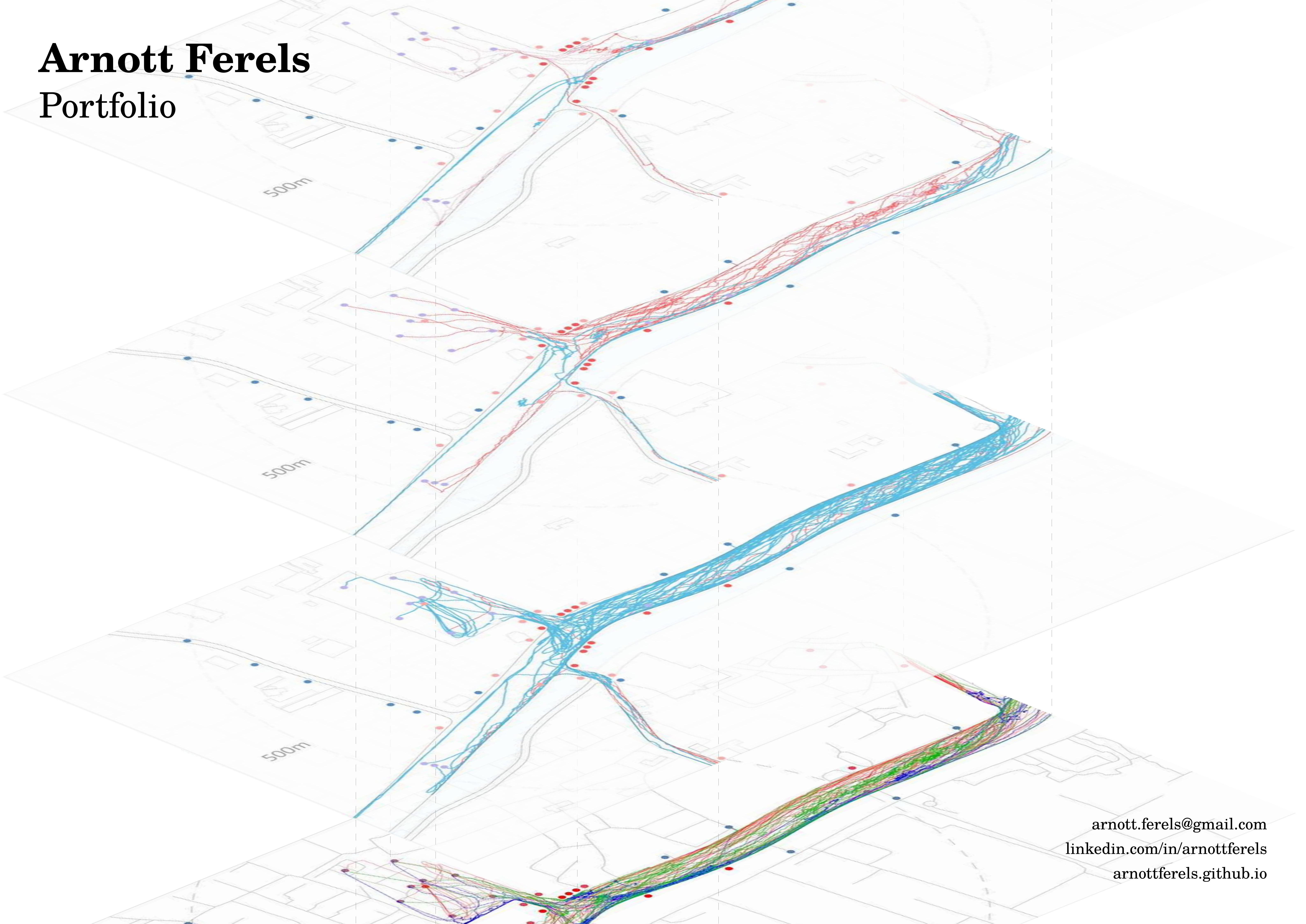
# **Arnott Ferels**

Portfolio

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Contents

# X Transit Hub

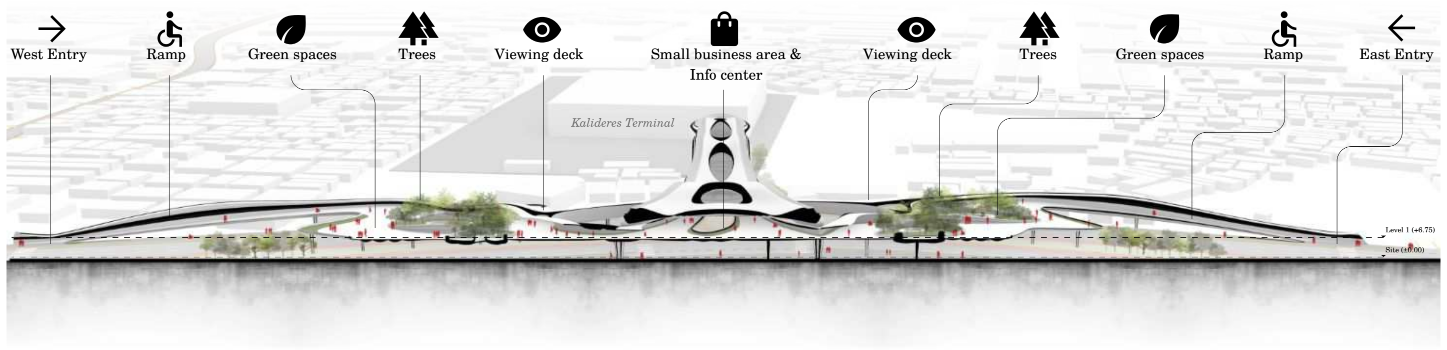
*Walkability Model Using Dynamic Multilayer Method in Transit Hub Design*

*Master's Thesis – 2023 | Urban Research; Transit Design; Public Space; Computation | West Jakarta, Indonesia*

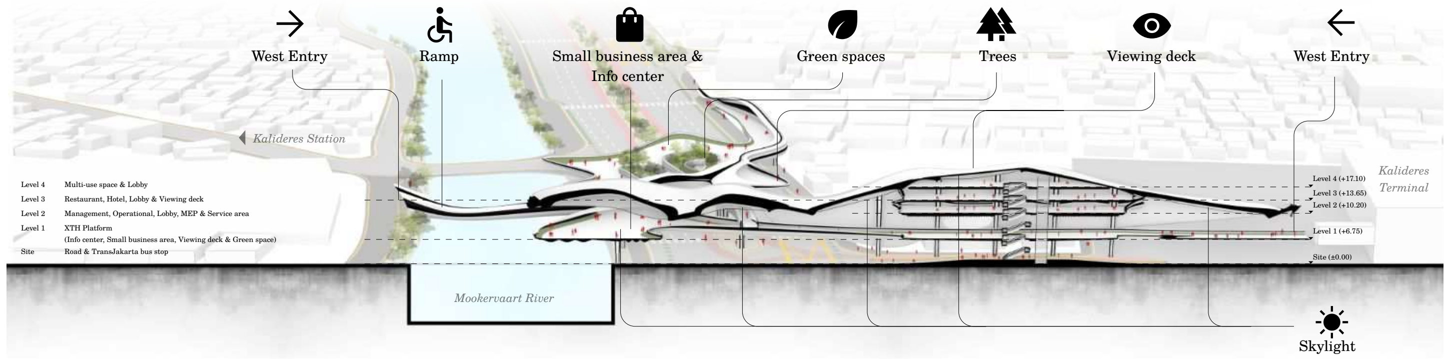
**Type** Individual work
**Software** Rhino, Grasshopper, Wallacei, Quelea, Caribou, Arachne, Kangaroo 2, Twinmotion, Adobe Photoshop
**Advisor** Aswin Indraprastha
**Jury** M. Donny Koerniawan, Heru W. Poerbo
**URL** `https://arnottferels.github.io/work/x-transit-hub`

This thesis delves into the challenges, methodologies, and solutions associated with the design of a transit hub (TH) in Jakarta that integrates both public transportation and public spaces (PS). A Dynamic Multi-Layer (DML) method addresses these intricate challenges by examining traffic density, simulating pedestrian movements, and optimizing for multiple objectives, such as minimizing distance to PS and reducing the total number of PS. The ultimate solution serves as a blueprint for the TH design, emphasizing human mobility, connectivity, and greenery.

## Design

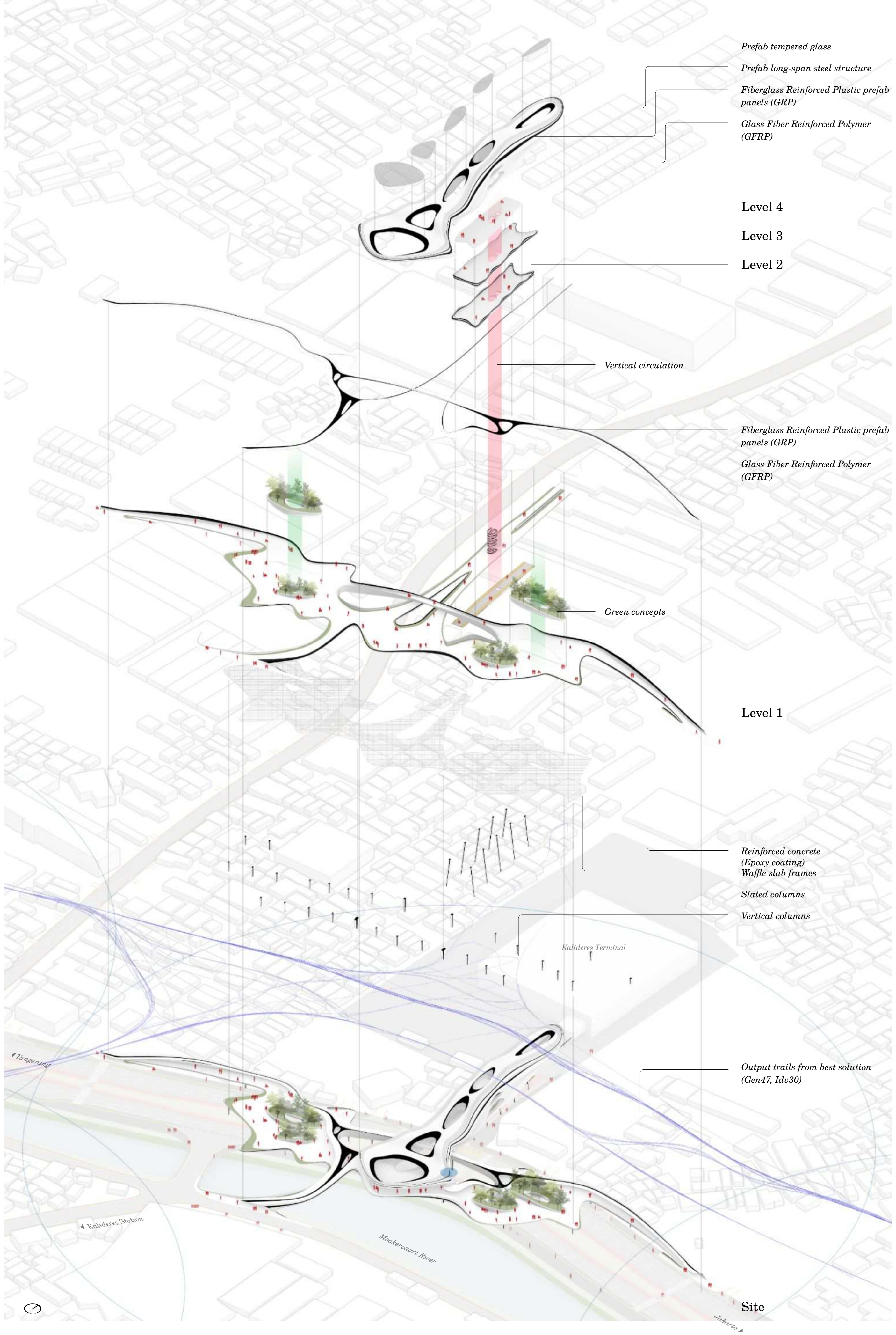



*Cross-section: West-to-east axis (Section A-A)*

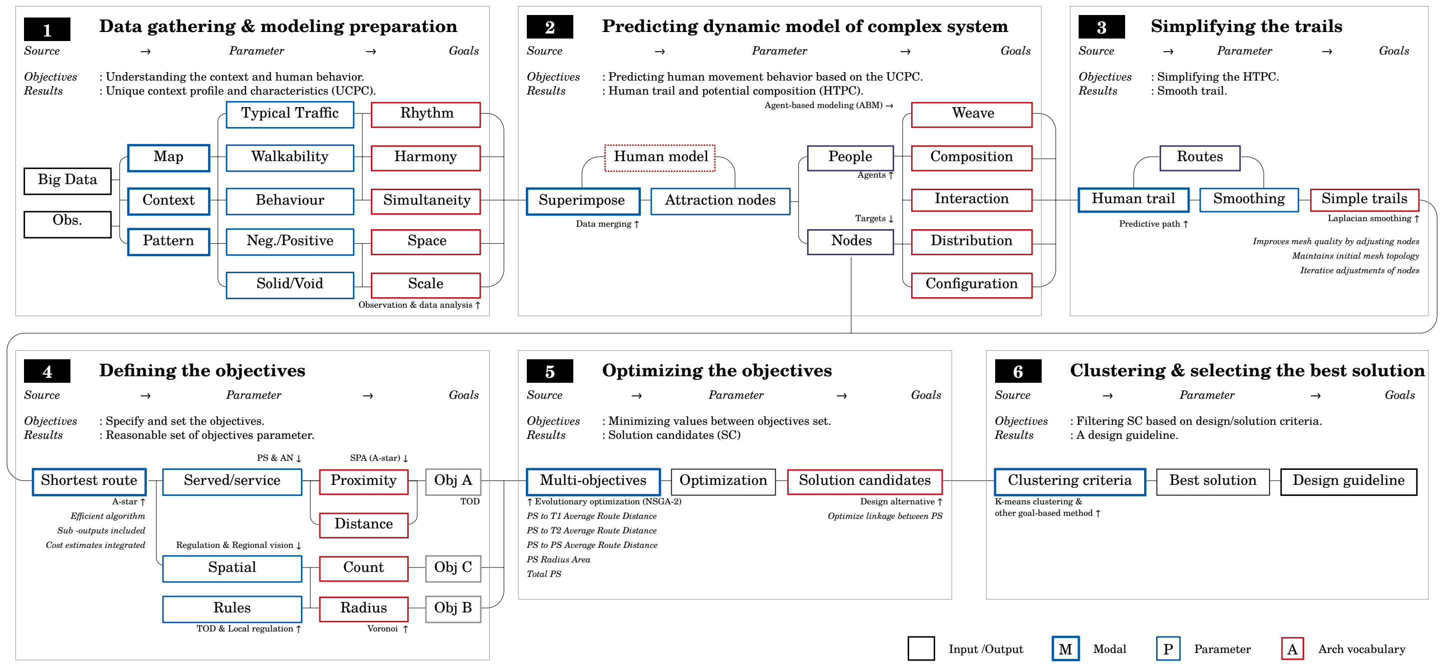



*Cross-section: West-to-east axis (Section B-B)*

*A perspective showing activities in green spaces and the extraction of major axis shapes from patterns using the Dynamic Multi-Layer (DML) method (explained on the following pages).*

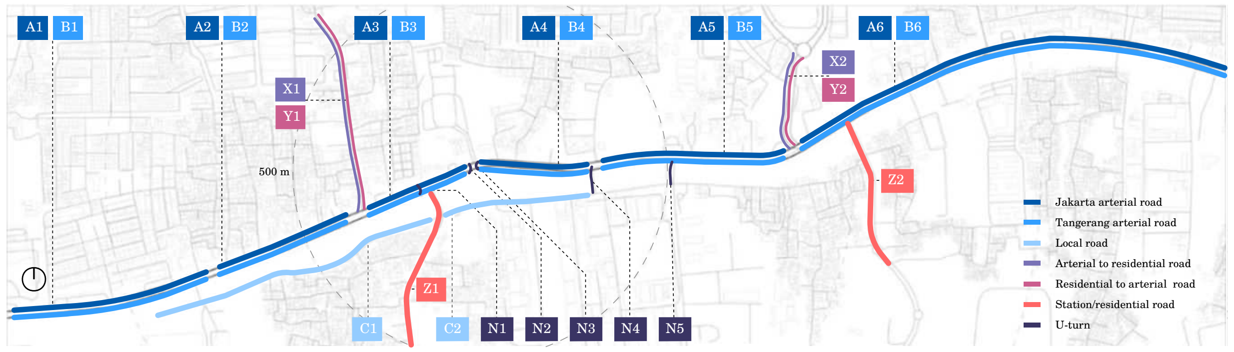


# Methodology



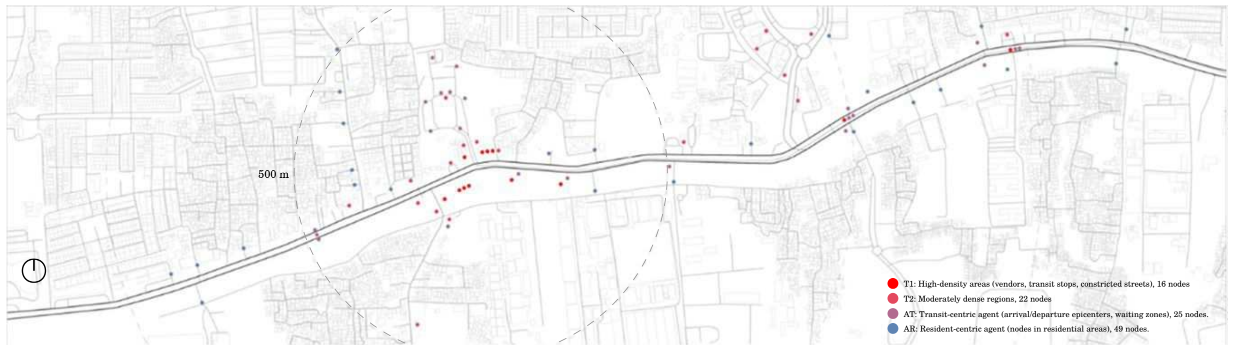

DML method framework. These are: traffic analysis (1), dynamic crowd modeling (2), the smoothing and simplification of multiple paths (3), multi-objective optimization (4 and 5), and solution clustering and selection (6).

## Data Gathering & Modeling Preparation (Traffic Analysis)




*The taxonomy of routes in Kalideres is based on traffic observations and pivotal variables, creating route segmentation.*

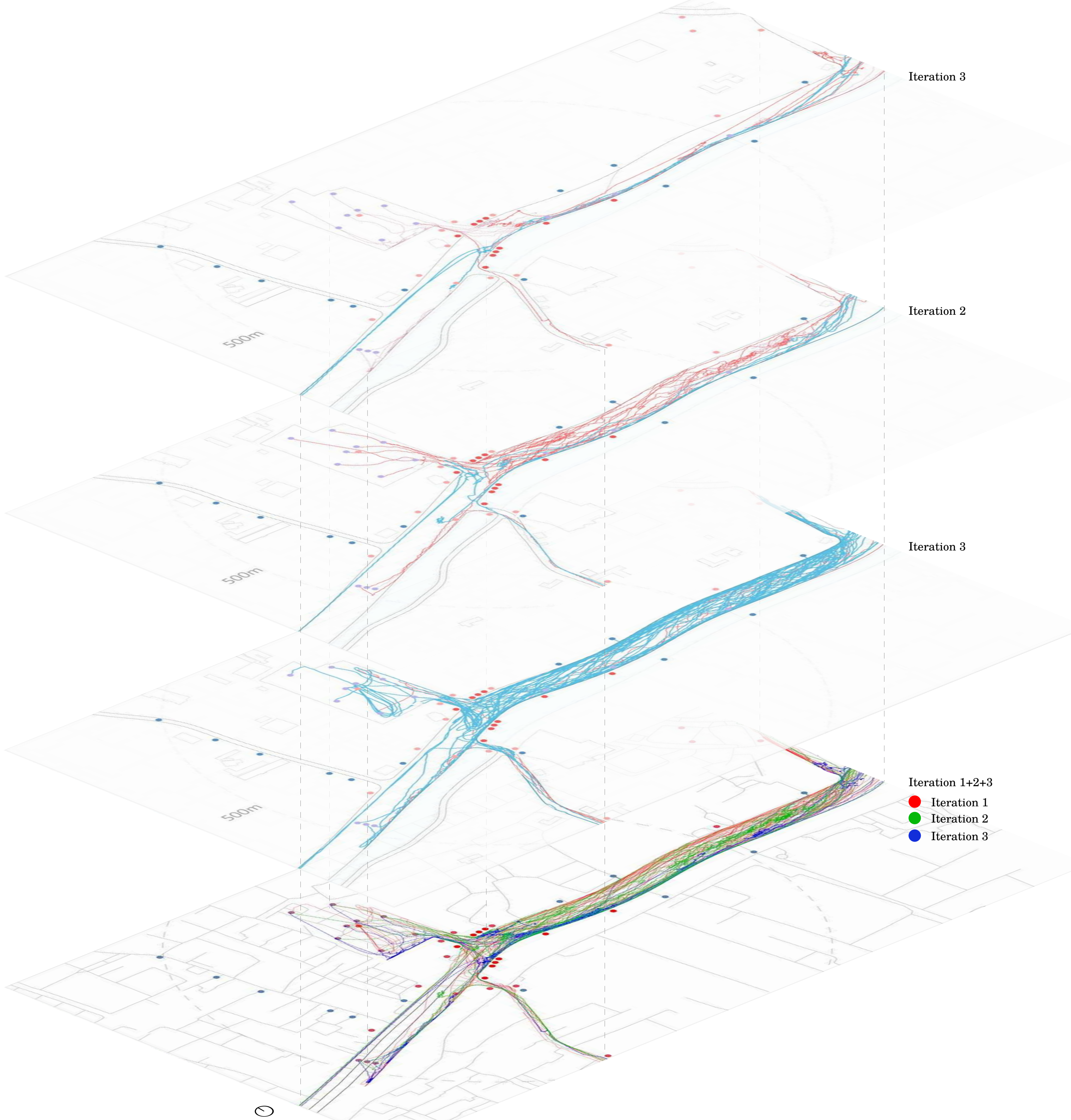

*Route scoring is based on route segmentation.*




*Point-map with agents (AR, AT) and targets (T1, T2).*

In Layer 1, Google Maps Typical Traffic (GMTT) data (6 AM — 10 PM) analyzed congested routes and pedestrian movements. On-ground mapping and digital tools like Rhino, Grasshopper, and Caribou played crucial roles. GMTT data, ranked 1 to 3 for traffic densities, guides Layer 2 in identifying attraction points and key agents.

## Predicting Dynamic Model of Complex System




*Aggregated results from agent-based simulations in Iterations 1, 2, and 3, illustrating crowd movement in the virtual environment.*

### Solo Commuting (Iteration 1)

Designed for students and working professionals, this configuration activates `Wandering` while deactivating `Align Force`.

### Solo Walking (Iteration 2)

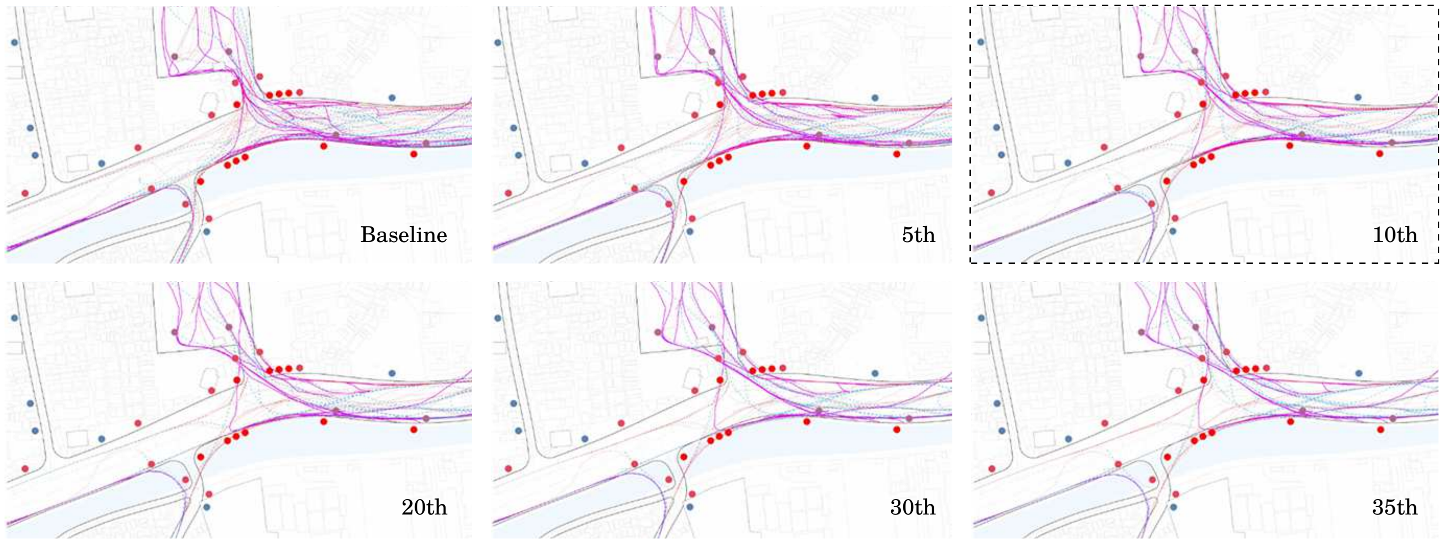
Tailored for leisure walkers, this configuration deactivates both `Wandering` and `Align Force`.

### Group Touring (Iteration 3)

Configured for group tours, this setup deactivates `Wandering` and activates `Align Force`.

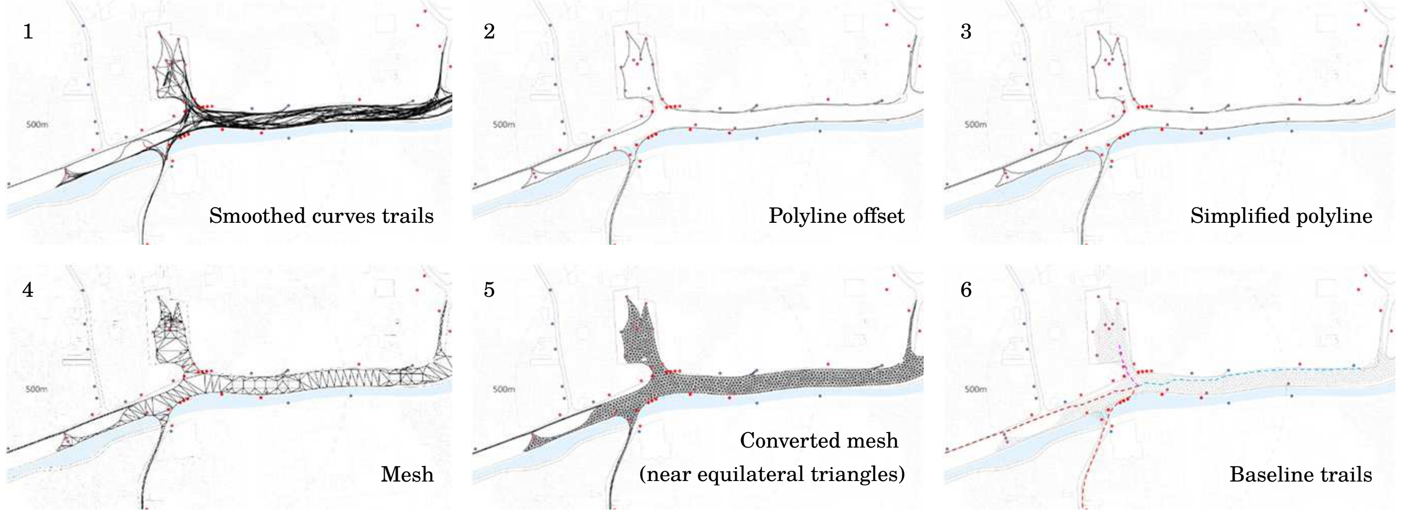
In Layer 2, utilizing agent-based simulation, agent configurations for AR, AT, T1, and T2 were derived from insights in Layer 1 through three iterative refinements. Configurations include Solo Commuting (students, professionals), Solo Walking (leisure walkers), and Group Touring (group tours). After 300 steps using tools like Grasshopper and Quelea, agent trajectories were evaluated, revealing patterns. Iteration 1 facilitates smooth navigation, Iteration 2 shows agent clustering in bustling zones, and Iteration 3 sees dense congregation around T1 and T2, indicating congestion hotspots. The simulations provide insights for urban renewal projects and infrastructure enhancements.

### Simplifying the Trails




In Layer 3, data from three Layer 2 iterations is smoothed using Laplacian technique, maintaining even spacing. Modal points undergo iterative modifications, aligning with the 10th iteration and defining mesh space with shortest path algorithm (SPA). Aligned with TOD Standard 3.0 and SDGs 11 for robust transportation infrastructure and urban design.

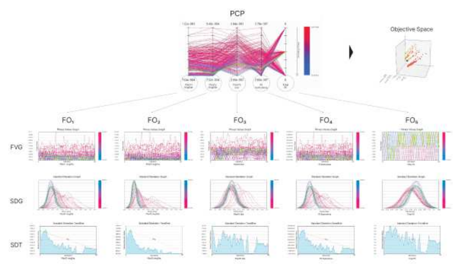
### Defining the Objectives



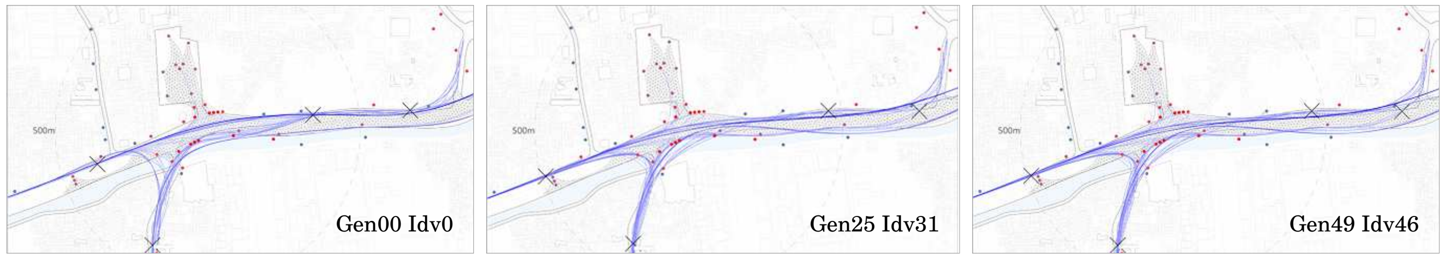

In Layer 4, SPA and A-star algorithms converge, paving the way for optimization in Layer 5. The computational agility of A-star transforms input lines into a refined foundational mesh using TriRemesh in Kangaroo2. This mesh serves as trails for SPA, with T1 and T2 as terminal markers (nodes).

### Optimizing the Objectives

*Diamond Fitness Chart (DFC) traces optimization progress.*

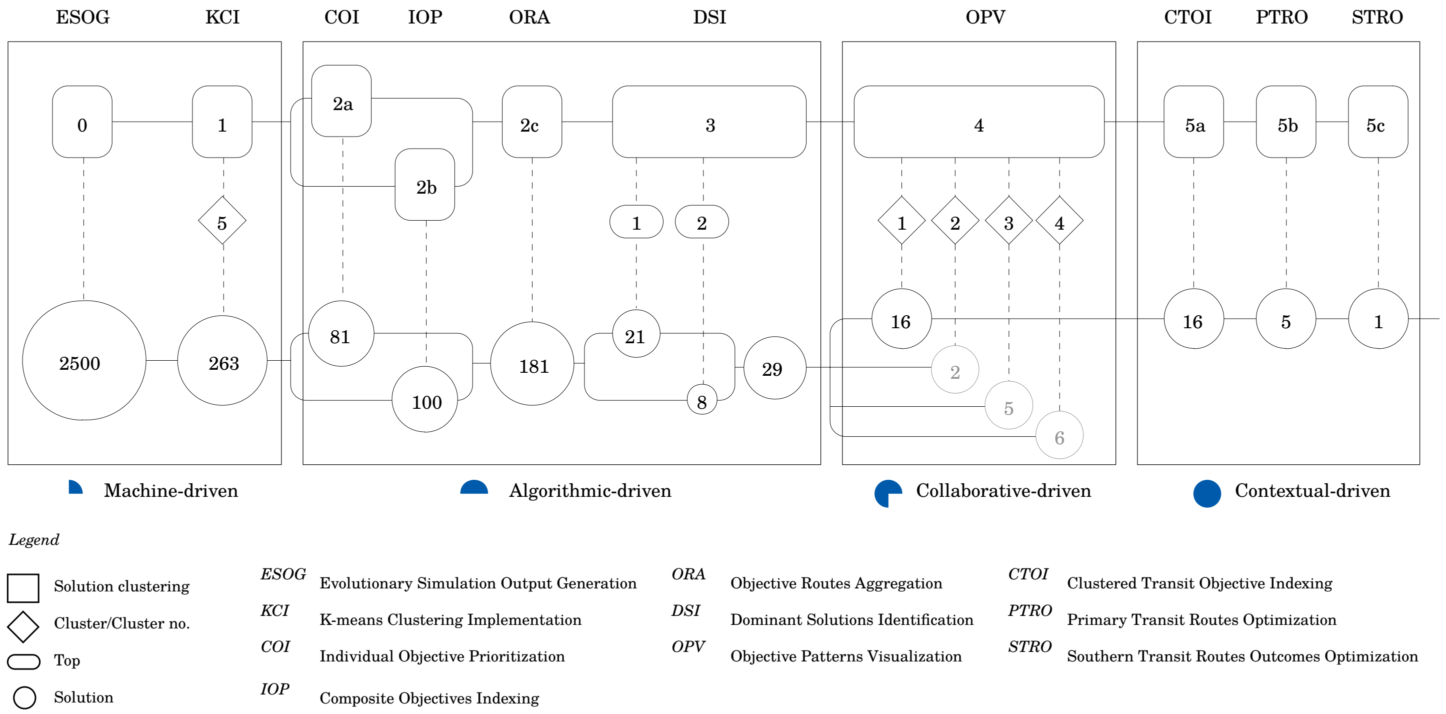


*PCP, FVG, SDG, and SDT offer a comprehensive view of generation.*



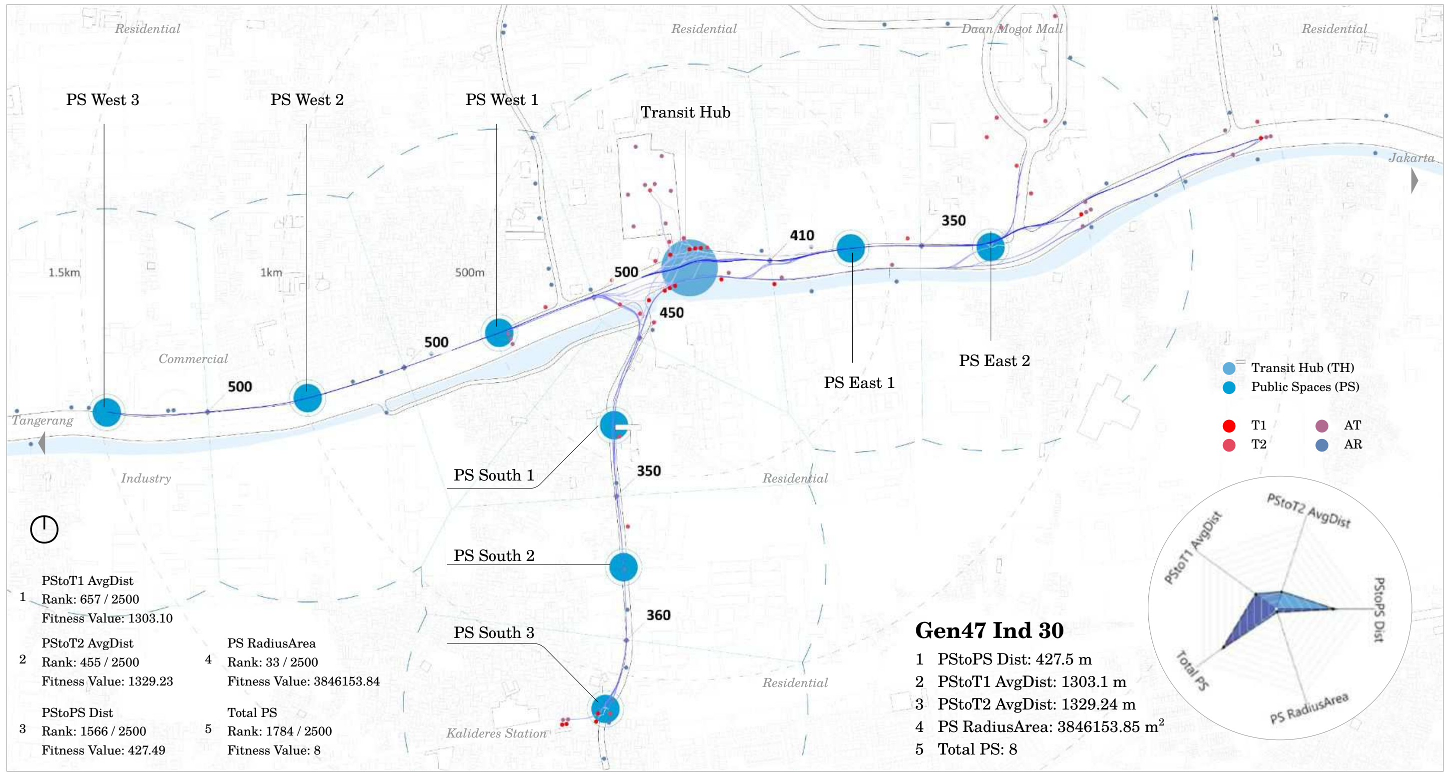

In Layer 5, EMOO simulation, driven by NSGA-II, aims for advanced outcomes. Fitness Objectives (FO) prioritize average route distances, Voronoi radii area, and total potential Public Space (PS) count, emphasizing uninterrupted mobility, placemaking, and urgency. The study, evaluating 2,500 potential solutions with Wallacei, confirms the method's effectiveness, setting the stage for the next layer to select the best design guideline through solution clustering techniques.

### Clustering & Selecting the Best Solution




*A method for clustering the set of solutions into the best solution. It is called the Selection Clustering (SC) method.*

In Layer 6, the focus is on detailed clustering of the extensive set of 2,500 solutions using the SC method. The objective is to determine the most pertinent design guidelines. This method unfolds over five phases, collectively termed "solution clustering," fine-tuned to choose the most suitable solution for the study.




*Best solution – Gen47 Idv30.*

Upon reevaluating the chosen solution (Gen47 Idv30), the initial criteria set for all FOs were revisited. Ideally, these criteria should align with the highest standards, particularly when compared to the clusters identified in Layer 6. Achieving the set goals for each FO is crucial. The assessment reveals that all objectives have been met, positioning the selected solution as a leading design guideline for the TH in the first section of this portfolio. Additionally, this solution serves as a blueprint for future planning of PS in the context.

## Finding

In the Dynamic Multi-Layer (DML) methodology, Walkability Model (WM) is employed to track agent movement effectively, distinguishing between primary and secondary movement patterns. This approach, combined with Agent-Based Modeling (ABM), provides valuable insights for designing TH and PS. The use of WM plays a crucial role in understanding the walkable aspects of urban spaces, aiding in the formulation of design guidelines.

# Kemayoran A4B Low-Cost Residences

*Harmonizing Sustainability and Affordability in Post-COVID Urban Living*

*Master's Design Studio 1 – 2021 | Low-cost Housing Research; Apartment Design; Design Optimization | Central Jakarta, Indonesia*

**Type** Individual work
**Software** Revit, Rhino, Grasshopper, Galapagos, Ladybug Tools, Twinmotion & Adobe Photoshop
**Advisor** Woerjantari Kartidjo
**URL** `https://arnottferels.github.io/work/kemayoran-a4b`

This study aims to create designs for government housing in Kemayoran, Jakarta, specifically for people with lower incomes. The approach is innovative, focusing on changing how buildings are designed. Despite challenges from the COVID-19 pandemic, the project transforms urban areas by combining flexibility and environmental consideration. The design incorporates nature-friendly concepts, including communal green spaces. Tools like the Galapagos Solver are used to shape the exteriors of buildings and adapt interiors based on the weather. The primary focus is on natural cooling and protection from the sun. The research suggests that planning cities this way results in homes that meet current needs and address significant challenges in the future.

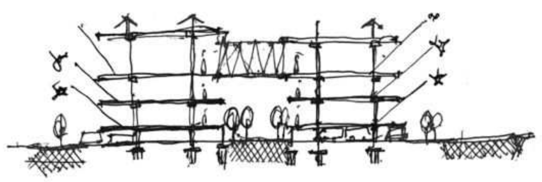
## Issues & Strategies

| Period | Issues | Strategies |
|---|---|---|
| COVID-19 pandemic (2020–2021) | Airborne virus transmission & Overcrowding prevention | Avoiding dense gatherings and maintaining physical distance |
| Post-pandemic & future (2022–2045) | Pandemic evolution into endemic state | Implementing passive measures for ongoing health considerations |
| Society 5.0 era (2045<) | Human adaptation to technological advancements and AI | Integrating smart features aligned with Urban Design Guidelines (UDGL) Kemayoran |

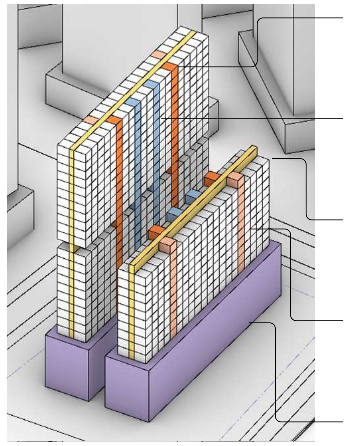
## Construction Context

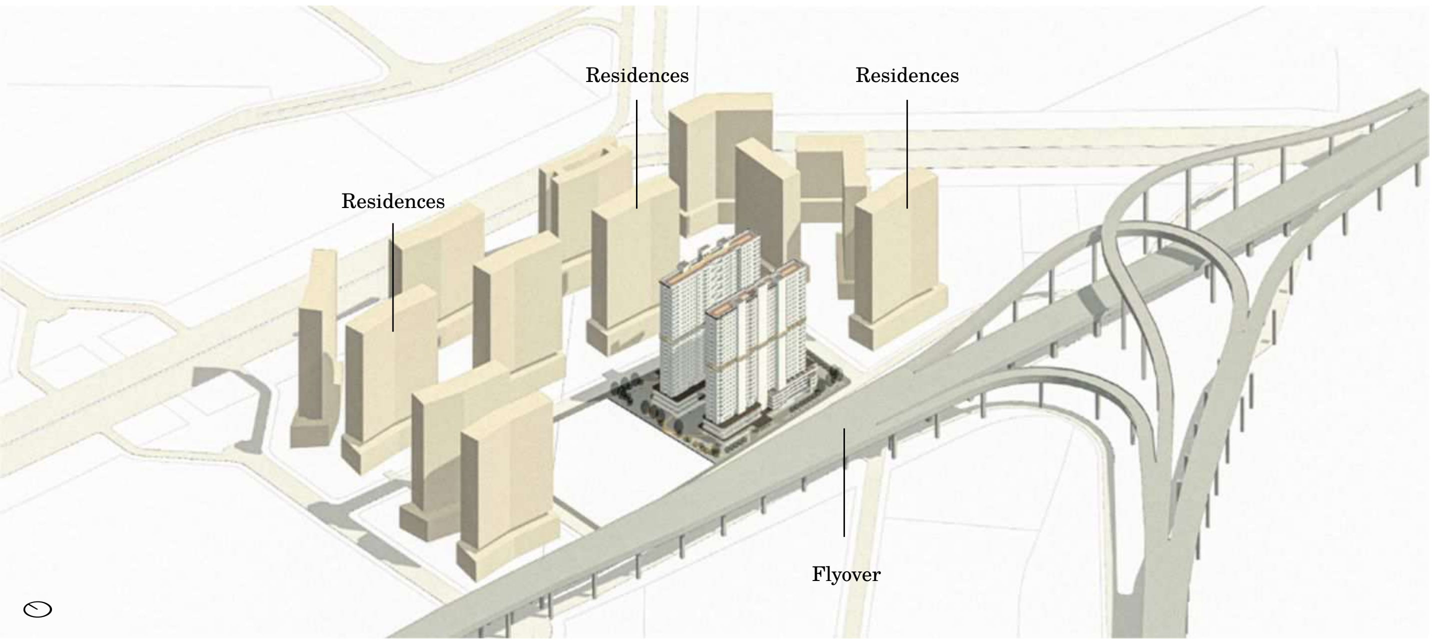
| | Why | What's next |
|---|---|---|
| 1 | Understanding low-income residents | Designs for low-income comfort |
| 2 | Scarcity of green and communal spaces | Green areas for health |
| 3 | Impact of the pandemic | Harmonious green-centric living |

## Concept

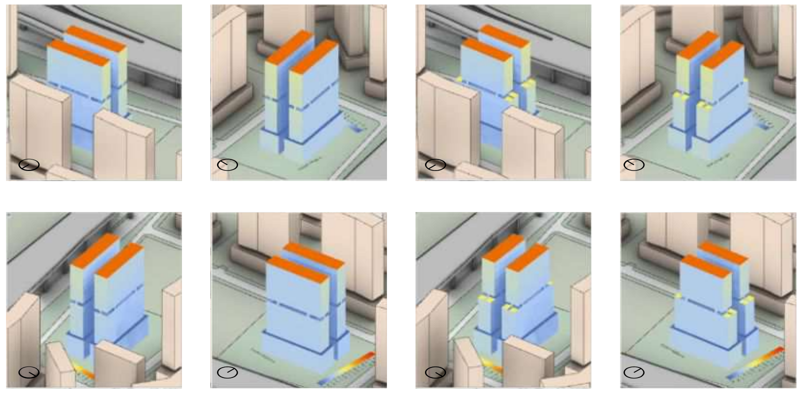


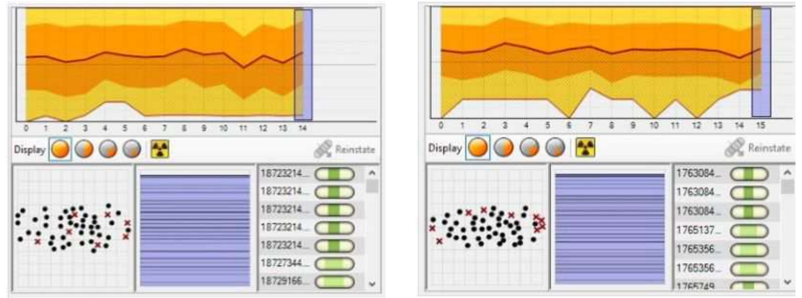
*A green corridor connects Kemayoran A4B and A4A, fostering unity and sustainability.*




## Optimization





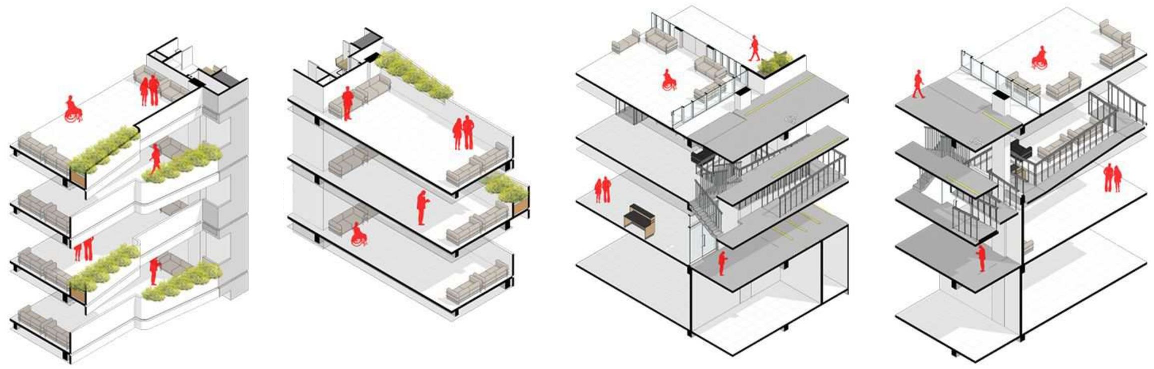

*Iteration A* *Iteration B*

In response to challenges posed by the COVID-19 pandemic, the architecture prioritizes adaptability. By using tools like the Galapagos Solver, the project strategically adjusts external appearances and spatial arrangements to facilitate natural cooling and protect against radiation, promoting sustainability.

Upon evaluating both designs, Iteration A emerges as the preferred solution. Achieving a 14° rotation from North in 38 minutes and 21 seconds, it records an annual solar radiation of 18.723 million kWh/m$^2$ (a 5.83% increase from Iteration B). Despite a double-loaded design and relying on the Vertical Pocket system for tower comfort, Iteration A excels in floor efficiency for the targeted 3,000 population, obtaining the lowest ASR ranking.

On the other hand, Iteration B, completed in 38 minutes and 20 seconds, adopts a 14° angle from North, resulting in an ASR of 17.630 million kWh/m$^2$. While maintaining the lowest ASR rank and providing more open spaces, it compromises on floor efficiency above the refuge floor and relies on the Vertical Pocket system for the comfort of the 3000-person target.

## Features

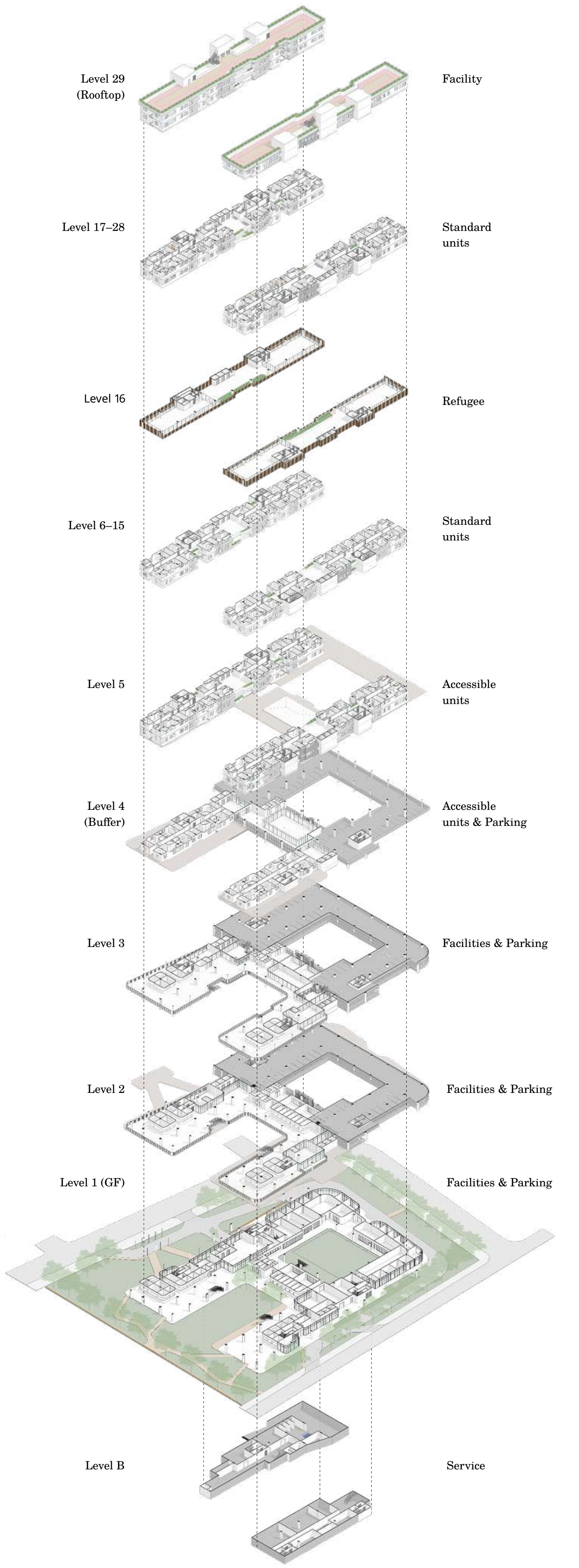


*Communal Area (Vertical Pocket)* *Lobby Area*

## Design

*The perspective at eye level from the road towards Kemayoran A4B.*

## Features

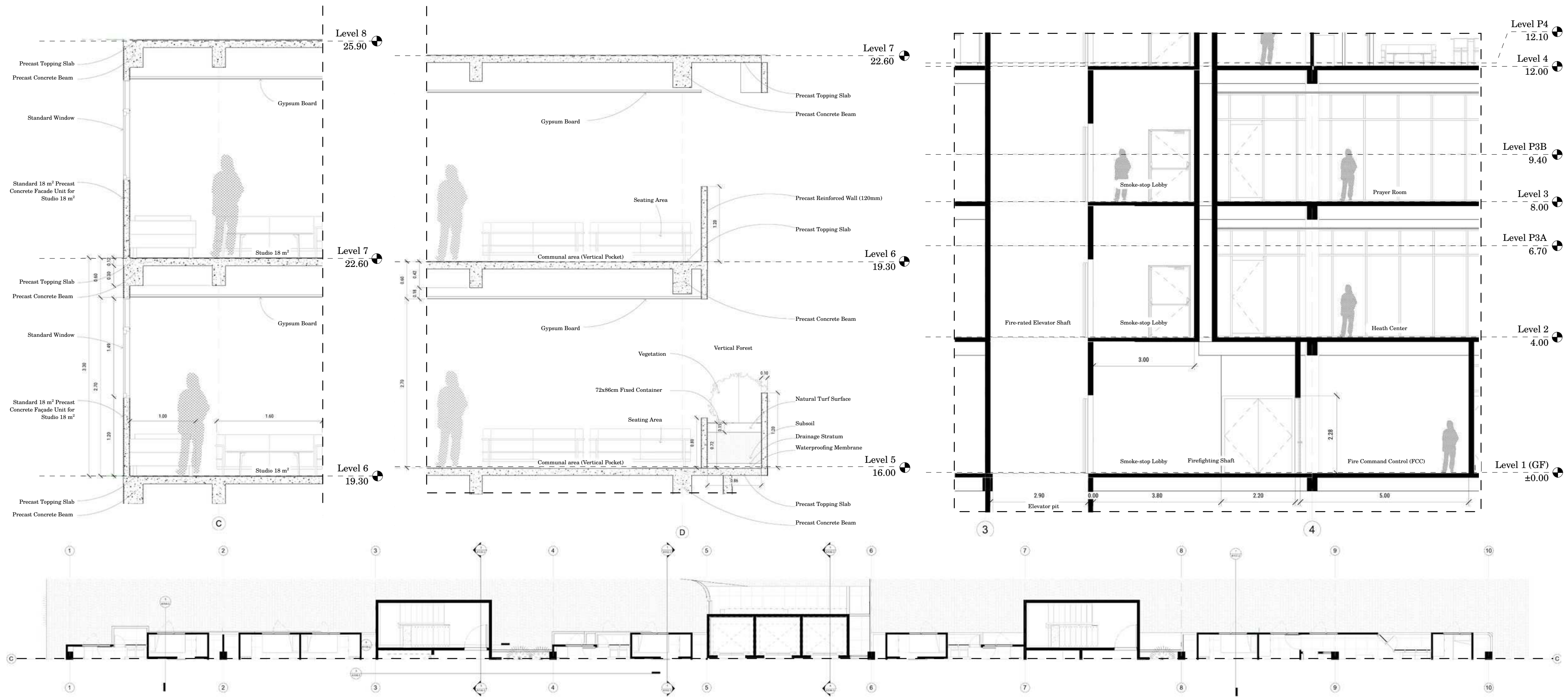



*Axonometric view illustrating the distribution of facilities across different floors in the building.*

## Unit config


In this design, various plans have been employed to accommodate different living spaces for different needs. The Standard Studio (18 $m^2$) designed for one person can be expanded into a larger Two-Bedroom (36 $m^2$) and further to a spacious Corner Three-Bedroom (54 $m^2$). Shared areas promote a sense of community among neighbors, while well-planned paths facilitate easy movement. Moreover, the design focuses on inclusivity and utility, offering both small and large apartments with attractive views. Accessible options, such as the Accessible Studio (36 $m^2$) and Corner Accessible Studio (36 $m^2$), are integrated to cater to a diverse range of residents.

## Drawing



# Riyadh Dream Villas

*Designing with a Biomimetic Approach*

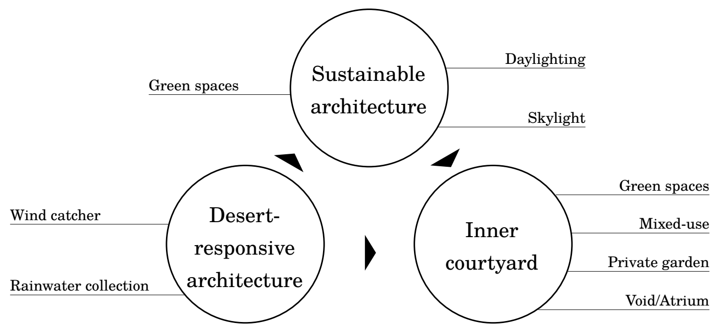
*Master's Design Studio 2 – 2022 | Form-finding; Biomimetics Design | Riyadh, Saudi Arabia*

| | |
|---|---|
| **Type** | International Competition by YAC (Young Architects Competitions) |
| **Contributions** | Conceptual, Analysis, SubD modeling & Visualization |
| **Software** | Rhino, Grasshopper, Lumion & Adobe Photoshop |
| **Collaborators** | Fikri Azmi |
| **Advisor** | M. Prasetiyo Effendi Yasin & Roro Diah Asih Purwaningrum |
| **URL** | https://arnottferels.github.io/work/riyadh-dream-villas |

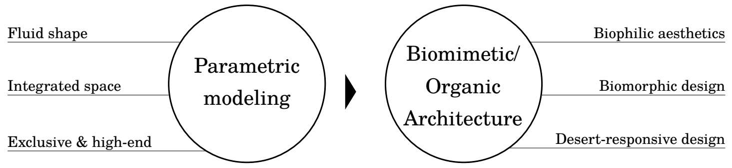
This project focuses on the design of 'dream villas' in desert environments, catering specifically to extravagant users. Employing an environmentally conscious approach, the design incorporates biomimicry to address site-specific challenges unique to the arid landscape. The villas feature dramatic and contextually relevant shapes that contribute to their aesthetic appeal and seamless integration into the neighborhood. By adopting an asymmetrical fluid form methodology, inspired by biomimicry, and incorporating inner courtyards in each villa, the design effectively tackles sustainability challenges associated with the desert climate. In conclusion, the project achieves a harmonious balance, prioritizing the comfort of residents both indoors and outdoors in a novel and refreshing manner.

## Concept

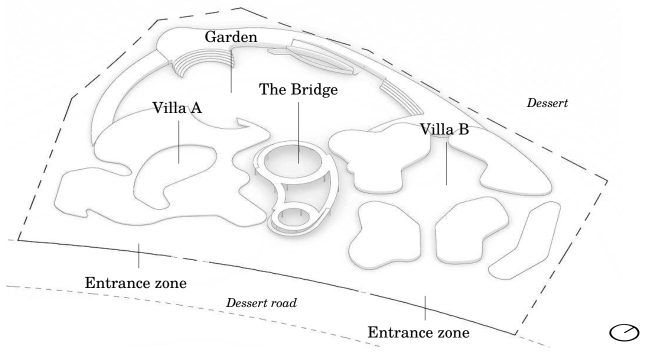
## Concept



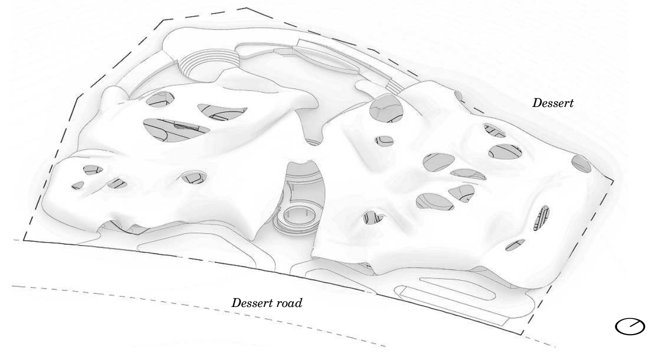

## Design Approach



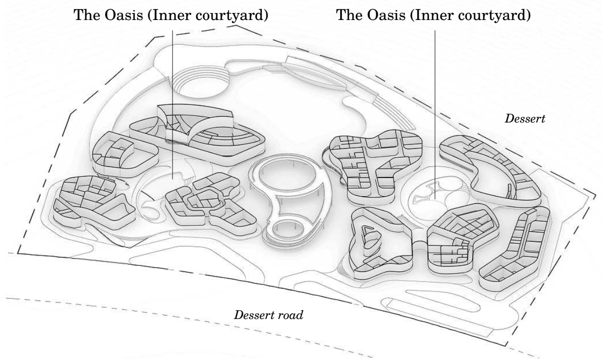

## Mass Transformation



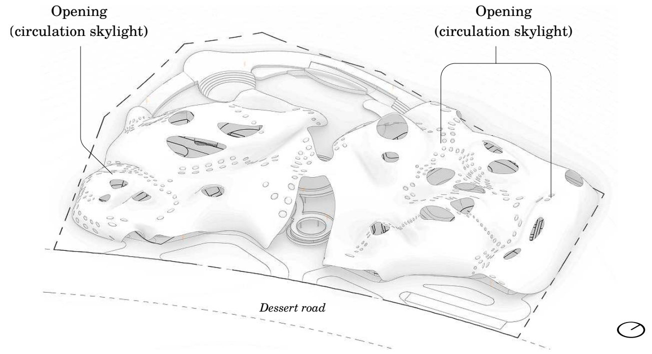

*1 – Initiating the process with initial zoning considerations for the villas.*



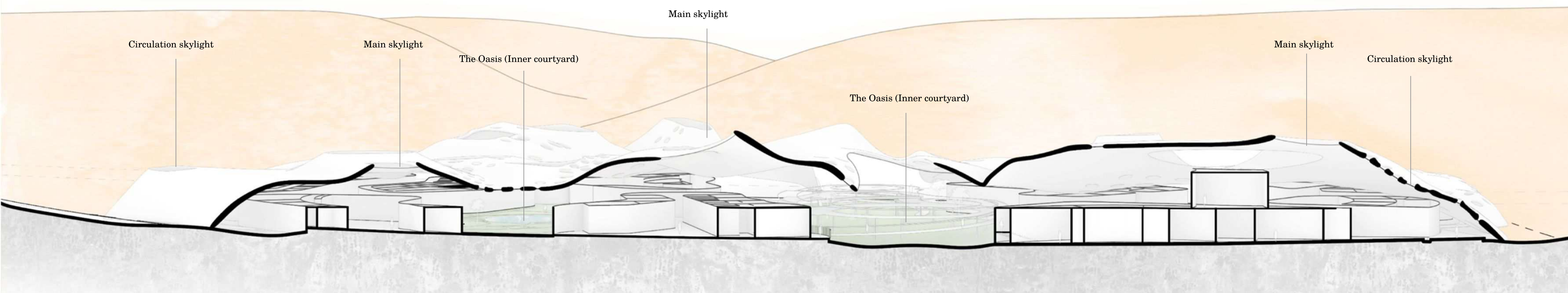

*3 – Designing roof shapes based on the contextual characteristics of the surroundings.*



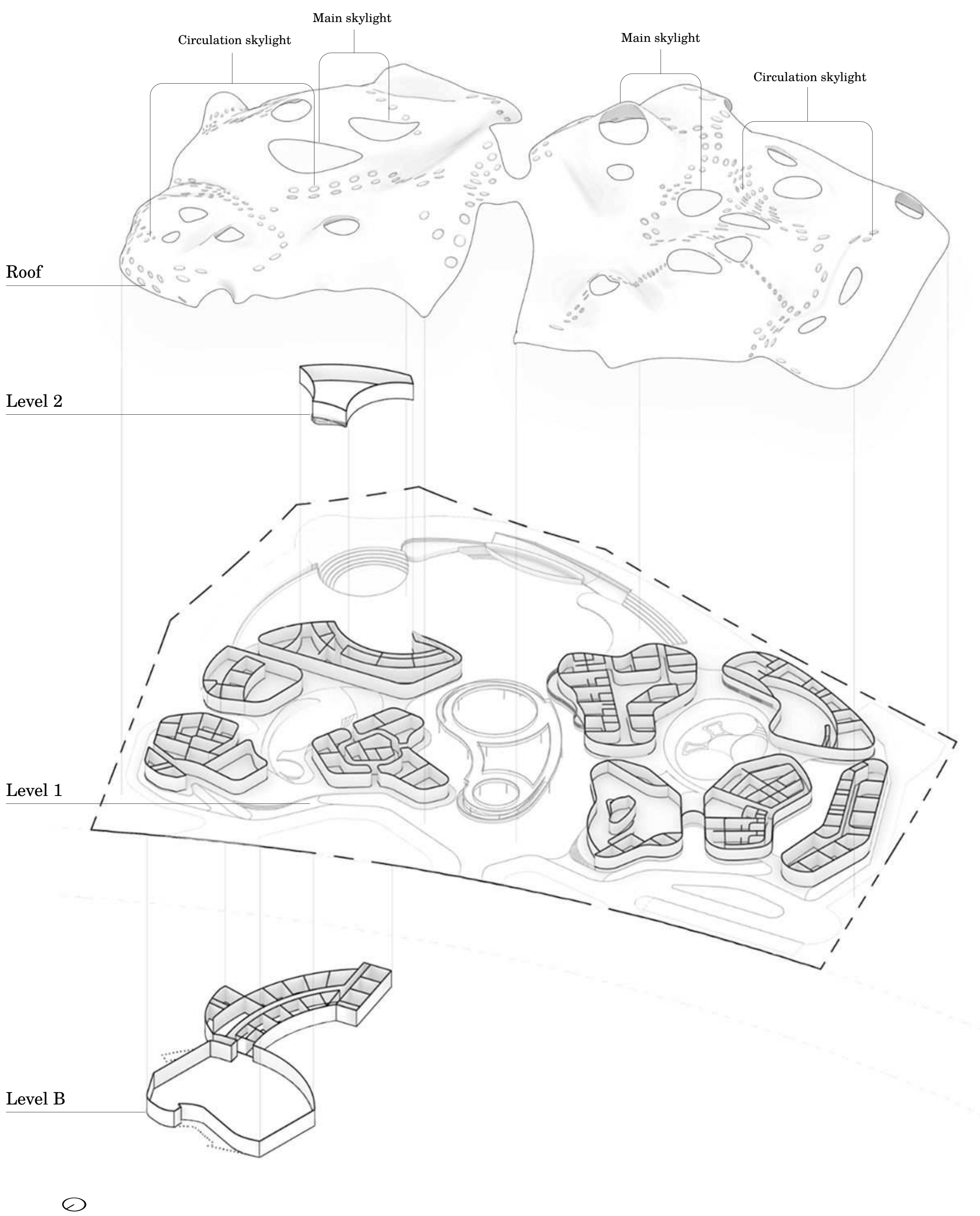

*2 – Programming each villa with an inner courtyard as a central / main feature.*




*4 – Introducing openings strategically, considering the superimposed projection of circulation underneath or below.*



## Features

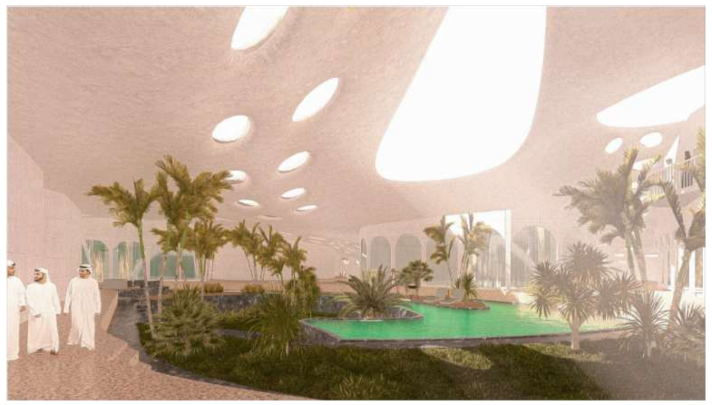



Exploded axonometric


Site Plan

The Bridge at the heart of the Villas

The main entrance



The oasis inside the Villa A

Garden area (backyard)

# NURTURE

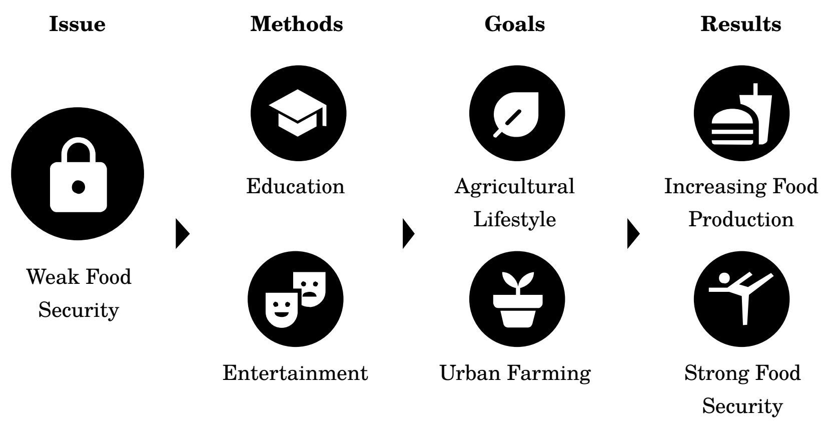
*Nutrient for future Singapore*

*Master's Design Studio 2 – 2022 | Urban Housing Research; Apartment Design; Sustainable Design | Singapore*

| | |
|---|---|
| **Type** | International Student Competition by Designing Resilience in Asia (DRIA) & TU Darmstadt |
| **Contributions** | Conceptual, Formal analysis, Software (3D modeling and simulation), Housing design & Visualization |
| **Software** | Rhino & Grasshopper |
| **Collaborators** | Fikri Nur Khalid, Ekky Maulidin, Citra Destianti, Farelio Artha & Hasrul Nurliansyah |
| **Advisor** | M. Prasetiyo Effendi Yasin & Roro Diah Asih Purwaningrum |
| **URL** | https://arnottferels.github.io/work/nurture |

This project aims to revitalize Singapore's urban environment, tackling critical issues like food security and environmental sustainability, which are primary concerns in the country. By integrating education-focused communities with advanced technology, the pond-centric design, especially in housing placement, promotes sensory learning within the Transit-Oriented Development (TOD) framework. The proposed design advocates for a self-sufficient strategy through both public and private housing, contributing significantly to Singapore's 2030 goal of attaining 30% food self-sufficiency. This initiative marks a comprehensive shift towards sustainable living for future residents of Singapore.

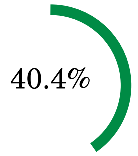
## Issues & Strategies




NURTURE aims to create education-focused communities in new residential areas in Singapore. These communities will encourage a harmonious coexistence with nature. The concept includes Waste Water Treatment Plants (WWTP) and educational technology to match the learning preferences and environmental appreciation of Singaporeans. NURTURE is a comprehensive approach that deals with both education and the environment, aiming to instill a sense of environmental independence. Starting at the Keppel Club site, this initiative aims to inspire nationwide change towards sustainable living.

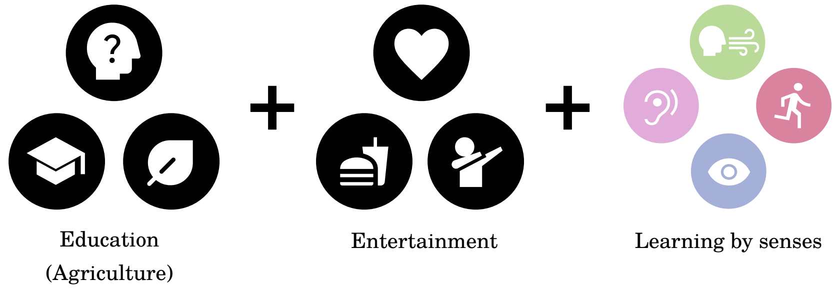
## Background


By 2030, Singapore aims to produce 30% of its own food, reducing its reliance on the current 90% imported.



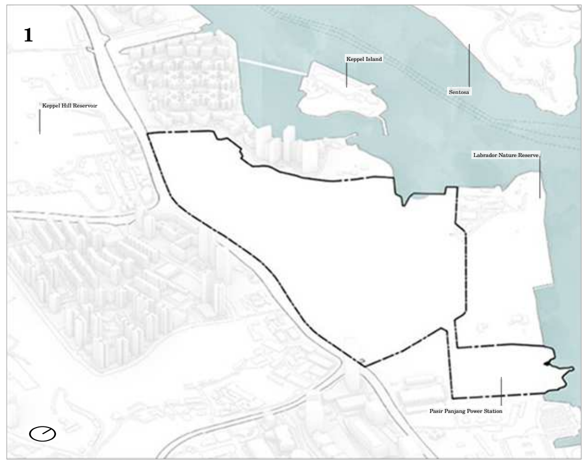

In Singapore, using 151 liters of water per day compared to the United States' 375 liters, there are plans to increase water recycling from 40% to 50% by 2030 for sustainability. By 2030, Singapore aims to produce 30% of its own food, reducing its reliance on the current 90% imported.

## Design Approach

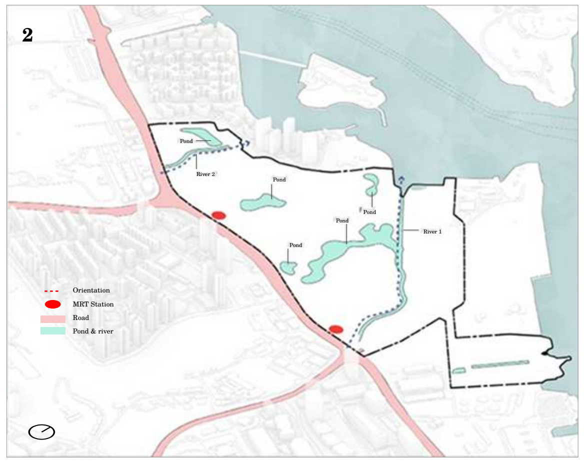



To promote farming and assist people in becoming accustomed to it, the site incorporates specific areas that blend education and entertainment, referred to as 'Eduagritainment.' This term merges Education, Agriculture, and Entertainment, emphasizing the integration of these elements on the site.

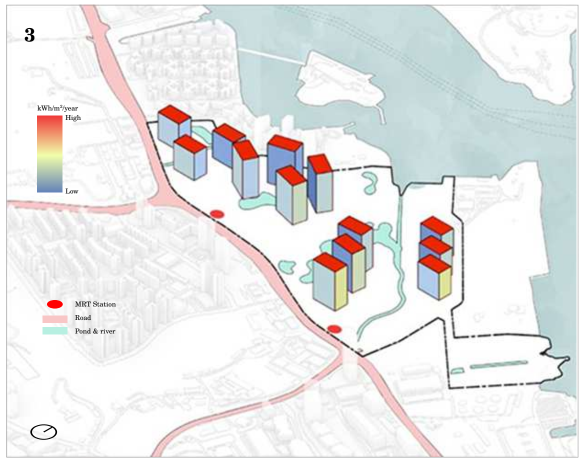
## Design Process



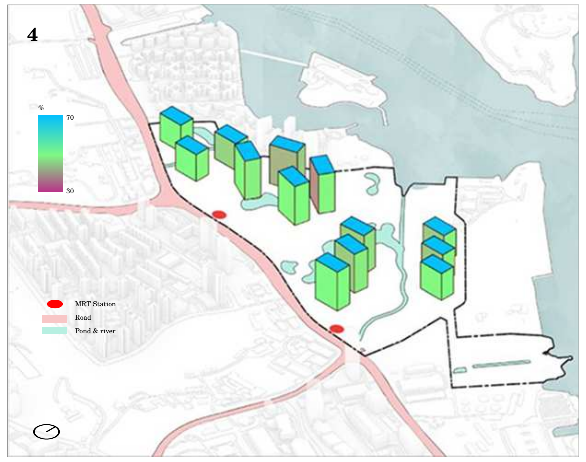

Context
*Describing the surrounding environment and setting.*



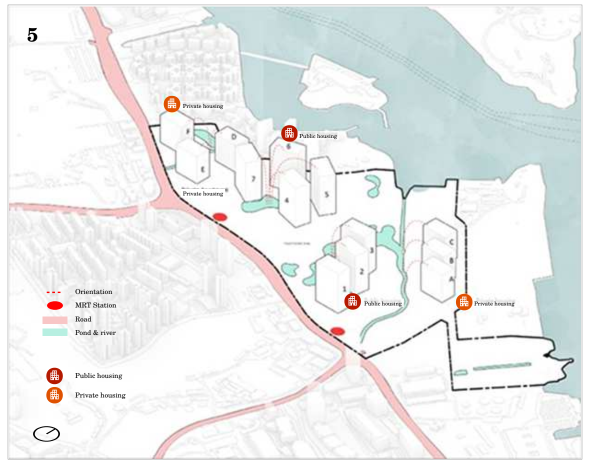

River Path & Ponds
*Examining the existing river and pond features.*




Radiation Analysis
*Studying the impact of radiation in the area.*




Spherical View Analysis
*Evaluating the panoramic view in a spherical perspective.*

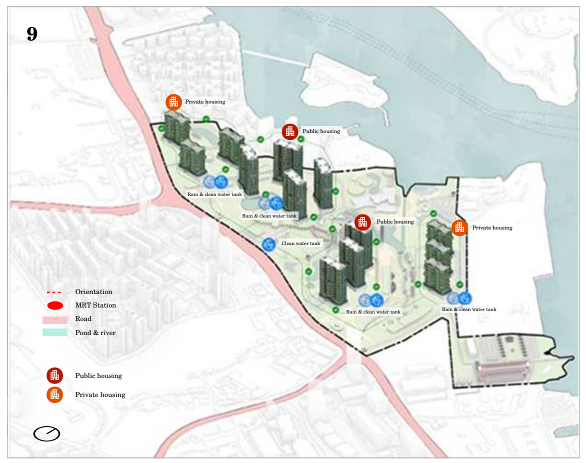



Housing Placement
*Selecting locations for residential buildings.*


Features
*Identifying roads, ponds, rivers, paths, and green areas.*


Concept: Learning by Senses (LBS)
*Educational approach focused on sensory learning.*

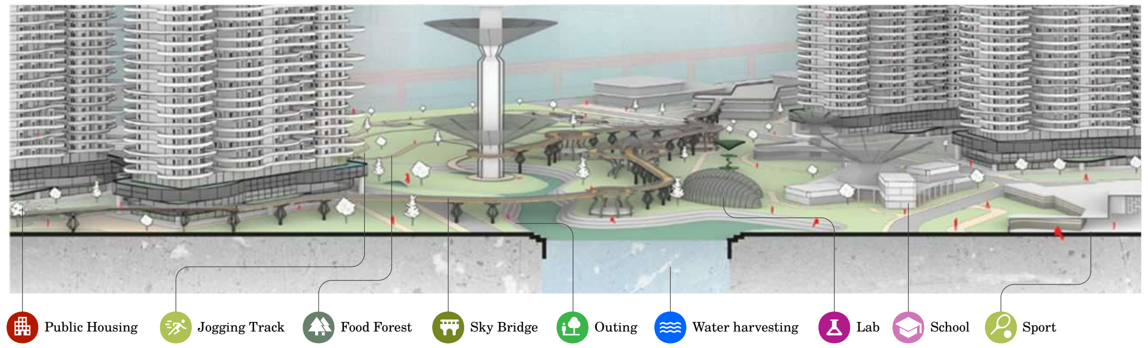

Design Adjustment & TOD
*Revisiting the design using Transit-Oriented Development.*

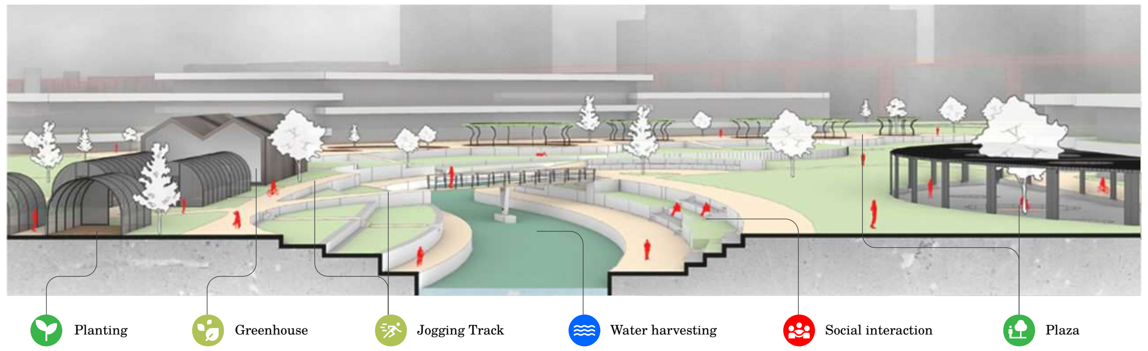



Water Treatment
*Water purification for housing units.*

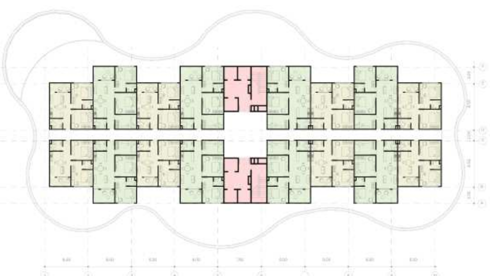

Final Design

## Activities

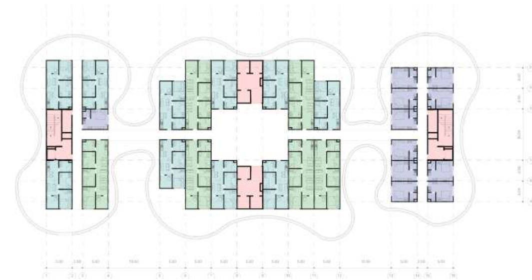


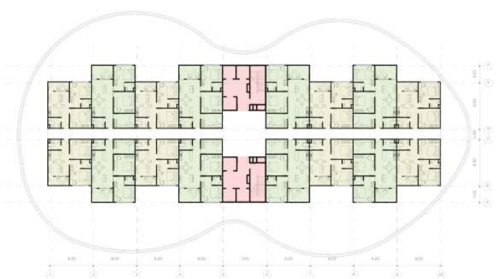

## Housing Layout Plan



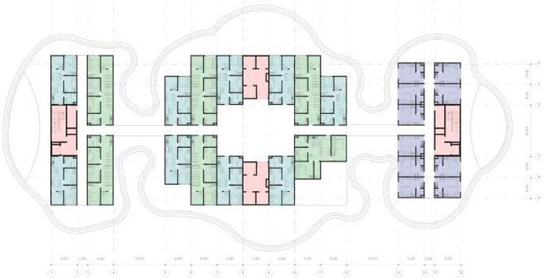
*Public Housing (Typical Floor 1)*



*Private Housing (Typical Floor 1)*



*Public Housing (Typical Floor 2)*



*Private Housing (Typical Floor 2)*

Vertical Circulation Type 68 m$^2$ (Public) Type 93 m$^2$ (Public) Type 20 m$^2$ (Private) Type 47 m$^2$ (Private) Type 68 m$^2$ (Private)

## Calculation

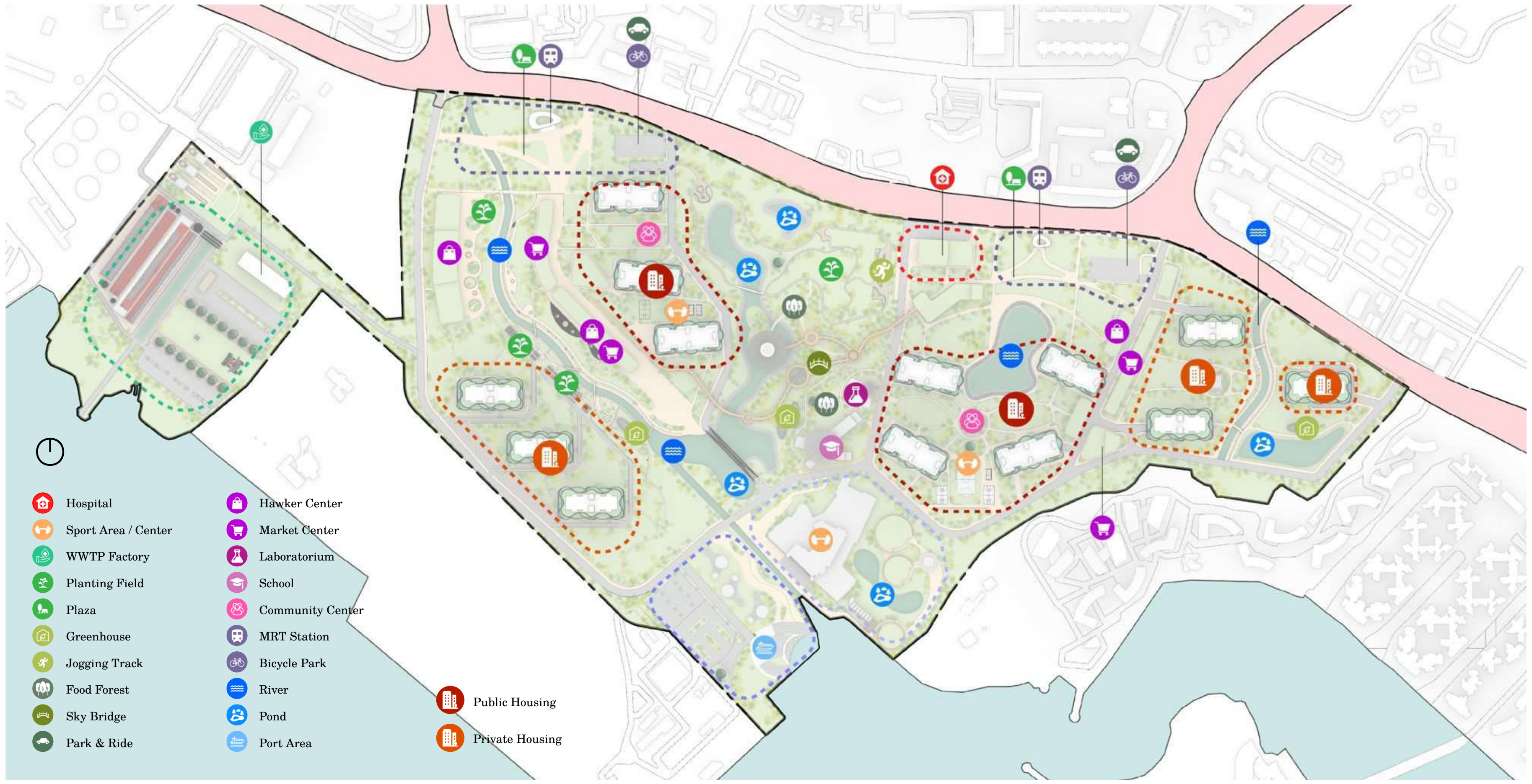
### Total Building Unit

| Housing Type | Total Building | Unit Type | Total Units |
|---|---|---|---|
| Public | 7 | 1 BR | 2684 |
| | | 2 BR | 2590 |
| | | 3 BR | 1554 |
| Private | 6 | Apartment | 1344 |
| | | Condominium | 1344 |
| **Total** | | | **9526** |

### Total Area Unit per Floor

| Housing Type | Total Floors | Unit /floor | Unit Type | Total Area (m$^2$) |
|---|---|---|---|---|
| Public | 37 | 26 | 1 BR | 250 |
| | | | 2 BR | 594 |
| | | | 3 BR | 490 |
| Private | 28 | 16 | Apartment | 893 |
| | | | Condominium | 653 |

## Programs




## Perspective

"The River" blends various activities along the waterfront, market center, and hawker center, forming a lively and diverse environment.

Aerial view – Showcase MRT station and housing placement, integration with surroundings, emphasizing their relation to ponds. The conceptual phase prioritizes a pond-centric approach, considering the conducted environmental analysis.

## Water Treatment Plan

# Beyond Static

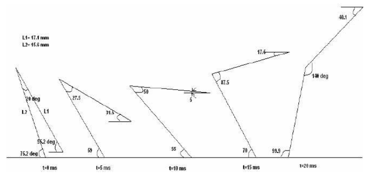
*Exploring Machine Learning for Adaptive Geometries in Expandable Structures*

*DigitalFUTURES International Workshop – 2023 | Computation; Assembly; Modules; Geometry; Machine Learning*

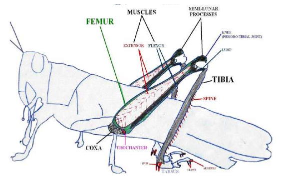
**Type** Individual work
**Software** @Rhino, Grasshopper, Kangaroo 2, Kohonen Map & Voxeltools
**Instructors** Hesham Shawqy & Esther Rubio Madronal
**URL** `https://arnottferels.github.io/work/beyond-static`

This study draws inspiration from grasshopper biomechanics and contemporary innovations, such as the Yaheetech Sideline Bench, to explore modularity and adaptability in design. Starting with foundational principles, it seamlessly integrates advanced techniques for a harmonious fusion guided by expansion and assembly strategies. The methodology refinement incorporates Machine Learning, specifically Self-Organizing Maps (SOM) by Teuvo Kohonen, diverging from conventional neural networks for a fresh perspective on design optimization.

## Inspiration



*Position of a grasshopper leg before take-off (Eroğlu, 2008).*

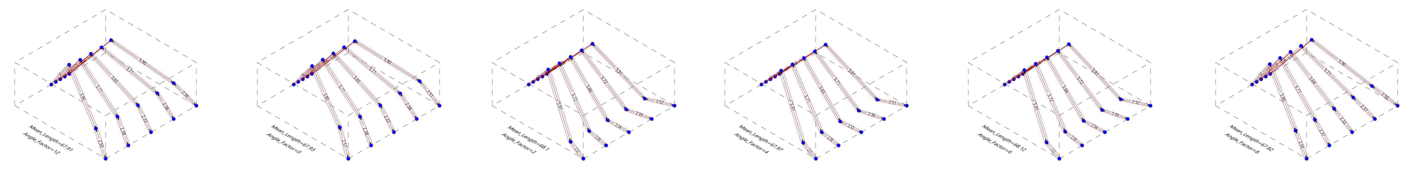



*Anatomy of a grasshopper and leg mechanism (Eroğlu, 2008).*

*Yaheetech 6 Seats Foldable Sideline Bench (Yaheetech, 2023).*

## Module & Geometry Rules

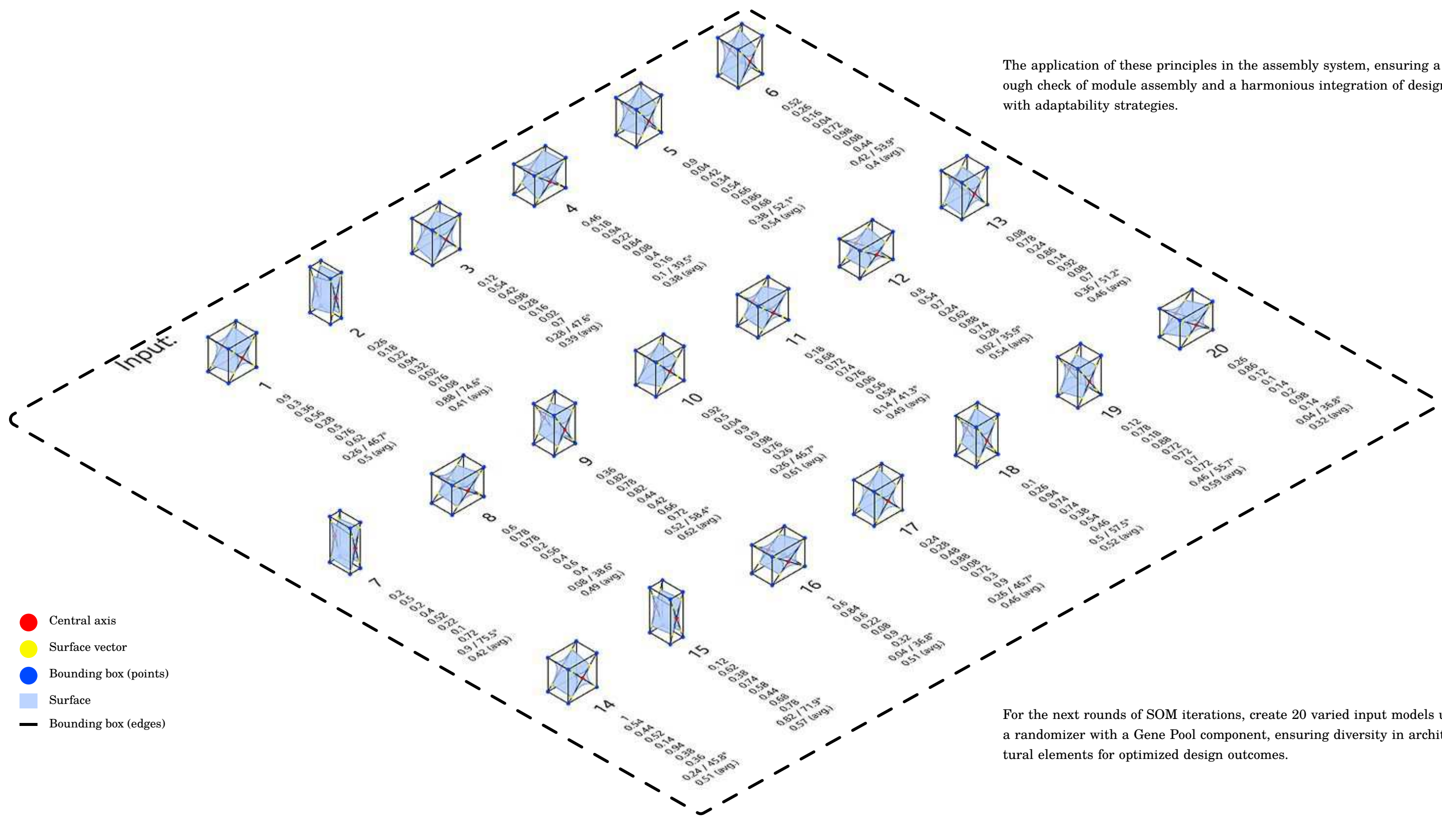
### Basic Rules



| A | B | C | D | E | F |
|---|---|---|---|---|---|
| Angle factor = 12<br>Mean Length = 67.91 | Angle factor = 0<br>Mean Length = 67.93 | Angle factor = 2<br>Mean Length = 68.1 | Angle factor = 4<br>Mean Length = 67.97 | Angle factor = 12<br>Mean Length = 68.12 | Angle factor = 8<br>Mean Length = 67.82 |

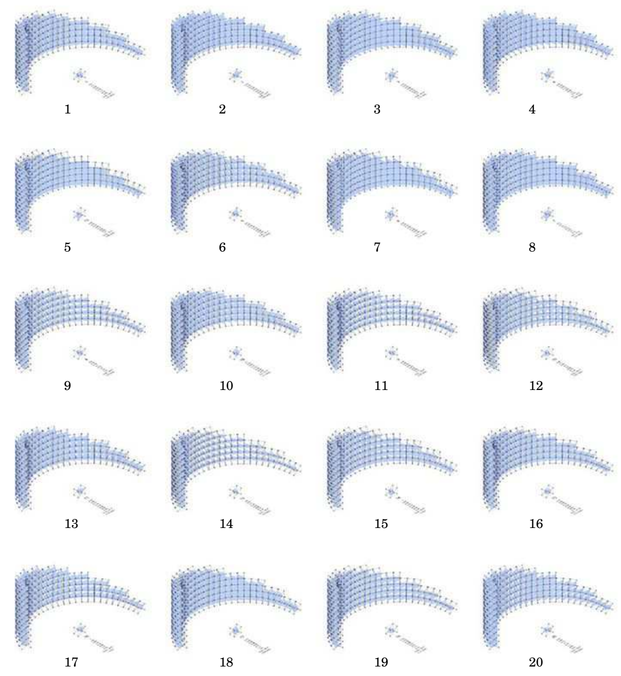
### Revised Rules (Adapted from the Basic)

The application of these principles in the assembly system, ensuring a thorough check of module assembly and a harmonious integration of designs with adaptability strategies.



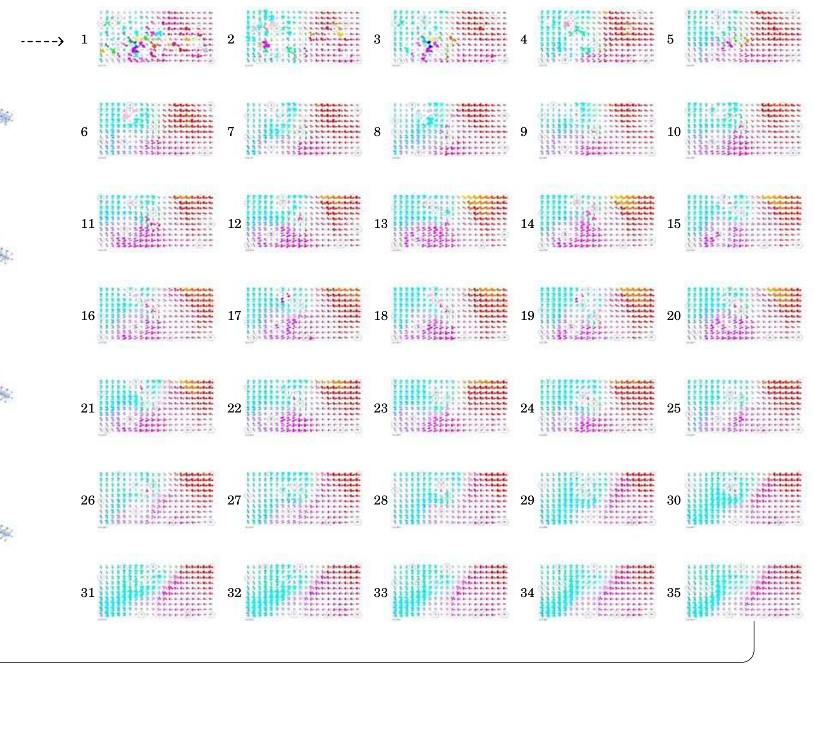

For the next rounds of SOM iterations, create 20 varied input models using a randomizer with a Gene Pool component, ensuring diversity in architectural elements for optimized design outcomes.

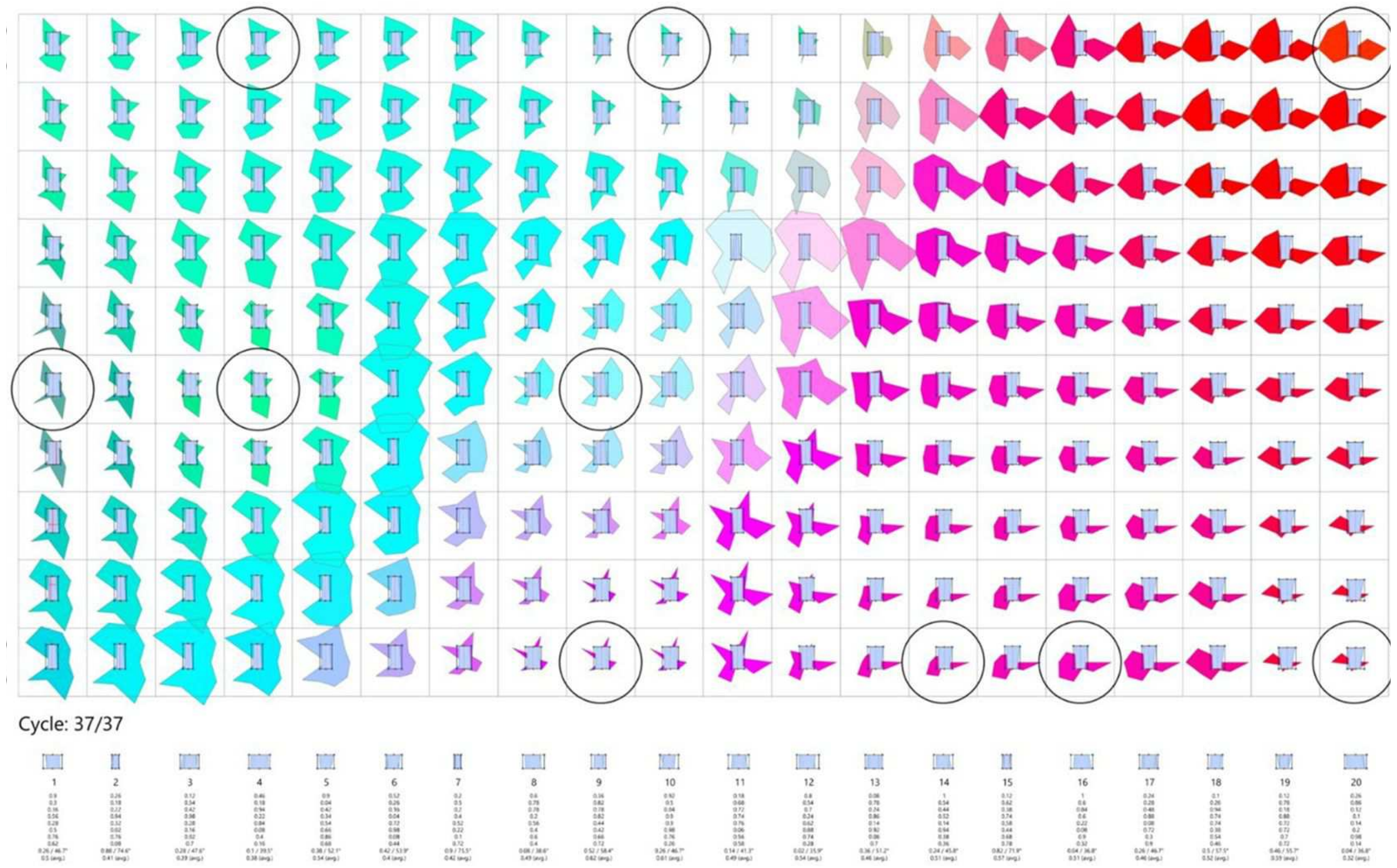
## Aggregation – Assembly System



## Machine Learning – SOM

In the ML process with SOM, cycles are performed, reducing dimensions until colors are well-defined, as seen in the iteration steps in the image, with the cycle reaching a maximum at 37. By the 36th cycle, the results have already repeated.






After 37 cycles, 10-dimensional 'glyphs' condense into a two-dimensional map, resembling the image from Cycle 37. Each circle represents the central value of each dimension, and 10 models are selected based on the RGB map as representatives.

# Mathematical Structures

*Exploring Natural Growth Patterns in Bio-Data Flow*

*DigitalFUTURES International Workshop – 2022 | Computation, Mathematical Form, Geometry*

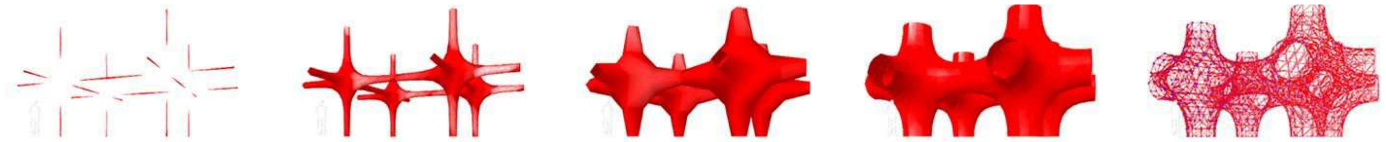
**Type** Individual work
**Contributions** Rhino, Grasshopper, Milipede, Parakeet, Karamba3D, Galapagos & Anaconda
**Instructors** Mahdi Fard, Crispina Ken & Patrish Kumar
**URL** `https://arnottferels.github.io/work/mathematical-structures`

This study integrates bio-data with mathematical structural dynamics to investigate how nature's imprints manifest on mathematical surfaces. Emphasizing adaptability and modularity, tools like Rhino, Grasshopper, and Milipede are employed to transform natural growth patterns into 3D architectures. As the study unfolds, it incorporates optimization mechanisms, notably the Galapagos plugin and K-means Clustering in machine learning. This fusion of traditional and contemporary techniques provides a comprehensive, data-informed perspective in the field of computational design.

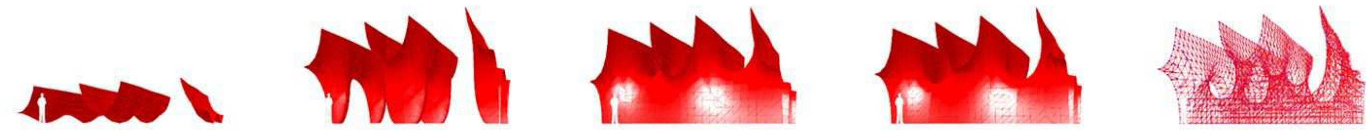
## Exploring Architectural Mathematical Surface/Minimal Surfaces

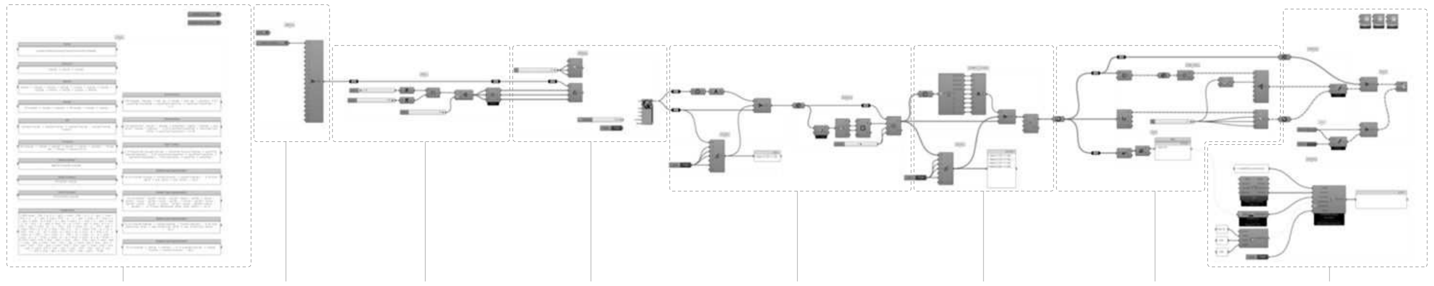
This section combines bio-data and mathematical dynamics to understand how nature influences mathematical surfaces.

A



B



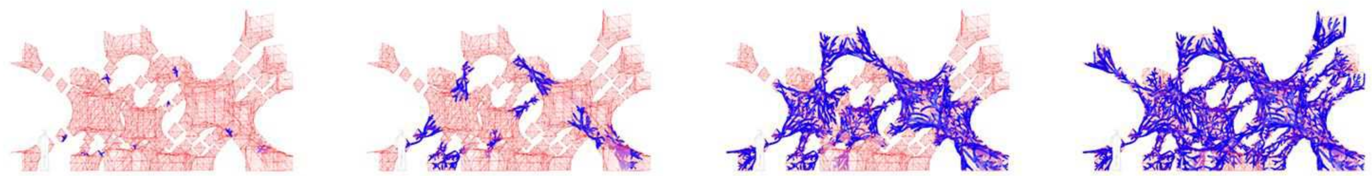


1 Mathematical Formulation | 2 Formula Selection | 3 Mathematics | 4 Millipede | 5 Verification & Duplication | 6 Validation & Translation | 7 Geometry Fattening | 8 Visualization

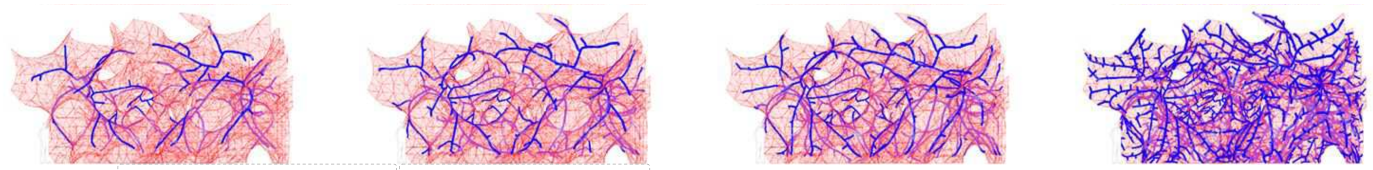
## Generating Structures: Venation/Growth Patterns

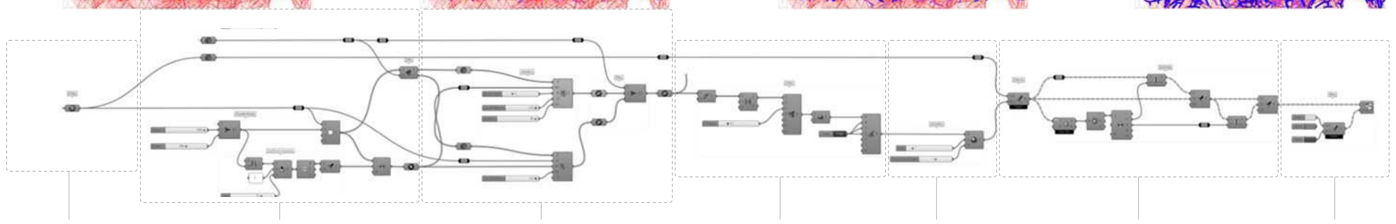
This section utilizes tools like Rhino and Grasshopper with Parakeet to translate nature's growth patterns into architectural forms, focusing on the intricacies of venation and organic development.

C



D

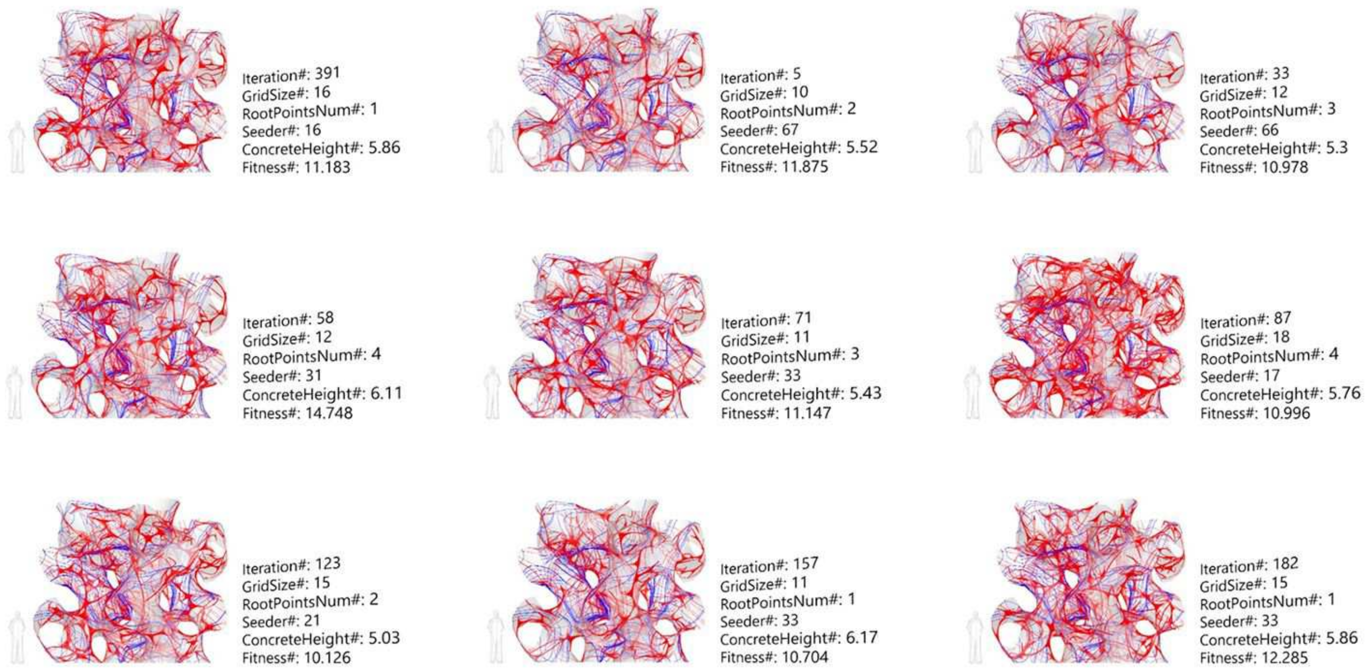




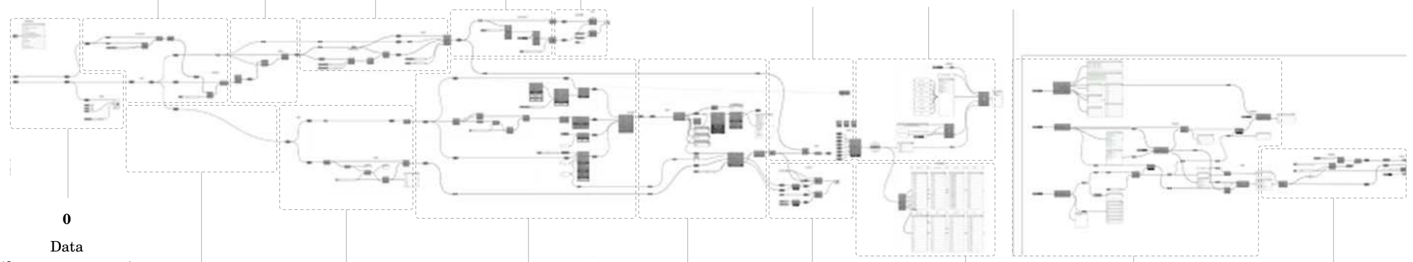
1 Data (from previous step) | 2 Populating Points | 3 Venation | 4 Geometry Fattening | 5 Smoothing | 6 Duplication | 7 Visualization

## Designing & Optimizing – Iterative Structural Analysis

This section delves into the process of refining designs post-structural analysis. Utilizing tools like Karamba and Galapagos, iterative adjustments of key parameters such as grid size, root points, and concrete height contribute to a purposeful trajectory towards architectural excellence. Each iteration, guided by predefined objectives and a fitness metric, ensures resulting structures meet both aesthetic standards and functional requirements.



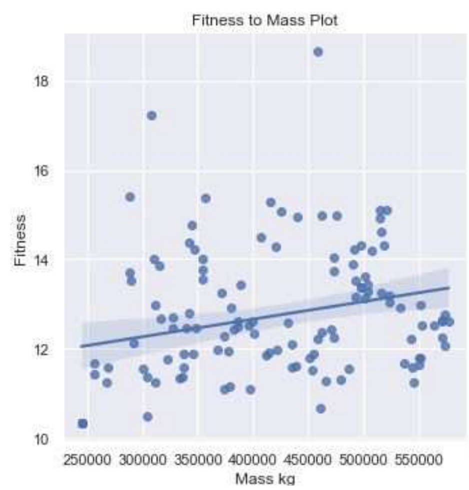

A1 Mesh Manipulation | A2 Mesh Evaluation | A3 Venation | A4 Geometry Fattening & Smoothing | A5 Data Visualization | B6 Optimization (Galapagos) | B7 Data Recording



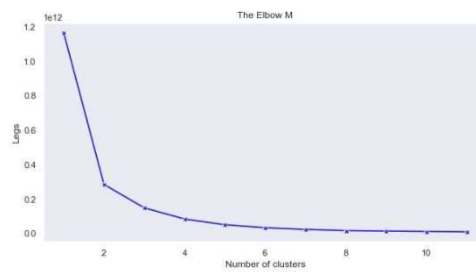
0 Data (from previous step) | B1 Mesh Data | B2 Geometry Preparation for Karamba3D | B3 Assembling Model | B4 Analysis | B5 Visualization | B8 Data Recording & Data Preview | B9 Visualization Preparation | B10 Visualization

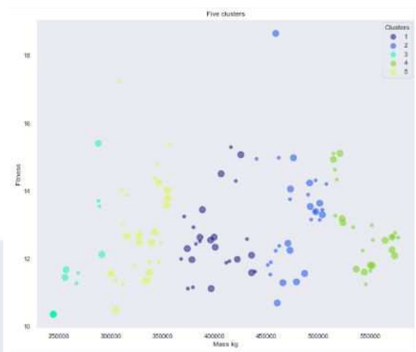
## Clustering Results – K-means Approach

This section employs the K-means Clustering technique within the Anaconda Jupyter environment, a machine learning approach. This methodology enhances the precision of the analysis of design elements, classifying and improving design outputs.




```
...

sns.set(color_codes = True)
# Plot Sections
sns.lmplot(x = 'Mass kg', y = 'Fitness', data = df, height = 5, aspect = 1)
plt.title('Fitness to Mass Plot')

sns.set_style("dark")
pit.show()

# df_new = df[['Fitness', 'Mass (kg) ']]

...
```




| | Disp (cm) | Elastic Es (kNm) | Mass kg | GridSize | RoofPointsNum | Sender | ConcreteHeight | Fitness | cluster |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 5.763 | 0.422 | 244570.662 | 10 | 1 | 57 | 5.02 | 10.354 | 2 |
| 1 | 1.896 | 0.991 | 551745.826 | 12 | 4 | 96 | 11.32 | 12.882 | 3 |
| 2 | 1.822 | 0.885 | 571242.144 | 13 | 3 | 81 | 11.72 | 12.254 | 3 |
| 3 | 3.959 | 0.301 | 291489.960 | 17 | 4 | 49 | 5.96 | 12.122 | 2 |
| 4 | 1.852 | 0.158 | 428633.080 | 12 | 6 | 71 | 8.63 | 14.296 | 0 |

# Acoustic Ray Simulation

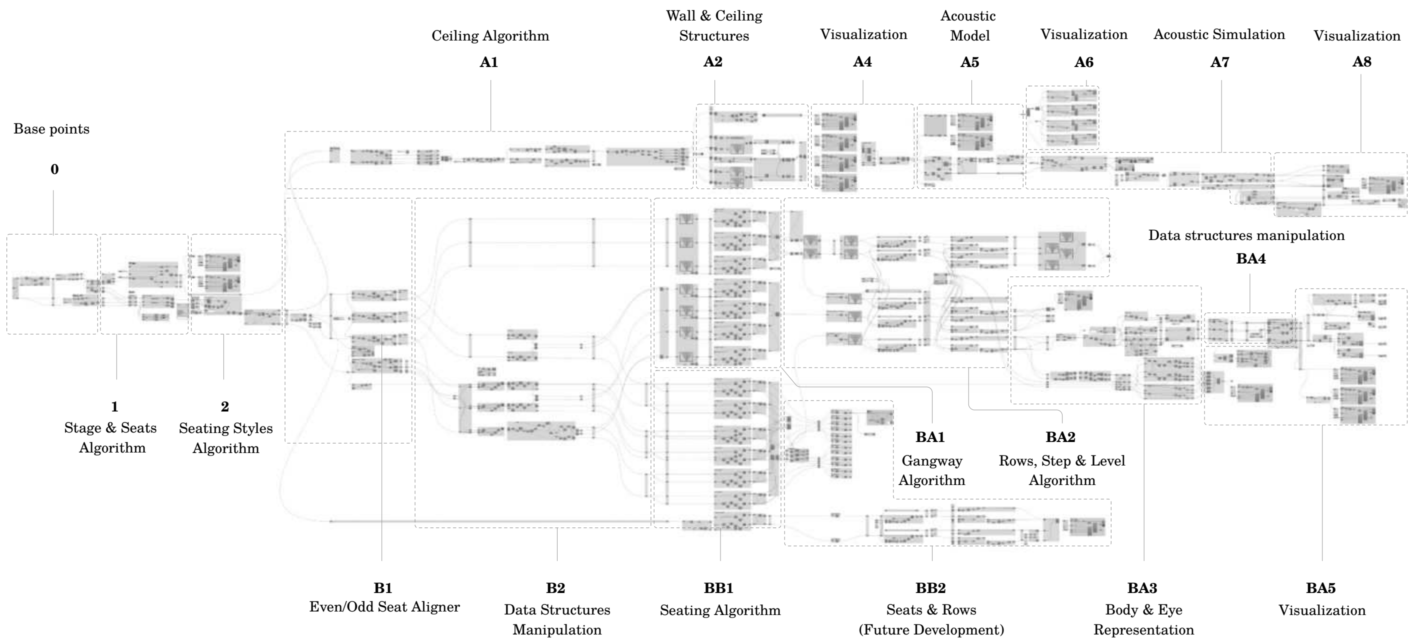
*Designing and Evaluating the KAI-MICE Auditorium Design*

*Professional Work – 2023 | Computation; Auditorium Design; Acoustic Design | Bandung, Indonesia*

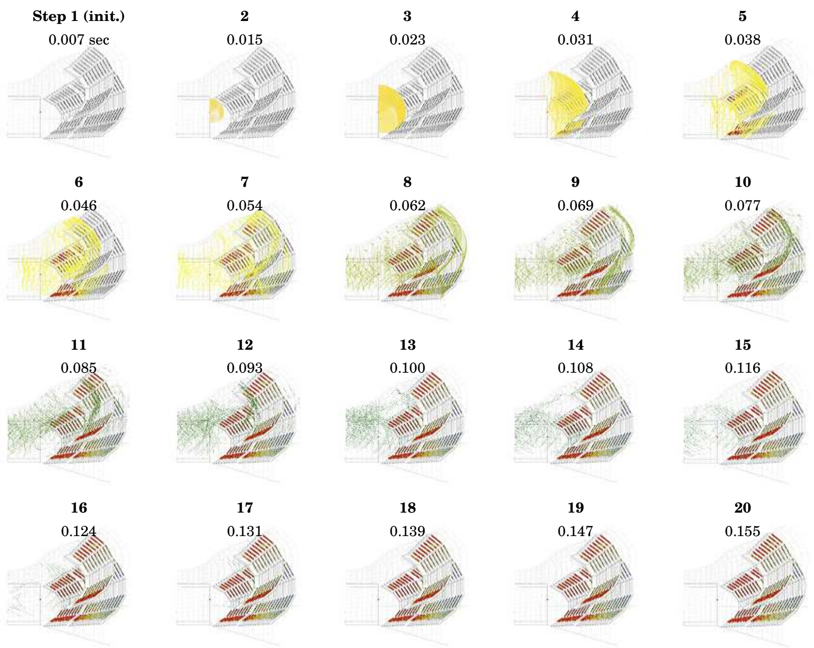
**Type** National Professional Competition by IAI West Java (Indonesian Institute of Architect West Java)
**Contributions** Research, Conceptual Design, Acoustic Modeling, Analysis and Simulation, Scripting & Visualization
**Software** Rhino, Grasshopper, Pachyderm Acoustic & Twinmotion
**Collaborators** Robby D. Juliardi, Ekky Maulidin, Ghina Z & Zulafa Azmi
**URL** https://arnottferels.github.io/work/acoustic-ray-simulation

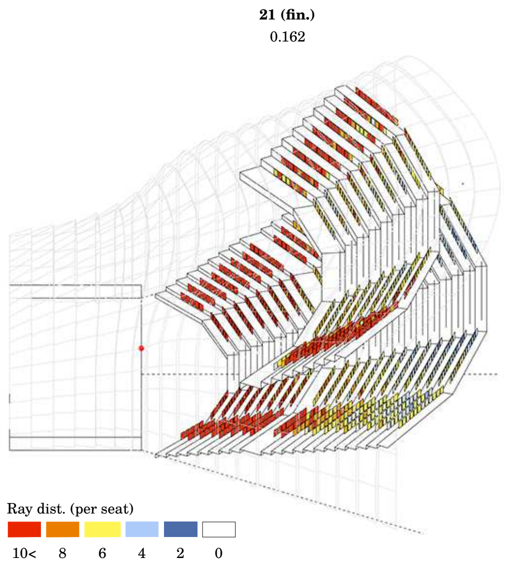
This study details the creation of a specialized auditorium model, inspired by Architect's Data by Neufert. Employing Grasshopper for algorithmic modeling, parameters were refined, emphasizing ray distribution simulation for acoustic analysis via Ray Pachyderm Acoustical Simulation. Data visualization, featuring a heat map, illustrates ray counts at each step for seats. In conclusion, this method offers insights into sound ray behavior in acoustics.

## Method

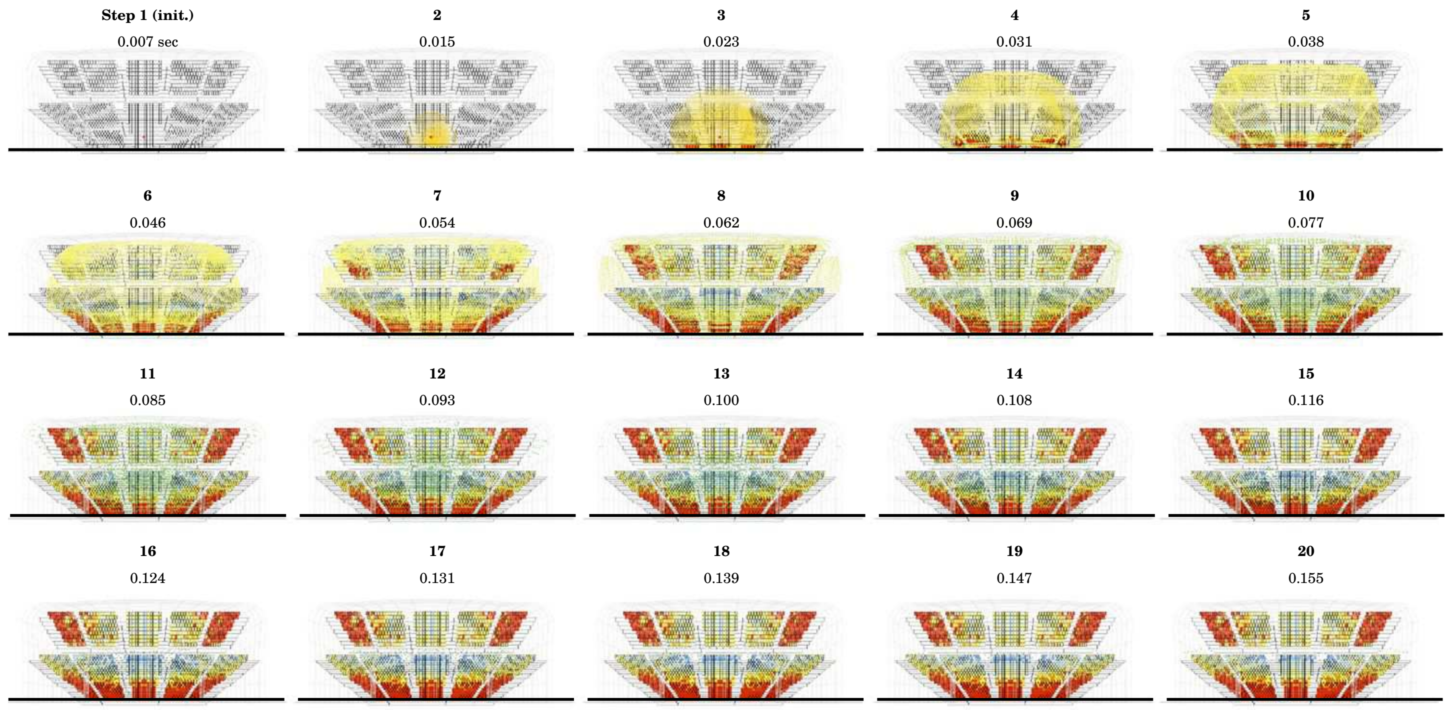


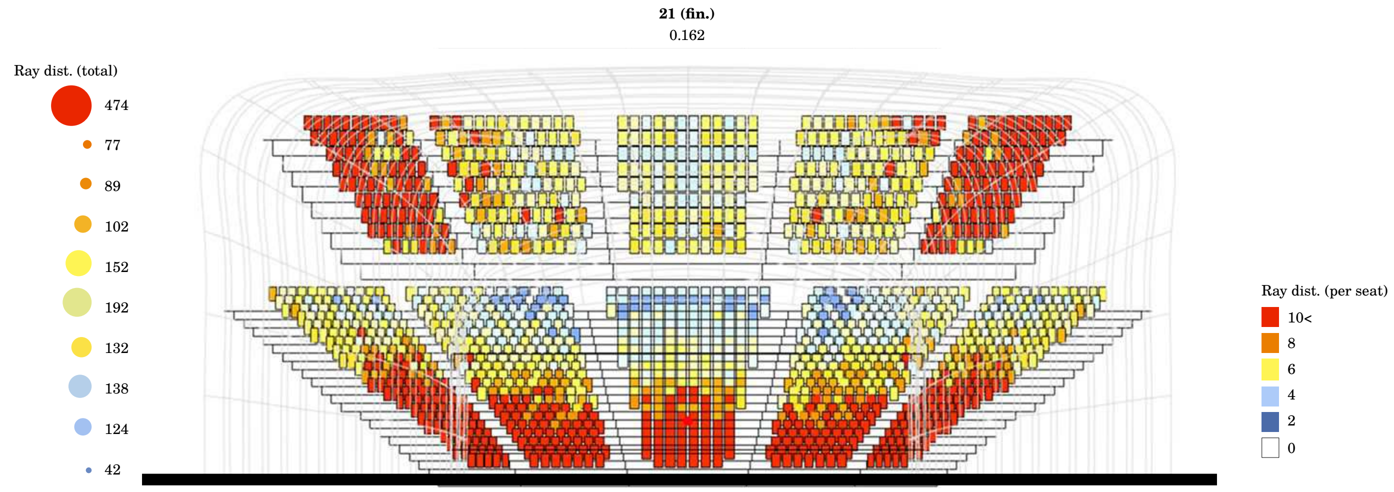

## Distribution of Sound Particles (Audio)




## Distribution of Sound Particles (Audio) – *(cont.)*




*The Heatmap Diagram and Distribution of Audio Sound Particles to Ear Height (EH) Levels in the Acoustic Ray Simulation Process reveal Arrival Time Delay (ATD) ranging from 0 to 0.16281 seconds in 21 steps.*

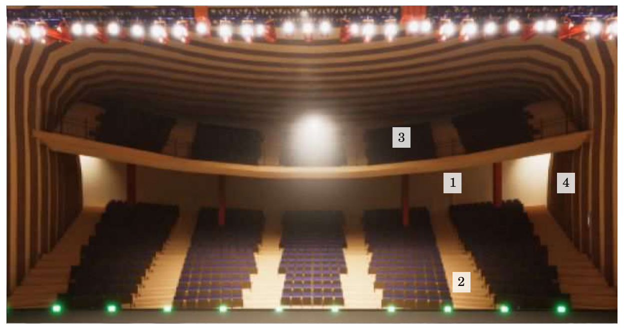
The diagram depicts the simulation in a 1530-seat auditorium, recording 61,208 Ray Curves (RC) for ATD. Red areas signal more than 10 sound reflections, while blue and yellow indicate 2 and 6 reflections, optimizing sound based on seat positions.

## Acoustic Material Recommendation – Sound Absorption for Optimization

| No. | Element | Material | Finishing | Absorption coef. (% energy absorbed) | | | | | | | | | Page Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 62.5 Hz | 125 Hz | 250 Hz | 500 Hz | 1K Hz | 2K Hz | 4K Hz | 8K Hz | Flatten All | |
| 1 | Wall | Rockwool 75mm | Fabric | - | 0.3 | 0.69 | 0.94 | 1 | 1 | 1 | - | 0.82 | 10 |
| 2 | Floor | Carpet | Fabric | - | 0.1 | 0.15 | 0.25 | 0.3 | 0.3 | 0.3 | - | 0.23 | 1 |
| 3 | Furniture | Chair | Fabric | - | 0.33 | 0.44 | 0.45 | 0.45 | 0.45 | 0.45 | - | 0.42 | 2 |
| 4 | Ceiling | Woodwool 50mm | Fabric | - | 0.3 | 0.4 | 0.5 | 0.85 | 0.5 | 0.65 | - | 0.53 | 3 |
| 5 | LED screen | - | - | - | - | - | - | - | - | - | - | - | 5 |

*Acoustic material recommendations for absorption in auditorium spaces. Source: Acoustic Projects Study (Acoustic Traffic LLC, 2023).*

The table outlines acoustic material recommendations for optimizing sound in the auditorium, considering material types, finishes, and absorption coefficients. Selection criteria include sound resonance, durability, and aesthetics. Follow these guidelines for enhanced sound quality and material durability in the auditorium.




*Implementation of acoustic materials in the auditorium space.*

Acoustic materials in the auditorium are optimized for the best sound absorption. From Rockwool on the walls to carpet on the floor, every element contributes to improving the room's sound quality.

# Daylight Enhancement in Architectural Design

*Transforming a Double 5-Story Residences Project with Iterative Louver Concepts*

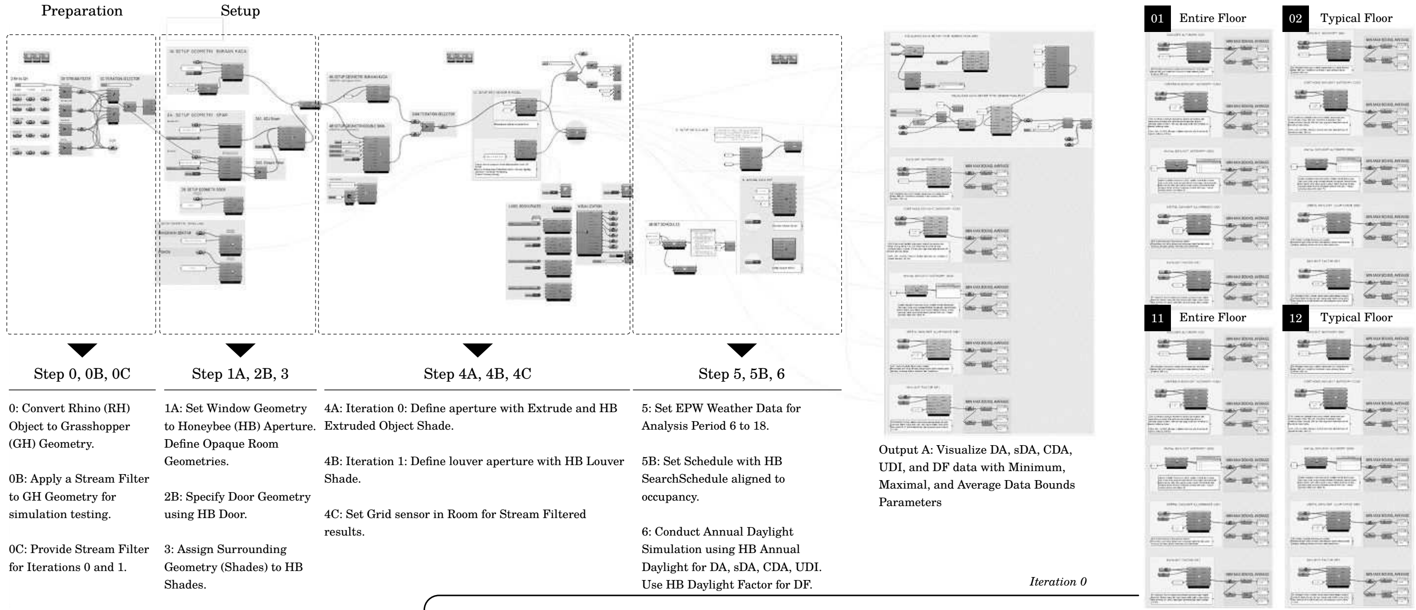
*Master's Architectural Modeling – 2021 | Computation; Simulation; Optioneering | Central Jakarta, Indonesia*

**Type** Individual work
**Software** Rhino, Grasshopper, Ladybug, Honeybee & Colibri
**Instructor** Aswin Indraprastha
**URL** https://arnottferels.github.io/work/daylight-enhancement-in-architectural-design

For an affordable double 5-story residences project, the original window design featuring a 10cm-long Egg Crate profile was revamped to incorporate a 50cm-long louver concept. Using the Brute Force approach through the Colibri Iterator Definition, the design underwent 50 iterations to assess the impact on illumination metrics like CDA, UDI, DF. The objective is to optimize daylight performance and adapt to specific design requirements through Design Explorer 2 analysis.

## Method

**Phase 1** Initialization & Preparation | **Phase 2** Geometry & Element Setup | **Phase 3** Iteration & Grid Setup | **Phase 4** Simulation & Output | **Output A** Simulation & Output | **Output B** Internalized Data




**Step 0, 0B, 0C**

0: Convert Rhino (RH) Object to Grasshopper (GH) Geometry.

0B: Apply a Stream Filter to GH Geometry for simulation testing.

0C: Provide Stream Filter for Iterations 0 and 1.

**Step 1A, 2B, 3**

1A: Set Window Geometry to Honeybee (HB) Aperture. Define Opaque Room Geometries.

2B: Specify Door Geometry using HB Door.

3: Assign Surrounding Geometry (Shades) to HB Shades.

**Step 4A, 4B, 4C**

4A: Iteration 0: Define aperture with Extrude and HB Extruded Object Shade.

4B: Iteration 1: Define louver aperture with HB Louver Shade.

4C: Set Grid sensor in Room for Stream Filtered results.

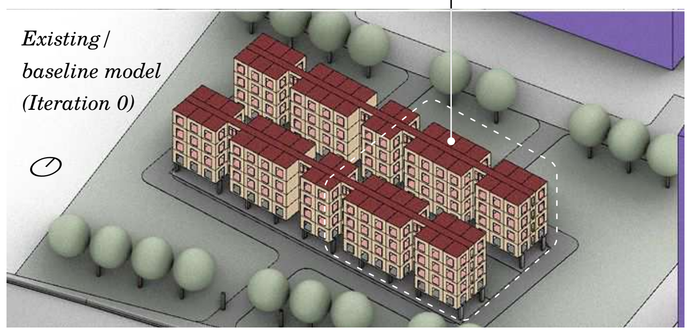
**Step 5, 5B, 6**

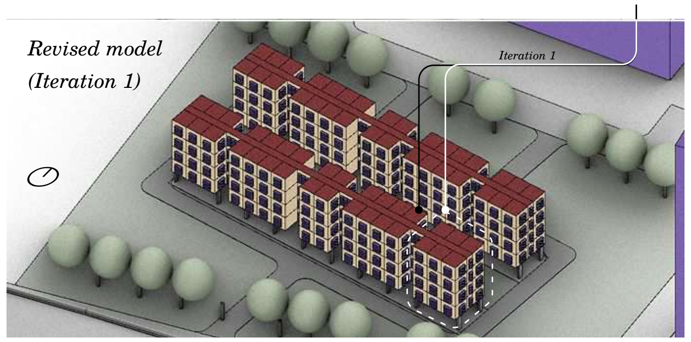
5: Set EPW Weather Data for Analysis Period 6 to 18.

5B: Set Schedule with HB SearchSchedule aligned to occupancy.

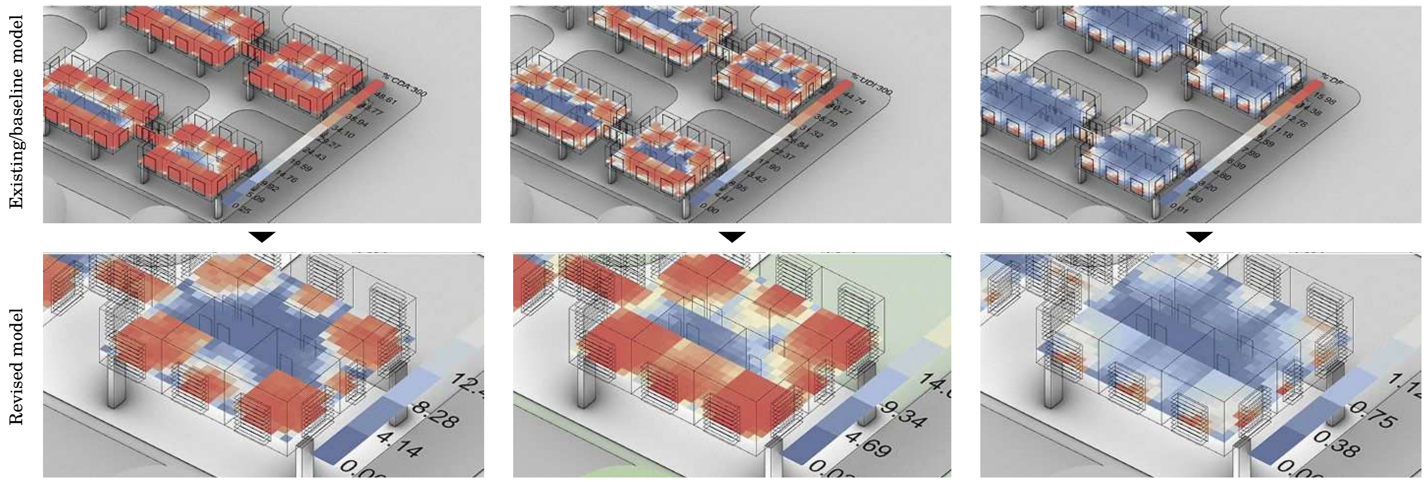
6: Conduct Annual Daylight Simulation using HB Annual Daylight for DA, sDA, CDA, UDI. Use HB Daylight Factor for DF.

Output A: Visualize DA, sDA, CDA, UDI, and DF data with Minimum, Maximal, and Average Data Bounds Parameters



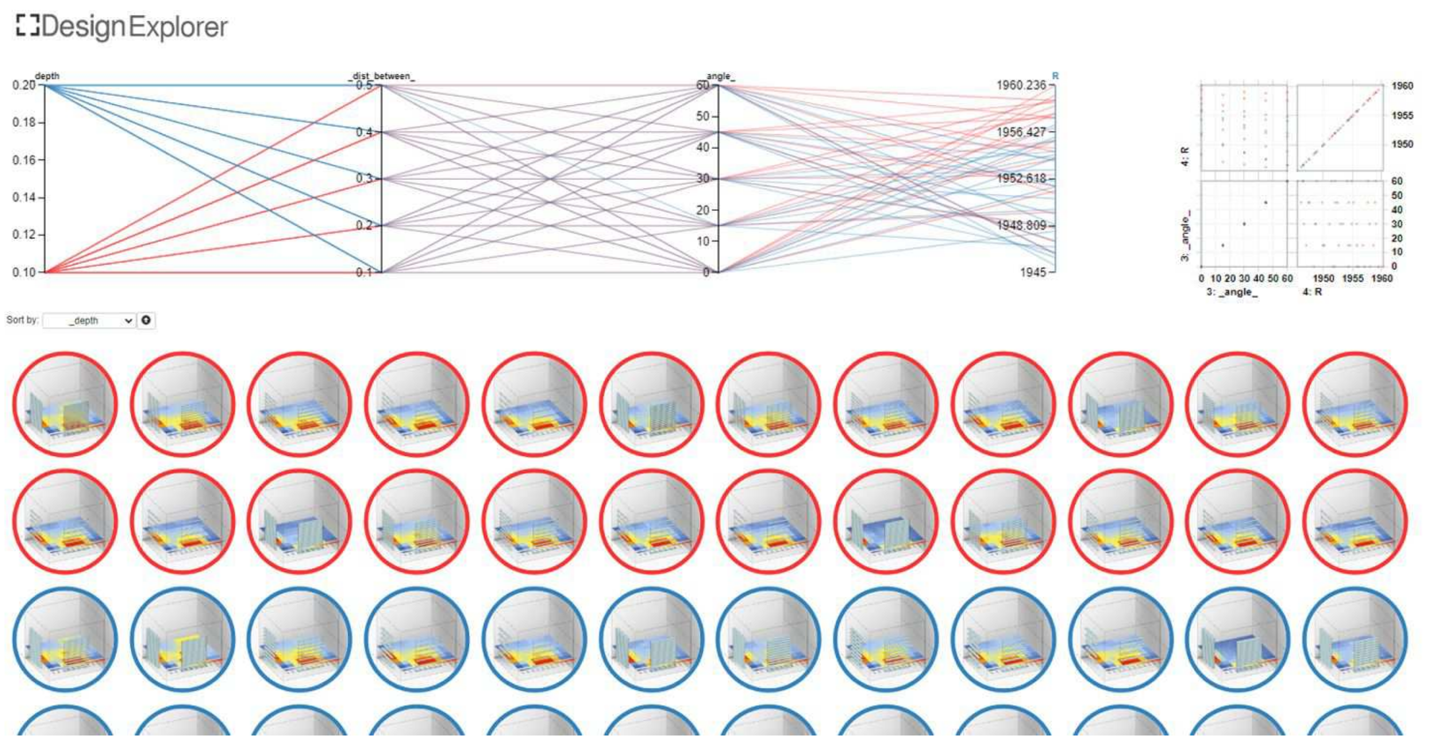




**Continuous Daylight Autonomy (cDA)** | **Useful Daylight Illuminance (UDI)** | **Daylight Factor (DF)**

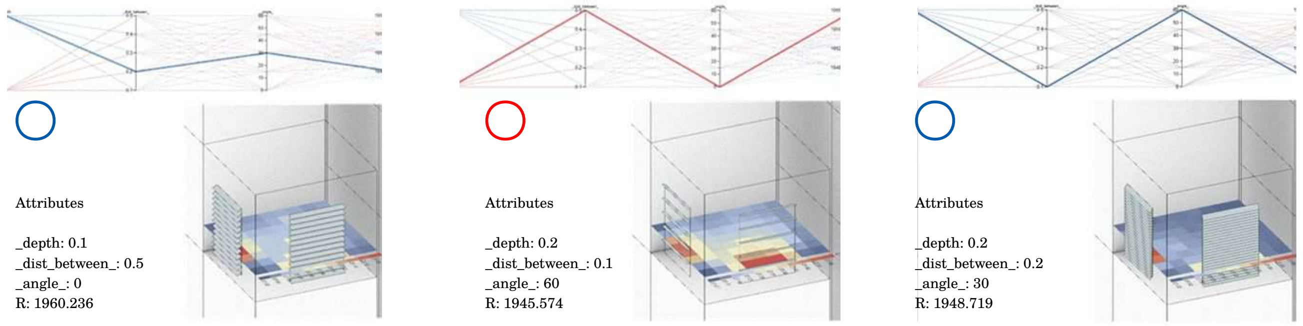



## Design Explorer

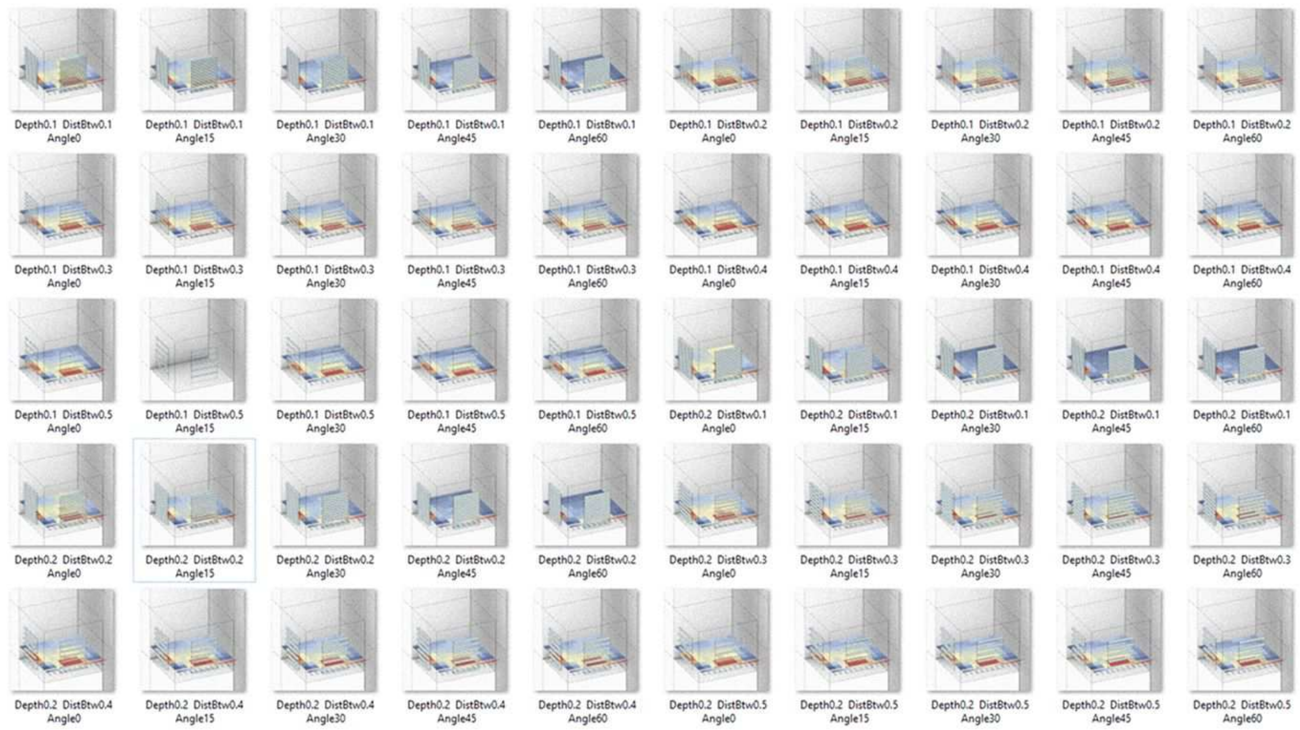
View on Design Explorer 2 ↗




## Exposure




*Minimal* | *Maximal* | *Ideal*




This design project involves 50 iterations using the Brute Force method via the Colibri Iterator Definition. The process generates multiple ImageCaptures, customizable through Design Explorer 2 to meet specific design requirements.

# Rattan Charm

*Redefining the Bedroom in BSD House with Full Ceiling Weave*

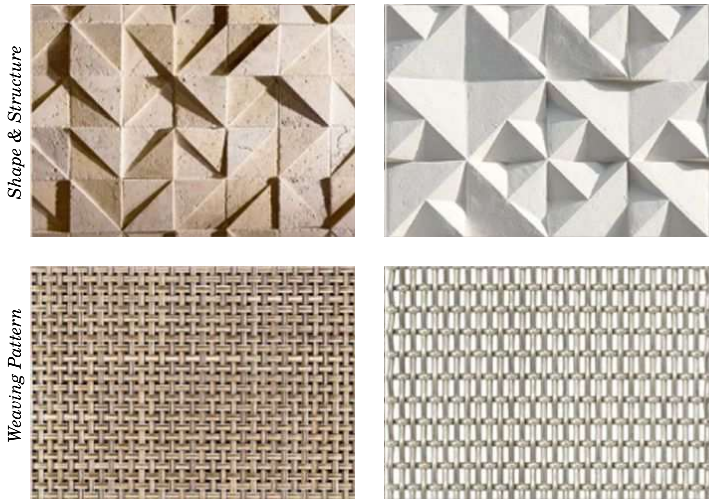
*Professional Work – 2021 | Rattan, Pattern Generation; Design | BSD, Indonesia*

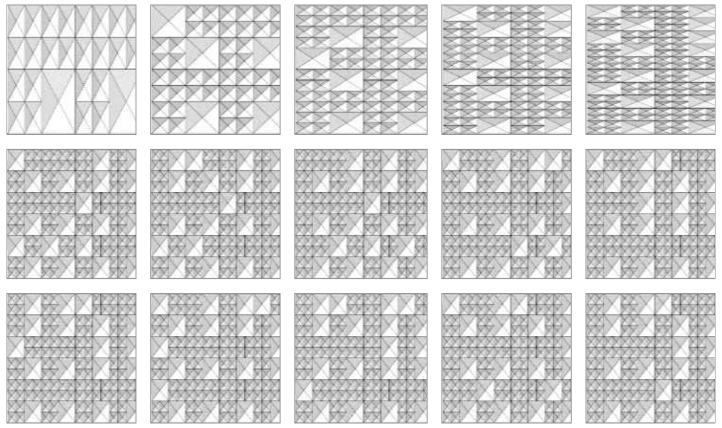
**Contributions** Research and Development, Conceptual Design, Digital Modeling & Scripting
**Software** Rhino & Grasshopper
**Team Leader** Trianzani Sulshi
**URL** `https://arnottferels.github.io/work/rattan-charm`

This project delves into two design options: Pyramid and Wave Rattan pattern generation. The Pyramid approach involves systematically creating intricate two-dimensional patterns, refining them in the third dimension using weaving techniques, thereby enhancing the understanding of multidimensional pattern manipulation. The Wave design introduces a rattan object shaped like a flag for the ceiling, fulfilling the client's need for visibility from diverse angles, particularly from the bed. This addition contributes a dynamic and visually appealing element to the overall space.

## Inspiration & Pattern Generation

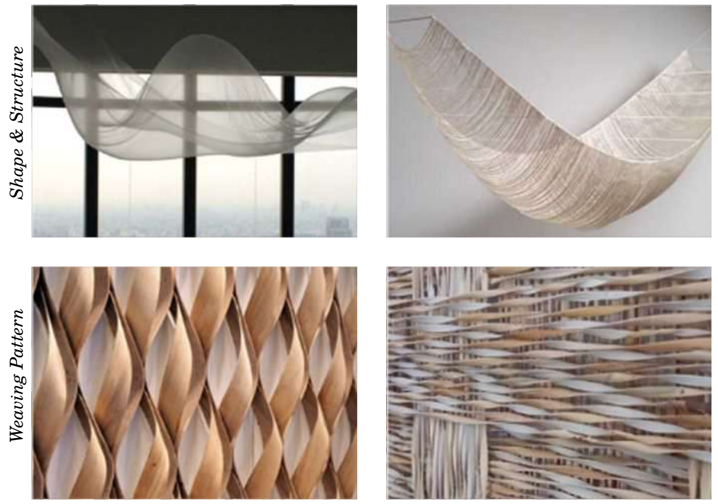
### Option 1: Pyramid

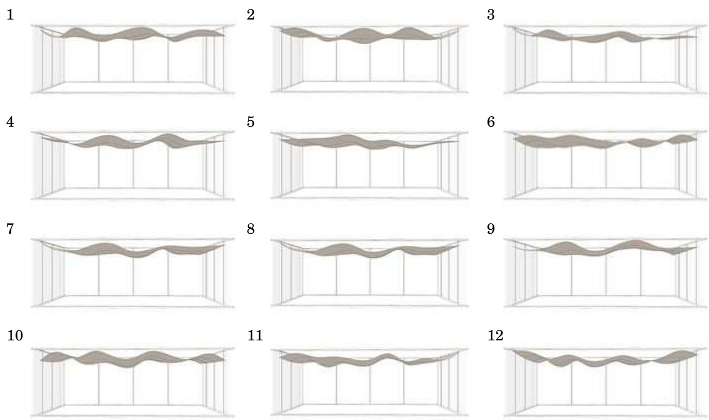


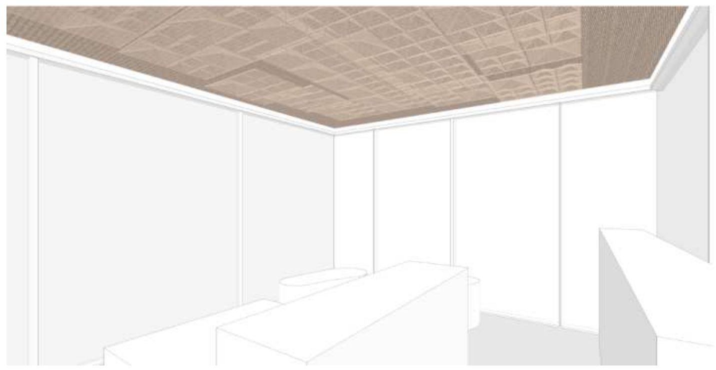
In Option 1 Pyramid Design, systematic iterations produced intricate 2D patterns extended into the third dimension (Z-coordinate). Weaving methods like (0-1-1-0) and (0-1-0-1) enhanced pattern manipulation across multiple dimensions.

### Option 2: Wave




In Option 2 Wave Design, a rattan object resembling a flag acts as an elegant ceiling ornament. The client's request for visibility, especially from the bed, enhances the space with a dynamic and visually appealing element.

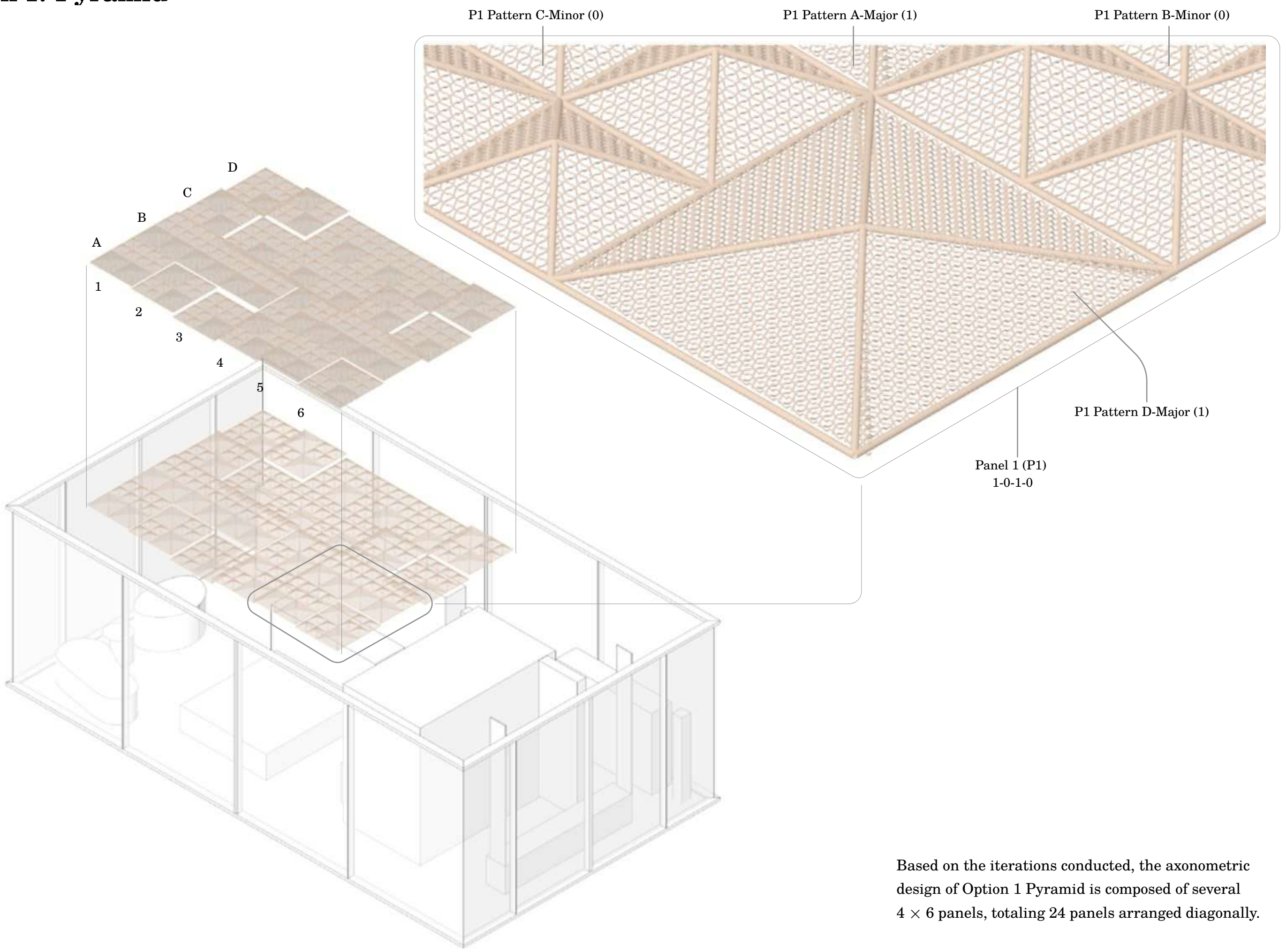


*Option 1: Pyramid*

*Option 2: Wave*

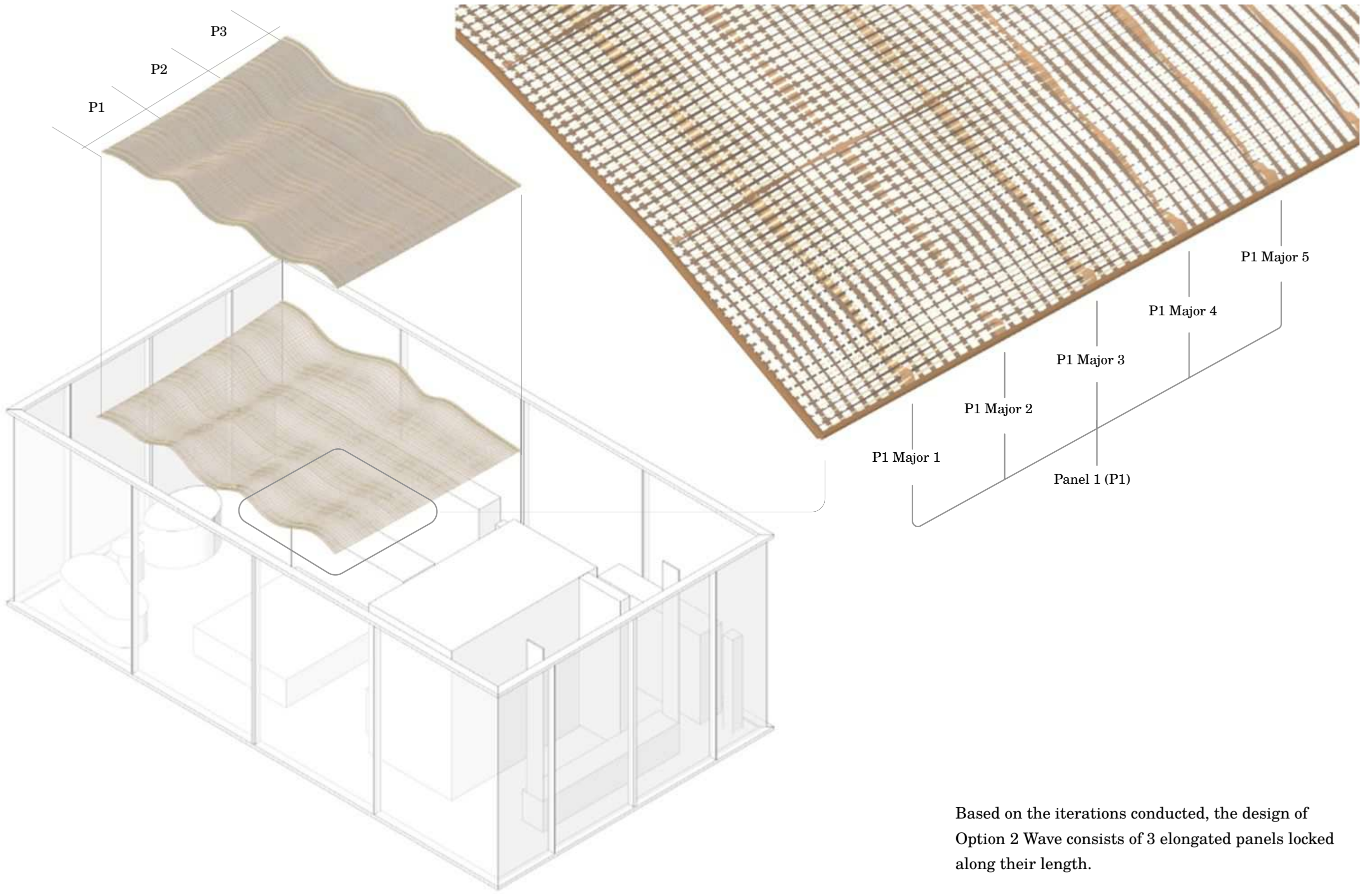
## Design & Details

### Option 1: Pyramid




Based on the iterations conducted, the axonometric design of Option 1 Pyramid is composed of several $4 \times 6$ panels, totaling 24 panels arranged diagonally.

### Option 2: Wave




Based on the iterations conducted, the design of Option 2 Wave consists of 3 elongated panels locked along their length.

# Dynamic Metamorphosis

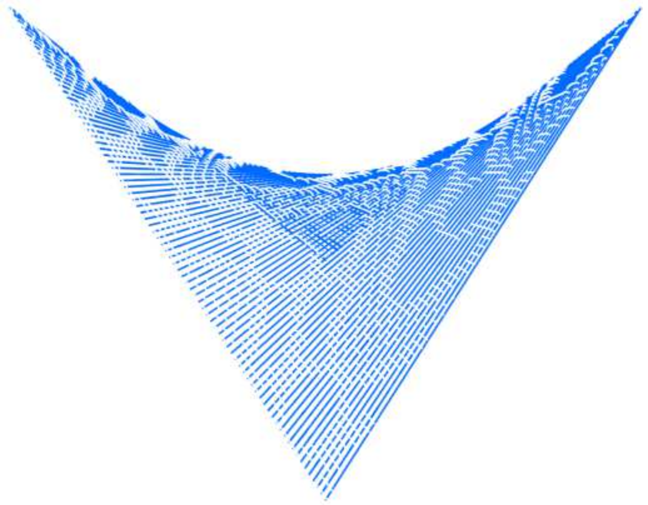
*A fusion of Architectural Innovation & Interactive Engagement*

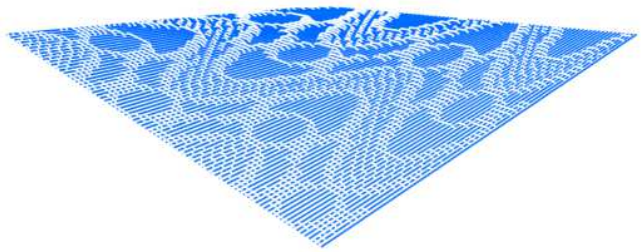
*Professional Work – 2021 | Rattan, Surface Exploration, Pattern Generation & Design*

**Contributions** Research and Development, Digital Modeling, Analysis and Simulation & Scripting
**Software** Rhino & Grasshopper
**Team Leader** Trianzani Sulshi
**URL** https://arnottferels.github.io/work/dynamic-metamorphosis

This project centers on refining Seniman Ruang's Hyperbolic Paraboloid design, aiming to optimize both aesthetics and functionality. Leveraging computational tools, the goal is to elevate the unique features of the design, creating an engaging and visually compelling space for visitors. This endeavor reflects a commitment to pushing design boundaries through innovative computational methodologies.

## Ideas

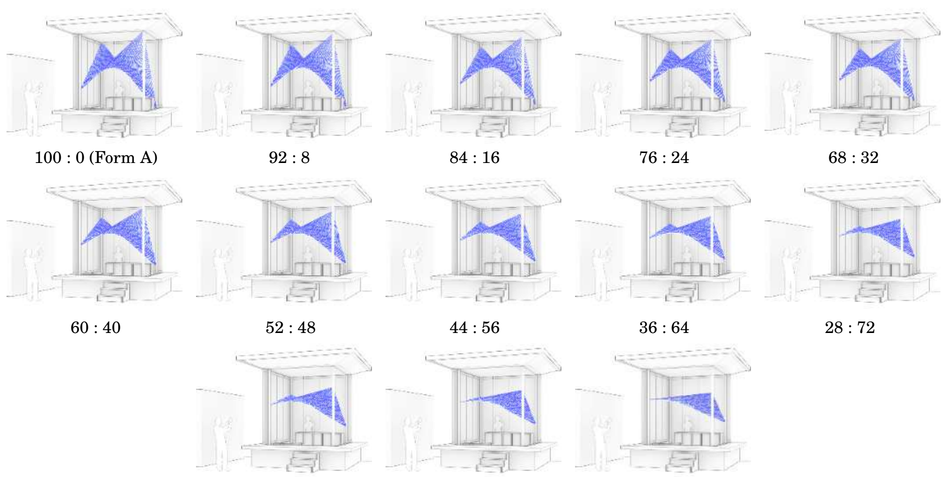




In conceptualizing this transformative project, a multifaceted approach is employed to seamlessly transition between two distinct shapes, Forms A and B. Form A, representing the dynamic Hyperbolic Paraboloid surface, is meticulously crafted to showcase intricate curvatures and fluidity. In contrast, Form B intentionally adopts a predominantly flat surface, creating a deliberate narrative contrast within the design.

Seniman Ruang's forward-thinking grid layout is composed of precisely shaped circular columns, forming the foundational structure for the Hyperbolic Paraboloid. Each column, uniform in thickness, contributes to the creation of a visually striking and static structure. The integration of a basic surface within each grid section, connected with opposing axes, defines the unique character of the Hyperbolic Paraboloid.

## Method




This illustration depicts the gradual shift from Form A to Form B, ranging from 100% Form A (100:0) to 100% Form B (0:100). To ensure day-long engagement, advanced methods are employed, including strategically placed motors for smooth Hyperbolic Paraboloid movement, creating a dynamic and interactive focal point during sales activities. These innovative design approaches aim to go beyond the ordinary, fostering enjoyable and intriguing spaces that challenge traditional design norms.

# Intersecting Dimensions

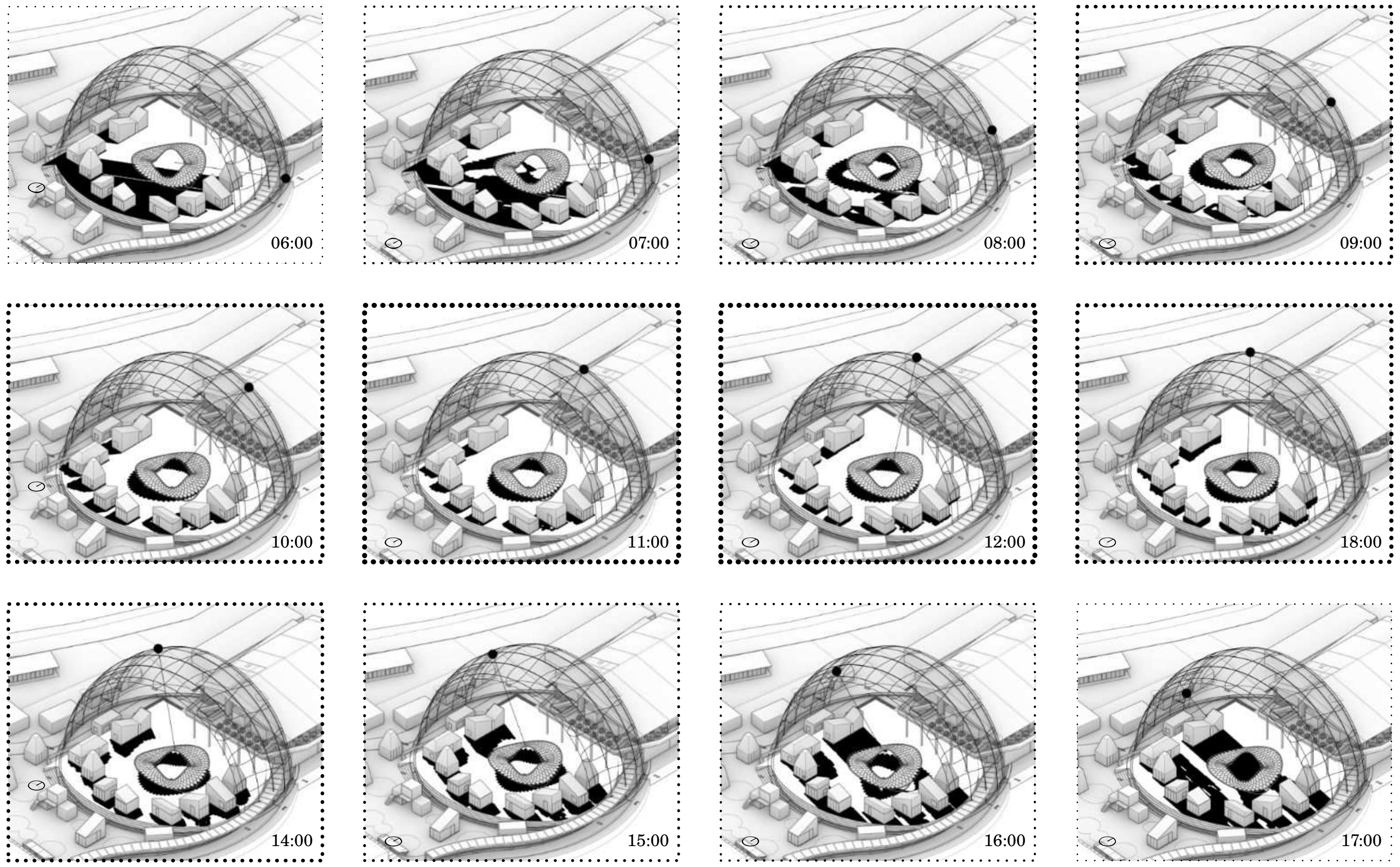
*Exploring Anthropocentric & Analyzing Comfort in a Massive Installation*

*Professional Work – 2021 | Rattan; Shadow Analysis | BSD, Indonesia*

**Contributions** Research and Development, Digital Modeling, Analysis and Simulation & Scripting
**Software** Rhino & Grasshopper
**Team Leader** Trianzani Sulshi
**URL** https://arnottferels.github.io/work/intersecting-dimensions

This project investigates shadow dynamics in a large installation at Kumulo Creative Compound, BSD. Scheduled for construction from February to April and exhibition until December 2021, it addresses the hot-humid tropical context. The analysis aims to understand shadow interactions, considering limited natural shade, and assesses the design's adaptability to pedestrian traffic and various activities.

## Method




In BSD, Tangerang, Indonesia, Kumulo is preparing a major installation, with construction scheduled from February to April and the exhibition until December 2021. The study focuses on limited natural shade in the hot-humid tropical area, examining shadows' interaction with the installation and assessing its adaptability. A shadow simulation on June 21, 2021, captures daily patterns, providing insights into impact areas. Preliminary findings guide potential design adjustments for enhanced functionality and aesthetic appeal within Kumulo's hot-humid tropical context.

# Algae Bio-façade System

*Innovating Integration for Sustainable Architectural Façade Design*

*Façade Ideas Competition – 2019 | Façade Design; Façade Ideas; Optimization | West Jakarta, Indonesia*

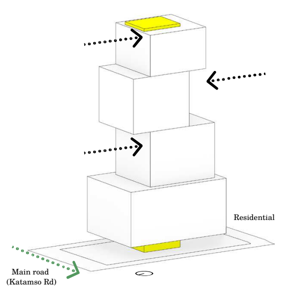
| | |
|---|---|
| **Type** | Student Competition by Green Building Council Indonesia (GBCI) |
| **Award** | Place for Innovative Façades Ideas |
| **Contributions** | Analysis, Concept, Façade Mapping & Modeling |
| **Software** | SketchUp, Rhino, Adobe Illustrator, Photoshop & Microsoft Excel |
| **Collaborators** | Cathleen Charity & Oliver Kenny |
| **URL** | `https://arnottferels.github.io/work/algae-bio-facade-system` |

This study introduces a new bio-façade system in Indonesia, bringing innovation to sustainable architecture. The design focuses on mapping, modeling, and simulating the façade. The algae modules, categorized as Dark, Standard, and Light, adjust to sunlight levels, making the building more comfortable. Simulations show a significant reduction in the Overall Thermal Transfer Value (OTTV) to an impressive 35 W/m$^2$, setting a benchmark for energy efficiency. The project generates 131,460 kWh annually, reducing 295,346.8 grams of $CO_2$ daily. It stands out as a model in sustainable architecture, demonstrating the potential of biophilic design in urban environments.

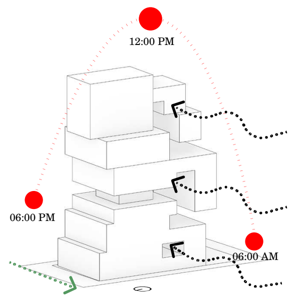
## Methodology

| Analysis | | | ▶ | Modeling | | ▶ | Simulation & Optimization | |
|---|---|---|---|---|---|---|---|---|
| Context | Climate | Function | | Basic geometry | Façade module | | OTTV | Bio-façade ratio |

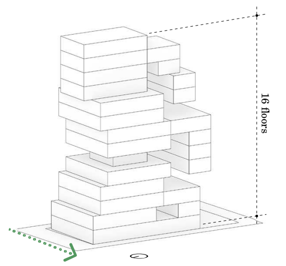
## Climate-Responsive Design & Functional Features



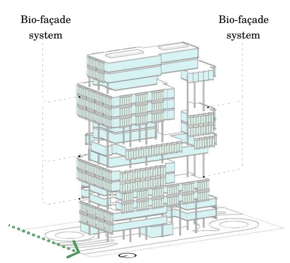

**1**: The structure's design follows local climate rules and building codes.




**2**: It adjusts to microclimates, using passive strategies for changes based on sun and wind patterns.

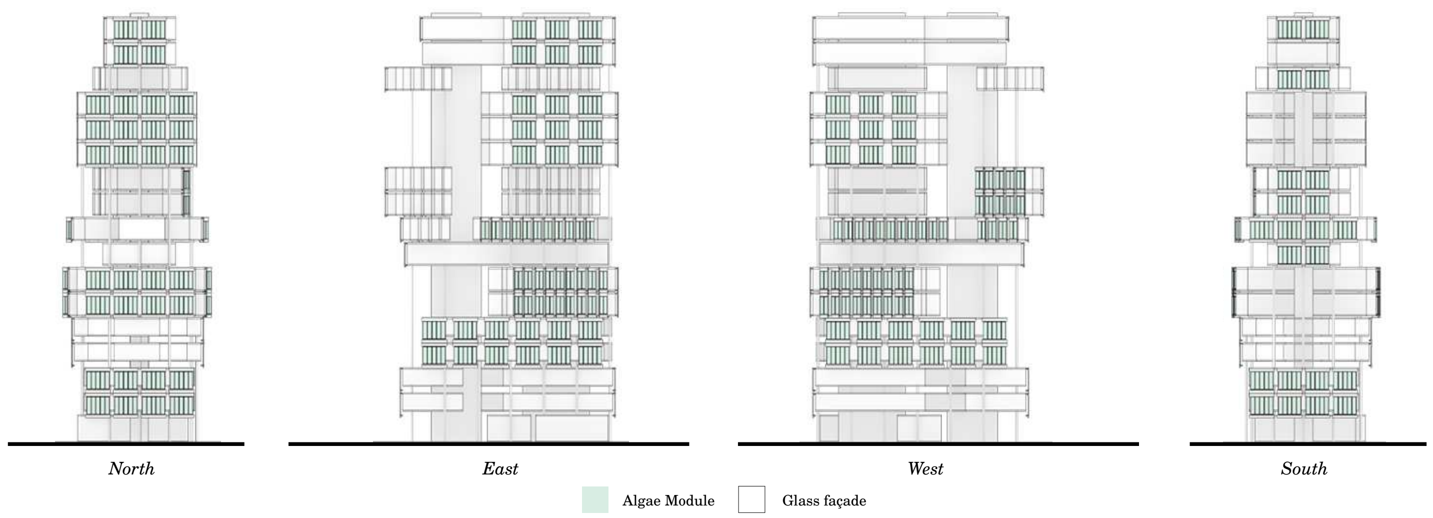



**3**: The building is mainly for offices, with co-working and retail as secondary functions.



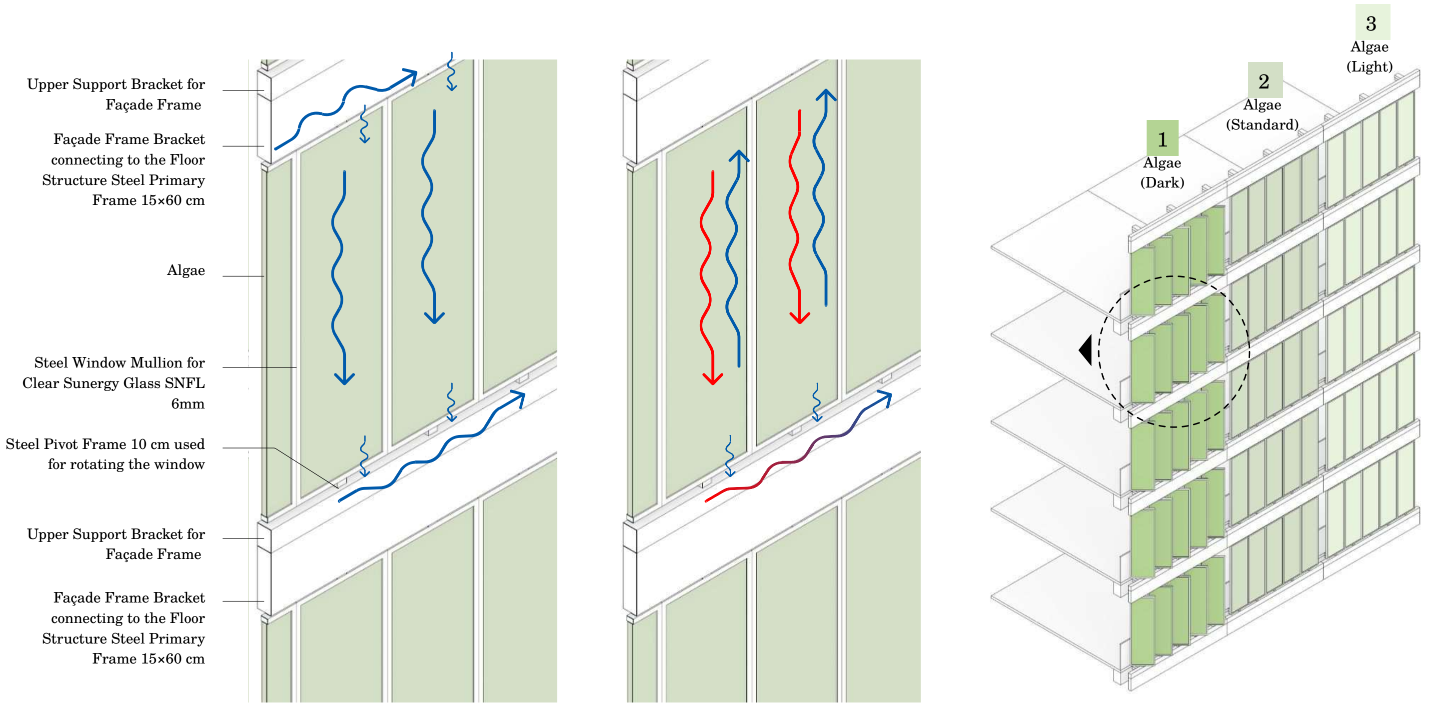

**4**: Design details involve placing algae façade modules and other materials.

## Facade Thermal Mapping & Algae Module Placement Optimization




In this phase, mapping assessed thermal exposure for each facade section, crucial for simulating OTTV calculations. After determining OTTV values in the first (1) and second (2) simulations, the third simulation (3) identified optimal Algae module placement along solar path lines in Jakarta—specifically in the North, East, and South directions.

## Biofaçade System – How the Façade System Works




*CO2 & O2 system* | *Biomass system* | *Biofacade implementation*

When the building is exposed to substantial sunlight, the density of algae increases, creating additional shade and contributing to the maintenance of thermal and visual comfort. In the algae module, three specific types are distinguished: Dark, Standard, and Light. The algae facade facilitates adaptive shading in response to sunlight. As the building receives more sunlight, the algae density grows, providing heightened shading that ensures ongoing thermal and visual comfort.

## Simulation & Optimization

### Simulations 1 & 2

| No. | Material (Opaque) | U Value (W/m²/K) | No. | Material (Glass) | U Value (W/m²/K) | Ref. |
|---|---|---|---|---|---|---|
| 1 | Bio-façade Algae | 1.19 | 1 | Sunergy Glass SNFL 6mm | 4.10 | (1) |
| 2 | Bio-façade Algae AGC Comercial Low-e Glass 23 | 0.23 | 2 | Bio façade Algae: Sunergy Clear (SNFL) 6mm + 10mm Air media Algae + Sunergy Clear (SNFL) 6mm | 1.19 | (2) |
| 3 | Concrete Column | 1.72 | 3 | Bio-façade Algae AGC Comercial Low-e Glass 23 | 0.29 | (1) |
| 4 | Brick | 2.22 | 4 | Material combination: No. 2 & 3 | 0.23 | (3) |
| ⋮ | | | | | | |

| Simulation | Total Wall Conduction, Opening Conduction, Radiation through Total Openings (W) | Total Façade Area (m²) | OTTV (W/m²) |
|---|---|---|---|
| 3 | 357,076.35 | 13,121.71 | 27.21 |

### Simulation 3 (Algae)

For the third simulation, the calculation involves utilizing the Algae bio-façade, with a 45% replacement of glass.

| Simulation | Total Wall Conduction, Opening Conduction, Radiation through Total Openings (W) | Total Façade Area (m²) | OTTV (W/m²) |
|---|---|---|---|
| 1 | 646,473.46 | 13,121.71 | 49.27 |
| 2 | 387,014.93 | 13,121.71 | 29.49 |
| ⋮ | | | |
| 3 | ... | ... | ... |

## References


[1] Asahi performance data.
[2] U-value for thermal transmittance, SC assumes a 40% reduction from Sunergy Clear SNFL 6mm.
[3] U-value for thermal transmittance, SC assumes a 40% combined reduction from No. 2 & 3.


## Results

The initial OTTV value without algae is 37 W/m$^2$, aiming for a targeted value of 35 W/m$^2$ and a maximum of 45. With a window-to-wall ratio (WWR) set at 70%, approximately 4,382.02 m$^2$ (45%) of the total facade area is covered by the algae facade. The algae facade generates 131,460 kWh/year, while the average energy consumption for office spaces is 250,000 kWh/year. Environmentally, it contributes to a daily reduction of 295,346.8 grams of $CO_2$, totaling 107,801,582 grams annually, equivalent to 107,801.6 kilograms or 107.8 tons per year. The estimated heat production for the building is 657,300 kWh per year.

# Container Village

*Redefining Urban Living with Kampong Container*

*Professional Work – 2019 | Urban Housing Research; Modular Design | East Jakarta, Indonesia*

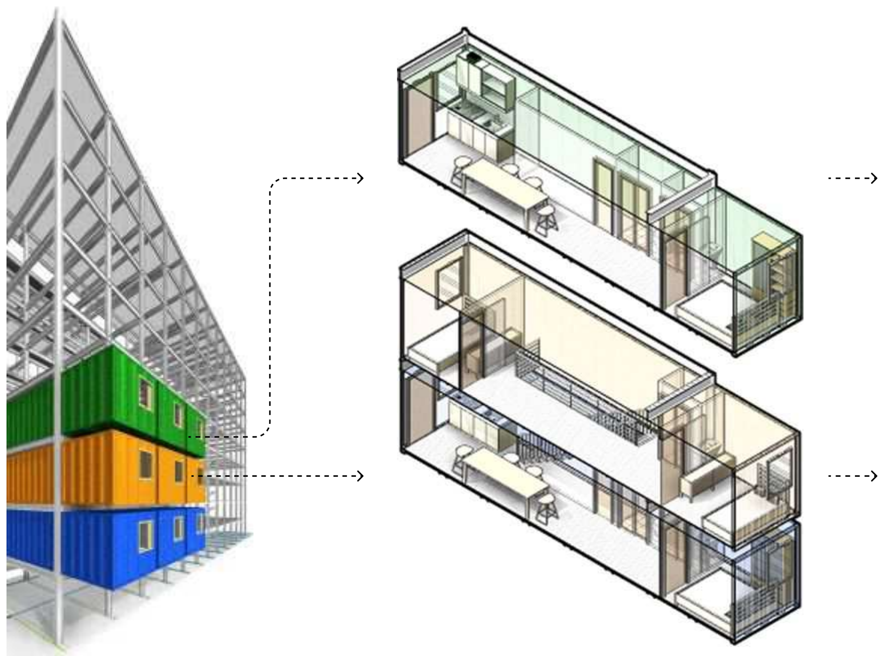
| | |
|---|---|
| **Type** | Professional Competition by Perumnas (National Urban Development Corporation) |
| **Award** | Top 10 & Semifinalist |
| **Contributions** | Research, Concept, Design, BIM Modeling & Visualization |
| **Software** | Revit, Lumion & Adobe Photoshop |
| **Collaborators** | Cathleen Charity & Oliver Kenny |

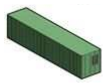
This project revolutionizes urban living in East Jakarta by employing an innovative housing approach using modular containers. Strategically placed near vital amenities, the development introduces two housing types, Type A and Type B, catering to different resident configurations. The inclusion of a plugin system boosts user mobility and facilitates an efficient, organic building process within the Kampong Container. Drawing inspiration from Indonesian culture, communal spaces on each floor cultivate a sense of community, encouraging self-economy and self-energy. Prioritizing sustainability and cultural values, the project addresses Jakarta's housing requirements while reshaping contemporary living standards.

## Introduction

An innovative housing project in East Jakarta repurposes a vacant plot initially designated for high-rises. Strategically located near TransJakarta bus stops, mosques, and schools, the site leverages Jakarta's container accessibility. Challenges include ergonomic adjustments and affordable housing demand. Opportunities involve surplus containers, Gen Y and Z entering the market, and addressing wealth gaps. The project aims to meet Jakarta's housing needs by capitalizing on container advantages and embracing the city's unique characteristics.

## Method: Unit Configuration

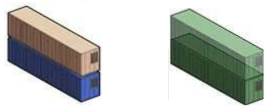




**One container configuration (Type A)**

*Size: 29.72m² (12.19 × 2.43m²)*

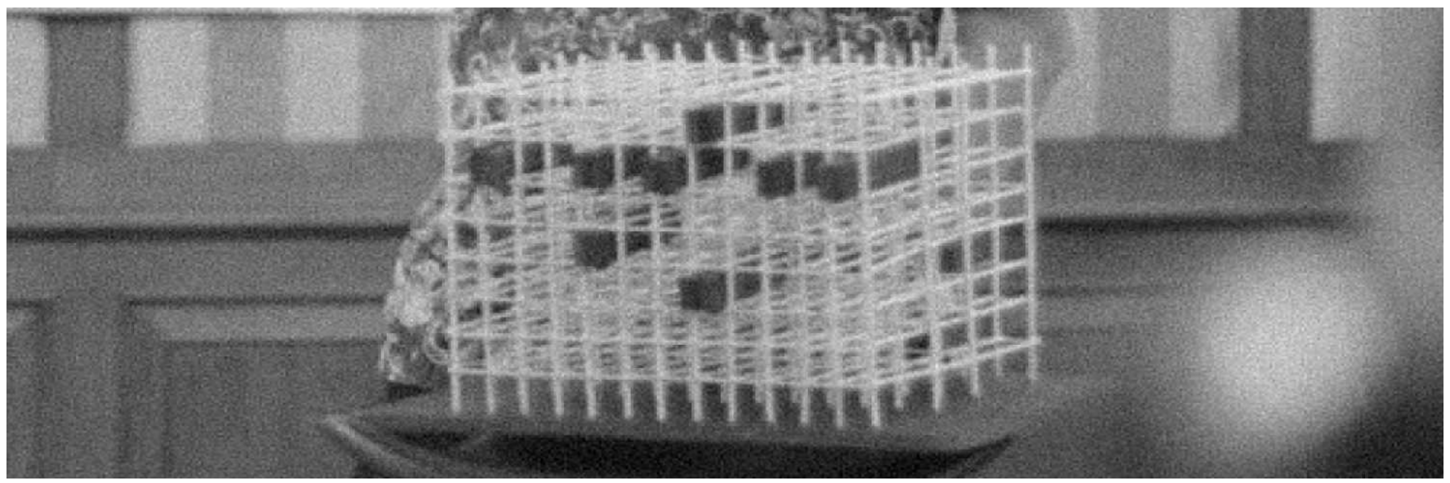
This housing type is ideal for married couples, providing sufficient space for a total of two people.



**Two container configuration (Type B)**

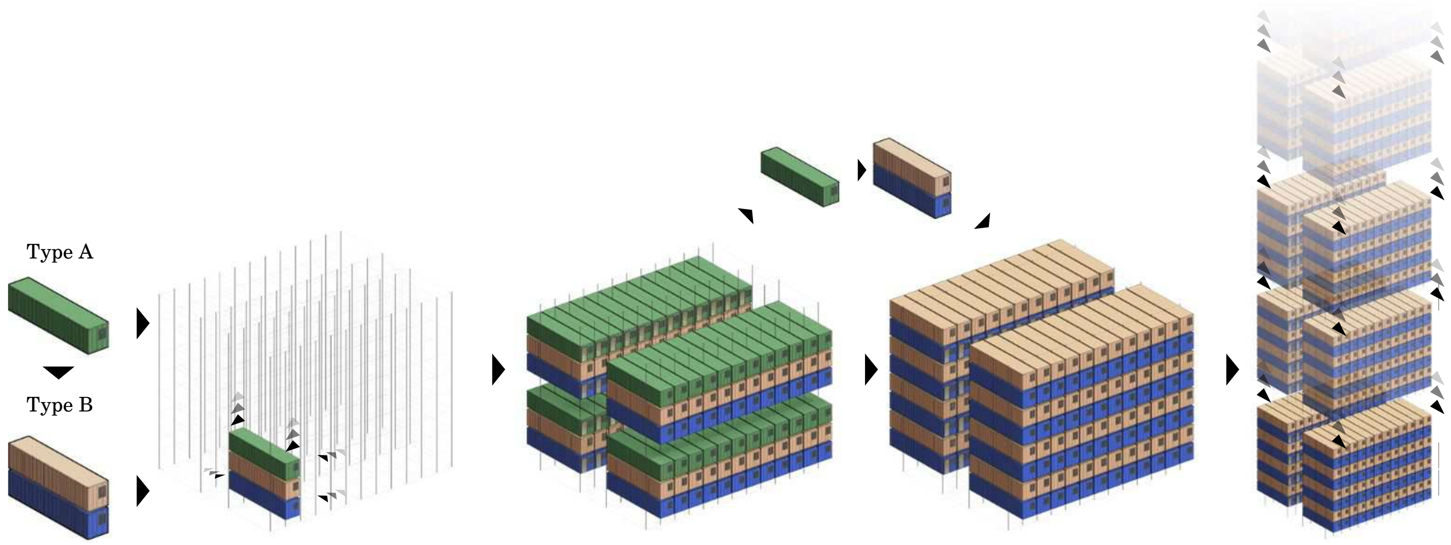
*Size: 59.44m² (2 × 12.19 × 2.43m²)*

This housing option is designed for married couples with two children, accommodating a total of four people. Users can choose either to upgrade from Type A to Type B or directly opt for Type B.



*Architectural model illustrating the operational principles of the plugin system.*

## Development Phase




**Phase 1**

Users have the option to purchase either container Type A or B and attach it to the steel structure.

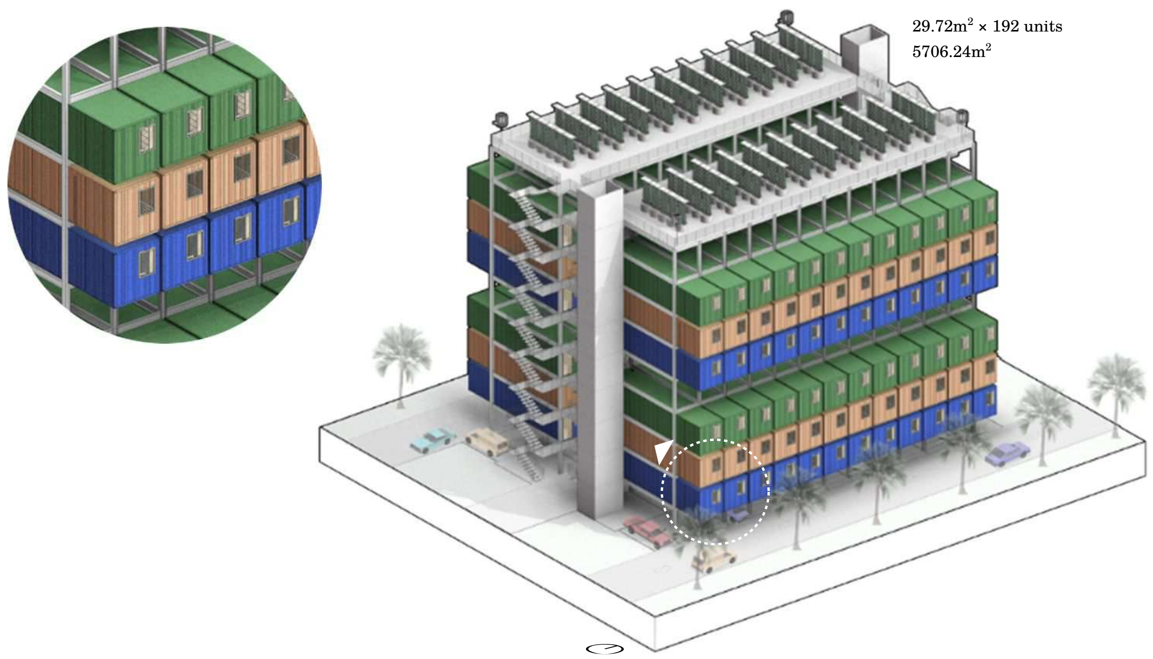
**Phase 2**

After full occupancy, users can upgrade from Type A to Type B modules.

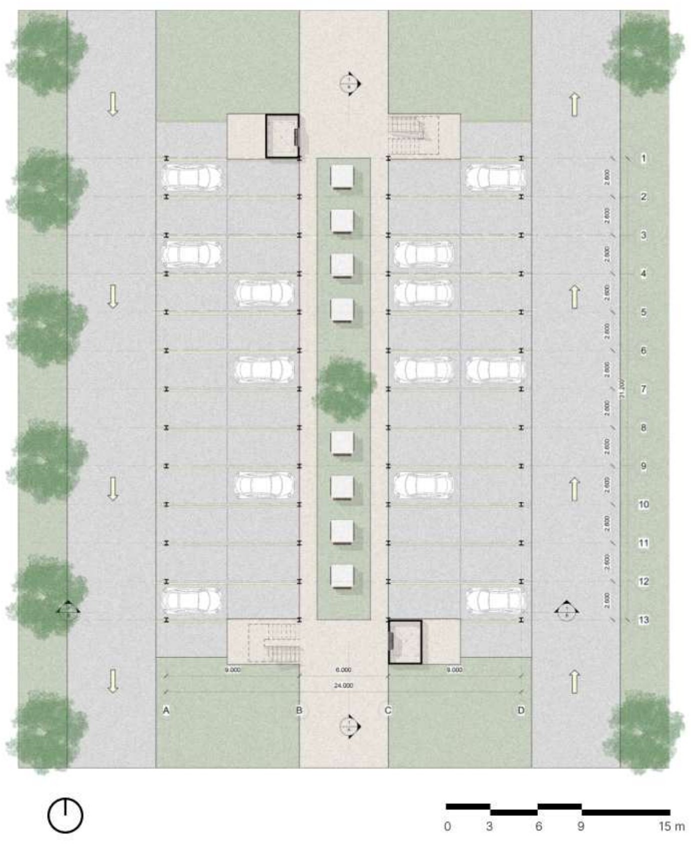
**Phase 3**

If all available areas are full, developers have the option to either create new ones or stack them up.

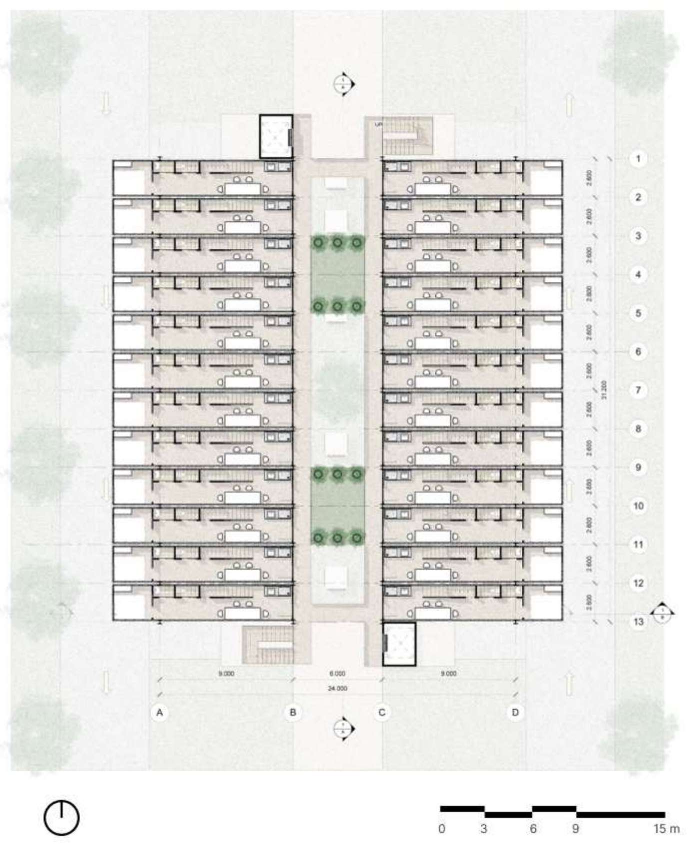
## Plugin System



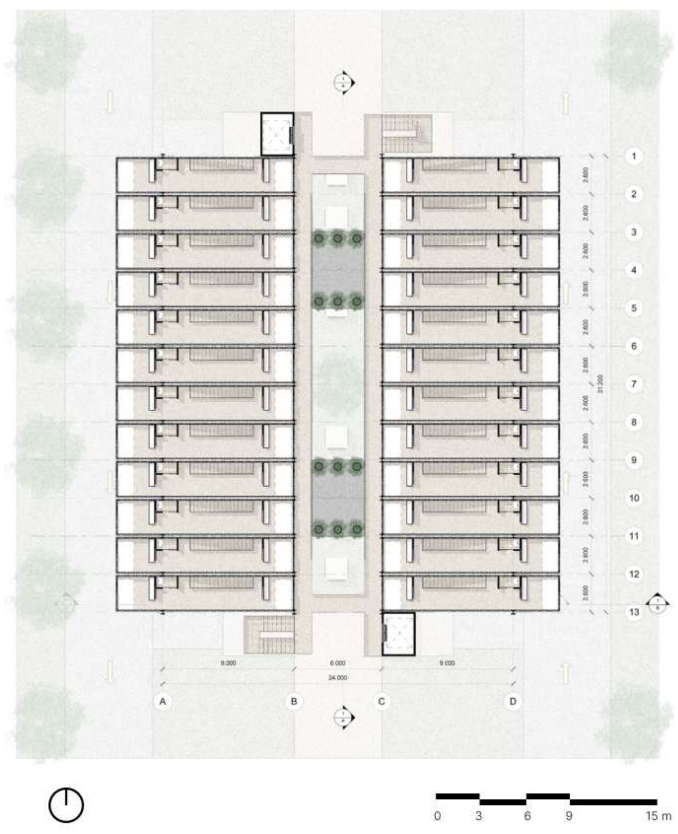

## Design



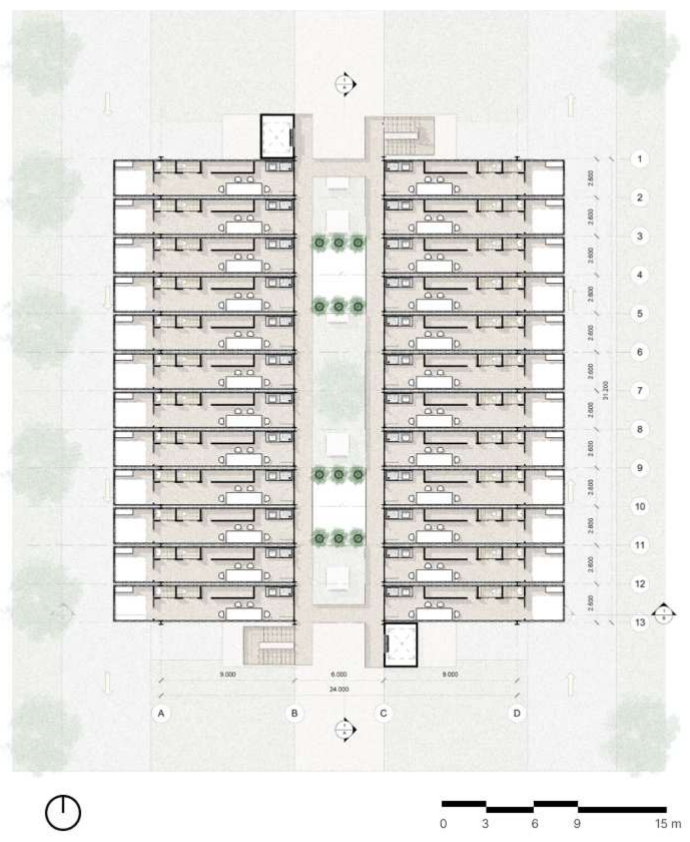
*Level 1 (GF)*



*Level 2 (Type B)*

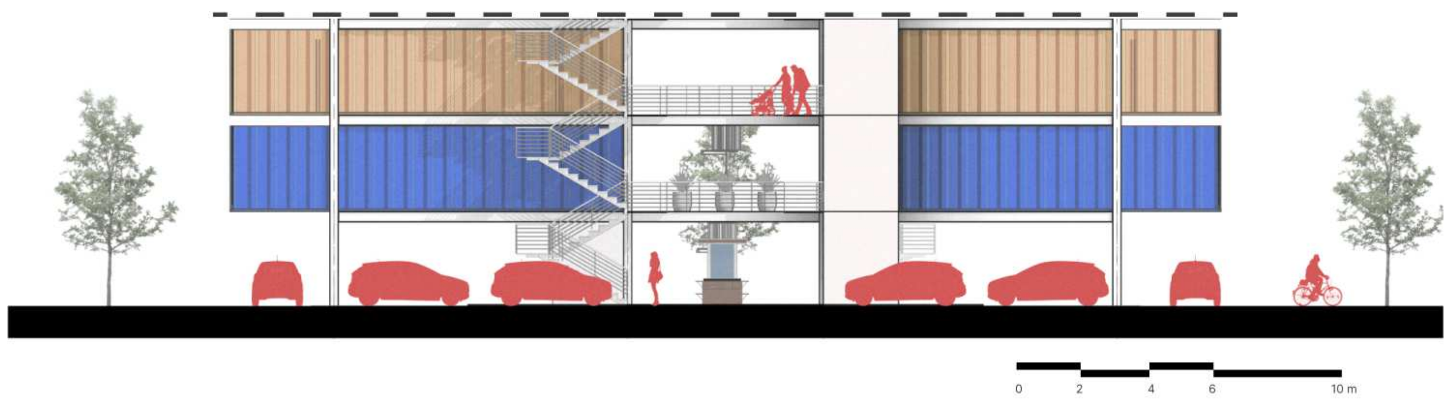


*Level 3 (Type B)*



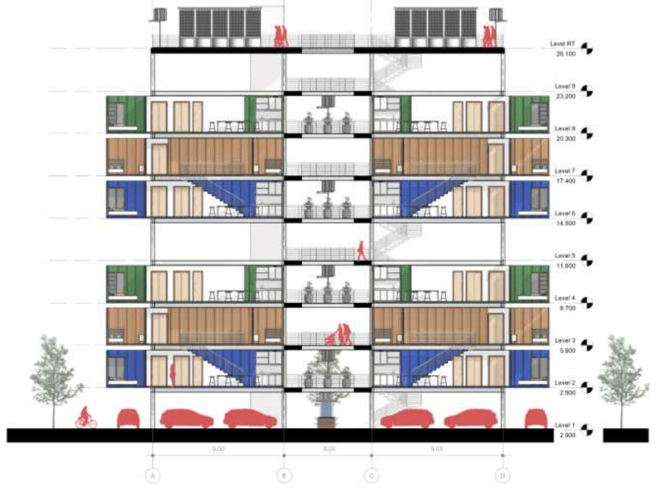
*Level 4 (Type B)*

## Concept: Self-economy



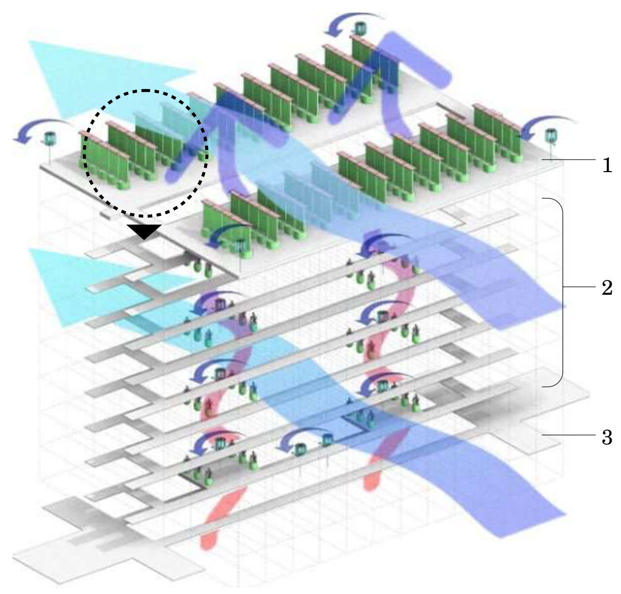

The communal spaces on each floor deck and atrium, inspired by Indonesian culture, encourage a sense of togetherness and gathering. The Indonesian cultural characteristics of the market concept in the Kampong Container (Container Village) can also contribute to the local economy.

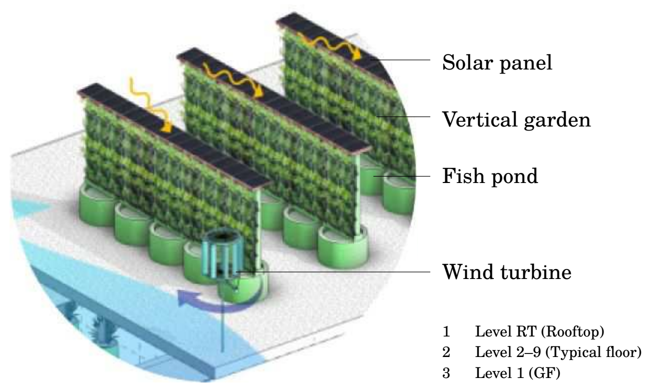
*Section A-A*



*Section B-B*

## Concept: Self-energy

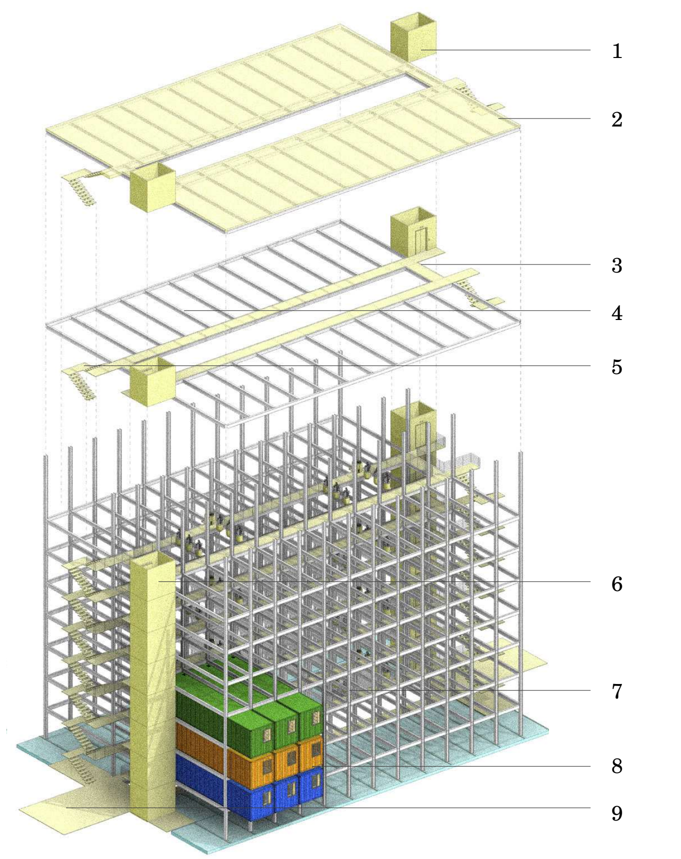



1 Level RT (Rooftop)
2 Level 2–9 (Typical floor)
3 Level 1 (GF)

The rooftop and decks of each floor are equipped with ecological independent energy sources such as vertical gardens, solar panels, fish ponds, and wind turbines.

## Concept: Self-installation




1 Elevator
2 Rooftop
3 Typical circulation
4 H Beam 400×400mm
5 Stair
6 Elevator shaft
7 Container socket
8 Parking area
9 Circulation

The plugin system, which allows for user mobility, contributes to the high efficiency and organic building process in the Kampung Kontainer (Container Village).

# Kalideres Integrated Bus Terminal

*Transforming Jakarta's Transportation Hub Towards Sustainability*

*Bachelor's Thesis – 2020 | Transit Design; Environmental Design; Parametric Design | West Jakarta, Indonesia*

**Type** Individual work
**Software** Rhino, Grasshopper, Ladybug Tools, Paneling Tools, Twinmotion, Photoshop & Illustrator
**Instructor** Yaseri D. Apritasari
**URL** https://arnottferels.github.io/work/kalideres-integrated-bus-terminal

This project transforms the Kalideres Integrated Bus Terminal into a sustainable transit model for Jakarta, Indonesia. Tackling population density challenges, it introduces renewable energy, green spaces, and sustainable materials for enhanced environmental quality. The design prioritizes efficient pedestrian and vehicular movement, incorporating an overpass road and promoting universal design principles. With a strong emphasis on green transportation, the project strategically integrates eco-friendly elements, contributing to Jakarta's resilient urban infrastructure and fostering a sustainable, accessible transportation hub.

## Issues & Strategies

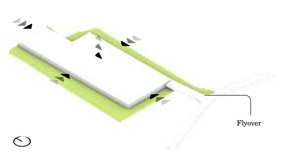
**Issues**
- Urban/Region Nodes
- Terminal Development
- Intermodal Integration
- Criminality
- Facilities

**Challenges**
- Facility Optimization & Traffic Management
- Development Opportunities & Zoning Enhancement
- Green Space & Groundwater Allocation

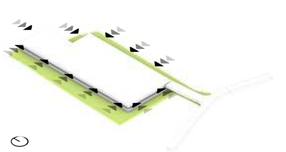
**Solutions**
- Efficient Circulation Management
- Violations Reduction & Green Implementation
- Park & Ride Optimization

**Strategies**
- Sustainable Transportation
- Green and Material Management
- Energy and Resource Sustainability
- Efficient Circulation Flow

## Design Generation

1


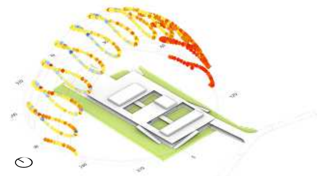

*Conceptual Massing*
Develop a basic building shape considering local context and adhering to regulations.

2


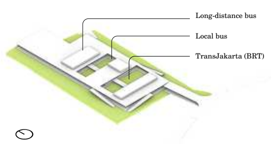
*User-Centric Refinement*
Tailor the design to meet user needs, with a focus on creating a smooth transition zone for commuting.

3

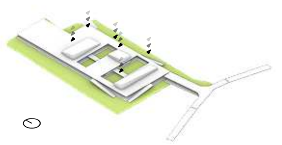

*Health-Conscious Design*
Integrate open spaces and pockets to promote a healthy environment.

4


*Solar Orientation Analysis*
Examine how the building aligns with the sun's path for optimal daylighting.

5



*Responsive Roof & Façade*
Design the roof and outer shell to respond intelligently to environmental conditions.

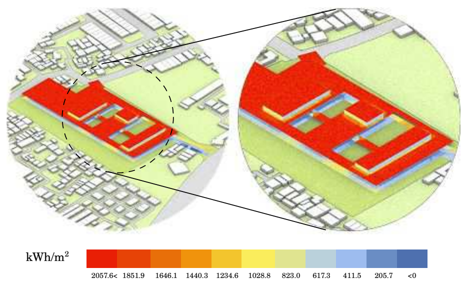
6


*Architectural Features*
Introduce additional design elements, considering architectural aesthetics and functional aspects.

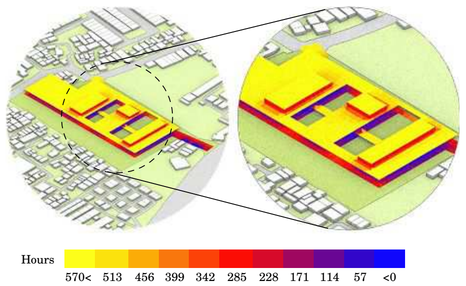
7


*Final Design Optimization*
Optimize the design by analyzing wind patterns to strategically place a durable tensile structure on the rooftop.

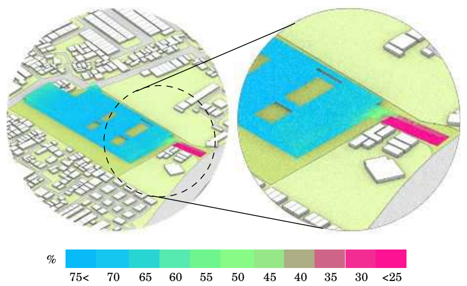
## Environmental Analysis




Radiation on the site is mainly on the roof and second floor, suitable for non-human activities. Human facilities align with climate analysis under a roof.




Due to its equatorial location, the site experiences substantial UV sunlight exposure (above 570 hours). However, the mezzanine floor at Level 1 receives limited UV sunlight (57 hours), suitable for introducing transitional zone functions.



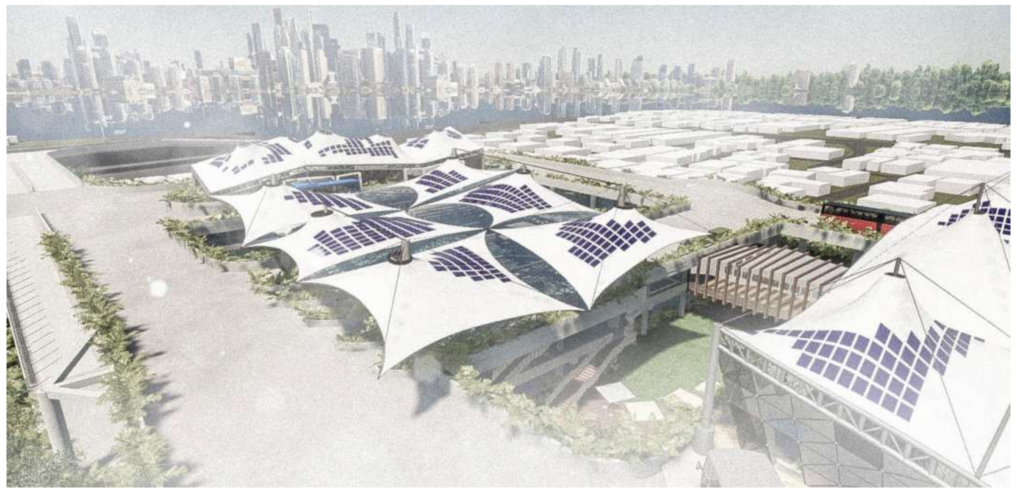

In most areas of the site, a 75% spherical view is achievable, except beneath the flyover, where it drops to below 35%. The design should incorporate a dedicated express lane while maintaining a concept of continuity.

## Design Strategy – How Bus & Human Circulation Works


**Flow**
- Main Circulation (Loop)
- Humans & Cyclists
- Parking
- Long-distance bus
- Local bus
- TransJakarta (BRT)

**Function**
- A Long-distance bus
- B Local bus
- C TransJakarta (BRT)

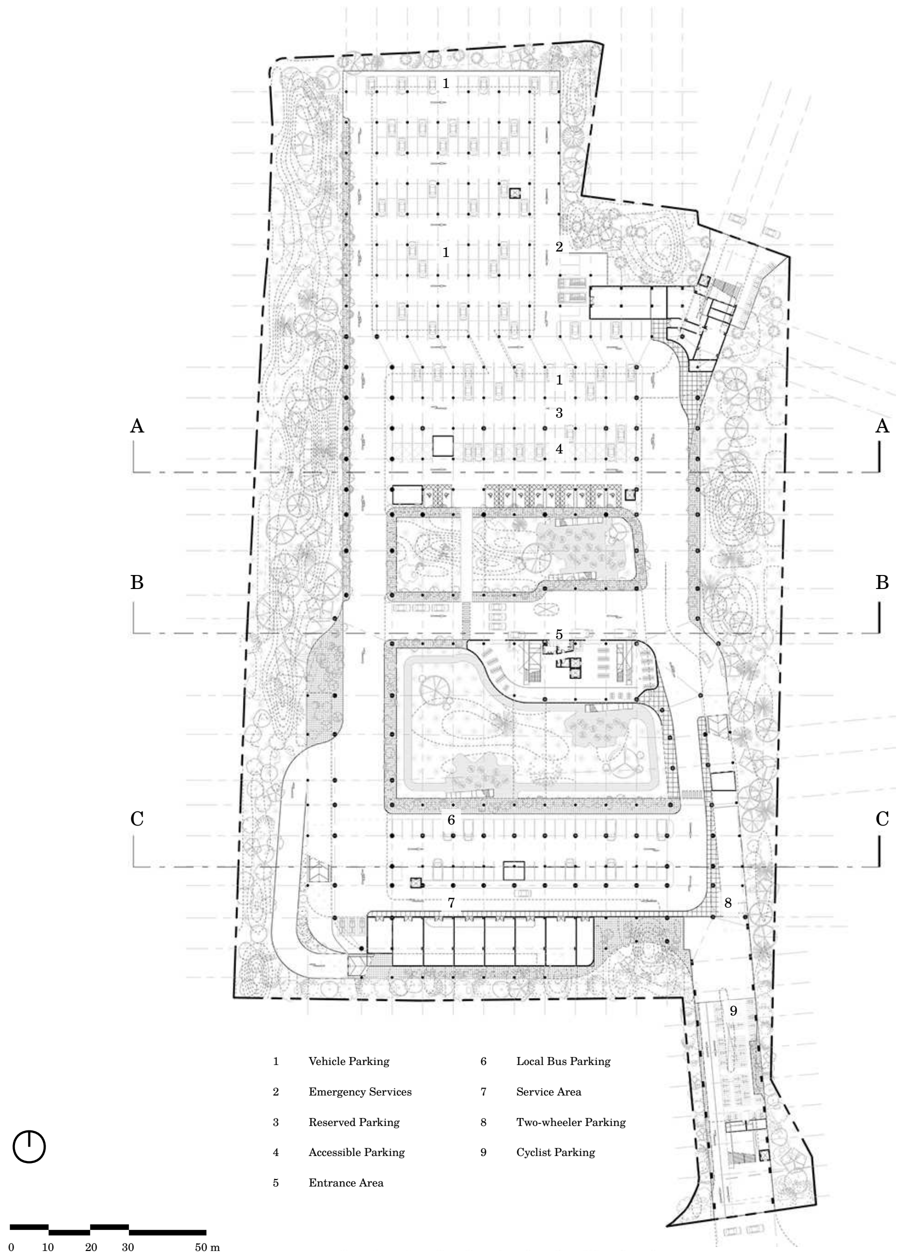
This site plan shows the layout divided into three sections from north to south: parking for long-distance buses, a building for long-distance buses, a building for local buses, a TransJakarta bus stop, and a bridge connecting to the main road (Daan Mogot Rd). Purposeful empty spaces (void) between each bus service area ensure ample light and air circulation, preventing overcrowding.



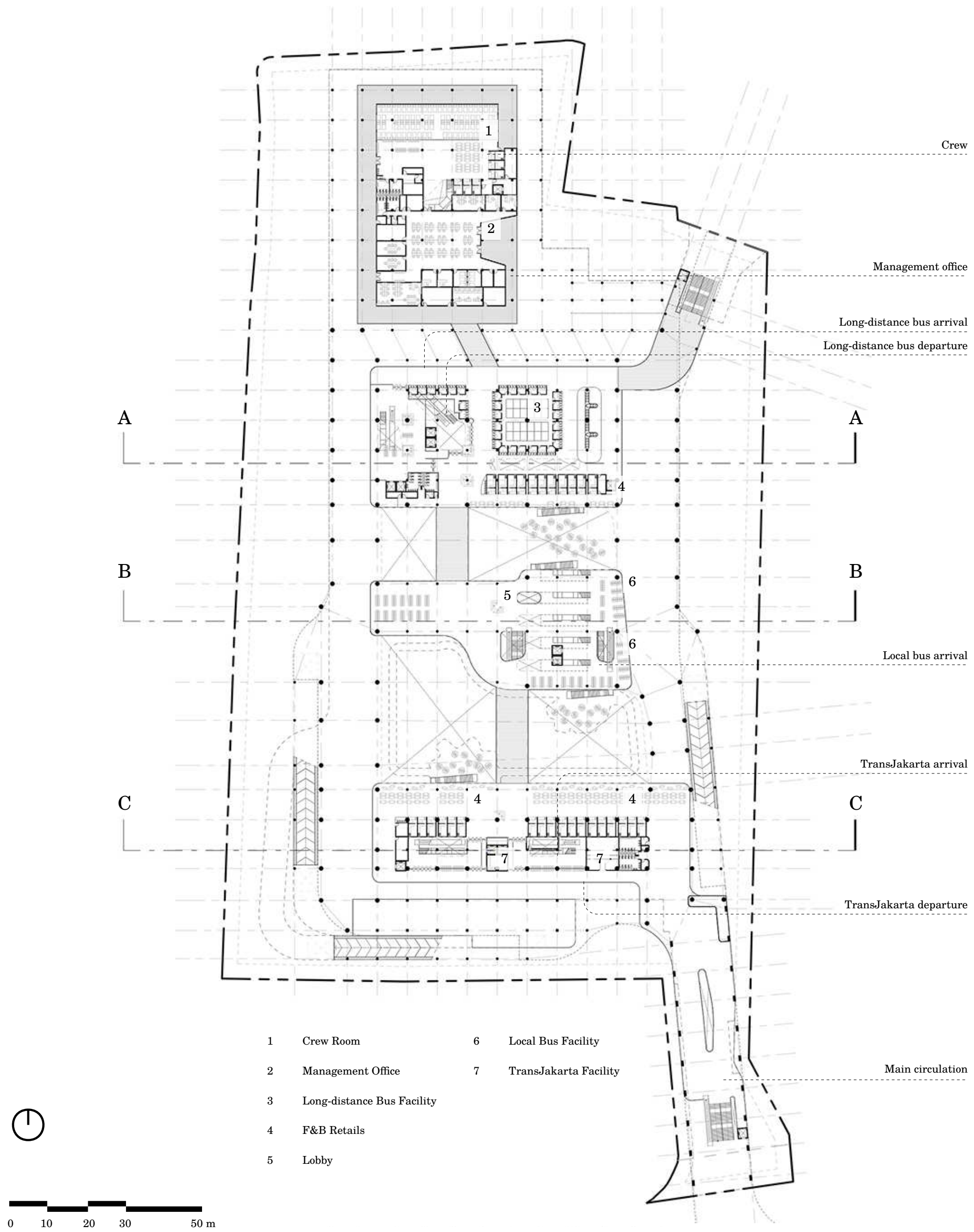
*Aerial View – Kalideres Integrated Bus Terminal*

Placement of lightweight solar panels on the roof of the PVTE Fabric Tensile Membrane.

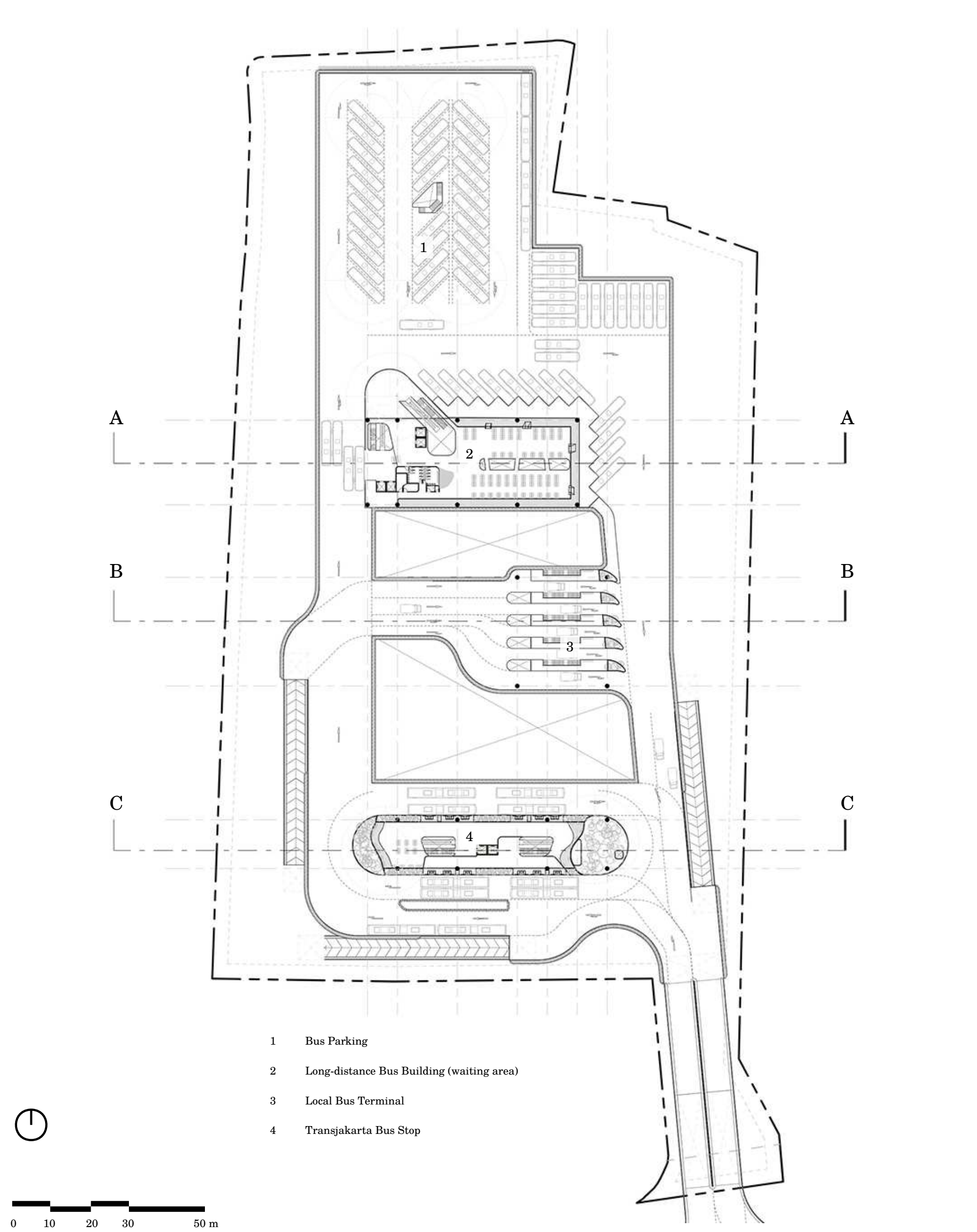
## Programs




*Level 1*




*Level 1M*



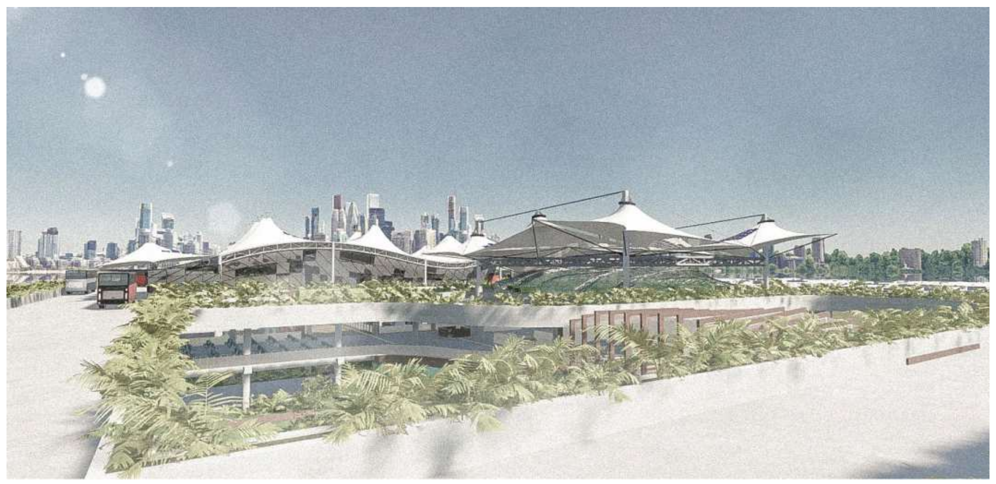

*Level 2*

On Level 1, there is a dedicated entrance for motorcycles, bicycles, and pedestrians. The parking space accommodates cars, public transportation vehicles, motorcycles, bicycles (including for firefighting and ambulances). A central area features a main lobby/midsection for drop-off and arrival areas, surrounded by a green open space called the "oasis" serving as a green area and outdoor F&B space. The surrounding site functions as a green zone with diverse local plants.

On Level 1M, there is a main transition zone that connects the parking area and the main entrance to terminal facilities, including Inter City Bus (with ticket counters), Local Bus (with a dedicated Local Bus Lobby), TransJakarta (with a TransJakarta Lobby), F&B Area (Commercial Retail), and Services on the North side (Management Office and Crew Room).

On Level 2, there is a dedicated circulation for vehicles accessed directly via the flyover on the South side of the terminal to avoid crossing with pedestrians. Arranged from North to South, there is a Bus Parking area, followed by the Long-distance Bus Building, Local Bus Terminal, and TransJakarta Bus Stop. There is a specific ramp directly to the first floor for parking and drop-off in the non-bus zone.

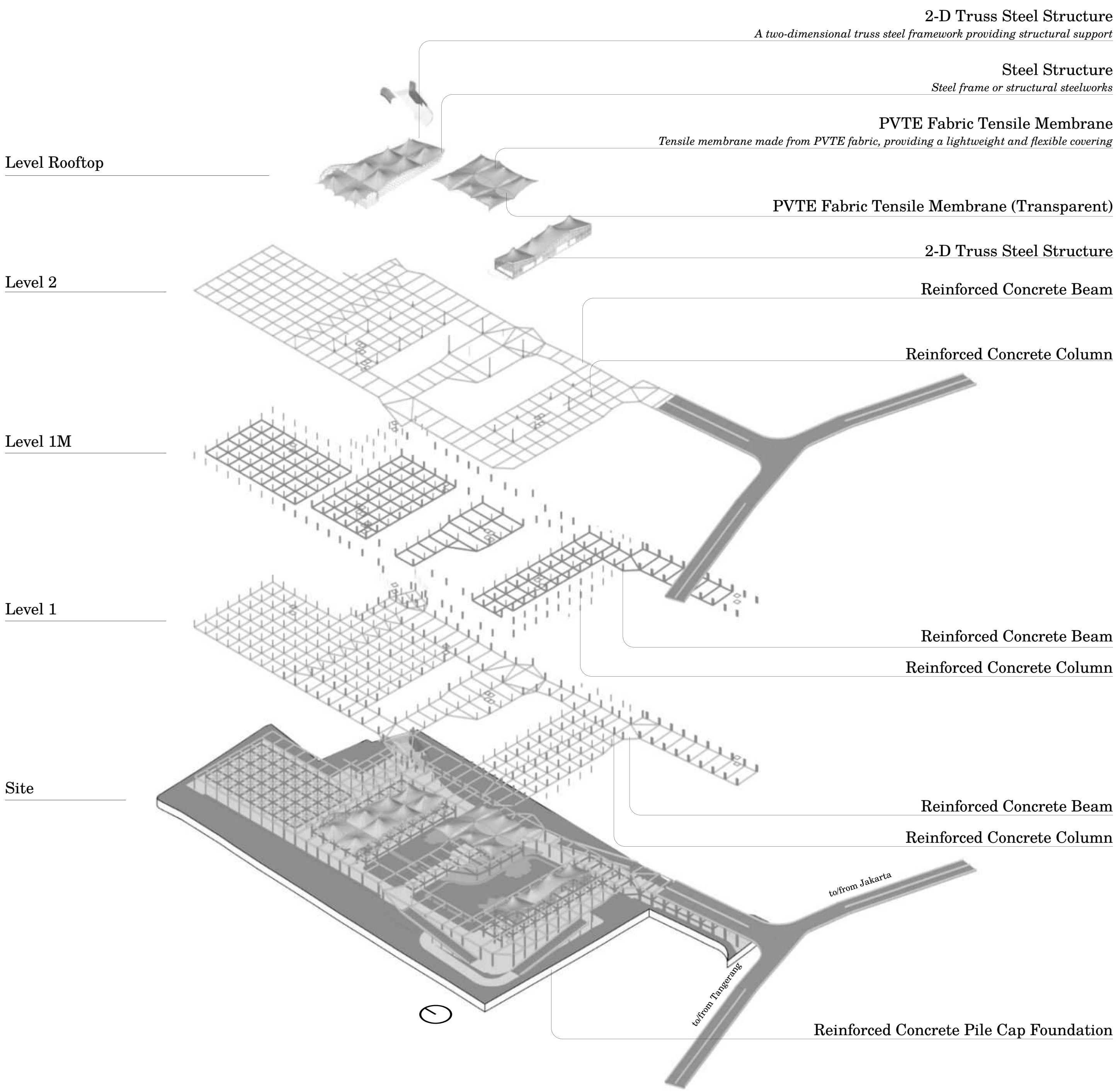
*Long-distance Bus Building & Local Bus Terminal*



*The layers of the building that showcase various activities and zones.*

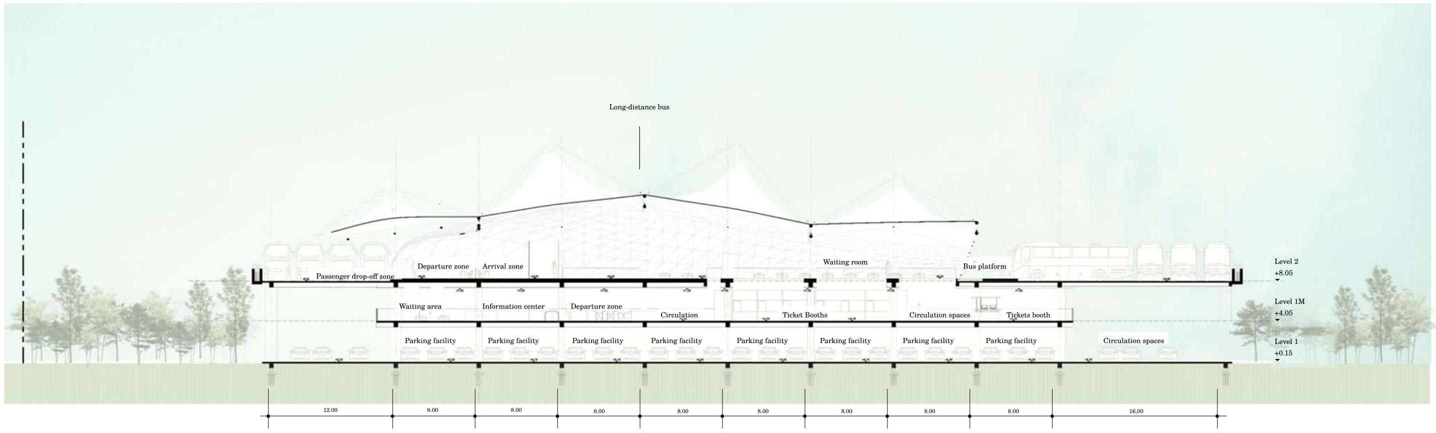
*Open Space – Oasis Pocket*

## Structural Systems & Building Materials

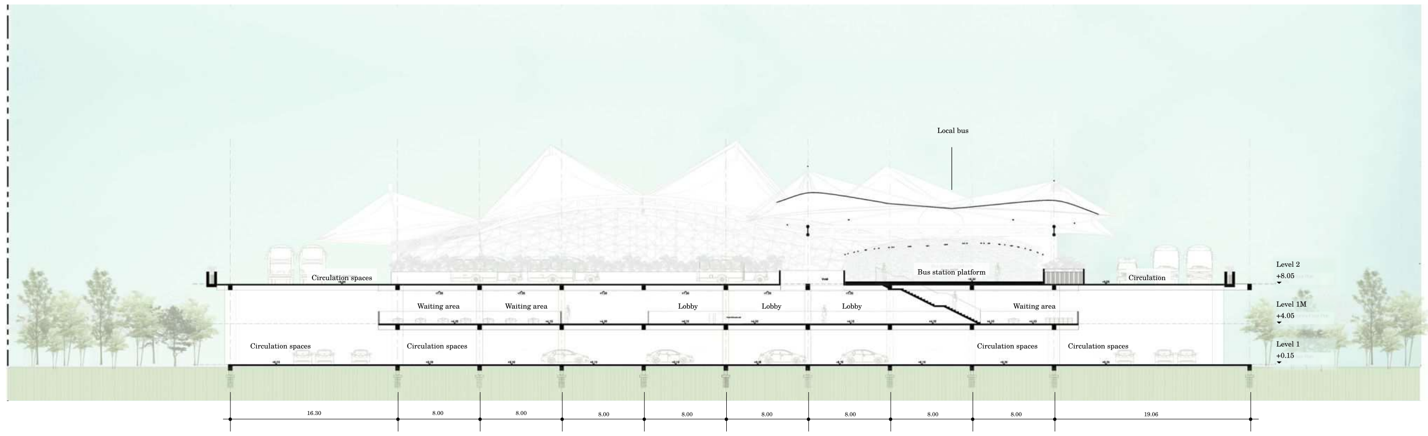



The ground and mezzanine floors' parking areas and general functions are efficiently supported by a reinforced concrete structure, optimizing the parking grid module. In contrast, the platform functions for long-distance buses, local buses, and TransJakarta utilize a steel 2D truss structure with a PVTE fabric tensile membrane. The terminal design prioritizes passengers' thermal comfort, evident in the 'oasis pocket,' an open space at the center contributing to a pleasant atmosphere.

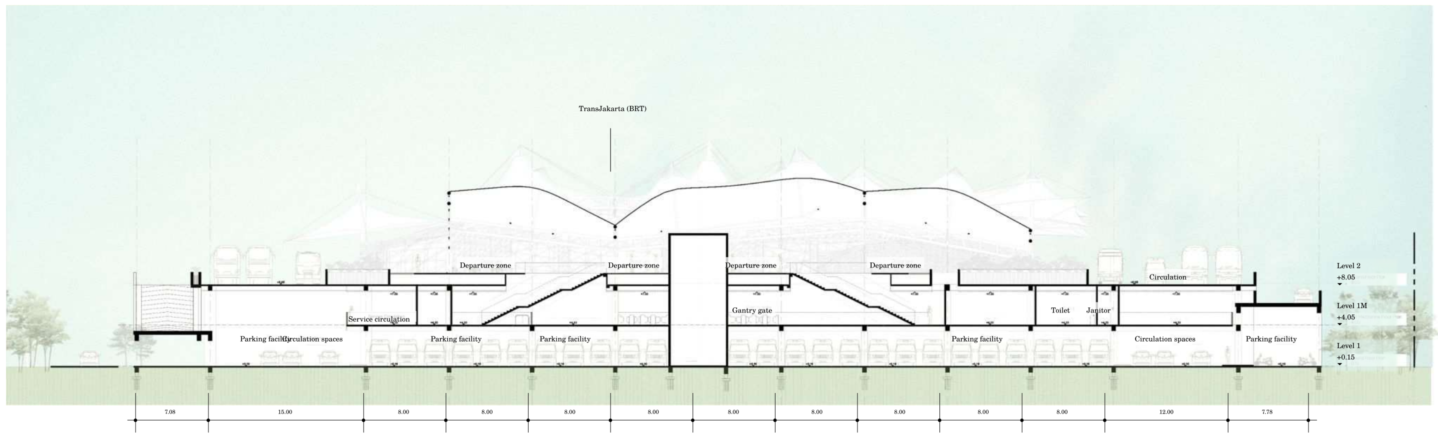
## Vertical Connectivity



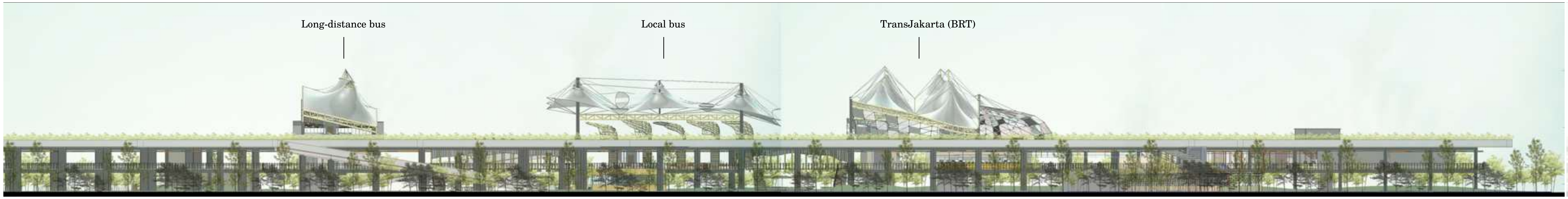

Section A-A




Section B-B




Section C-C




*East Elevation*

# Hawker Center Jakarta Experimental

*Innovative Concepts & Designs Emerging from Thematic Experimentation*

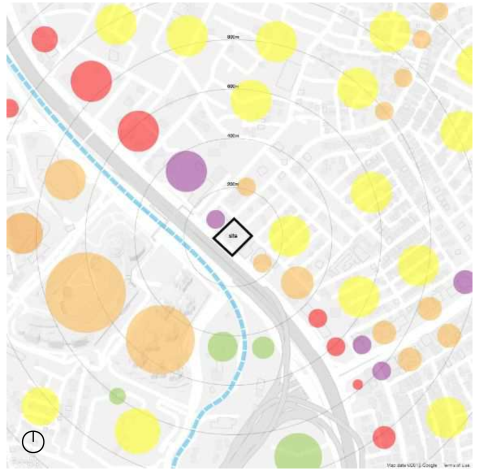
*Bachelor's Experimental Studio – 2019 | Experimental Design; Parametric Design; Tensile Structures | West Jakarta, Indonesia*

**Type** Individual work
**Software** Rhino, Grasshopper, Kangaroo 2, Paneling Tools, Lumion, Photoshop & Illustrator
**Instructors** Trianzani Sulshi & Audrey Juliana
**URL** https://arnottferels.github.io/work/hawker-center-jakarta-experimental

This project relocates informal street vendors from West Jakarta along Letjen. S. Parman Rd, using experimental architectural exploration to create multi-dimensional spatial definition. Featuring a floating acrylic vista for zone and circulation definition, the design addresses challenges of limited green space and diverse zones near the busy road. Integrating experimental layers, materials, and facades, the Hawker Center creatively tackles the district's shortage of public spaces and green areas. The split structure incorporates elements like a steel frame, polycarbonate panels, and tensile structures, enhancing architectural creativity and the urban environment.

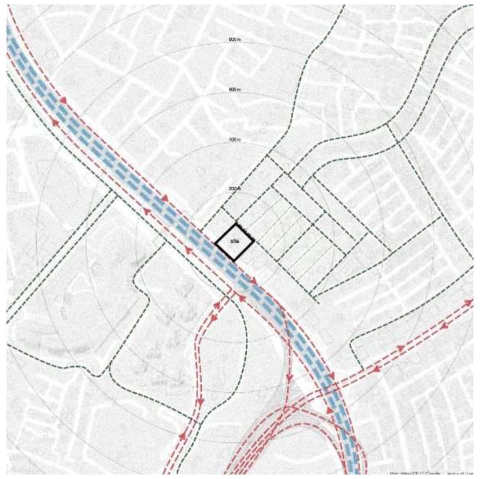
## Site Analysis

*Zoning*



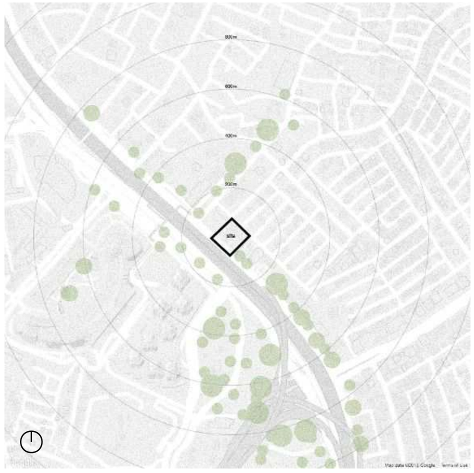
Commercial  Government  Residential
Mix-used  Greenery

*Circulation*



Highway  Artery road
Local road  Private road

*Greenary*



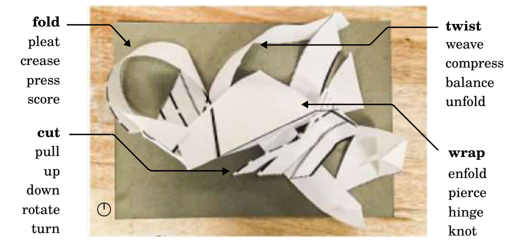
Heavy  Medium  Light

The site is positioned adjacent to the vibrant Letjen S. Parman road, extending from the West to the South. It is surrounded by diverse zones, including commercial, government, and residential areas. The vicinity comprises various road types, ranging from expansive highways to smaller local ones, emphasizing the significance of mobility considerations. Tall buildings with mixed functions encompass most sides, while shorter residential structures are situated on the Northern and Eastern sides. Unfortunately, there is limited green space in the area.

*Aerial view – Hawker Center Jakarta Experimental*

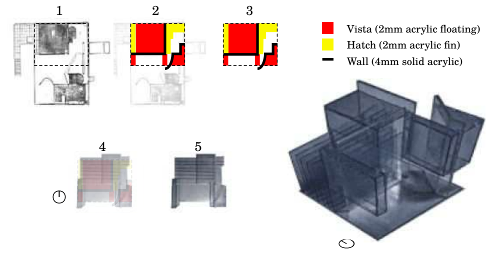
## Experimental Architectural Exploration – From Abstraction to Form

1 **Daydream Spaces**
Creating abstract geometry with annotated printouts crafted from cut verbs and nouns.

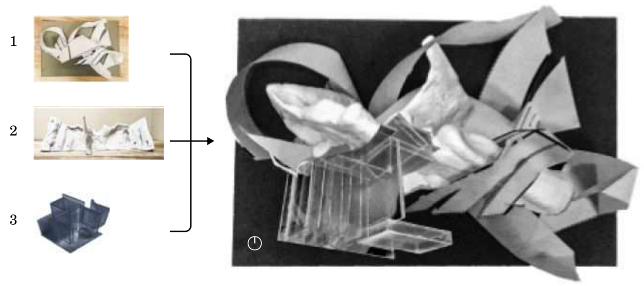



2 **Dance and Space**
Forming dance movement with clay.

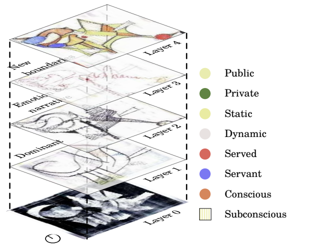

3 **Open Text**
Crafting acrylic plans to shape spatial divisions.



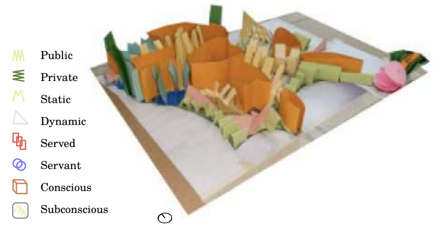

4 **Space Aggregation**
Creating an intriguing aggregation derived from Steps 1, 2 & 3.



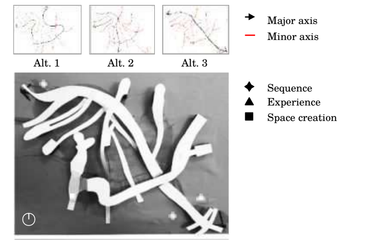
5 **Architectural Notation**
Symbolically representing architectural concepts in 2D.



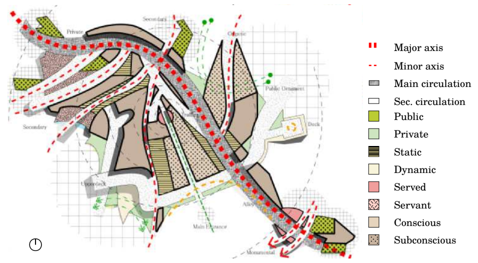

6 **Multi-dimensional**
Defining spatial zones unexpectedly in 3D from the 2D of step 5.



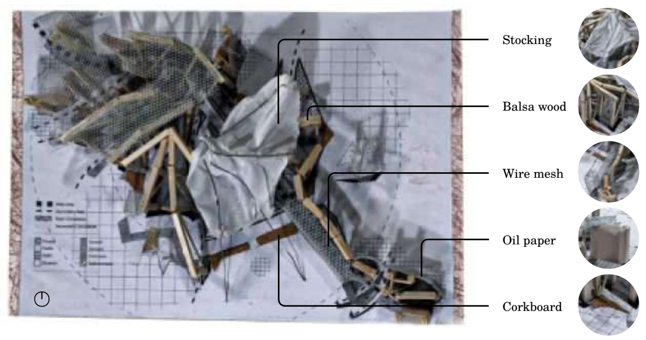

7 **Movement as Circulation**
Defining spatial flow and circulation from its main axes.



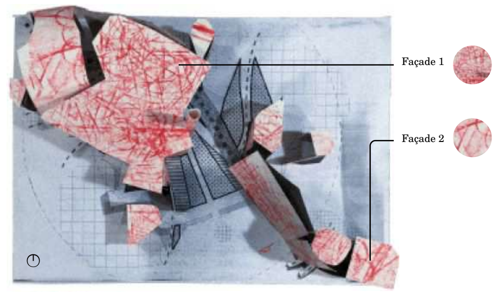

8 **Layer and Function**
Determining experimental layers and integrating functions.



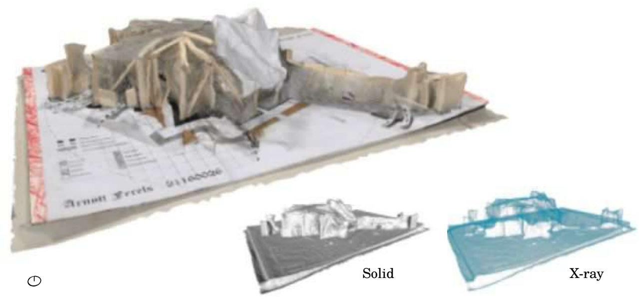

9 **Structures and Materials**
Defining architectural elements and material palette based on representative materials.




10 **Façade Framework**
Determining the form and geometric face patterns.




11 **Photogrammetric Analysis**
Architectural evaluation through photogrammetry & documentation.




This architectural workshop delves into themes such as abstract geometry, dance movement, spatial aggregation, and architectural notation through experimental exercises. We engage in manipulating materials, creating layers, and evaluating structures using photogrammetry to foster creativity and innovation in architectural design.

## Design Strategy

**Location**
Strategically situated on Letjen. S. Parman Rd., the site accommodates schools, offices, and residences.

**Hawker center**
Organizing a centralized Hawker Center to accommodate and relocate informal street vendors from Tomang, West Jakarta.

**Supporting functions**
Integrating vital supporting functions, such as public spaces and green areas, to tackle the district's shortage.

**Educational space**
Introducing an educational space for new street vendors, addressing the lack of formal education based on surveys.

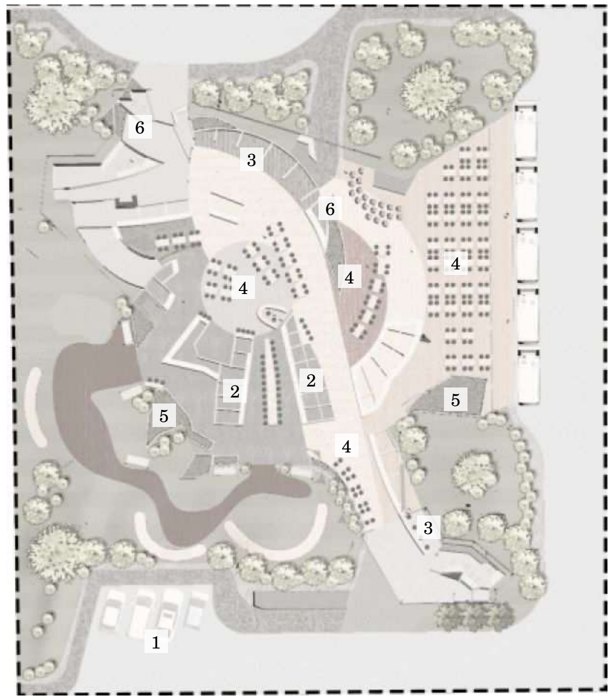
**Multifunctional design**
Creating flexible areas capable of serving multiple functions, ensuring optimal utilization.

**Temporary kiosks**
Utilizing easily assembled materials for temporary street vendor kiosks, enhancing adaptability for various events.

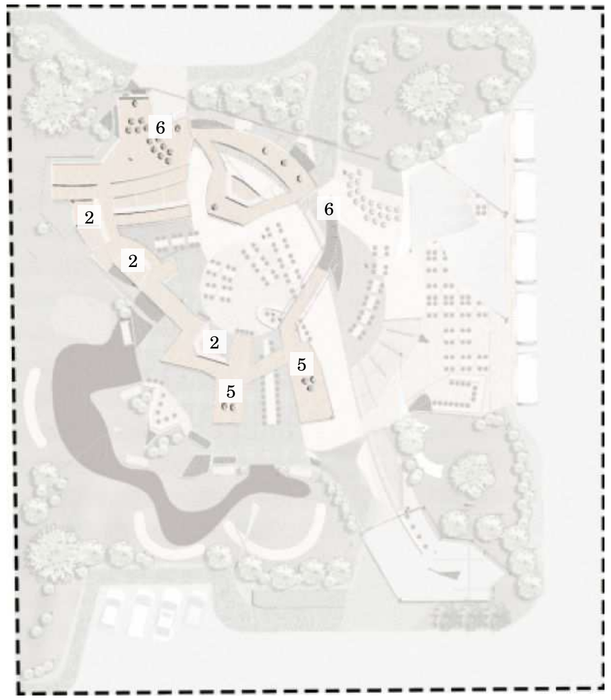
**Accessibility**
Prioritizing accessibility for all, particularly focusing on flat and non-slip surfaces for the ground floor.

**Circulation**
Creating a clear axis from the arterial road to Gelong Rd. for easy orientation and maintenance.

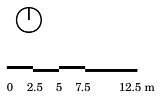
## Programs



*Level 1*



*Level 2*

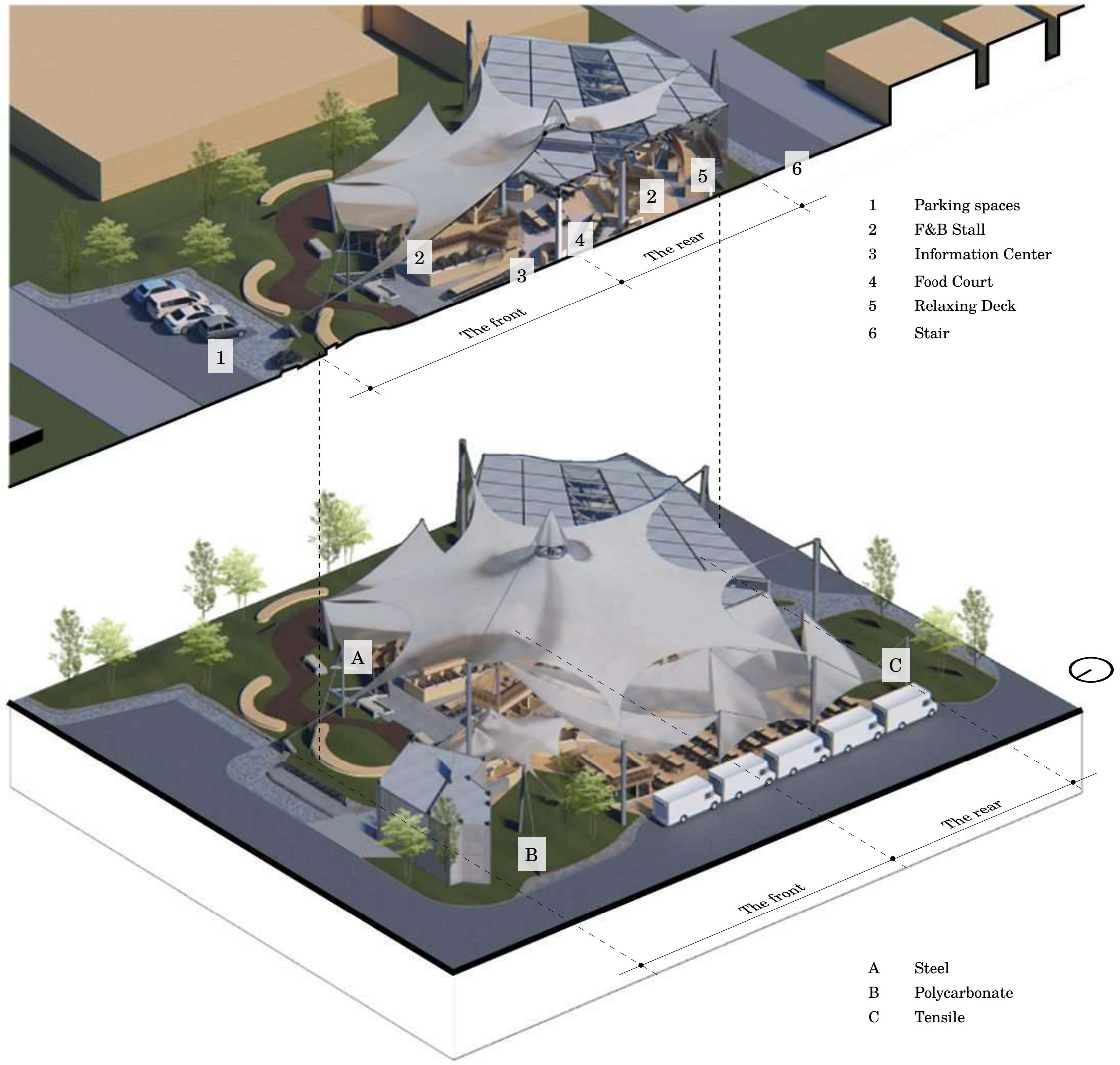



1 Parking spaces
2 F&B Stall
3 Information Center
4 Food Court
5 Stair

The initial level includes public F&B stalls, food courts, and dining areas. The Northeast section hosts a private service area. Additionally, mini F&B stalls and conference rooms on the first floor create a semi-private character.

*Front elevation (Southwest)*

## Programs *(cont.)*




1 Parking spaces
2 F&B Stall
3 Information Center
4 Food Court
5 Relaxing Deck
6 Stair

A Steel
B Polycarbonate
C Tensile

The structure is split into two primary segments: the front, designated for public use, and the rear, allocated for private and service purposes. A commercial zone and public space are positioned between these two segments.

*Bicycle park*

*Food court (atrium)*

*Food court*

*Main entrance*

# Circular Hub

*Lingkaran Hubung - Community Integration through Ecosystem, Culinary & Education*

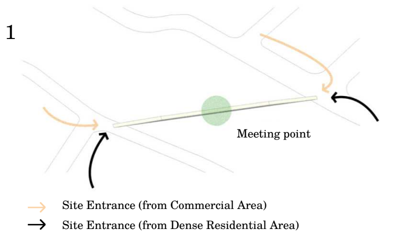
*National Student Competition – 2018 | Placemaking; Inclusive Design; Design Participatory | Central Jakarta, Indonesia*

**Type** Professional Competition by Perumnas (National Urban Development Corporation)
**Award** Top 10 & Favorite
**Contributions** Research, Concept, Design, Modeling & Visualization
**Software** SketchUp, Lumion, Photoshop & Illustrator
**Collaborators** Steven Verdianta & Billy Kurniawan
**URL** `https://arnottferels.github.io/work/circular-hub`

This project signifies a transformative change at Jakarta's Kebon Melati Reservoir (KMR), establishing connections among communities through a circular design, inclusive culinary spaces, and versatile platforms. The primary objectives include boosting the local economy and addressing Nature Deficit Disorder, creating a harmonious environment for community growth. Established in 1966, KMR holds a vital role in Jakarta, strategically positioned between slums and commercial areas, near landmarks like Grand Indonesia Mall, Thamrin Residence, and Mall. Serving as a connecting bridge, the reservoir dynamically transforms, reflecting the principles of Jurgen Habermas, the German philosopher.

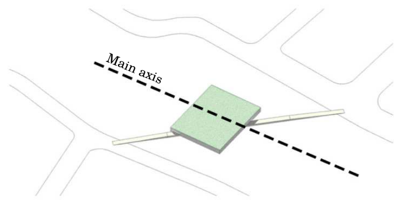
## Generate – Inclusive Architectural Solutions for Community Enrichment

1



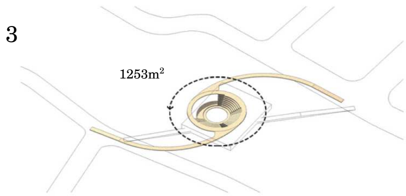

Creating a bridge using a ramp to connect various societies.

2



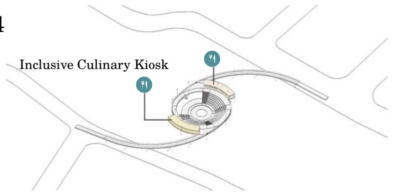

Developing a versatile platform for inclusive social and spatial activities.

3



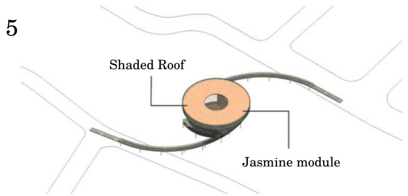

Utilizing a circular shape to eliminate spatial boundaries.

4




Implementing an Inclusive Culinary Kiosk platform to boost the local community's economic condition around the KMR.

5




Implementing a shading roof for those on the move and establishing an area for thriving jasmine flowers.

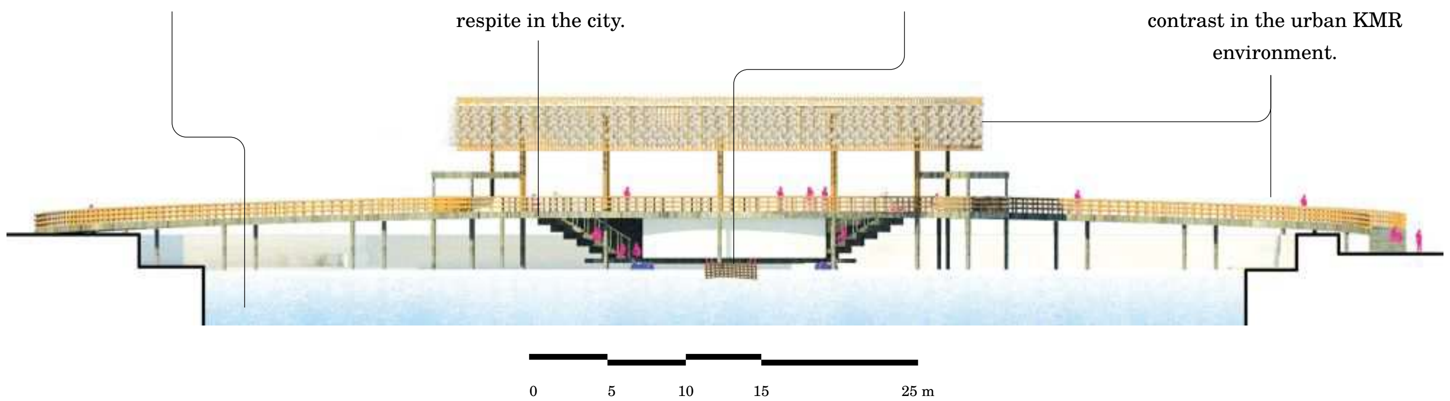
## Programs – Ecosystem Integration for Community Enhancement

**Water Use**
Irrigating jasmine flowers for enhanced greenery.

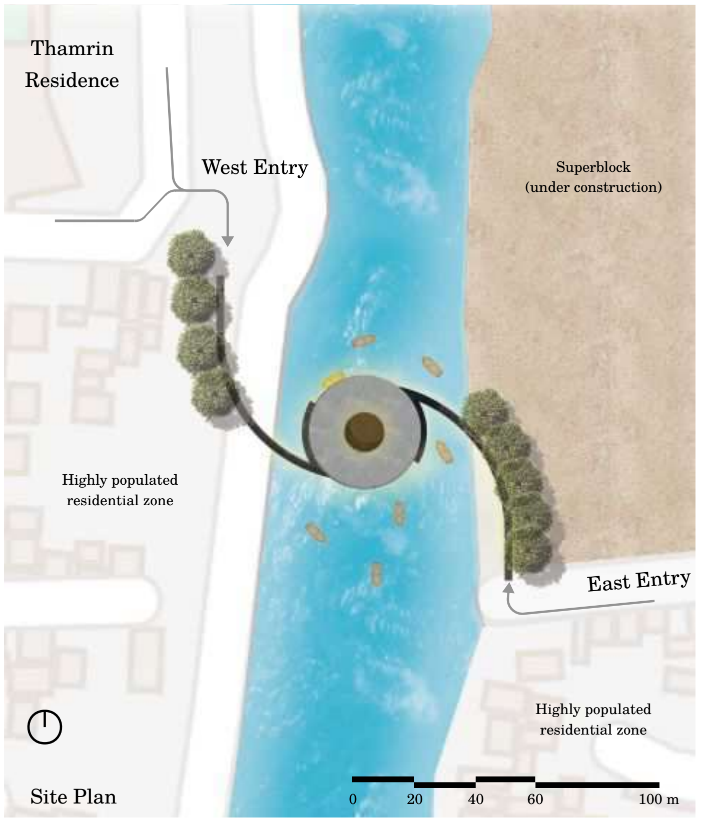
**Grass & Concrete Design**
Creating visual diversity with patterns, offering a green respite in the city.

**Fishnet Installation**
Fostering a safe connection between people and nature.

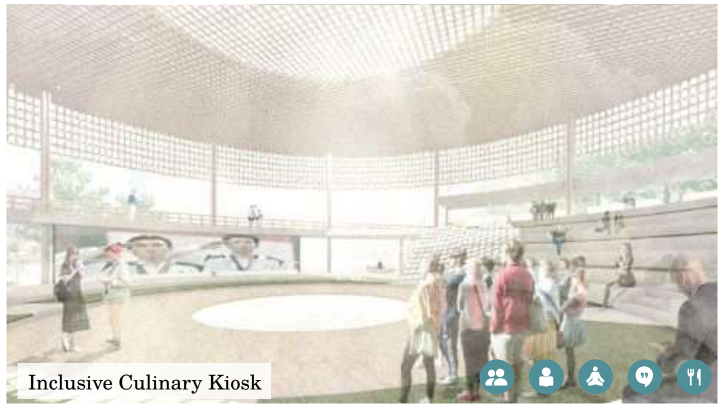
**Bamboo Module**
Serving as containers and roofs, providing aesthetic contrast in the urban KMR environment.




## Programs – Ecosystem Integration for Community Enhancement *(cont.)*




Site Plan

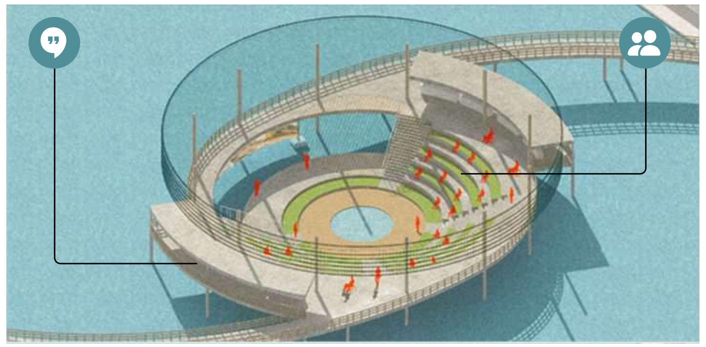


Inclusive Culinary Kiosk

The Platform

## Activities – Holistic Platforms for Community Integration

Hangout platform | Communal platform | Education platform | Reflection platform | Culinary platform



*Education scheme*

*Communal scheme*

# Rawa Buntu Station 2.0

*Revolutionizing Urban Mobility through 'Order in Circulation'*

*National Competition – 2019 | Transit Design; Behavioral Design | South Tangerang, Indonesia*

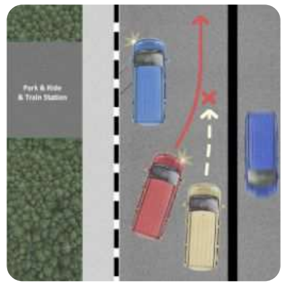
**Type** National Student Competition by Tarumangara University (Architectural Design Week)
**Award** Top 10
**Contributions** Research, Conceptual Design, Design Development & Visualization
**Software** SketchUp, Lumion, Photoshop & Illustrator
**Collaborators** Oliver Kenny & Harry Marvin
**URL** `https://arnottferels.github.io/work/rawa-buntu-station-2-0`

This project introduces a redesigned station to improve how people move around the existing station. The main idea in this design is called 'Order in Circulation.' The key focus is on organizing the movement of passengers, couriers, cars, motorbikes, and apartment residents. By solving the main issues at Rawa Buntu Station, the overall urban environment is expected to become more efficient and organized.

## Issues & Strategies

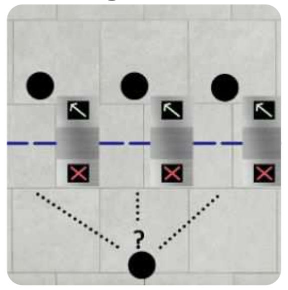
**Issue**

### Traffic congestion



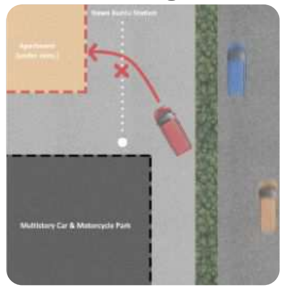

Main road congestion at Rawa Buntu Station

### Passenger collisions



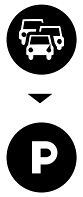
Clashes at the tap-gate system between arriving and departing passengers

### Station congestion

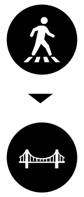



Cross-circulation causing congestion within the station

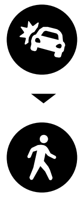
**Strategy**



Create a new parking setup to ease congestion.



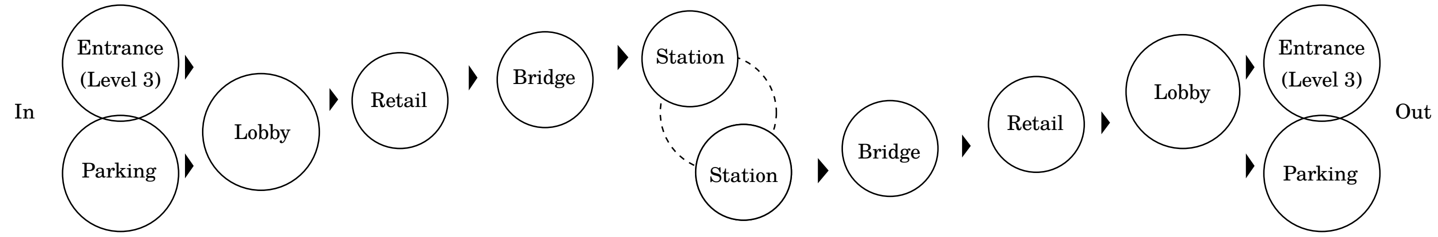
Redesign the tap-gate system to prevent collisions



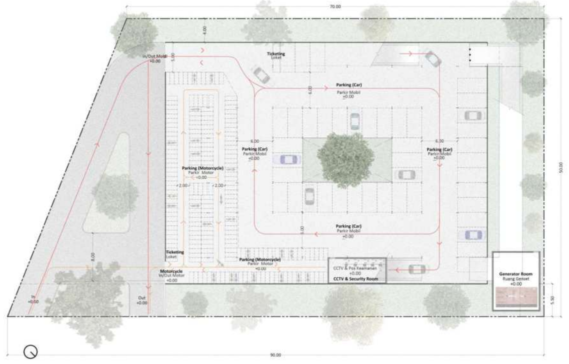
Introduce a dedicated passenger bridge to improve flow.

*Aerial view – The bridge & viewing deck*

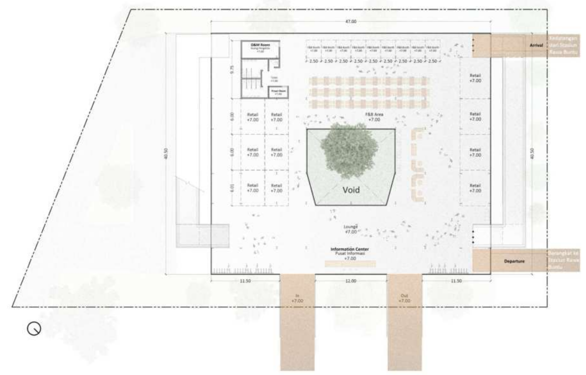
## Concept & Programming – Order in Circulation



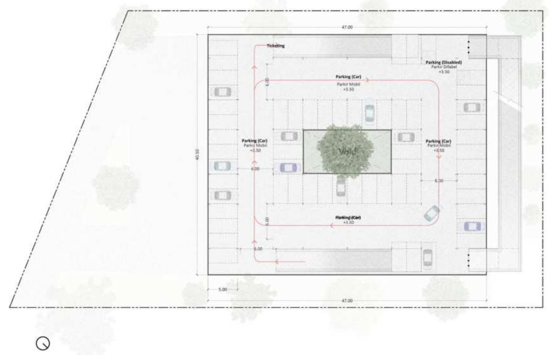

This initiative aims to create a distinctive public parking facility by emphasizing comfort, openness, and inclusivity, including features for people with disabilities. The goal is to encourage a shift in community behavior towards utilizing public transportation, reducing the impact of traffic congestion.



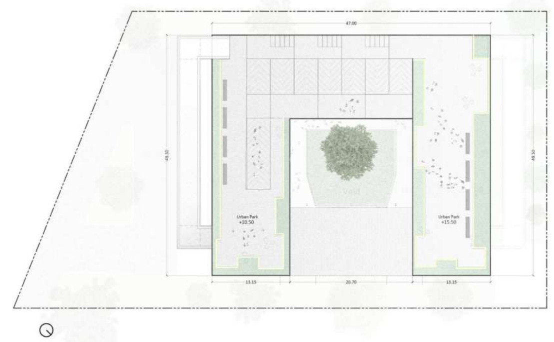
Level 1



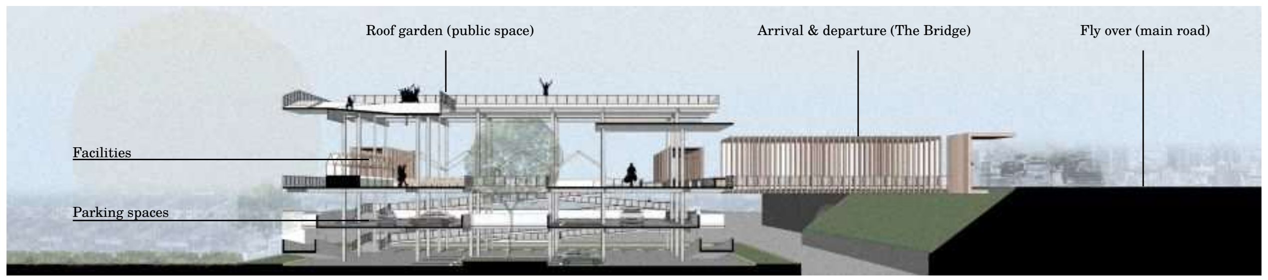
Level 3



Level 2

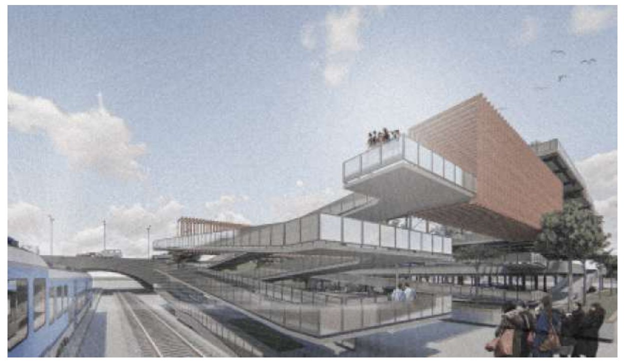


Level 4 (Rooftop)




*Front elevation (Southwest)*

*The Bridge & viewing deck*



*Ramp from/to the train platform*

# LUNA

*Living in Urban with Nature – Placemaking for Community Spaces & Local Business Support*

*ITB Summer Course – 2022 | Creative Branding; Placemaking; Design Participatory | South Jakarta, Indonesia*

| | |
|---|---|
| **Contributions** | Research, Conceptual Design & Visualization |
| **Software** | Rhino, SketchUp, Twinmotion, Photoshop & Figma |
| **Collaborators** | Placemaking Group B (Analisia, Asyara, Bintan, Fadhilah, Fathur, Karunia, Prisca, Reliya, Shanina & Zahrul) |
| **Instructors** | Widiyani & Ardzuna Sinaga |
| **URL** | `https://arnottferels.github.io/work/luna` |

This project, named LUNA (Living in Urban with Nature), repurposes an old Paragon warehouse in Jakarta into a sustainable community space. Focused on inclusive green areas, eco-friendly practices, and diverse activities, LUNA transforms the space into a vibrant hub supporting local businesses. With plans for culinary events, sales training, and shared kitchen experiences, LUNA aims to boost the Agricultural Hub brand through effective marketing and social campaigns. The project seeks to diversify revenue streams with co-working spaces and retail sales, ensuring sustained success and community enrichment. In summary, LUNA is an architectural initiative aligned with local needs, transforming an underutilized space into an environmentally conscious haven.

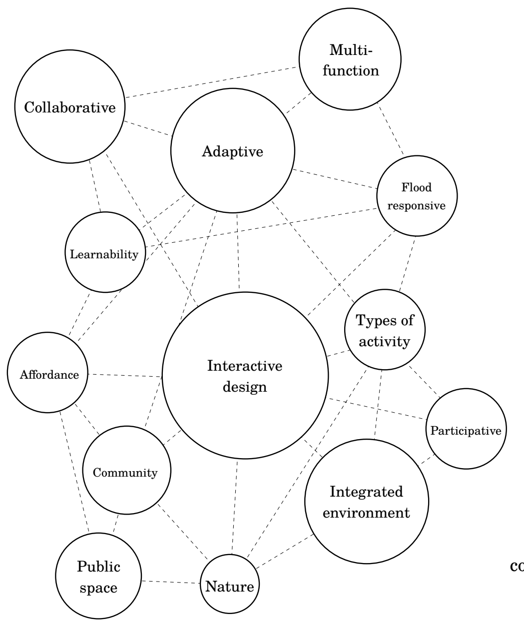
## Design Concept

The project aims to create a collaborative space for the surrounding community, fostering engagement and interaction.

In response to user needs, the project provides study rooms, promoting empowerment for both individuals and the surrounding environment.

The project is accessible to the community and serves as a supportive space for local small and medium enterprises

The design emphasizes inter-space integration, creating strong connections between the community, public space, and nature.




Projects are designed to accommodate various functions with adaptable spaces that respond to changing needs over time.

To address flooding concerns, the project incorporates pilotis building models and catchment areas, allowing for activities during non-flood periods.

Projects offer the flexibility to accommodate various types of activities in parks and adaptive reuse buildings.

The project actively involves local communities in the design and construction processes of different areas, ensuring a collaborative and inclusive approach.


## Design Framework

### Vision & Mission

**Vision**

Designing eco-friendly spaces to enhance local well-being

**Mission**

Creating a sustainable park supporting robust public activities

Developing adaptive reuse buildings with Eco-friendly designs for productivity and user welfare

### Issues

- Lack of study room
- Lack of play & sport area
- Lack of play & sport area
- Lack of health services
- Lack of business area

### Opportunity

- Warehouse utilization
- Less productive land: ±2,000m²
- High mutual values
- Organic waste awareness
- Citizen gardening enthusiasm

### Strategy

- Adaptive approach
- Public space & Nature Integration
- Interactive strategy
- Sustainable food system

### Programming

- Education
- Playroom
- Multifunction
- UMKM
- Open space
- Agriculture
- Sport
- Shared Kitchen

### Users

- Children
- Common
- Adult

### Improvements

**Mutual Value**

- Playing
- Gathering
- Studying
- Gardening

**Economy Value**

- Cooking
- Selling
- Trad. cuisine
- Veil & Rug factory
- Handicraft

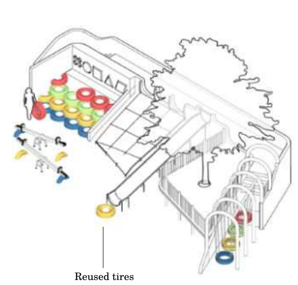
## Activities

| Time | Public Park | Ex-Warehouse |
|---|---|---|
| Morning<br>05:00 AM - 02:00 PM | Sports Zone, Public Park, Plaza & Street Market, Agricultural Hub, Play Area | Co-working space, Retail Space |
| Afternoon<br>2:00 PM - 7:00 PM | Counseling & educative discussion, Plaza & Street Market, Agricultural Hub, Play Area | Co-working space, Retail Space, Canteen & Shared Kitchen, Learning Hub |
| Evening/Night<br>7:00 PM - 12:00 AM | Outdoor events | Indoor events |

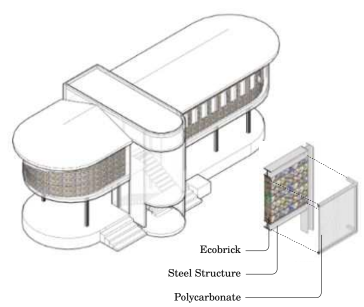
The facility meets community needs with spaces for sports, cultivation, sightseeing, and gatherings. It offers areas for play, work, study, and shopping. The Badminton Court hosts sports, and the Park serves as a venue for community gatherings. The Shared Kitchen features monthly programs like 'cooking with a chef.' In summary, it's a compact and accessible hub for diverse activities.

## Participatory Design

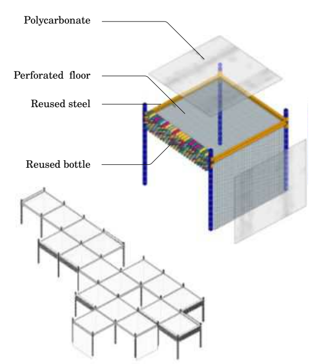
**Play Area**



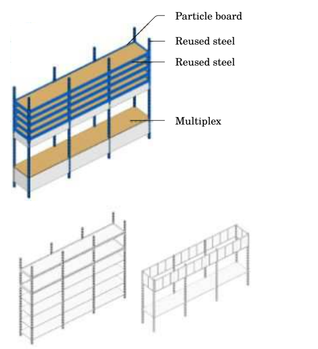

**Community Hall**




**Pavilion**
(Plaza & Street Market)

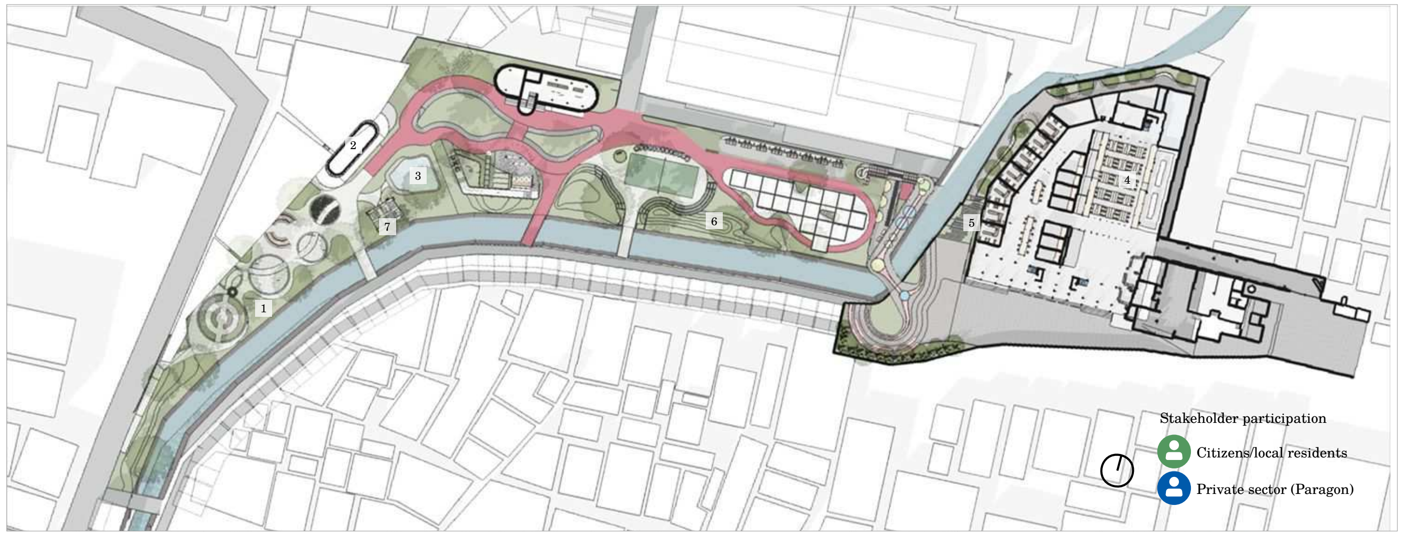



**Canteen & Shared Kitchen**




Participatory design guides our use of recycled materials in the Playground, Community Hall, Pavilion, and Canteen & Shared Kitchen, employing sustainable elements like polycarbonate, particle board, perforated floor, and reused steel for an eco-friendly approach. This commitment aligns with our vision for a sustainable, community-centric environment.

## Sustainable Food System Integration: Public Park & Warehouse (Local Residents)



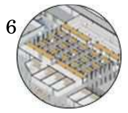

1  **Producing**
Crop (conventional)

2  **Producing**
Crop (hydroponics)

3  **Producing**
Crop & fish (aquaponic)

4  **Processing**
Shared Kitchen

5  **Retail**

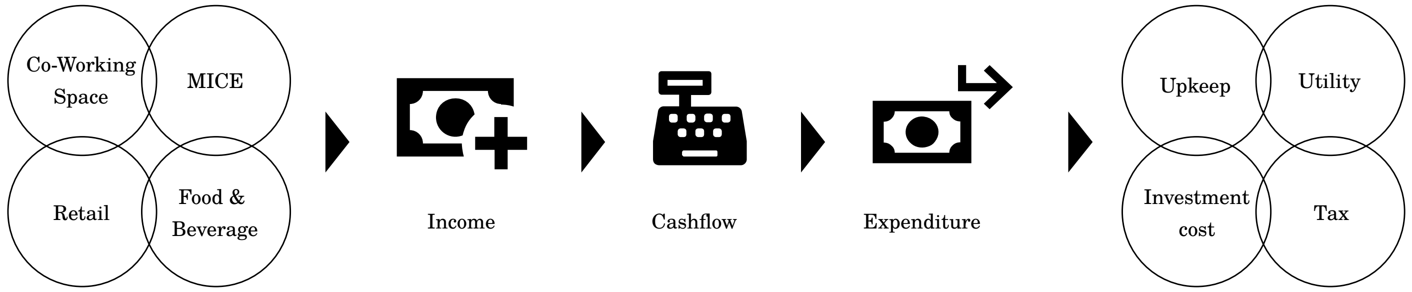
6  **Consumer**
Canteen

7  **Waste Management**
Aerobic composting & vermicomposting

## Sustainable Food System Approach for Construction Phase

| Phase | Park participatory plan | | Ex-Warehouse development plan | |
|---|---|---|---|---|
| | *Development* | *Time est.* | | |
| 1  Park completion 50%<br>Ex-Warehouse 0% | Collecting used materials (tires, drums, plastic/glass bottles) | *6-12 mos* | *Warehouse area construction has not been started* | |
| | The making of guard fence using eco-brick | *2-4 wks* | | |
| | Bridge structure manufacturing and bridge eco-brick | *2 wks* | | |
| | Land leveling for sport arena and temporary place of gathering | *4 wks* | | |
| | The making of guard fence using eco-brick | *4-8 wks* | | |
| | *Development* | *Time est.* | *Development* | *Time est.* |
| 2  Park completion 100%<br>Ex-Warehouse 50% | Agricultural Hub and Green House construction | *4-8 wks* | Tidying the site, sorting, and taking out of shelf structure | *4-6 wks* |
| | Plaza & Street Market (Pavilion) construction using structure from Ex-Warehouse | *4 wks* | Construction of partition & utility, and landscape for first floor (Canteen & Shared Kitchen) and second floor (Learning Hub) | *4-6 wks* |
| | Construction of Connecting Deck to Co-working Building (Ex-Warehouse) | *4-8 wks* | | |
| 3  Park completion 100%<br>Ex-Warehouse 100% | *Park area construction has completed* | | Brand image building, marketing & event management | |
| | | | *Development* | *Time est.* |
| | | | Construction of partition & utility for additional function of retail F&B and non F&B | *4-6 wks* |

## Financial Scheme




The financial strategy relies on revenue from Co-Working Space, MICE events, art performances, and profit sharing from retail and F&B sales in repurposed Ex-Warehouses. These funds support the maintenance and activities at Public Park, fostering a sustainable business ecosystem.

## Stakeholder Engagement & Sustainable Initiatives

**Citizens/ Local Residents**

as target users, activity participants, and managers.

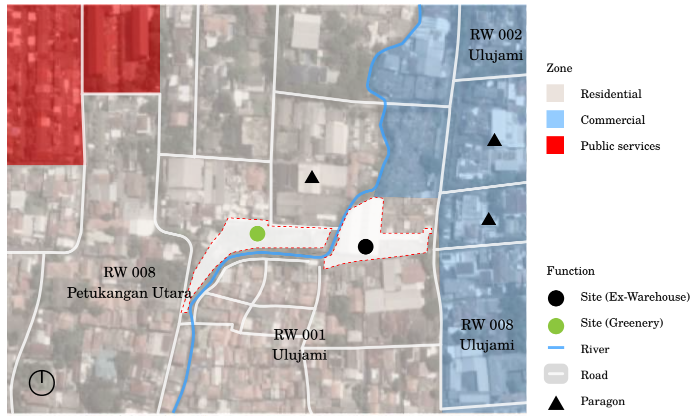
RW 008 Petukangan Utara

RW 008 Ulujami

RW 001 Ulujami

RW 002 Ulujami

In Indonesia, RW, or 'Rukun Warga,' is a community unit overseeing neighborhood affairs, fostering collaboration, and addressing local issues for residents' well-being.




**Paragon**

as the landowner and facilitator.

**Retail & Brand Management**

Having a streamlined assets and retail team, Paragon offers sales training to residents. Monthly cooking events at the Shared Kitchen, featuring guest chefs, aim to attract diverse audiences.

**Integrated Brand Empowerment**

Prioritizing the brand's centrality in project activities, Paragon initiates a social experiment and campaign to effectively engage the target audience. Practical approaches for online and offline orders, coupled with straightforward strategies, elevate the brand's market visibility.

**Customer Engagement Initiatives**

Introducing a loyalty program tailored for Co-working and Shared Kitchen customers, Paragon aims to enhance customer loyalty and satisfaction.

*Agricultural Hub*

*Community Hall*

*Play Area*

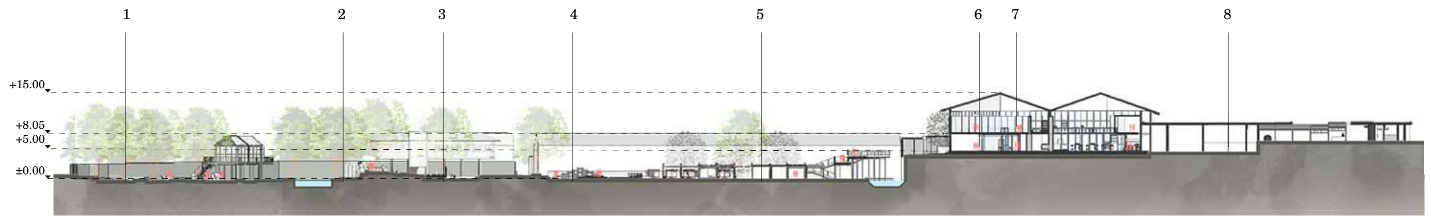
*Sports Zone*

*Canteen & Shared Kitchen*

*Plaza & Street Market (Pavilion)*

*Community*

*Co-working Space & Event Hall*



# Modeling with Algorithms

*Expressing Computational Thinking in Design*

*Personal Project – 2023 | Parametric Design; Algorithm Design; Architectural Visualization*

**Software** Rhino, Grasshopper & Twinmotion
**URL** https://arnottferels.github.io/concept/?v=g

In this project, I explore algorithmic modeling using Rhino and Grasshopper, with the goal of integrating my skills to express computational design thinking and methods through the abstraction and implementation of architectural geometry in both parametric and generative approaches. The main focus is on showcasing these concepts through prototyping modeling. Inspired by Bryan Albeiro García Agudelo's visualization approach, the project emphasizes the significance of clarity and standout features in the visualized model, employing monochrome styles to enhance the architectural work.

X Transit Hub

X Transit Hub

X Transit Hub

X Transit Hub

Inspired by El Palmeral de Las Sorpresas by Junquera Arquitectos, with modifications.

El Palmeral de Las Sorpresas

Inspired by El Palmeral de Las Sorpresas by Junquera Arquitectos, with modifications.

El Palmeral de Las Sorpresas

Voxel Space 1

Voxel Space 2

Voxel Space 3

Voxel Space 4

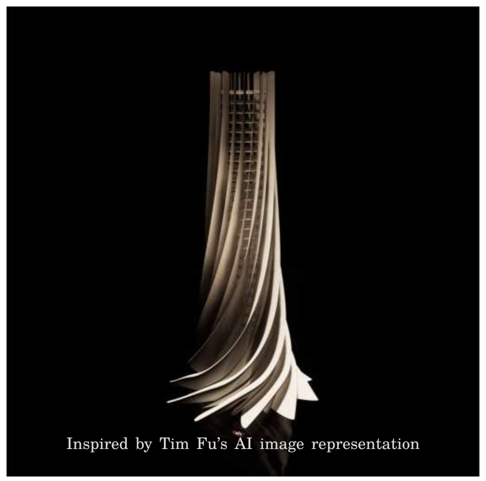
Christmas Tree 1

Christmas Tree 2

Boundless Wings

Inspired by Lina Ghotmeh's Serpentine Pavilion project

Serpentine Pavilion

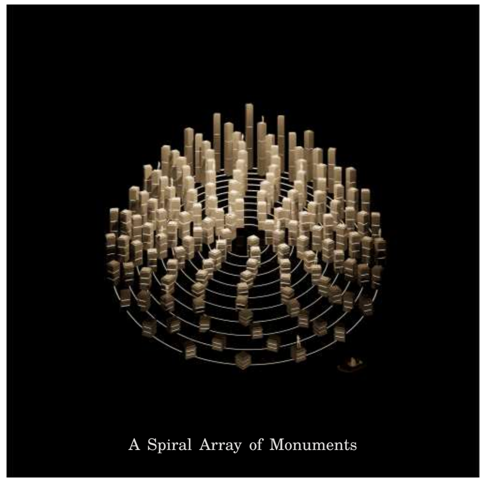


Inspired by Tim Fu's AI image representation

Boundless Skyspace

Onion

Pulse Tower



A Spiral Array of Monuments

Helix Spire Symphony