 and 2030 into an innovation, education, and special economic zone, and coupled with the maturation of the Victorian Digital Build program circa 2020, have dedicated a substantial funding package to develop a new CAMP (Construction through Advanced Manufacturing Precinct) at Fishermans Bend, following the successful implementation of a CAMP pilot in regional Victoria. This new CAMP at Fisherman's Bend will relieve housing supply pressure in the inner city suburbs and also provide a new education campus for the evolving construction workforce.

A consortium of 9 construction innovators have secured the joint bid to deliver a new housing production scheme, which incorporates a range of technological advances built upon generative computing, advanced robotics and autonomous machines, net zero energy and carbon positive material systems. The housing will be created with a range of complementary approaches, founded on the principles of circular construction and platform design for manufacturing, assembly, and disassembly.



Models from "Blank: Speculations on CLT"
Jennifer Banner, 2021



Splitting
Gordon Matta-Clark
New Jersey 1974



Burst House
systemarchitects
Mid-North Coast AU 2005

Student Semester Outcomes:

01 Final Proposals:

1.1 Workplaces of Future Construction

Students in pairs final studio design proposals of The Constructions Through Advanced Manufacturing Precincts (C.A.M.P) at Fishermans Bend. Representations of the culmination of research and development occurring through the semester.

Smart Sip Hub.
Proposal #1

Saraf Golpo and Rehila Hydari

Introducing Our Vision for 2050: SMARTSIP HUB

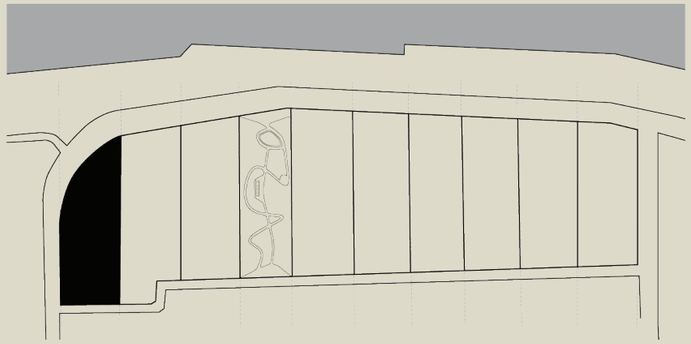
Looking ahead to 2050, we envision a transformative future with Project SIPSmart Hub, specialising in producing biologically STRUCTURAL INSULATED PANELS (SIPS) for agricultural applications, like barns, sheds, storage facilities, and educational centres.

Advanced robotics, including the Boston Dynamic's Spot, will revolutionise our operations. They will streamline production, ensure precision, and take over roles traditionally held by human workers, enhancing efficiency and innovation.

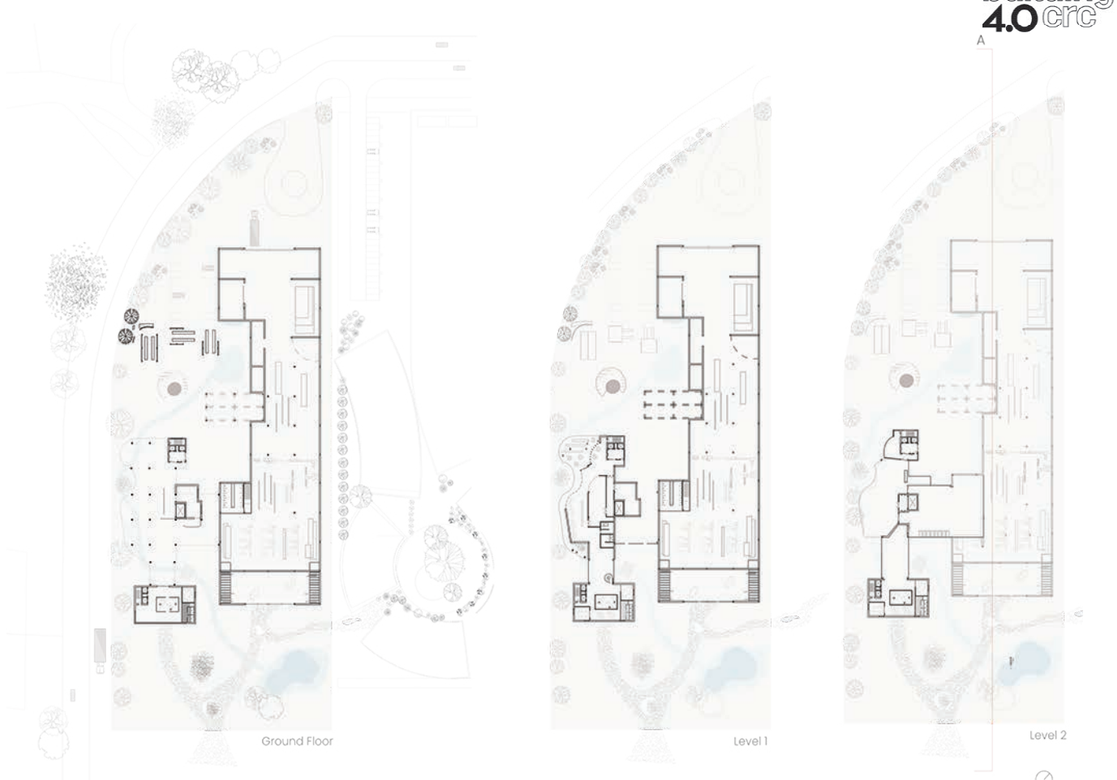
The core of Project SIPSmart Hub includes administrative offices, an assembly line, and storage facilities. The Wild Card Program: Food Collective and Urban Farming Facility is critical to our project, which integrates advanced robotics into SIP manufacturing and fosters collaboration between human and robotic elements.

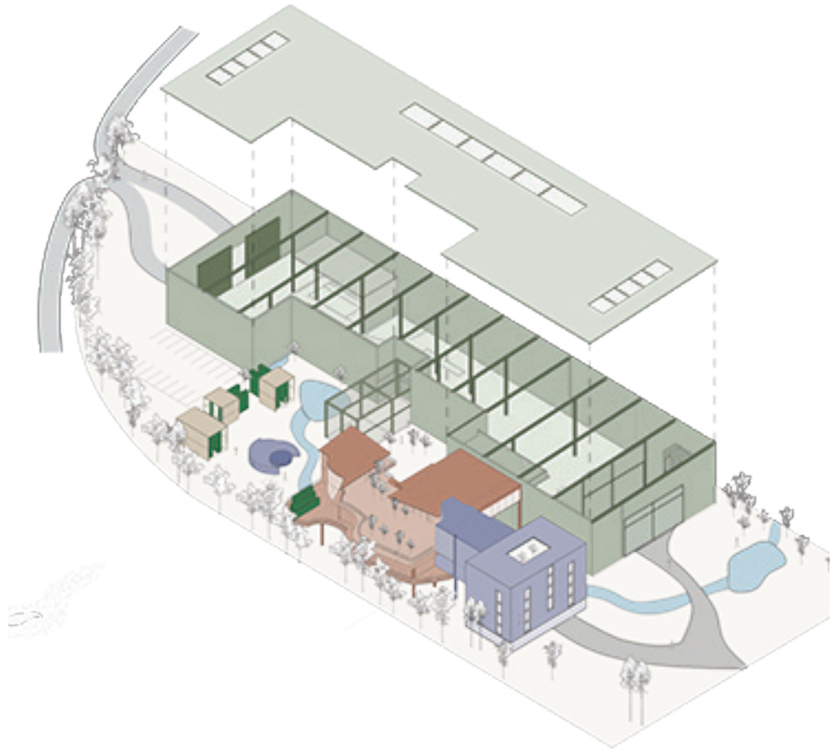
Inspired by Greg Lynn's Embryological House, our hub's design merges organic and digital elements for enhanced functionality and beauty. Featuring a canteen and food collective space, it fosters community among employees and supports innovative food programs, including urban farming initiatives.

A small river system on-site enhances the atmosphere and supports sustainable water collection for farming and landscaping. The office hosts SIP manufacturing and food collective management, with urban farm spaces promoting knowledge exchange and client collaboration.



Key Plan Transect Location Diagram







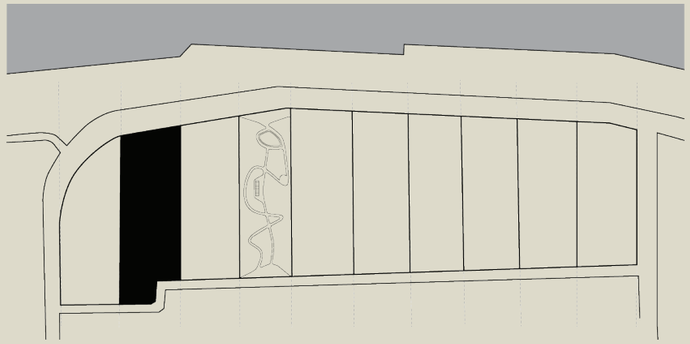
PLAN VIEW
SCALE 1:50 on A0



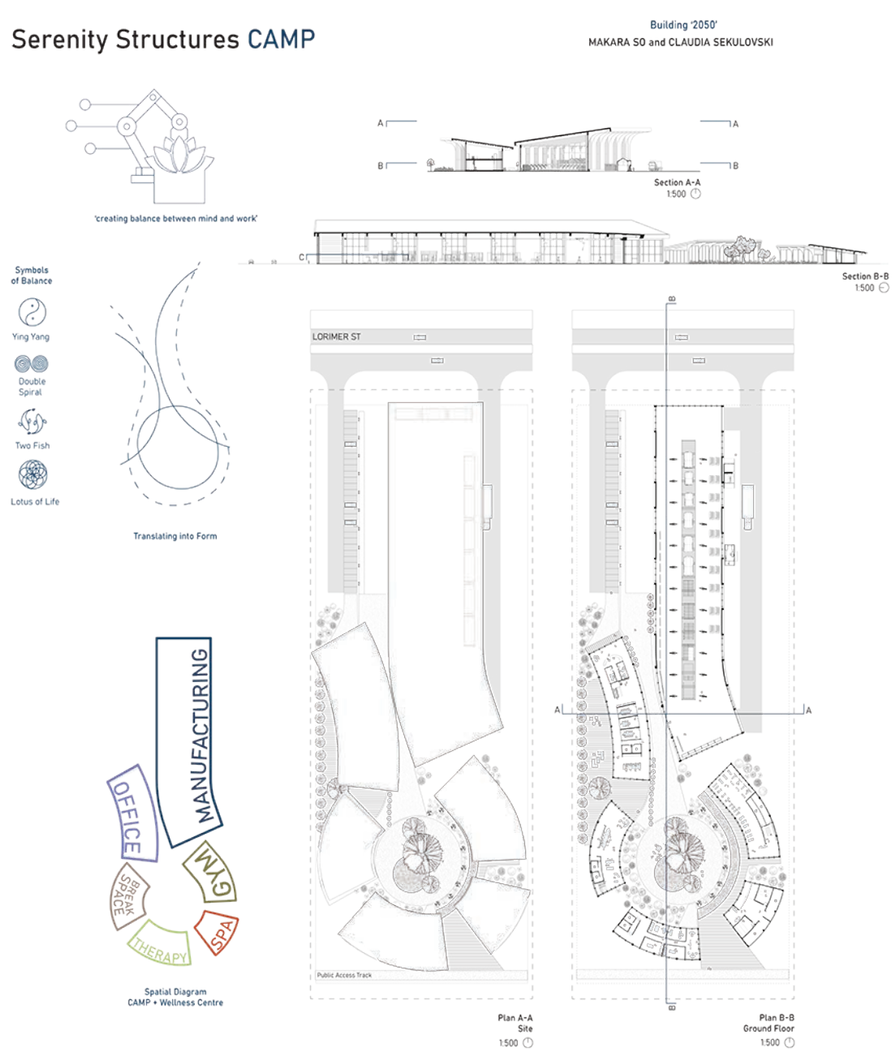
Serenity Structures
Proposal #2

Claudia Sekulovski and Makara So

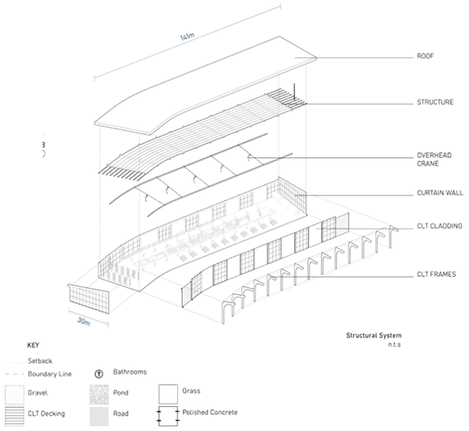
The project involves the design and building of an advanced factory complex that includes a wellness facility. This complex aims to completely transform industrial production and improve the well-being of employees by the year 2050. The facility specialises in volumetric customised manufacturing, utilising advanced technologies for tailored production processes. Furthermore, it includes a comprehensive wellness centre aimed at fostering the physical and mental well-being of employees.

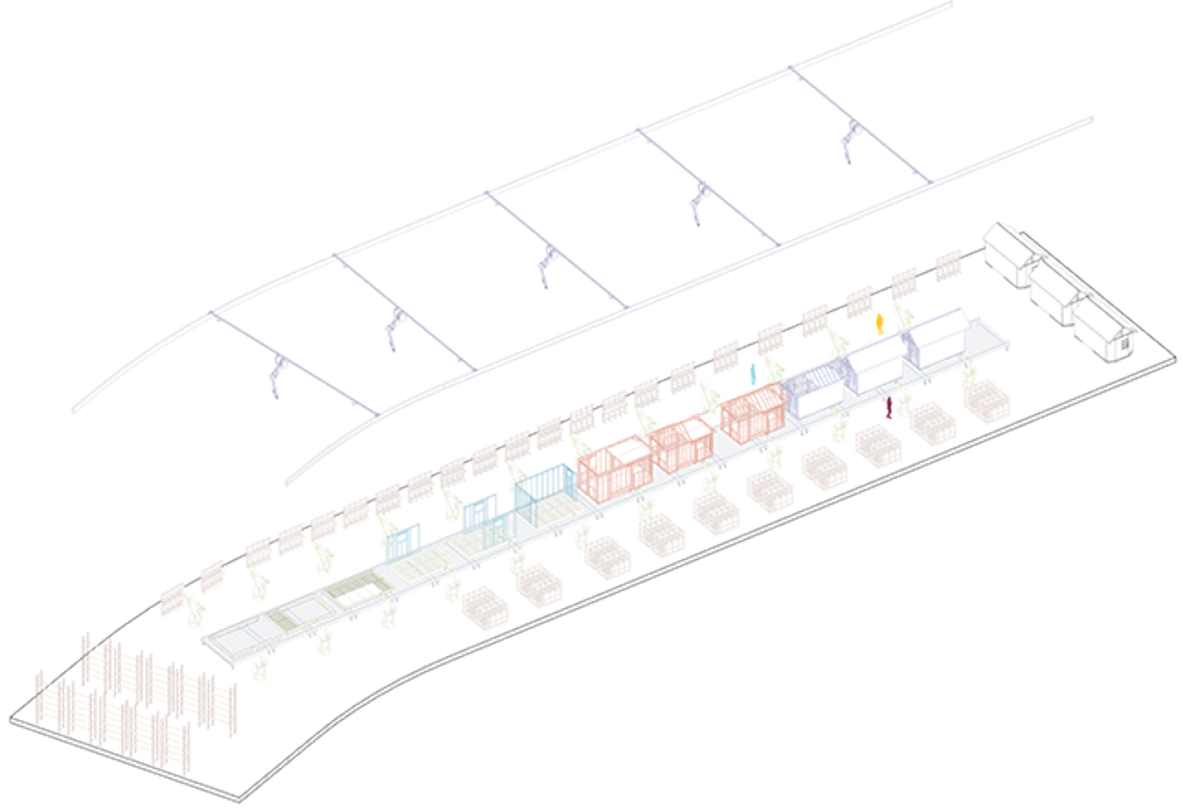


Key Plan Transect Location Diagram







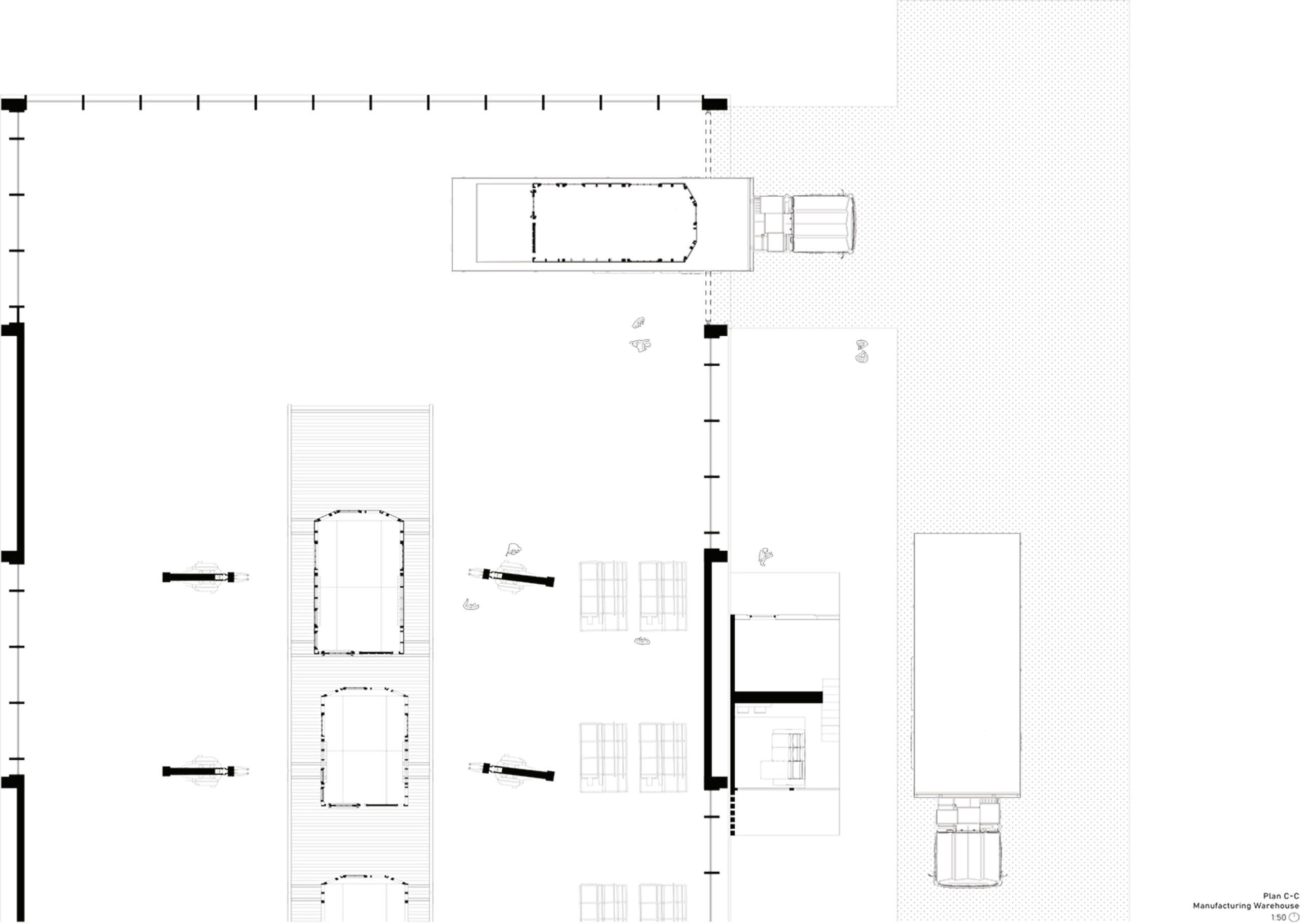


Material Flow Diagram

n.t.s

- Cranes
- AI Robotics
- Conveyor Track
- Storage
- Flooring
- Walls
- Roofing
- Finishes
- Plumbing Team
- Electrical Team
- CarpTech Managers
- Final Units

SECTION A-A
Connection of Office and Warehouse
1:50



Plan C-C
Manufacturing Warehouse
1:50

Fisherman's Bend Warehouse

Proposal #3

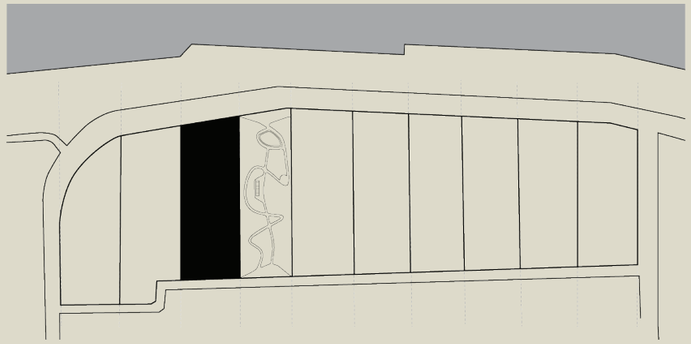
Meka Rakhmat and James Kouskouras

The Fisherman's Bend Warehouse project is a speculative envisioning of the future of the construction industry or a least some possible aspect of it. The project is predicated on research and analyses, as well as a goal to find and explore the solutions required for a sustainable future. The research led to exploration of precedents in prefabricated construction, Kit Of Parts systems, and the opportunity to implement The Internet Of Things technology in future construction workflows.

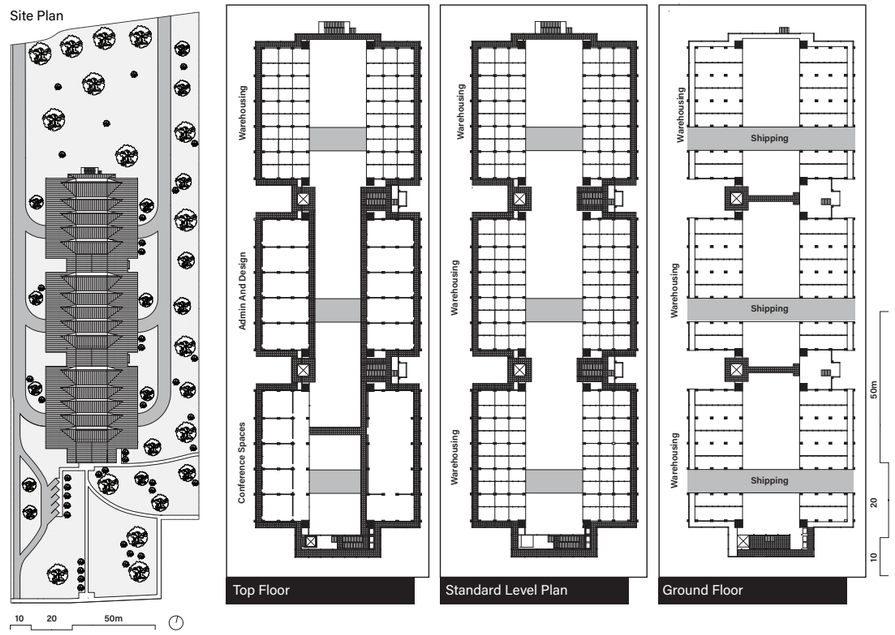
The warehouse, inspired from this research, serves the primary function of a Kit Of Parts "library". Rather than manufacturing any products onsite this system outsources the manufacturing of parts, focusing instead purely on managing organisational, and logistical aspects of operating a commercial Kit Of Parts System. It is designed to streamline logistical and communication processes between manufactures, clients, and construction teams. Functionally and Formally design is systems based, The systems being a freight container (or tray) vertical storage and movement system, and a Kit Of Part construction system. The same Kit Of Parts that that the warehouse is a library for. The Warehouse proposed is a result of the application of these systems and their logics. The project doesn't look too far forward in terms of envisioning radical new technology and its application, rather it proposes a future where the emerging and existing innovations of today have been fine-tuned and evolved to work in collaboration with each other. They complement and streamline the workflows of one another, increasing efficiency and redundancy.

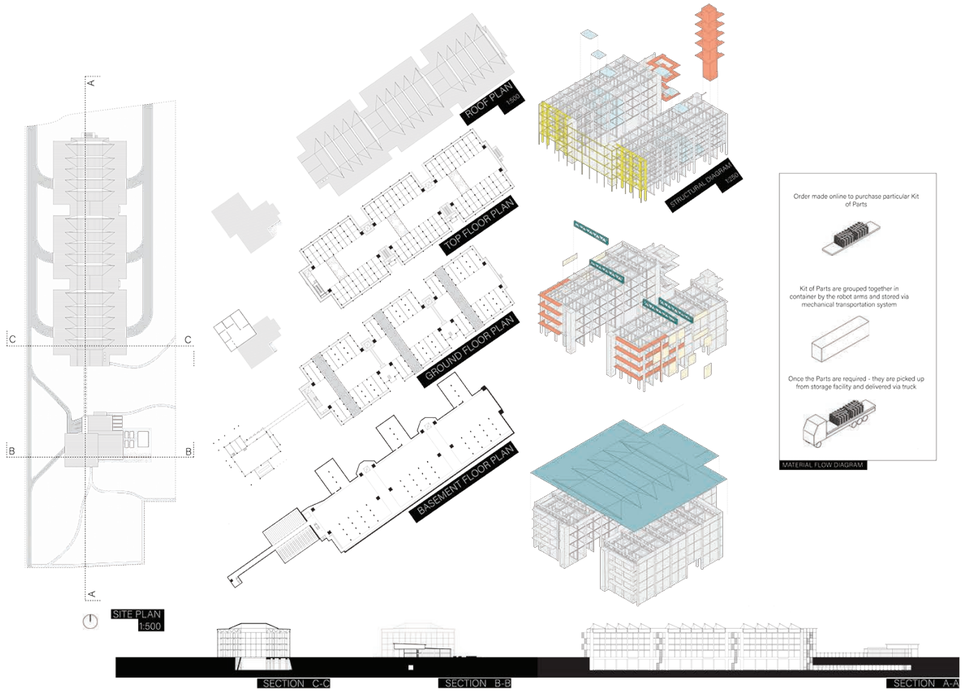
A similar approach has been applied to the Future Worker. How has the future workplace changed to support the worker rather than vice versa, the worker adapting to the evolution of the workplace. This approach avoids excessive gadgets and augments required to keep humankind relevant in a world of technological solutions and autonomous machines. Rather it focuses on the utilisation of smart environments to create spaces safe, comfortable, accessible spaces. Spaces which streamline workflows and maximise the any given workers effectiveness.

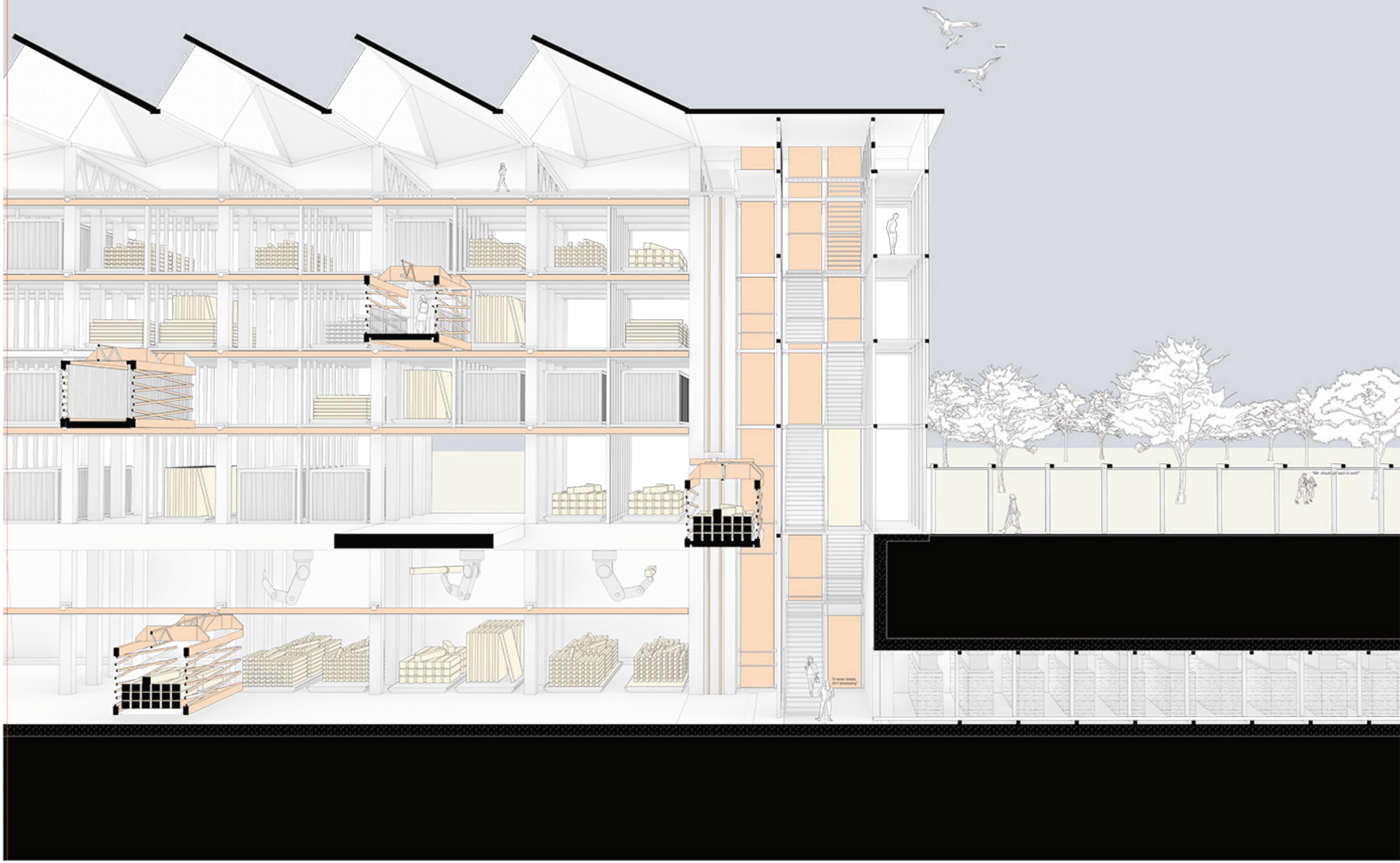
The site also includes a wild card brief of a conference and a Internet Of Thing server host (data centre) centre creating a mixed-use environment. The conference space utilises the products and methods facilitated by the warehouse and datacentre to support its operation. In this regard it has a secondary function as an applied showcase of the products and services offered by the site. The project on the whole visualises an infrastructure which caters for the demands of its time (2050), and the people who inhabit it.



Key Plan Transect Location Diagram

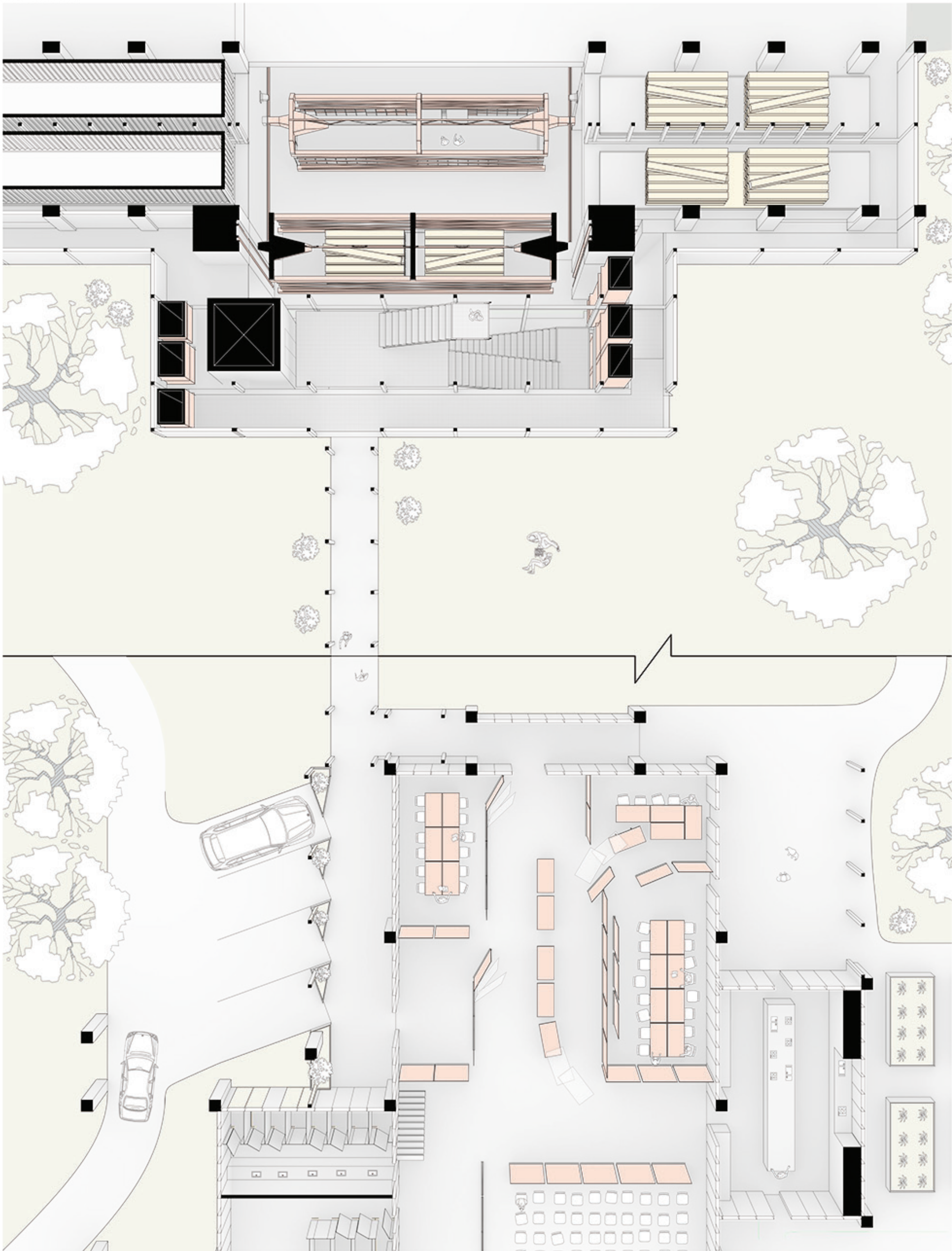






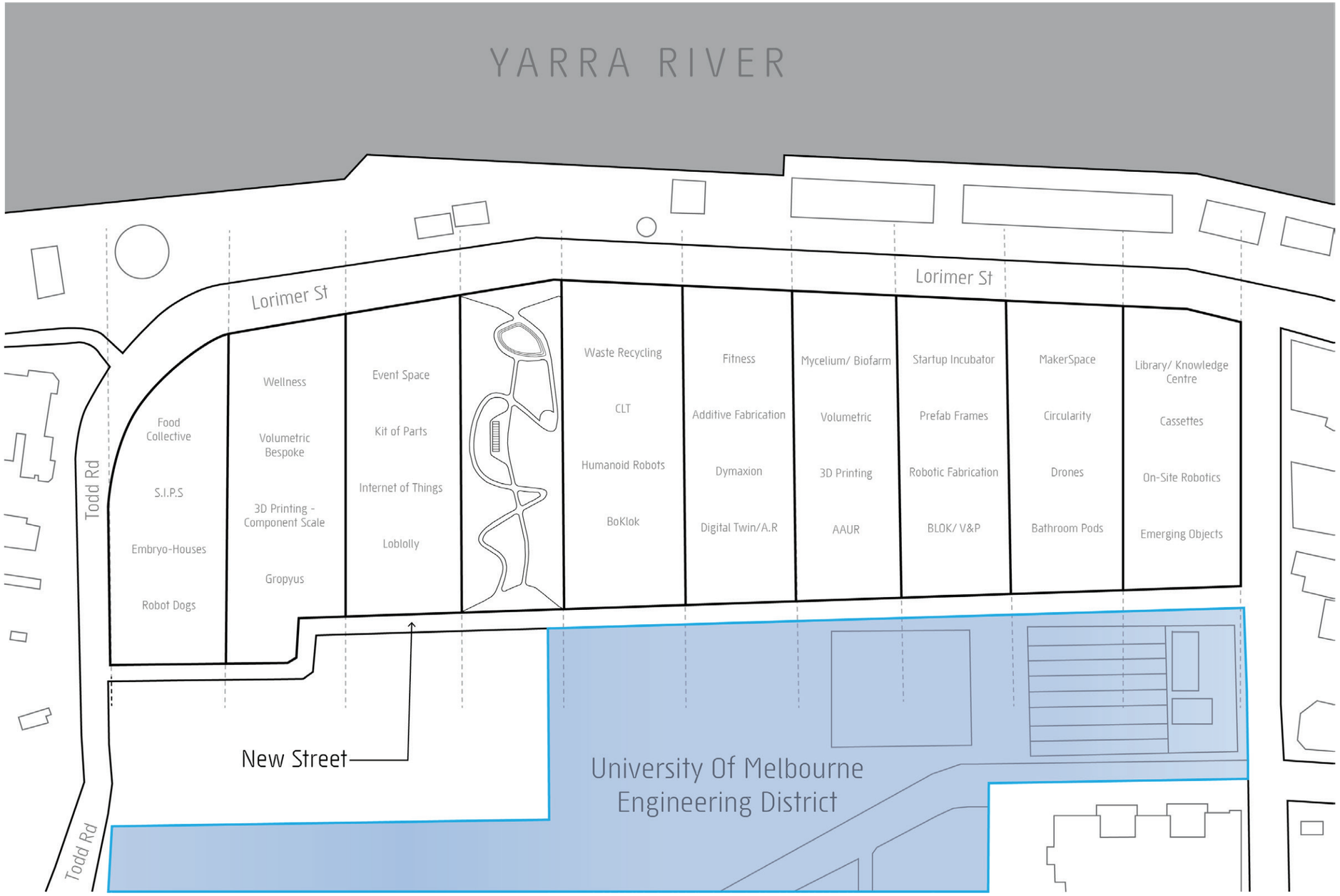
Perspective Section - 1:50

Perspective Plan - 1:50



Garden/ Park Space
Green Wedge

Something here about its link to providing amenity and linking together the precinct.



CLT Hub

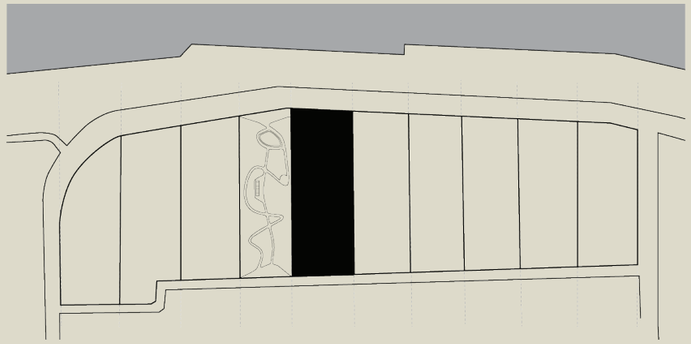
Proposal #4

Cho Woo Jin and Chin Chang Hung

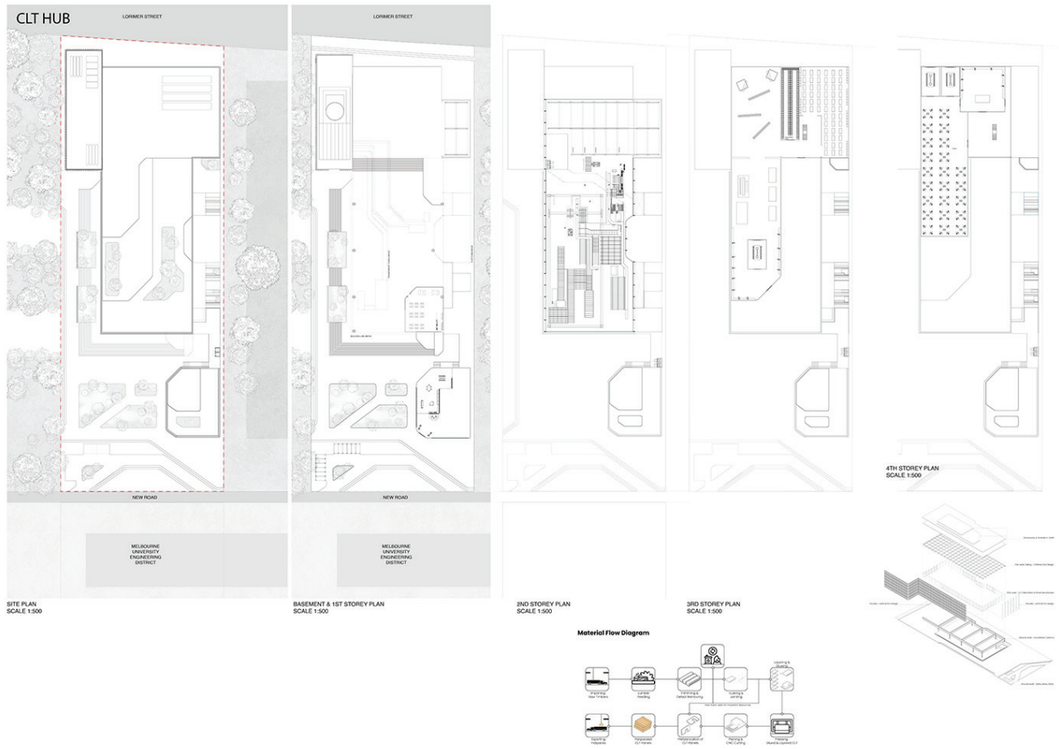
We are focusing on delivering flatpack CLT panels and building elements for our customers.
(DFMA). There are 2 different kinds of flatpack panels:- a. Standardised panels for built-to-order housing schemes, b. Designed elements for the different design schemes. We are delivering CLT products ranging from floor slabs, wall panels, roofs and beams. Our flatpacks come with proprietary joineries for on site assembly.

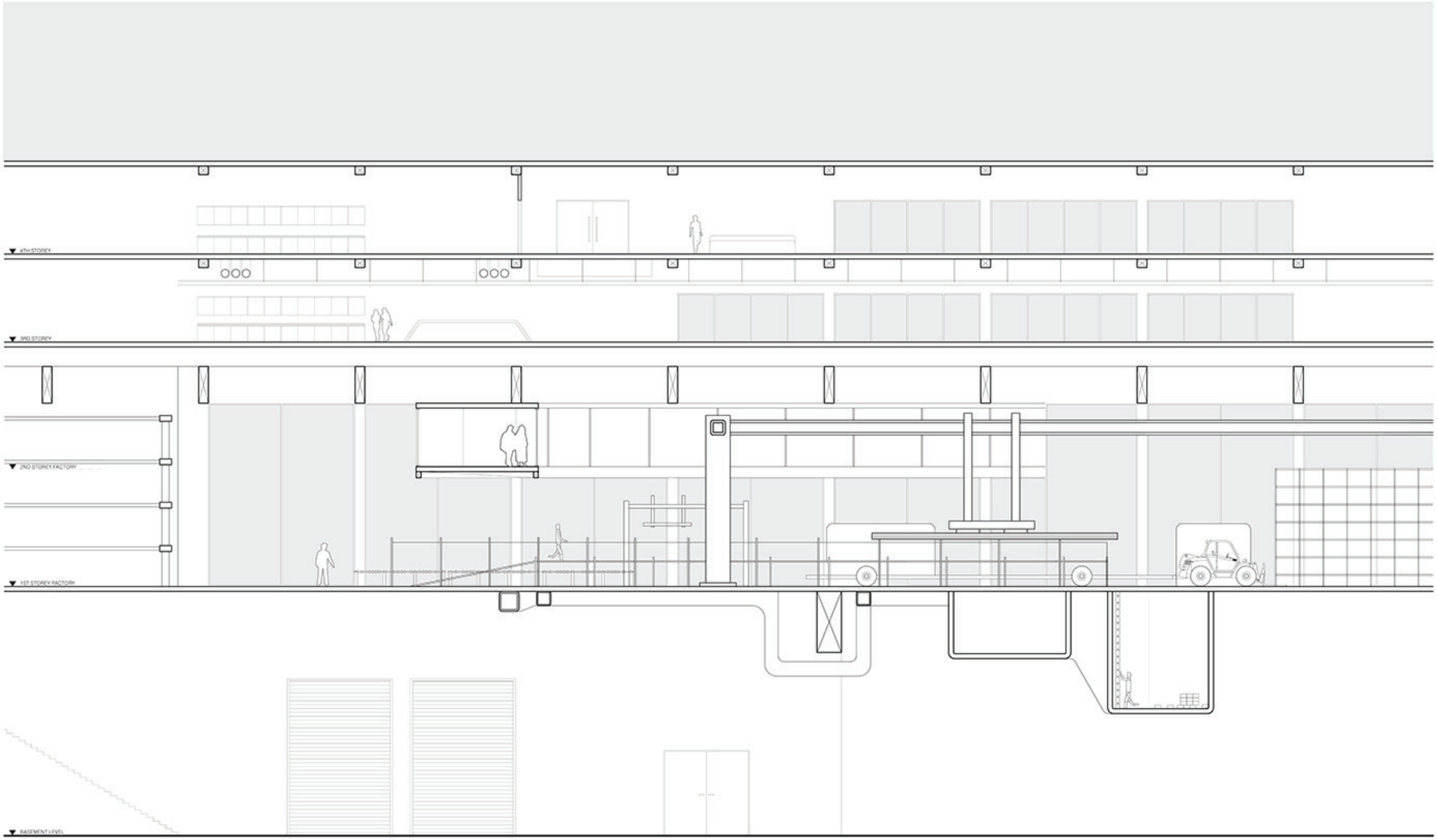
We are aiming to maximise the efficiency and delivering a massive number of CLT products to various housing schemes, in order to have a steady supply chain for the CLT sector. We are aiming to utilise the offsite prefabrication method to eliminate or keep construction errors to the lowest in order to reduce cost and time for on-site construction.

Our wildcard facility is a waste recycler. It converts waste which are recycled into energy. We are taking in external waste from the public and in within the facility to generate electricity. Wood pellets can also be produced through CLT waste, acting as biomass for energy generation at the same time. We are also manufacturing panelised insulation and panelised acoustics as our sub-products. Both of these products are made from excess wood chips and saw dust from CLT manufacturing. This helps us to keep our waste percentage to 0% throughout the process. Humanoid robots are here to help streamline the processes of manufacturing CLT, in both production and transporting finished products in within the facility. Humanoid robots are to be trained in construction methods and assembly of CLT and to be sent on site to streamline the construction processes.



Key Plan Transect Location Diagram





SECTION A-A
SCALE 1:50

0 1m 5m

PACKAGE 01

PACKAGE 02

PACKAGE 03

PACKAGE 04

PACKAGE 05

OVERHEAD PLATFORM BRIDGE ABOVE

KONTOZINK

SECOND STOREY FACTORY FLOOR PLAN
SCALE 1:50

Vertical Forge: Fusion of Walls and Ascension

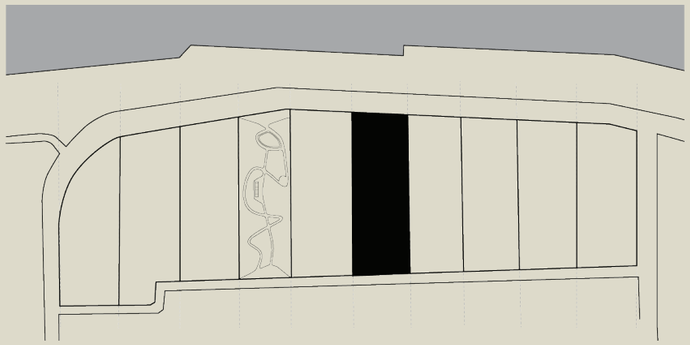
Proposal #5

Robin Deepthi Mahanthi and Sara Amin

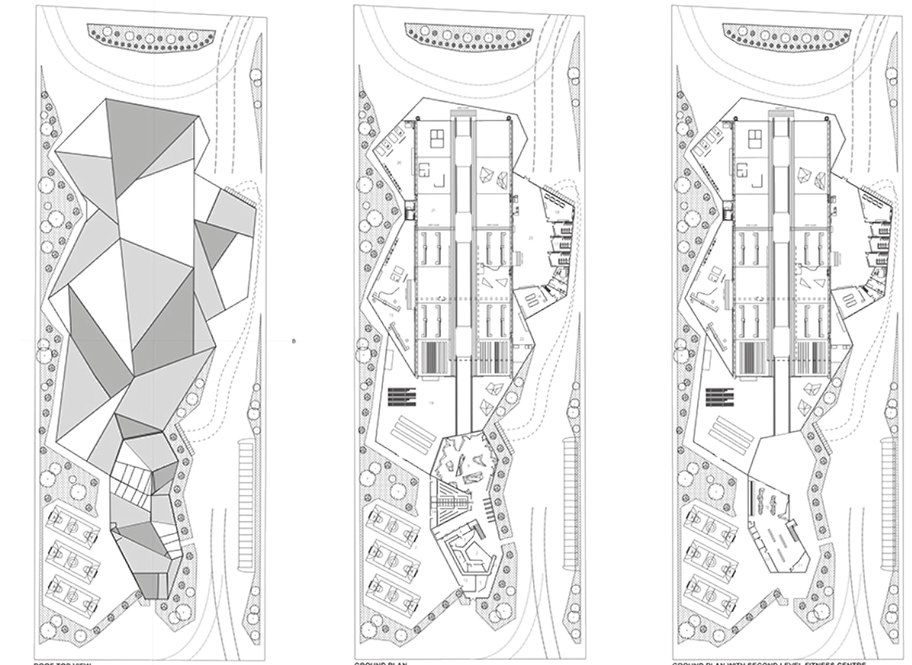
Our CAMP complex integrates architects managing design through project completion, factory workers overseeing 3D printing and quality control, and engineering apprentices from Melbourne University for hands-on training. Fitness trainers at Wild Card Bouldering Centre specialize in VR and MR fitness. Wearables and equipment monitor performance and conditions in both our factory and bouldering space.

Technologies include factory cranes loading printed walls for on-site installation, 3D printers using concrete, ceramics, or plastics, and robotic arms moving walls. We offer concrete, ceramic, and plastic printing with varied qualities and design options, customized through AR with Fologra‌ph.

By 2050, our factory advances include exoskeletons for workers and mixed-reality wearables. At the fitness center, trainers use AR, VR, and MR technologies alongside wearables like mixed reality glasses, heart rate-monitored headphones, control armbands, smart rings, Nymi bands, and RUFUS cuffs for training and performance monitoring.

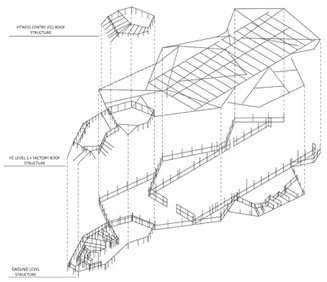


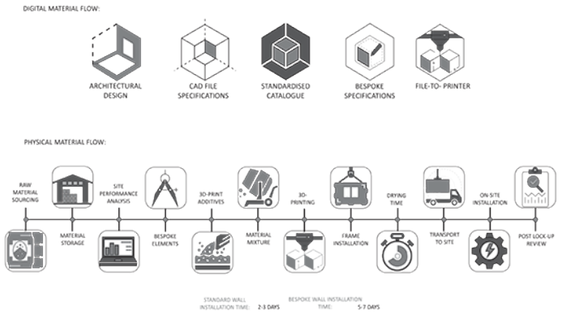
Key Plan Transect Location Diagram

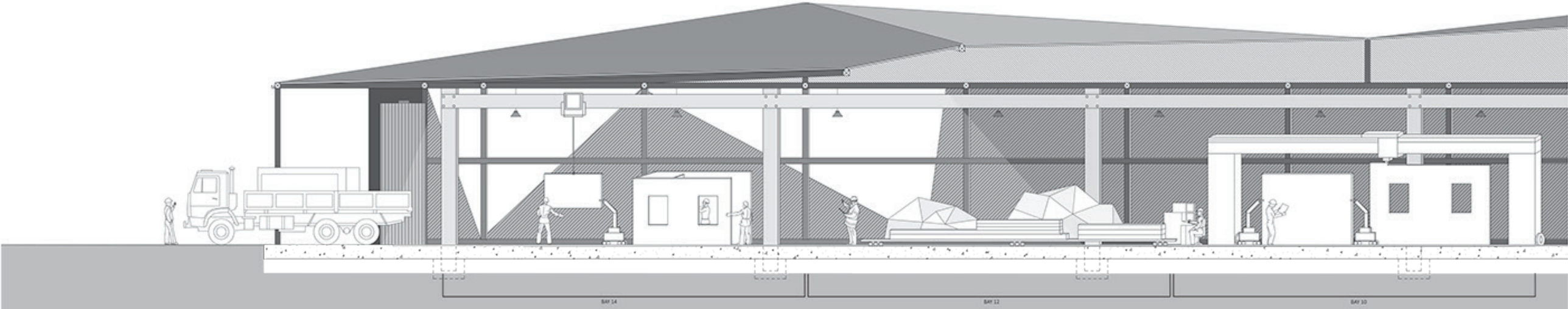












SECTION C-C
SCALE 1:50

COURTS
BATTERY
STORAGE

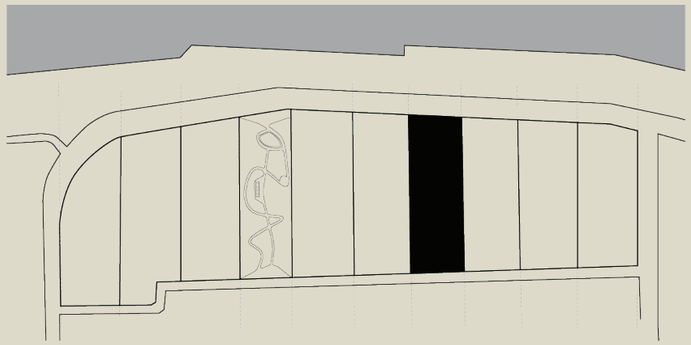
GROUND FLOOR PLAN
SCALE 1:50

BiWell Mycelium Works
Proposal #6

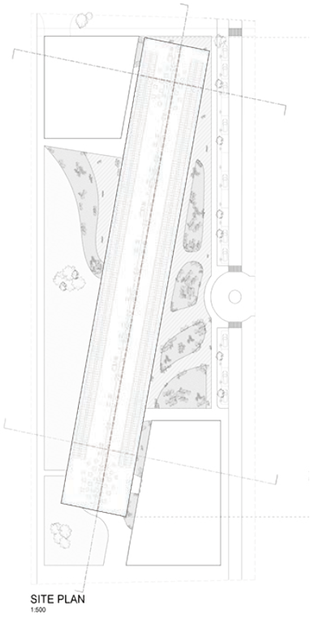
Jarrad Frahamer and Saida Bakhsh

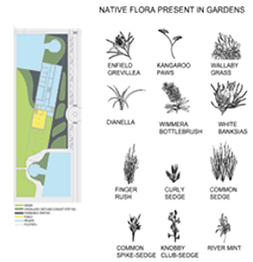
In 25 years, a groundbreaking architectural project showcases a revolutionary approach to prefabricated homes, inspired and guided by cutting-edge advancements in mycelium architecture. This innovative structure utilizes a novel fabrication methodology within a state-of-the-art 'CAMP' (Construction through Advanced Manufacturing Precinct), featuring mycelium elevator wells at both ends. Allowing the movement of resources and products through the stacked levels, using the two ends of the 200m long factory. The project embodies a harmonious integration with its natural surroundings, emphasizing careful consideration of the built environment and its impact. By incorporating mass timber construction, the design significantly reduces environmental footprints, offering a sustainable and ecologically balanced solution that reflects the future of eco-friendly architecture. Additionally, an integrated gardenscape containing native Victorian f lora assists in connecting port Melbourne to its Pre-colonial heritage, further enhancing its sustainability.

The CAMP's workforce benefits from an array of advanced technologies designed to enhance efficiency and safety. AR-integrated helmets overlay real-time data and instructions, while spinal reinforcement implants and artificial toxin filter implants ensure physical well-being and protection from contaminants. Neuralink implants facilitate seamless connection with robots and computers, and robotic limbs and gloves provide enhanced dexterity and strength. Together, these innovations enable workers to perform tasks with precision, ensuring a harmonious blend of human skill and technological support in the factory's operations.

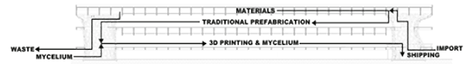


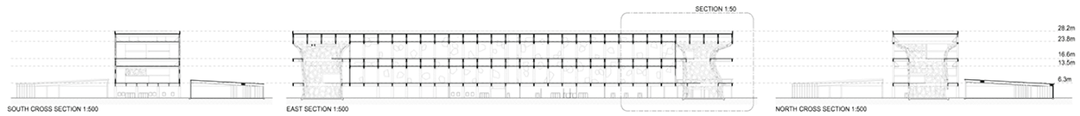
Key Plan Transect Location Diagram

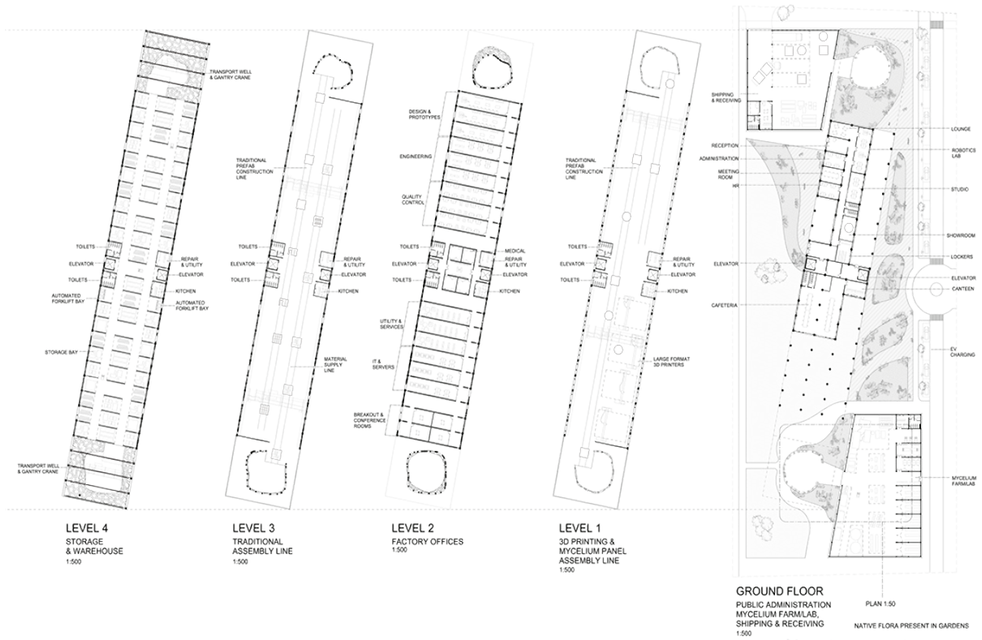












ROOF

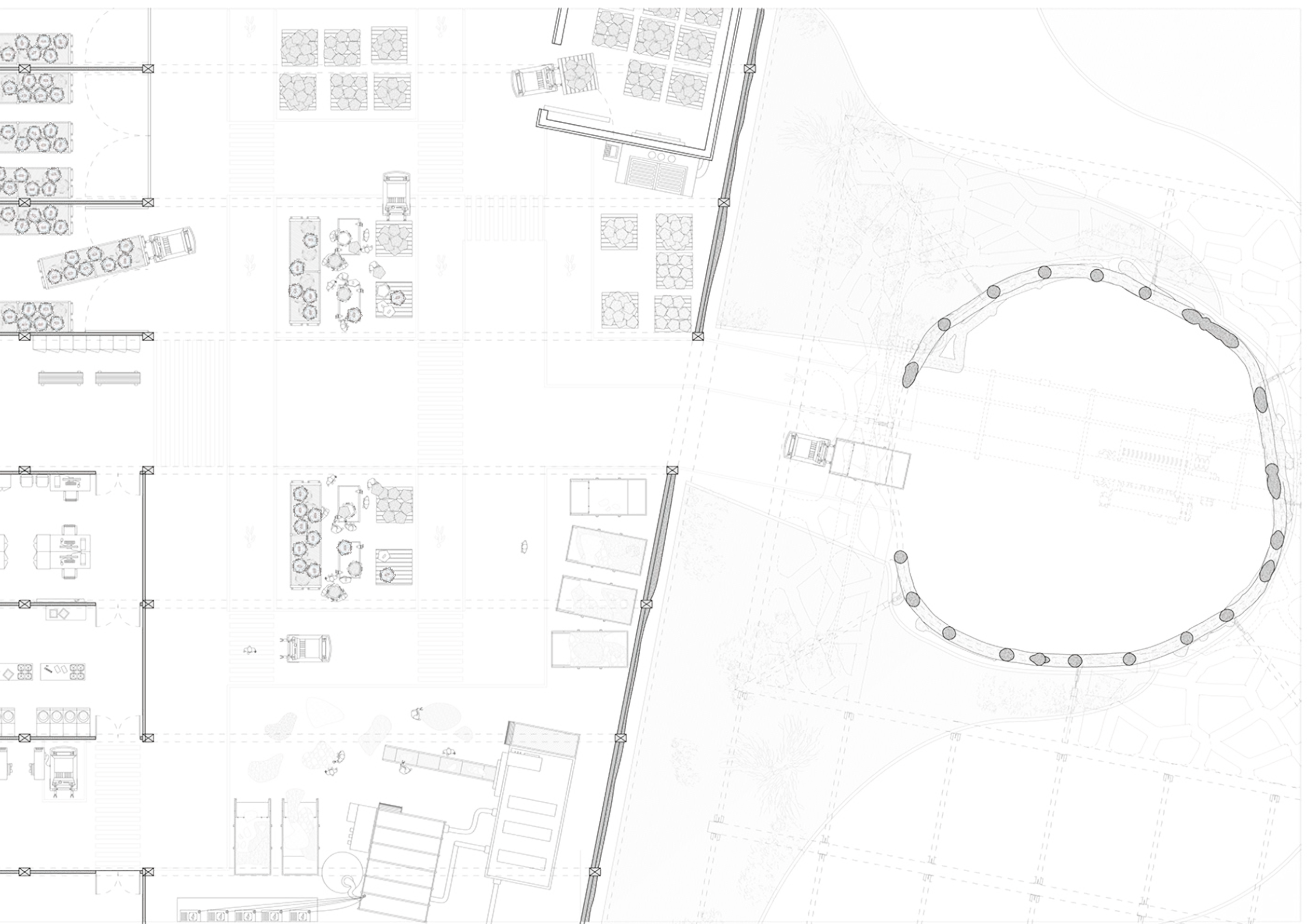
FOURTH FLOOR

THIRD FLOOR

SECOND FLOOR

FIRST FLOOR

GROUND FLOOR



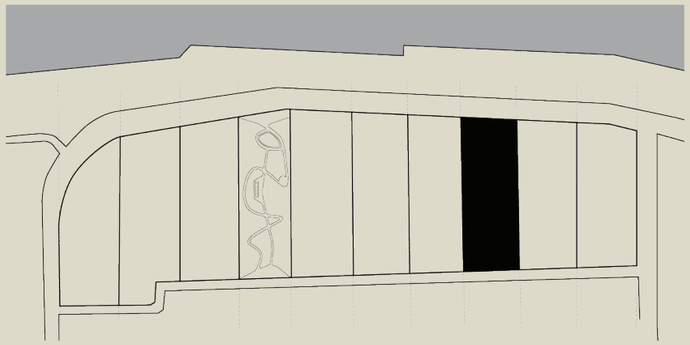
SmartBuild Incubator

Proposal #7

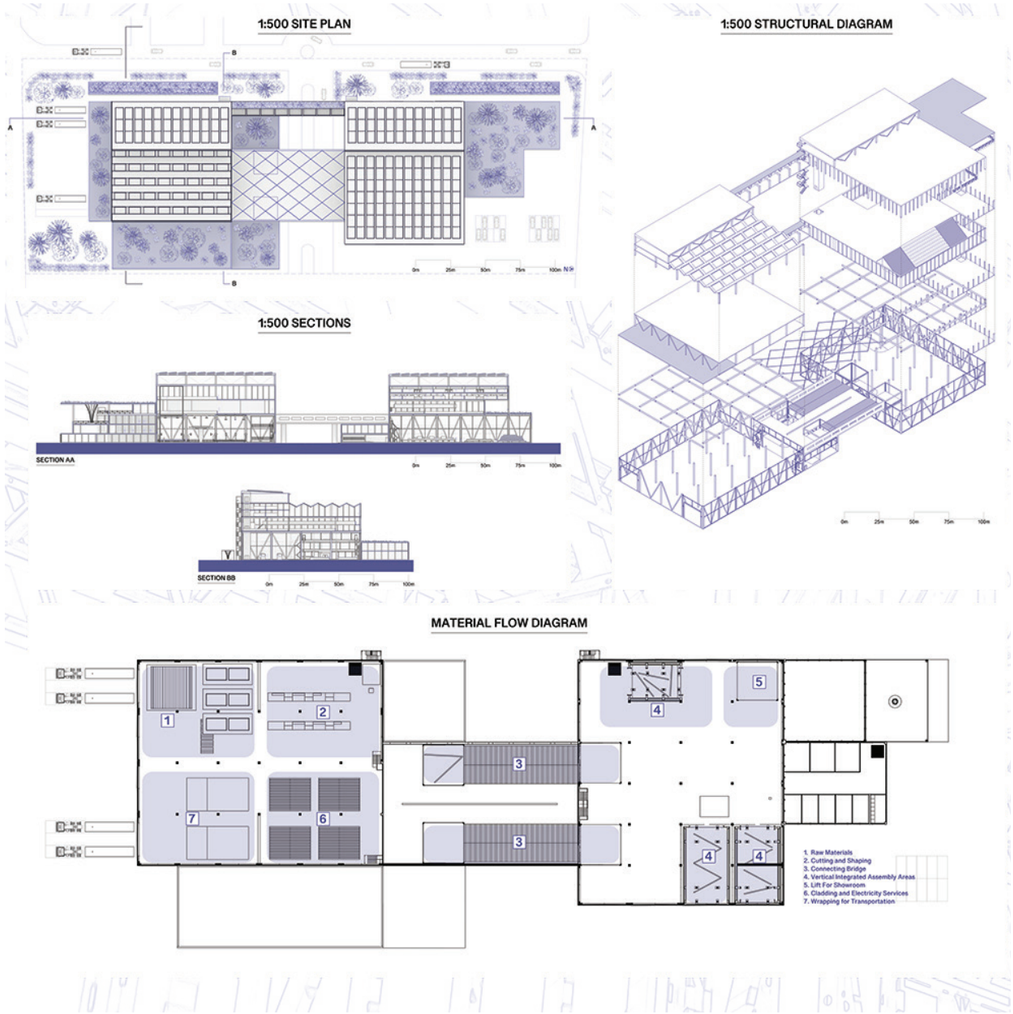
Marlow Brown and Su Wutt Yee

In 25 years, a groundbreaking architectural project showcases a revolutionary approach to prefabricated homes, inspired and guided by cutting-edge advancements in mycelium architecture. This innovative structure utilizes a novel fabrication methodology within a state-of-the-art 'CAMP' (Construction through Advanced Manufacturing Precinct), featuring mycelium elevator wells at both ends. Allowing the movement of resources and products through the stacked levels, using the two ends of the 200m long factory. The project embodies a harmonious integration with its natural surroundings, emphasizing careful consideration of the built environment and its impact. By incorporating mass timber construction, the design significantly reduces environmental footprints, offering a sustainable and ecologically balanced solution that reflects the future of eco-friendly architecture. Additionally, an integrated gardenscape containing native Victorian f lora assists in connecting port Melbourne to its Pre-colonial heritage, further enhancing its sustainability.

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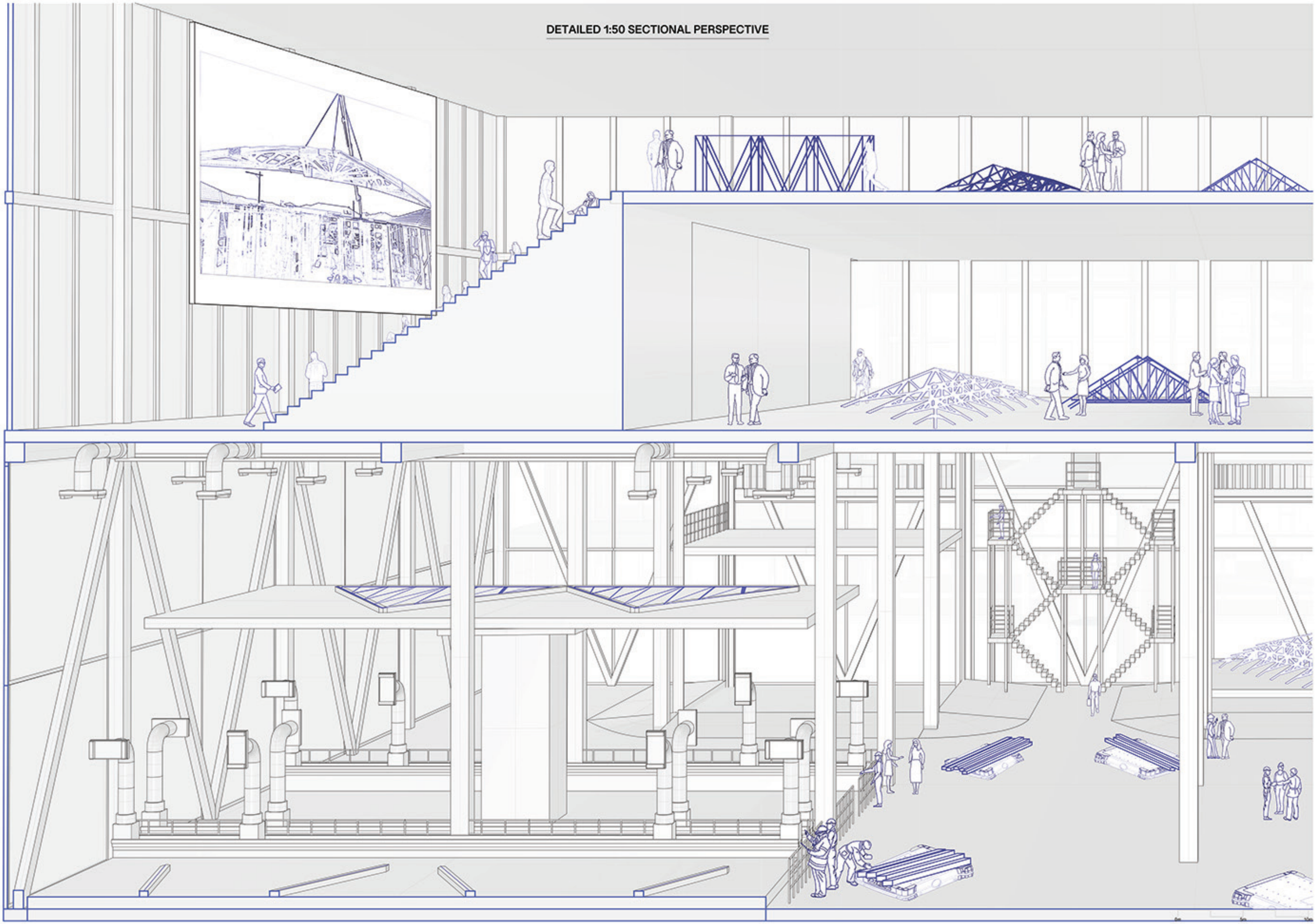


Key Plan Transect Location Diagram





DETAILED 1:50 SECTIONAL PERSPECTIVE



DETAILED 1:50 PLAN

Autonomous Manufacturing and the Preservation of Trade

Proposal #8

Blair Albrecht and Trent van Elwoud

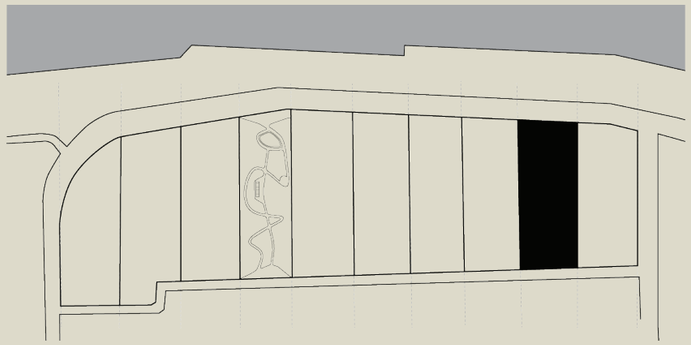
Our C.A.M.P factory design is focused on the production and manufacturing of bathroom pod typologies, using autonomous machinery and drone technology for manufacturing and shipping respectively. Using principles of circular economy and design for disassembly to define the parameters behind the program and ambitions of the proposal. Including a wildcard program of a Maker's space to intertwine public interaction within the proposal and use the Makers Space as a foundation for up skilling workers and preserving current and past trades.

The project is split into two main elements, human and non-human areas. The maker's space program and design decisions are then the key to tying the project narrative together, tying together the human and autonomous elements of the proposal and the transition that has theorised to occur within the workforce, through the intervention of the bridge structure. Physically and conceptually connecting the two, whilst providing the public opportunity to travel through the maker's space showroom gallery that is housing the lost trades being exhibited from the maker's space workshops to a viewing platform allowing people to see the physical transition from the contemporary trades of 2024 to the future possibility of production and assembly in the autonomous arms assembly and drone transits.

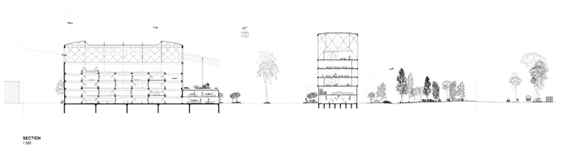
Hypothesising the future worker was the other key consideration to the design of the C.A.M.P complex and understanding the spatial requirements of programs. Our project supports two main categories of workers, either Office and Administrator Workers, who are focused on drone technologies and operation in the Project or Design and Engineering Workers, who focus on the autonomous manufacturing machinery operation and output.

The administrator and office worker are responsible for managing the drone operation aspects of the project such as the logistics, shipping and receiving, customer service, data analysis and quality. Being the lower qualification position with a hypothisised requirement of a 'Bachelors in Automated Aviation Technologies, and Logistics' within the project using VR technologies for live update tracking and monitoring of the drones in real-time. The design and engineers are responsible for managing the operation of autonomous robot arms and assembly lines this includes responsibilities such as production efficiency, troubleshooting and diagnosis, repair and research and development technologies and materials to improve the operation efficiencies. It is a higher qualification job with a theorised requirement of a 'Master's degree in Autonomous Robotics Engineering' Using a VR digital interface to user operate and program drones to remove and replace malfunctioning robot arms allows seamless interchange between issues diagnosis and maintenance repair, efficiency of process without exposing the worker to safety concerns within the assembly line.

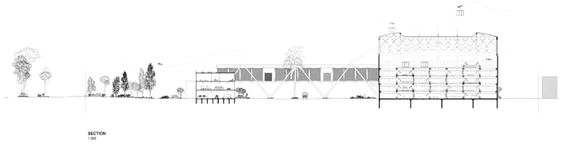
Overall, the C.A.M.P complex represents an innovative approach to the requirements and conditions of the 2050 manufacturing and construction methodologies and the future of the workforce within Fisherman's Bend, Melbourne



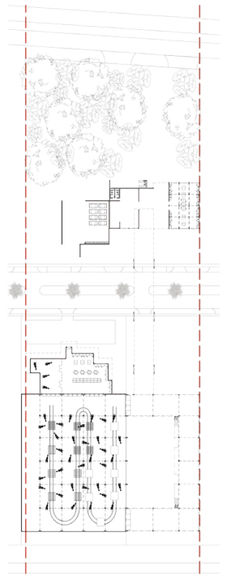
Key Plan Transect Location Diagram



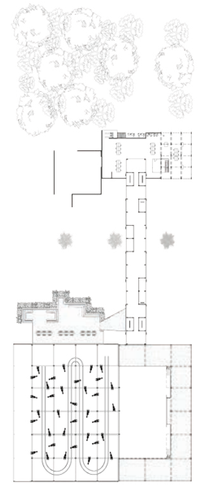
SECTION



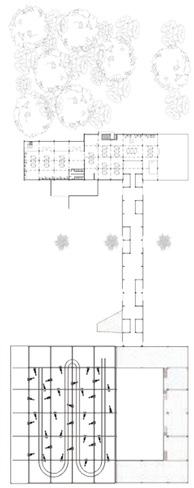
SECTION



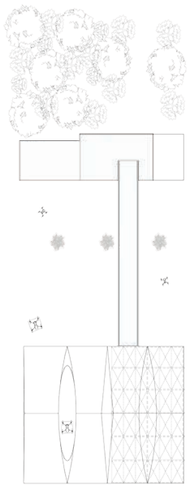
GROUND FLOOR PLAN



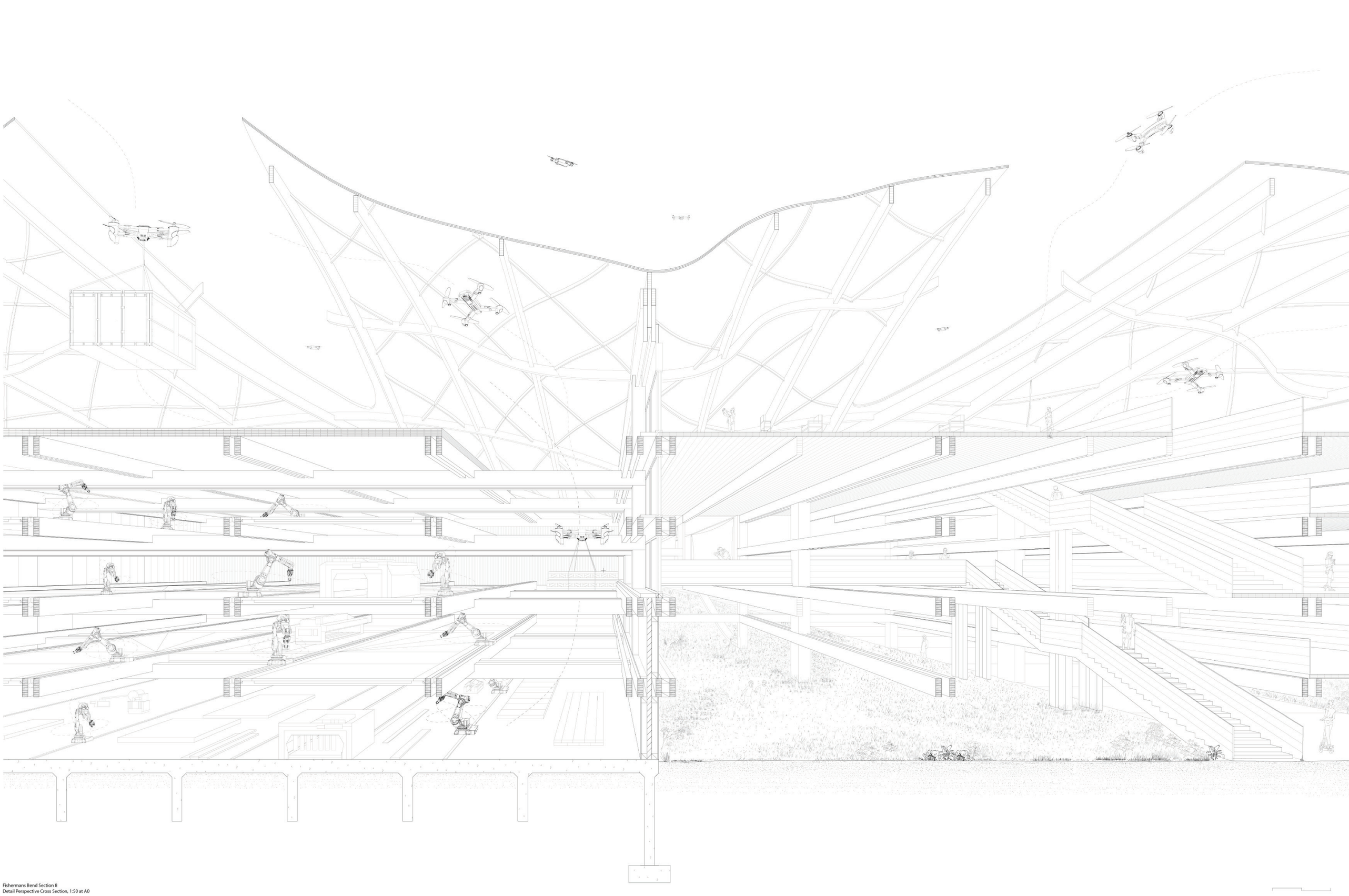
SECOND FLOOR PLAN



THIRD FLOOR PLAN



ROOF PLAN



Fishermans Bend Section 8
Detail Perspective Cross Section, 1:50 at A0

DETAIL FLOOR PLAN
1:50

Robo Factory

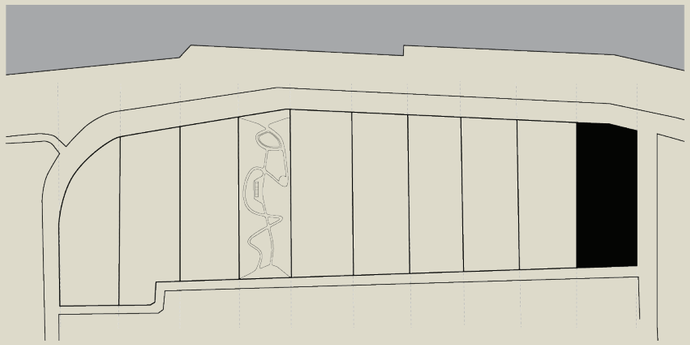
Proposal #9

Tong Zhao and Somana Sok

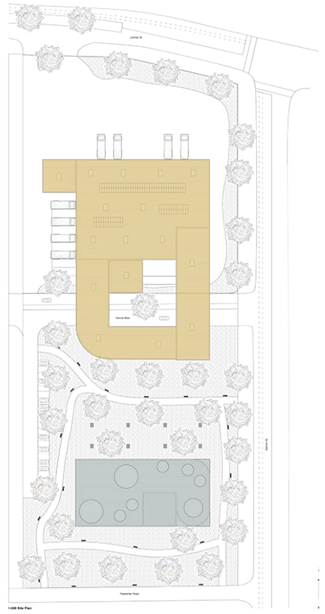
Our proposal leverages advanced 3D printing technology for housing construction, integrating on-site robotic technology inspired by emerging trends. We propose a factory that produces construction robots via 3D printing, which are then deployed to build houses off-site. The factory's assembly line integrates raw materials and non-3D printed components, printing robotic arms and legs, installing electronics, and setting up software, all under a monitored inspection system. Operating 24/7 with both human and robotic workers, the factory utilizes a cross-laminated timber structure with a 3D printed translucent plastic facade that regulates temperature, detects weather, and possesses self-healing capabilities.

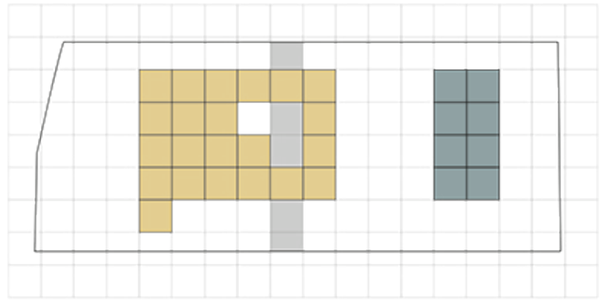
Adjacent to the factory, a 3D printed library accessible to the public, especially the University of Melbourne community, features open and private spaces, interactive technology, and a canteen. The library's design allows for future adaptability through partial demolition and reprinting, based on a modular roof concept.

Future factory workers will blend traditional manufacturing skills with technological expertise, ensuring efficient operations and adaptability. The project aims to promote a circular economy by manufacturing construction robots that use recyclable materials, enabling environmentally friendly demolition and reprinting. This vision fosters flexible, sustainable construction, allowing buildings to be easily relocated, modified, or expanded, thus reducing construction time and costs while minimizing environmental impact.

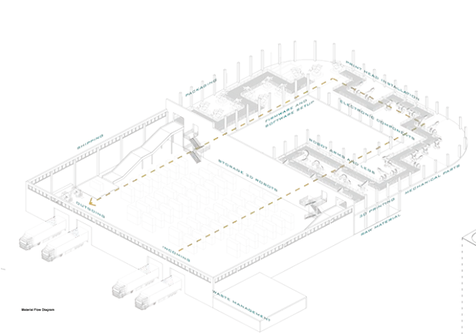


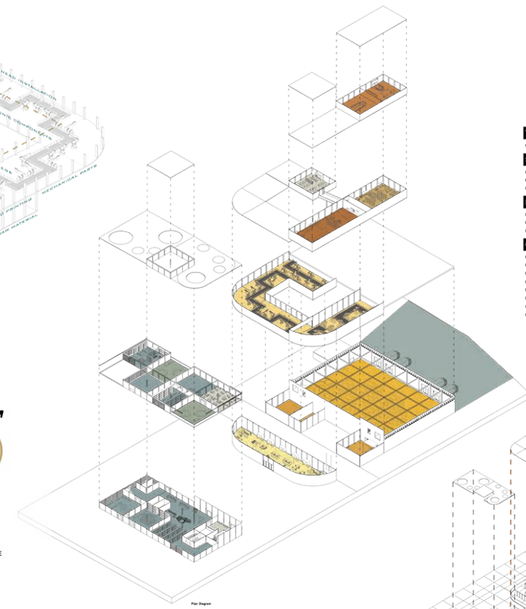
Key Plan Transect Location Diagram

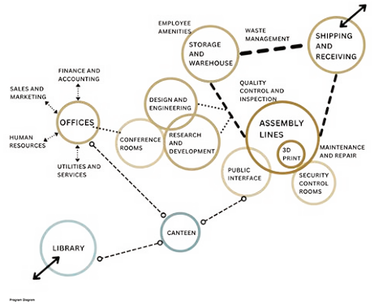


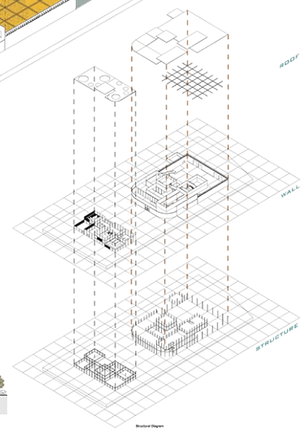


Vertical factories have the potential to produce energy and promote a circular economy, shaping new urban paradigms. They make efficient use of limited urban space by capitalizing on vertical density. Designed with flexibility and adaptability in mind, they can better withstand future uncertainties.



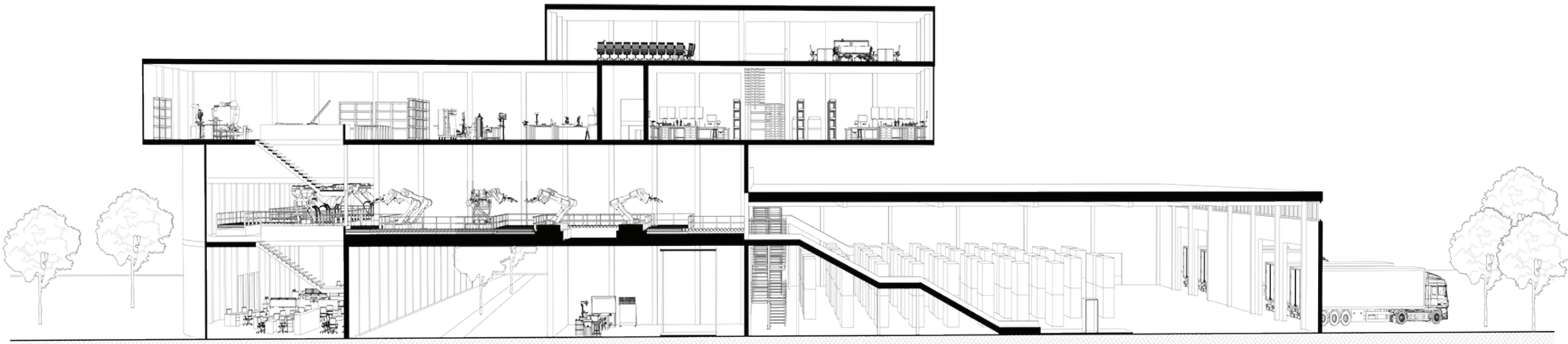




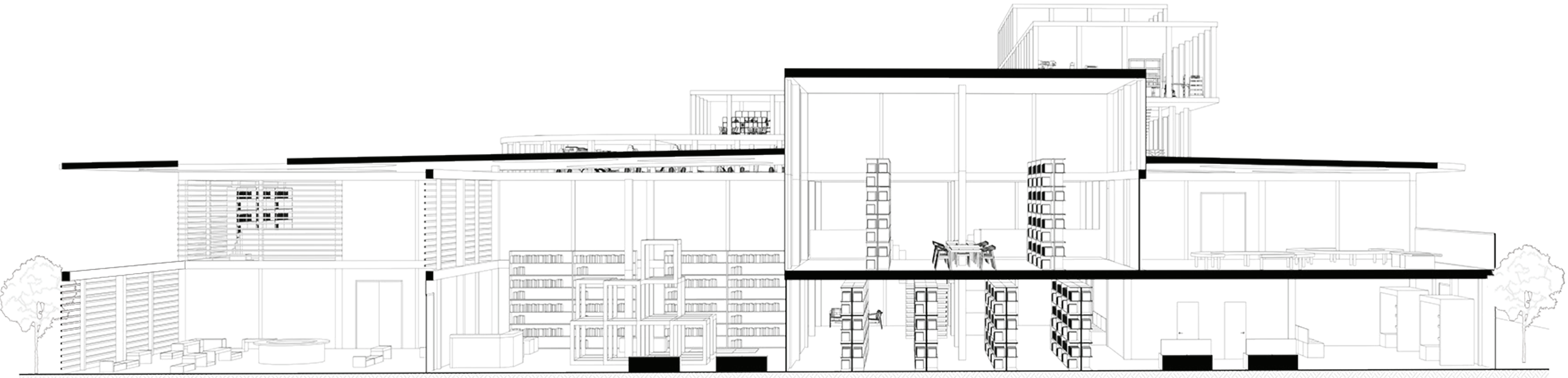




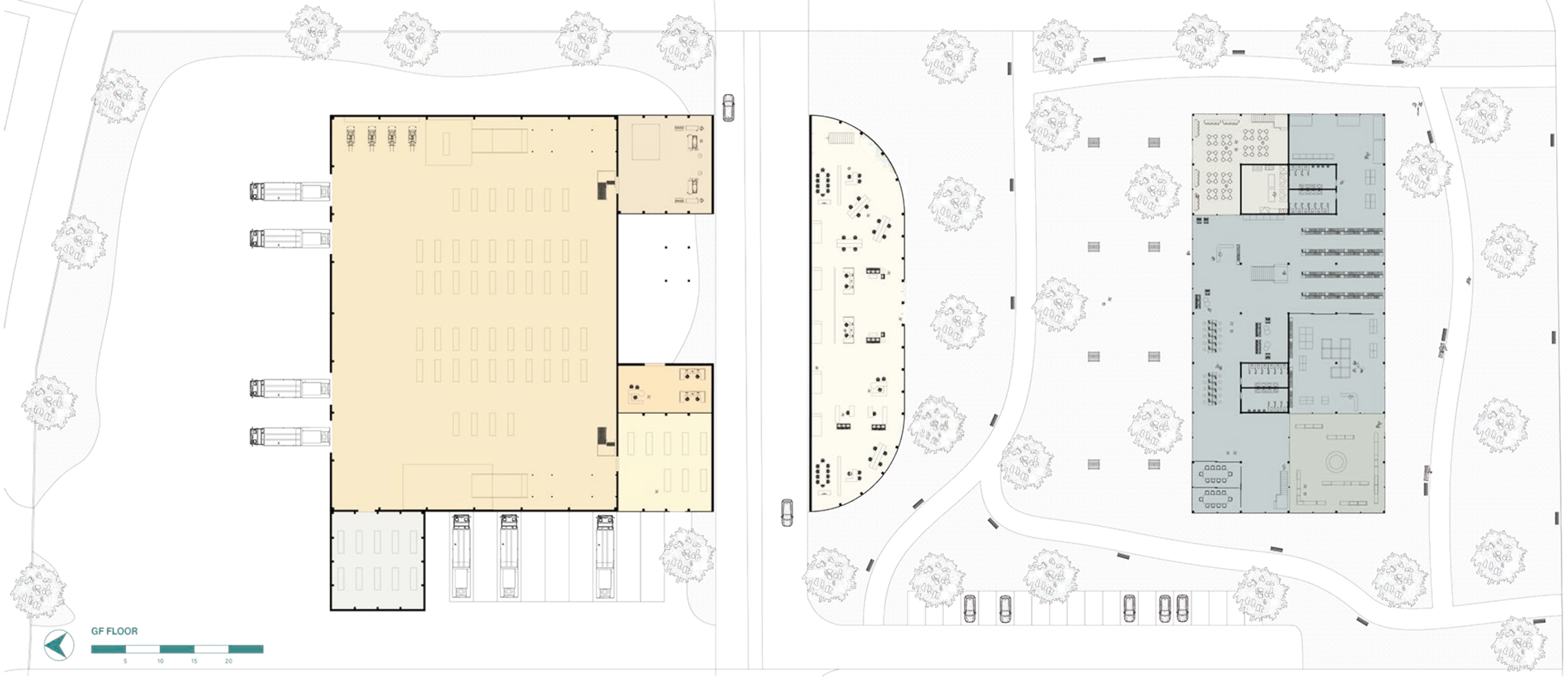


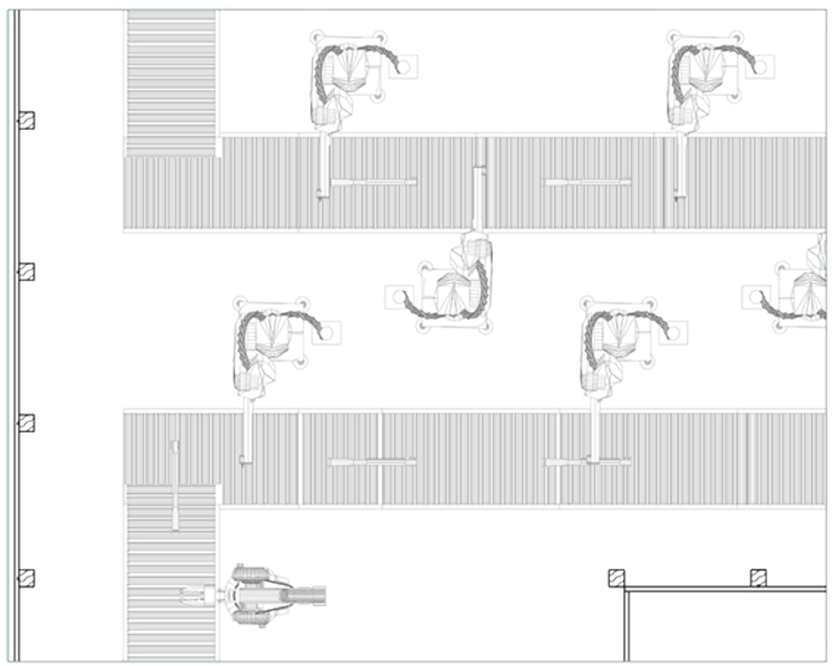


FACTORY SECTION 1:75

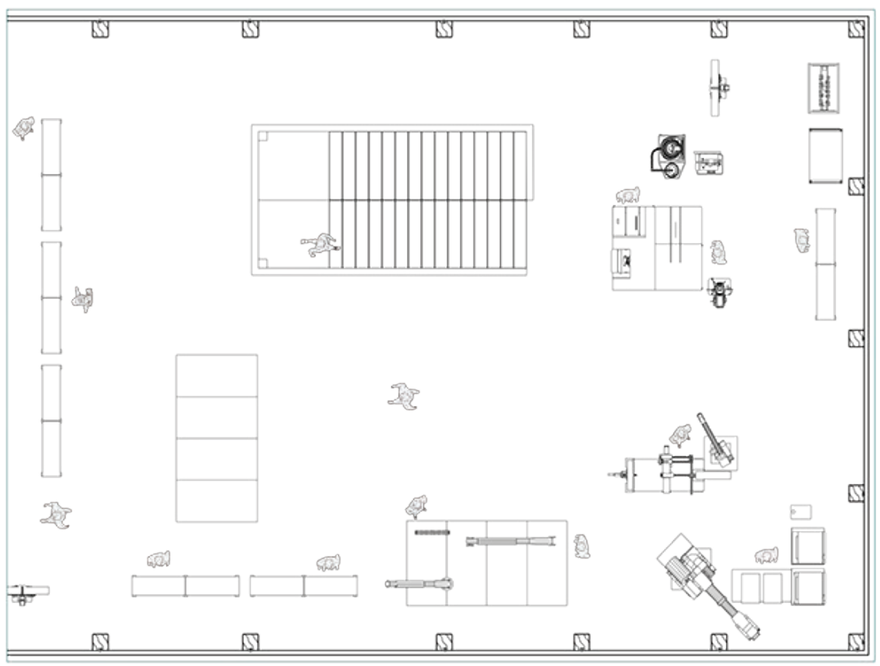


LIBRARY SECTION 1:100

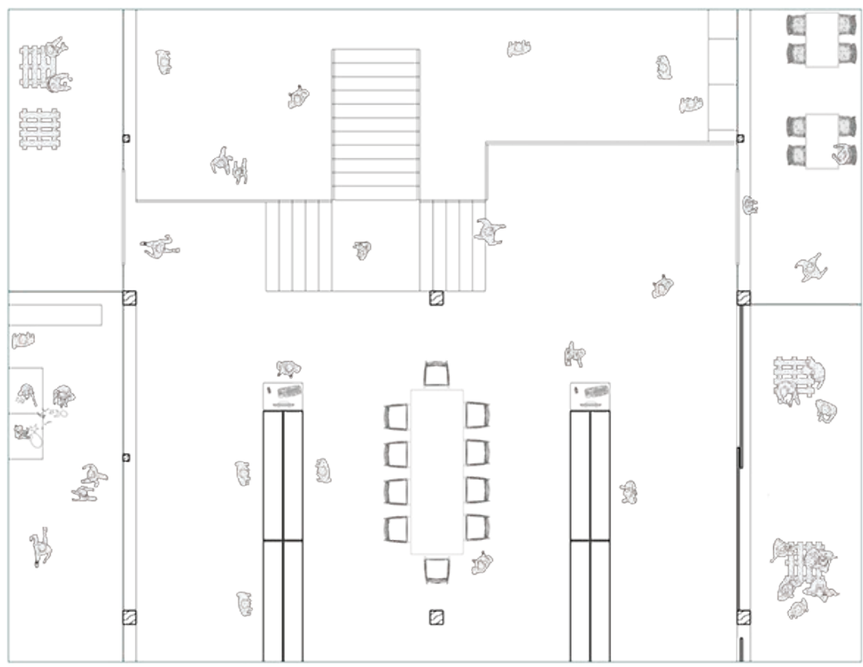




DETAILED PLAN - ASSEMBLY LINE - 1:50



DETAILED PLAN - D&E - 1:50



DETAILED PLAN - LIBRARY - 1:50

1.2 Workforces of Future Construction

Students in pairs final studio theorisations of the future workforces required for the C.A.M.P proposals with spatial video representations of the intended human qualitative aspects of the C.A.M.P design proposals.

Smart Sip Hub.
Workforce #1

Saraf Golpo and Rehila Hydari

C.A.M.P

Client Background:

Construction Hub is a specialized medium-sized company focusing on the production of Structural Insulated Panels (SIPs) for the agricultural sector. Their primary products are utilized by farmers to build barns, sheds, storage facilities, and educational centers, offering durable, energy-efficient, and cost-effective building solutions.

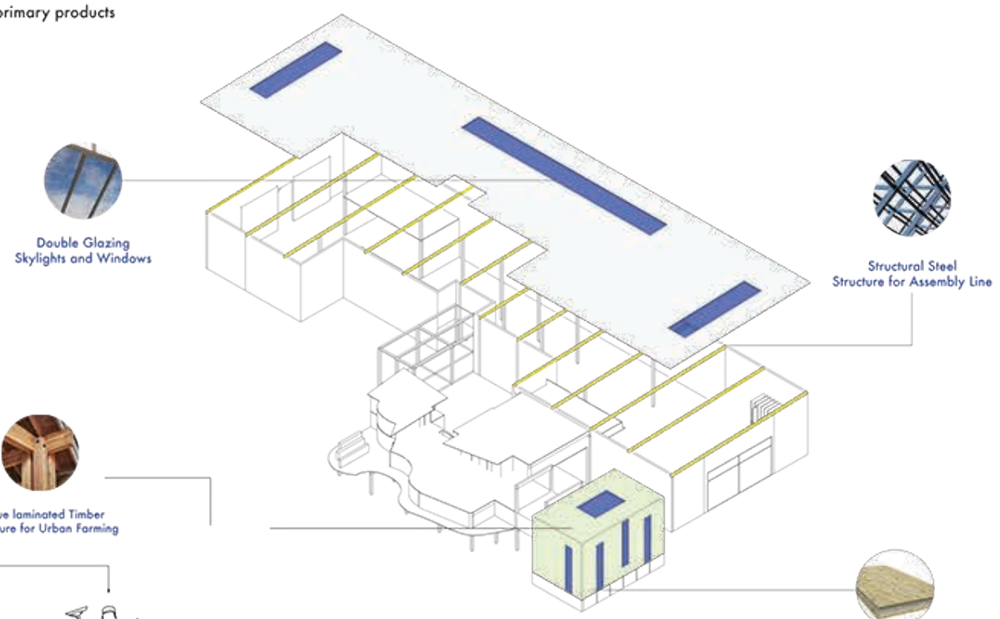
How They Use the Construction Hub?

1. Primary Office and Production Line:
-Central hub for administrative operations, project management, client communication, and business management.
-Main site for SIP production.

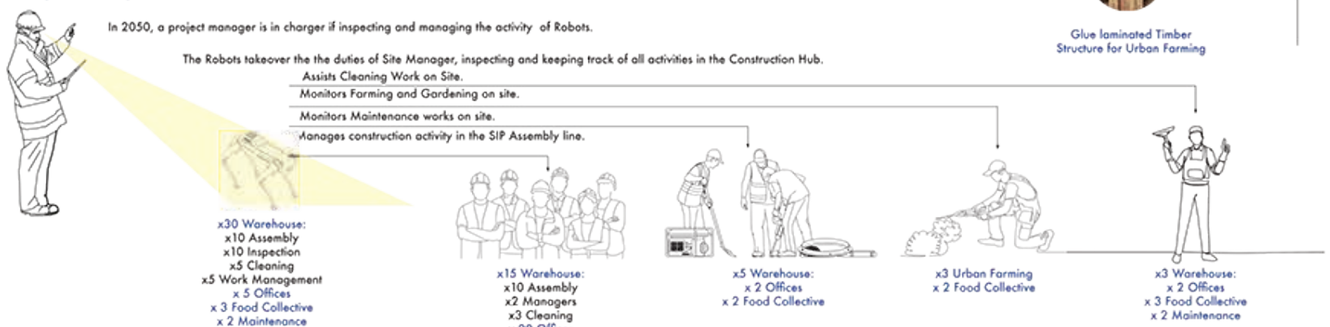
2. Storage:
-Efficient storage facility for raw materials, finished products, and production inventory.
-Ensures timely delivery and effective inventory management.
Innovation Center:

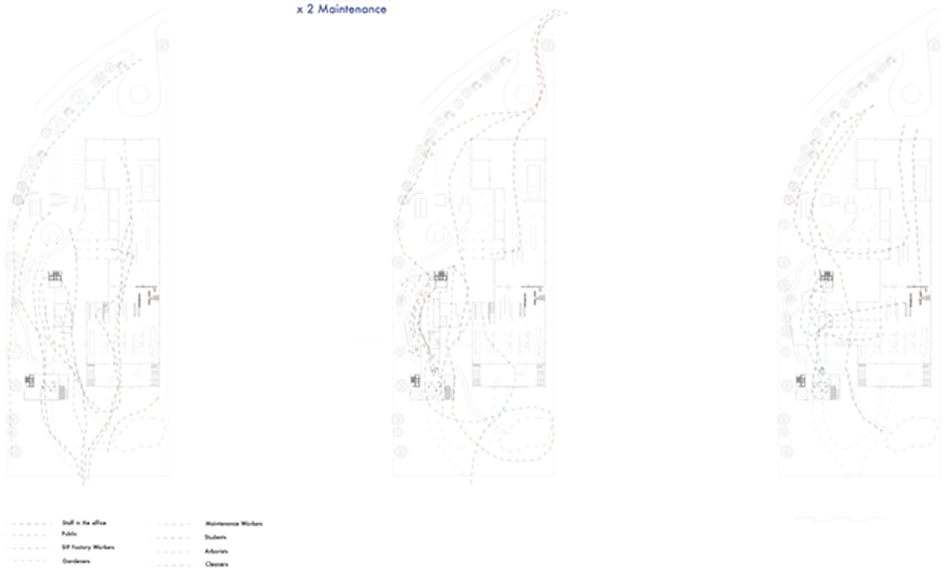
3. Dedicated space for research and development.
-Focus on exploring new technologies, materials, and construction methods to enhance SIP performance and sustainability.

4. Project Data Management:
-Centralized platform for managing project data, digital databases, software systems, and documentation.
-Facilitates efficient data access, analysis, and sharing among team members and clients.

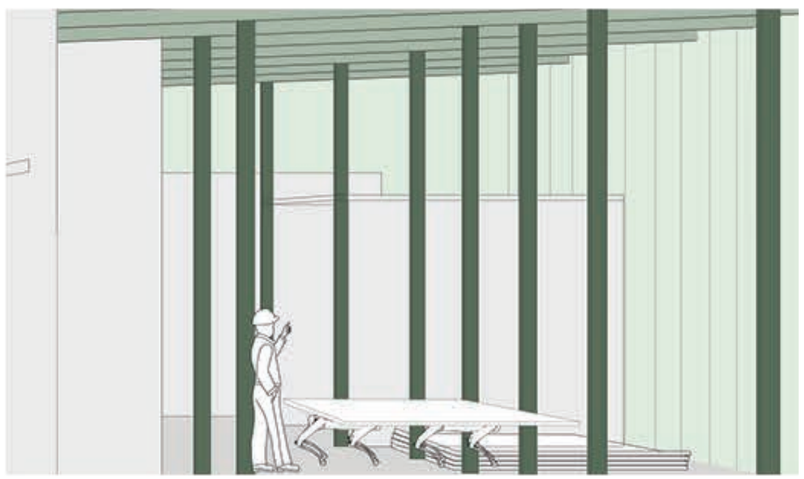


Worker, Workflow , Skills and Attributes:





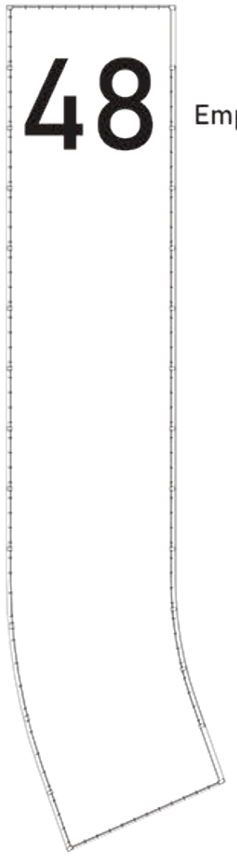
SPOT assisting in SIP Assembly Line:



QR code link to spatial temporal video representation.

Serenity Structures
Workforce #2

Claudia Sekulovski and Makara So



48 Employees

- Business Division
- Design Division
- Trade Division
- Specialists Division

Manufacturing

- Plumbing Team
- Electrical Team
- Machinery Specialists
- CarpTech Managers
- Transport Team



- Cranes
- Conveyor Track
- AI Robotics

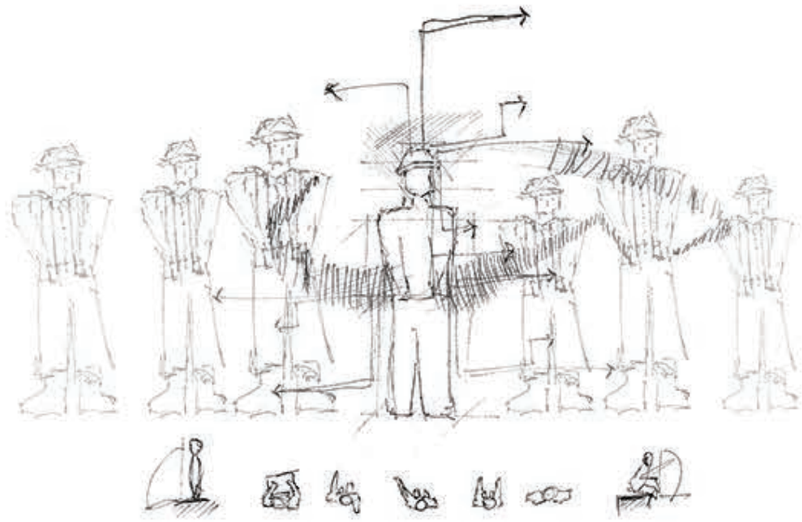
Office

- Admin Team
- Finance Team
- Marketing Team
- Sales Team
- Architects
- Engineers
- Interior Designers
- Research Specialist
- Cafe Team

Wellness

- Admin Team
- Gym Trainers
- Therapy Team
- Spa Specialists
- Maintenance Team

Prototypical Worker : CarpTech Managers



Knowledge Traits

- Construction Process
- Structure of Units
- Materiality Variations
- Management
- AI Robotics Technology

Skill Traits

- Able to read blueprints
- Able to navigate an online model of the units
- Able to adjust Robotic Technology
- Can use machinery to assist robots
- Can install components robots cannot
- Can manage a set of deliverables

Physical Attributes

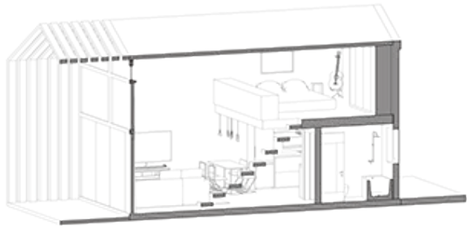
- Problem Solving Skills : able to respond quickly to issues regarding placement and technology.
- Strong Hands: mobility is quick to assemble parts if required.
- Organized: capable of delegating tasks via machinery robotics.

Education

- Qualified Carpenter with experience
- Course Certificate in Robotic Technology
- Course Certificate in Project Management

Demographic

- High Ranked – Above 40
- Entry Level – Above 25



End Outcome

A bespoke unit made volumetrically off site.



"BUILDING" 2050

QR code link to spatial temporal video representation.

Fisherman's Bend Warehouse
Workforce #3

Meka Rakhmat and James Kouskouras



TRUCK DRIVER

Pick up Kit of Parts components and deliver to KOP storage facility

3 drivers:

Kevin
Terry
Marcus

Knowledge + Skills
. VIC license + heavy vehicle license
. Must be able to comfortably and confidently drive large vehicles as well as picking up and dropping off crates



MACHINE OPERATORS

Monitor the movement in storage facility from automated electromagnetic lifts and robot sorting arms

6 operators (1 per lift zone):

Ben
Alex
Marty
Patty
Haro
Mark

Knowledge + Skills
. Must have knowledge on operation and settings of machines
. Must be able to manually operate machines if autopilot malfunctions
Safety



ADMINISTRATION TEAM

Manage orders and organise deliveries for the storage facility

3 admin workers:

Lily
Sharon
Demarcus

Knowledge + Skills
. Efficiently manage incoming orders
. Sort delivery issues and pass on instruction to drivers



DESIGN TEAM

Offer advice to clients who need help creating a building using the KOP

3 designers:

Darcy
Josh
Charlotte

Knowledge + Skills
. Know the products
. Create building suited to clients needs



MAINTENANCE CREW

Fix issues that occur in the machines to allow a safe and effective work environment

4 maintenance workers:

Coral
Flynn
Jimbo
Paul

Knowledge + Skills
. Find the source of the issue in the machines.
. Find solutions to any malfunctions that retain safety and effectiveness



CONFERENCE CENTRE WORKERS

Event preparation

6 event workers:

Amber
Michelle
Cameron
John
Nancy
Kate

Knowledge + Skills
. Prepare the conference centre for specific events
. Catering
. Serve food for workers



QUALITY CONTROL

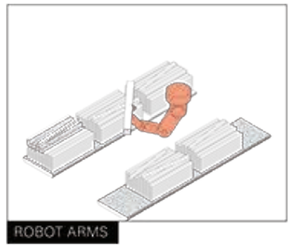
Check products to check if they are up to standard

3 quality control workers:

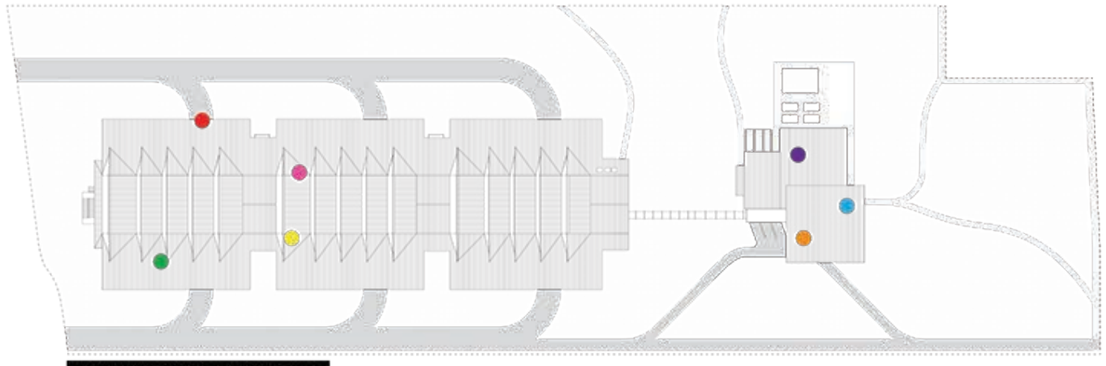
Lauren
Harold
Muhammad

Knowledge + Skills
. Know the products
. Assess and check for defects
. Fix in real time

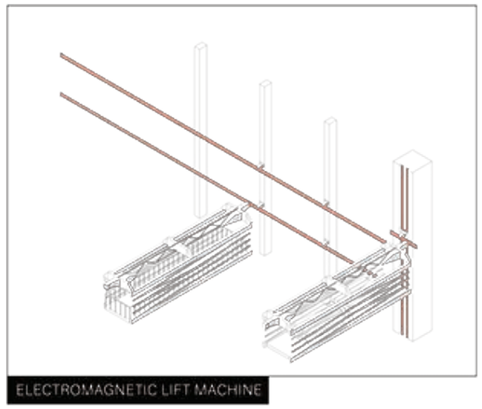
EMPLOYEE PROFILES



ROBOT ARMS



EMPLOYEE ZONES / CIRCULATION



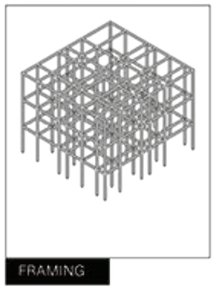
ELECTROMAGNETIC LIFT MACHINE

"BUILDING" 2050

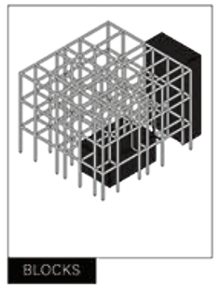
QR code link to spatial temporal video representation.

Kit Of Parts System

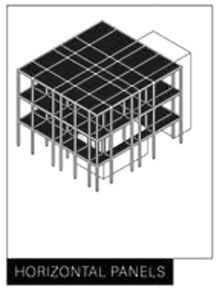
The following Kit Of Parts is based on Kieren Timberlakes Elements of New Architecture. This is the kit of parts that will stored in the warehouse/library facility in Fishermans Bend.



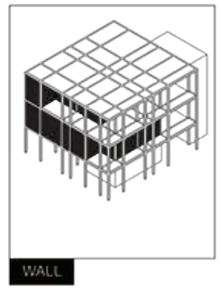
FRAMING



BLOCKS



HORIZONTAL PANELS

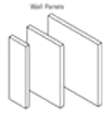


WALL









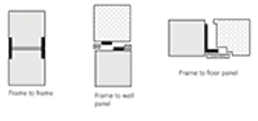








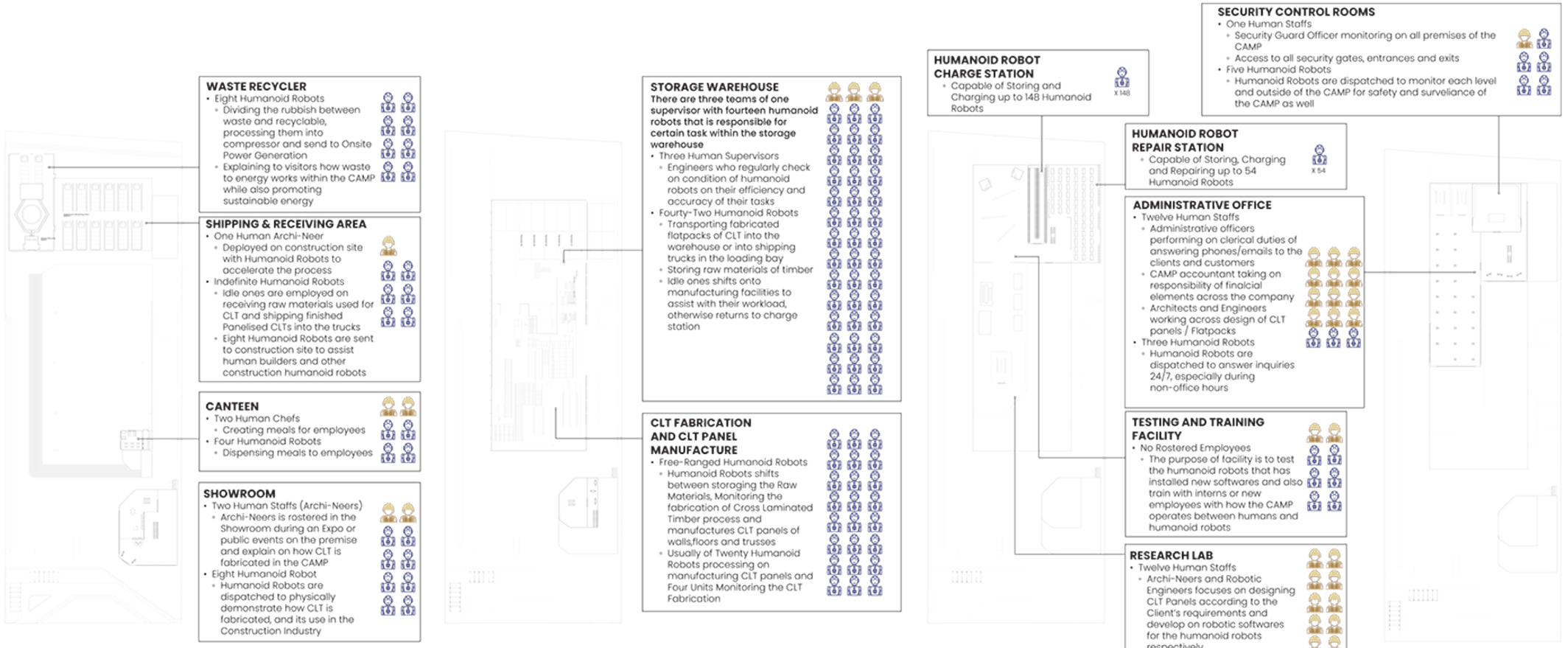
Example Connections (sections)



(Left) The building describes the chronological order for assembly using the Elements of New Architecture. The site would be prepared for assembly beforehand i.e earthworks and footings. The larger of the interior blocks may need to be installed in conjunction with the framing. Horizontal Panels refer to both roofing and flooring panels .

CLT Hub
Workforce #4

Cho Woo Jin and Chin Chang Hung



DESIGN & CONSTRUCTION TEAM



Position: Master Architecture
Profession: Sustainable and Contemporary Architecture
Education: Master of Architectural Design at Monash University

Knowledge Traits:
- Architectural Design Principles
- Environmental Sustainability
- Materials and Contemporary Technology
- Construction Administration Skills
- Structural Engineering Knowledge

Skill Traits:
- Collaborative Communication with Engineers and Stakeholders
- Design and Modeling Skills
  - Building Information Modeling
- CLT Design Proficiencies

Special Augmentation : AR GOGGLES and Gen II Nanosuit



Position: Principal Robotineer
Profession: Robotic Engineer & Researcher
Education: Master of Advanced Robotic Engineering in Waseda University

Knowledge Traits:
- Electrical Engineering
- Computer Science
- Robotics Engineering
- Sensor Technology
- Artificial Intelligence and Machine Learning
- Studies

Skill Traits:
- Adaptability to New Technologies
- Attention to minor and major details
- Programming
- Testing and Debugging
- Continuous Learning
- Communication and Teamwork

Special Augmentation : Augmented Glasses and Gen II Nanosuit



Position: Professional Archineers
Profession: Structural and Mechanical Engineer + Architecture
Education: Master of Structural Engineer and Architectural Design

Knowledge Traits:
- Understanding of Timber Knowledge
- Knowledge of CLT Properties and Behavior
- CLT Design Expertise
- Building Codes and Regulations
- Sustainability Design Principles

Skill Traits:
- CLT Design Proficiencies
- Structural Analysis Software Proficiency
- HVAC System Design for CLT Structures

Special Augmentation : Pasteel HSA Helmet, AR Goggles, Gen II Nanosuit

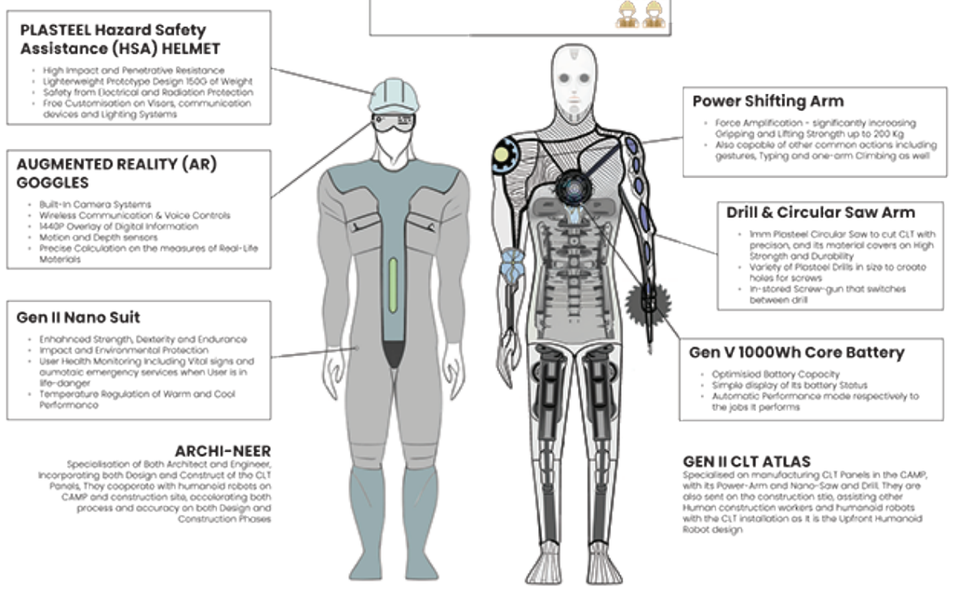


Name: CLT Atlas
Generation: Fourth Generation
Profession: CLT Fabrication
Creator: Santiago Barros Robotics Organisation

Knowledge Traits:
- CLT Knowledge
- Fluent Proficiencies in Languages of English, Japanese, Chinese and Spanish
- Environmental Sustainability

Skill Traits:
- Dexterity and Strength
- Precision and Accuracy of CLT Design measurements
- Teamwork Organisation

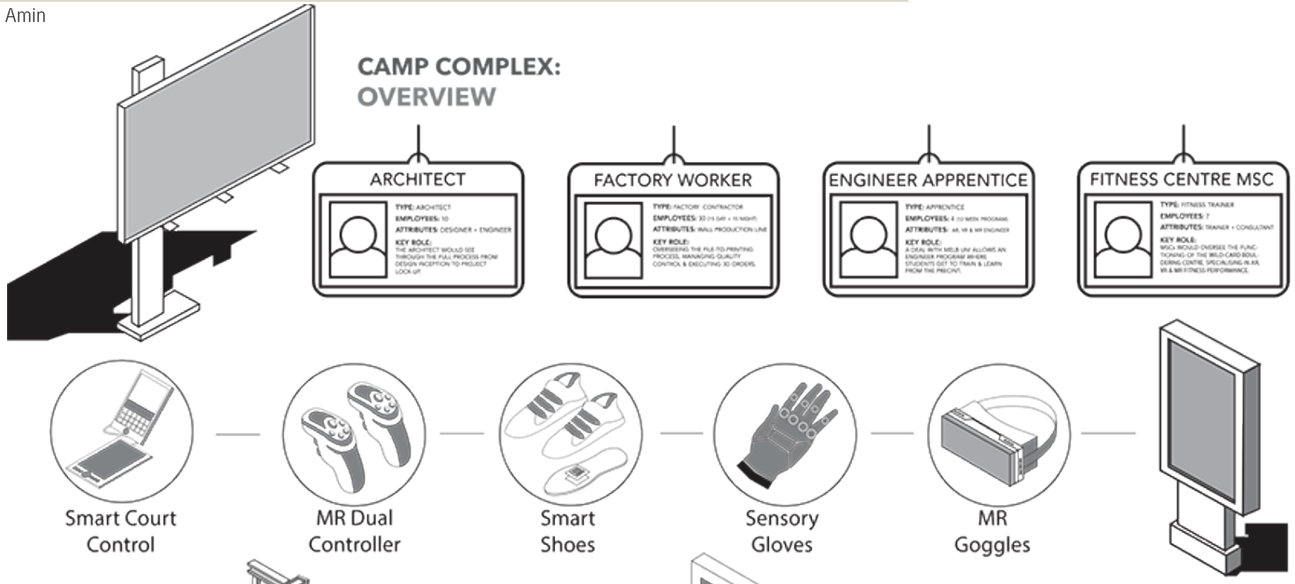
Special Augmentation : Sensor Fusion Technology & Modular Tool Attatchments of Chainsaw, Power Hammer and Drills, 200Kg Power Shifting Arm

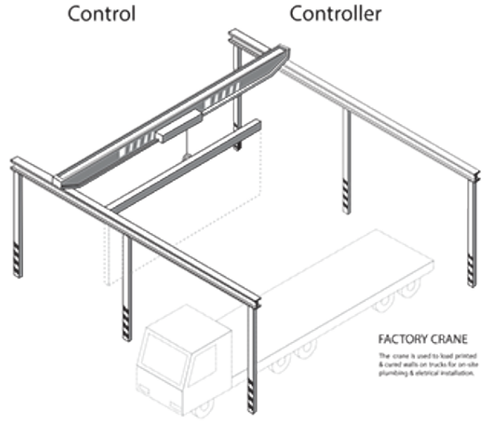


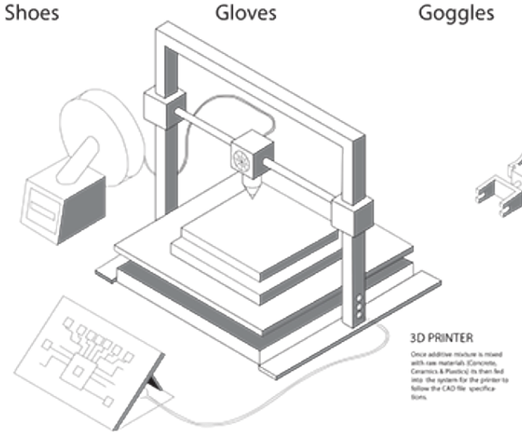
QR code link to spatial temporal video representation.

Vertical Forge: Fusion of Walls and Ascension
Workforce #5

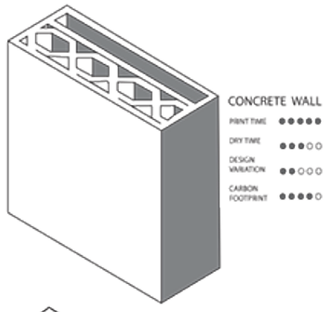
Robin Deepthi Mahanthi and Sara Amin

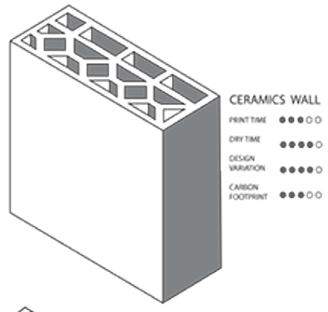


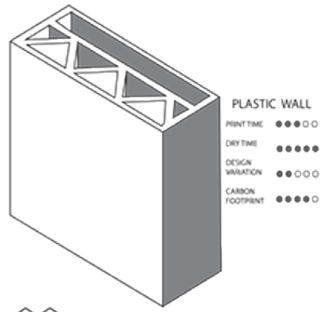








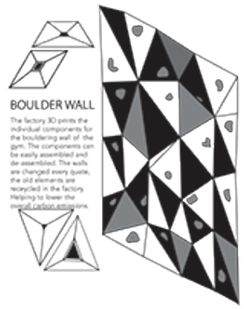








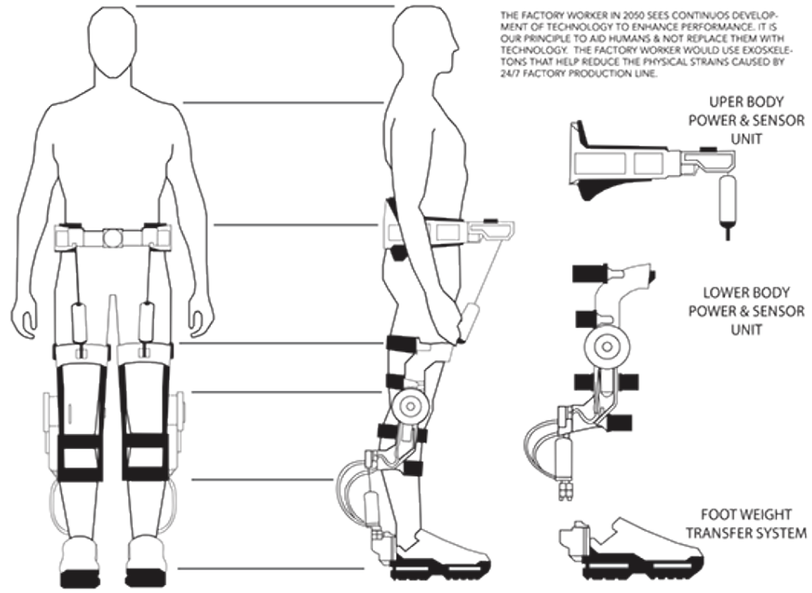


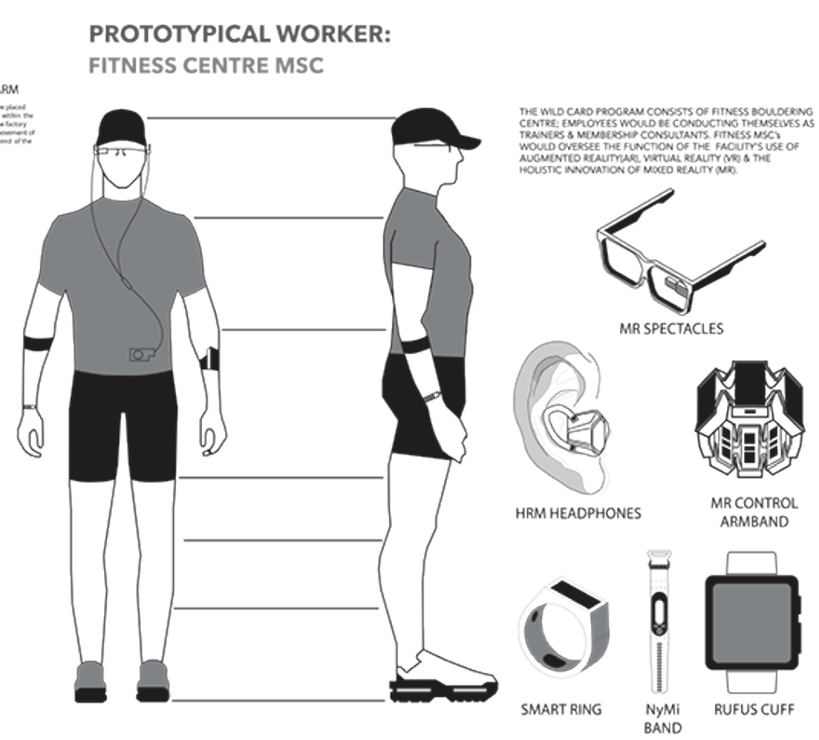






QR code link to spatial temporal video representation.

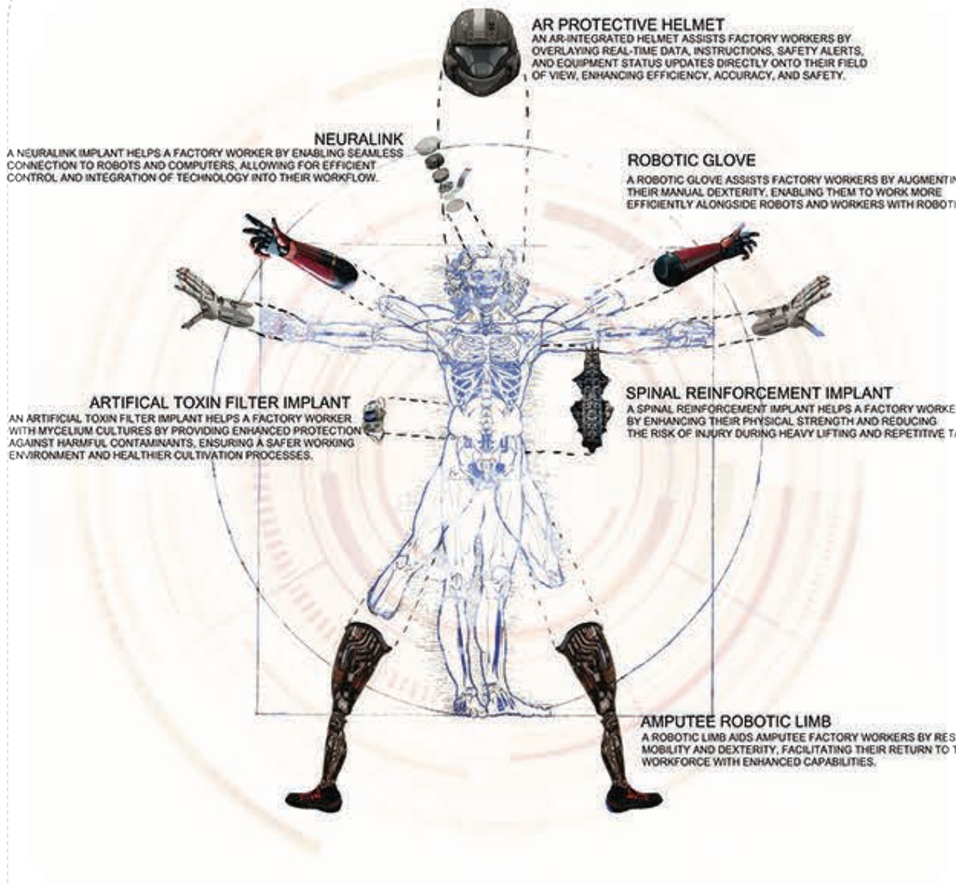


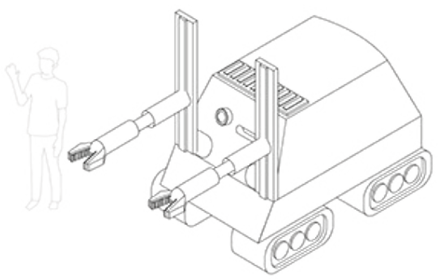


BiWell Mycelium Works
Workforce #6

Jarrad Frahamer and Saida Bakhsh

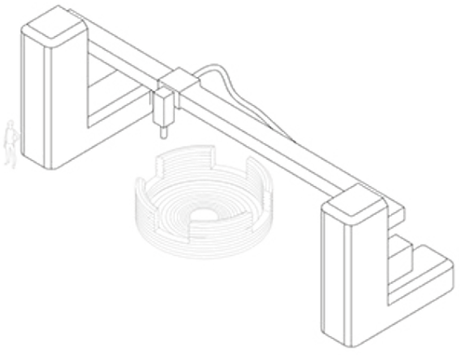
FACTORY WORKFORCE





AUTOMATED FORKLIFT

A ROBOTIC FORKLIFT STREAMLINES THE MOVEMENT OF HEAVY EQUIPMENT AND MATERIALS, ENHANCING EFFICIENCY IN FACTORY OPERATIONS WHILE ALSO IMPROVING SAFETY FOR WORKERS BY REDUCING THE RISK OF MANUAL HANDLING INJURIES.



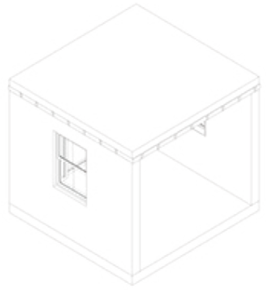
AUTOMATED LARGE FORMAT 3D PRINTER PLATFORM

LARGE FORMAT PRINTERS ASSIST IN PRODUCING BUILDINGS BY ENABLING THE EFFICIENT CREATION OF ARCHITECTURAL PLANS, BLUEPRINTS, AND CONSTRUCTION DRAWINGS AT SCALE.

"BUILDING" 2050

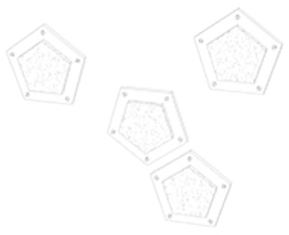
QR code link to spatial temporal video representation.

FACTORY PRODUCTS

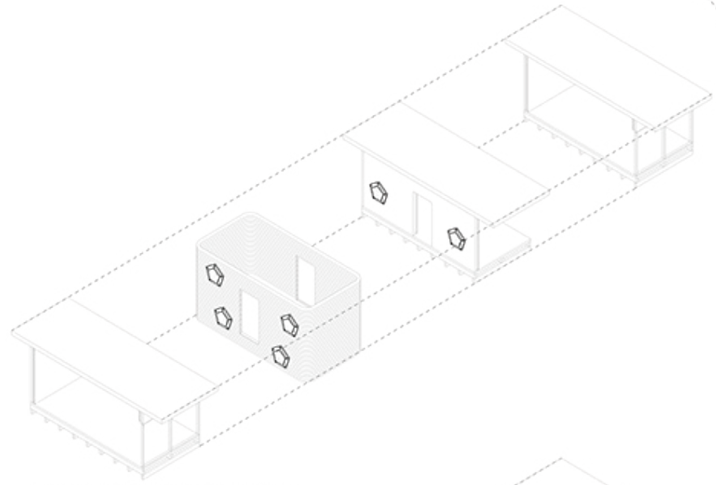


TRADITIONAL RECTILINEAR MASS PREFABRICATION

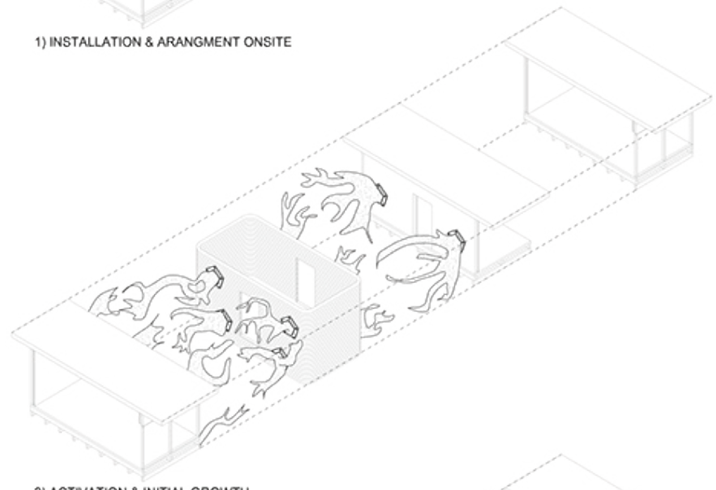
LARGE FORMAT 3D PRINTED BESPOKE PREFABRICATION



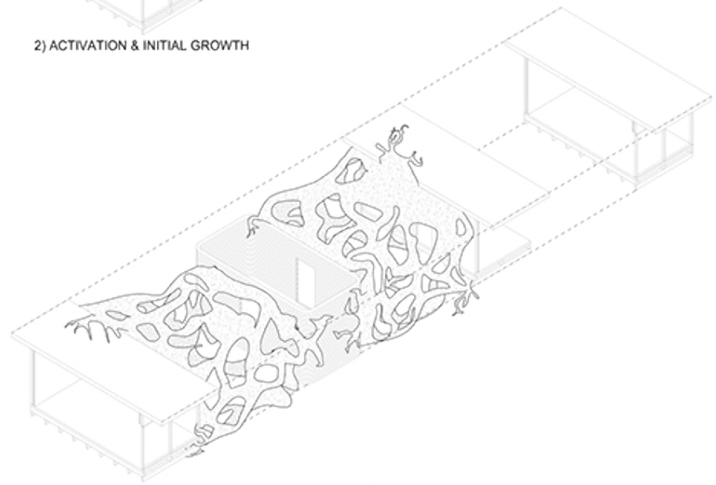
MYCELIUM JOINER STARTER PANELS



1) INSTALLATION & ARANGMENT ONSITE



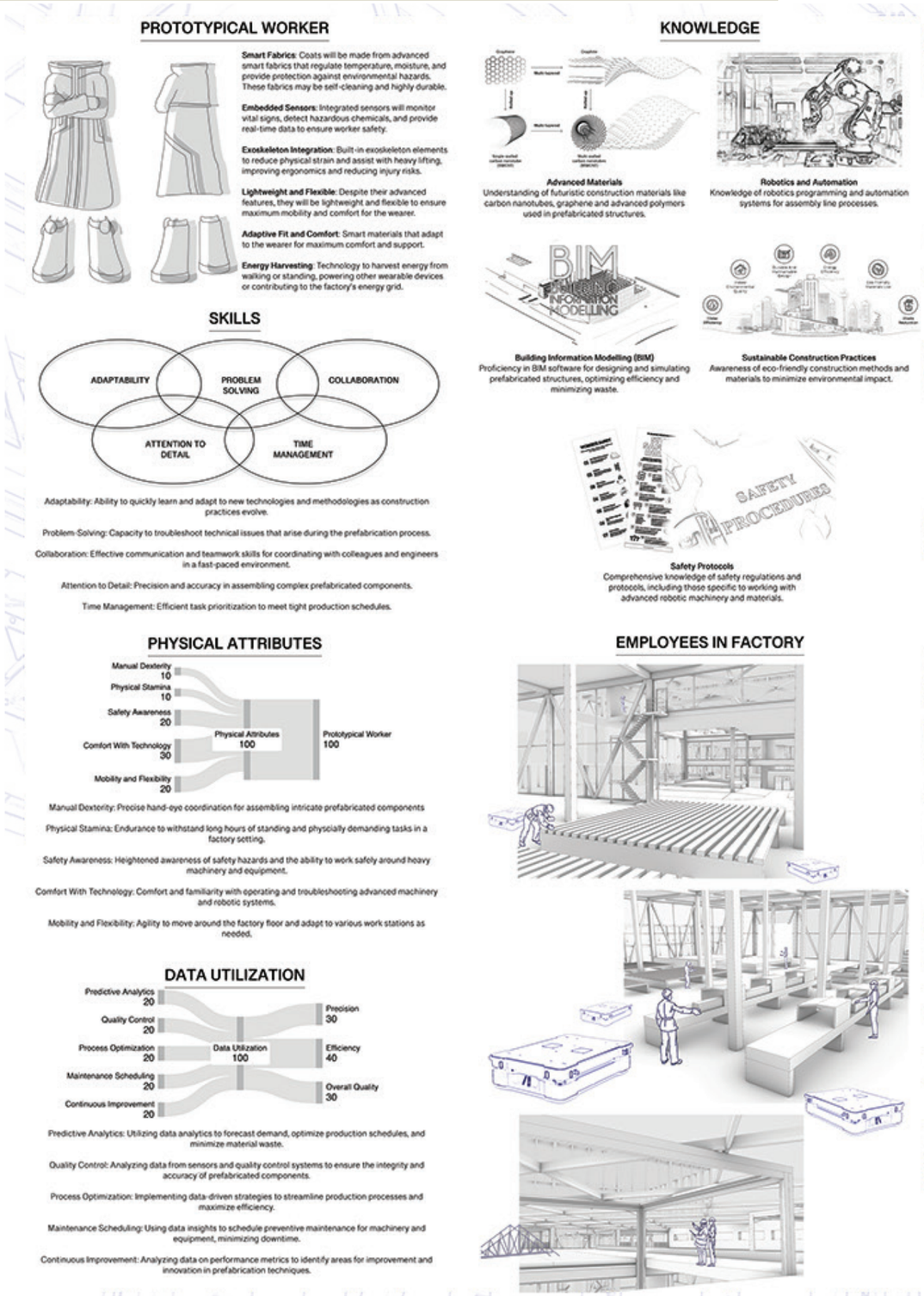
2) ACTIVATION & INITIAL GROWTH

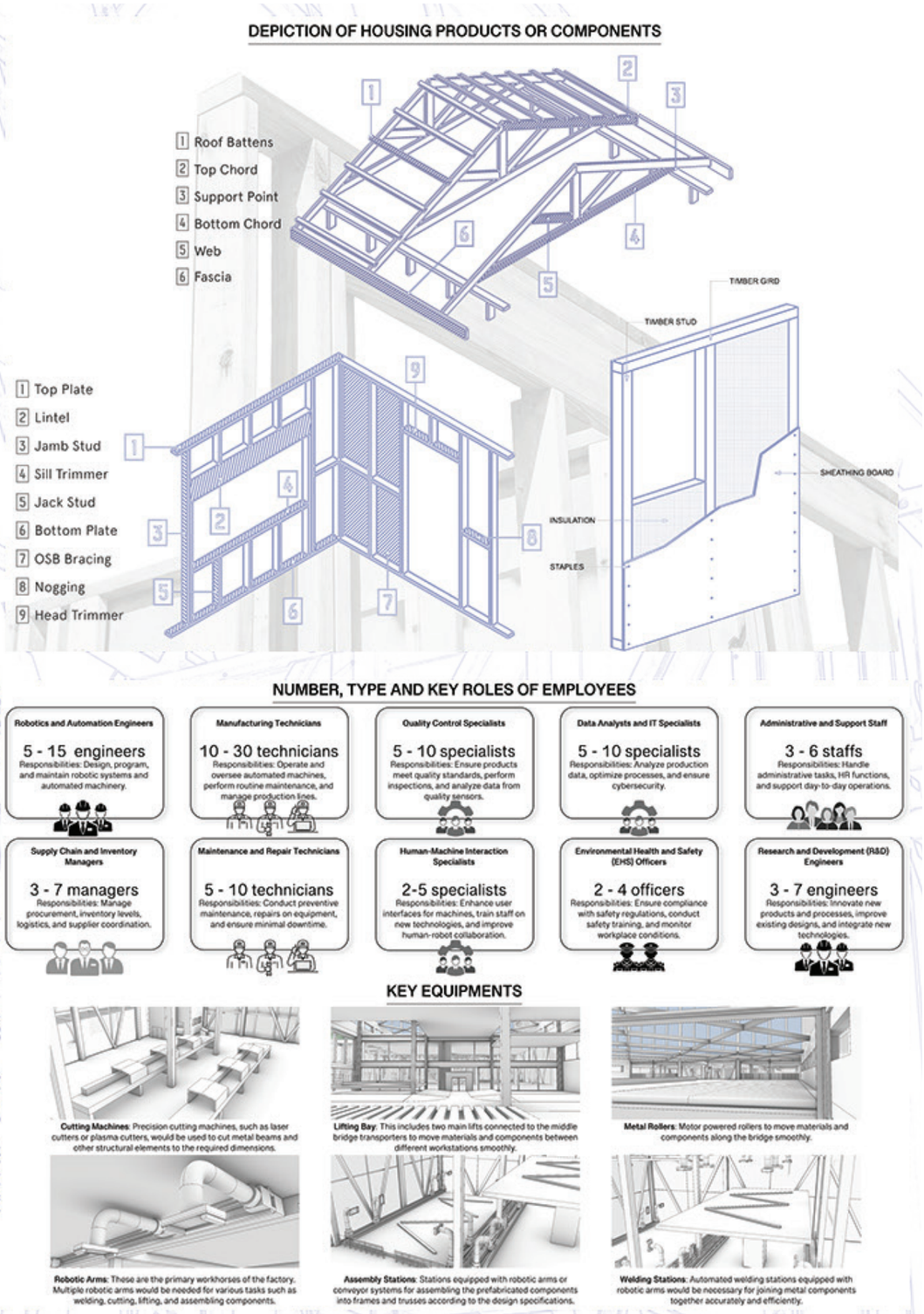


3) MYCELIUM GROWTH STOPPED & STRUCTURE COMPLETE

SmartBuild Incubator
Workforce #7

Marlow Brown and Su Wutt Yee





"BUILDING" 2050

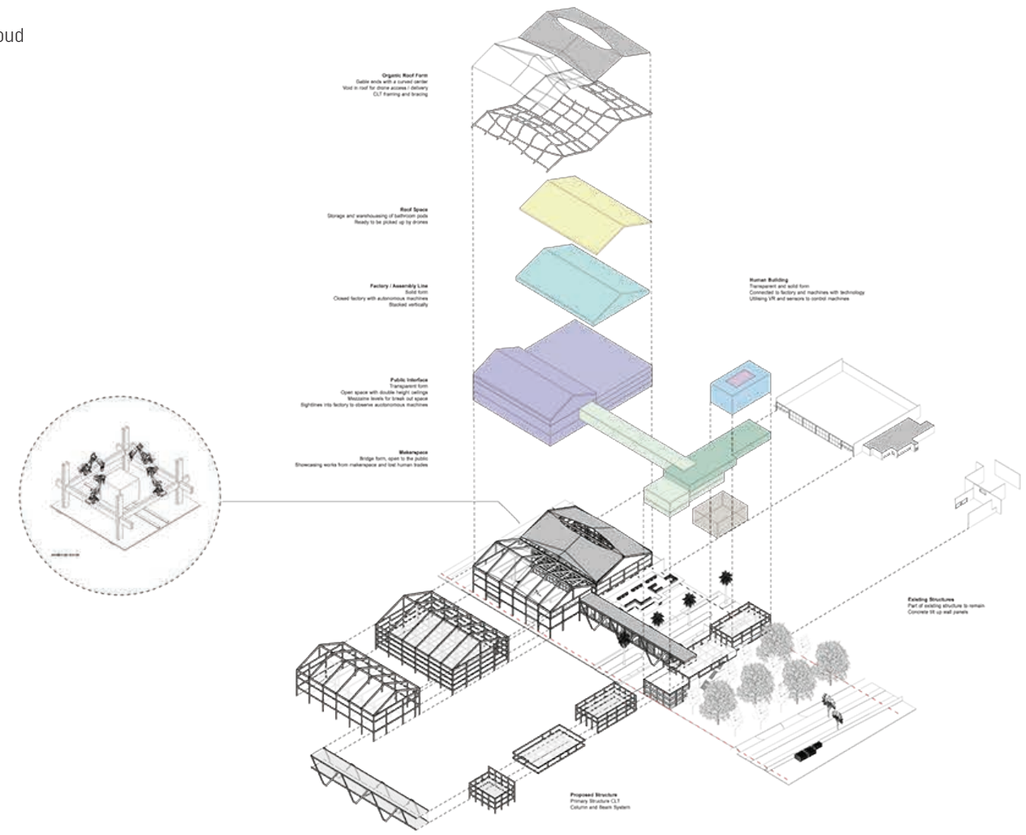
QR code link to spatial temporal video representation.

Autonomous Manufacturing and the Preservation of Trade

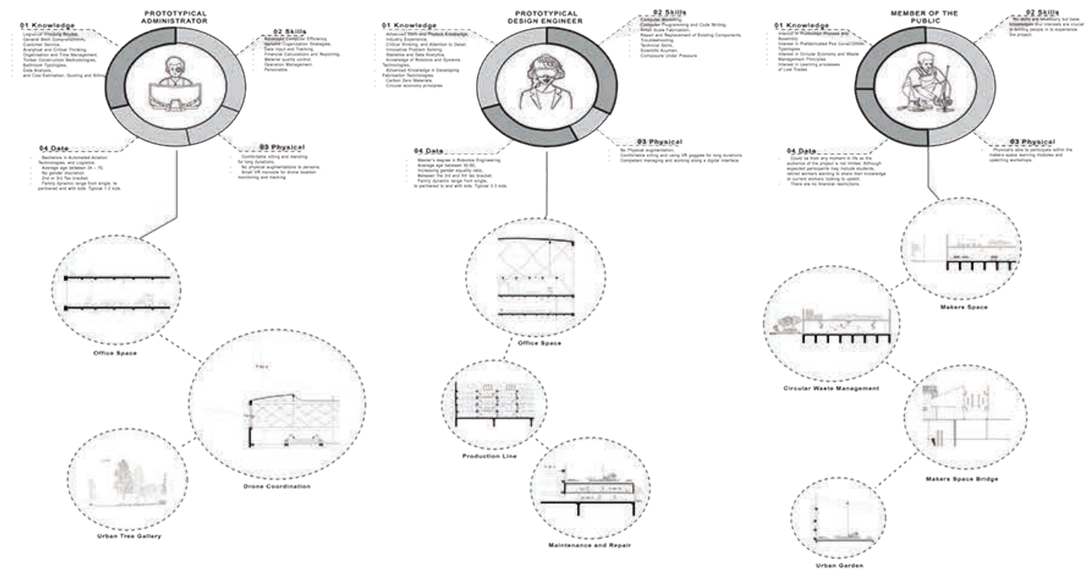
Workforce #8

Blair Albrecht and Trent van Elwoud

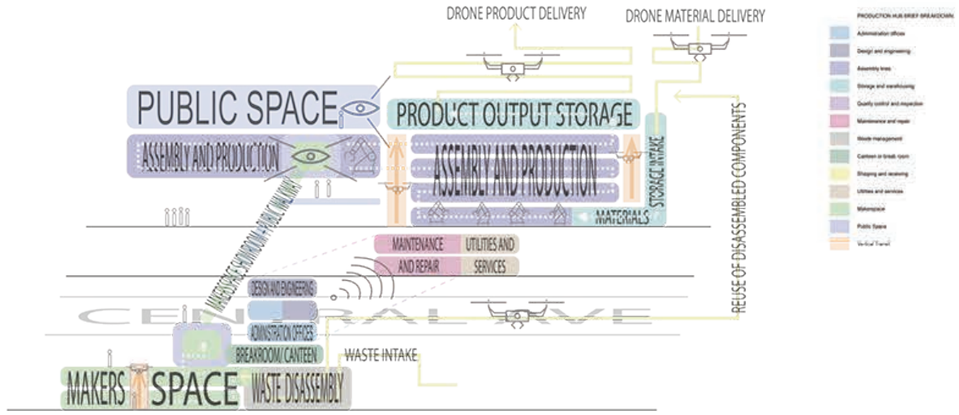
C.A.M.P Complex Profile



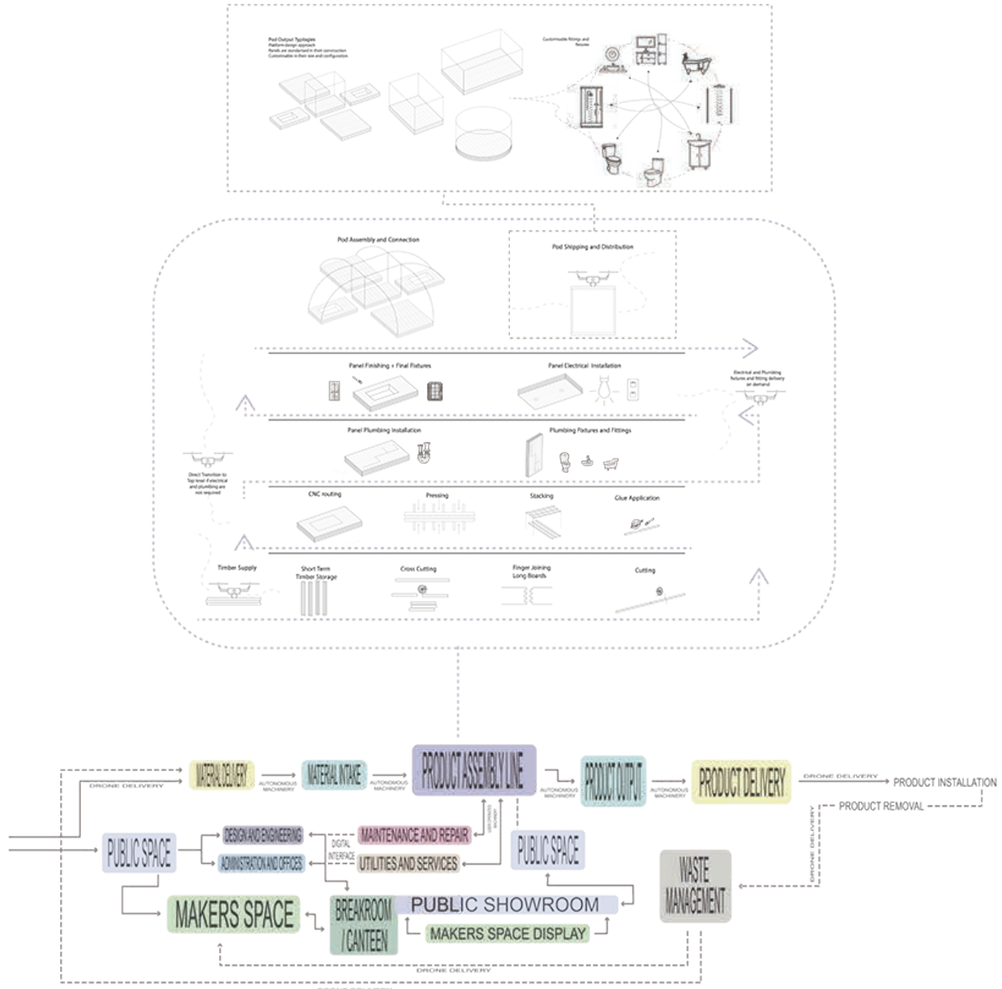
C.A.M.P Worker Profiles



C.A.M.P Complex Program Diagram



C.A.M.P Complex Production Flow Diagram



QR code link to spatial temporal video representation.

Robo Factory
Workforce #9

Tong Zhao and Somana Sok

HUMAN



Materials Scientists

Develop new materials optimized for 3D printing processes, with a focus on enhancing properties like strength, durability, and flexibility.



Robotics Engineers

Skilled in designing, programming, and maintaining advanced robotic systems.



Maintenance Workers

Specialize in maintaining and repairing the mechanical components of 3D printers and other manufacturing equipment.



Quality Control and Assurance Specialists

Ensure products meet quality standards through rigorous testing and inspection.

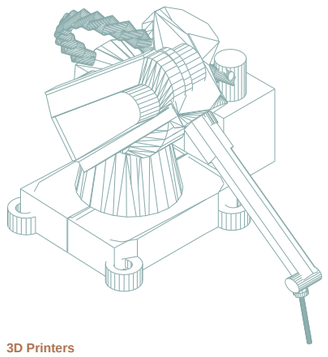


Logistics and Inventory Personnel

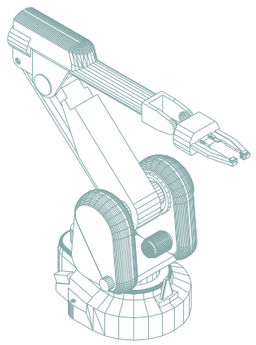
Effectively manage the flow of materials and products, optimize inventory levels.

-Sustainability Experts
-Safety Inspectors
-Cybersecurity Professionals
-Supervisors and Managers

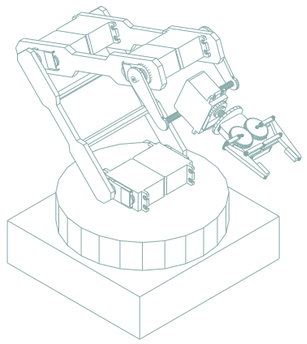
NON-HUMAN



3D Printers

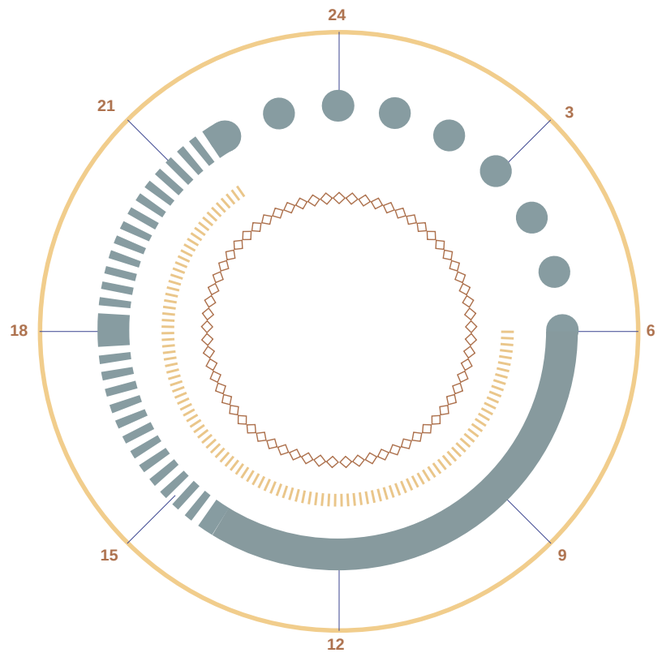


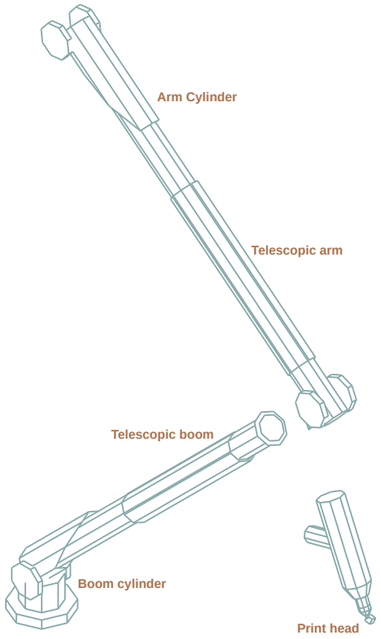
Robotic Arms

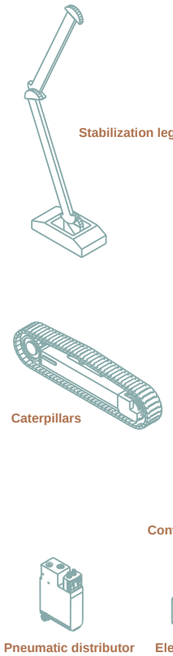


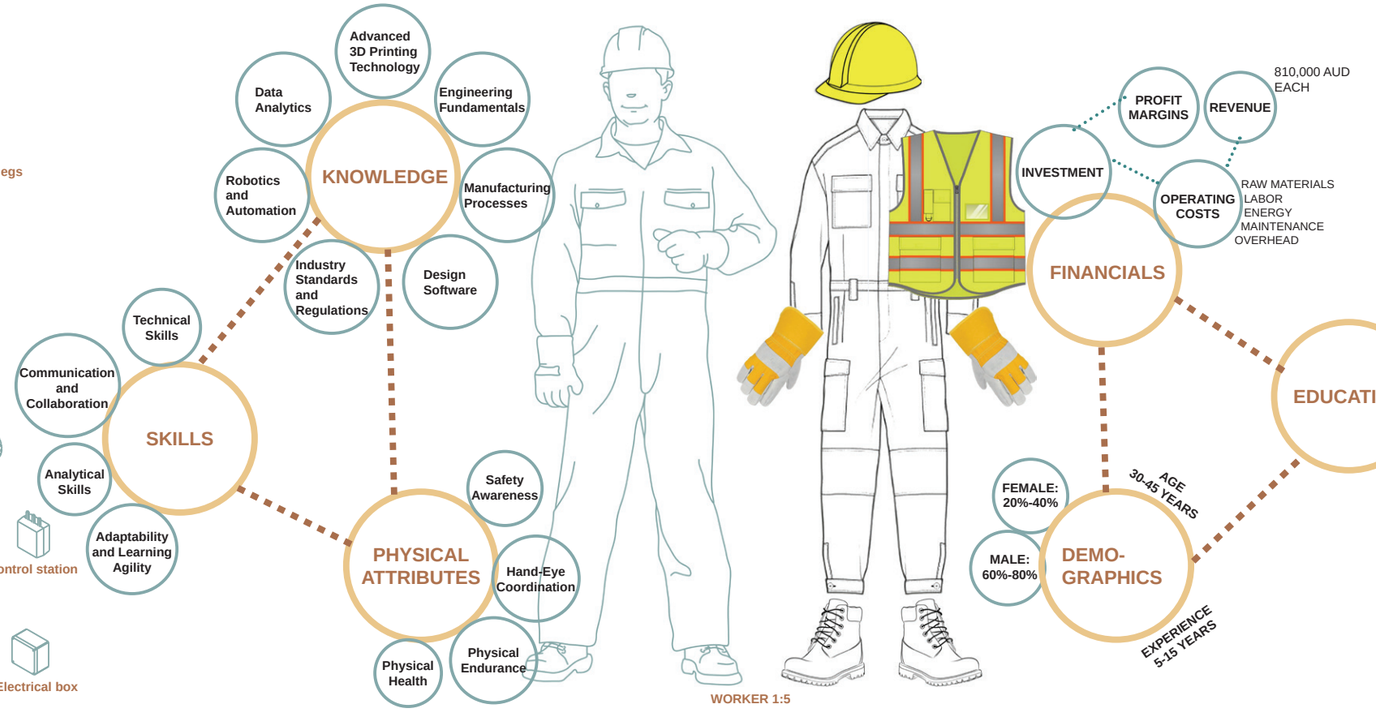
Robotic Arms

- **Automation System**
- **Quality Inspection Systems**
- **Environmental Monitoring Systems**
- **Advanced Manufacturing Technologies**
- **Safety Equipment and Systems**









QR code link to spatial temporal video representation.

1.3 Exhibitions and Showcase Forum Photos


4.0
ANNUAL SHOWCASE
AND FORUM
WED 19 JUN 2024


"BUI
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"BUI
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2050

Precedent Research Index:

02 Research Contexts:

Task Over View:

The "Building 2050" studio aimed to produce building designs based on an intellectual framework established through a series of preliminary studies. The first preliminary study conducted was divided into two parts (1.1 Reading and 1.2 Technology or Precedent). The studio was split into pairs that had to analyse and visually interpret the key findings or recommendations from assigned readings. The readings, varying from reports to narratives, had to be creatively summarised in a graphic presentation, highlighting potential changes in the building industry and possible impacts on the workforce. At the same time, investigating and researching a disruptive technology or precedent to illustrate its impact on the building workforce and the opportunities for innovative change.

Research Outcome:

Short paragraph talking about the successes and learning oportunities uncovered by the class and the significances of conducting this intial reasearch.

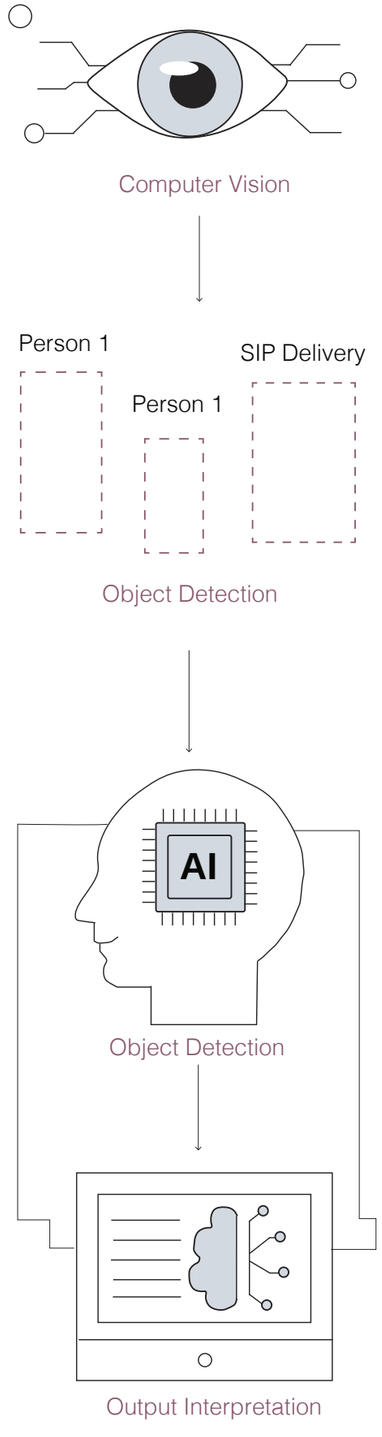
3.1: A house is not a Car (Yet), by Aitichison +
3.2: Computer Vision

The article "A House is not a car yet" examines the historical interconnection between Australia's automotive and housing sectors, explicitly addressing the current challenges of a housing affordability crisis and the diminishing automotive manufacturing presence. The author emphasises the need to understand housing's distinct characteristics compared to other industries. Proposing a departure from the stereotype of industrialised housing as a mere "good idea" with inadequate execution, the article advocates for innovative and disruptive solutions to meet housing demands. It delves into the historical context of prefabricated housing in Australia, highlighting the mining industry's influence. The narrative underscores discerning disparities between houses and cars as industrial products, fostering informed approaches to industrialised building production. The article concludes by advocating for collaborative efforts between the housing and automotive industries to address challenges within the housing sector comprehensively.

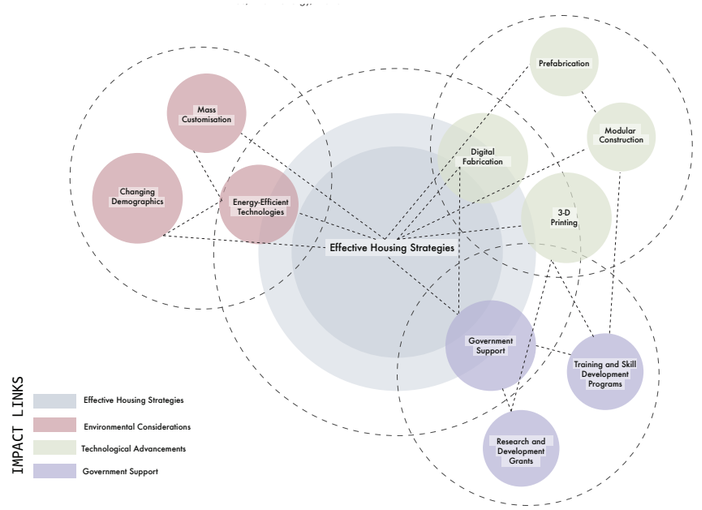
This next section of the reading shifts from historical analysis to the practical insights from industry. The discussion builds on prior research, introducing additional reasons cautioning against drawing a direct analogy between the housing and automotive industries. Notable points include the sheer size disparity between houses and cars, the challenges of breaking down houses into discrete parts, site-specific complexities, diverse user needs, and the profound impact of climate on housing. The reading also explores the intricate web of building codes, materials, tolerances, customisation, perception, and the significant financial disparity between houses and cars. This examination encourages a thoughtful reconsideration of the applicability of automotive industry practices to housing.

Computer vision is a field of artificial intelligence (AI) and computer science that enables machines to interpret and understand visual information from the surrounding environment. At its core, computer vision seeks to replicate the human visual system by processing digital images or videos to extract meaningful insights and make informed decisions. It involves a series of sophisticated algorithms and techniques, including image acquisition, preprocessing to enhance image quality, feature extraction to identify relevant patterns or objects, recognition and classification to label and categorise elements in the images, and finally, output interpretation where the results are analysed and acted upon. Computer vision finds applications across various industries such as healthcare (medical imaging), automotive (autonomous vehicles), retail (object detection for inventory management), security (facial recognition), and more, revolutionising how machines perceive and interact with the visual world.

Saraf Golpo and Rehila Hydari



Computer Vision Diagram.



Effective Housing Strategy Diagram

This diagram is exploring understanding Computer Vision in relation to Housing and Car manufacturing - digital and automated fabrication methodologies, with increasingly powerful computational design tools; rising concern for environmental sustainability and energy use, creating demand for high-performance, low-energy, and zero-carbon buildings.

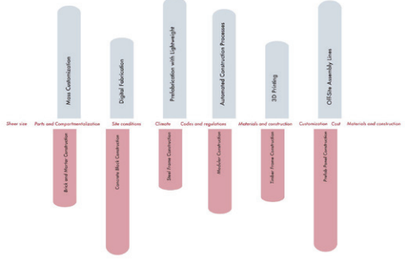
Understanding Specificities: Both have a call for a deeper understanding of specificities. In computer vision, this translates to the need for algorithms that can interpret diverse visual data, similar to the text's emphasis on understanding the unique characteristics of housing.

Breaking Stereotypes: The text emphasis breaking free from stereotypes in the housing industry, computer vision theories often strive to move beyond traditional approaches, embracing more innovative methods. Such as breaking away from conventional image recognition models towards techniques like deep learning.

Comparative Analysis: The article highlights the importance of comparing housing and automotive industries while acknowledging their differences. In computer vision, comparative analysis involves understanding the distinctions between various models and algorithms to determine their effectiveness in different scenarios.

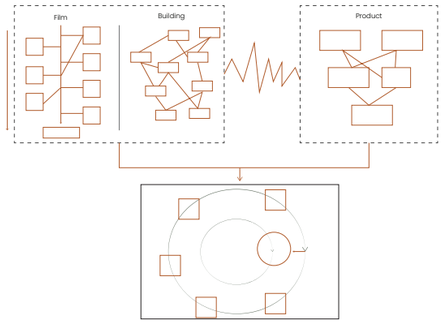
Innovative Solutions: The call for innovative and disruptive solutions in housing parallels in computer vision for novel approaches to improve accuracy, efficiency, and adaptability in recognizing and interpreting visual information.

Collaboration: The housing and automotive industries resonates with the collaborative efforts in computer vision research and application development. Cross-disciplinary collaboration often leads to more comprehensive solutions

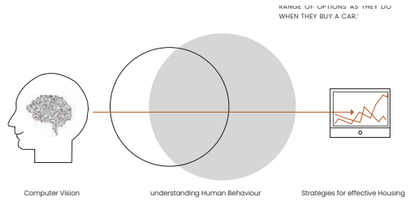


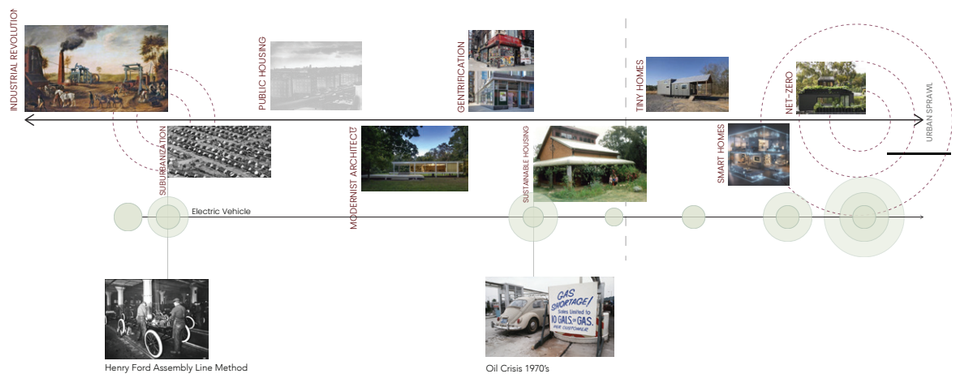
‘People often ask me ‘Why prefabrication?’ and I make an analogy with automobile production. Cars–whether top-of-the-line BMWs or economical Saturns–are all produced in a factory, thus eliminating the variables that come with an uncontrolled environment and guaranteeing efficiency and standardization in construction. It’s useful to look at the fabrication of houses in the same way. To be sure, there are poorly constructed Factory-built homes, just as there are cheap cars. But luxury cars are also factory-built and, as we’ve shown, well-designed homes can be, too.’

‘Toyota demonstrated that factory-made products, even complicated ones like cars, did not all have to be identical. The factory could adapt and, within limits, make whatever the customer wanted. When applied to housing customers can participate in the design of their house, at least to the extent of choosing from a range of options as they do when they buy a car.’



These diagrams explore management styles, How other sectors go about managing their process and system and what the building sector can adapt/learn from?





Housing Landscape Context Development Diagram

This representation conveys the importance of comparing housing and automotive industries while acknowledging their differences. These can be taken as date in computer vision, where comparative analysis involves understanding the distinctions between various models and algorithms to determine their effectiveness in different scenarios.

3.1 Processes We Do Not See, by Kieran and Timberlake +
3.2 Artificial Neural Networks (ANNs)

Kieran and Timberlake highlight areas of Focus with relation to the future of Architecture, including:

1. Defying Gravity
2. Part by Part Construction
3. The Goliath Scale
4. Grand Blocks
5. Production Evolution
6. New Modular Production
7. Modular Production Supply Chain
8. A Harmonious Supply Chain
9. The Art of Joinery
10. Reduction Theory
11. The Final Assembly

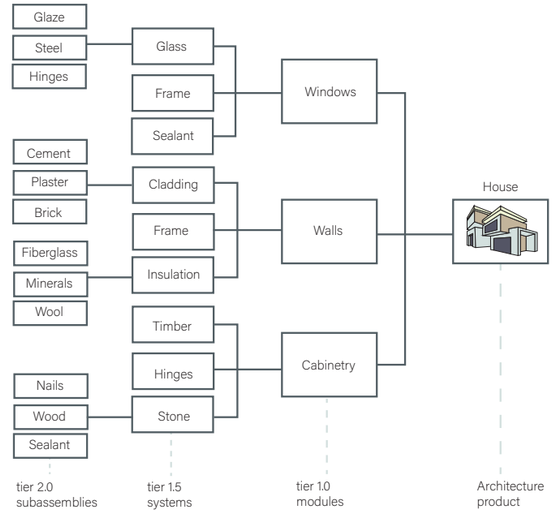
Reading ‘the processes we do not see’ illustrates an outlook into modular systems. In the book, it is applied to large objects rather than architecture itself, but by delving into the history of building large objects, you can notice the patterns and themes that architecture took throughout the same time. Noticing the changes in modular design shows us that architecture will further innovate the idea of modular components within their design, where the ultimate goal is to achieve efficiency and “get more for less” (91, Kieran and Timberlake)

A Harmonious Supply Chain

Conveys that the best cars in the world today are manufactured with parts that multiple other separate companies make, but when put together for one car, they fit perfectly. The same could be said for architecture and the materiality supply chain. Good architects have the ability to source the best components, materials, strategies that ultimately can work harmoniously together in one build. This equivalates differently to stakeholders of a building such as, construction workers, project management, engineers, etc.

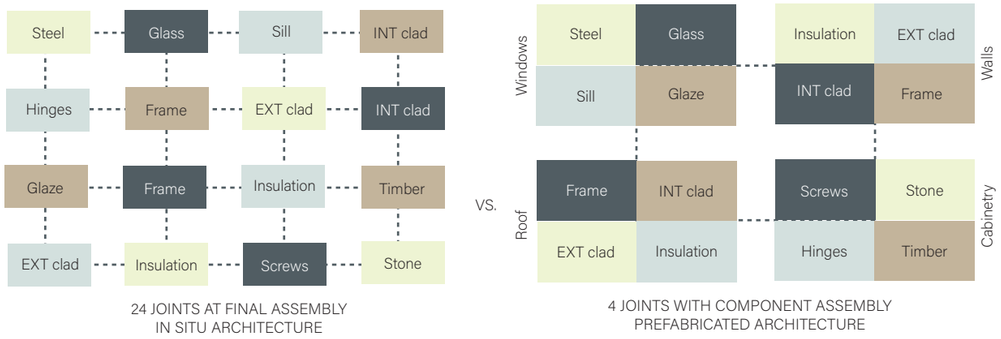
Reduction Theory

“Now take the mathematics of joining onto the assemble floor or to the building site. Each joint is now a matter of craft […] The sheer volume of parts at the point of final assembly is a logistical log jam. Shortcomings in quality in this method of assembly were inevitable, as were issues of productivity and cost” (95, Kieran and Timberlake).



“The production chain is condensed so that as few parts as possible arrive at the point of final assembly”
(87, Kieran and Timberlake)

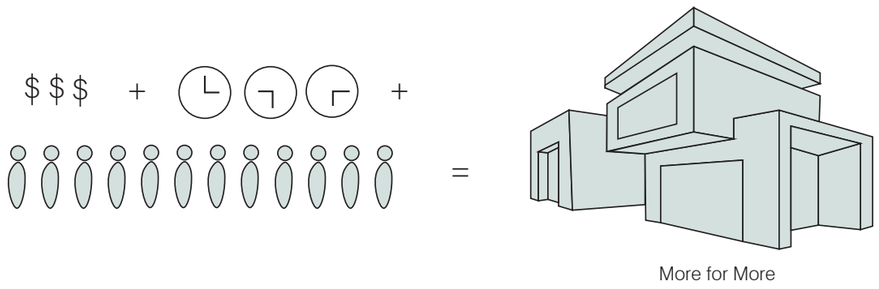
Housing Landscape Context Development Diagram



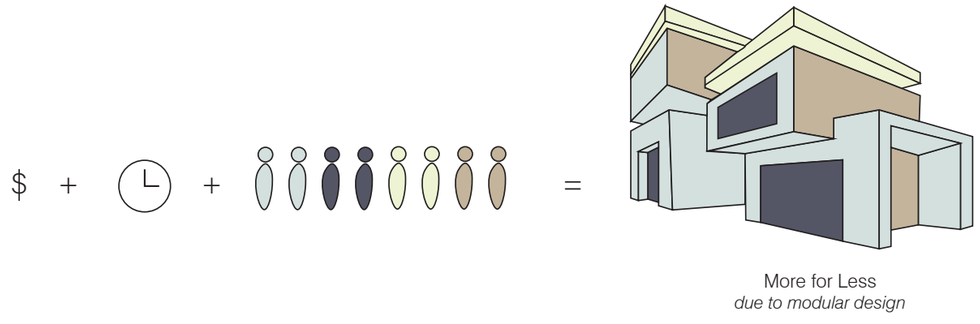
24 JOINTS AT FINAL ASSEMBLY
IN SITU ARCHITECTURE

4 JOINTS WITH COMPONENT ASSEMBLY
PREFABRICATED ARCHITECTURE

This diagram begins to make an interesting comparison and connection to architecture. Because in-situ architecture is usually considered an art craft, or sculpture of building, where the concrete pour would be different in every location but if it were poured in a factory the standardisation of it would make it less of a body of artwork rather than just a module.



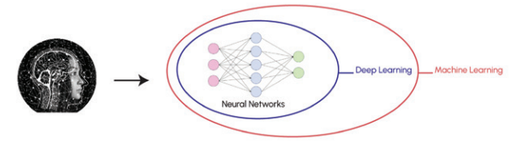
More for More

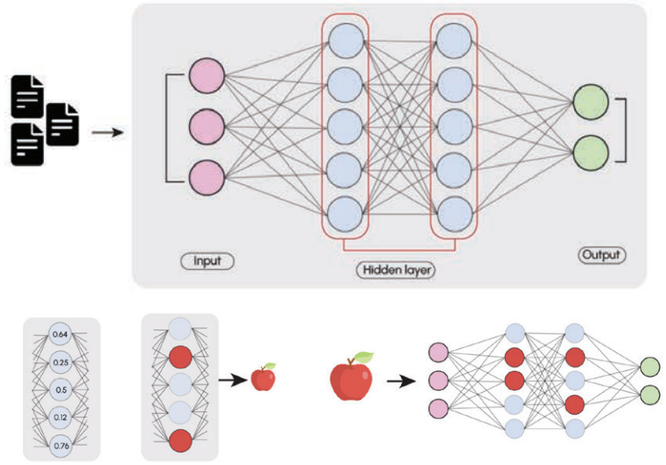


More for Less
due to modular design

This diagram illustrates the notable changes highlighted in modular design, portraying that architecture will further innovate the idea of modular components and its integration within design. "If you do not believe that less is more, anyone can get you more for more, but it takes a genius to get more for less" (91, Kieran and Timberlake)

Artificial Neural Networks (ANNs) are computational models inspired by the human brain, that are designed to recognise patterns and solve complex problems through a system of interconnected nodes or 'neurons.' In architecture, ANNs could theoretically be are applied in various ways, such as optimising building designs, enhancing energy efficiency, and improving structural analysis. The ability to analyse vast amounts of data from simulations and real-world conditions, enables architects to create more sustainable and innovative structures. ANNs can also assist in the generation of architectural layouts and automating the design processes, streamlining workflows, and facilitating creative explorations.



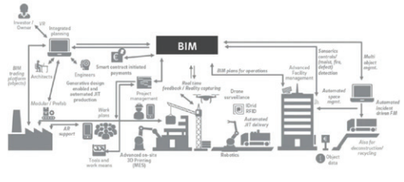


The series of diagrams illustrate the process of A.N.Ns,from data input to, the recognition of inputs and patterns to ultimately producing predicted outputs.

Effects of Artificial Neural Networks
Issue: The construction sector requires a high energy and resource-demanding field, produces a significant amount of greenhouse gas emissions and waste generation.

Key Solutions Include:
-Being sustainable with the help of ANNs system, AI or machine learning providing informed guidance.
-Can it be used for the sustainable development in the construction industry, due to accuracy and efficiency in control, materials testing and controls, energy management, decision making and forecasting.

Future of Artificial Neural Networks
The construction industry incorporates ANNs system, AI, machine learning for:
Predictive maintenance
• Safety monitoring
• Real-time project optimisation



Robotics and autonomous construction equipment may become more commonly used, improving efficiency and decreasing the likelihood of accidents.

Overall, the potential ability to learn from data and adapt to new information makes ANNs a valuable tool worth exploring its integration into modern architectural practice and design.

3.1 Waste Equals Food, by McDunnough and Braungart +
3.2 3D Printing

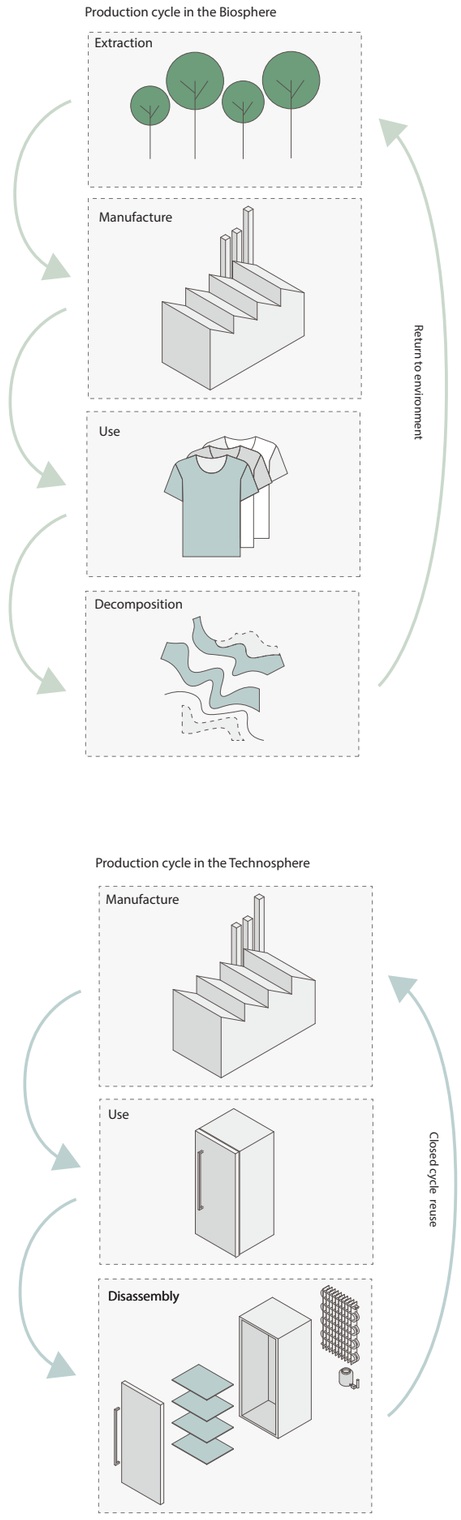
During this probe we were given the simple task of analysing Mcdonough and Braungrat's Food Equals Waste and researching the topic of 3D printing. The findings from both had to be returned in purely diagrammatic format.

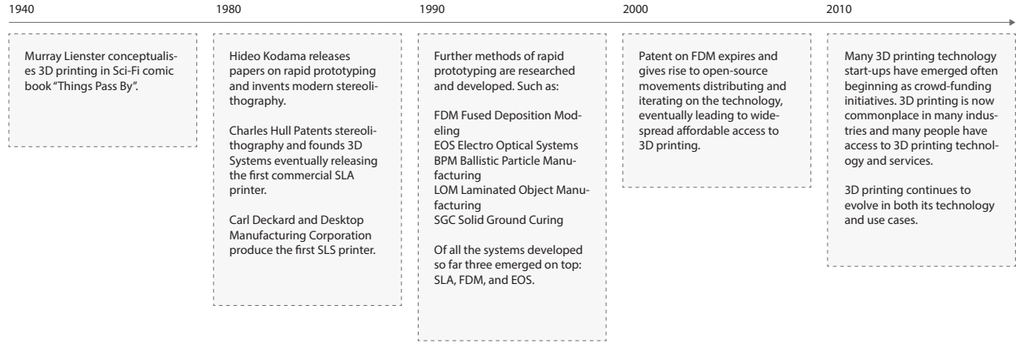
Food Equals Waste spoke about circular economies. The first point related to was about natural cycles, of growth and decomposition. Derived from this was the important concept of "Nutrients", which was used to describe the flow of matter within a cycle or circular economy.

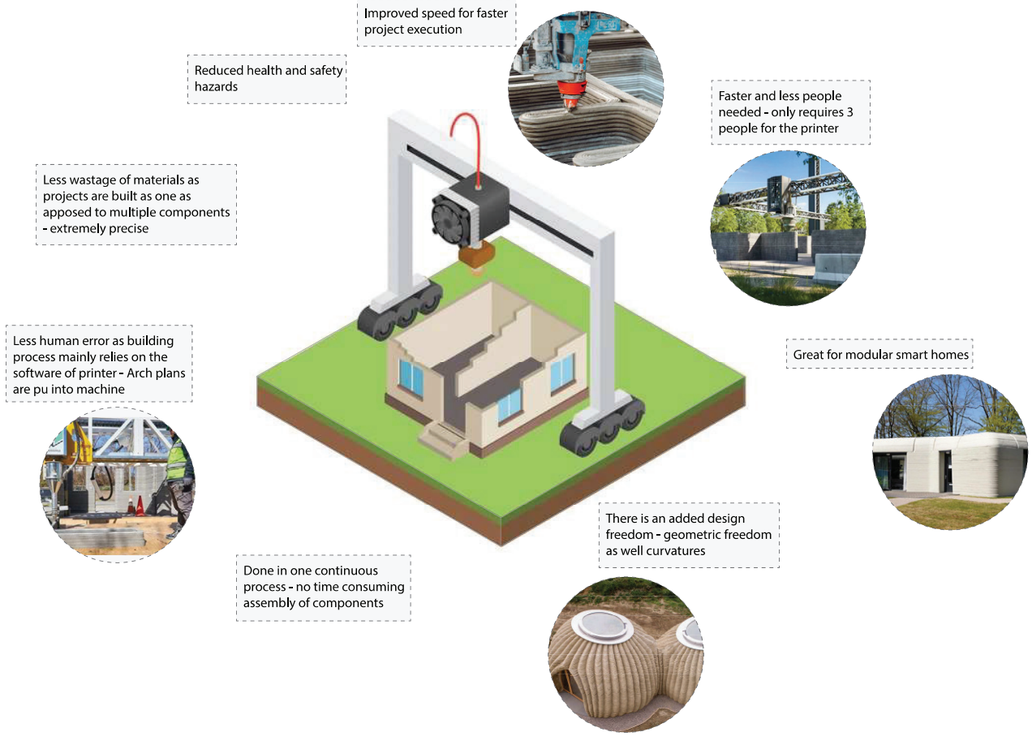
The author then compared ancient Cradle-to-Cradle cycles of nutrients to the present day linear Cradle-to-Grave nutrient flow, a product of extractive consumer cultures. Mcdonough and Braungrat argue the need for Cradle-to-Cradle nutrient flows, a return to systems which flow into each other, looping endlessly. Proposed was the concept of two semi-independent closed cycles emerging, a Biosphere where nutrient could grow, be used, and decompose, and a Technosphere where machine part and technological assets would recycle or upcycle near endlessly.

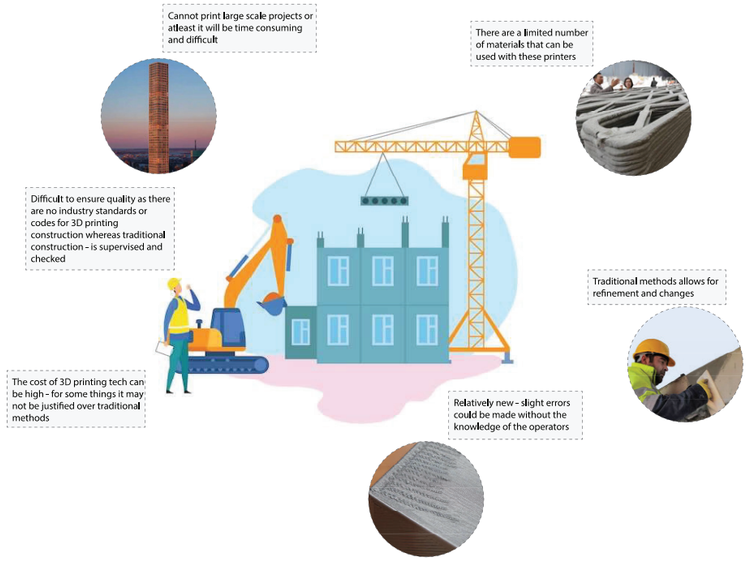
Our research into 3D Printing began with an overview of its history. Beginning in the 1980s stereolithography was invented by Hideo Kodama but quickly patented by Charles Hull. Charles hull also founded the company 3D Systems which would lead the way in the commercial development of 3D printing and all of its uses. 3D printing found its way as specialised machinery into a number of industries however was not easily available to the masses until the Patent on FDM expired in the 2000. The was the signal for the technology to become available to hobbyists and amateurs, which eventually led to the technology being commonplace and widely accessible as it is today.

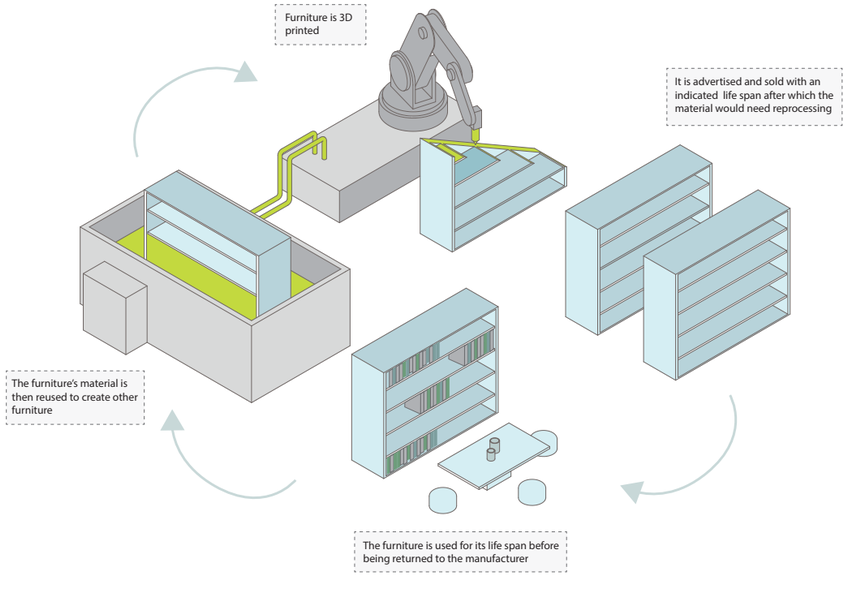
In construction 3D printing is not widely used today. 3D printed houses and buildings have only recently begun to emerge and are usually executed at a smaller scale. However, its place in the architecture a construction industry seems bright, holding much potential in mass onsite printing and re-printable modular designs. It seems that its greatest advantage over traditional building methods lie within the production of complex forms, where the use of 3D printing of by far the most efficient option.





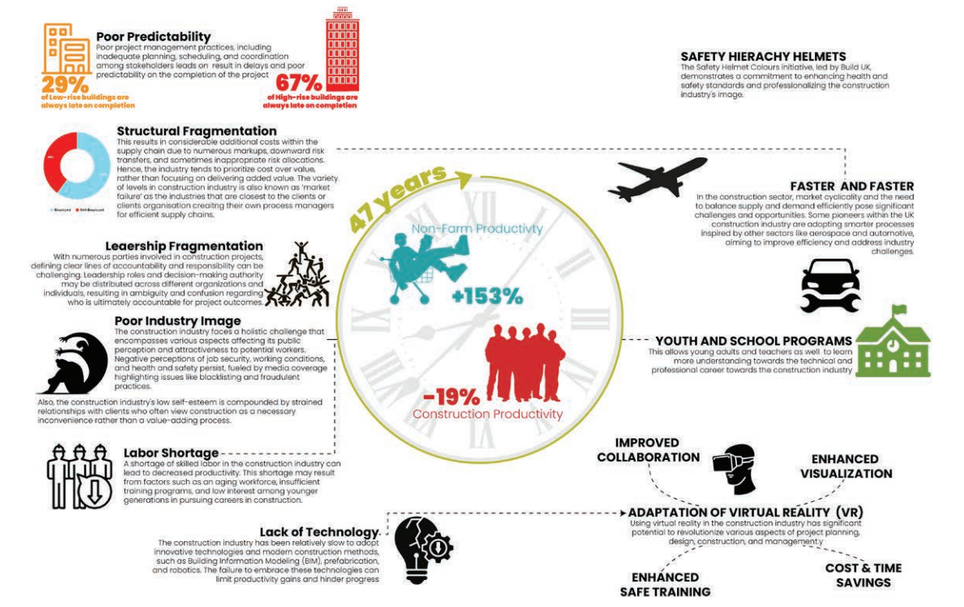




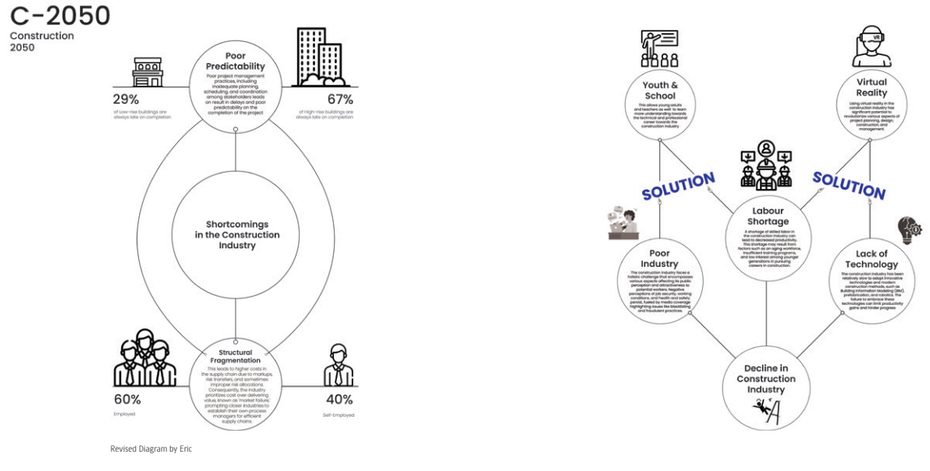


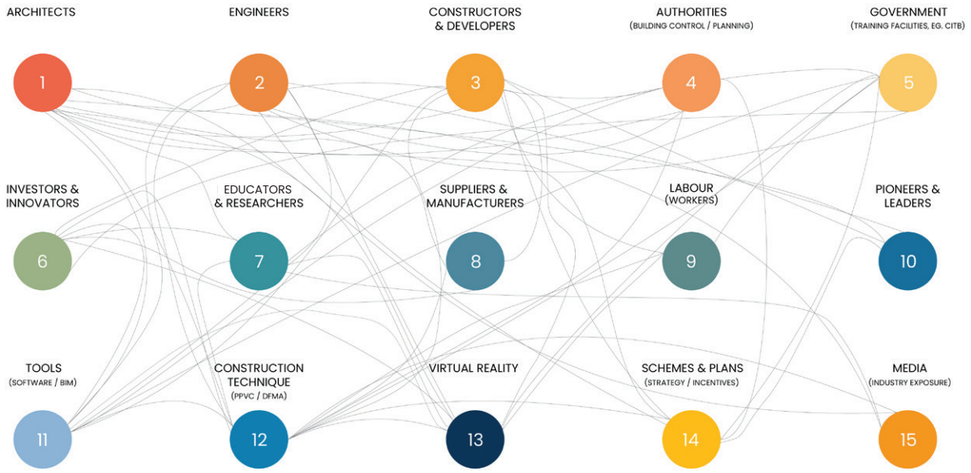
3.1 Modernism or Die, The Farmer Report + 3.2 Virtual Reality

The infographic diagrams below depicts the shortcomings in both the labour model and the prevailing business model of the construction industry, along with proposed solutions to the identified problems listed in this report. Issues of underinvestment in training, development and innovation aimed at raising productivity in construction have been a major focus in the industry since 2015. Professionals are striving to improve the situation and reduce the industry's structural vulnerabilities.

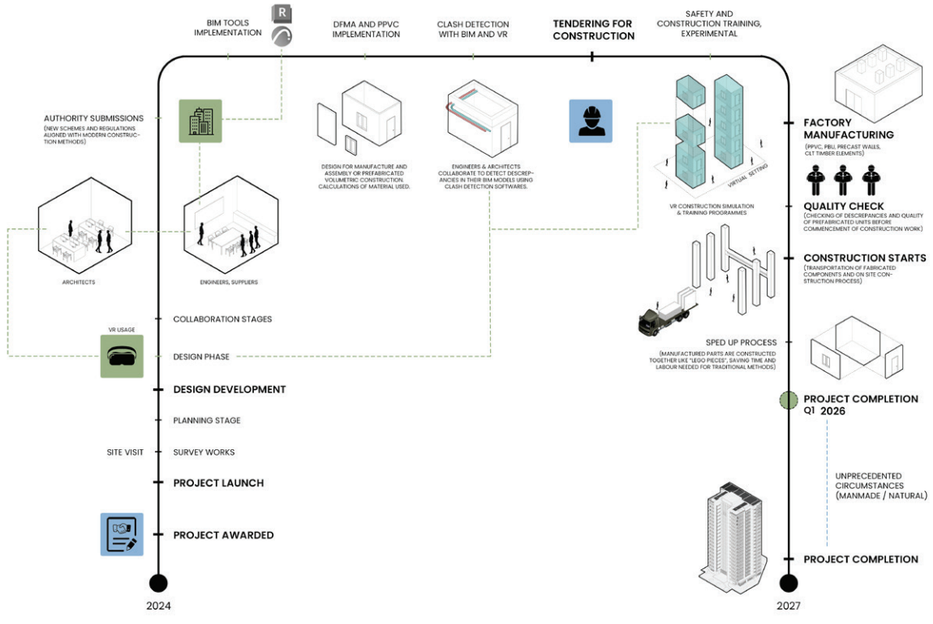


week 01, probe 1A + 1B.





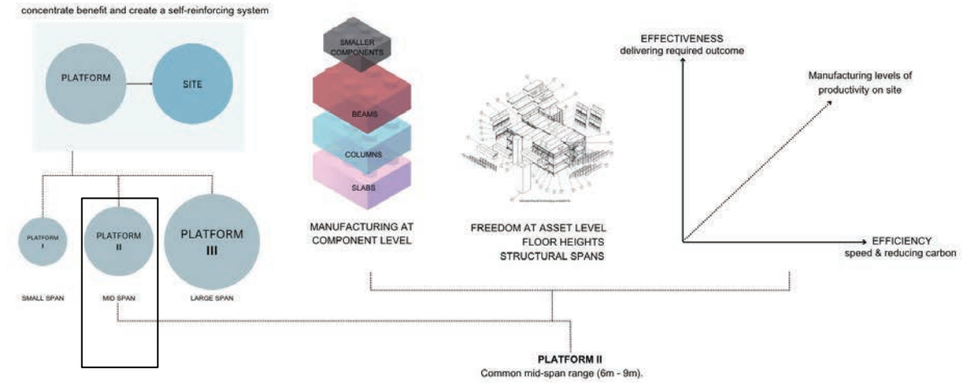
TThis Built Environment Category Map involves different stakeholders and professionals integral to the Built Environment (BE), alongside a comprehensive array of transformative technologies, tools, and schemes designed to revolutionise the industry. This diagram clearly maps out the relationships between different parties, a line is drawn between each of these categories to visualise their connections. As mentioned in the previous reading, innovative new methods and tools could be implemented across multidisciplinary practices to improve the construction scene.



This construction timeline differs from the dense and complicated traditional construction timeline. It is supplemented with a series of new initiatives and methods, specifically Virtual Reality in the construction process. It also revolves around multiple stakeholders which were mentioned in the diagram before. BIM softwares can be paired with VR in order to perform co-ordination work or clash detection checks between different practices; safety and construction training simulation can be carried out regularly; all of these to be done before construction work commences. This reduces the structural vulnarabilities of the built environment industry as modern tools and construction methods are adopted, ensuring safety and efficiency of projects both in cost and timing.

Cho Woo Jin and Chin Chang Hung

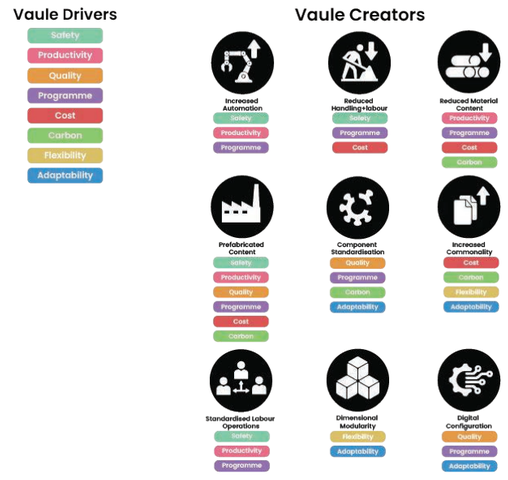
3.1 Platforms in Practice, by Bryden Wood +
3.2 On Site Robotics



The Platform II Platforms in practice by Bryden wood conveys an approach to Design for Manufacture and Assembly (P-DfMA) that identifies features such as floor heights and structural spans that are shared across different types of buildings (e.g. schools, apartments and healthcare facilities) to reveal the kit of standardised parts that can be used to deliver assets across multiple sectors embodied within the diagrammatic breakdown.

Values: In the first pages of the document the projects values are dissected, bringing forward what is driving a successful platform and what outcome values does that correlate with. The text highlights a suite of values and their correspondence with one another, helping to support the validity of their new construction framework proposal and decisions they have made within.

Labour Productivity: Illustrations of the simplistic joining brackets and discussions of prison trials, calls forward the role labour demands has on a project. Through streamlining the construction elements/ process so that anyone could undertake/construct with them. This allows for projects to engage with local workers without the need of training/specialist, engaging with the local community through social sustainability and additionally labour shortages. Also assisting in the goals of increasing efficiency, precision and reducing costs, defects, mistakes or rework.



Jarrad Frahamer and Saida Bakhsh

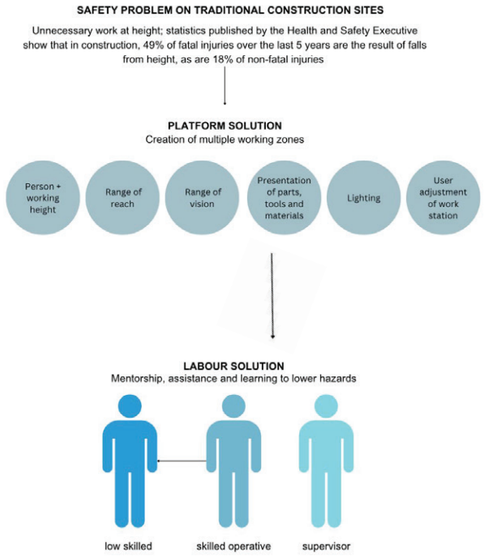
Flexibility: With the outlining of a rigid method for construction, the need for flexibility within the dimensions and appearance of the project are present. Through the curation of materiality and techniques, the simplistic frame design can easily be resized to meet the requirements of the structures programme. As shown below, the design also promotes the ability for freedom of aesthetics thanks to the barebones structure and un-protruding construction method.

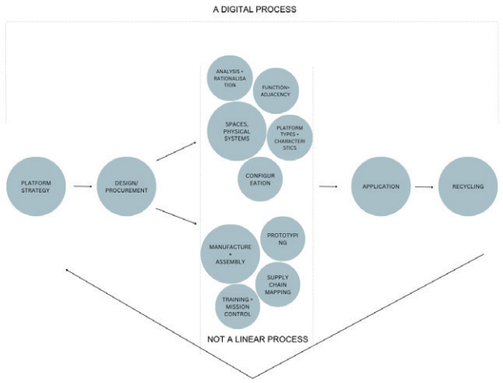
Materiality: One of the major proposals of the project is materiality. It discusses in terms of the best material for what elements, construction methods, design flexibility and carbon footprint. Throughout the text are a variety of depictions comparing the process involved and statistics/ calculations of the end results. There is a discussion additionally of Onsite vs prefabrication for each area of the platform II project. in some cases its more efficient and sustainable for onsite such as concrete pouring however, complex items like the MEP (mechanical, electrical and plumbing) are to be prefabricated and brought to site.

Prefabrication: Consideration is commonly brought forward by the text, on the validity of prefabrication for every stage of the platform. Where huge amounts of resources and time such as the "prefabricated nature of the MEP resulted in a reduction of 30,000 hours of site labour.' However, For some items it would be a detriment to the project's sustainability/carbon footprint, highlighting the need for an active analysis of fabrication choices/ methods within a project.

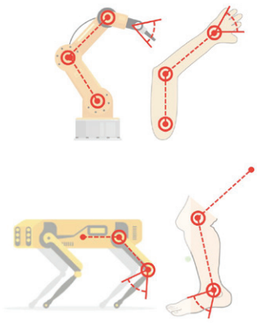
Digitalisation: The Platform II text mentions the aspiration for project advancement alongside a digital portal. Embracing a forward-looking stance on digitalisation entails the storage of data in digital formats for subsequent utilisation, whether through reconfiguration, repurposing, recycling, etc. Platform II uses a digital library of components comprising pre-defined interfaces and relationships, thereby streamlining automated design processes. This emphasizes the role of BIM automation as a pivotal platform facilitating the storage of structural elements within a digital library, encompassing standard columns, beams, connections, and the like, subsequently transmitting them to the fabricator, that is bringing these systems to life physically.

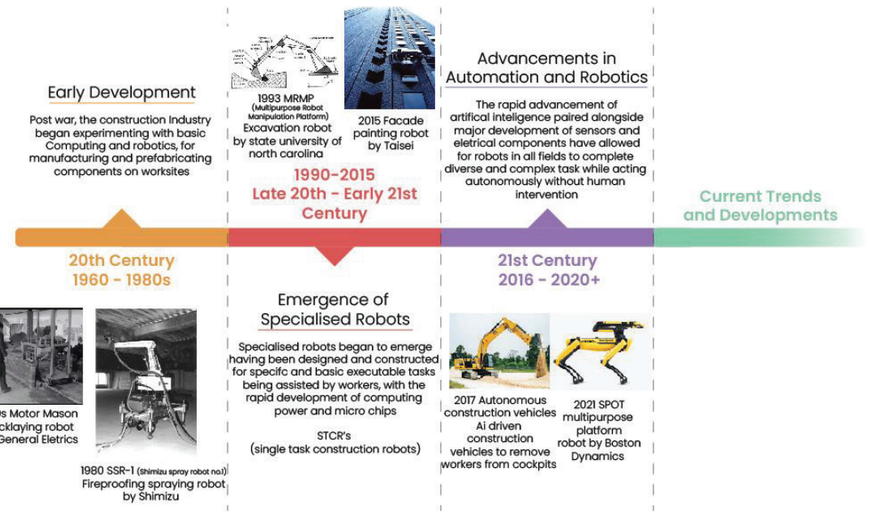
Circularity: Alongside the clear focus of efficiency, a large quantity of designed or considered components allow for temporary use and promote sustainability within the platform. Some are simply only used during the construction phase, being removed on completion for reuse on the following construction. The construction methods themselves allow for the reversal of joins or ease of replacement, allowing for the extended lifespan of the structure. The recyclability of materials used in the project also allow for such removed elements to be broken easily to its core material and easily recycled.



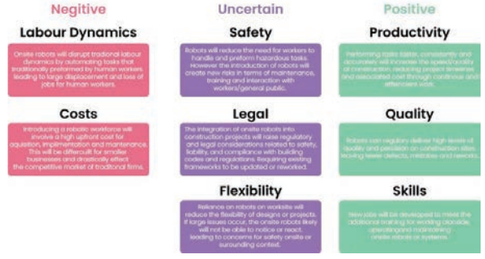


On Site Robotics: Onsite robots are robotic systems designed to perform various tasks directly at a construction site. It aims to imitate humans. They are equipped with sensors, actuators, and sometimes artificial intelligence, these robots autonomously or semi-autonomously carry out specific construction-related tasks. These robots aim to increase productivity, improve safety, and reduce costs by automating repetitive or hazardous tasks traditionally performed by human workers. As part of the broader trend towards automation and digitalisation in the construction industry, onsite robots offer innovative solutions to common construction challenges and have the potential to revolutionize the way buildings are designed and constructed. The diagram shows how.





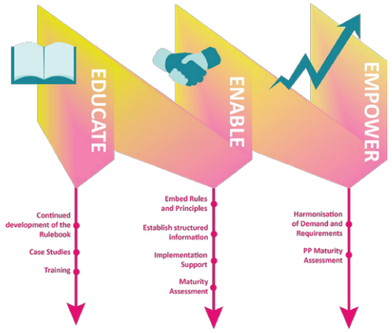
Reflective Questions
How would a fleet of robots be able to approach a flexible set of construction work?
Could the same optimisation of design for low skilled workers, additionally boost the efficiency/flexibility of onsite robots?
If a building can be easily prepared via a kit of parts, can the robots simply execute the digital file?
With the removal of workers for onsite robots, would the speed be drastically increased with the same simplistic works?
Could the worksite run autonomously or would human supervision always be required?
Could platform 2's reduction of reliance on prefabrication play well with onsite robots in regards to logistical timing/needs?



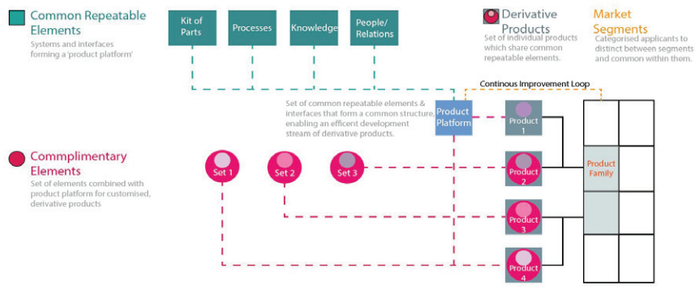
3.1 Product Platforms Rulebook, by Construction Innovation Hub (UK) +
3.2 Augmented Reality

A product platform in the Rulebook Construction Innovation Hub serves as a foundational framework for developing innovative solutions and features. It enables standardized components, interfaces, and processes, fostering collaboration and rapid iteration across diverse projects.
The PPRB is a way to educate, enable and empower. Not just in regards to the design/construction world, but the government, companies, providers, consumers and overall society. These 3 strivers have separate points on who will be educated and how will that knowledge be shown, what will it enable and what or how will it empower.

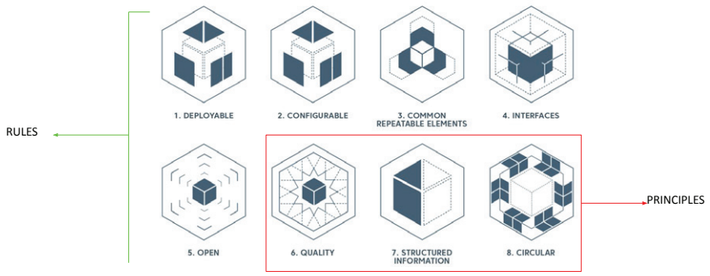
Rules and principles in a product platform, as outlined by the Rulebook, establish guidelines for consistent design, functionality, and interoperability. They ensure coherence, scalability, and ease of integration across various modules and applications within the platform ecosystem.



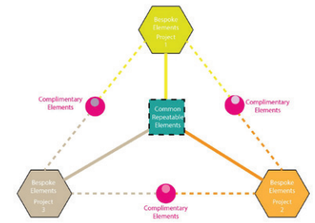


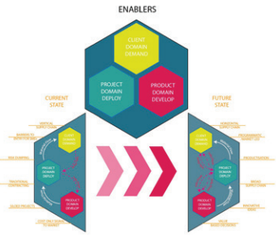


Bespoke elements in a product platform, per the Rulebook Construction Innovation Hub, offer tailored solutions to specific user needs, enhancing customization and flexibility. Complementary elements extend functionality and enhance user experience, while common repeatable elements streamline development, promoting efficiency and consistency across the platform.



Robin Deepthi Mahanthi and Sara Amin

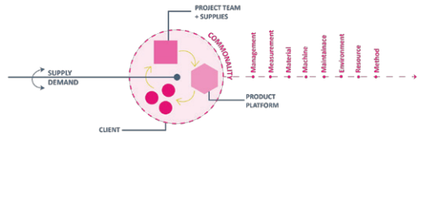




Enablers in a product platform provide essential infrastructure and support services, facilitating seamless operation and growth. Currently, enablers focus on basic functionalities like vertical supply chain and traditional contracting, while in the future, they will evolve to encompass a horizontal supply chain and program-driven insights, enhancing platform capabilities and user experiences.

Product platforms offer benefits such as scalability, interoperability, and accelerated development. However, challenges include balancing standardization with customization, managing complexity, and ensuring security and privacy compliance amidst evolving technologies and user needs.



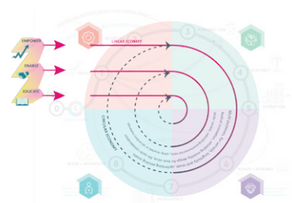


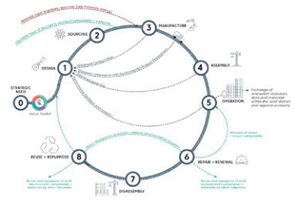
PPD is a layout for the developer to follow in order to develop the product platform.

STRATEGY STAGE: Establishing the strategic direction for a platform by assessing its suitability and, if deemed appropriate, defining the areas of focus and winning strategies.

PLANNING STAGE: Precisely outlines the problem and approach for the proposed product platform

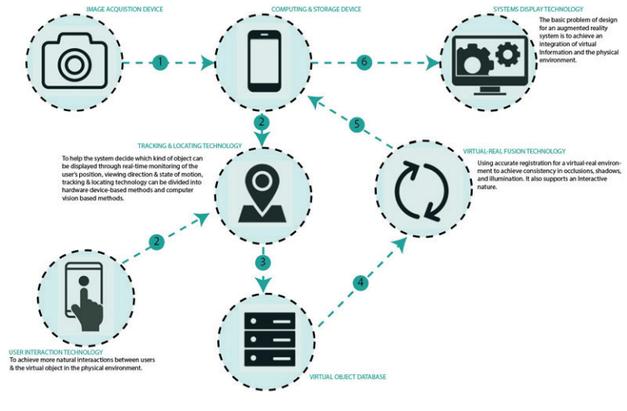
DESIGN STAGE: Creating the product platform along with on and off-site production and certain processes to align with the plan and strategy







Augmented reality overlays virtual information onto the real world through devices like smartphones or AR glasses, using sensors and cameras to track the user's environment. This creates an immersive experience where digital objects appear to coexist with the physical surroundings in real time.



The benefits of AR divided into GENERAL USE and the BUILDING WORKFORCE. They do blend with each other. In regards to general use, it includes accessibility, education, social interaction and applications. In regards to the building workforce, it can include construction site planning and visualization, training and skill development, remote assistance and collaboration and efficient project management

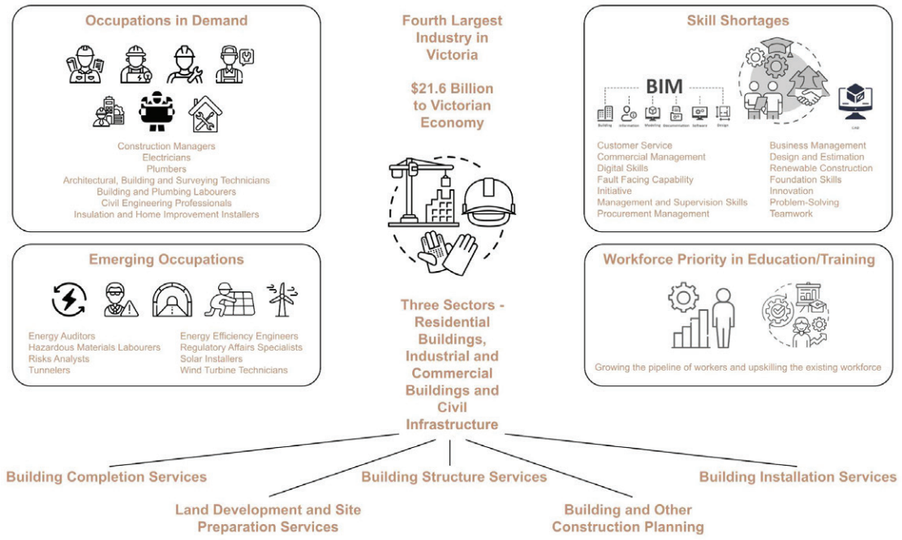
Overall, the future of AR is limitless and constantly changing and expanding. This means that the future of the BUILDING WORKFORCE will continue developing on-Site Construction Assistance, Remote Assistance, Construction Site Planning, Safety Training and Monitoring and Equipment Maintenance.

The future of THE WORLD AND SOCIETY will increase Environmental Awareness, Emergency Response and Public safety, Tourism, Enhanced Customer Experience, Accessible information, Entertainment, Gaming, Improved healthcare and Enhanced education.

The future of COMPANIES will enable an increase of Corporate events and exhibitions, Data visualisation and analytics, Marketing, Advertising, Training development, and Product Visualisation.

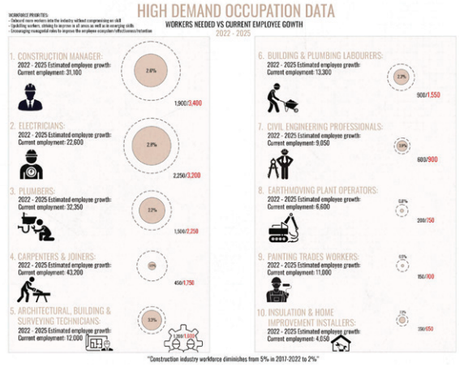


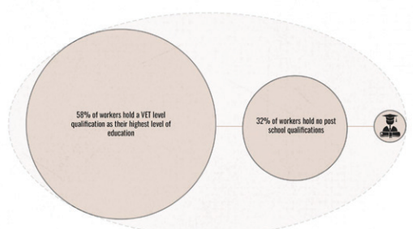
3.1 Victorian Skills Authority, Victorian Skills Plan, Construction Industry Insight 2022 + 3.2 Lean Production

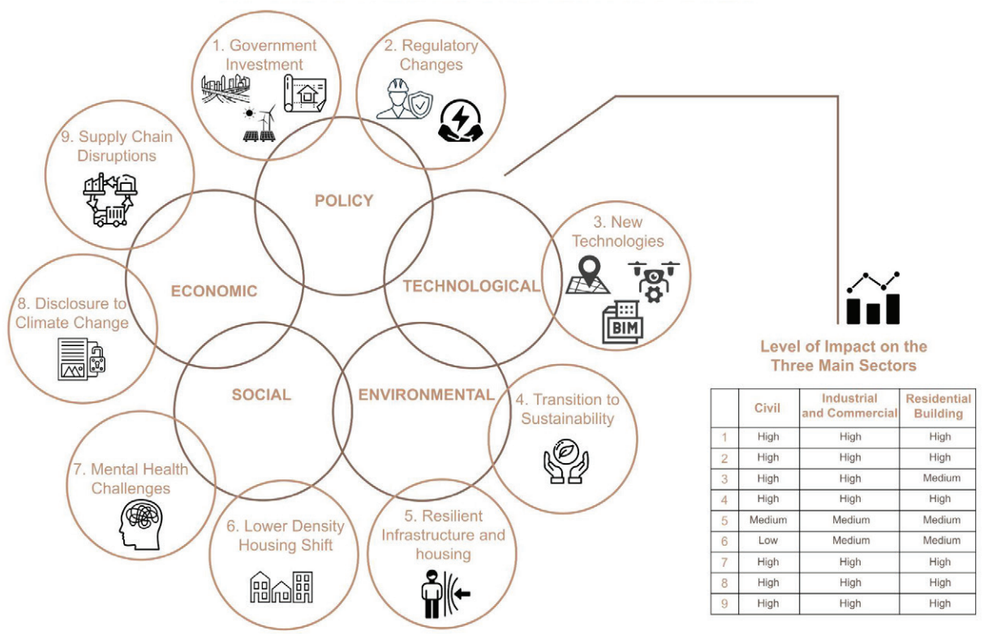


The reading that was summarized is the Victorian Skills Plan Construction Industry Insight 2022. It shows demand for occupations and workforce issues for industry and provider partners, which allows the Victorian Government and training partners to be able to come up with actions and responses.

Lean production is a systematic approach to manufacturing and management that aims to minimize waste while maximizing efficiency and value creation. It originated from the Toyota Production System (TPS) developed by Toyota in Japan in the 1940s and 1950s and has since been widely adopted across various industries beyond manufacturing.

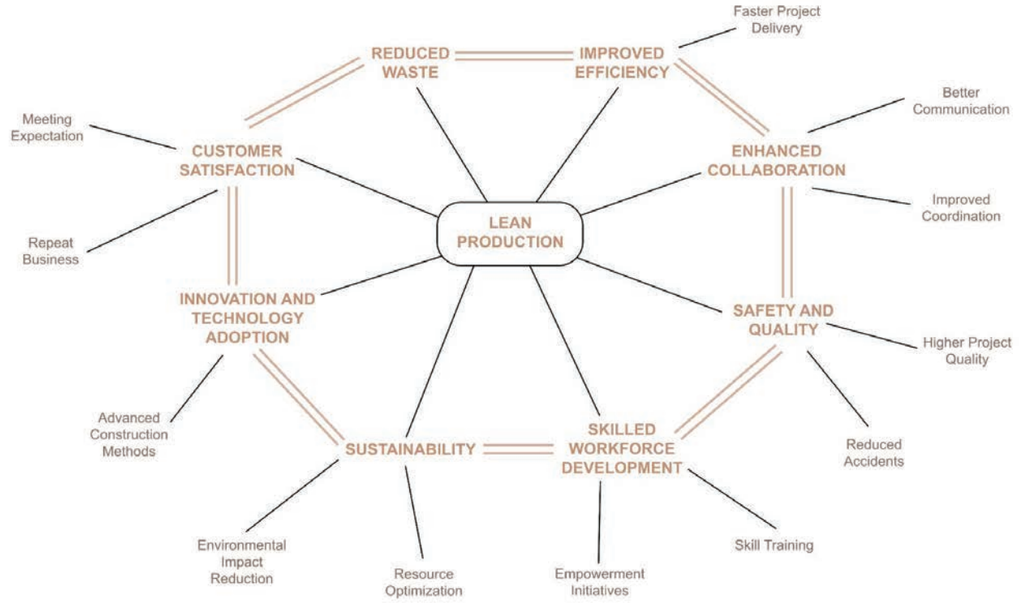


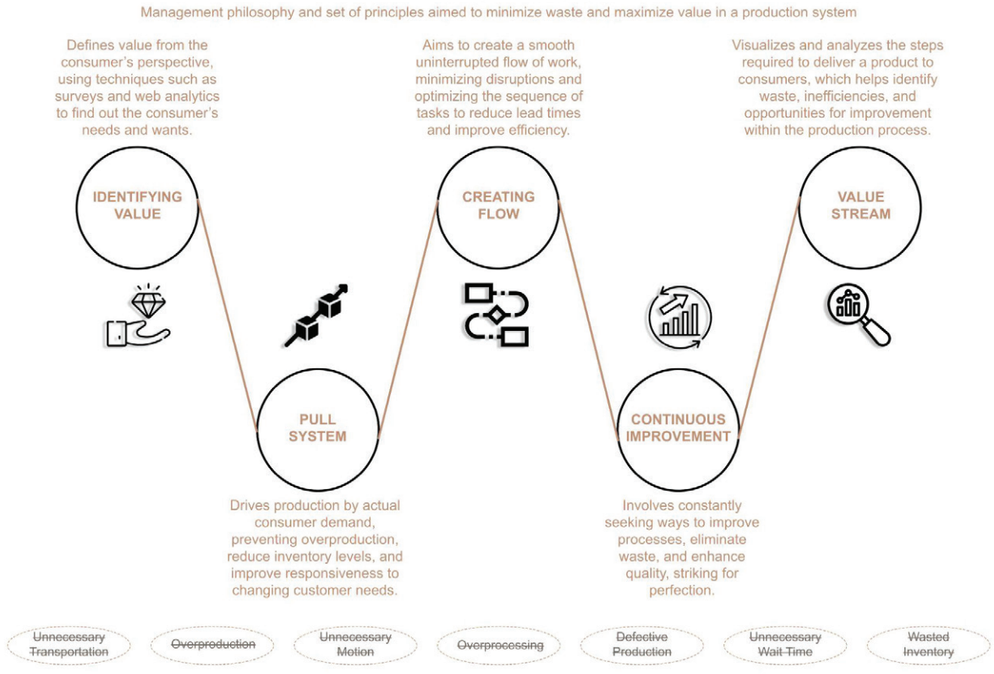




Level of Impact on the Three Main Sectors

	Civil	Industrial and Commercial	Residential Building
1	High	High	High
2	High	High	High
3	High	High	Medium
4	High	High	High
5	Medium	Medium	Medium
6	Low	Medium	Medium
7	High	High	High
8	High	High	High
9	High	High	High





3.1 Master Builder Association of Victoria, Innovative Approaches to Construction Industry Transformation, 2023. + 3.2 Volkswagon Platform Approach to Assembly

Part 1: Workforce
The section of the report looks into the workforce within the construction industry, breaking down the various levels of skill and experience. While also looking at future workers and how a more diverse workforce can be achieved.

1.1 Skill Shortage:-Global disruptions to industry affecting workers and skills.
Covid pandemic, (GFC) global financial crisis, and glocal disruptions- During high industry demand there is limited capacity to upskill- During low industry demand skilled and experienced workers leave industry

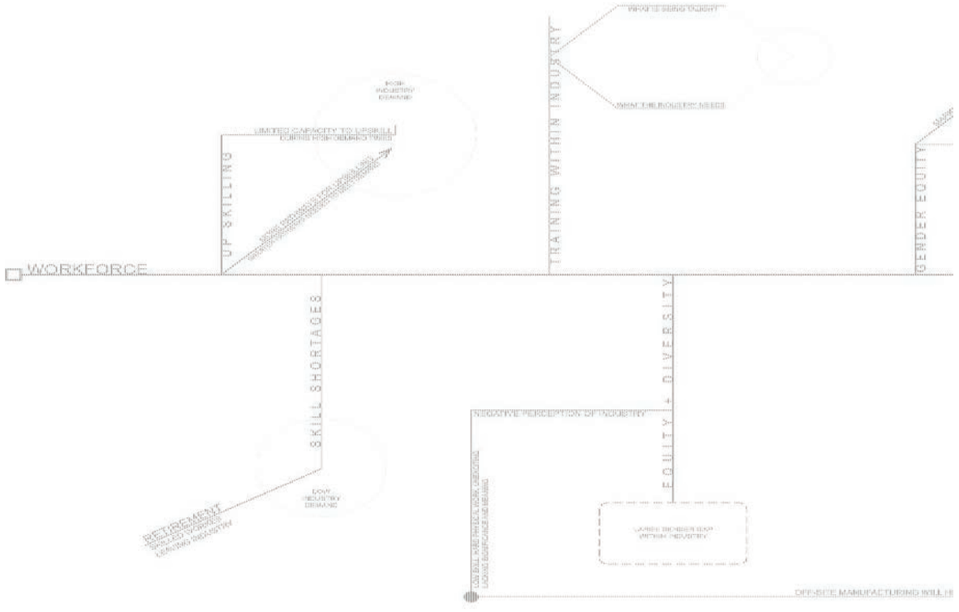
1.2 Negative Perception on Industry:
Society view that a university degree is more successful than a vocational degree.- There is a lot more debt with a university degree compared to vocational degree.

1.3 Equity + Diversity:
- Gender gap in industry New skills and a more diverse workforce.
- Gender gap in the industry, linked to this is the idea that the industry is low on skills, hard physical work, unexciting, and lacking significance and meaning.
- Possible manufacturing approach can create a more attractive image of the industry.

1.4 Health + Safety:
-Work-life balance
-Mental Health
Pandemic shut down construction site with fewer site meetings and working from home arrangements.
-Growing concern for work-life balance with workers.
-The issue of mental health in the industry.

Parts 1.1 and 1.2 of the report further explores the difficulties of upskilling workers within the industry and attracting workers to the industry. Parts 1.3 and 1.4 breaks down the lack of diversity and gender gap in the workforce. While also exploring how a more diverse workforce can be more attracted to the industry.

The report shows how a manufacturing approach to construction can create a better image of the industry. Helping to attract a diverse workforce.



Part 2: Construction Processes and Methodologies
This section of the report addresses the following key areas of industry transformation: design and construction; supply chains and materials and; digitalisation.

2.1 Design + Construct:
-Towards greater integration and standardisation
-Accelerates process and increases efficiencies
Building capacity towards MMC-Skills and training, different skills will be required on site as components come pre fitted and finished.-Government support through development of manufacturing hubs; micro-factories; government-backed demonstration projects and; support mechanisms.

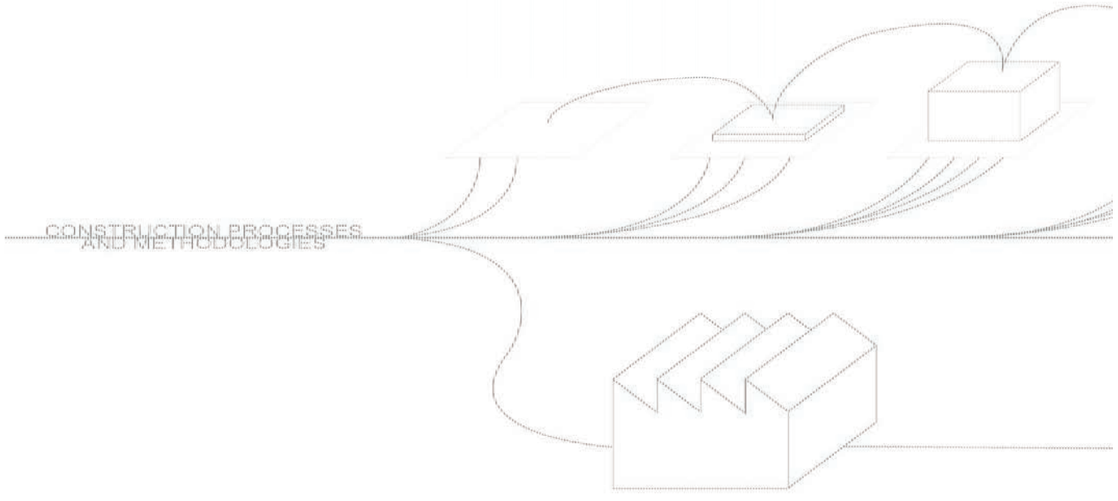
Part 2.1 of the report examines how innovation can speed up processes and efficiencies. The report shows how standardisation and Modern Methods of Construction (MMC) can be utilised with an off site manufacturing approach to construction

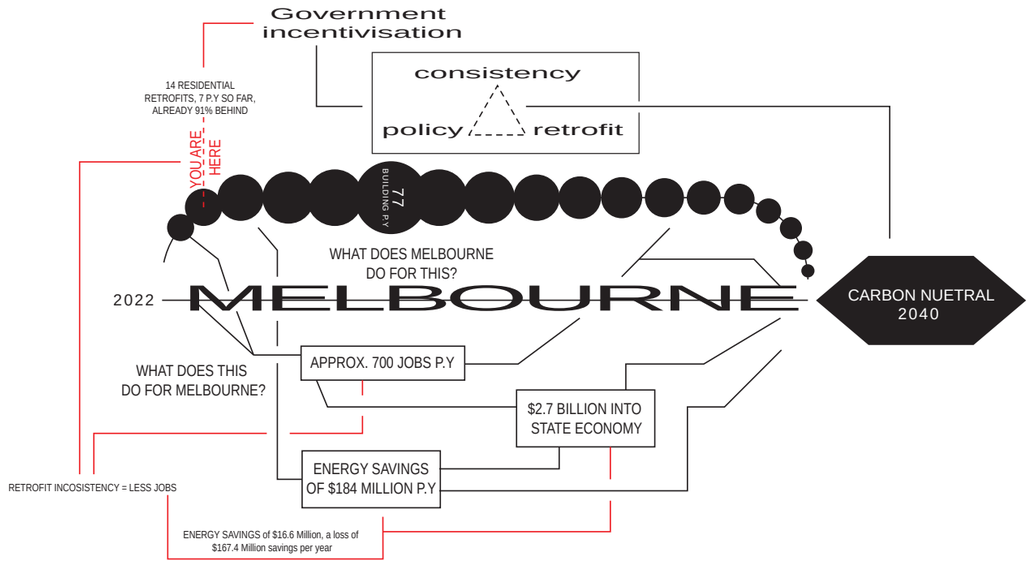
2.2 Supply Chain + Materials:
-Towards greater integration and standardisation
-Accelerates process and increases efficiencies
1. Overreliance on a unique supplier, which was advanced as one of the reasons that house builders are not making the transition to offsite in the US: 2. Logistical challenges associated with on-site assembly, including the craning and storage of pre-built modules and other components.

Part 2.2 of the report explores the benefits in the supply chain when utilising MMC. Manufacturing hubs can reduce the steps in the supply chain while also reducing the carbon footprint of material production and transportation to site.

2.3 Digitalisation:
-Regulating with digitalisation
-Integrating digital systems to design and planning
-Increasing industry digital capabilities
Digital systems such as virtual reality can offer significant feedback for reducing tolerances. Smart glasses can deploy a real time understanding of the accuracy of what has been built on site.

Part 2.3 of the report looks at how digitalisation of the industry can increase its capabilities while acknowledging the difficulties of upskilling the industry with small and large sized companies.





Part 3: Climate Resilience and Industry Preparedness
This section of the report looks at addressing key areas of industry transformation. Exploring key innovations in construction methodologies, supply chains and material use and availability. While evaluating key innovation that currently exists in improving building standards and regulations towards climate adaptivity. Using these factors to breakdown and analyses international case studies, technology and data systems, and government regulations and policies. Before theorising a victorian implementation.

3.1 Circular Economy:
- Policy Shifts. Introduction of data systems are pivotal for a circular economy. Implementation of purchasing restriction of materials and products which exceed a carbon footprint threshold.
- Material Innovation. As it currently stands the buildings construction methodology of what is commonly built represents a massive challenge for the reuse of materials. Existing structures of legislative frameworks lack clarity and efficiency.

3.2 Decarbonisation and energy retrofit:
- Energy performance regulation in Europe. First implemented in 2002 and revised in 2018 the Energy Performance of Buildings Directive (EPBD) introduced mandatory reporting of property energy performance.
- Path to Net Zero in Europe and the UK.
- Retrofit consistency and learning rates remain a challenge.
- Government efforts towards decarbonisation in the U.S.

3.3 Disaster Resilience
- Internationally the development of a program by IBHS aimed to prepare homes for wildfires. Built upon a decade of research and studying how fires move, embers spread, land and accumulate resulting in building ignitions.
- Within Australia the IBHS is working alongside James Cook University wind driven rain penetration and damages. Examining the impact his has on longevity, performance and efficiency and overall building sustainability.

Implications for Victoria
The government's current 10 policy and action plan towards reaching a circular economy outlining a state ambition for reducing waste and pollution, fostering recycling, while still enabling an economic growth. The building industry is crucial in demonstrating sustainable leadership in creating and sustaining new markets, form material innovations, design standards and specifications, data systems and management, legal frameworks and education and training. To establish a transparent network of information accessible to all parties. The greatest challenge being low carbon retrofitting as complex as restructuring the system. To allow for the far greater among of existing dwelling to improve than there are new built sustaining new jobs alongside education.

Part 4: Building Outcomes and Consumers
This sections examines te the following key areas involved with the building industry building quality and performance, demand and market performance and housing outcomes and affordability. Assessing key innovations that exist to improve current building standards and regulations. While exploring the implications on emerging innovations in f inancial tools and contracting practices that guide management of business risk and incentivise housing outcomes and affordability.

4.1 Building Quality and Performance
The research has shown that regulations are universally the cheapest and most effective measure for improving performance and innovation while lifting affordability. "As a regulator, we often think about a triangle with business in one corner, the consumer in another, and the regulator in the third... two corners of the triangle entirely missing"

4.2 Demand and Market Performance
Data extracted from victoria between 2016-2018 found that 86% of newly built class one residences were designed to only meet 1 star while only a 3% were being built to comply with the soon to be mandated 7-Star minimum.
Data extracted from victoria between 2016-2018 found that 86% of newly built class one residences were designed to only meet 1 star while only a 3% were being built to comply with the soon to be mandated 7-Star minimum.

4.3 Housing Outcomes and Affordability
The current housing affordability crisis in Australia separates the population between renters and owners. Owners receiving tax breaks while renters face prices beyond the retail price index.

Implications for Victoria
Increasingly Victoria has faced significant rises in costs of materials and building products. Resulting in financial difficulties for builders, suppliers, and subcontractors. The has resulted in best practice building to contractual end at a financial loss, directly hindering this is the lack of policies around providing data, price and availabilities of materials.
Victoria could aim to implement strategies to ensuring contracts are fair across the industry through builders to consumers. Through tracking real time supply and demand to create accurate live data creating the potential for variable evidence based cost summaries. Allowing government incentivisation and support to sectors and address supply and cost chokepoints.

Overall, this report contained the documentation of the research project collecting primary and secondary data across the US. Canada, the UK. and Europe. Used in forming an evidence base of International best practice in the Buildings and Construction sector.

Collectively, the topics examined add up to significant challenges and opportunities in Victoria, working in collaboration with government and consumer stakeholders, to lead through the coming transition to a safer and more sustainable future. The opportunity now is to build on Victoria's position and ensure the industry is sustainable, resilient and affordable, where a built environment is produced, upgraded and maintained efficiently and effectively by a highly skilled and innovative workforce.

The building and construction industry in Victoria currently faces an unprecedented opportunity, to expand, draw in and develop new skills, technology and expertise, and lead the transition of the Victorian built environment. As the case studies in this report demonstrate, this opportunity will be made easier through new partnerships with government, finance, peak bodies, training and research organisations and civil society in addition to innovation in building practices, materials, technologies and regulation.

Volkswagen Platform Approach to Assembly:

The Volkswagen MQB Platform is a company strategy that was introduced focused on shared modular design and construction for its transverse, front engine and wheel drive layouts for automobiles. Transverse mounted engine means it is mounted parallel to the axles east to west.

MQB stands for Modularer Querbaukasten or a modular transversal toolkit. It is a modular adaptable process to engineer and build cars. The notion behind the platform that was first introduced over a decade ago was to have flexibility of assembly. The potential to be able to assemble and manufacture any of their parts across any of the factories installed with the MQB technologies. It is not a platform in the traditional sense, instead a systematic process of rationality behind the design configurations and combinations across eleven separate automobile companies.

The system works by laying down a series of 'hardpoints', these hardpoints determine the range and common design possibilities of the production line. Examples of these hardpoints could be as simple as an axle, stereo, aircon or brake system. Reinforcing that their present success was indicative of the support provided by the MQB Platform. Solidifying the company through its economic resilience and efficiency. Built upon the research resultant of platforms PQ25 (old polos) PQ35 (old golfs) and PQ46 (old passats).

The modular assembly matrix created by the MQB Platform program has permitted a standardisation of production processes in all areas, creating more flexibility and reduced costs. Pathing innovation of sophisticated technology, low weight, and dynamic design evolution. It allows for supply to meet the demand of products, resulting in only what needs to be manufactured taking precedence over building sock. Using the previously mentioned hardpoints as standards of fabrication and manufacturing parts to predetermined mounts reducing design time and increasing performance and efficiency.

The main advantage of using this approach is the cost efficiencies and performance efficiencies that largely outweigh the substantial initial investment required. This is clear through investing in single high quality modular parts or 'hardpoints' that can be used across multiple models. This reduces a loss of resource in spreading resources o develop similar quality non interchangeable components. The previously mentioned ideas of efficiency impacting production flexibility/ Highlighting the significant advantages and continual refinement of the MQB has allowed a range of variation and evolution across automobile design.

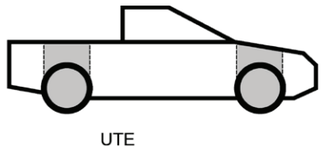
The MQB approach to car manufacturing can increase efficiencies in the factory as multiple cars can use the same platform meaning there is a lower cost per car.

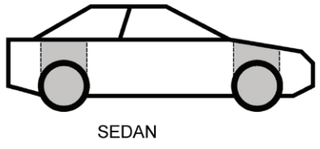
This standardisation of part of the car allows for better integration during the manufacturing process and a more streamlined workflow.

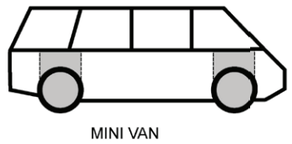
British magazine Car said "the idea heralds a return to basic principles of mass production in an industry where over the last 100 years, complexity has spiralled out of control. By creating a standardised, interchangeable set of parts from which to build a variety of cars, (the company) plans to cut the time taken to build a car by 30%."

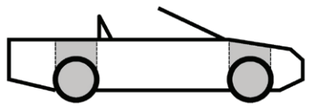
Although it is important to understand that this methodology and approach to to manufacturing and assembly does suffer drawbacks. The limitations which can persist through this structure of program almost caps the all round development in order for prioritising the overall, performance, quality and efficiency of automobiles.

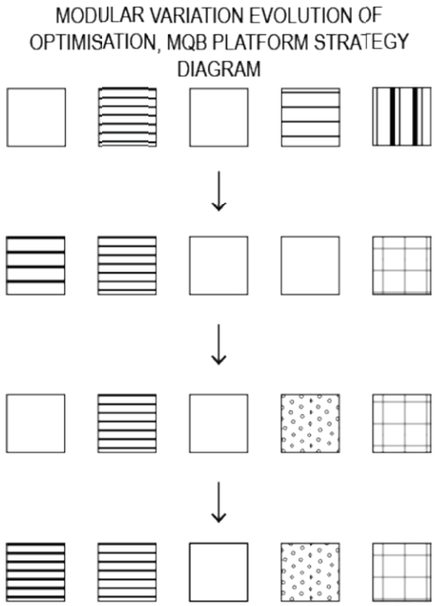
Highlighting how this is a vast improvement of automobile manufacturing development. Similar to how the MQB was based of the research and results of previous manufacturing platforms the system is not unflawred and should follow the same system of progression that these other platforms went through.









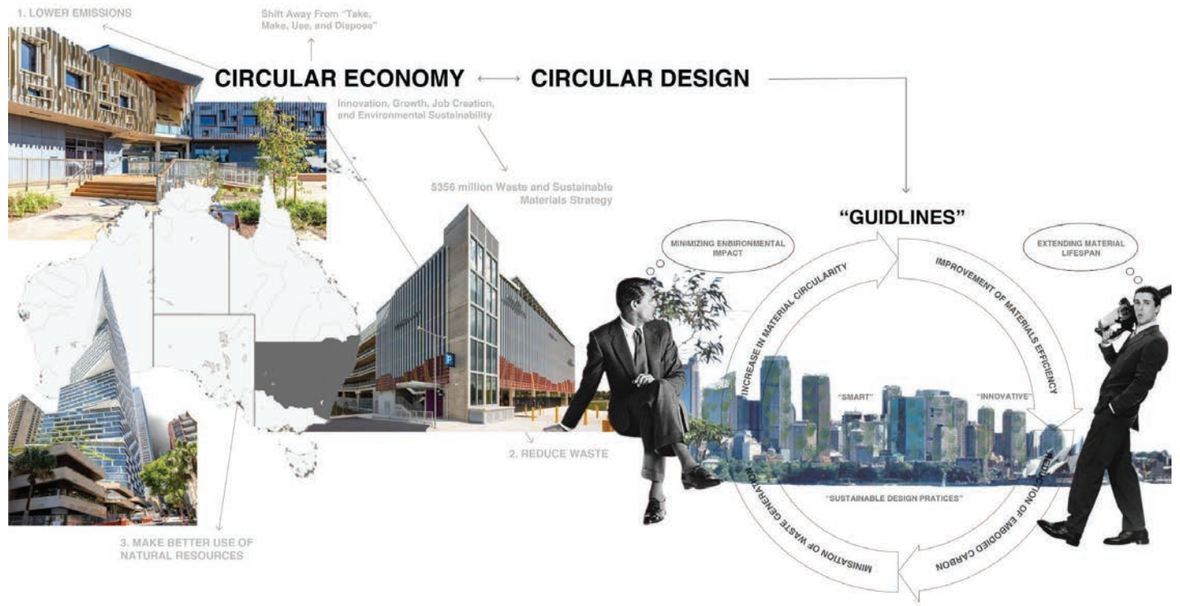


Blair Albrecht and Trent van Elwoud

3.1 Circular design guidelines for the built environment, NSW Office of Energy and Climate Change, 2023 +
3.2 Intelligent City P4L

NSW is adopting circular economy principles to shift from a linear model to one that values resource efficiency and prolongs product lifespan, integrating these principles into building and infrastructure design, with a $356 million Waste and Sustainable Materials Strategy to reduce waste, lower emissions, and better use natural resources, aiming to foster innovation, growth, job creation, and environmental sustainability for future generations.

Adopting a circular economy approach involves transitioning from resource extraction to regeneration by applying principles like circular design to various resource systems, which brings economic, social, and environmental benefits, reduces emissions, fosters new industries, meets sustainability goals, and enhances urban resilience, aligning with global and national policies for sustainable development and emissions reduction.



It discusses various strategies and tools for implementing circular design principles through different phases of projects.

Tong Zhao and Somana Sok

CIRCULAR ECONOMY
APPROACH



Resource Extraction

Resource Generation



Improving Urban and Regional Areas



Creations of New Industries



Sustainability Reporting and Ratings



Emission Reduction and Economic Benefits



Economic, Social, and Environmental Benefits

PRINCIPLES



Design Out Waste and Pollution



Keep Products and Materials in Use



Regenerate Natural Systems



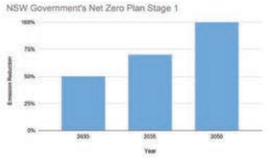
Promoting resilient infrastructure, sustainable industrialization, and efficient resource use.



Australia's National Waste Policy and Action Plan

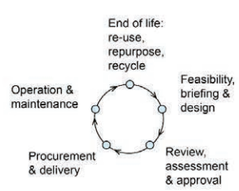
NSW Circular Economy Policy Statement shifting to circular economy → Emphasizing circular design, sustainable procurement, and support for re-use and repair

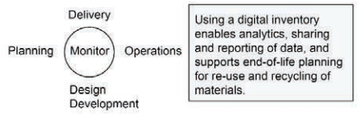
NSW Government's Net Zero Plan Stage 1



Circular Design Strategies

1. Design for longevity
2. Design for flexibility and adaptability
3. Design to maximise materials circularity and enable disassembly
4. Design for material efficiency
5. Design for the best practice operational waste management
6. Re-use existing assets or materials
7. Select products with recycled content
8. Select products that are designed for disassembly
9. Select product and materials that have an identified end of-life use
10. Select low-impact materials
11. Incoporate green infrastructure
12. Maintain a materials database
13. Procure products as a service





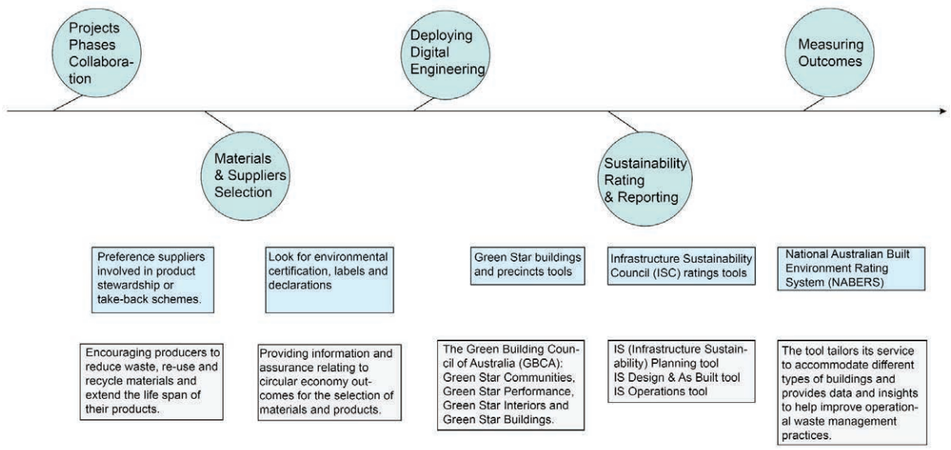
Using a digital inventory enables analytics, sharing and reporting of data, and supports end-of-life planning for re-use and recycling of materials.

Comparing design options and measuring and report on the outcomes of applying circular design strategies.

Quantify the tonnage of material flows and the embodied carbon and waste of products.

Assessing circularity before and after circular design interventions.

Digital twins | Materials databases | Life cycle assessment | Circularity assessment



HIGN-TECH MANUFACTURING + **HIGH-QUALITY PRODUCT**

SCALABLE ADAPTABLE

=

MASS TIMBER SYSTEM

DESIGN ENGINEERING SOFTWARE

PASSIVE HOUSE PERFORMANCE SYSTEM

AUTOMATED MANUFACTURING SOFTWARE

PROPRIETARY PARAMETRIC SOFTWARE

Intelligent City

Platforms for Life (P4L)

DESIRABLE URBAN HOUSING





Source: https://intelligent-city.com/announcements/introducing-the-p4l-design-engineering-guide/

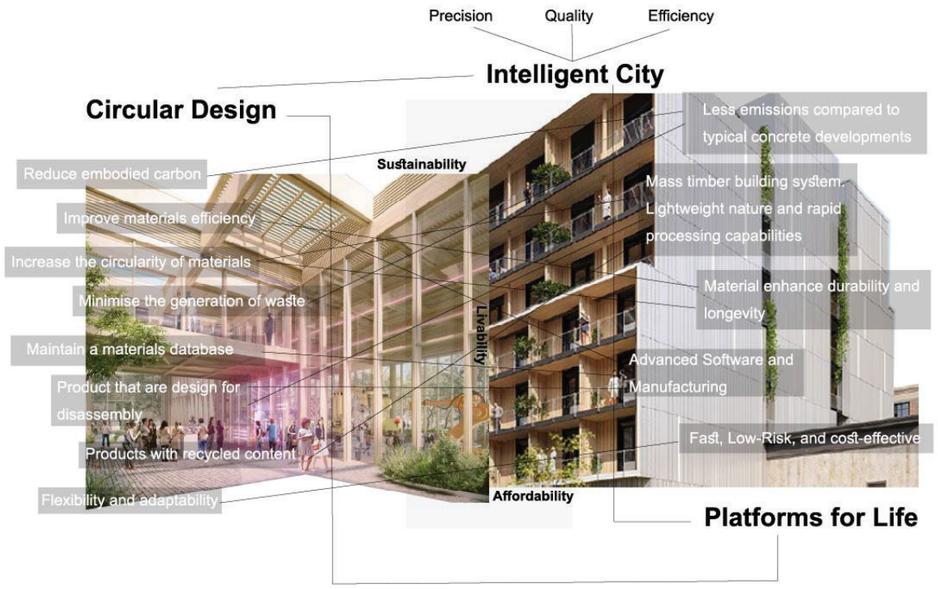
90% less emissions compared to typical concrete developments

Up to 50% less construction and life cycle cost

Up to 30% more efficient apartment layouts

Up to 38% faster design and construction time

Intelligent City is a company that focuses on redefining sustainable urban buildings through the integration of various technologies and design principles. Their technology, known as P4L (Platforms for Life), combines mass timber construction, modular prefabrication, high structural performance, and Passive House thermal performance.



This is a diagram that explains the relationship between Platforms for Life and the circular economy. It illustrates what they have in common.

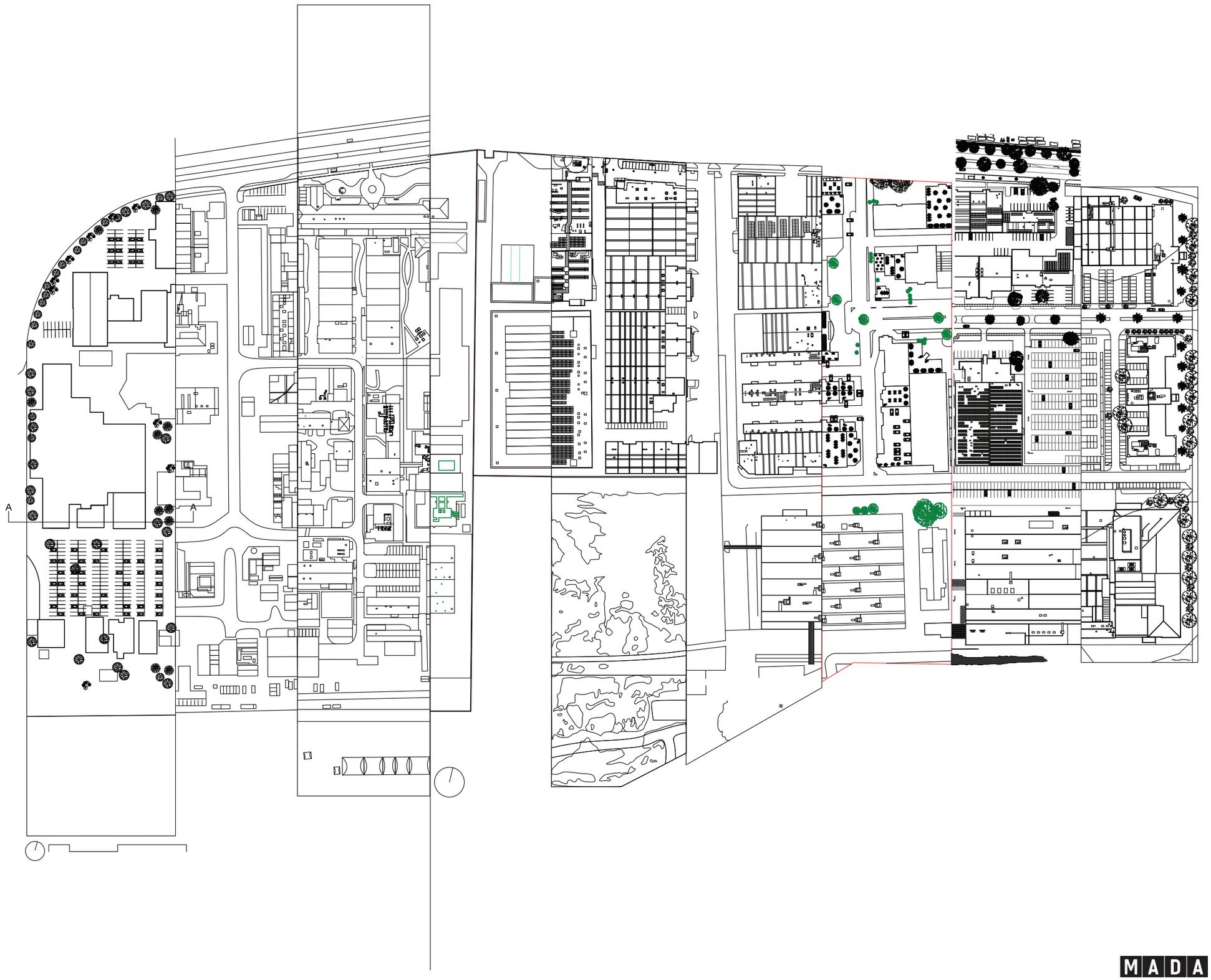
03 Urban Contexts:

Task Over View:

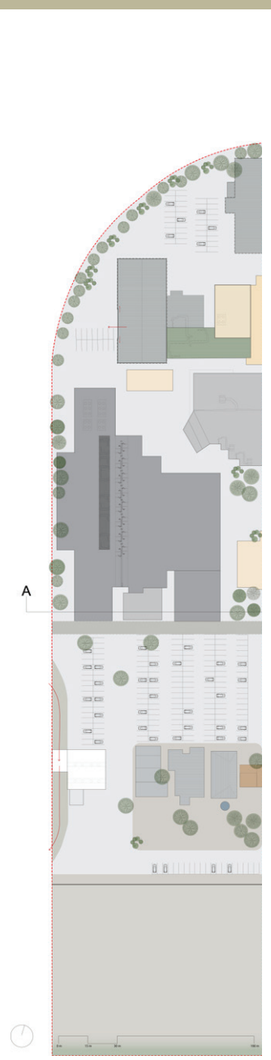
The second stage of the research phase of the studio, continuing in the student pairs, included visiting the site location and documenting the visit through conceptualising the development and changes of the area between current and 2050 conditions though a to scale composite drawing of a designated transect of the site, including plans and sections to represent individual groups differing perceptions of the site collating the individual drawings to a conjoined class representation. Alongside this creating a narrative cinemagraph representation envisioning the site's transformation by 2050, showcasing changes in massing, materiality, landscape, demographics, and transport at a human level. Portraying the student understandings of the current conditions and grasping the possibilities of the potential future 2050 conditions.

Research Outcome:

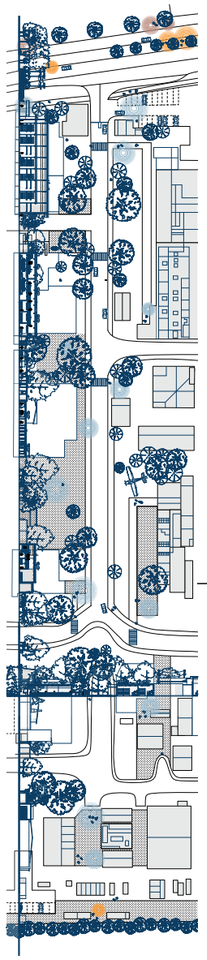
Short paragraph talking about the successes and learning oportunities uncovered by the class and the significances of conducting this intial reasearch.


A
A

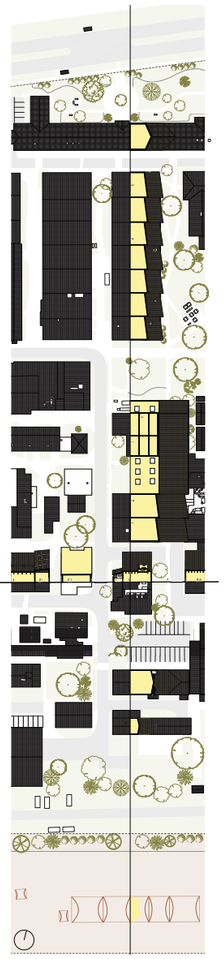
Class Collated Stitched Site Map



1.



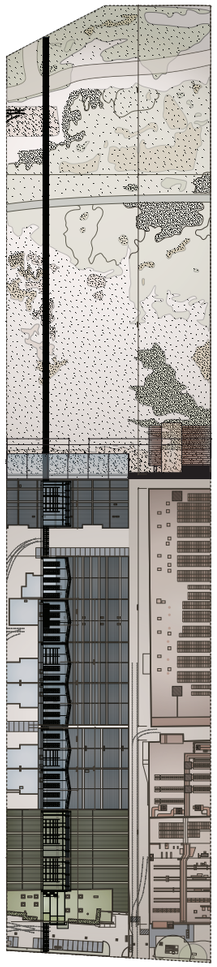
2.



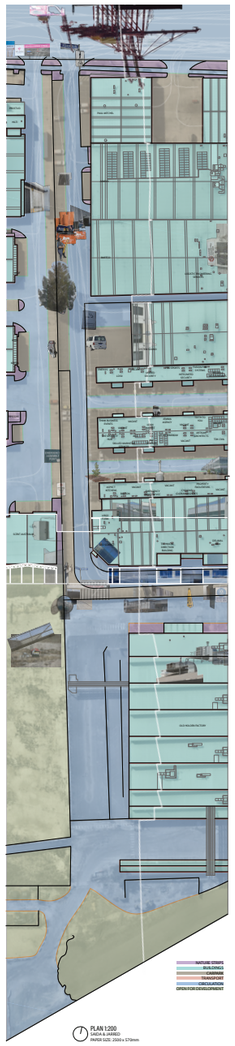
3.



4.



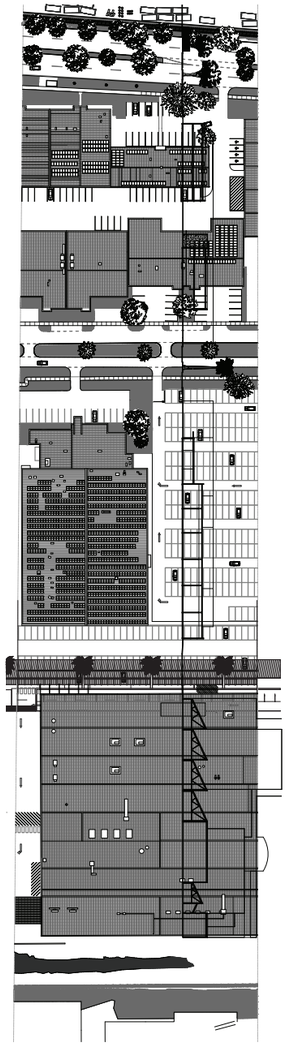
5.



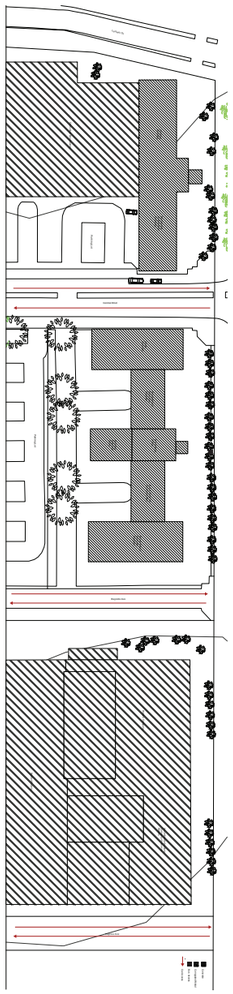
6.



7.



8.



9.

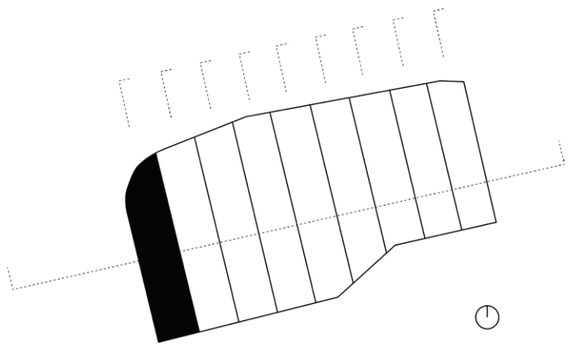
QR code link to collated class contextual spatial temporal video representations.

1. Saraf Golpo and Rehila Hydari
2. Claudia Sekulovski and Makara So
3. Meka Rakhmat and James Kouskouras
4. Cho Woo Jin and Chin Chang Hung
5. Robin Deepthi Mahanthi and Sara Amin
6. Jarrad Frahamer and Saida Bakhsh
7. Marlow Brown and Su Wutt Yee
8. Blair Albrecht and Trent van Elwoud
9. Tong Zhao and Somana Sok

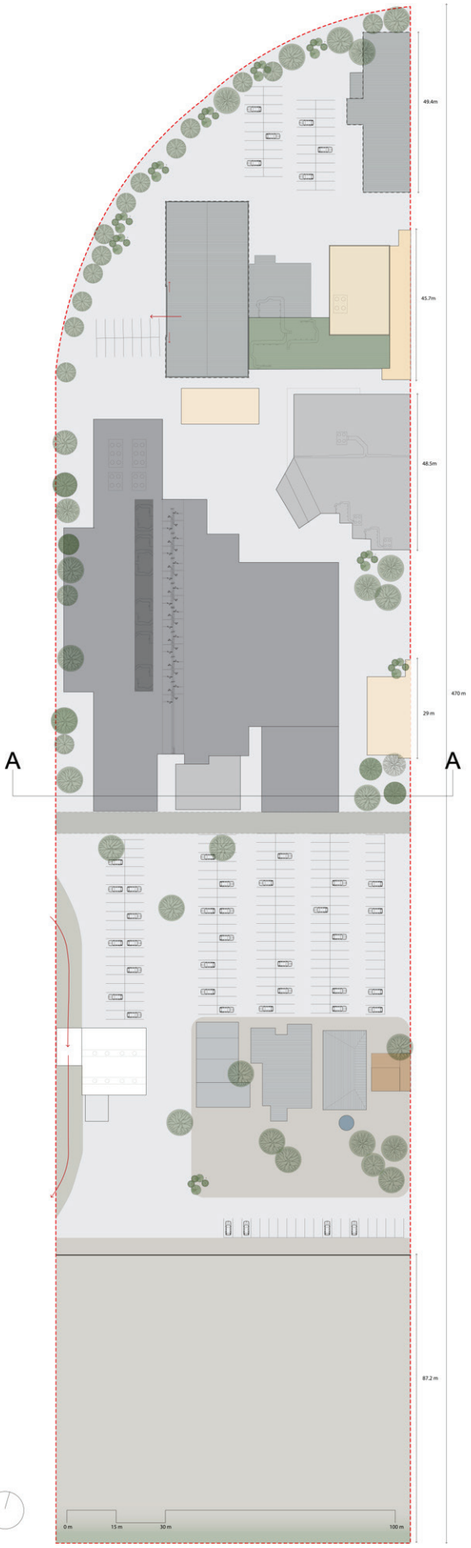
Context Transect No. 1

Saraf Golpo and Rehila Hydari

QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram

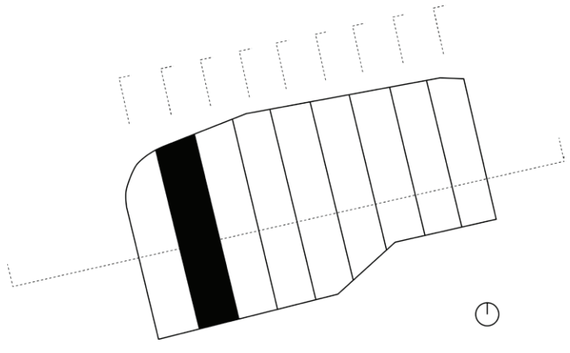


Composite Drawing

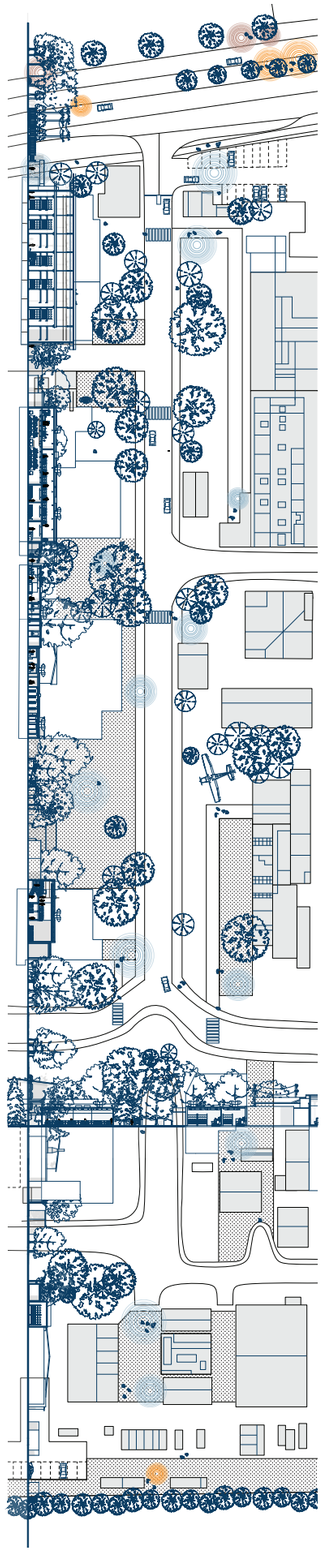
Context Transect No. 2

Claudia Sekulovski and Makara So

QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram

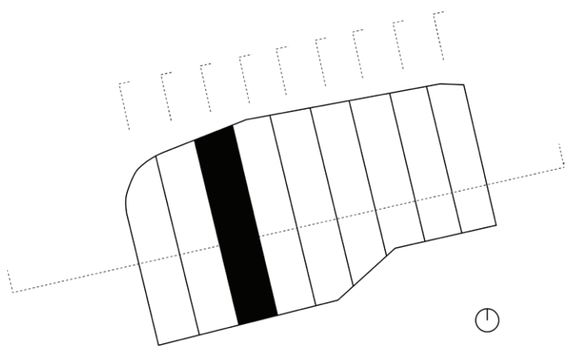


Composite Drawing

Context Transect No. 3

Meka Rakhmat and James Kouskouras

QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram

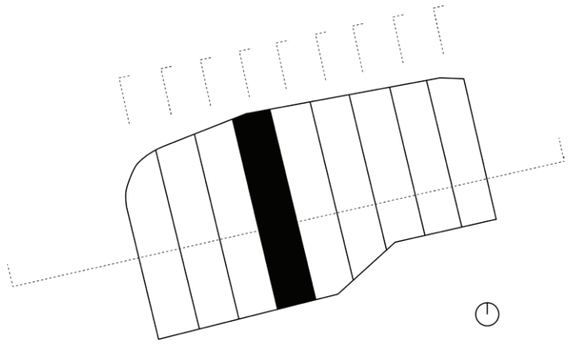


Composite Drawing

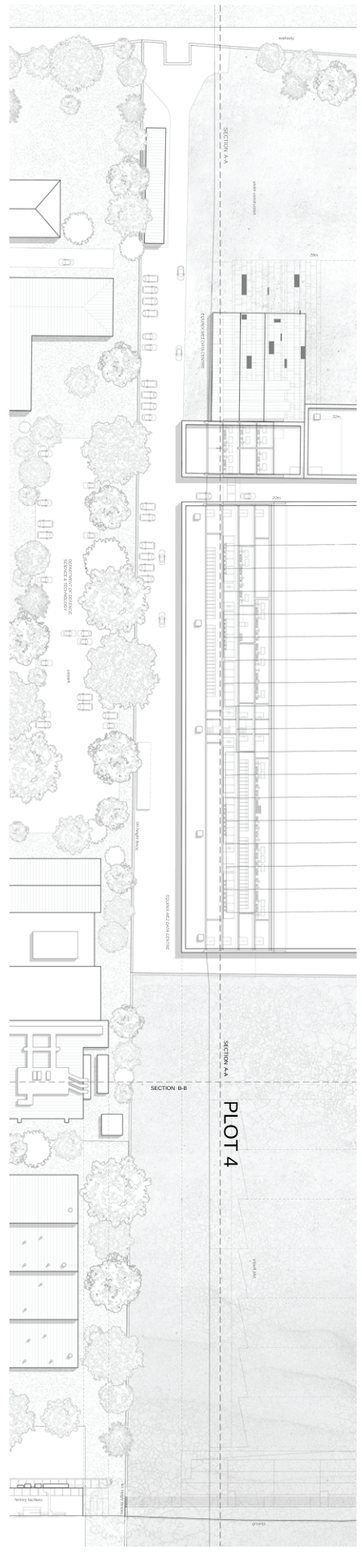
Context Transect No. 4

Cho Woo Jin and Chin Chang Hung

QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram

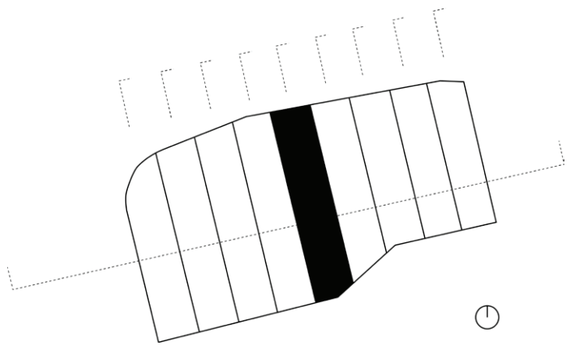


Composite Drawing

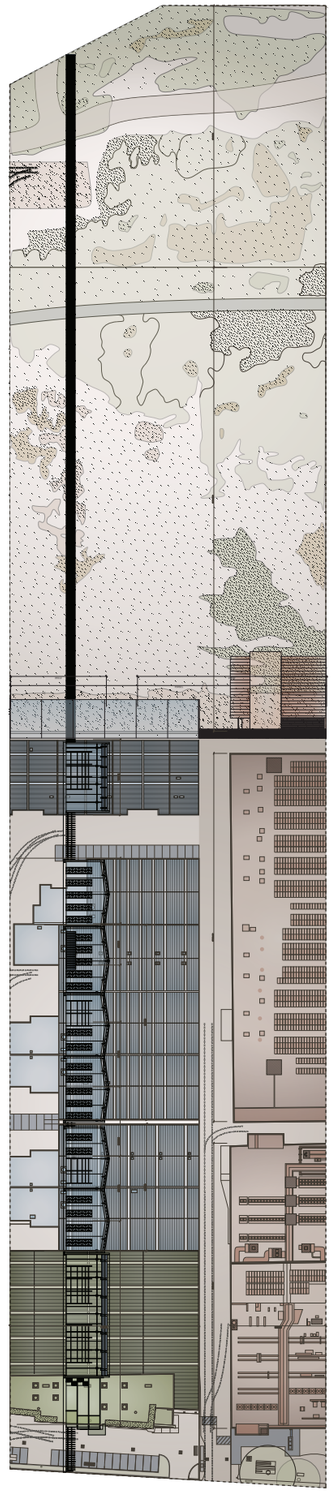
Context Transect No. 5

Robin Deepthi Mahanthi and Sara Amin

QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram

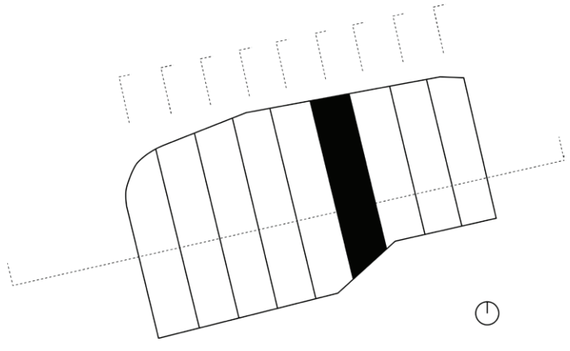


Composite Drawing

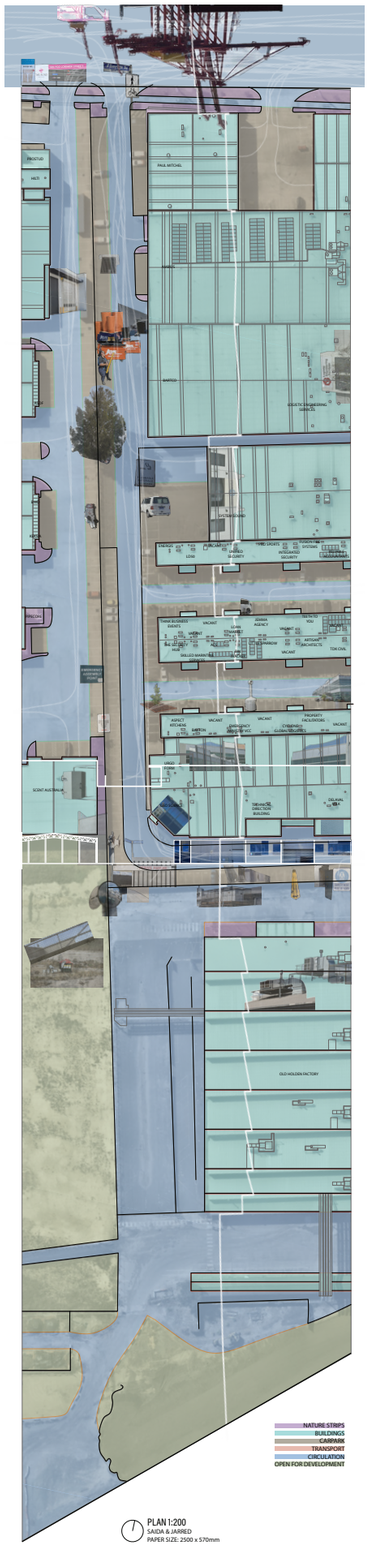
Context Transect No. 6

Jarrad Frahamer and Saida Bakhsh

QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram



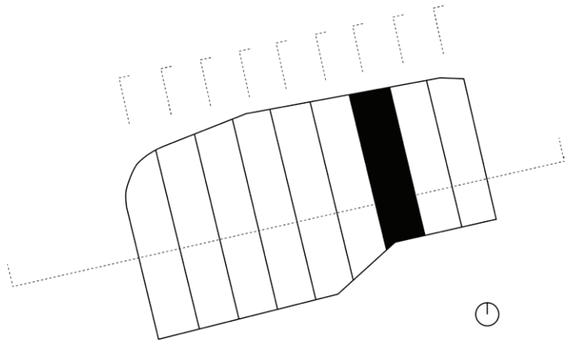
Composite Drawing

Context Transect No. 7

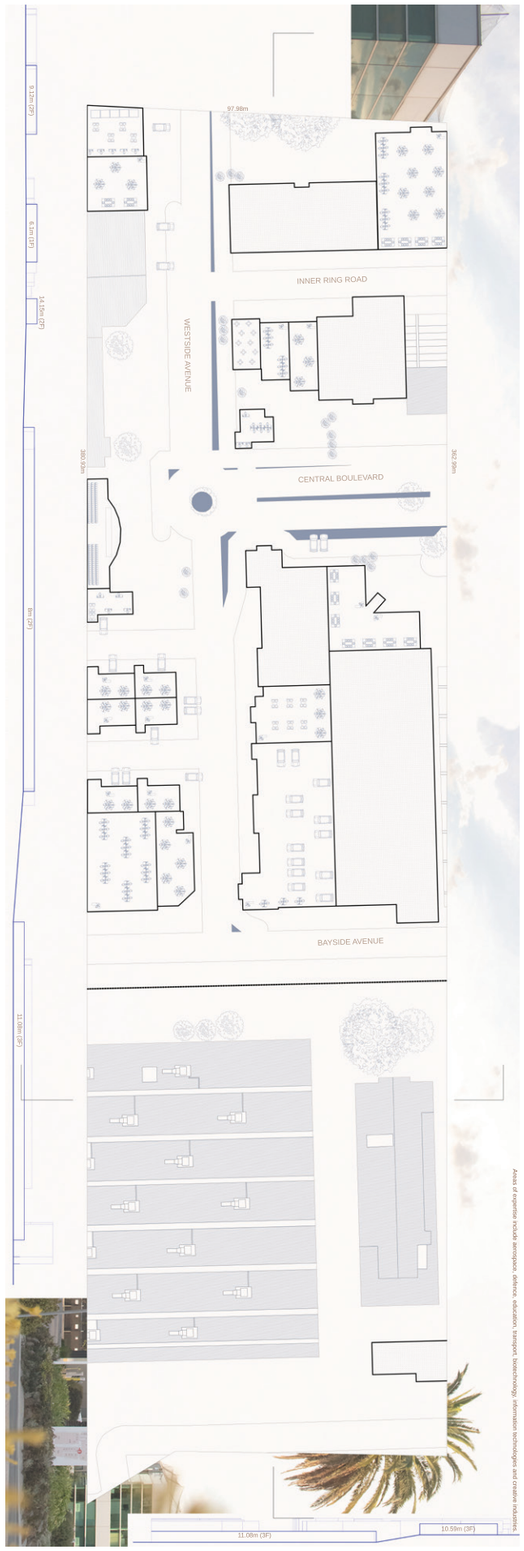
Marlow Brown and Su Wutt Yee



QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram

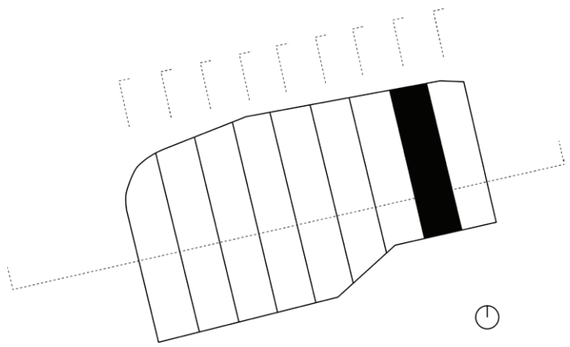


Composite Drawing

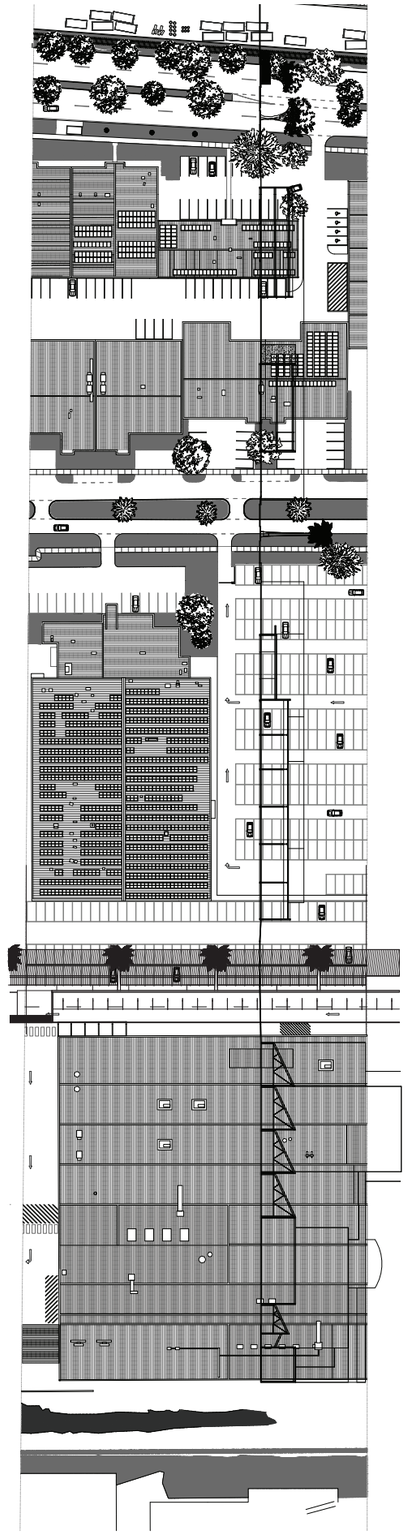
Context Transect No. 8

Blair Albrecht and Trent van Elwoud

QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram

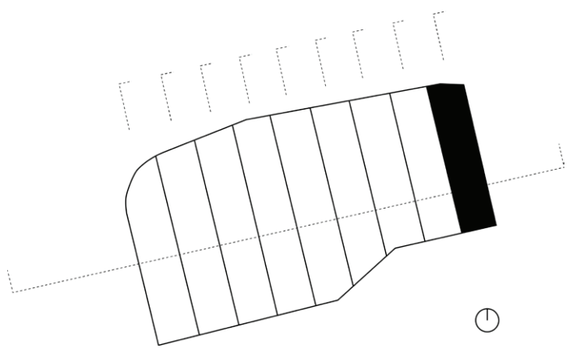


Composite Drawing

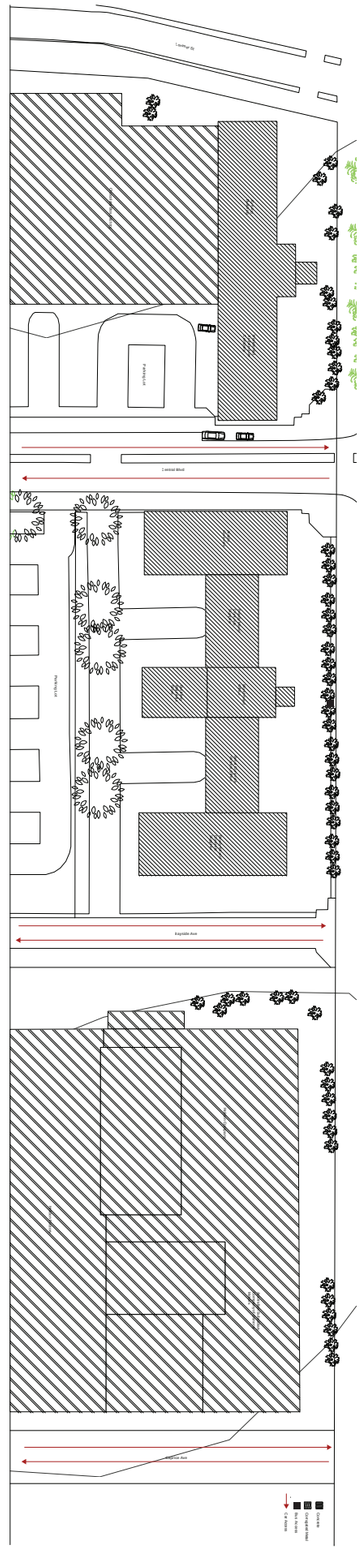
Context Transect No. 9

Tong Zhao and Somana Sok

QR code link to spatial temporal
video representation.



Key Plan Transect Location Diagram



Composite Drawing

04 Research Contexts:

Task Over View:

The final stage of the research component of the semester, continuing in the same pairs, was defining the objectives of the upcoming proposals, from manufacturing outputs to social activation programs. Defining the program and character of a construction hub and the types of buildings and/or products generated by the hub. Each group researching 4 branches of the typological contexts needing to be considered, including, a disruptive technology, a future housing precedent, an off site manufacturing typology and a wildcard program. The assignment integrates technical, conceptual, and collaborative exploration to envision transformative construction ecosystems for 2050 and the potential overlaps and possibilities indicative off these combinations and exploration of research threads. .

Research Outcome:

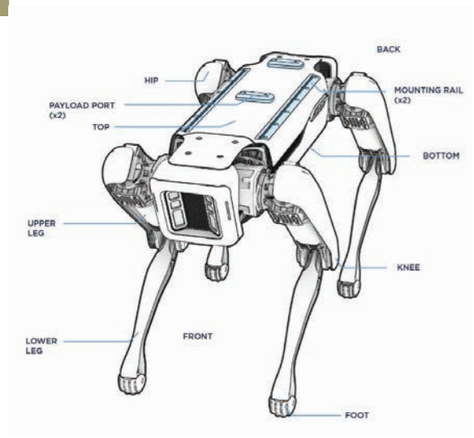
Short paragraph talking about the successes and learning opportunities uncovered by the class and the significances of conducting this final research.

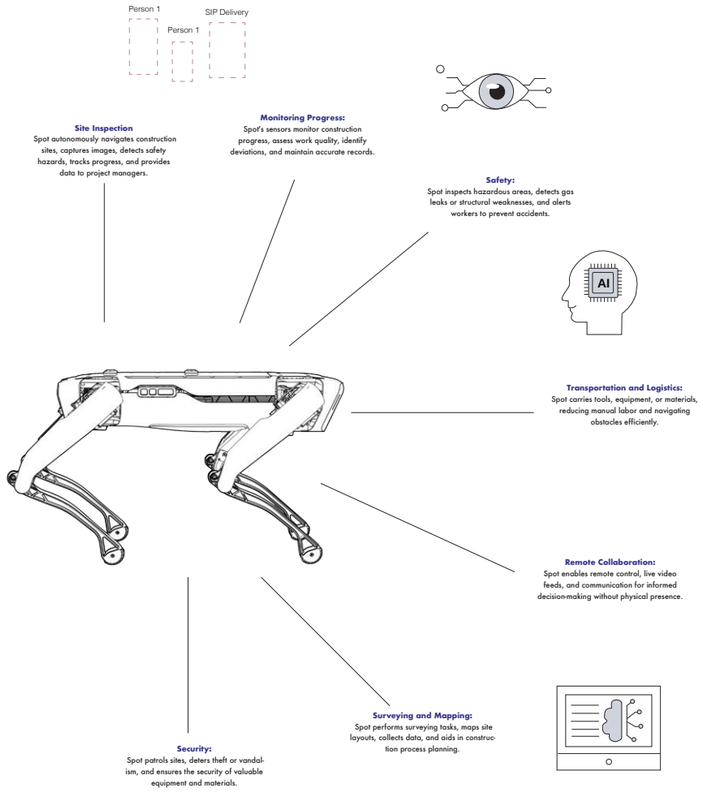
Saraf Golpo and Rehila Hydari

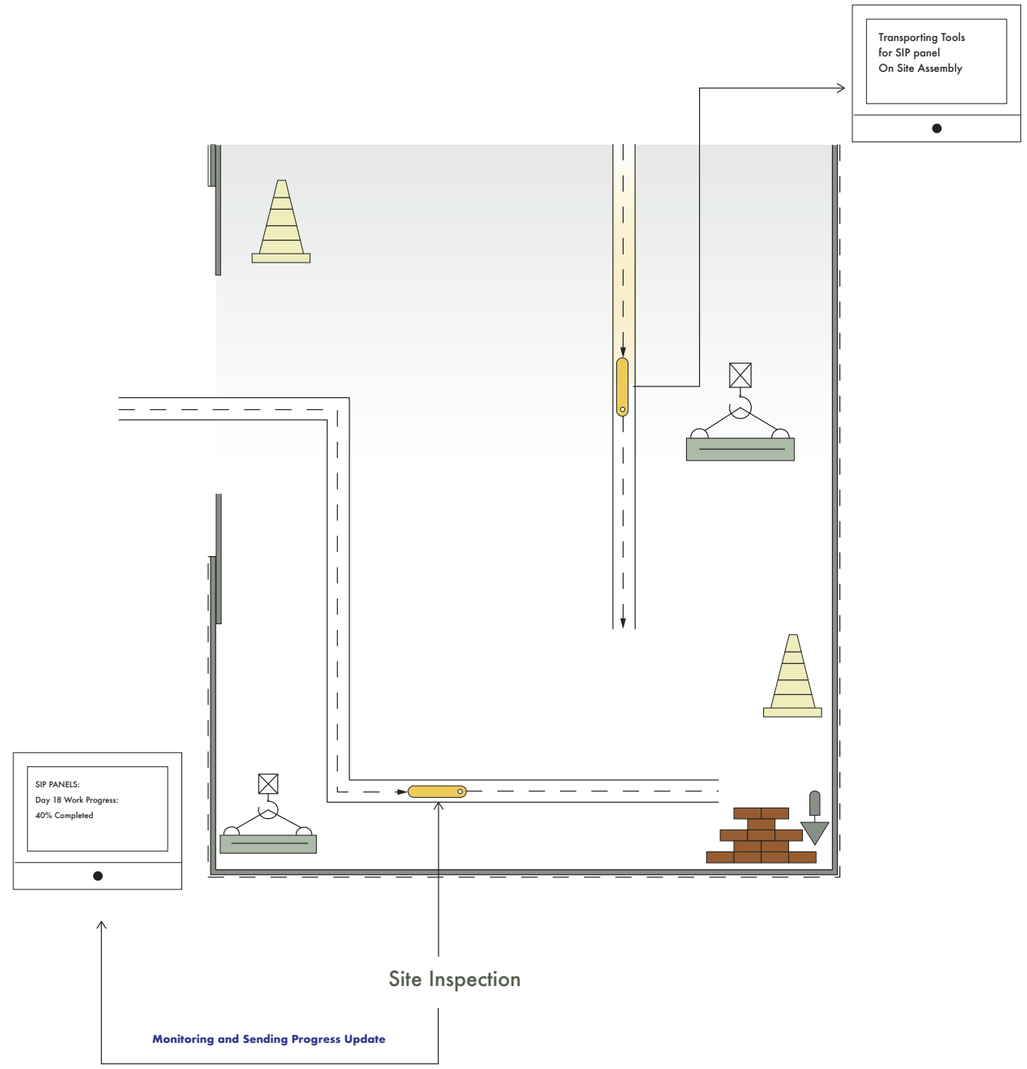
5.1: Companion Robots (Boston Dynamics 'Spot'),
5.2: Greg Lynn FORM - Embryological Houses,
5.3 : Structural Insulated Panels, +
5.4: Canteen / Food collective.

5.1 Companion Robots:

Boston Dynamics' "Spot" is a highly adaptable companion robot designed for diverse environments. It boasts advanced mobility features such as walking, running, stair climbing, and adept navigation of rough terrains. Equipped with sensors and cameras, Spot can autonomously interact with surroundings or operate under human guidance.
Spot finds utility across various sectors, including industrial inspections, construction, logistics, research, entertainment, and public safety. Its capabilities include carrying payloads, manipulating objects with its robotic arm, and collaborating seamlessly with other robots or human counterparts. Furthermore, Spot's modular design enables customisation to suit specific applications, enhancing its value as a versatile tool in robotics and automation, promising transformative impacts across industries







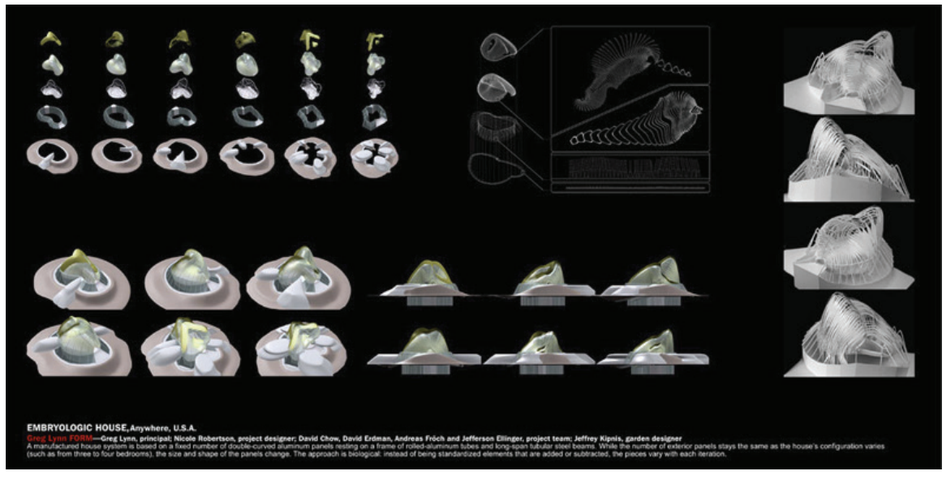
Spot: Enhancing Construction Site Efficiency and Safety
This diagram illustrates Spot's multifunctional role in modern construction sites, from autonomous inspections and progress monitoring to material transport, security patrols, and collaborative tasks. Spot's advanced capabilities contribute to improved efficiency, safety, and productivity, revolutionising how construction operations are managed."

5.2 EMBR:

Greg Lynn, a visionary designer, explores the fusion of digital design and manufacturing to create architecture reflecting modern cultural and technological contexts. His portfolio includes the oretical projects, collaborations, and built works pushing architectural boundaries with fluid, non-Euclidean forms known as "BLOb" architecture. The iconic Embryological House epitomizes his approach, aiming to redefine house typology, offer customizable variations, and leverage automated manufacturing technologies. Developed digitally using Microstation and Maya, the House remained conceptual, showcasing Lynn's mastery in merging organic and digital metaphors. Its innovative design and digital realization make it a notable case study in contemporary architecture.

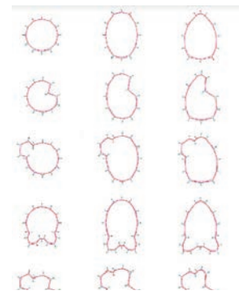


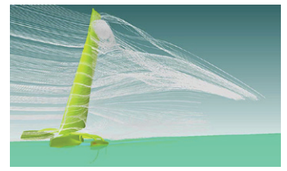
Greg Lynn, Embryological House: Size "A" eggs, ca. 1999



The RV (Room Vehicle) is a 1/5th scale model of a residence, resembled as a cocoon form rotated in two axes on a robotic base. Several criteria need to be taken into consideration and had an influence on material selection for this model of residence. They focused on keeping the idea of a movable model. Therefore, the Room Vehicle was made of a carbon fiber fabric. Structural simulation of the form was used to determine the thickness of the material.

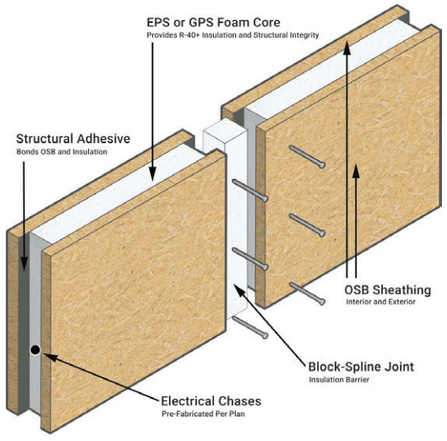






5.3 Structural Insulated Panels:

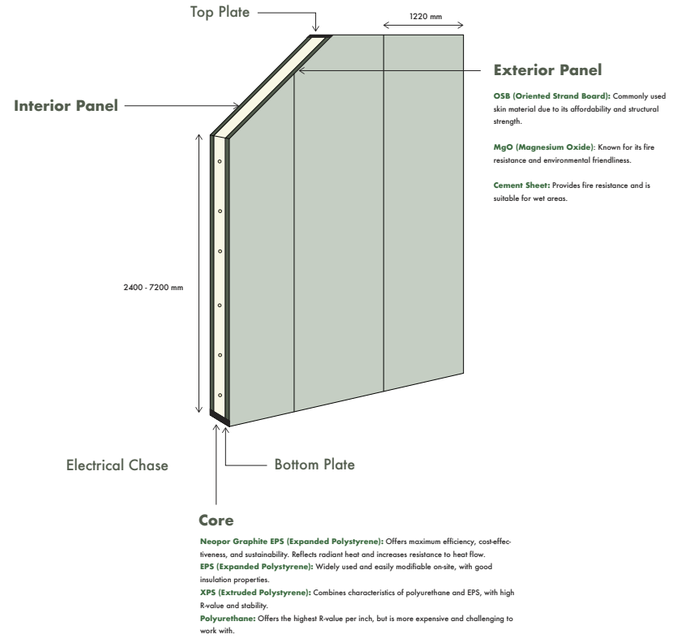
Structural Insulated Panels (SIPs) have undergone a transformative evolution since their inception in the 1930s, initially finding utility in military housing before widespread adoption in residential and commercial construction. Today, companies like Smart SIPs are in charge of SIP innovation, offering panels with advanced materials such as Neopor Graphite EPS, which enhance insulation and overall performance. SIPs are composite building materials with a foam core sandwiched between two structural facings, often made of oriented strand board (OSB). These panels offer excellent insulation properties, a high strength-to-weight ratio, and quick assembly. They provide exceptional thermal insulation, expedite construction timelines, and contribute to sustainable building practices. Their versatility is evident in various building applications, from residential homes to commercial structures, showcasing their adaptability and efficiency. While SIPs present challenges such as initial costs and the need for specialised skills, their significant contributions to energy efficiency, structural integrity, and sustainable construction practices make them a preferred choice in modern building projects. Despite these challenges, SIPs continue to evolve and innovate, driving advancements in the construction industry.



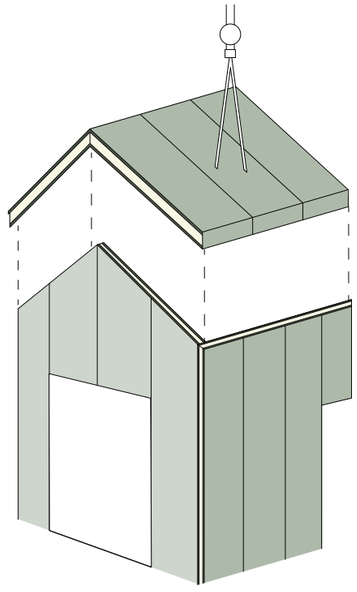








Standard Sizes Include:
Widths of 1.220 meters and heights varying from 2.440 meters - 7.200 meters (24 feet). Thickness options range from 114mm to 610mm.



Structural Insulated Panels (SIPs),
lend themselves adeptly to prefabrication, facilitating streamlined construction processes for workshops and industrial buildings. Assumptions include heightened structural robustness, energy-efficient designs, and cost-effective assembly methods, positioning SIPs as an intellectually sound choice for contemporary industrial construction endeavours

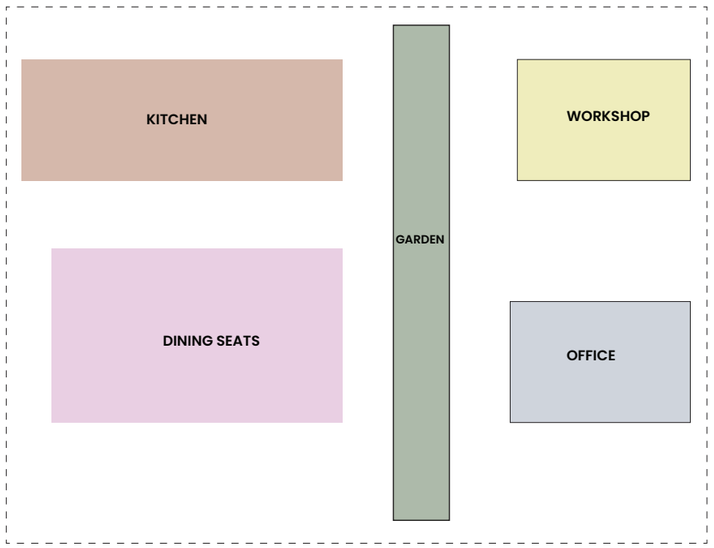
5.4 Canteen/ Food Collective:

There are digital platforms that connect food retailers and consumers on a broad scale. The platform enables users to place orders in bulk and accommodate specific dietary requirements. Such an example is Canteen Hub not only redefines the traditional canteen experience but also acts as a conduit between food retailers and consumers. It offers a dynamic platform where individuals and organizations can access diverse culinary options tailored to their dietary needs, facilitating seamless transactions on a larger scale. The integration of technology and innovation in both the Canteen Hub and modern cafeterias underscores a broader trend towards enhancing convenience, choice, and sustainability within the food industry. And in that same sphere, there are community-driven organisations dedicated to addressing and researching inequalities within the food system. They facilitate workshops to foster connections and understanding of individuals' food identities.

Large Cafeterias are similar to those commonly found in countries like South Korea catering to the needs of universities and corporate businesses. These cafeterias offer a wide array of food choices to cater to diverse tastes and preferences and play a pivotal role in various settings as hubs of social interaction and nourishment. Furthermore, the integration of urban farms within office buildings is a significant step towards sustainability and self-sufficiency in urban environments.







Strategies and Applications
With the combination of the large scale cafeteria and canteen food collectives that can operate in together. The left and right being separated by the green garden.







- vegetables and other plants are grown in and around the building. Such as confereance room and inbetween walls.
- The items are harvested by the office workers according to their taste.
- Then it it taken to the kitchen where the chefs prepare a meal from them.

Pasona Urban Farm Location:Tokyo, Japan Architect: Kono Designs Built Year: 2010 Type: Office Building 'Located in downtown Tokyo, Pasona HQ is a nine story high, 215,000 square foot corporate office building for a Japanese recruitment company, Pasona Group.

It is a major renovation project consisting of a double skinned green facade, offices, an auditorium, cafeterias, a rooftop garden and most notably, urban farming facilities integrated within the building. The green space totals over 43,000 square feet with 200 species including fruits, vegetables and rice that are harvested, prepared and served at the cafeterias within the building. It is the largest and most direct farm-to-table of its kind ever realized inside an office building in Japan.'





Top up food card or pay at kiosk

order food or self-serve

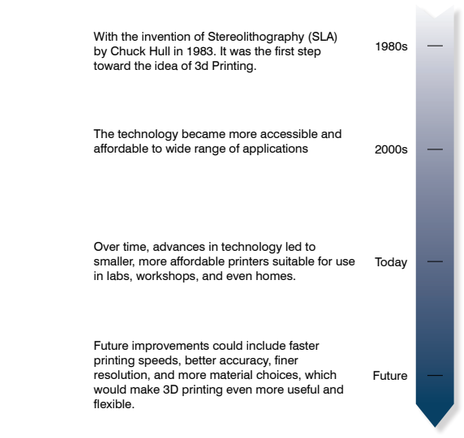
clean tray and food waste

Office/Corporate Intitution Cafeteria in South Korea

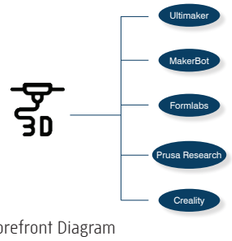
Claudia Sekulovski and Makara So

5.1: 3d Printing - Small Scale and Components,
5.2: Gropyus (Berlin),
5.3: Volumetric - Bespoke, +
5.4: Wellness Centre.

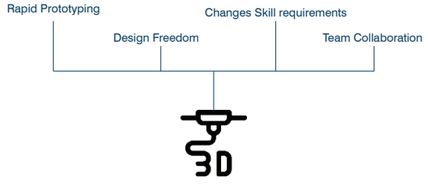
5.1 3d Printing, Small Scale and Components:



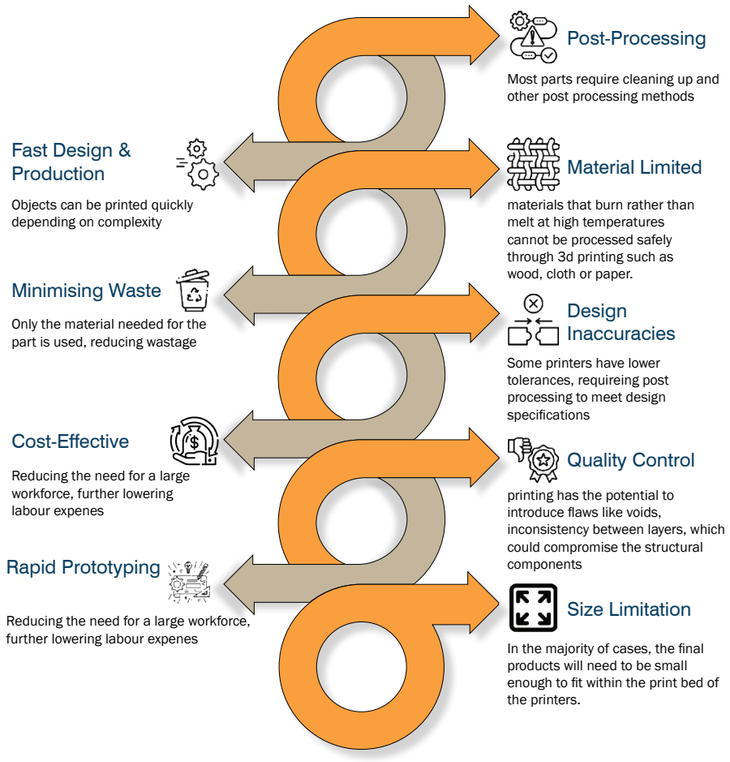
Technology Evolution Diagram



Technology Forefront Diagram



Impact the Design and Building Workforce Diagram



Benefits and Drawbacks Diagram

Building Bytes: 3D-Printed Bricks

"You could have several of these machines working simultaneously on site using pre-made or locally manufactured material," "It doesn't have to be necessarily ceramic - it could be concrete or cement or any mixture of building materials." - BRIAN PETERS

Project Brief

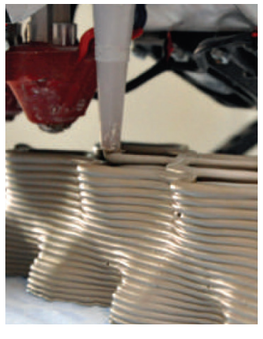
Building Bytes is an ongoing research project looking into combining traditional building materials with advanced technology of 3D printing. The goal is to revolutionize the construction industry by providing a low-cost and accessible method for producing building components, specifically ceramic bricks, with desktop 3D printers.

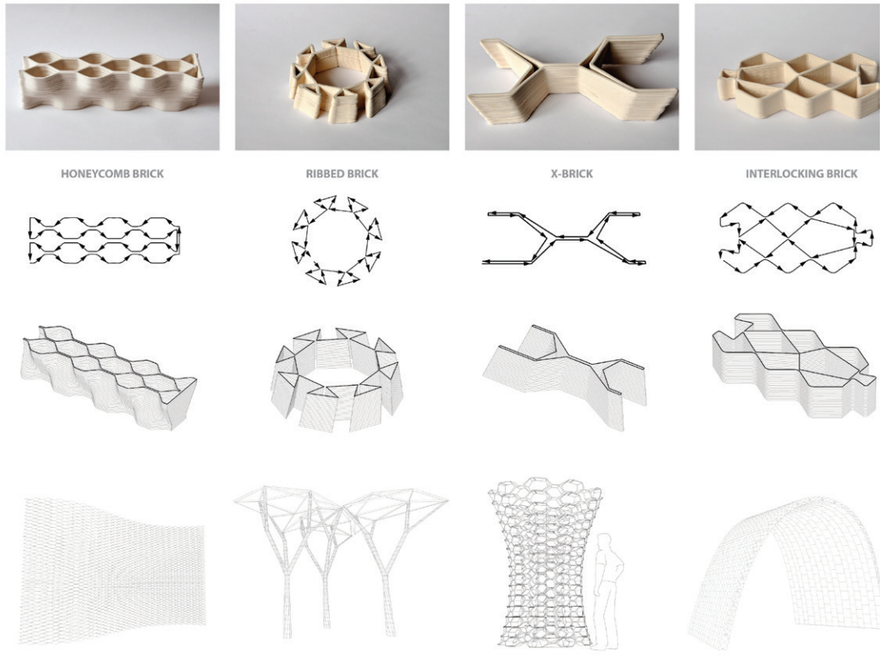
Overall, Building Bytes envisions a future building site where local designers and builders are fabricating bricks on site using a series of easily accessible desktop 3D printers with local materials.





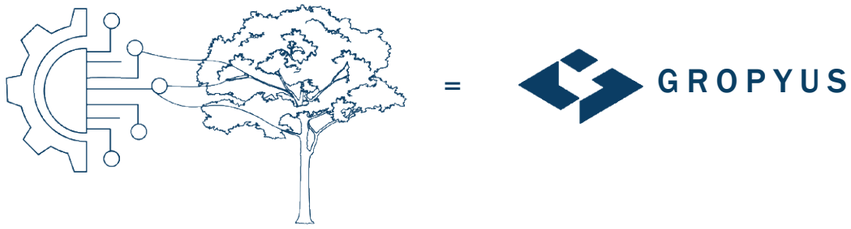






5.2 Gropyus (Berlin)

"Combining technology and sustainability to create new generations of buildings."



Approach Diagram



Affordable

- New costs efficiency standard
- Measurable time savings
- Groundbreaking operational efficiency

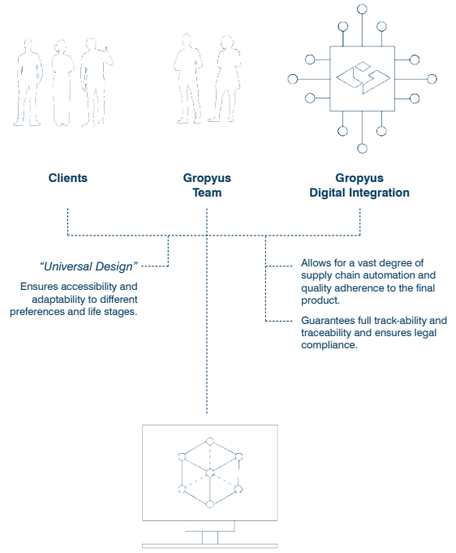
Sustainable

- Flexibility in design
- Ready for the sustainable future of construction
- Breakthrough production and scalability

Aspirational

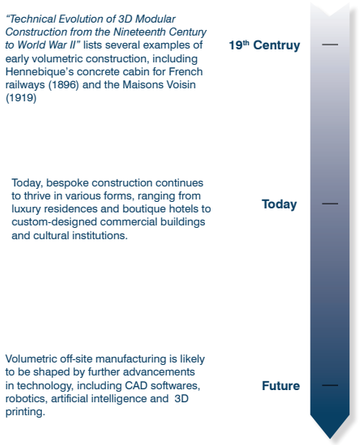
- One-of-a-kind experience
- Social Participation

Benefits Diagram



Gropyus Process Diagram

5.3 Volumetric - Bespoke:



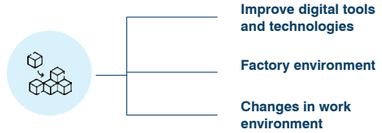
Technology Evolution Diagram

KIER GROUP - UK

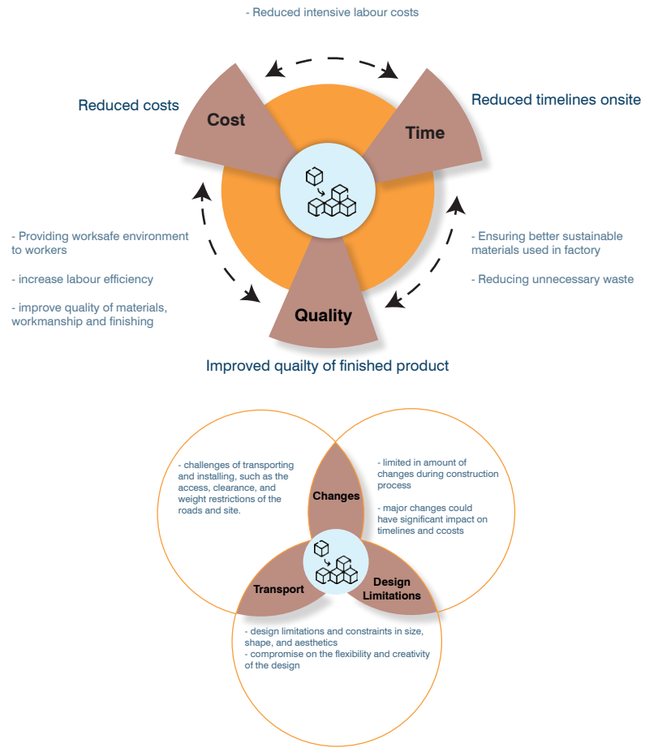
ARKIT - MELBOURNE

BROAD SUSTAINABLE BUILDING - CHINA

Forefront Diagram



Impact the Design and Building Workforce Diagram



Benefits and Drawbacks Diagram



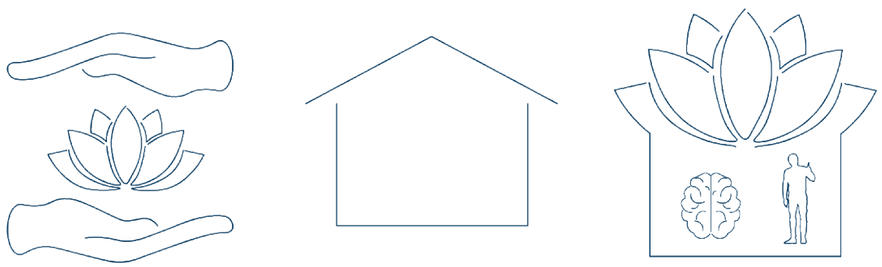
ARKIT - Advanced Prefabricated Architecture

Little City

Stockland Experience Centre

Collingwood Apartments

5.4 Wellness Centre:



Approach Diagram



Provide fresh, clean air	Select Healthy Materials
Provide daylighting and views	Select supportive lighting
Control glare	Support healthy eating
Design for acoustics	Design for movement
Access to Nature	Reinforce community
Design for inclusion	Create Safe spaces



Outcome Diagram

Quiet Room	Counseling Room
Spa/Sauna	Gym
Yoga/Meditation	Workspaces
Kitchen/Cafe	Physiotherapy
Beauty Room	Soundbath

Program Diagram

Architectural Synaesthesia

A Harmonious Fusion of the Senses in Design



= **Deeply Experiential**

- Sensory Design
- Kinetic Design
- Acosutic Design
- Tactile Design

"By embracing architectural synesthesia, designers seek to transcend the traditional boundaries of form and function, crafting spaces that are not just visually appealing but also deeply experiential. The goal is to create a more profound connection between individuals and their surroundings, fostering a sensory-rich and memorable experience within the built environment" - Pertanto

Experiential Diagram

Meka Rakhmat and James Kouskouras

5.1: Sensing networks/ Internet of Things,
5.2: Kieran Timberlake Loblolly House and Cellophane House,
5.3: Kit of Parts / Componentised, +
5.4: Event Space / Conference Centre.

5.1 Sensing Networks/ IOT:

It is a system of interconnected devices that collect data via sensors and then transfer and exchange that information over a wireless network without any human intervention. With improved response, monitoring and analytical capabilities, IOT is being adopted in almost all industries: manufacturing, transportation and logistics, retail, public sector, health care are readily.

Delivery Costs:
Tracking vehicles, the routes that they take, the fuel consumption - can help them monitor and reduce costs - tracking systems can also be offered to the customer t provide a comfortable experience where they can track their packages

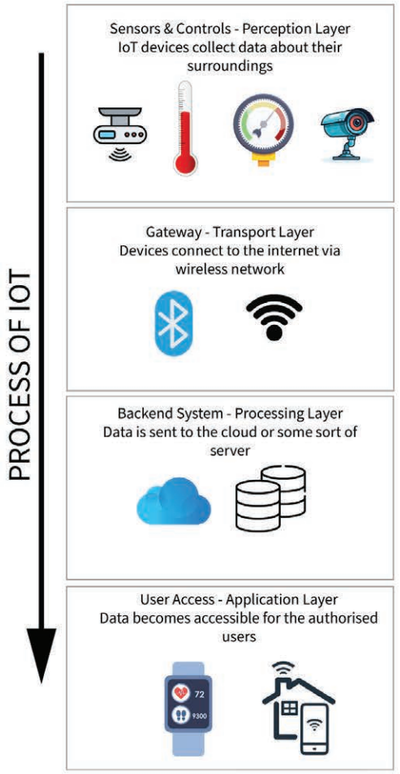
Banking:
Banking applications use IoT also this allows people to view all transactions made whenever they have used their card in person or online - their able to view their funds what they've spent, what they have received - and as well you can literally send people money via your phone. Having this system in place and used to frequently has made people forget how amazing that action is of being able to send your money which isn't tangible, to another person or purchase something on line - very sophisticated and advanced. Can track user behaviour as well as location to offer ATM 's etc.

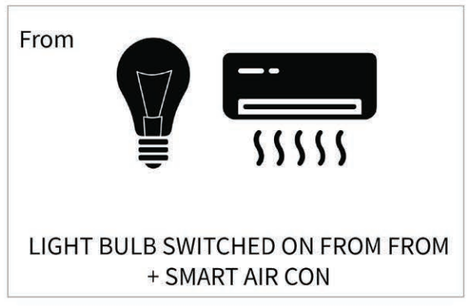
Health:
Smart watches are able to absorb information from your body and your movements and display it to you, along with its affect on any health goals you have and what not -to which your then able to analze on your phone. You track your steps - this data can then be used with AI systems to provide you with any lifestyle changes to achieve whatever goal you have. Integration of sensing technologies with Iot enabling real time monitoring of patients

Initial cost - implemented iot can be expensive as it requires the purchase and installation of sensors and other hardware

Security risks - iot can be vulnerable to security breaches. Providers may not always offer reliable support for their IoT systems, which could lead to major operational disruptions when something goes wrong

Complexity- The IoT involves a complex network of interconnected devices, which can be difficult to manage and maintain.







IoT in Construction:
IoT's integration into construction sites goes beyond mere tracking; it encompasses timely maintenance, efficient management of parts, and optimizes the utilization of machines.

Structural IoT - can detect the maturity of concrete, its real time strength and its temperature and collect curing data for the concrete. It helps prevent property losses and casualties. Better quality control and reduces the risk of structural failures.

Reality capture IoT - real time surveillance of work sites (worker cameras, drones and fixed cameras). Views all kinds of work site conditions in real time. Helps with job safety, planning and security- helps identify and address potential hazards improving safety.

Excavation sensor technology is also having a significant impact (excavation is a crucial part of construction projects).

Safety and accuracy are vital in this process. Excavation sensors can detect soil conditions, detect underground utilities and track the movements of the excavation equipment and people around. Allows for better decision making and less mishaps optimising equipment usage. This leads to safer work environments.

Environmental IoT - can inform workers of harsh weather conditions and provide measures to avoid issues and help with storage planning of equipment. This benefits worker safety and protects valuable goods.

Improved efficiency: The IoT can help construction companies improve their processes by providing real-time data on equipment usage, maintenance needs, and the progress of projects. This can help reduce downtime and improve productivity.

Enhanced safety: The IoT can help construction companies improve safety by providing alerts when safety hazards are detected or when equipment is being used improperly .

Better decision-making: The IoT can provide construction companies with real-time data on various aspects of their operations, allowing them to make better informed decisions .

Increased cost savings: The IoT can help construction companies save money by reducing the need for manual labor and helping to optimize equipment usage and maintenance.







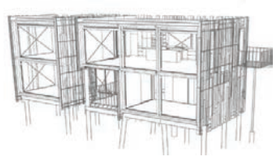


5.2 Kieran Timberlake Loblolly House and Cellophane House

The Loblolly House, located in Maryland USA, was designed by the home owner Stephen Kieran and the architects at Kieran's practice, Kieran Timberlake. The house is most notable for its pre-fabrication. It was almost entirely manufactured o-site and was assembled onsite in six weeks. Despite the house's industrialised construction, Kieran conceived the building to be apart of the site rather than separate to its nature and was named after the Loblolly Pine trees on the property.







The Cellophane House was commissioned by the Museum of Modern Art for an exhibition in 2008. It advances the philosophies found in Kieran Timberlake's Loblolly House in many ways. It achieved a construction time of under one week and much higher levels of disassembly and recyclability.





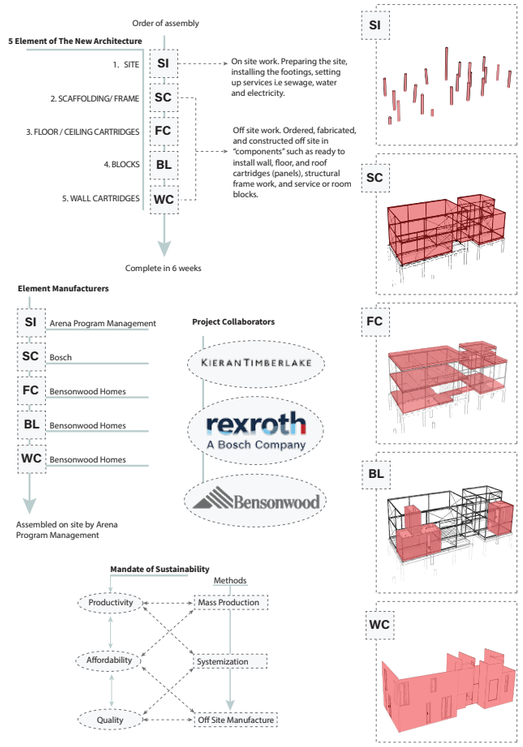


Amongst the over philosophies and agendas pushed in the two houses, Kieran Timberlake are also strong advocates for the use of

Digital Parametric Models. The Loblolly house was developed as a SoildWorks model in conjunction with Bensonwood Homes the project's o-site manufacturer.

In the design of both homes Kieran Timberlake Architects paid much attention to their lifecycle. They designed not only for fast on site assembly but also for the reverse, disassembly. The next life of these buildings (and all buildings) was a major concern resulting in buildings optimised for reuse, relocation and recycling. The Cellophane House notably used many recycled materials in its construction but also materials that were recyclable, resulting in a building that was 82% recyclable.

The construction of the Cellophane House was an assembly of a series of volumetric block modules, a process which reduced the construction time to six days in comparison to the Loblolly House's six weeks. Both projects utilised light weight aluminium framing produced by Bosch.







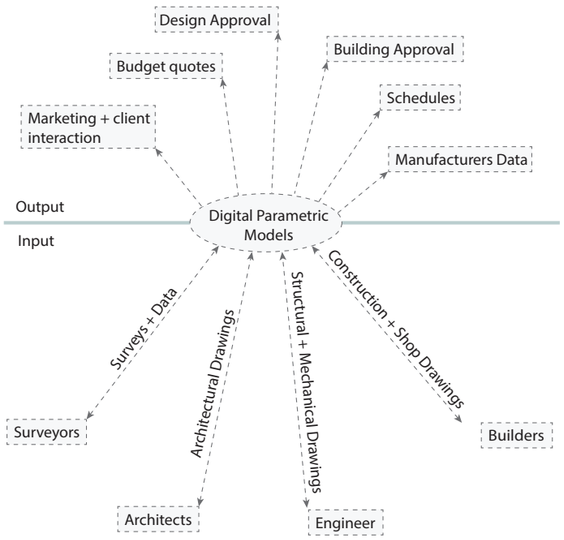








Read the other way for deconstruction.

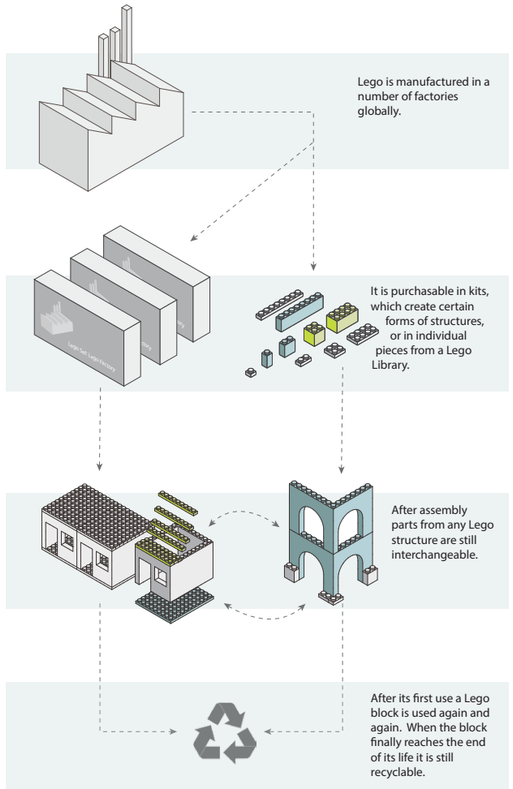


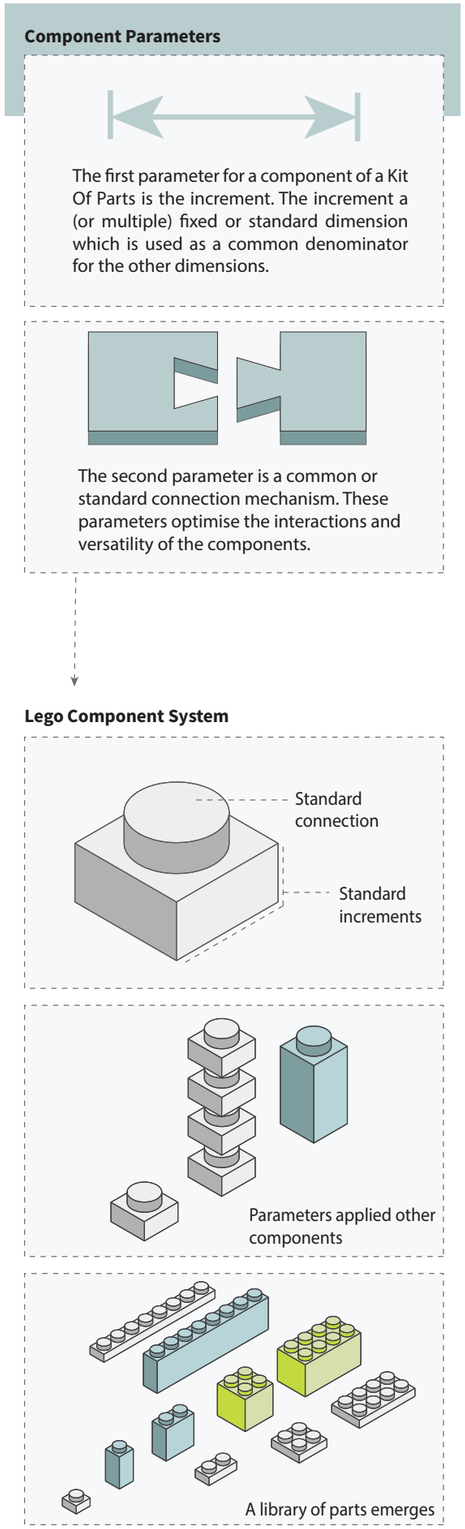
5.3 Kit of Parts / Componentised

Kit Of Parts construction is a building method which makes use of a library of components which have been optimised for compatibility in a large variety of situations. Kit of Parts construction is a form of industrialised construction. The building components (Parts) are designed for mass production and o-site manufacture. The system lends itself to disassembly and component reuse.

Frequently Kit Of Parts libraries are accessed and used via digital interface. The methods and theories which form the basis of this construction typology push strongly for sustainable, reusable, adaptable and affordable buildings.

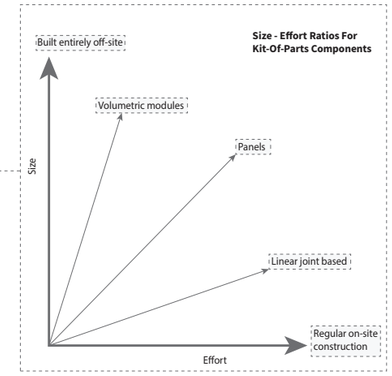
Lego System Example:
The widely known children's toy Lego, although not a construction method, proves useful in understanding Kit-Of-Parts systems. Each of its pieces is useable with any other piece in an endless variety of configurations. Beyond the first perhaps intended use a Lego block finds itself continuously reused in all manner of ways.

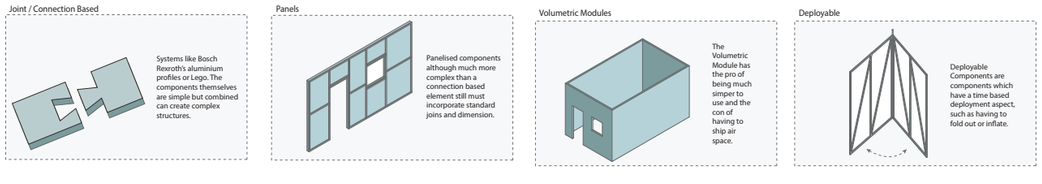




Kit Of Parts construction is a building method which makes use of a library of components which have been optimised for compatibility in a large variety of situations. Kit of Parts construction is a form of industrialised construction. The building components (Parts) are designed for mass production and off-site manufacture. The system lends itself to disassembly and component reuse. Frequently Kit Of Parts libraries are accessed and used via digital interface. The methods and theories which form the basis of this construction typology push strongly for sustainable, reusable, adaptable and affordable buildings.

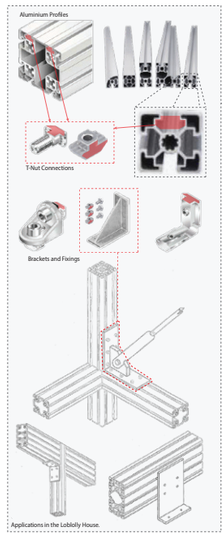
The components of a Kit Of Parts system generally come in four typologies. These are connection based (although typologies must have common connections), panel based, volumetric modules, and deployable elements. While a Kit Of Parts system is not conned to one typology often they are strongly rooted in one.

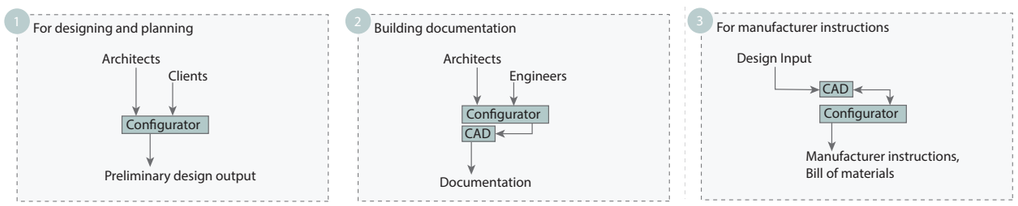




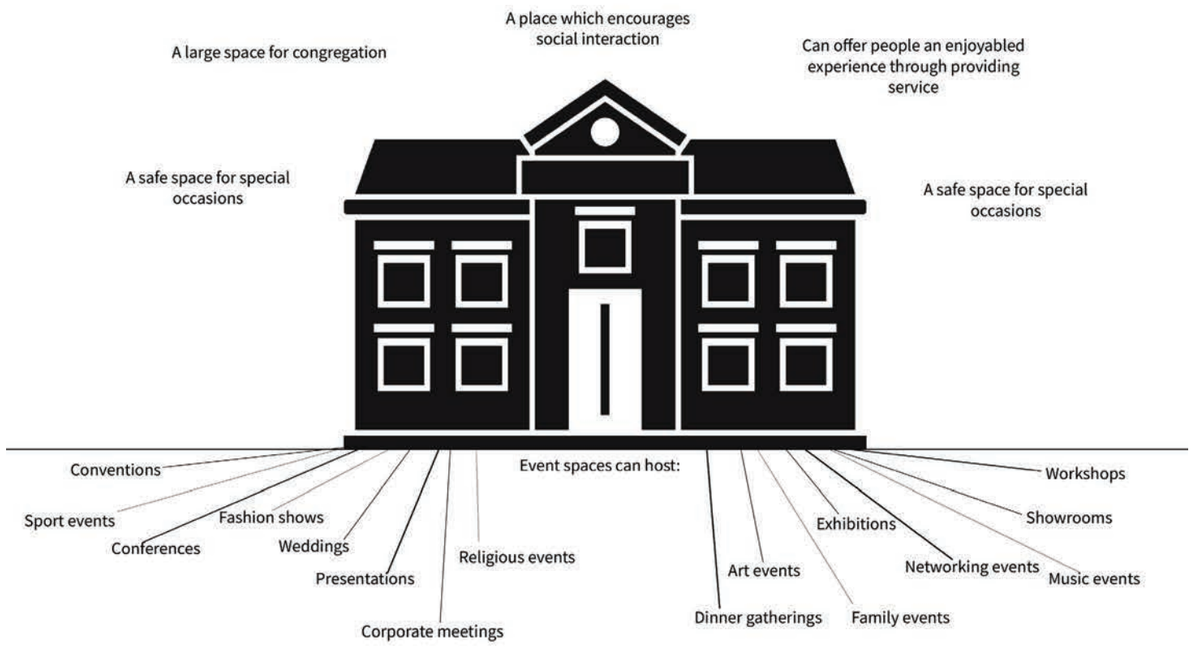
Bosch Rexroth Extruded Aluminium Pro les are a Kit of Parts system utilised by both the Loblolly House and the Cellophane House. The lightweight aluminium system was used as scaffolding/framing in both cases. The system features an adjustable T-Nut based standard connection, which is non-permanent and simple to disassemble and reuse. The Isometric diagrams are re-produced from Kieran Timberlake Architects and document the use of this Kit Of Parts in the Loblolly house.

Below are three concepts for the integration and application of configuration software into Kit Of Parts systems. A configurator is a digital software interface for a Kit Of Parts library. It serves to aid designers and manufacturer with using a Kit Of Parts through direct connections to CAD and manufacturing facilities or simply by providing a digital interface for the system.

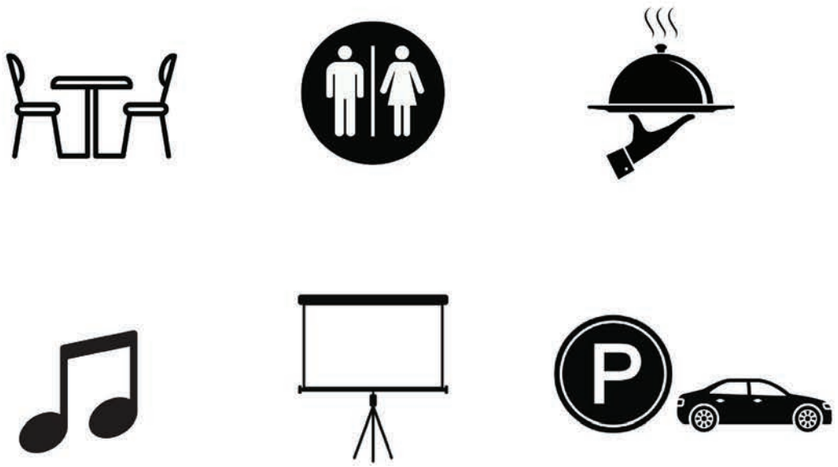




QUALITIES



REQUIREMENTS



CONSIDERATIONS

High quality and decorative lighting



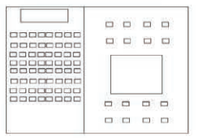
Ambience to evoke certain moods



Size of kitchen / what they offer



Can it hold multiple events



Multipurpose



Capacity

Inside and outside?



Energy efficiency



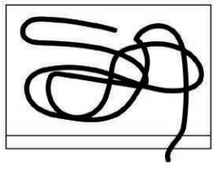
Acoustics



Materials - certain materials may stimulate aesthetic looks + the level of quality of the material



Circulation



Colour / textures





LEONDA BY THE YARRA
2 Wallen Rd, Hawthorn VIC 3122





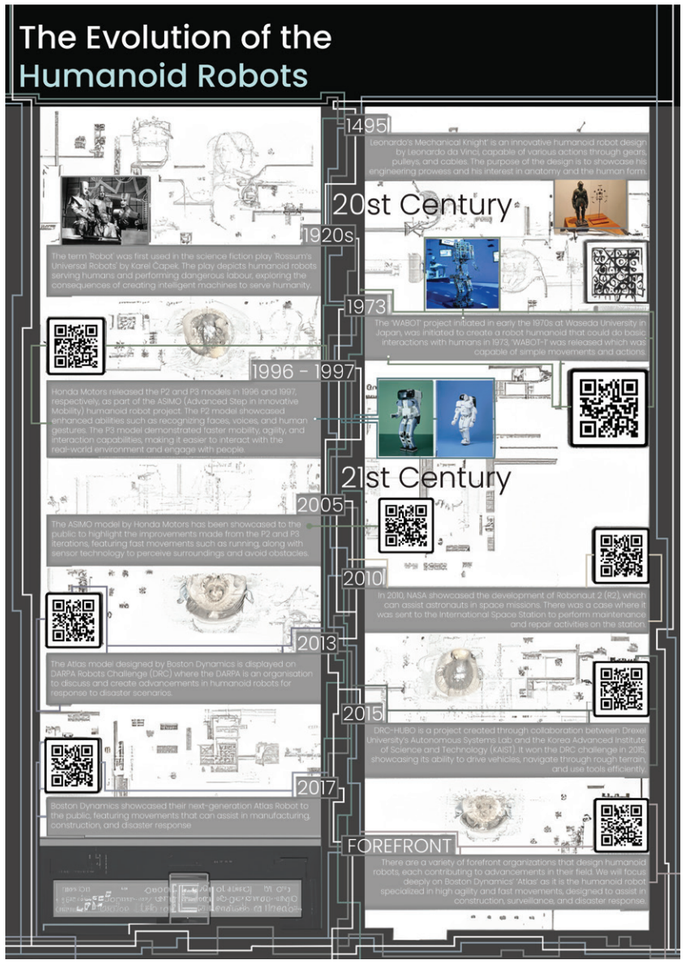


THE MELBOURNE EXHIBITION AND CONVENTION CENTRE
1 Convention Centre Pl, South Wharf VIC 3006

Cho Woo Jin and Chin Chang Hung

5.1: Humanoid robots (Boston Dynamics 'Atlas'),
5.2: Boklok UK,
5.3: Cross Laminated Timber, +
5.4: Waste Recycler/ Reseller.

5.1 Humanoid robots (Boston Dynamics 'Atlas')

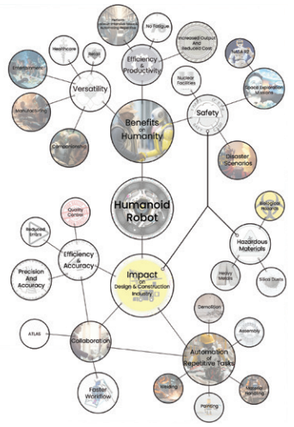


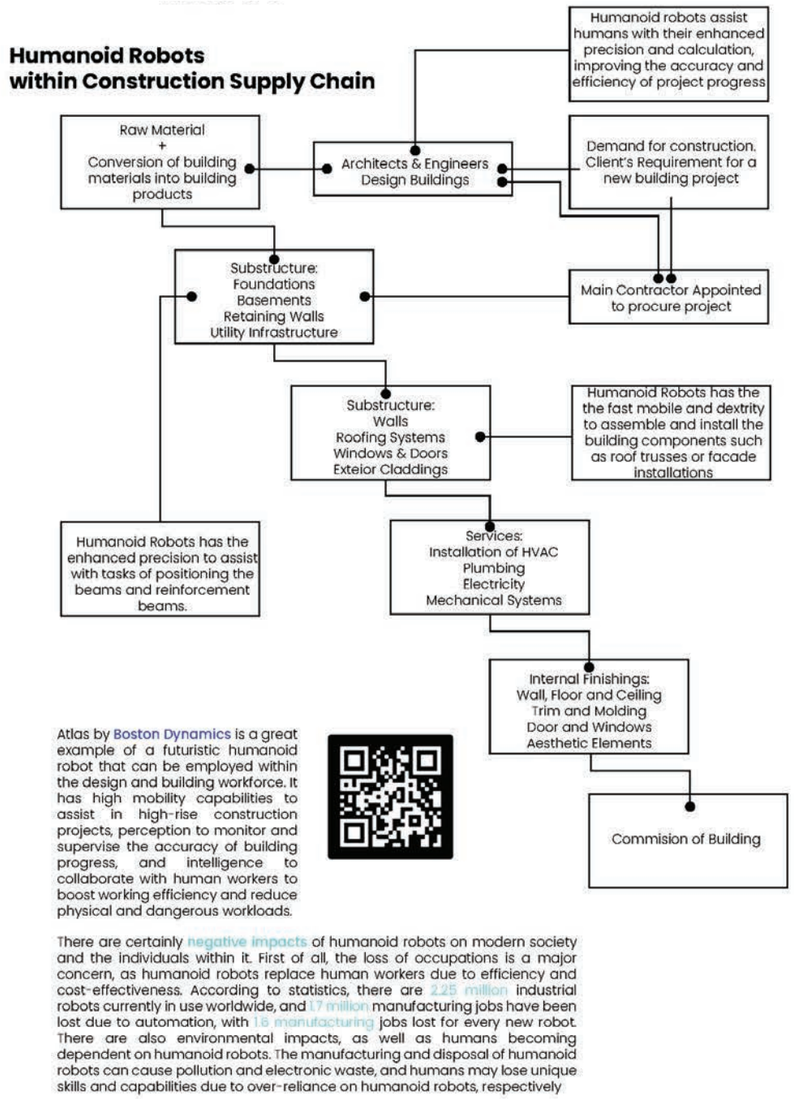
The diagram on the right is based on the research of the evolution of humanoid robots. In the current task, we were given the opportunity to research deeper into a specific humanoid robot type called Atlas.

Atlas is a highly advanced humanoid robot developed by Boston Dynamics, designed to assist in a variety of tasks with a focus on mobility and agility. Atlas is capable of navigating challenging terrain and performing complex movements with remarkable precision. Atlas can walk, run, jump, and even perform backflips, thanks to its sophisticated control systems and hydraulic actuators. Equipped with advanced sensors and vision systems, Atlas can navigate environments autonomously, avoid obstacles, and manipulate objects, which I believe it is known as LiDAR (Light Detection and Ranging) technology.

Atlas is designed for research and development in robotics, with potential applications in search and rescue, industrial automation, and hazardous environment operations. In our particular case, Atlas may be the perfect candidate to replace more human labour in the construction or the manufacturing realm.

The diagrams below explores the dynamics or a humanoid robot with humans. Humanoid robots can be our allies in changing the construction supply chain for the better. Humanoid robots can replace humans in performing tasks which are far more difficult and deemed not egronomical for humans, without compromising safety, time and cost in construction or daily tasks.





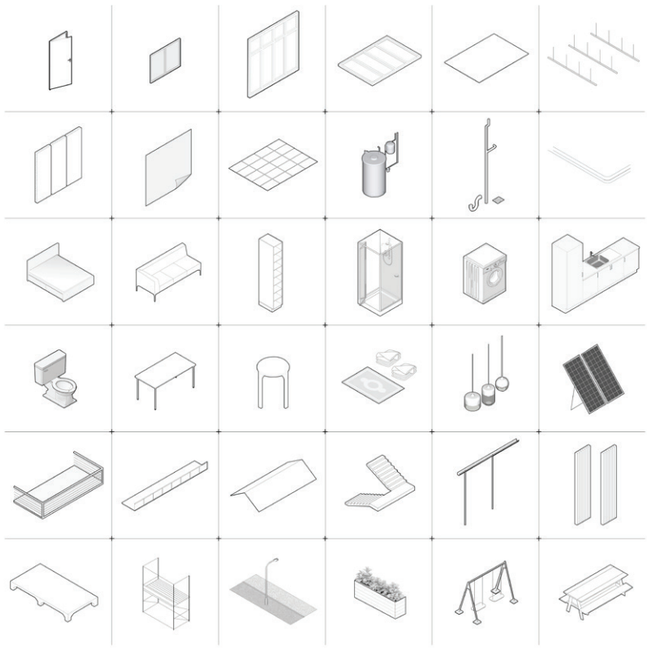
Atlas by Boston Dynamics is a great example of a futuristic humanoid robot that can be employed within the design and building workforce. It has high mobility capabilities to assist in high-rise construction projects, perception to monitor and supervise the accuracy of building progress, and intelligence to collaborate with human workers to boost working efficiency and reduce physical and dangerous workloads.

There are certainly negative impacts of humanoid robots on modern society and the individuals within it. First of all, the loss of occupations is a major concern, as humanoid robots replace human workers due to efficiency and cost-effectiveness. According to statistics, there are 2.25 million industrial robots currently in use worldwide, and 1.7 million manufacturing jobs have been lost due to automation, with 1.6 manufacturing jobs lost for every new robot. There are also environmental impacts, as well as humans becoming dependent on humanoid robots. The manufacturing and disposal of humanoid robots can cause pollution and electronic waste, and humans may lose unique skills and capabilities due to over-reliance on humanoid robots, respectively

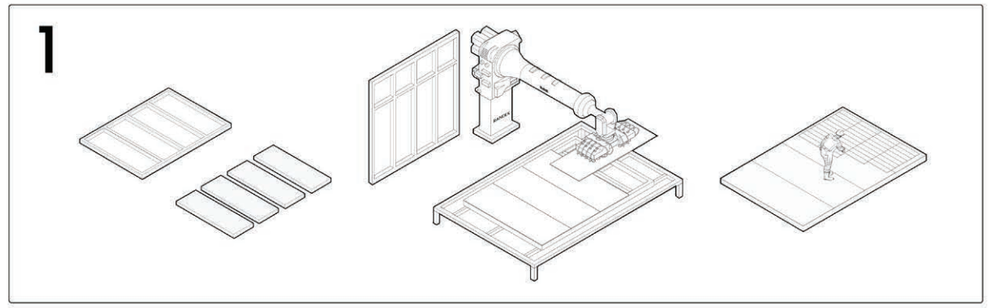
5.2 Boklok UK

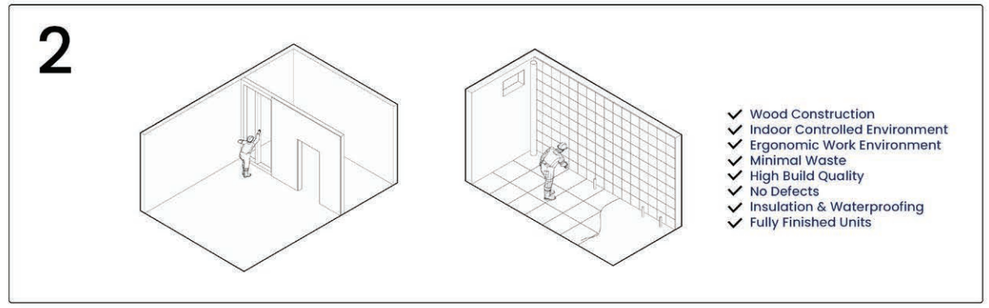
BoKlok is a residential housing concept providing sustainable home ownership for many people. The concept is developed and jointly owned by Skanska and IKEA. Skanska is an industry leader in residential development and construction. IKEA has the same reputation within home furnishings and furniture production. With 25 years' experience, the extensive BoKlok partnership takes the strengths from each company and creates a pioneering concept where innovative, industrialised construction meets the human aspects of what a home should be.

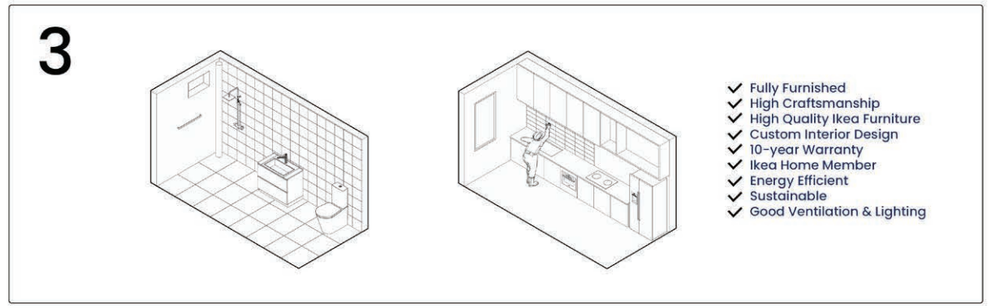


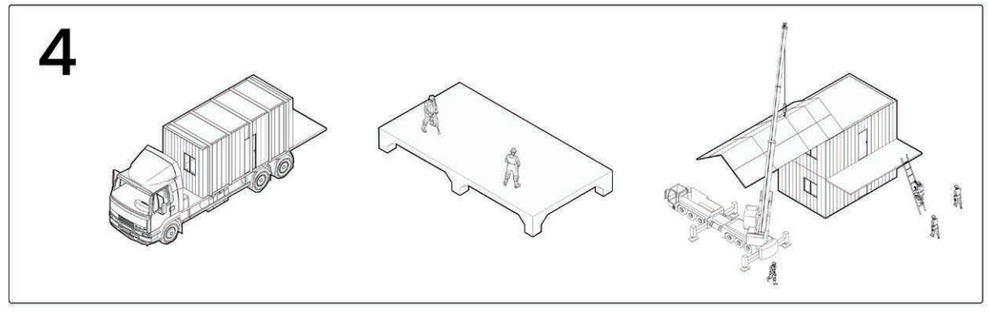


BoKlok modular units fully equiped with IKEA furniture, ranging from tables, appliances, bed to white goods. The modules are complete with the doors, windows and insulation already installed. They are then transported to its location for on site construction or assembly.









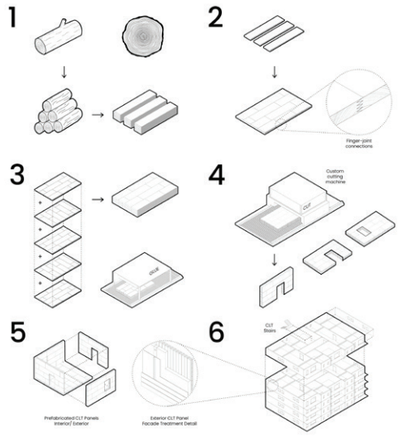
BoKlok runs a factory based production. This allows the company to optimise both workflow and production due to the highly standardised processes. BoKlok has started to utilise robotics from Randek to speed up processes of producing walls and flooring systems. Highly skilled craftsmen then come in place to assemble these manufactured parts and complete the modules with finishing and built-in furniture.

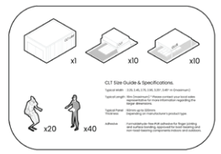
5.3 Cross Laminated Timber CLT

CL T panels are made from several layers of solid wood panels, which are bonded with structural adhesive. These panels are ideal for the construction of large roof, floor and wall elements. Mass timber can reduce carbon dioxide emission compared to concrete and steel.

This diagram to the right is a depiction of the manufacturing process of CLT panels in a typical CLT factory. Rough sawn wood are used as feedstock for the CLT panels manufacturing. Wood panels undergo cuttings into particular length and are joined together to form a long plank using the finger-joint method to creat a secure bond. The panels are then stacked on top another in alternative directions. Layers of adhesives are applied before the stacking process (cross-laminated). CLT panels can also be cut and delivered with openings being precut in the factory as intended in the customer's design.

The diagram below is research on one of the products known as Cross-Laminated Timber, covering its development history, current market usage, and product characteristics holistically. KLH and Stora Enso are the current leaders in the CLT industry. Projects emerging all around the world are starting to adopt CLT as their sole construction material due to its beneficial characteristics. Using only wood, these projects are pushing the boundaries of sustainability in architecture, particularly considering the product and material lifecycle.









CLT

CROSS-LAMINATED TIMBER

1920
1st patent resembling CLT in Washington, USA.

1985
Speculated actual 1st patent in France.

1994
Significant developments made in Austria by Gerhard Schickhofer with proper PhD thesis research.

1997
Companies such as KLH Massivholz GmbH, Binderholz, Mayr-Melnhof Holz Group, Hasslacher and Stora Enso have been established.

Present
CLT manufacturing flourished in the Europe region especially in Austria, Sweden, Germany and Finland.

CLT started making its way to Australia and Asia. Projects started to utilise more CLT designs.

Benefits.
Impacts & design.
Supply Chain & Market.

+ Sustainability.
Carbon Storage
Carbon Sink
Renewable

- Manufacturing of materials such as cement and steel contributes to 11% of global greenhouse gas emission (CO2).
- Manufacturing of CLT requires less production energy, as wood is harvested from sustainably managed forests and renewable.
- Wood acts as a carbon storage. it can store carbon during the building's lifetime.
- Wood can be recycled. Storage of the CO2 continues even longer when reused.
- 15 - 26% reduction in global warming. Negative carbon balance.

+ Durability.
Seismic Tolerances Strength

- CLT is engineered to make building elements. Walls, floors, roofs, stairs.
- CLT is stronger than concrete whilst being lightweight. Wood can be machined to incredibly high tolerances.
- CLT has high seismic performance. A shake table has proven CLT could withstand seismic forces of 1995 earthquake in Kobe, Japan.

+ Construction.
Prefrabication Ease of Assembly Management

- Harvesting of wood and duration may depend on availability and natural conditions of the forest.
- CLT panels can be prefabricated offsite, unlike other conventional construction materials.
- Lesser installation time on site, due to ease of assembly, lesser joineries.
- Easier to meet project timelines, saving costs and time.

+ Other Qualities.
Fire Resistance Moisture Retention

- CLT structures provide significant fire resistance. It remain structurally stable for extended durations when exposed to fire.
- Studies shown a CLT structure could withstand more than 90 minutes of burning. A single-story wood-frame home collapsed after just 17 minutes.
- Timber buildings face risks of fungal decay, which can occur if the moisture content within the building product exceeds 20% for an extended period of time.
- CLT has at least 5 layers, which is considered waterproof, used both externally and internally. However, manufacturers do not recommend installing CLT panels without an exterior cover.

+ Market.
Job Creation Supply Chain

- Harvesting and managing local forests requires local workers. Timber are sourced mostly locally.
- Manufacturing of CLT requires skilled workers. Creating job opportunities for locals.
- Supply in the manufacturing chain could not meet demands. Taking into account of natural disasters, affecting harvesting.

‘Standard’ Version

Manual Pre-Sorting:
Employees sort out the recycling before it goes through automated sorting machines to pick out the non-recyclable materials, especially focusing on removing contaminants, as they can damage both employees and machines if they pass through the automated system

Automatic Machine-Sorting:
With the use of powerful magnets, steel materials are extracted, while optical scanners separate paper and plastic, which are then sorted into large bundles or bales for processing

Collection Services:
There are many collection services in Australia, with one example being rubbish trucks that go around local communities to collect waste and recyclable bins every week on certain days.

Quality Control Measures:
The 'standard' waste recyclers always ensure that the quality of recyclable materials is good for integrity and marketability. This is achieved through actions such as inspection, testing, and certification of recycled materials to meet the standard quality requirements for clients to use in recreating products.

Sustainability Compliances:
The facility is required to adhere to sustainable or environmental regulations and standards to control the waste generated by local councils. It must utilize sustainable methods to recycle the waste and minimize pollution and environmental impacts.

‘Exceptional’ Version

Humanoid-Robot:
The advanced technology of humanoid robots can be employed in the 'exceptional' version of waste recyclers, as they possess infinite stamina, faster agility, and enhanced sensors to distinguish between different categories of recyclables.

Dark Warehouse:
The term 'fully-automated warehouse' can be applied to a waste recycling facility as well, where operations are conducted without human labor and are solely managed by machines and humanoid robots.

Advanced Tech-Truck:
This is an idea for a future rubbish truck equipped with an AI-detector that scans household bins and detects chemical wastes that cannot be recycled. It separates them using an automated system. Warnings and fines can be issued if hazardous materials are found within household bins, promoting a sense of lawfulness and sustainability within the community

SIZES

Small Recyclers



Drop-Off Recycling Center



Transfer Station

Medium Recyclers



Material Recovery Facility (MRFs)



Regional Waste Recycler

Large Recyclers



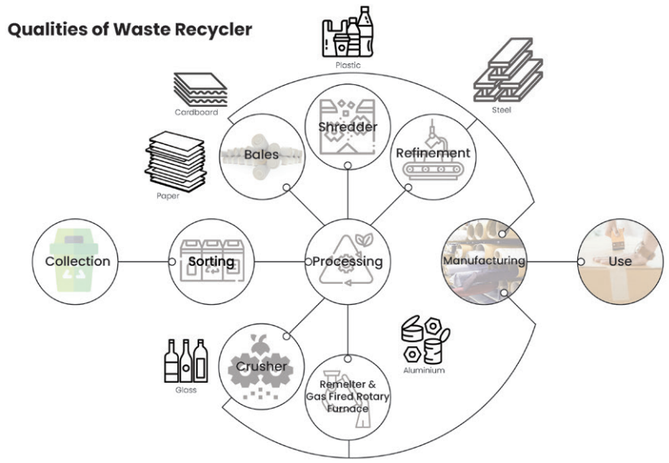
Waste-to-Energy Plant

A waste recycler plant is a facility designed to process and convert waste materials into reusable resources. These plants play a crucial role in waste management and environmental sustainability by reducing the volume of waste sent to landfills and minimising the environmental impact.

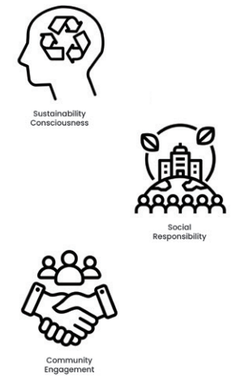
Waste recyclers can play a major role in tackling sustainability issues in current days. Some waste recycler plants also incorporate energy recovery systems, where non-recyclable waste is converted into energy through processes like incineration, anaerobic digestion, or gasification.

The diagrams is a more detailed description of the functions and possibilities in within a waste recycler. Its functionality can also be infused with our disruptive technology, working in conjunction with the type of housing that we are delievering as a factory. The key term in these researches will be “fully autonomous”

Qualities of Waste Recycler



Experiential Characteristic of Waste Recycler



Requirements:
Safety and Environmental Management, Community Engagement, Quality Control and Assurance, Supply Chain Management, Equipment and Facilities, Legal and Regulatory Requirements, and Sustainability knowledge and Expertise.

The diagrams on the right describes the functionality side and characteristics of a waste recycler. There are a few well developed waste recyclers that we can look into further, for instances, the Hemmant Box Plant in Queensland and Copenhill in Copenhagen.

Domestic Precedents

Hemmant Box Plant Queensland

Hemmant Box Plant is Visy's new corrugated cardboard box factory located in the suburb of Hemmant in Queensland. It was created with the purpose of reducing landfill and creating thousands of green-colored Australian manufacturing occupations as well. It recycles and utilizes mixed paper and cardboard from Queensland businesses and households to recreate corrugated boxes for the local state's products.



International Precedents

Copenhil, Copenhagen

Copenhil is a waste-to-energy plant and ski slope architecture project designed by the Bjarke Ingels Group (BIG). It is considered an innovative design in waste recycling, serving two major purposes: sustainability and entertainment for the local community, thereby creating a unique urban space in its location. Additionally, it allows for engagement with both the public and the local community, as recycling requires public participation to fulfill its purpose.



Material System

- Natural, plentiful or renewable
- Locally available, saving energy and
- Resources in transportation
- Salvaged, refurbished or remanufactured
- Reusable or recyclable or contain recycled content
- Durable.
- High Corrosion-Resistance due to chemicals from wastes and recycles.



Recyclable Materials

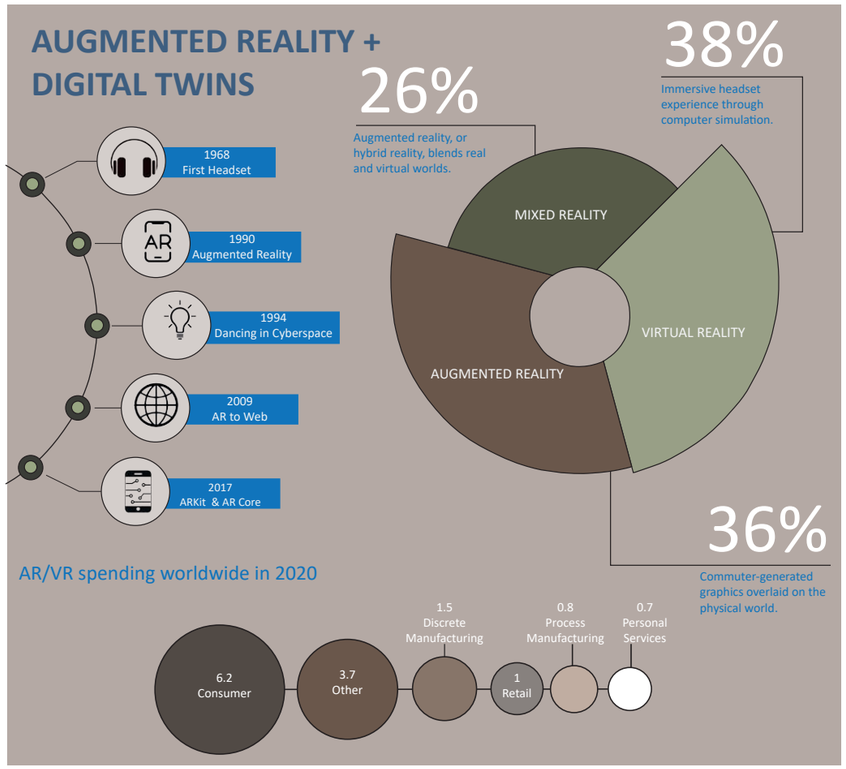


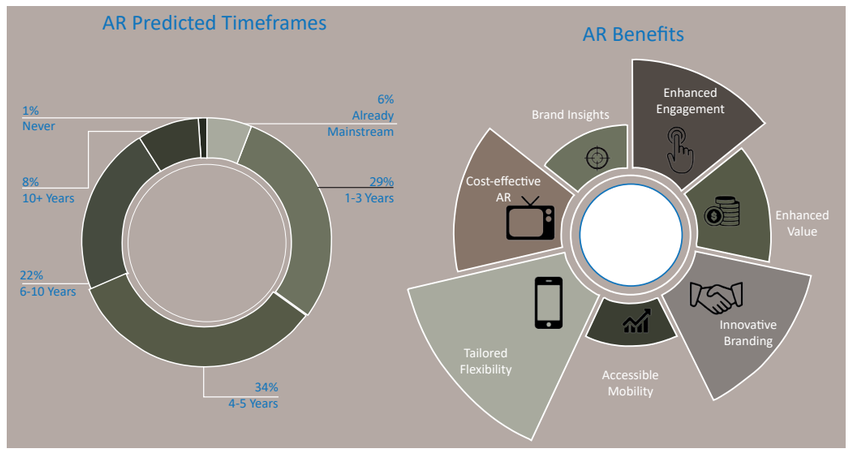
Stainless Steel

Robin Deepthi Mahanthi and Sara Amin

5.1: Augmented Reality and Digital Twins - CyberPhysical Interaction,
5.2: Buckminster Fuller - Dymaxion and Witchita Houses,
5.3: Additive manufacturing, +
5.4: Fitness / Gym.

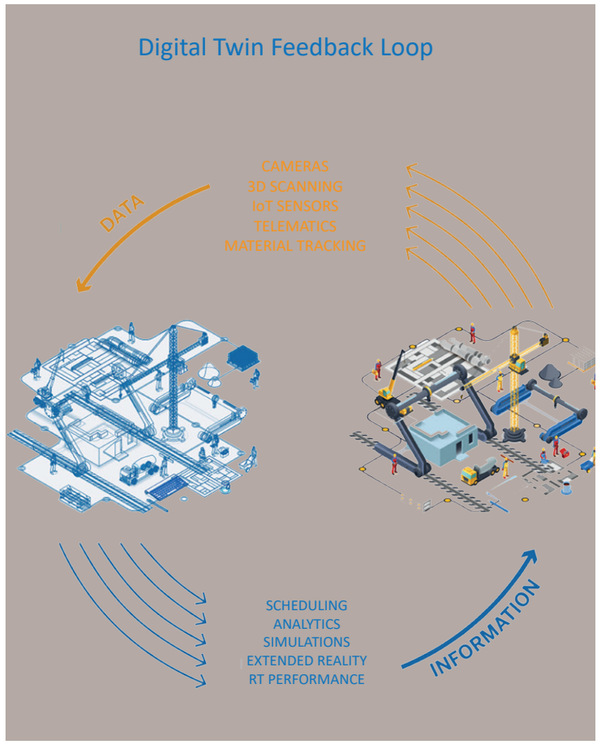
5.1 Augmented Reality and Digital Twins - CyberPhysical Interaction:

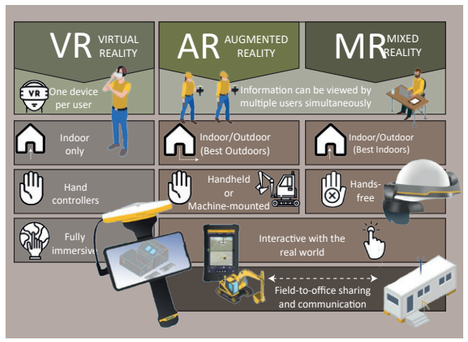


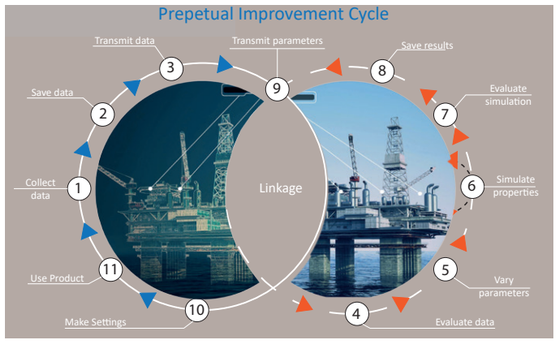












5.2 Buckminster Fuller - Dymaxion and Witchita Houses:

Dymaxion Houses: Buckminster Fuller's Dymaxion Houses were primarily constructed from aluminum, a lightweight and durable material. Fuller designed his homes using prefabricated components that could be mass-produced in the future. His vision was to hope for factories that could produce standard parts that could easily be assembled on-site. A unique way to not only help with population on growth but the environment too, while reducing construction on me and costs

Energy Efficiency:

Passive solar heating and natural ventilation were the two main energy efficient factors that were incorporated into the Dymaxion homes.

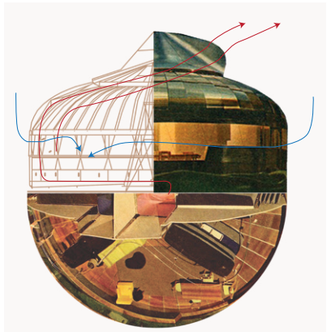
Natural Ventilation: The first home had a round roof to circulate air smoothly while the second home had a roof that could detach and bring in a fresh breeze.

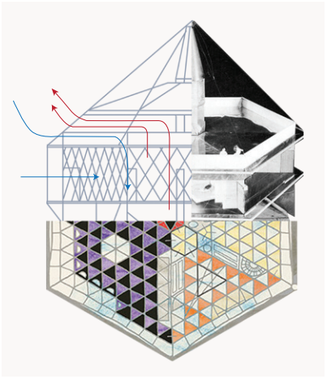
Passive Solar Heating: Using allminium for the roof, it allowed to reflect the sunrays but retain thermal radiation to transfer into the home. Windows were also placed in certain areas to minimise sun rays from entering the house but allowed for air to travel through and around the house

Pre-Fabricated Parts
Areas of the house and other components were prefabricated to enable for speedy on-site assembly while lowering costs, construction, and time. The bedroom, bathroom, and kitchen sections were constructed separately, with built-in storage, sinks, faucets, and bedroom space, and then assembled on-site. The roof, walls, doors, windows, flooring systems were also pre-fabricated.

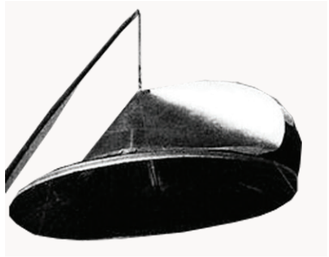
The prefabricated sections were interchangeable, allowing for simple alterations and expansions. However, each component would have to be standardized. This fosters flexibility and adaptability. Providing quick but unique interior design customisations and the ability to relocate to many areas with varying climates, terrains, or situations.

Transportability: The detachable and prefabricated components could be disassembled and moved to a new location, providing flexibility to those who move frequently

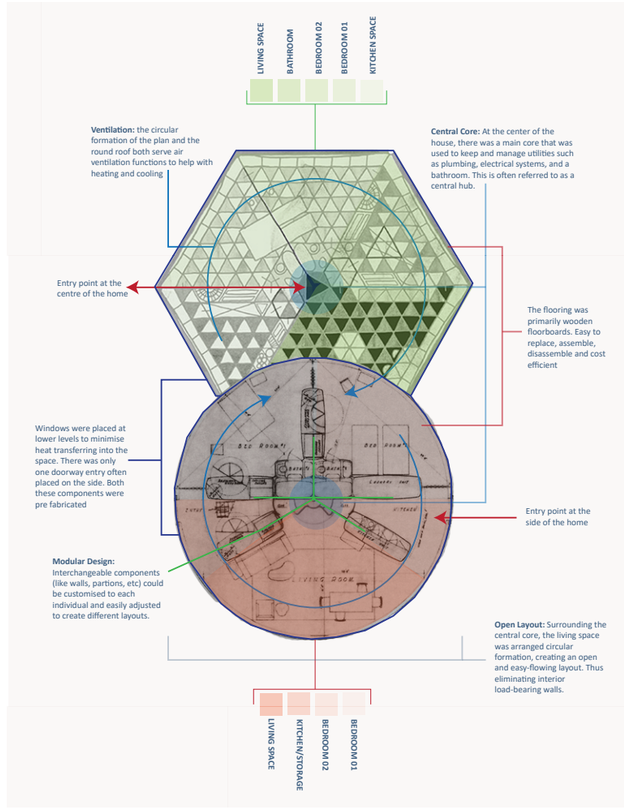








Richard Buckminster Fuller (1895-1983) was an accomplished American architect, inventor, engineer, author, and futurist. Fuller spent most of his time researching how to construct sustainable and efficient designs that could address global issues including housing, transportation, and environmental sustainability.



Floor Plan Layout:
The circular floor plan combines multiple living spaces such as bedrooms, kitchens, dining areas, and living rooms into a single seamless area, improving space efficiency and multifunctionality. It promotes easy movement and contact among residents.

How does it challenge 'business as usual' practice? How does this type sit in a supply chain of production?

The Dymaxion Houses challenge 'business as usual' through its prefabricated and modular construction, sustainability/efficiency, and innovative qualities.
By abandoning traditional on-site construction (such as building everything on-site with a large number of workers and supplies), it has disrupted the usual supply chain of construction materials and labor. It will be replaced by manufactured parts produced off-site and assembled on-site. This revolutionary method is significantly more sustainable because its design and concept strike a balance between speed, affordability, comfort, and environmental concerns.
Prefabricated components would still entail a supply chain of manufacturers who make particularly chosen materials, insulation, windows, doors, and other structural parts, which would be delivered and built on-site. In addition, there would be a supply chain of transporters to help move those pre-fabricated parts, as well as extra companies to assist with system and utility integration.

5.3 Additive manufacturing:

Additive manufacturing, also known as 3D printing, is the process of layering materials to make three-dimensional things. Unlike traditional subtractive manufacturing methods, which entail cutting material from a solid block, additive manufacturing creates products from the ground up using digital 3D models.

How has it Evolved? Since the 1980s, 3D printing has evolved significantly, expanding from plastics to metals, ceramics, and composites. Its precision and speed improvements have enabled applications across various industries like aerospace, automotive, healthcare, and consumer products. Offering design flexibility, customisation, waste reduction, and rapid prototyping, 3D printing continues to advance through materials and process innovations, enhancing manufacturing innovation and sustainability.

Benefits? Additive manufacturing lets you design freely, customize easily, and prototype quickly, all while reducing waste and time. It handles complex shapes and is great for making batches affordably, which streamlines supply chains and helps local production. Storing designs digitally means less physical inventory and more flexibility, which is better for the environment. It is continuously expanding in terms of sustainability, affordability, creativity and size.

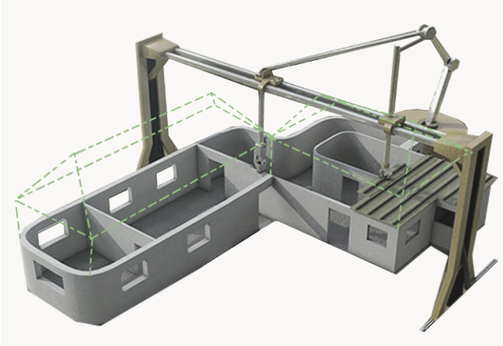
Additive manufacturing opens new doors for designers by allowing them to create intricate and innovative designs that were once challenging with traditional methods. To make the most of it, designers should master 3D modeling software and learn about different printing materials. Also, it fosters collaboration between designers, engineers, and manufacturers to fine-tune designs for printing.

Additive manufacturing makes some construction activities easier, such as printing structural pieces, but qualified workers are still required for assembly, finishing, and site preparation. The construction workforce must adopt new procedures and technologies related to additive manufacturing. This includes learning how to use 3D printers and combining printed components with traditional building techniques.

Additive manufacturing fits into the construction supply chain at various stages, such as:
Material Sourcing: finding suitable concrete or metal powders for printing
Component Manufacturing: Pre-fabricated printing off-site but assembled on site
On-site Printing: Using large scaled printers to print on-site (depending on location and accessibility)
Integration with Traditional Construction: used to print custom components to help builders/designers construct







EXAMPLES



Architecture and Construction:
Additive manufacturing is revolutionizing the construction industry by enabling the fabrication of architectural models, prototypes, and even full-scale buildings, using large-scale 3D printers that uses materials like concrete and composite materials.

E.g ICON vulcan-printed houses at community first village in austin, texas, for individuals experiencing chronic homelessness

Negative: Additive manufacturing could disrupt traditional industries, potentially leading to job displacement and changes in skill requirements.

Automotive Industry:
Automotive manufacturers use additive manufacturing for rapid prototyping of vehicle components, tooling, and even end-use parts.

For example, companies like BMW, Ford, and Volkswagen utilize 3D printing to create prototypes of new car designs and customize components

Negative: Ensuring the quality and safety of 3D-printed parts, especially for critical applications, requires rigorous testing and certification processes.



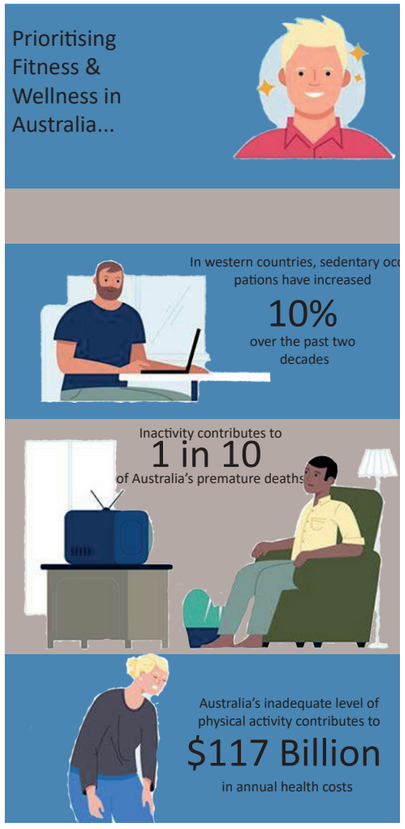


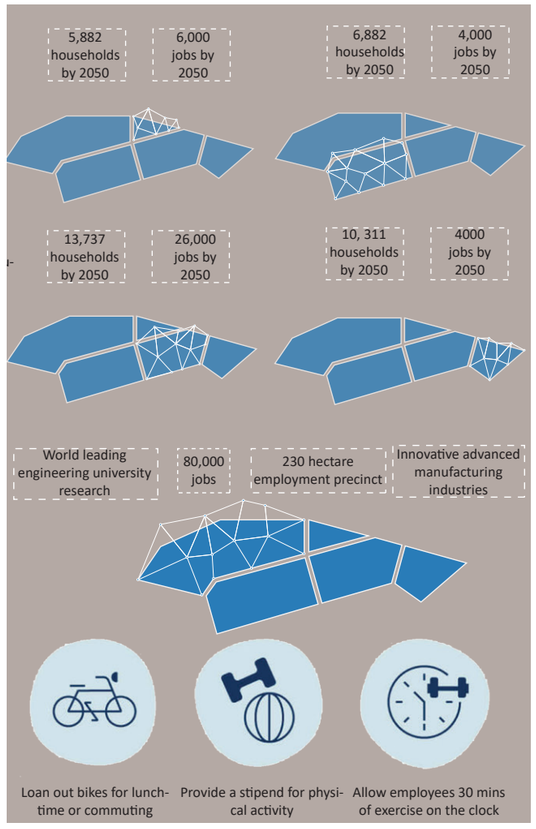
Education and Research:
Additive manufacturing is also widely used in educational institutions and research facilities for teaching, research, and experimentation purposes. Universities and research labs utilize 3D printers to explore new materials, processes, and applications

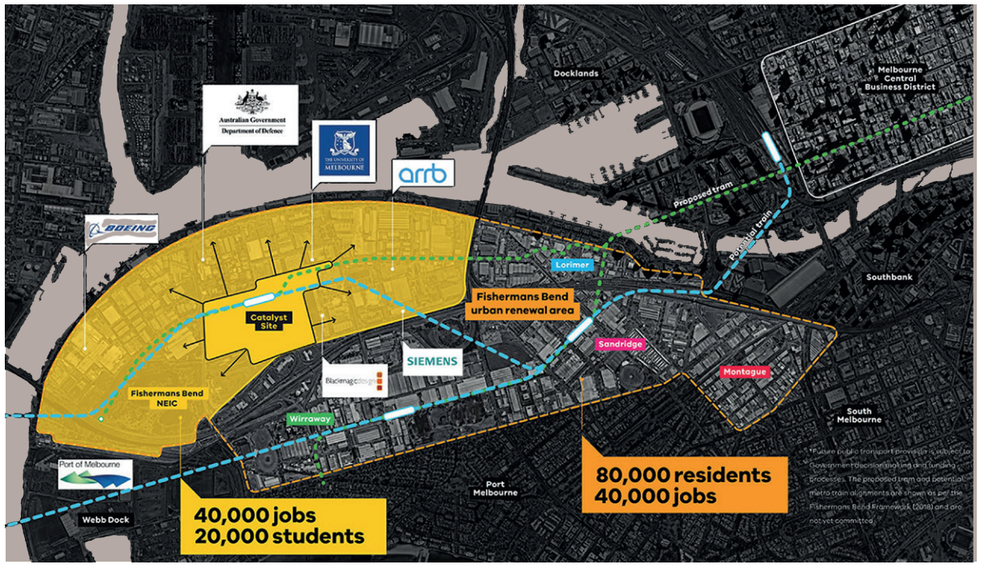
Monash has many such as SLS (SELECTIVE LASER SINTERING, RESIN, and CERAMIC)

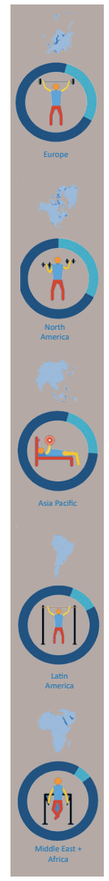
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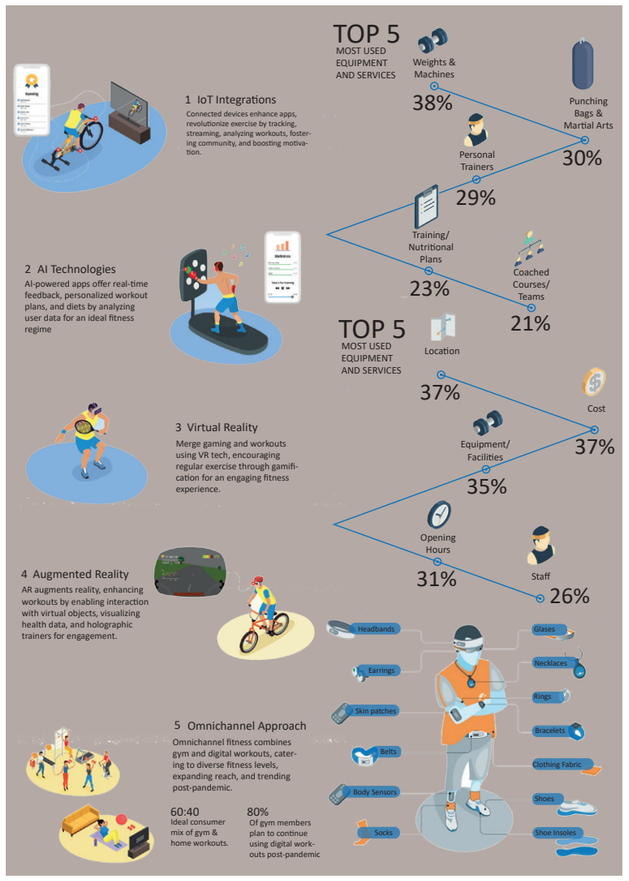
5.4 Fitness / Gym:

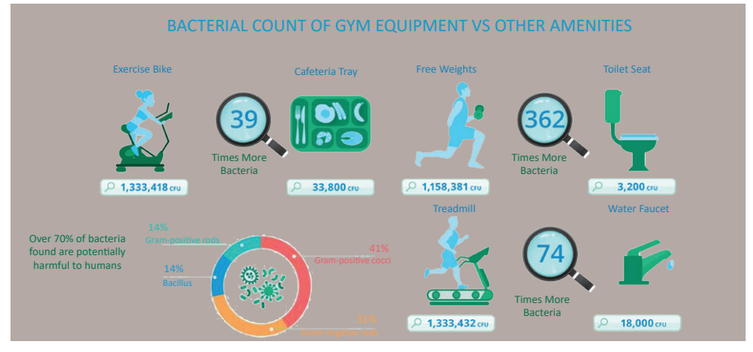


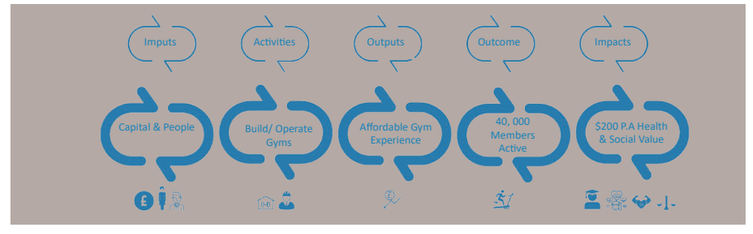










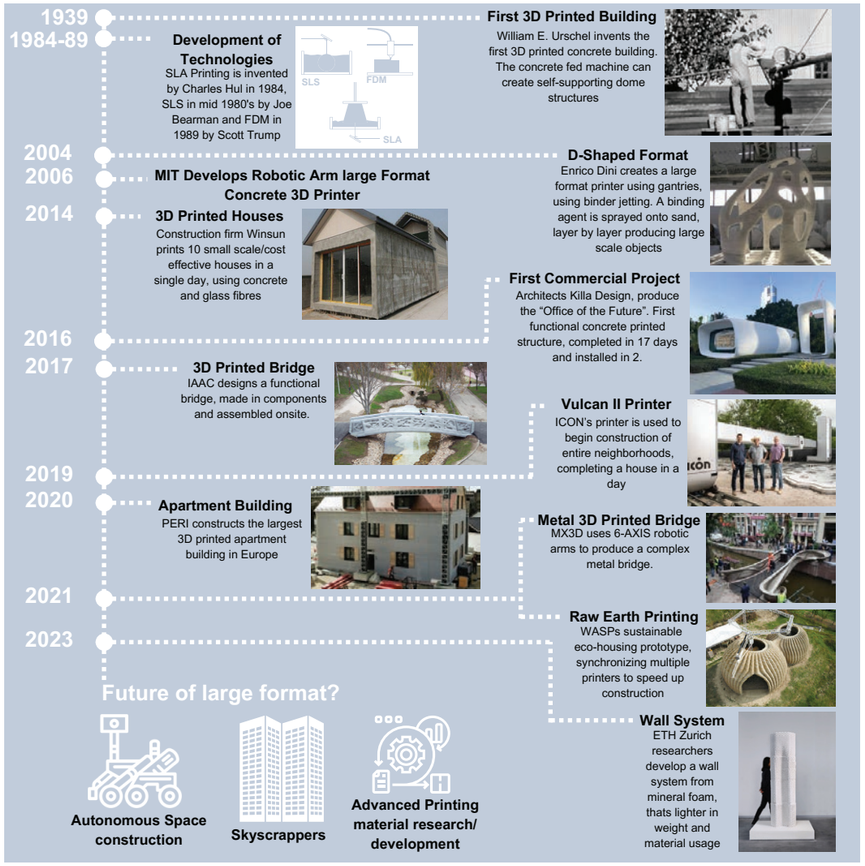


Jarrad Frahamer and Saida Bakhsh

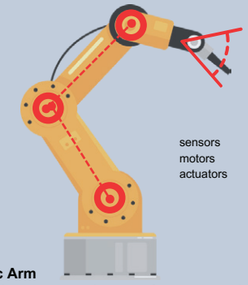
5.1: 3d printing - Large scale (Contour Crafting),
5.2: AAUR - Automated Architecture (Giles Retsin + Mollie Claypool),
5.3: Volumetric - Rectilinear, +
5.4: Mycellium Farm / Biomaterial Production.

5.1 3d printing - Large scale (Contour Crafting):

Large format 3D printing integrates various disciplines such as architecture, engineering, material science, and computer science to enable the creation of accurate, complex structures using additive processes with a large variation of materials.

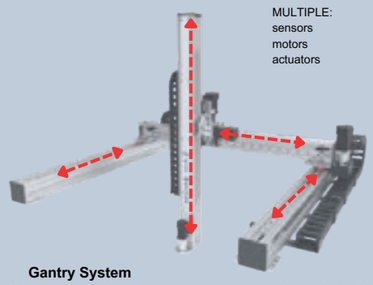






Robotic Arm

The robotic arm uses an axis to rotate for movement, mimicking the movement of a human arm, with a higher degree for flexibility but the length of arm is the limited range of motion.



Gantry System

The gantry uses a linear movement, moving up and down, side to side, thus being more stable. It uses the size of the bed, and cannot print out of this area. Faster than robotic arm printing but harder to assemble axis.



Testing in a small scale setting in lab



Testing of the gantry system in lab



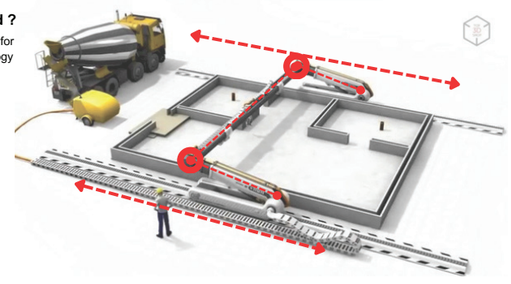
The 27-ft-high curvy Phoenix House is now on display in Austin, Texas

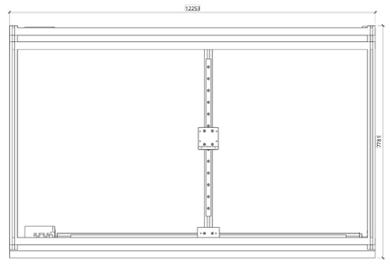


house made of printed mud in Ravenna, Italy.

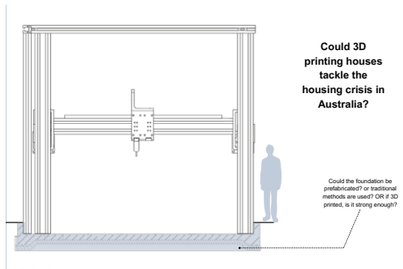
Robotic Arm + Gantry System combined ?

Combining the robotic arm and gantry system allows for better accuracy, movement and control. This technology





Top View 1:50



Transverse Section 1:50

5.2 AAUR - Automated Architecture (Giles Retsin + Mollie Claypool):

The framework decentralises automation and places local communities at the centre in order to alleviate disparities in the built environment. It is creating an automated micro-factory ecosystem on a global scale to provide millions of people with attractive, cheap, and sustainable architecture. A network of current home builders is granted licences by AUAR to use its minimal capital expenditure robotic micro-factories and technology stack, allowing them to produce economical and environmentally friendly homes on a large scale.



Automation reduces labor and time, cutting project costs and making housing more affordable. It ensures error-free processes, devoid of human limitations, and empowers local communities in a decentralised construction approach, challenging traditional models.

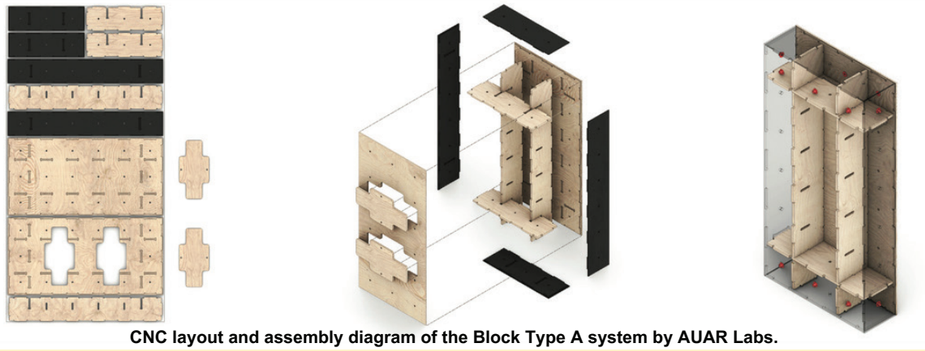




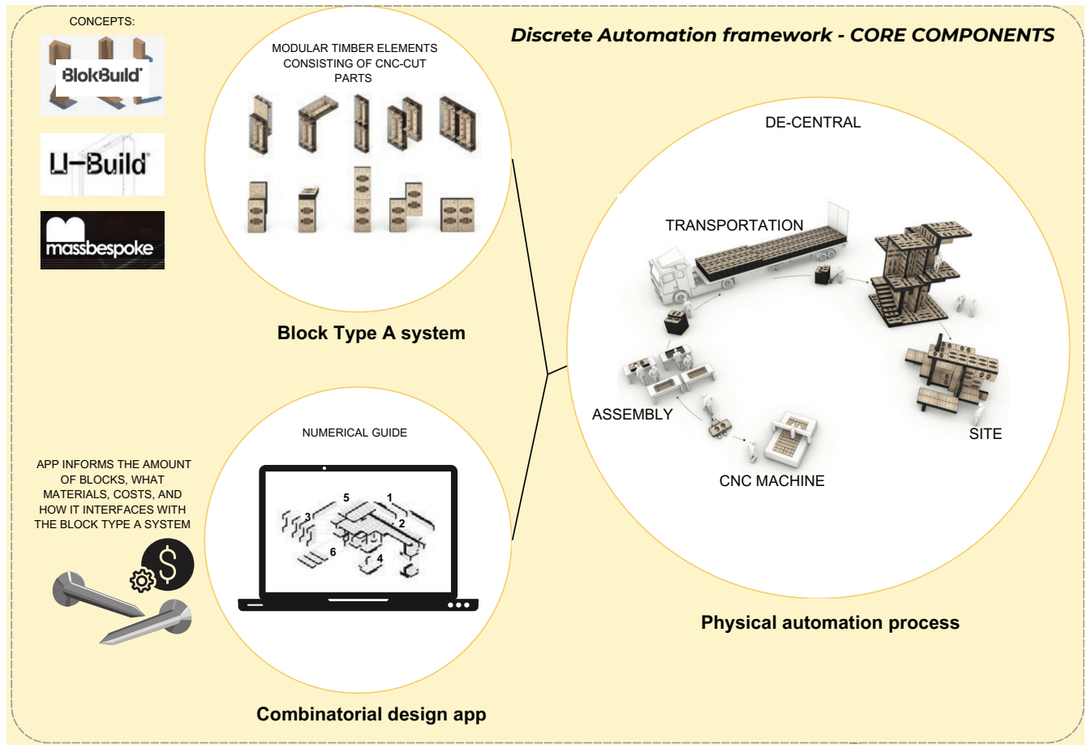
Housing prototype Block West, Media Centre in Bristol, UK.

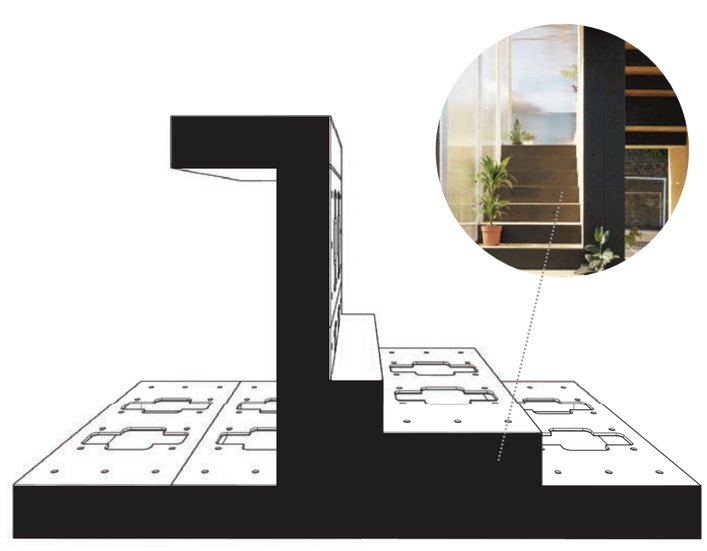


Prototype of the Automated Living System (ALIS)

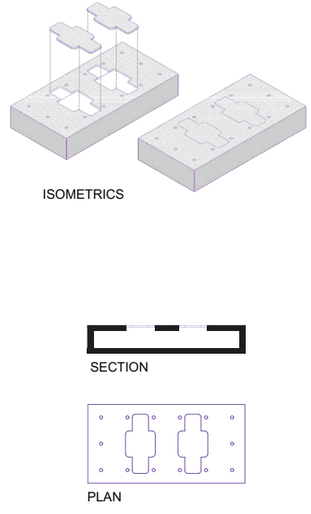


CNC layout and assembly diagram of the Block Type A system by AUAR Labs.





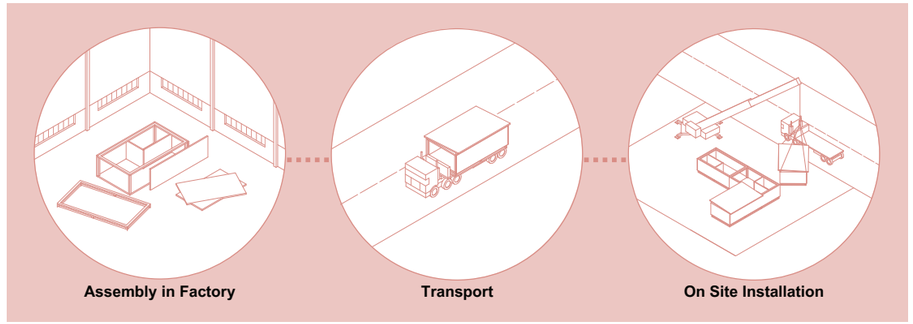
3D random iteration of Type A blocks NTS



1:20 Drawings of TYPE A Blocks

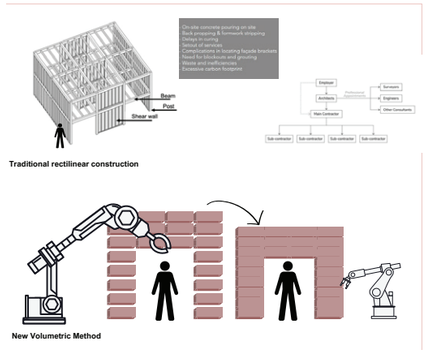
5.3 Volumetric - Rectilinear:

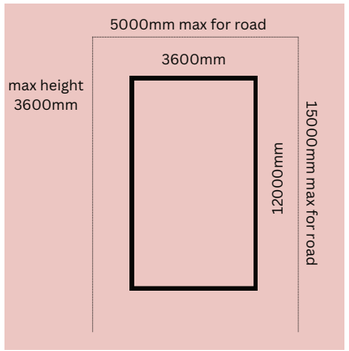
Volumetric rectilinear design is a method of designing and constructing building modules in rectilinear in form and are assembled to create larger structures.



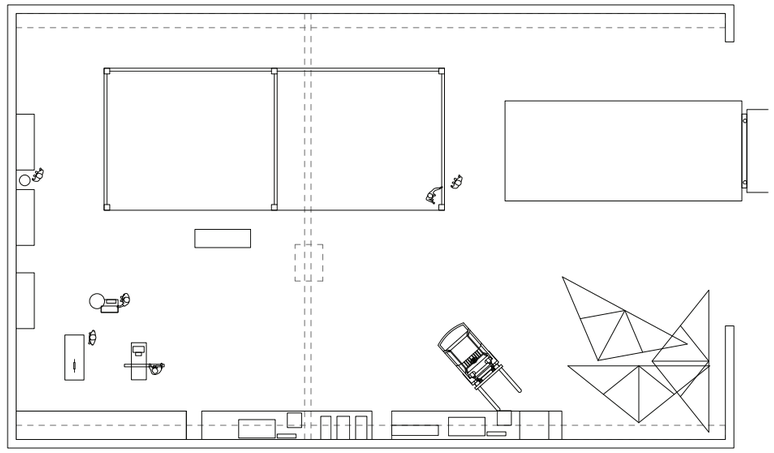
In prefabrication, building elements are manufactured off-site in controlled factory conditions, then transported to the construction site for assembly. Volumetric rectilinear design focuses on creating modules that are easily stackable, transportable, and can be assembled in various configurations to accommodate different architectural needs.



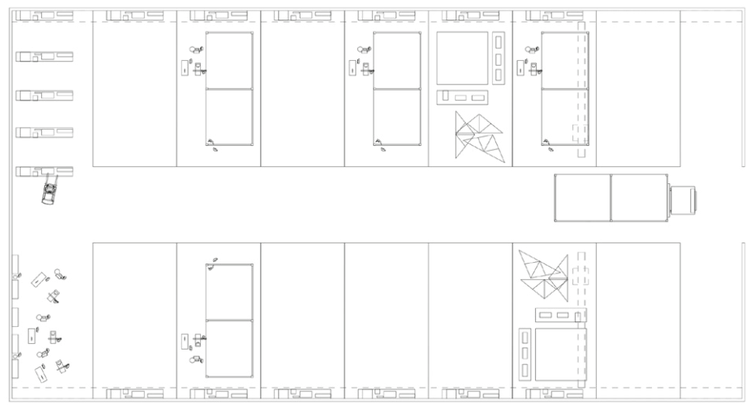




Transportation Constraints:
Example measurement for modular structures, the best sizing followed by the max allowed on roads without the large vehicles requirements



Small Setup 1:100



Large Setup 1:300

5.4 Mycellium Farm / Biomaterial Production:

Growing mycelium for architecture involves cultivating fungal mycelium with organic waste materials, resulting in lightweight, durable composite materials. These materials offer excellent insulation properties and biodegradability, providing sustainable alternatives for a range of architectural applications

Sustainable
Mycelium is renewable, biodegradable/ compostable, and can be grown using organic waste materials. In bad conditions it will decompose in 3 weeks but good conditions allows for 20 years.

Lightweight
Mycelium structures are typically lightweight yet strong. The material is usable for small load bearing structures, with a compression strength of 30 psi.

Insulating
Mycelium-based materials have good thermal and acoustic insulation properties. Itself can be fire/water/mold proof, but these qualities degrade over time

Versatile
can be grown into various shapes and forms to suit different architectural applications.





Hy-Fi Pavilion
The Living
2014



The Circular Garden
Carlo Ratti Associates
2020



Wall Insulation
Ecovative Mushroom
2014

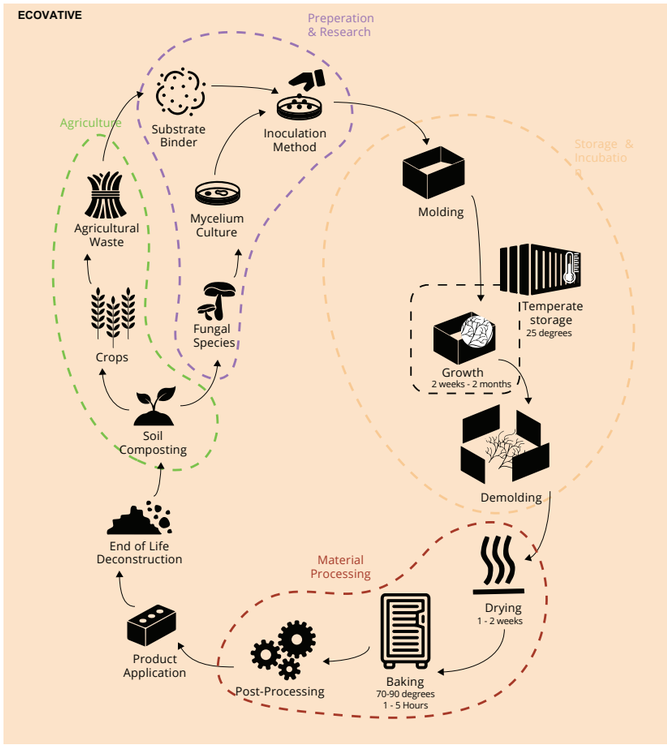


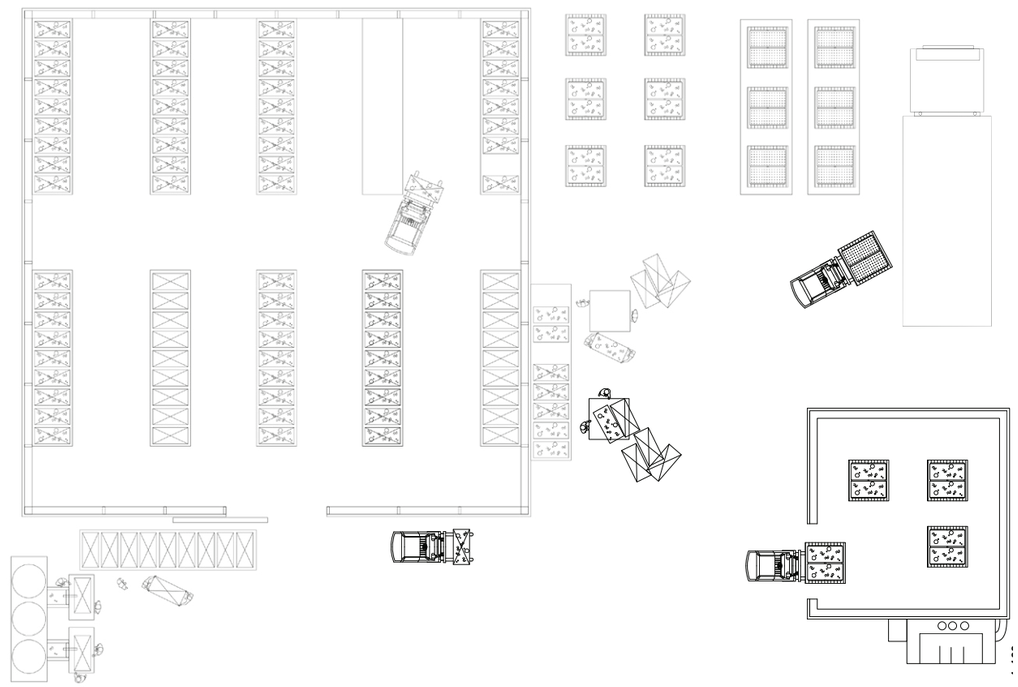
MycoTree
Dirk Hebel & Philippe Block
2017



Growing Pavilion
Pascal Leboucq & Krown Design - 2019





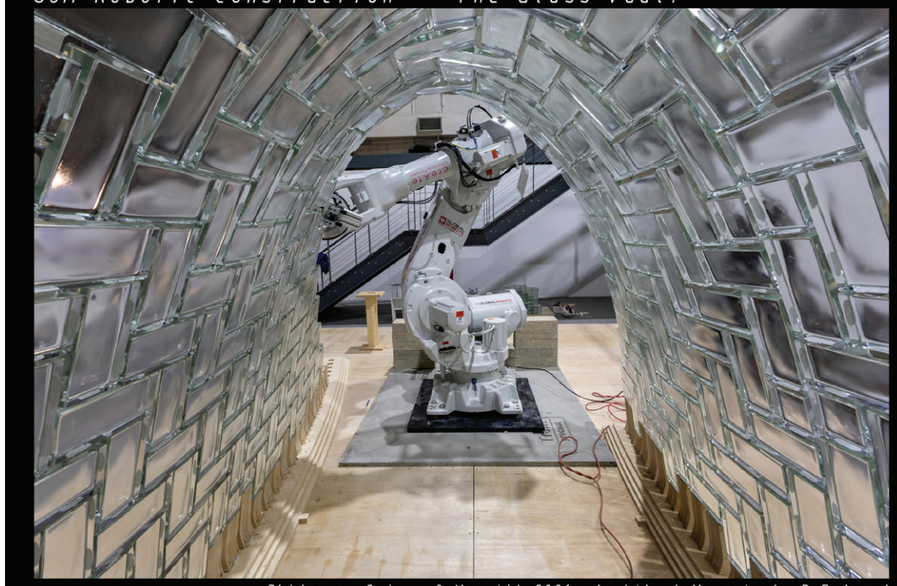


Marlow Brown and Su Wutt Yee

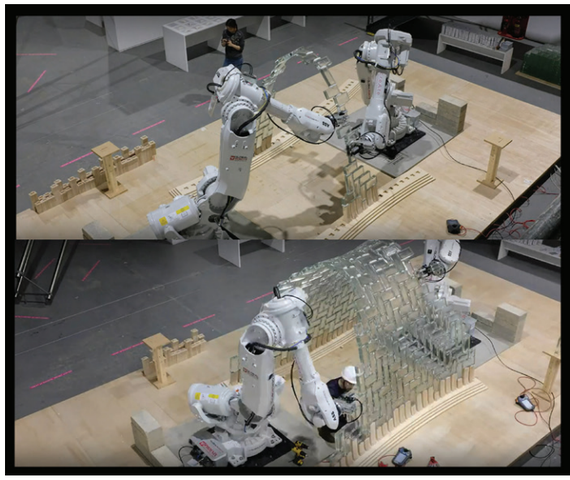
5.1: Robotic Fabrication and Assembly (Factory Based),
5.2: BLOK Modular with V&P,
5.3: Prefabricted Frames and Trusses, +
5.4: Tech startup Incubator.

5.1 Robotic Fabrication and Assembly (Factory Based):

SOM Robotic Construction - 'The Glass Vault'



Skidmore, Owings & Merrill 2021, Architect Magazine's R+D Award



Precedent Analysis:

Pracising on a smaller scale has been crutial for SOM in particular but also a display of perfect in their process through the build robotic build of the glass vault (using a old bricklaying technique).

What are the risks/downsides associated with Robotics?

It seems the losses incured on a project when trying something brand new is extremely intimidating within construction & assembly. Having an error in the code can cause a massive mistake if not overseen. That slow transition of responsibility we pass to robotics to eventually make us obsolete within hard physical must be taken with extreme care.

ROBOTIC FABRICATION AND ASSEMBLY (FACTORY-BASED)

Benefits:
- Less human labour meaning less payroll
- Better safety due to less physical input
- Faster fulfillment on products & services
- Optmise material storage & minimal wastage
- Scalability & Autonomy (24/7 workflow)

Summary:
Factory-based Robotic fabrication and assembly is an effecienty based style of manufacturing. Today robotic fabrication is mostly used for high precision, repetative but complex design capabilities.



ROBOTICS ASSEMBLY USE CASE

Since 2009 wages in China have quadrupled, putting the pressured on company owners to reduce tthe work staff as much as possible, hence the move towards Robotics & AI.

ALGORITHIMS

DATA

COMPUTER CHIP

MACHINE LEARNING

LIGHTS OUT MANUFACTURE:
The manufactureres strive to achieve a grand vision of no human beings with the whole process being run autonomously



Philips 128 Robot Arms:
Philips Electronics factory assemble electric shavors with 128 robot arms

"I think we might exceed a 1:1 ratio of humanoid robots to humans" -Elon Musk



Machine Learning encourages the idea of coding *thought process* into robots

(To not only recognise objects, but to operate with excellent precision, pressure, and strength control.

Starting the notion of *"Co-Bots"*, to work along side employees.

Leading to companies using their robotic production line to produce more robots.

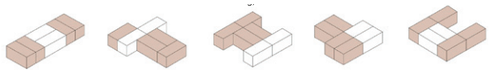


5.2 BLOK Modular with V&P:

Blok challenges the mass-produced, off-the-plan, ugly modular homes on the market, demanding, and delivering, more.

Bloks are built off-site in our factory environment. This controls cost, is twice as fast as conventional construction and reduces waste, environmental impact, and disruption to your life.

Blok Modular was born out of director, Daniel Burnett's dream of using modular production to produce highly refined, precision-built architecture, affordably.





On a modular mission, changing the way the world views modular buildings by producing finely crafted prefab architecture that responds to the client's site, brief and budget.

WHY BLOK?

- No Builidng Cost Blow-Outs
- Bespoke Architecture, Timeless Design
- Minimal Disruptions to Your and Your Neighbours' Life
- Delivery to Homes all across Australia
- Faster, Safer and More Precise Than A Traditional Build
- Green Buildings, with Minimal Impact to the Environment
- Sloping Sites, Difficult Sites and Awkward Access are Not A Problem
- Effortless End to End Process



BLOK PROCESS

1. Establish Your Brief and Budget
2. Let's Talk!
3. Design Phase
4. Fabrication Phase
5. Move-In Day!





2022
Residential
Completed

Blok Belongil, Blok Modular's collaboration with architecture practice Vokes and Peters, is built on the edge of the sand dunes at Belongil Beach, Byron Bay. In response to rising sea levels, the council forbids construction here unless the building can be demounted and moved within a certain time frame.

BLOK BELONGIL

- Fat Plan
  - Composed to six modules: two on ground and four above
  - Compound building with a series of connected but discrete parts, both internal and external, roofted and unroofed
- Project as A Boutique rather than A House
- Facilities
  - Lobby
  - Restaurant
  - Private Garden
  - Guest Suites
- Panoramic views of the ocean and mountains with the idea of "infinite natural wilderness
- Dismounting
  - Lifting lugs still attached. Process is to cut welds, unscrew bolts and crane the modules back onto a truck

BLOK STAFFORD HEIGHTS BY BLOK MODULAR WITH VOKES AND PETERS

New House under 200m2 category in the 2023 Houses Awards



2021
Residential
Completed

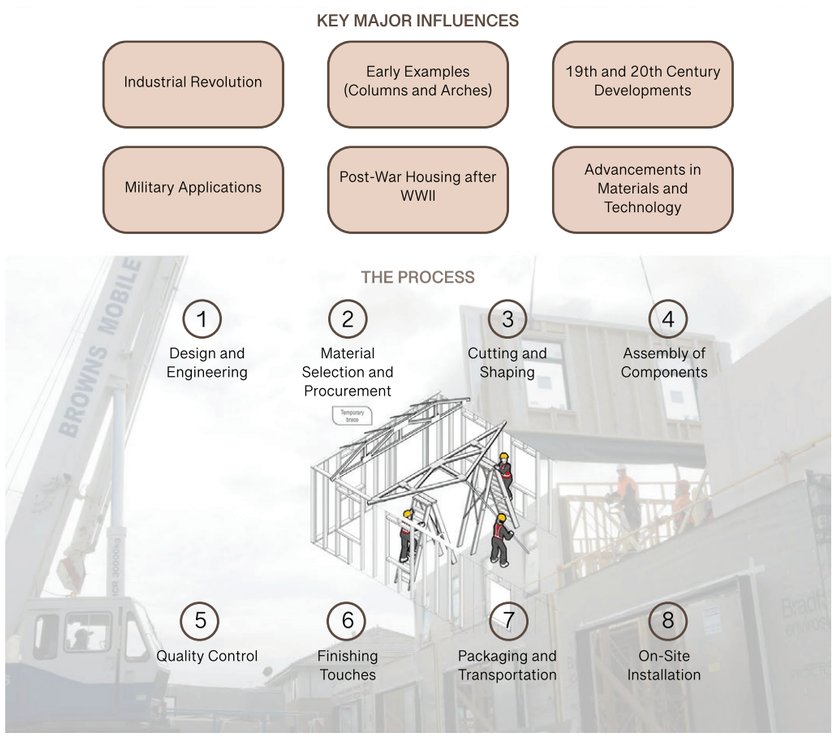
Blok Modular's approach to modular construction delivers architecturally engaging and bespoke homes without sacrificing quality or creativity.

- Low-Cost Family Home
- Strong Architectural Response, Compressed Timeframe
- Presence of Nature with the Preservation of Open Space
- Knock Down Rebuild
- Mid-Century Brisbane Suburban Modern Aesthetic
- Minimal Ecological Disturbances
- Connection with Neighbours

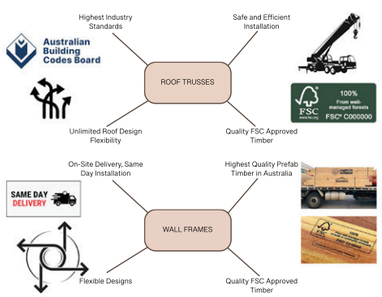
5.3 Prefabricted Frames and Trusses:

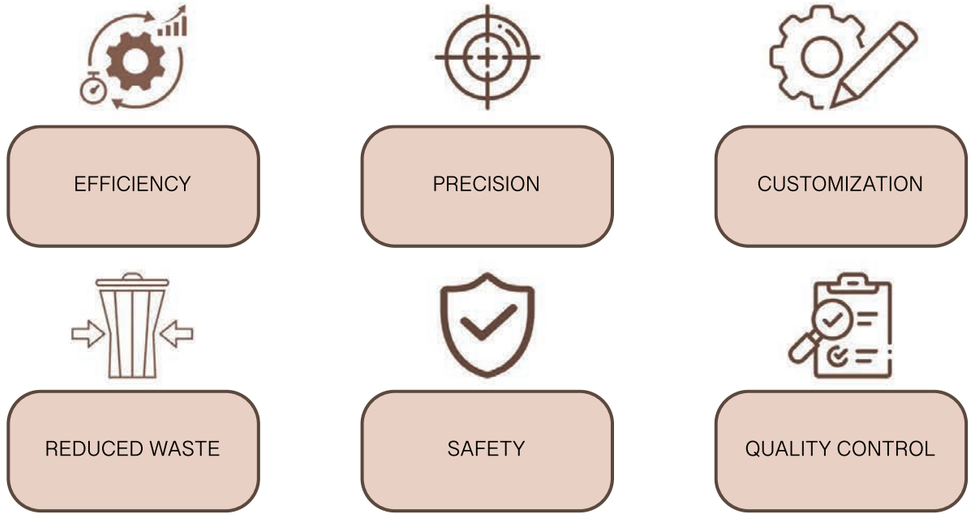
Prefabricated frames and trusses are components of buildings that are manufactured off-site in a factory-controlled environment and then transported~to the construction site for assembly. They are pre-engineered to meet specific design requirements and are typically made from materials such as steel, timber, or engineered wood



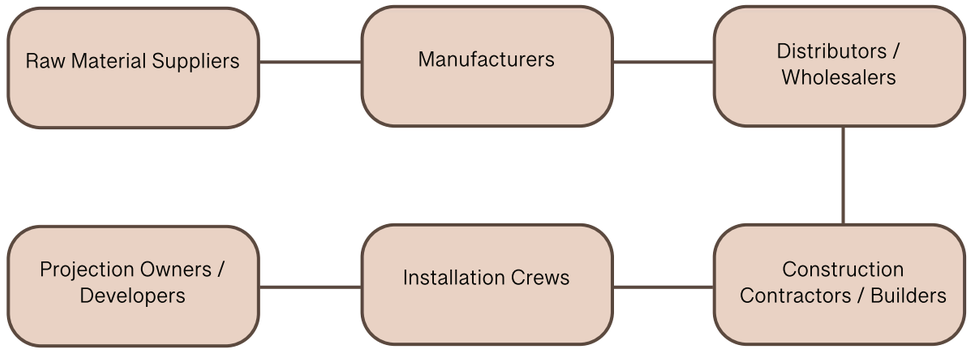


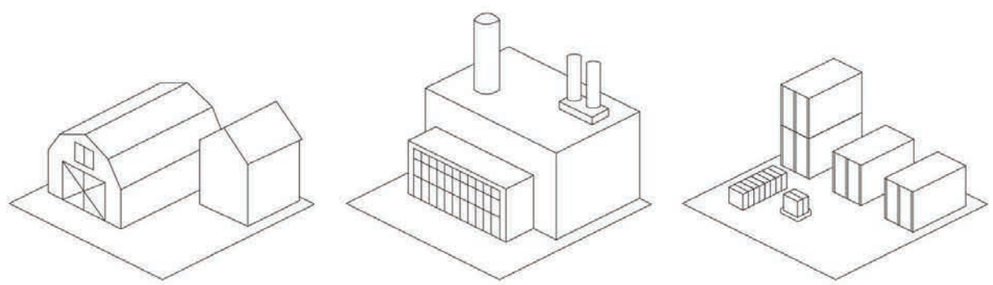






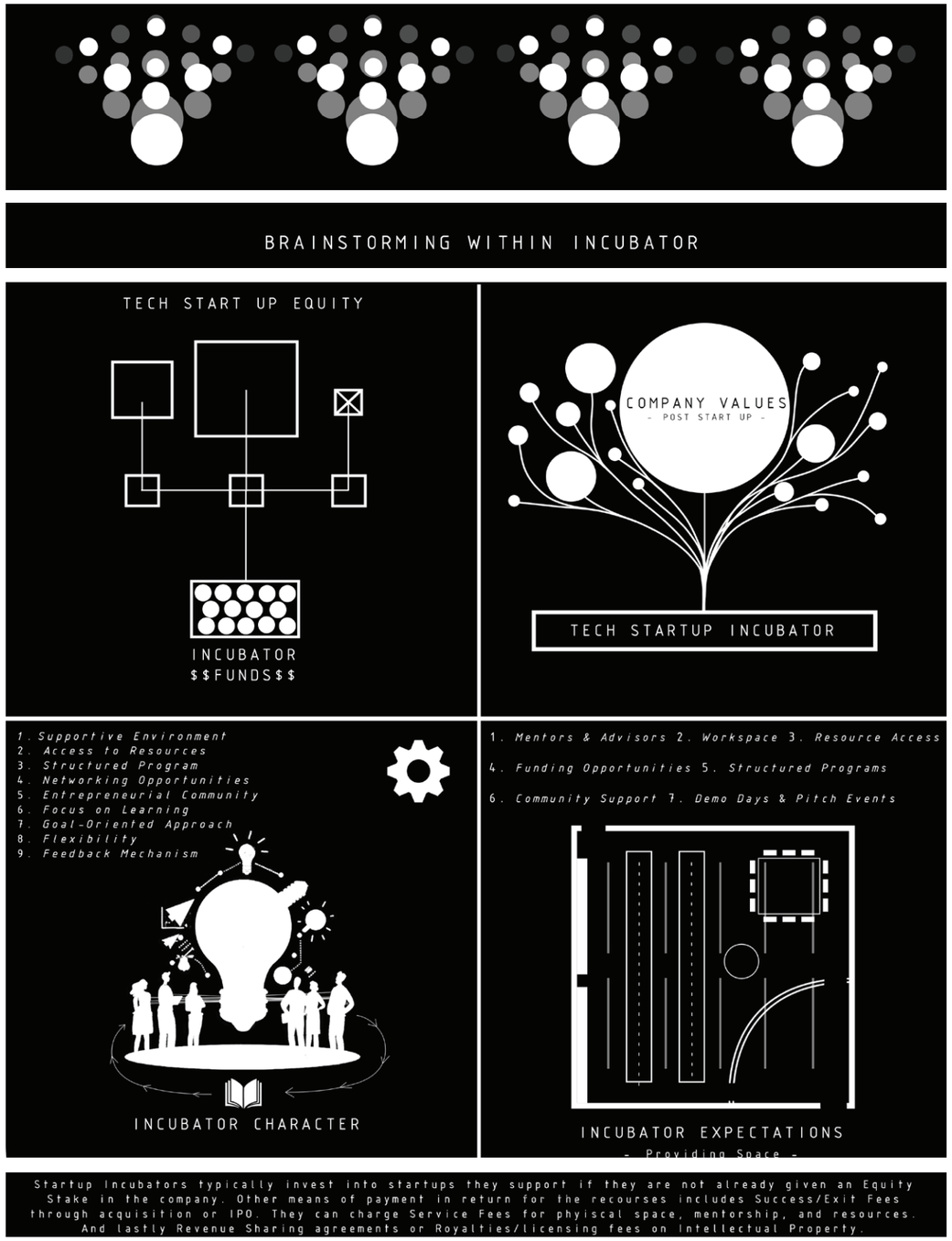
Benefits and Impacts:
Prefabricated frames and trusses are components of buildings that are manufactured off-site in a factory-controlled environment and then transported to the construction site for assembly. They are pre-engineered to meet specific design requirements and are typically made from materials such as steel, timber, or engineered wood. Prefabricated frames and trusses offer several advantages over traditional on-site construction methods, including:

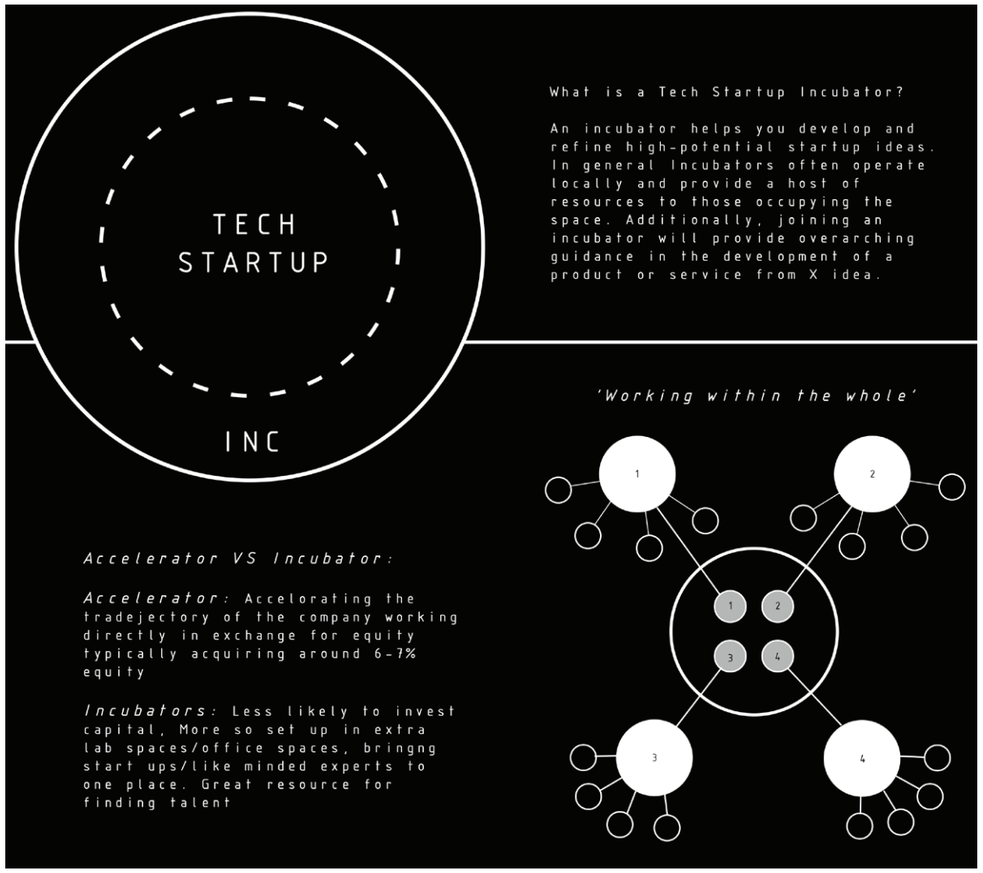


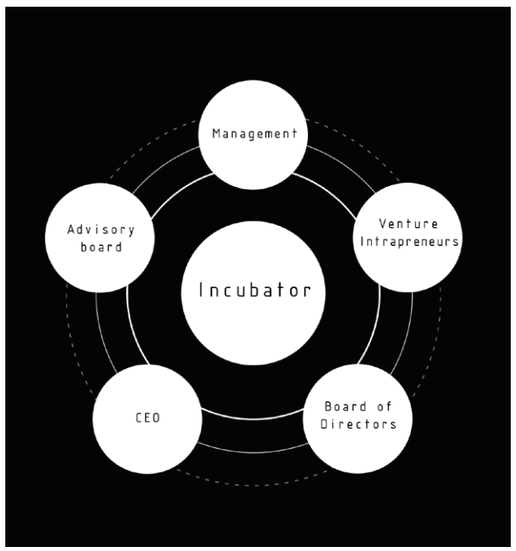


Its place in the supply chain:
Prefabricated frames and trusses occupy a crucial position in the construction supply chain, typically falling under the category of manufactured building components. Their placement within the supply chain can vary depending on the specific project and the procurement strategy adopted by stakeholders.

5.4 Tech startup Incubator:





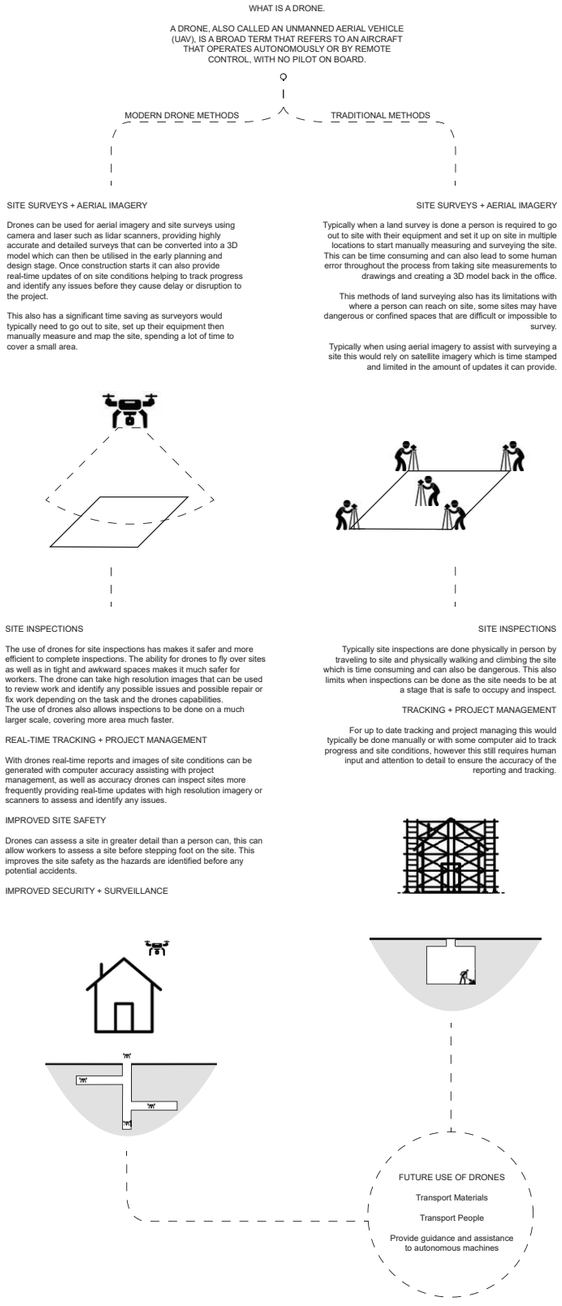




Blair Albrecht and Trent van Elwoud

5.1: Drone Construction and Autonomous Machines,
5.2: Circular / Disassembly (ARUP circular toolkit),
5.3: Bathroom Pods, +
5.4: Makerspace - Public Workshop.

5.1 Drone Construction and Autonomous Machines:



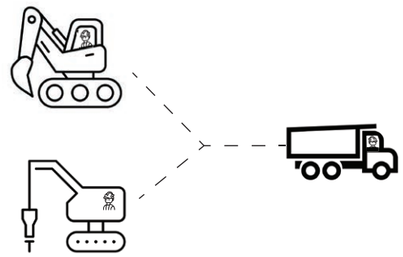
Autonomous machines have began to be used in construction in recent years more typically in on commercial sites where heavy machinery is used and in its early prototype stages. Compared to self driving cars there has been little uptake in the construction industry for autonomous machines.

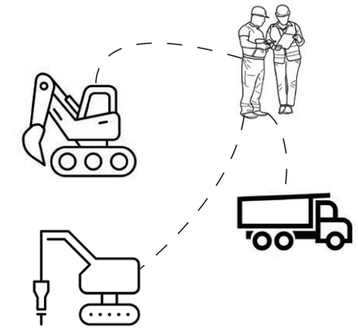
Heavy machinery has made use of autonomous self driving technology using GPS, Lidar, cameras, and sensors to detect its environment and safely navigate through it. These machines are typically used on quarry mining sites this is due to their wide temporary roads and they are in remote locations where there are less hazards for the machine. Compare this to a residential construction site that is in a constant state of change and short lived, this makes it much harder to implement automation at this scale.

Types of Autonomous Machines in Construction, Skilled Labour Machines:
Rebar Installer, Utility Detection, Marking / Set out, Rovers carrying tools, and materials Plasterboard installer.

Types of Autonomous Machines in Construction, Self Driving Heavy Machinery:
Dozers, Excavators, Load carriers, Haul trucks, Pile Driver Roller, Material Delivery, Real-time tracking + Reporting.

There are many lightweight automated machines in construction these machines are more technical and can offer assistance or perform skilled trades. This can create greater accuracy while reducing waste and accidents, these machines and robots use a combination of human control and AI to perform tasks. For automation to take off in the construction industry there will likely be uptake in semi-automated machinery then eventually one person will be able to monitor and operate multiple automated machines. Increasing productivity and efficiency.









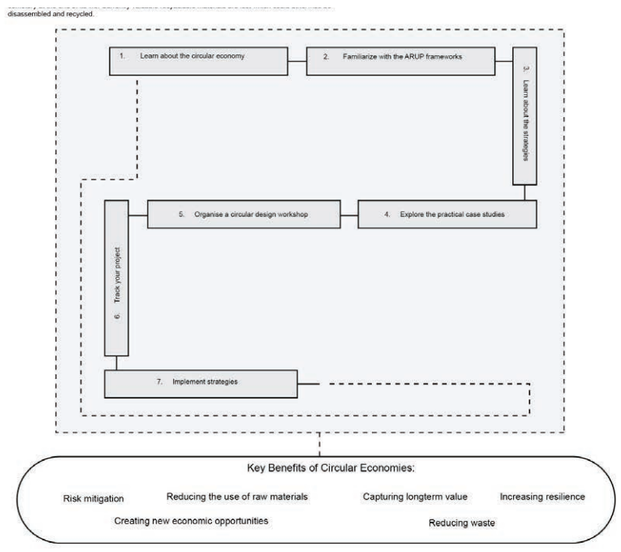
5.2 Circular Disassembly:

Away from the traditional linear model, circular economy adopts a regenerative approach and restorative. Fundamental change in the way design, construction, use and disposal of buildings occurs.

There are several examples of how this can be intertwined with residential construction:
-The design is for durability and longevity, hence reducing the need for frequent replacement and minimising waste.
-Energy efficiency improvements, improving the efficiency reduces demand and therefore reduces resources consumed and encourages renewable energy sources away from fossils fuels.
-Resource efficient construction materials, using sustainable and recycled materials through construction or renovations reducing waste and ensuring resource remaining in the system eg through reclaimed materials or recycled products such as low impact insulation or responsibly sourced wood.
-Recycling and waste management, homeowners implementing systems of effective recycling such as composting organic waste, minimising single use item, or upcycling/ re purposing furniture and fixings.
-In addition to the physical aspects its also a lifestyle change, active decision making such as minimising consumption, embracing second hand stores, extended warranties and repairing over replacing.

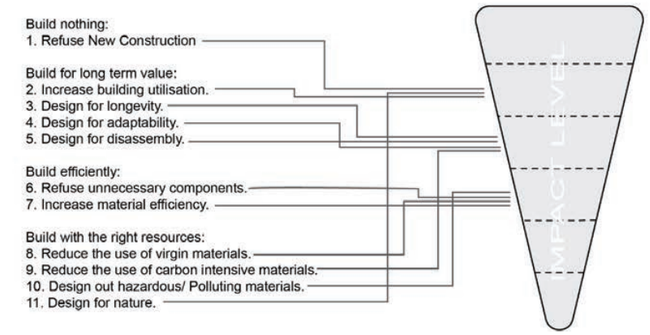
Its not as simple as the traditional system currently in place instead it takes an enormous attention to detail and flexibility to think outside the normal expectations of house construction. To get the best results it looks to assessing whats existing for what needs to change, what an be kept and or repurposed. Demolition becoming the last resort, with an unwillingness to compromise. A balance of achieving the clients aims whilst utilising what is at your disposal. With a consideration to the future always in mind not only envisioning its first us but its last.

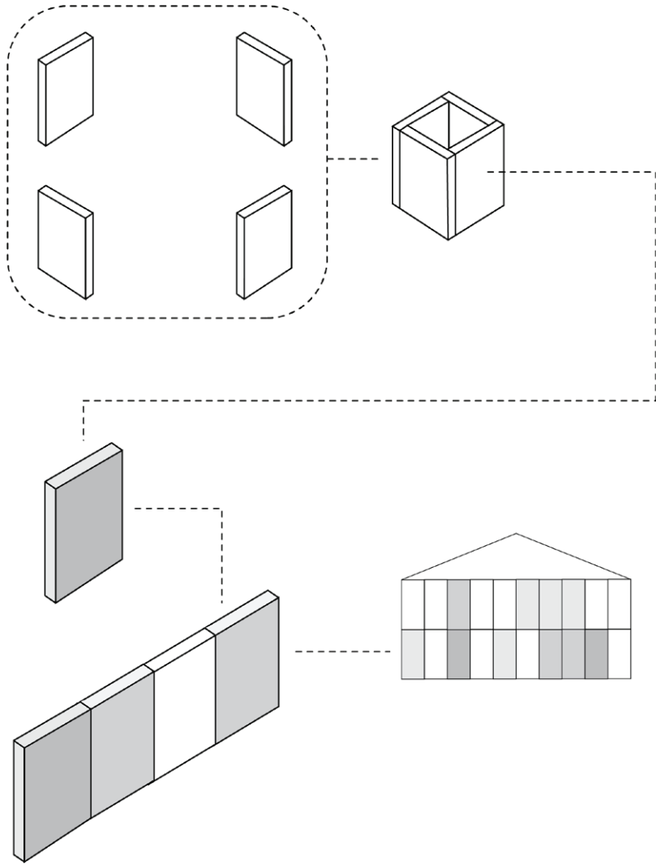
Current issue with disassembly is there are no systems which track and allow a value of all aspects within a structure and it gets lost in he process and just becomes waste. The value of constructing far outweighs the value of deconstructing and is the key issue of where we currently hold the value. An example being a Danish company which proudly state their recycling to be 87% of all building waste, this is te weight although not a measure of quality or economic value. This is impressive although it just blatantly highlights the flaws in the systems. That in order to encourage this standard of down cycling it can not be down cycled until it reaches its lowest economic value. Instead incentivisation needs to happen to make this a common practice and economically viable for companies. An ideology of value beyond a buildings lifetime, and not a material cemetery at the end of its life. Currently valuable recyclable materials are lost which could otherwise be disassembled and recycled.



Design for disassembly, it is a holistic approach which the intention is to make any given product or component easy to disassembly into its individual components. And is a cornerstone in allowing the circular economy to efficiently be implemented withing industry standard practice. It can be applied to any product through any scale or level of complexity. The main consideration overlooked is connection, that it must be a reversible system that doesn't damage the components, away from nails and glue towards bolts, screws and nuts. This is achievable through accessibility and even visibility of connection points.

ARUP STRATEGY







5.3 Bathroom Pods:

A bathrrom pod is a fully fitted bathroom that is constructed off site with fittings and fixtures then transported to site and installed in one module on site.

Bathroom pods are built off-site at a factory, building the floor, walls, and ceiling installing linings and waterproofing, then fitting and fixtures can be installed. Then once constructed the pod is ready to be transported to site and installed on site, this involves craning the pod into position then connecting the pod to services and utilities.

Process:
Design. Bathroom pods can come pre-designed or can be custom designed to suit a project or budget. The design needs to be communicated to the manufacturer to ensure a smooth workflow.

Manufacture. The bathroom pod is constructed off-site in a factory, the floor, walls, and ceiling are built and lined with plumbing points roughed in. Then the floor and walls can be waterproofed with the tiling installed, then the finishes can be applied such as painting, electrical, plumbing fittings and fixtures.

Delivery. Once the pod is ready it is transport to site on a truck and hoisted into the building using cranes.

Installation. When the pod is hoisted into the building its placed on rollers to help move it into position, then the rollers can be removed. Then the pod can be connected to services and external walls fixed and connected. Finally then the pod can be cleaned and checked internally for levels and connections.

Time Saving.
One of the major benefits of the bathroom pods is the time savings it can offer with project timelines, the pod can be constructed off site in the early stages of construction then when the project is ready the pod can be transported to site and installed. For large project with hundreds of bathrooms this can save significant time.

Quality Control.
Being built in a factory setting there is greater control over the conditions and quality of work, defects can be easily identified and resolved before the pod arrives at site. The factory setting creates a production line methodology with consistent quality repetition.

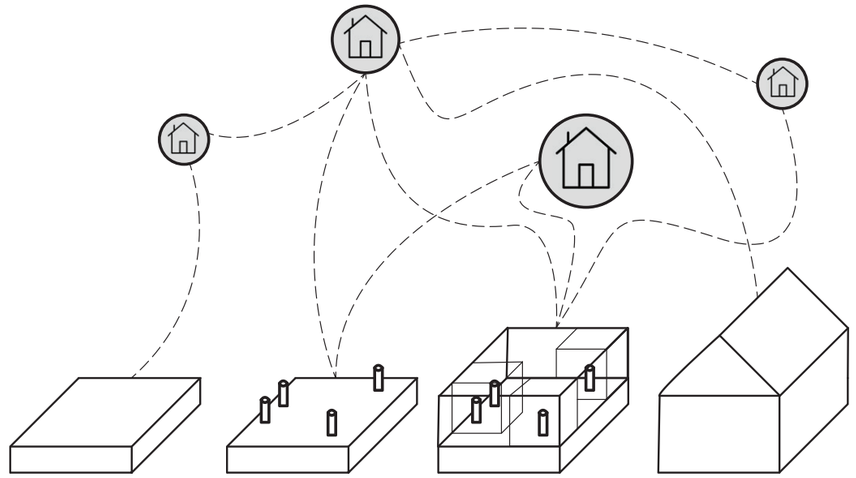


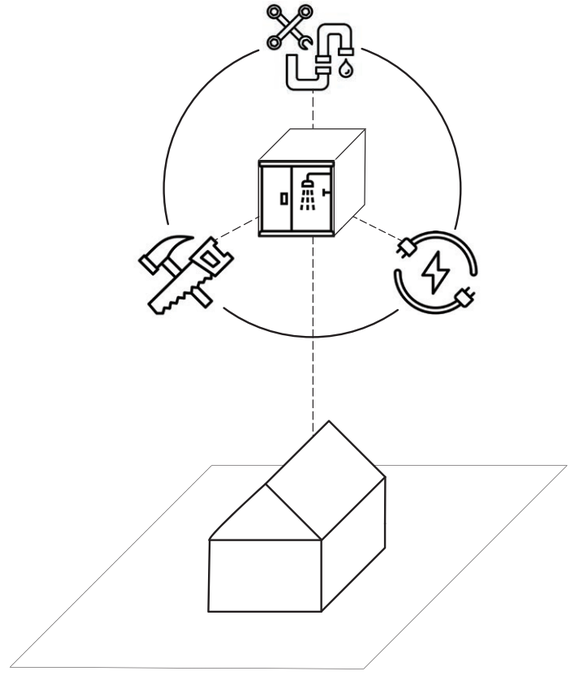




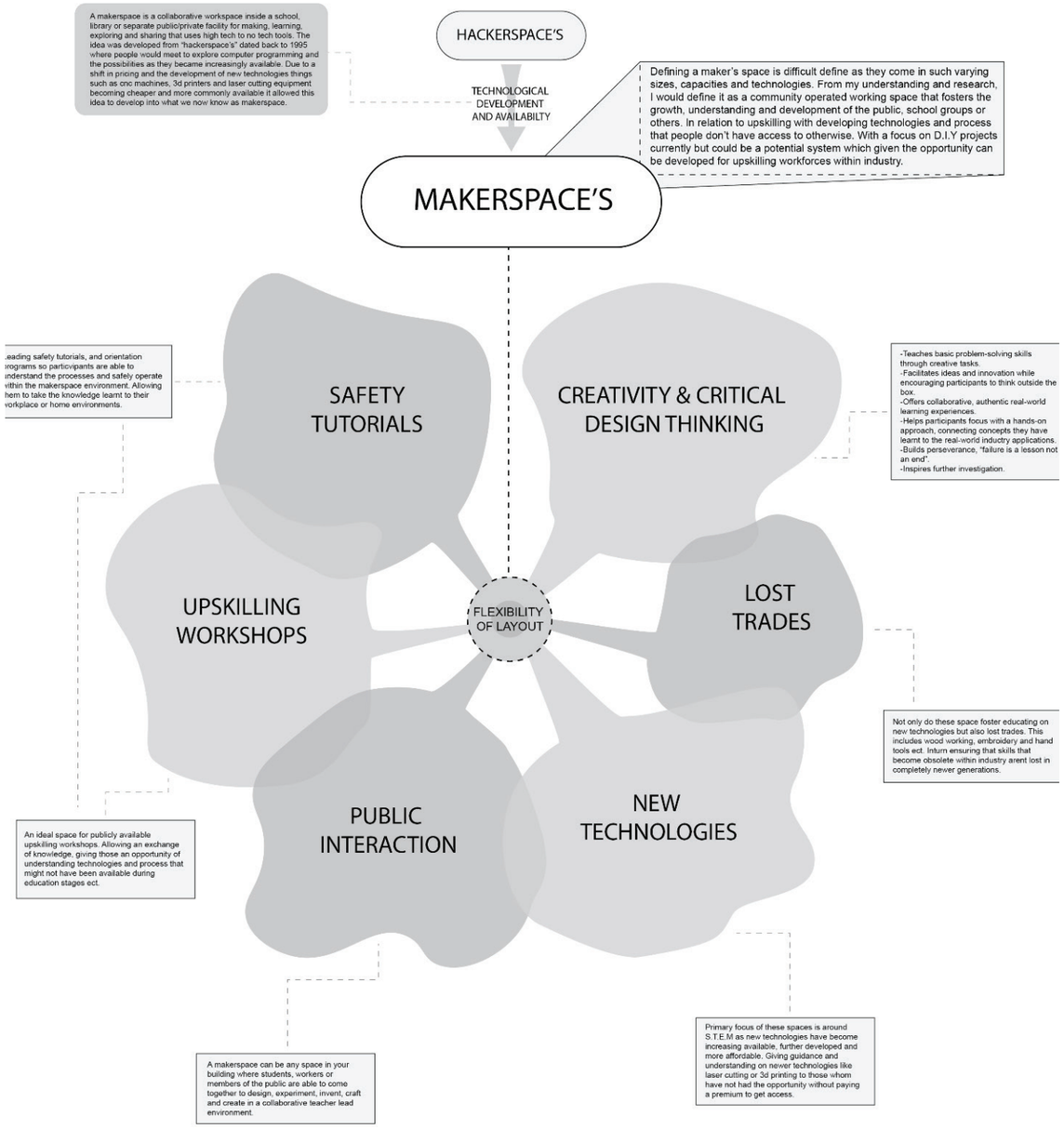
Australian Suppliers.
PUDA - Commercial
Interpod
Moov Modular
Backyard Pods
King Domes
Add a bathroom
Eco Structures
Tidy Bathrooms
Sync- by Hickory
Buildom

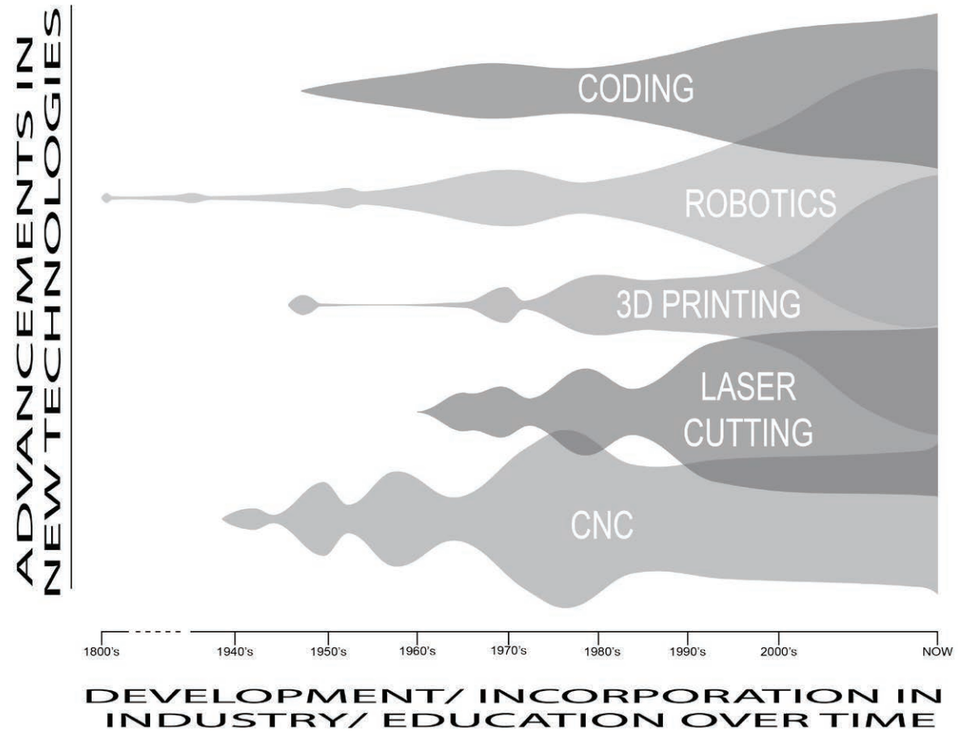
International Suppliers.
Walker Modular - England B
athsystem S.p.A - Italy
Off Site Solutions - United Kingdom
Sanika - Italy



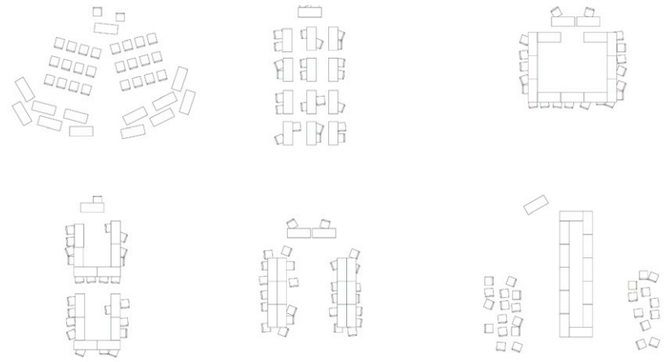


5.4 Makersspace - Public Workshop





DEVELOPMENT/ INCORPORATION IN INDUSTRY/ EDUCATION OVER TIME



Key questions to consider when planning a maker space:
Who will be using this space?
What is the purpose of this space?
What type of area would best suit their needs?
What equipment is needed? How much space does the equipment take?

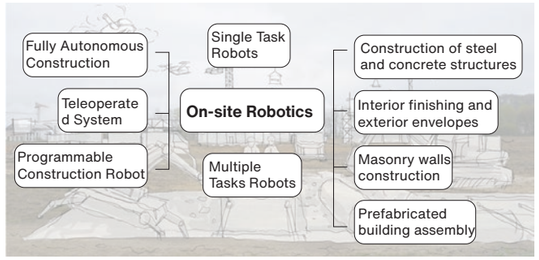
The first thing to consider is the maximum participants that will be able to attend the Makerspace workshops at any one time. Needing to ensure when selecting your Makerspace setting there is always enough room to work safely.

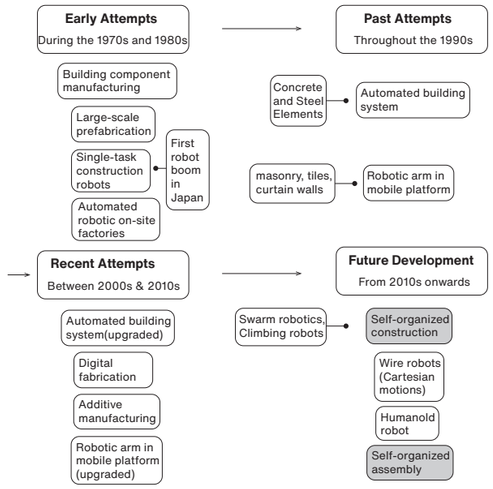
There will also need to be a designated area for displaying project ideas, as well as flexible furniture options that support inclusive and collaborative learning, there is no one-size-fits-all layout and work best when are completely adaptable.

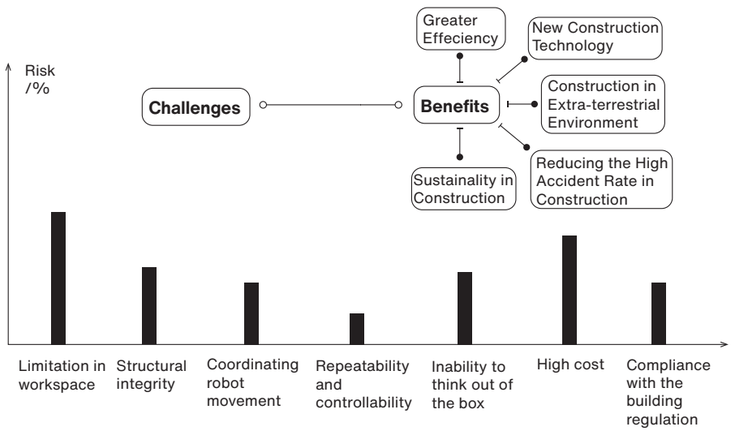
Tong Zhao and Somana Sok

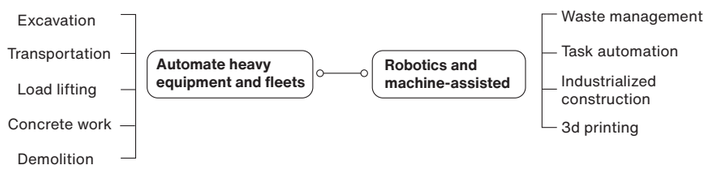
5.1: On-Site Robotics (Canvas, RWTH),
5.2: Emerging Objects / Ronald Rael Mud Architecture,
5.3: Panelised Cassettes, +
5.4: Library / Knowledge Centre.

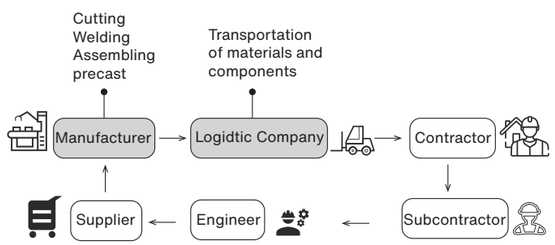
5.1 On-Site Robotics (Canvas, RWTH):

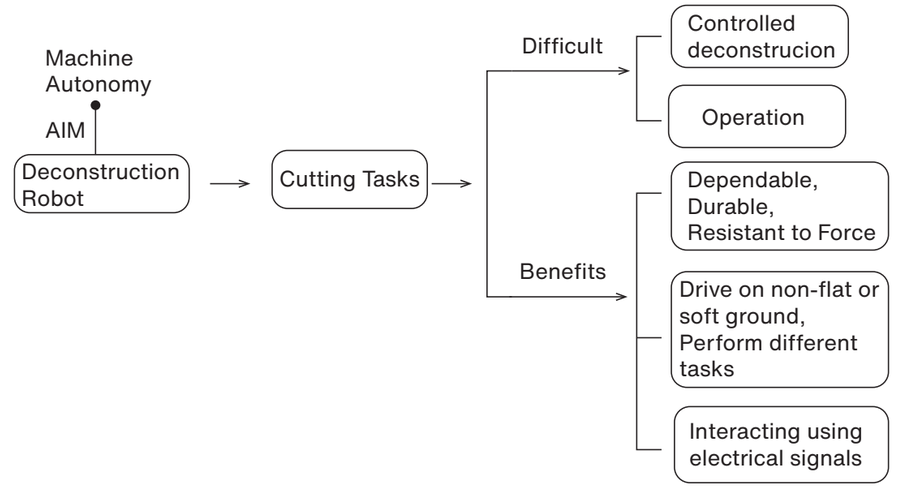


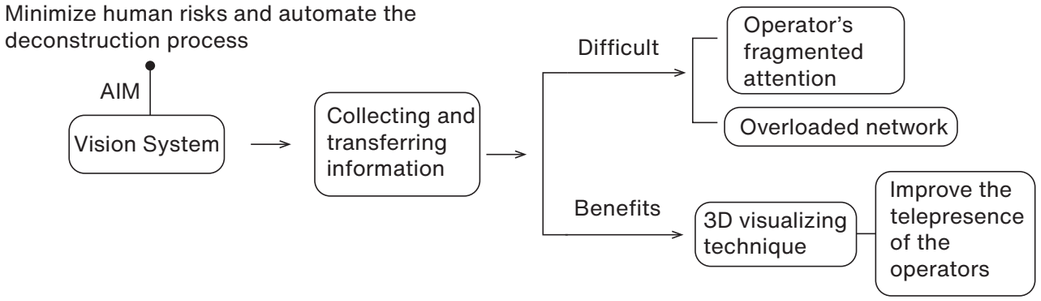


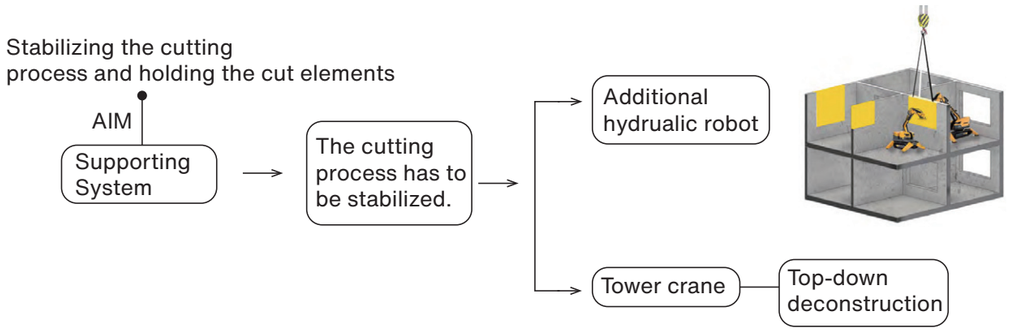




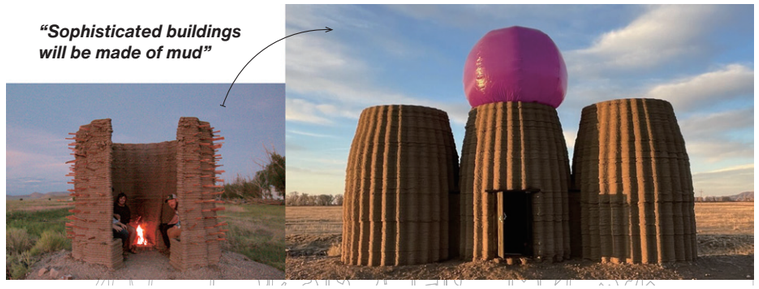


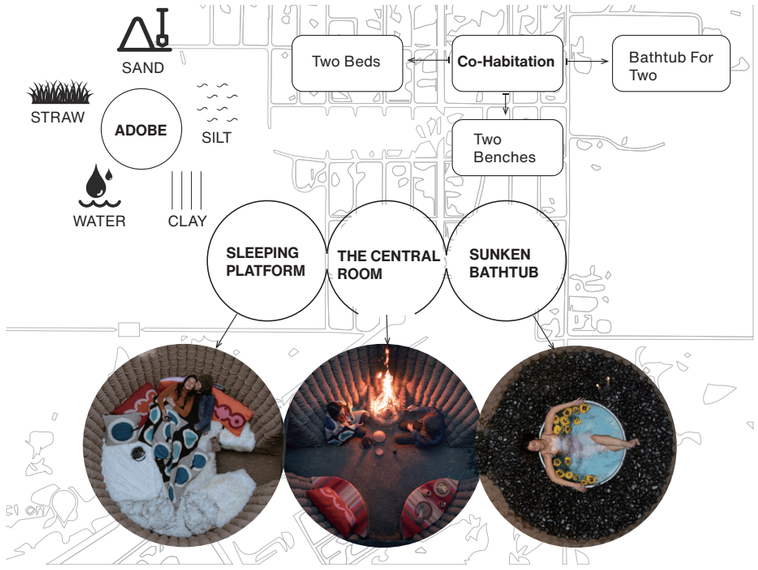


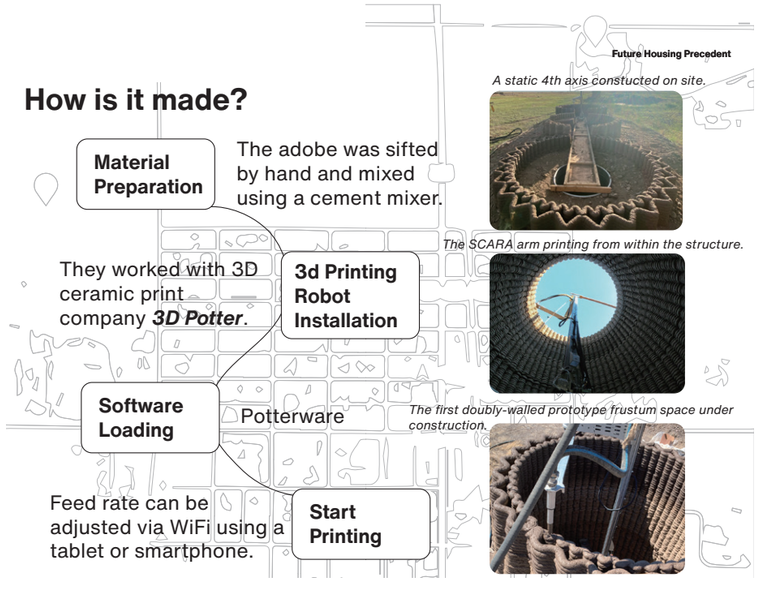


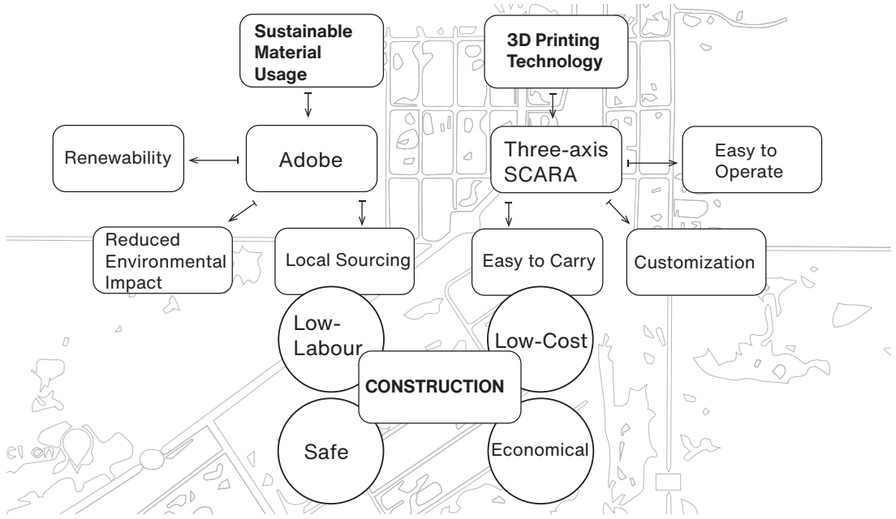


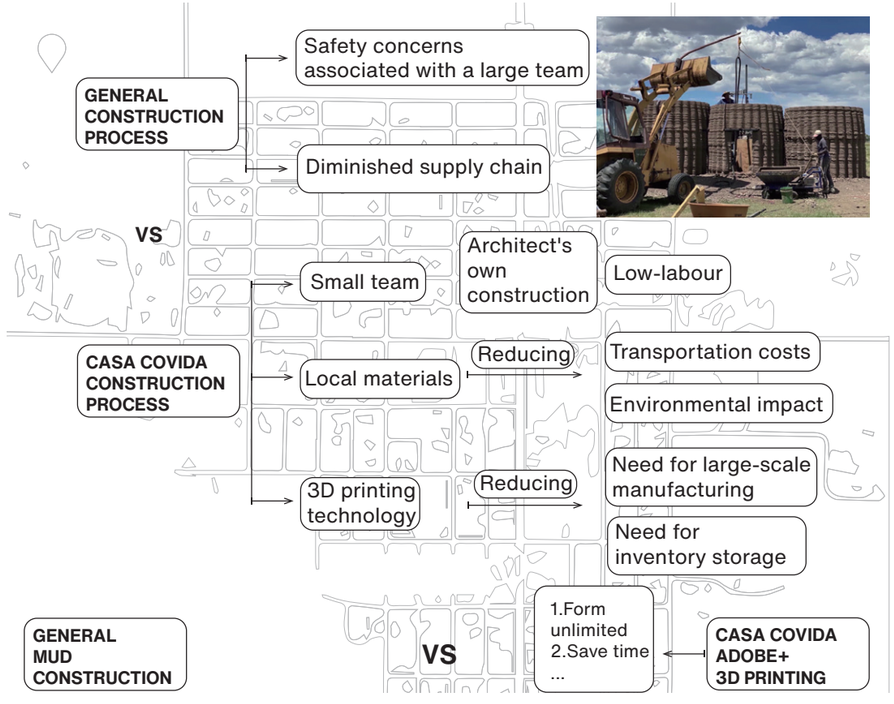
5.2 Emerging Objects / Ronald Rael Mud Architecture:





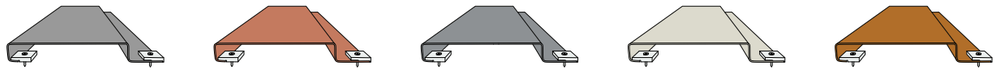






5.3 Panelised Cassette

MATERIALS



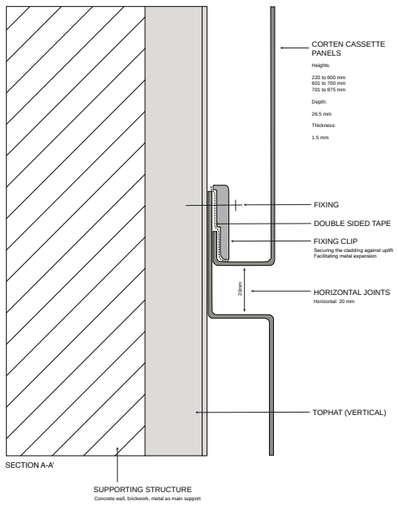
VMZINC
50-80 years

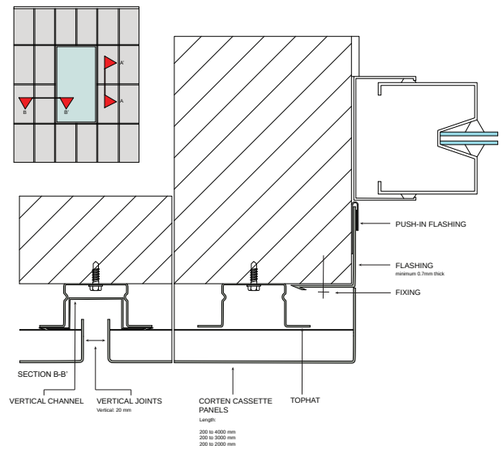
COPPER
70-100 years

ALUMINIUM
40-60 years

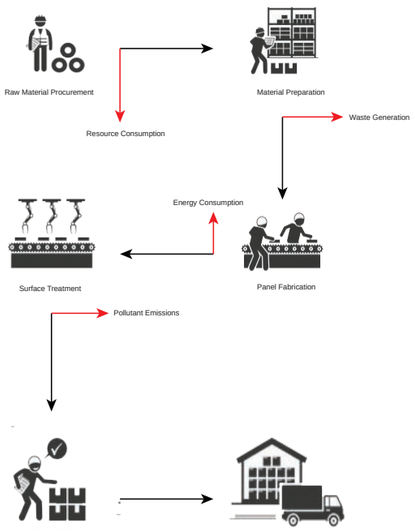
COLOR BOND
Last 50 years

CORTEN
Rust-like appearance for several years

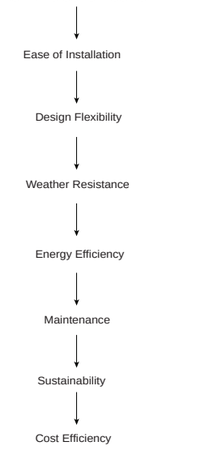




PRODUCTION PROCESS

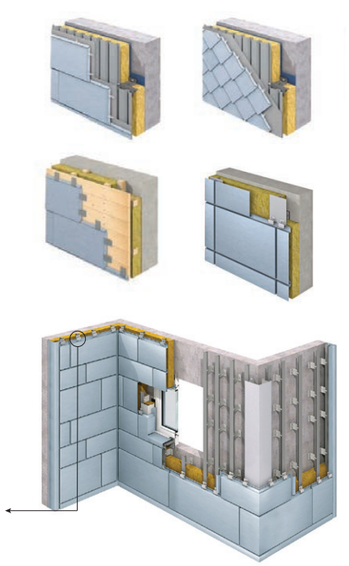


FUNCTIONAL PURPOSES IN BUILDING CONSTRUCTION



The typical panels have an up-stand at the top which is fixed to the framework with special clips and another up stand at the bottom which locates into the clips on the preceding panel.

Areas of application: Vertical walls (slope 90°) and soffits



MID-20TH CENTURY

Cassette Panles developed to address the demand for efficient and economical building construction

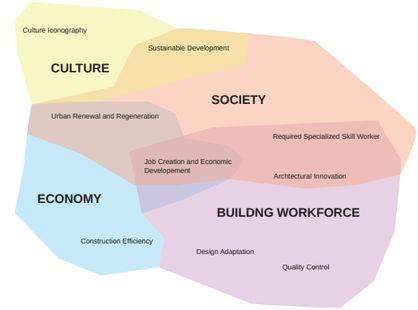
1960s - 1970s

Industrialization of Cassette Panel Construction

POST-WAR DEVELOPEMNT

Demand for affordable building to tackle housing shortages and urban redevelopment

Panels can prefabricated off-site, enabling quicker assembly on-site and lowering construction time and labor expenses.



CASSETTE PANEL IMPACT ON SOCIETY, ECONOMY, CULTURE, AND BUILDING WORKFORCE

ADVANCEMENTS IN MATERIALS

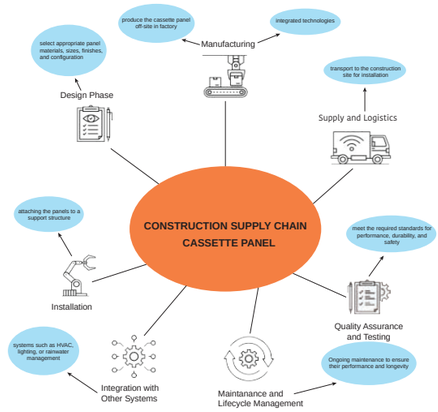
Evolved to incorporate a wider range of materials, including aluminum, composite materials, and advanced polymers.

ENERGY EFFICIENCY

Integration of insulation materials, high-performance coatings, and the use of renewable energy technologies

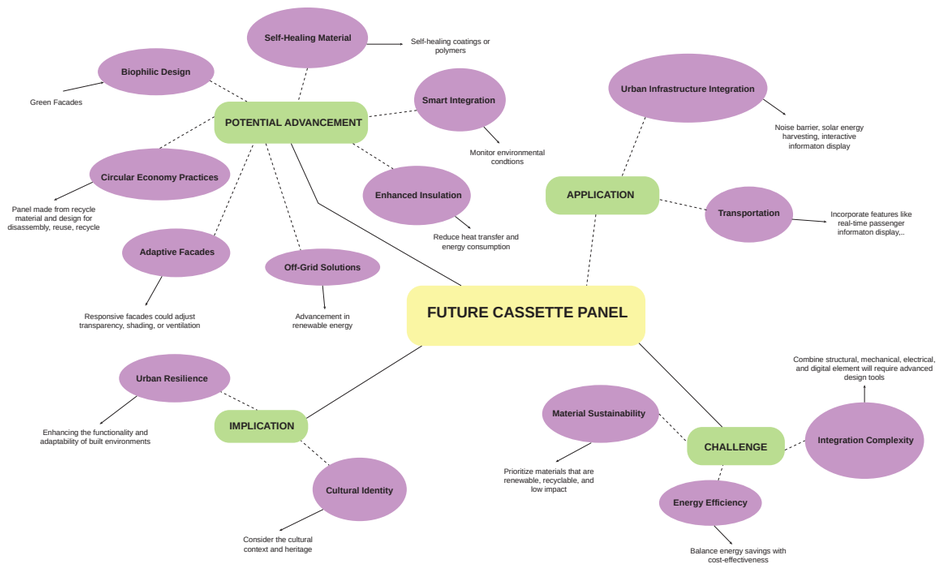
DIGITAL TECHNOLOGIES

The adoption of digital design tools and computer-aided manufacturing (CAM) technologies revolutionised the design and production of cassette panels.



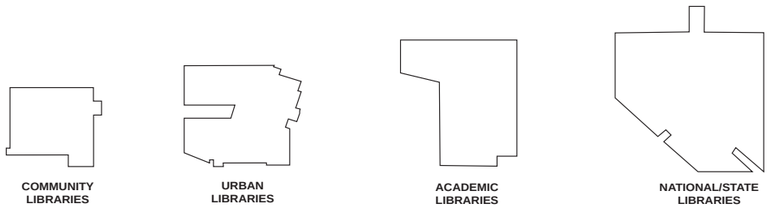
SUSTAINABILITY

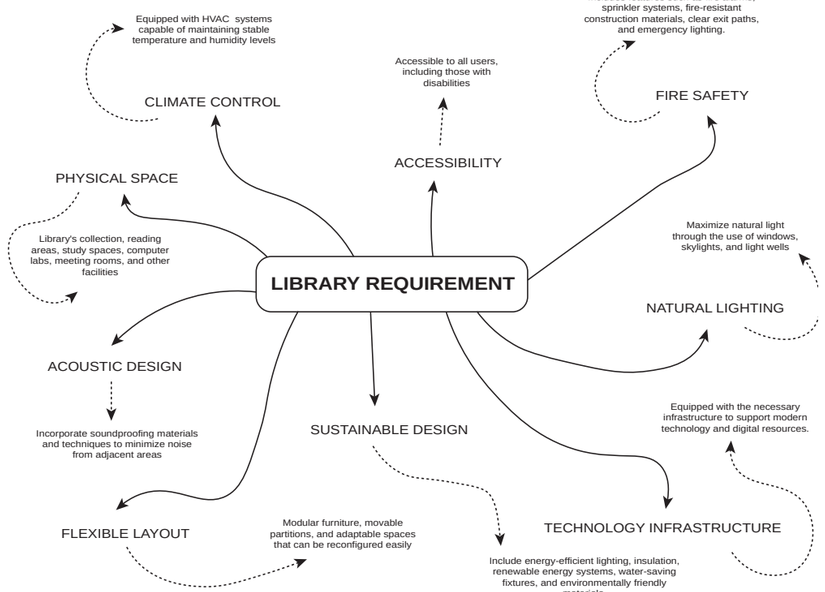
Cassette panel manufacturers started to develop eco-friendly materials, optimise production processes, and incorporate energy-efficient features

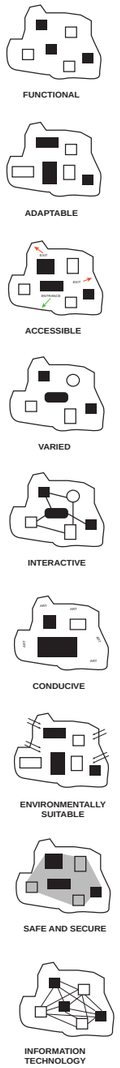


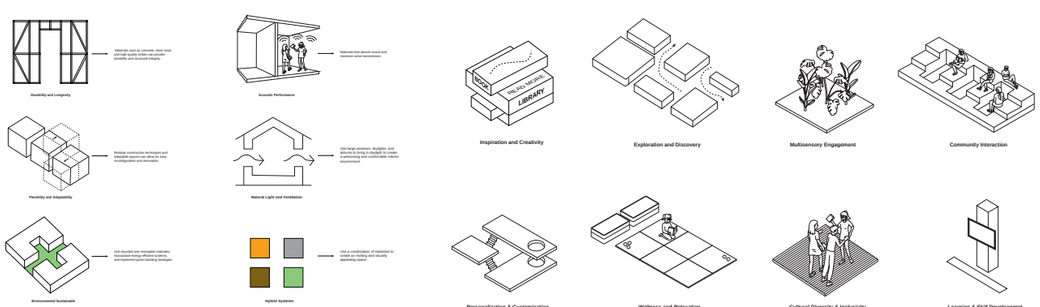
5.4 Library / Knowledge Centre:

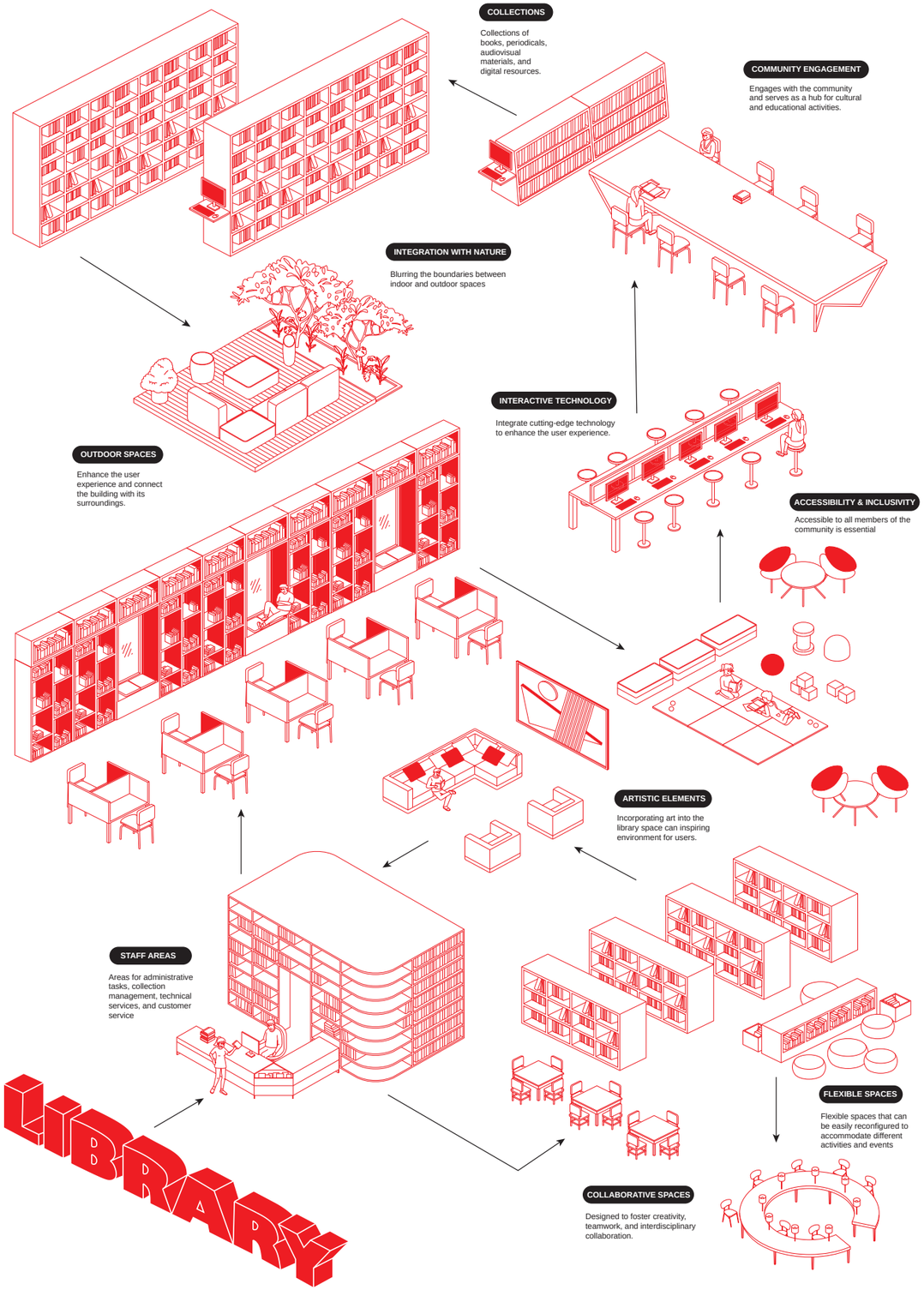
The size of library can vary depending on various factors such as its purpose, location, user population, budget, and available space.











building 4.0 crc

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