P O R T F O L I O

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ABOUT ME

I am an MSc Digital Design and Manufacturing student at PrintCity with a system-level approach to engineering problem-solving. My background in architecture and urban design has trained me to structure complex problems, manage constraints and translate high-level concepts into practical outcomes.

I apply this approach to additive manufacturing and reverse engineering, combining 3D scanning, CAD reconstruction and physical prototyping to support reliable, real-world production workflows.

01 Replacement Enclosure

Reverse Engineering an Air Pump Housing

This project focuses on reverse engineering a missing enclosure for an aquarium air pump, addressing a common issue in consumer products where the failure or loss of a single component renders an otherwise functional device unusable.

Through a structured workflow combining structured-light 3D scanning, scan data processing, parametric CAD reconstruction, and iterative additive manufacturing, a functional replacement enclosure was digitally recreated and physically tested.

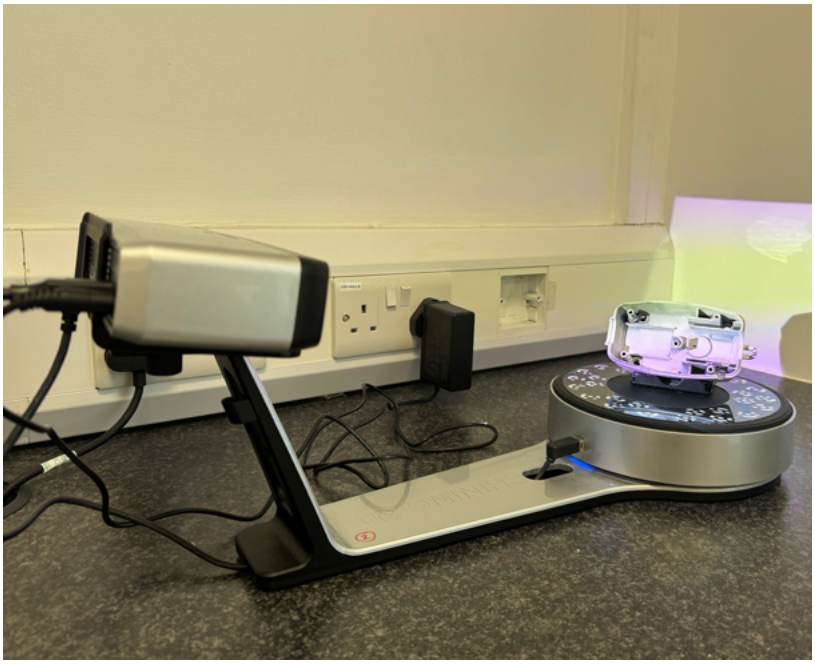
The project demonstrates how digital design and manufacturing techniques can support repair, extend product lifespan, and reduce unnecessary electronic waste, while also highlighting the importance of geometric accuracy, material selection, and print optimisation in real-world reverse engineering applications.

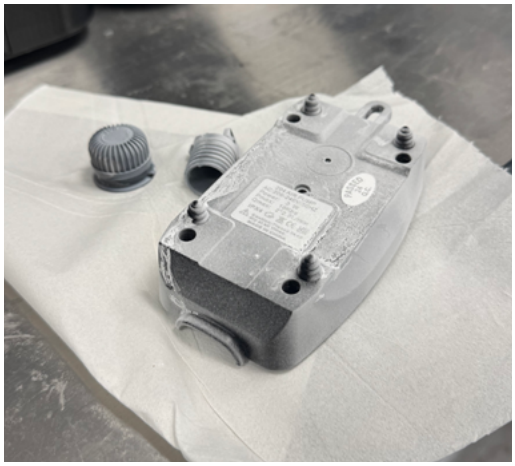
Background

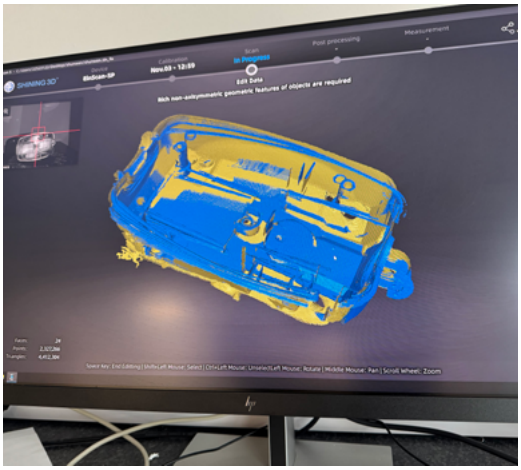
This project addresses repairability and right-to-repair challenges by using reverse engineering and digital manufacturing to produce a functional replacement component in alignment with WEEE principles.

Issue and Task

A missing air pump enclosure exposed internal components; the task was to reverse engineer and digitally manufacture a replacement.

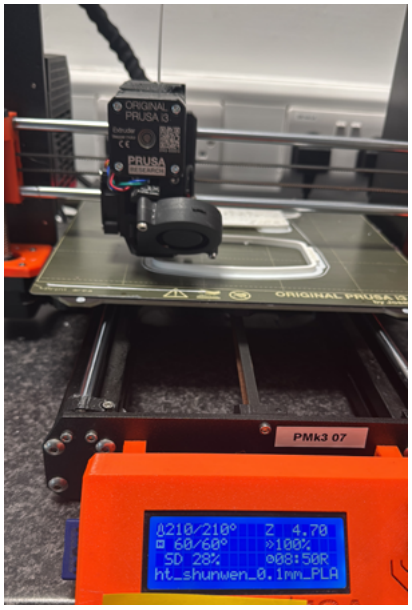






1. Structured-light 3D Scanning

Structured-light 3D scanning was used to capture the geometry of the air pump.



2. Scan Data Test

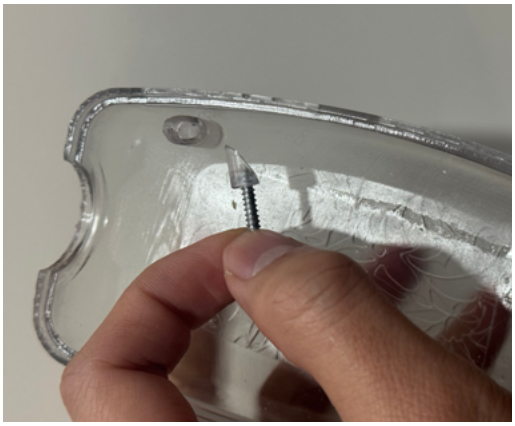
The reconstructed geometry was 3D printed to evaluate the accuracy of the scan data. Physical fit testing with internal components confirmed acceptable dimensional fidelity.

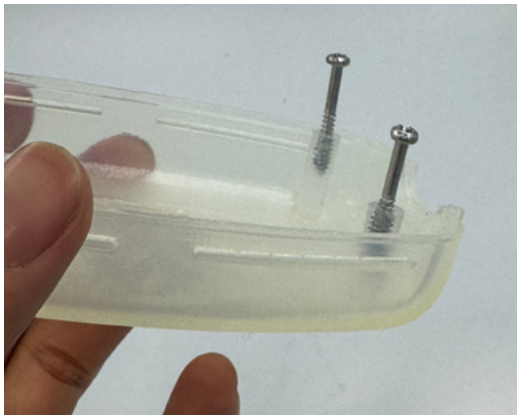
3. Geometric Fit Iteration

Geometry was iteratively refined to achieve accurate fit with the air pump components.

4. Functional and Aesthetic Optimisation

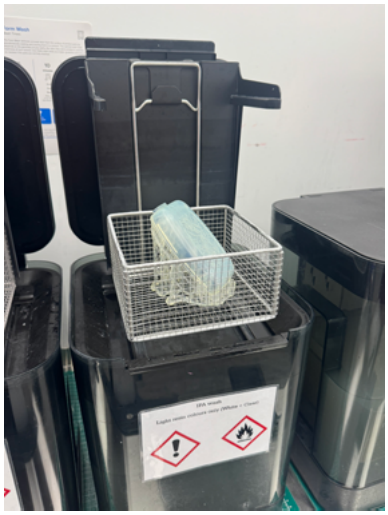
Functional features and surface details were refined to improve usability and overall build quality.

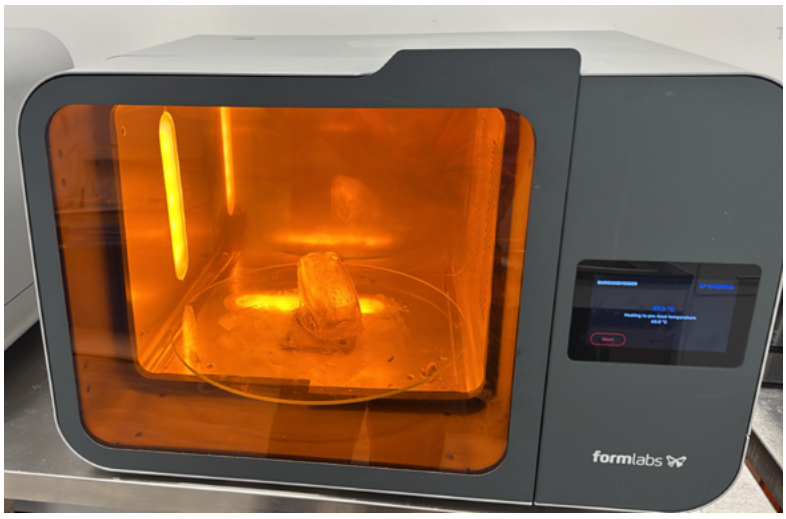




5. Material Selection

Materials were evaluated to balance strength, durability, and suitability for assembly.





6. Post-processing

Post-processing was carried out to remove supports and fully cure the printed part for final strength and fit.

7. Physical Testing

Physical testing was conducted to verify fit, assembly, and functional performance.

02 ANTE

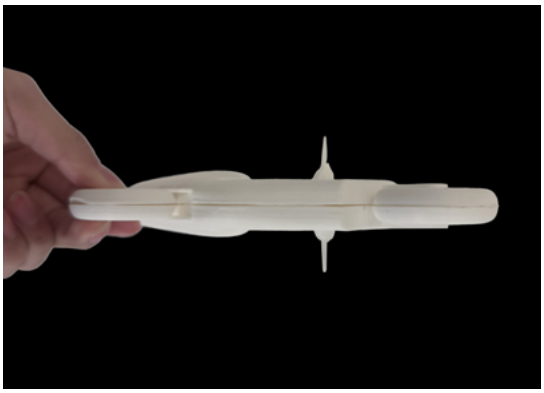
Lightweight Emoped Prototyping

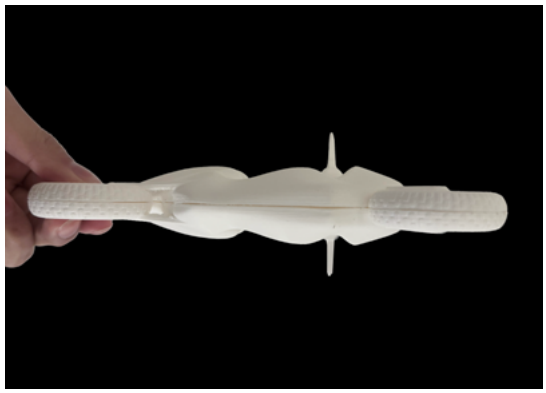
This project explores a lightweight e-moped concept for the UK urban mobility context through a manufacturing-led design workflow.

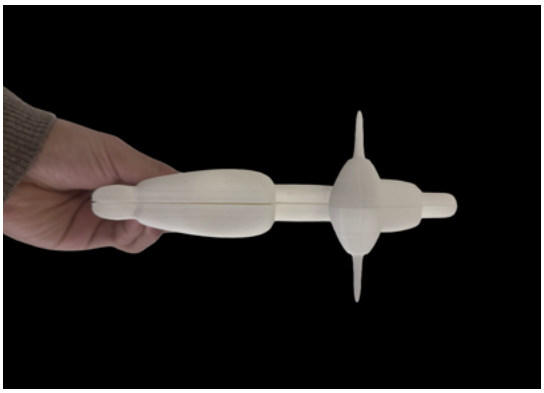
The development was driven by iterative CAD modelling and additive manufacturing, with multiple generations of 3D-printed prototypes produced to test form evolution, functional packaging, and assembly relationships. Rather than serving as a final validation step, physical prototyping was used throughout the process to generate rapid feedback and inform design decisions based on real-world constraints and manufacturability.

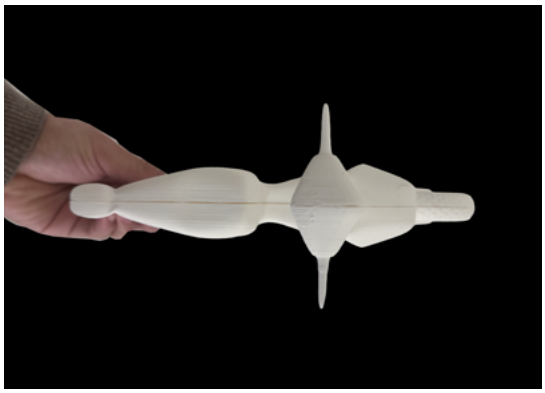
Once the core geometry and system logic were established, AI-assisted rendering tools were introduced at a later stage to support clarification of aesthetic direction and visual language.

Rapid Prototyping Iterations







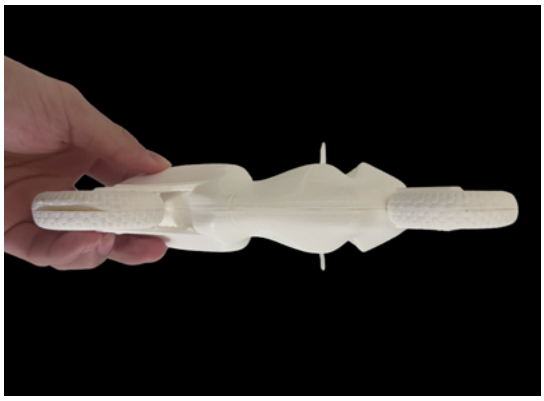


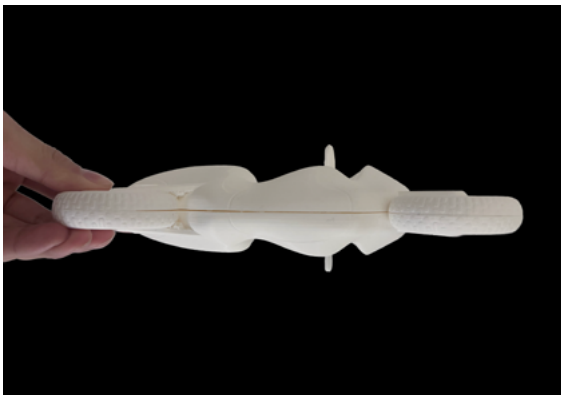
Iteration 1

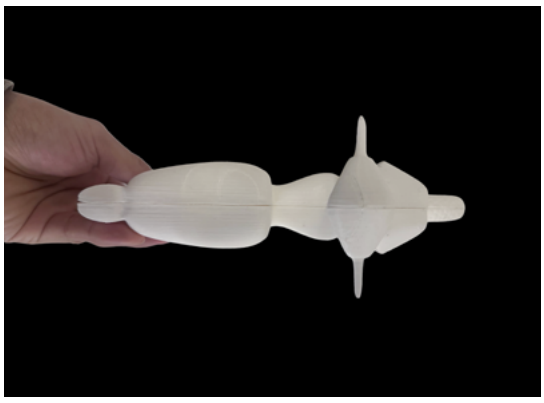
Define the **fundamental form** and establish the **design ethos**.

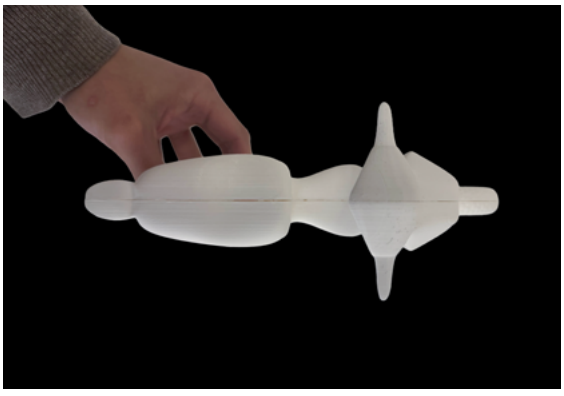
Iteration 2

Define functional details such as **suspension**, **headlights** and **tyres**.









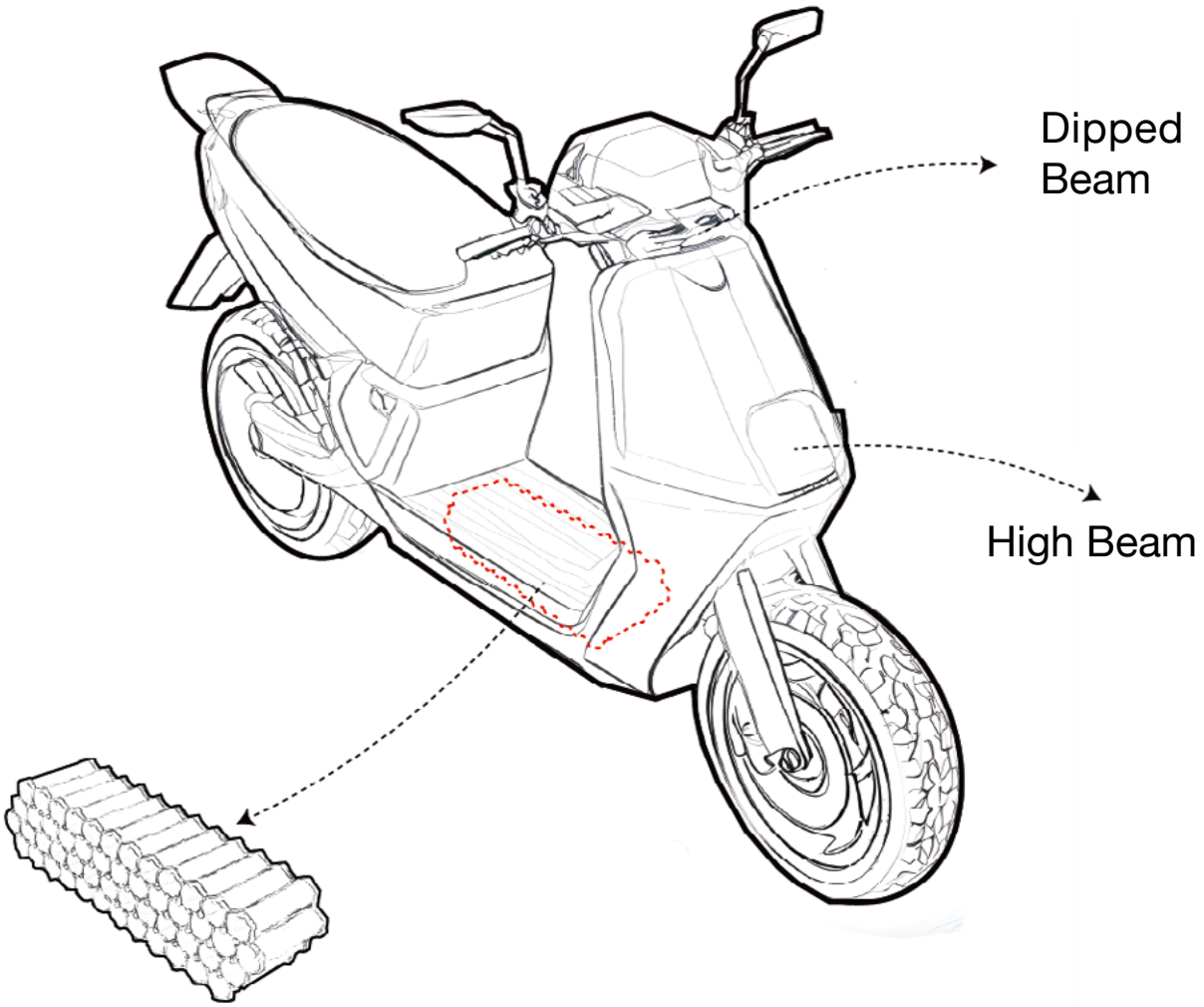
Iteration 3

Define the **rear wheel electric hub motor**, **battery pack**, and **BMS**.

Iteration 4

Determine the final **streamlined** geometry to minimise aerodynamic drag.

Functionality Demonstration



Battery Pack and Controller

The battery pack features a **non-removable design** to deter theft. However, purchasing Ante Care insurance entitles you to a replacement battery when the capacity falls below 80%.

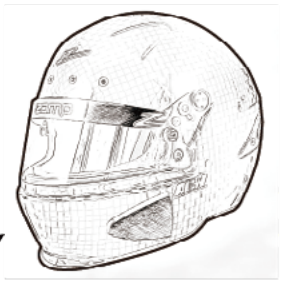
Storage

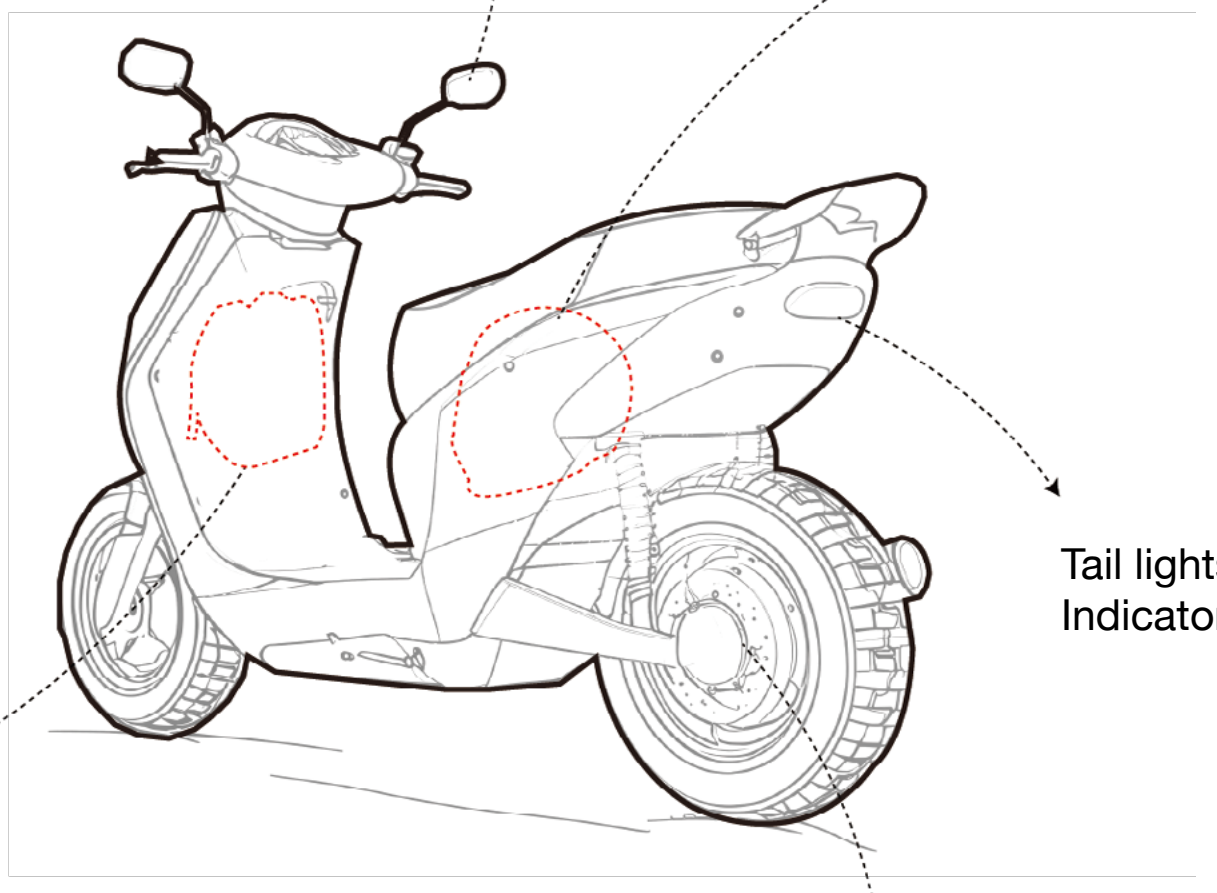
To **simplify** the design, this emoped has dispensed with all storage space. However, we shall include a **complimentary waterproof bag** that can be **hung on the hook** whilst riding.

Safety

To ensure **safety** and comply with **legal requirements**, we have included helmets in the purchase package. Simply store it beneath the seat after each ride.

Rear-view Mirror





Tail lights /
Indicators

Rear wheel electric hub motor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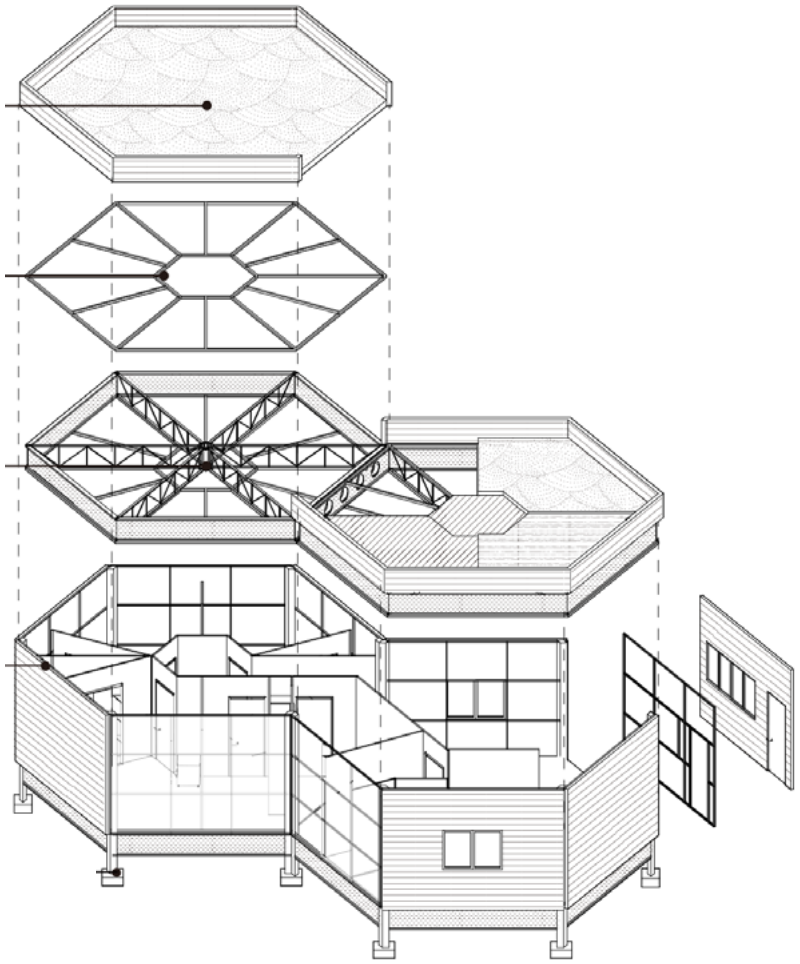


03 CITY IN THE WAREHOUSE

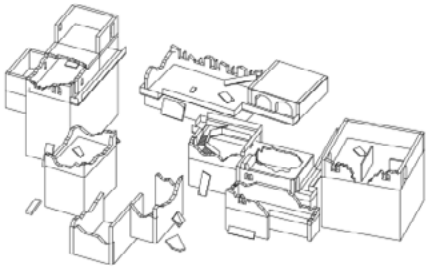
Circular Reconstruction for Earthquake-Prone Regions

Sichuan Province faces frequent seismic events where complex terrain and limited infrastructure challenge conventional post-disaster construction. This project proposes a system-based, modular reconstruction framework designed for rapid deployment, disassembly, and reuse.

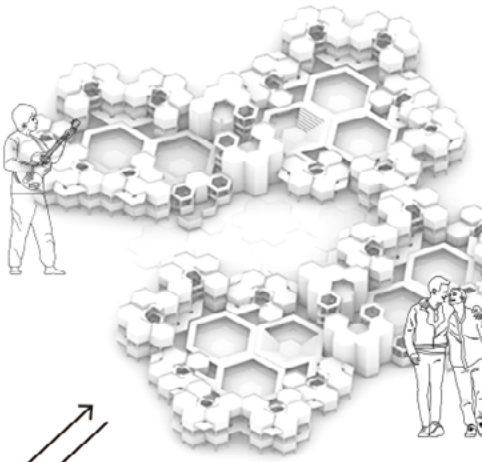
The scheme operates as a closed-loop construction system, integrating prefabrication, logistics, on-site assembly, and feedback-driven adaptation. Data-informed spatial logic is used to optimise component typologies, site layout, and assembly efficiency, while self-buildable modules enable community participation and reduce reliance on centralised resources.

By allowing components to be reconfigured and redeployed as demand changes, the project aligns post-disaster housing with principles of circular construction, material efficiency, and long-term resilience.

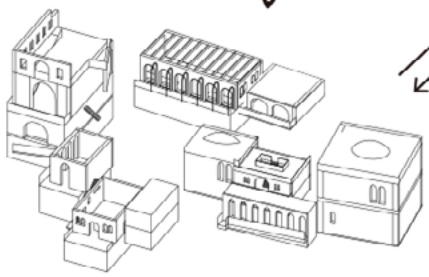
Systemic and Circular Reconstruction Framework



Reconstruct



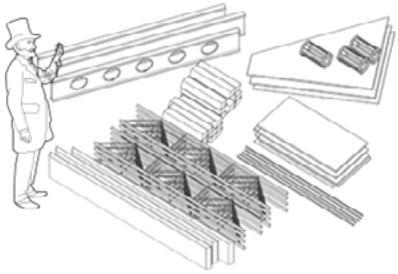
7.Rebuilding home



6.Expand according to demand

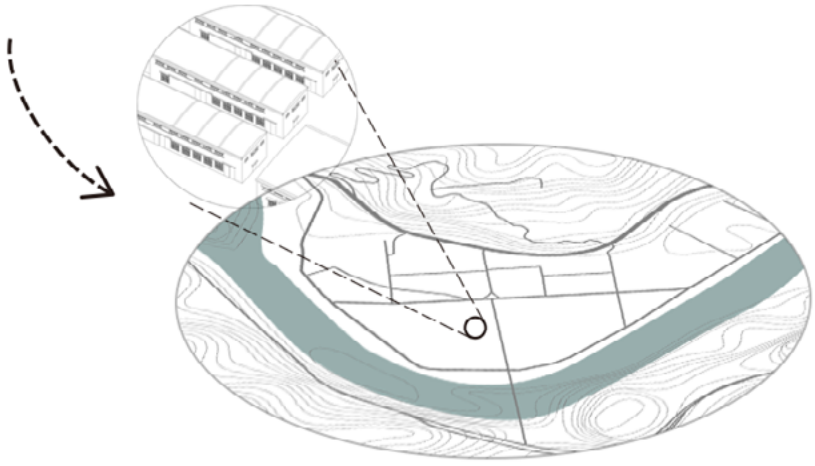
Destroyed

Disassemble

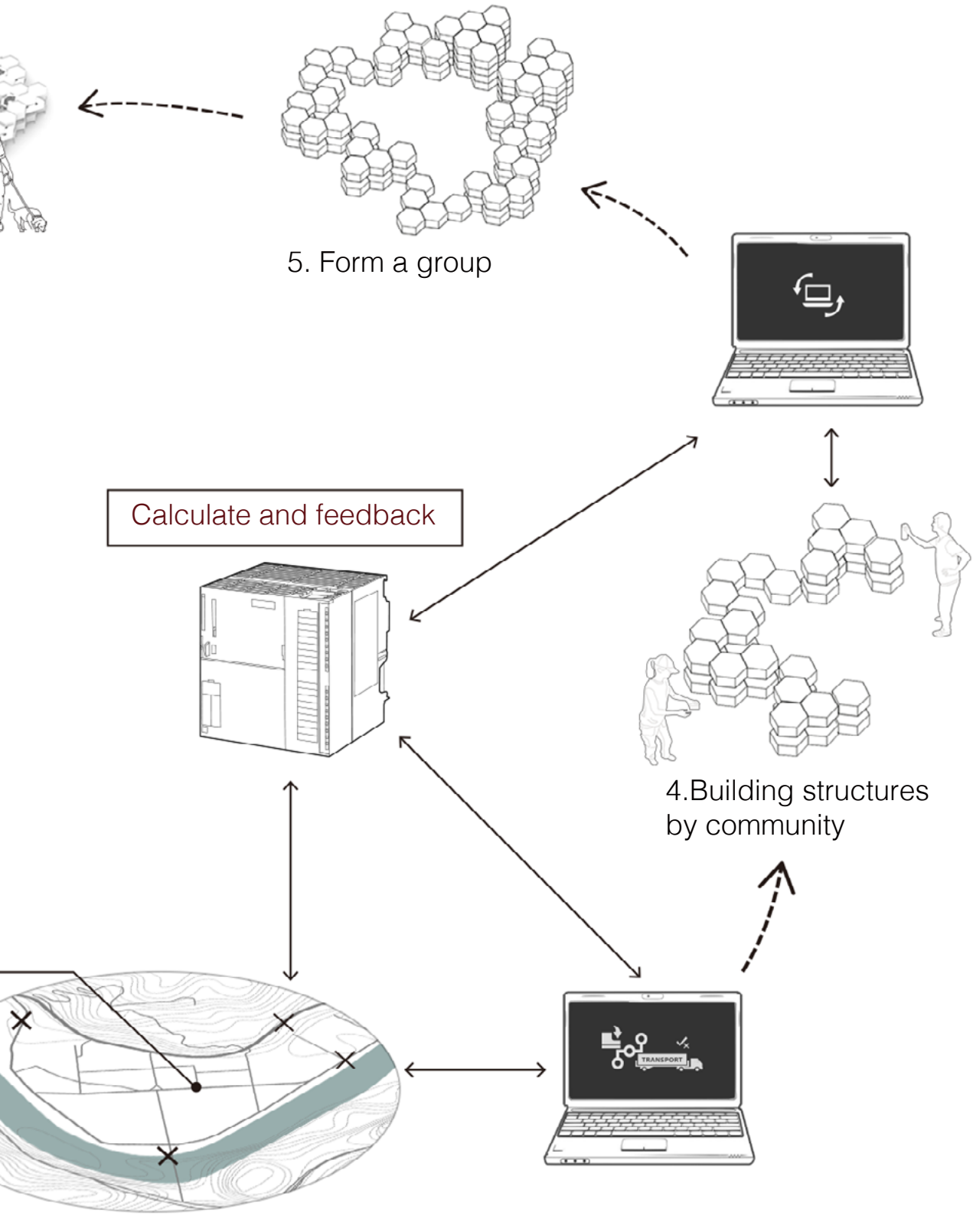


1.Purchase of prefabricated

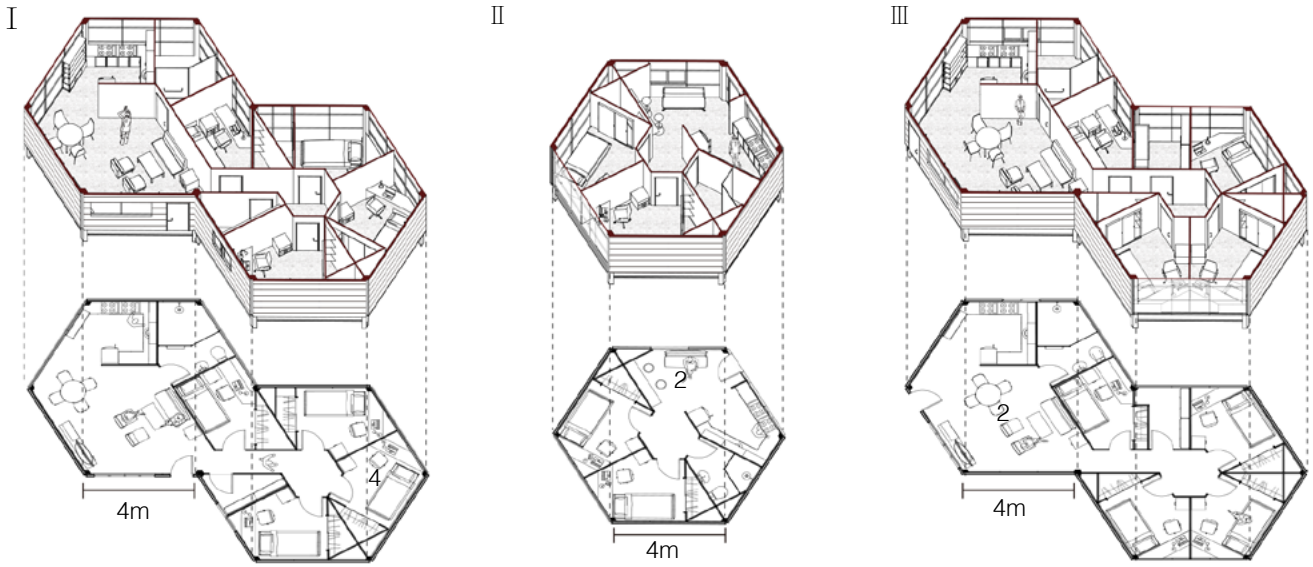
Information collect:
The number of victims
Road damage
Houses damage
...



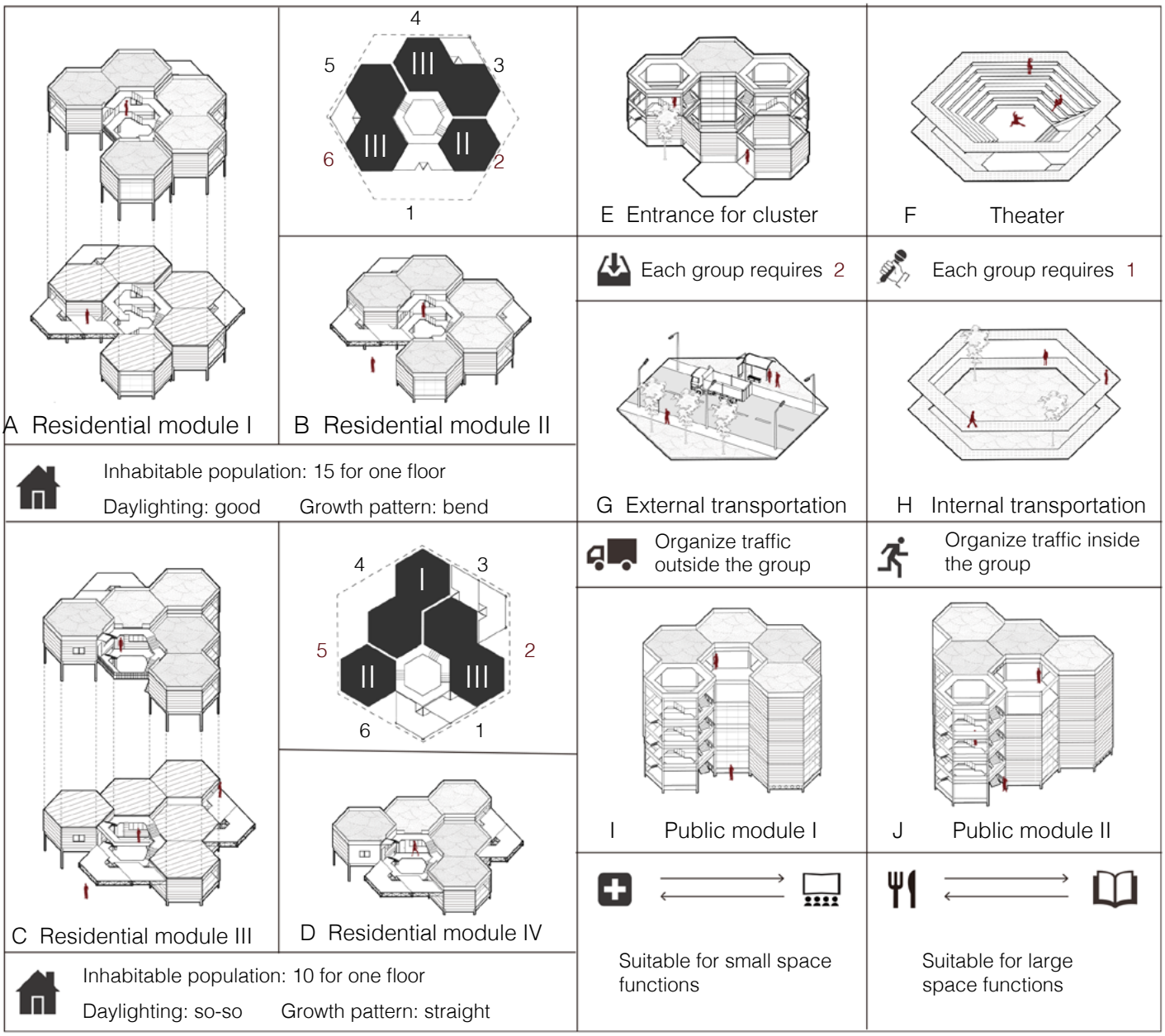
2.Put the components in the warehouse.


5. Form a group
Calculate and feedback
4.Building structures
by community
TRANSPORT
3.Earthquake happened

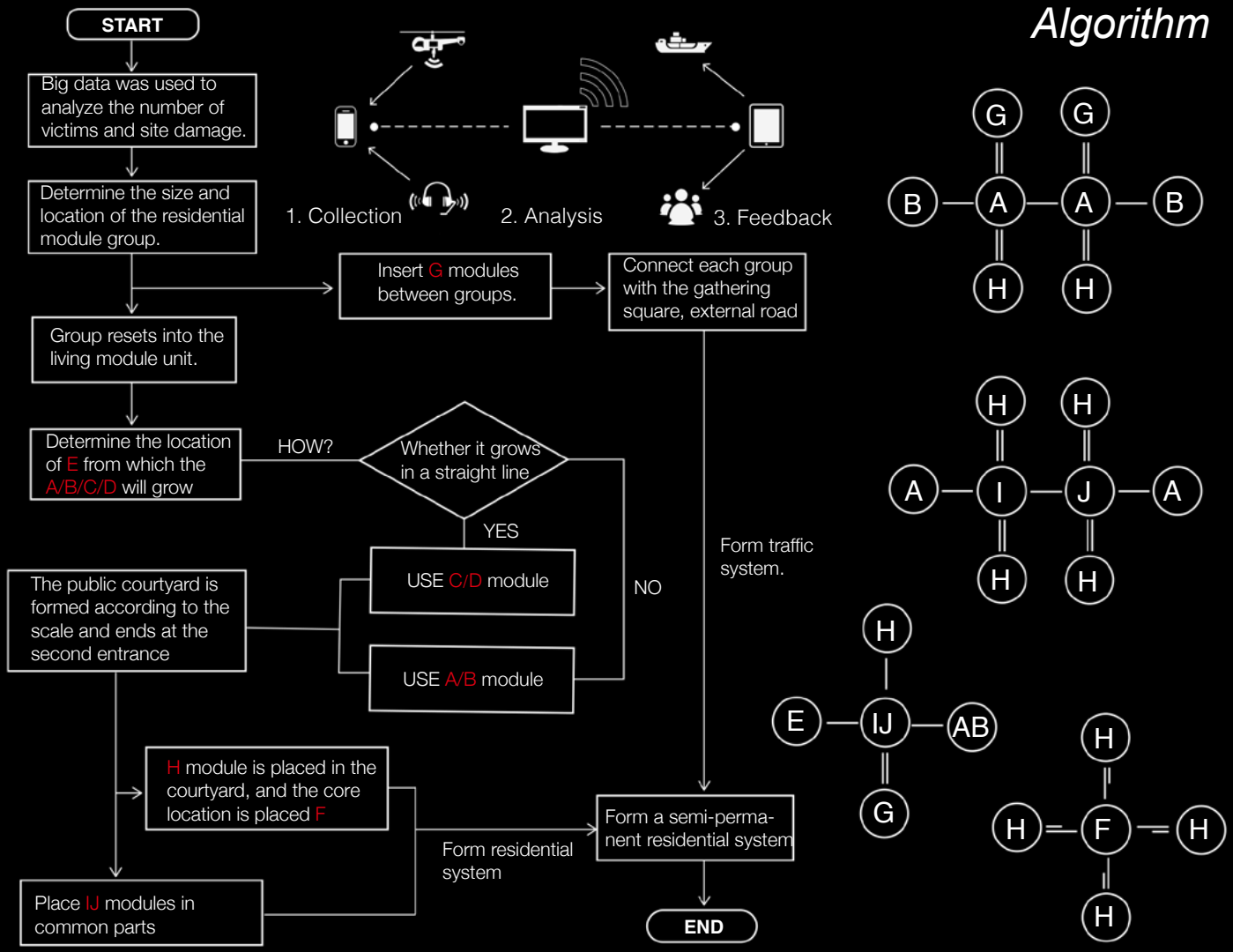
Level 3 components



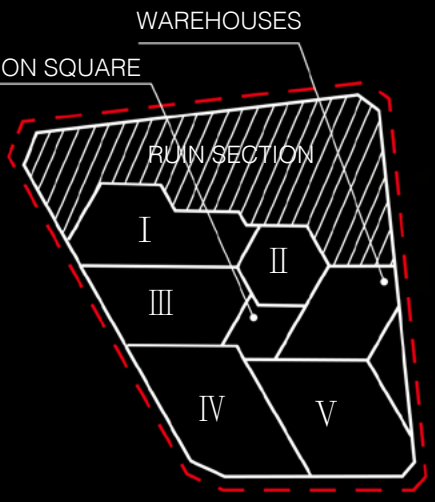
Level 2 components



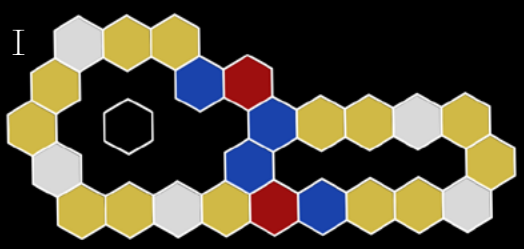
Algorithm

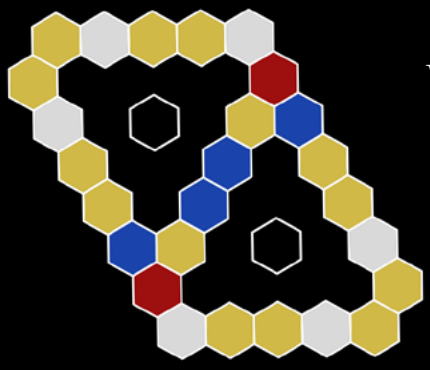


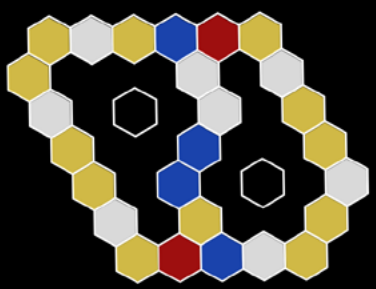
Operation results



Plan for temporary settlements

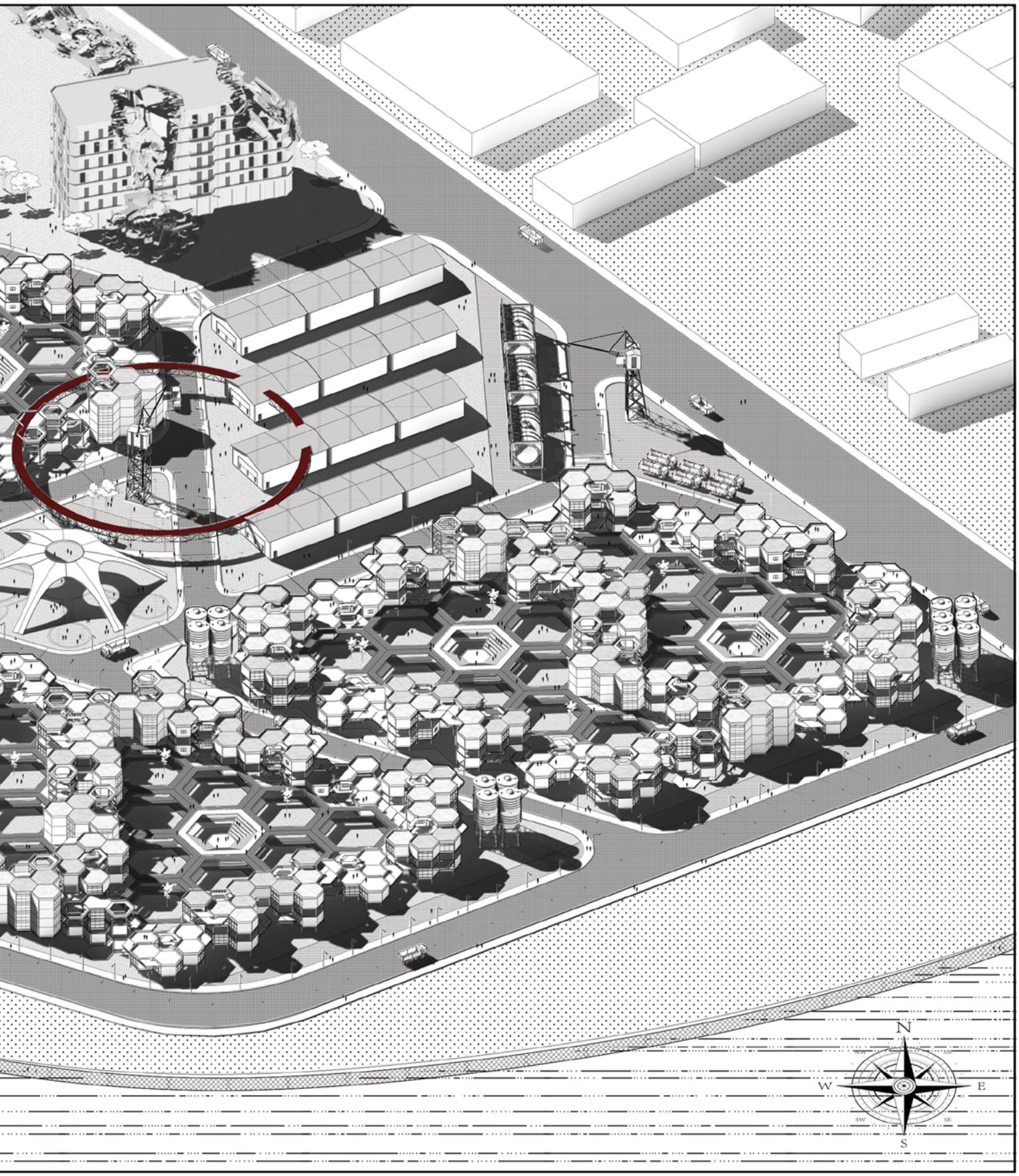






Systemic Circular Reconstruction Scenario

A system-level demonstration of a closed-loop, modular reconstruction framework, integrating prefabrication, reuse, and adaptive deployment to support scalable and resilient post-disaster rebuilding.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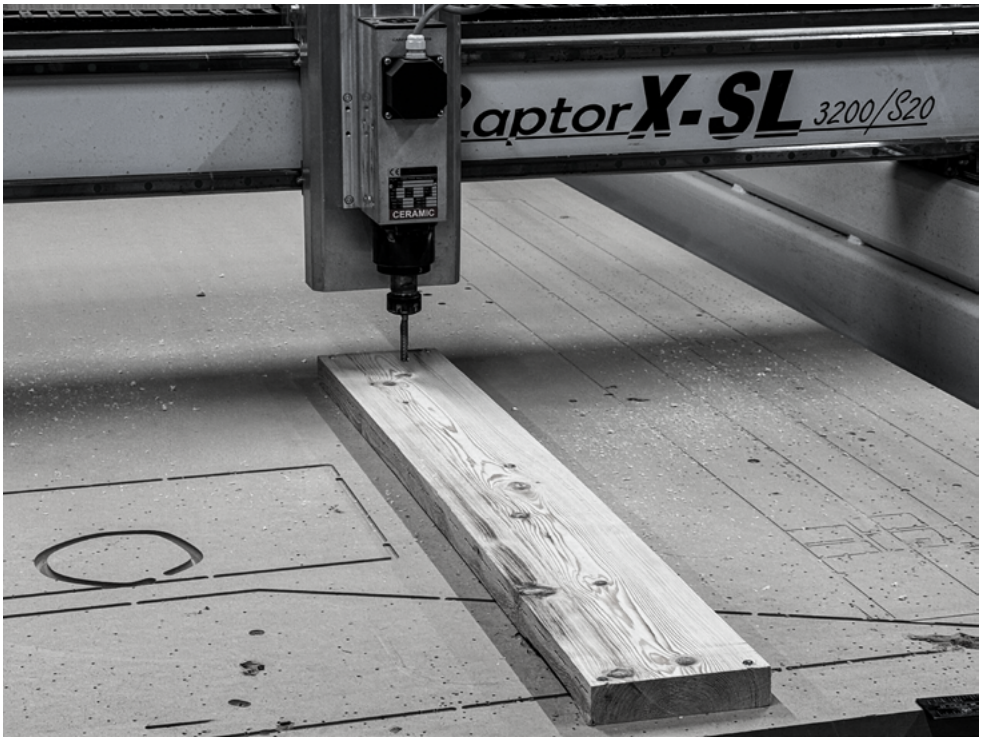

CNC Workshop - Iaac

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