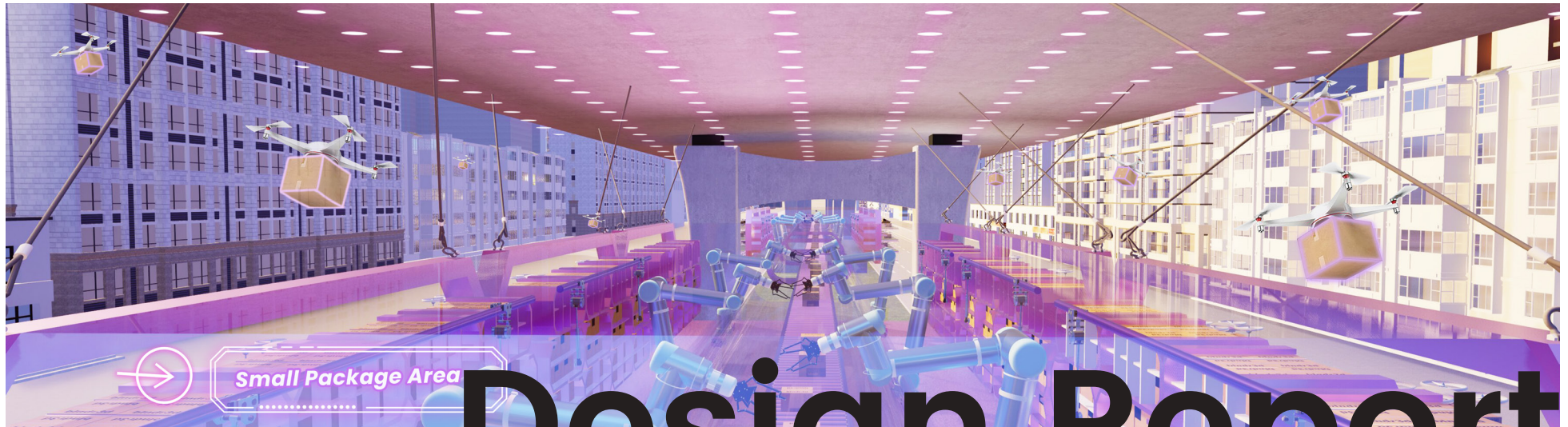


Final Major Design



# Design Report

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# Abstract

This paper primarily examines the issues of urban space development during Xiamen's rapid urbanization, focusing particularly on transforming the "leftover spaces" under viaducts into automated logistics distribution centers. The study integrates Rem Koolhaas's "congestion culture" theory, Jane Jacobs's urban vitality concept, and Yona Friedman's "mobile architecture" ideas to explore effective utilization of urban fringe lands as logistics nodes that connect communities and meet diverse community needs.

Due to indiscriminate urban expansion and non-standard planning, many peripheral urban areas have become difficult to plan and reuse, turning into "invisible" waste spaces. This research emphasizes re-evaluating these urban spaces' potential and aims to establish a new perspective on urban space through innovative design.

Combining questionnaire surveys and literature reviews, this study analyzes public acceptance and demand for transforming the space under elevated roads into automated logistics centers. The ultimate goal of the research is to propose new ideas for the planning and utilization of urban surplus spaces, promoting sustainable urban space development.

# Chapter 1: Introduction



## Urban leftover space

Focus on the transformation and reuse of leftover space in the city

Xiamen, Fujian, China

As an urban infrastructure, the viaduct not only creates leftover space on a three-dimensional level but also acts as a physical threshold, dividing and reconnecting the urban fabric. According to Rem Koolhaas's "Congestion Culture" theory, new public spaces can be created under viaducts, establishing a new urban spatial model.

This project aims to utilize the space under the viaduct to establish an unmanned delivery logistics center, providing rapid and convenient parcel reception solutions for residents of surrounding communities. This design not only optimizes urban functions but also offers innovative perspectives for urban planning and design, promoting sustainable development of urban spaces and enhancing community vitality.

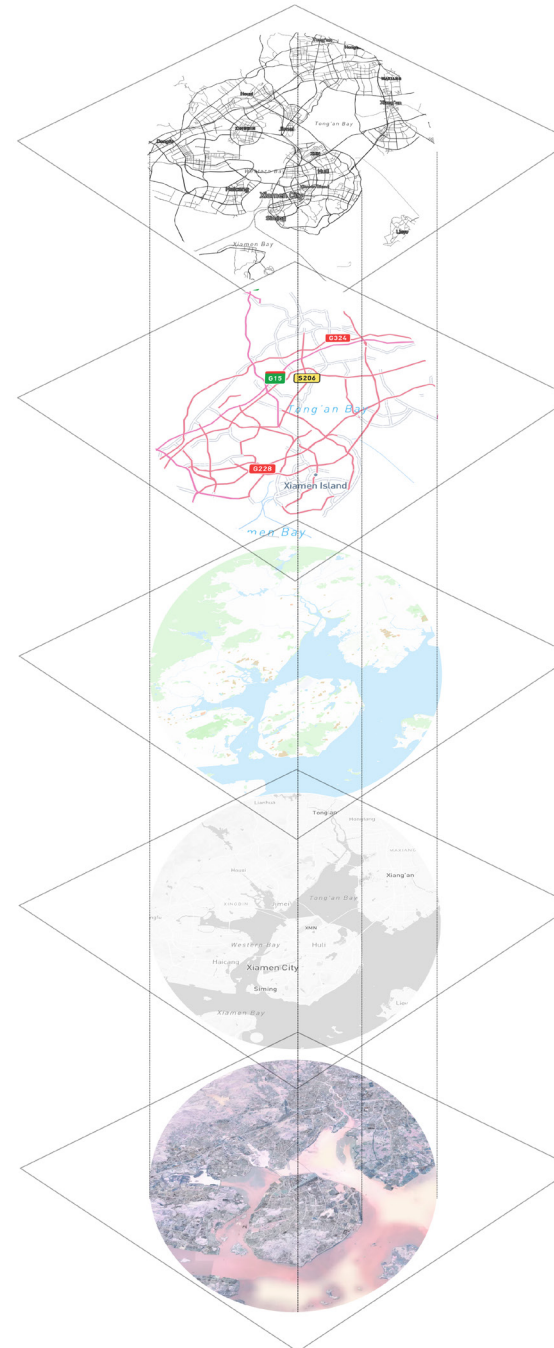
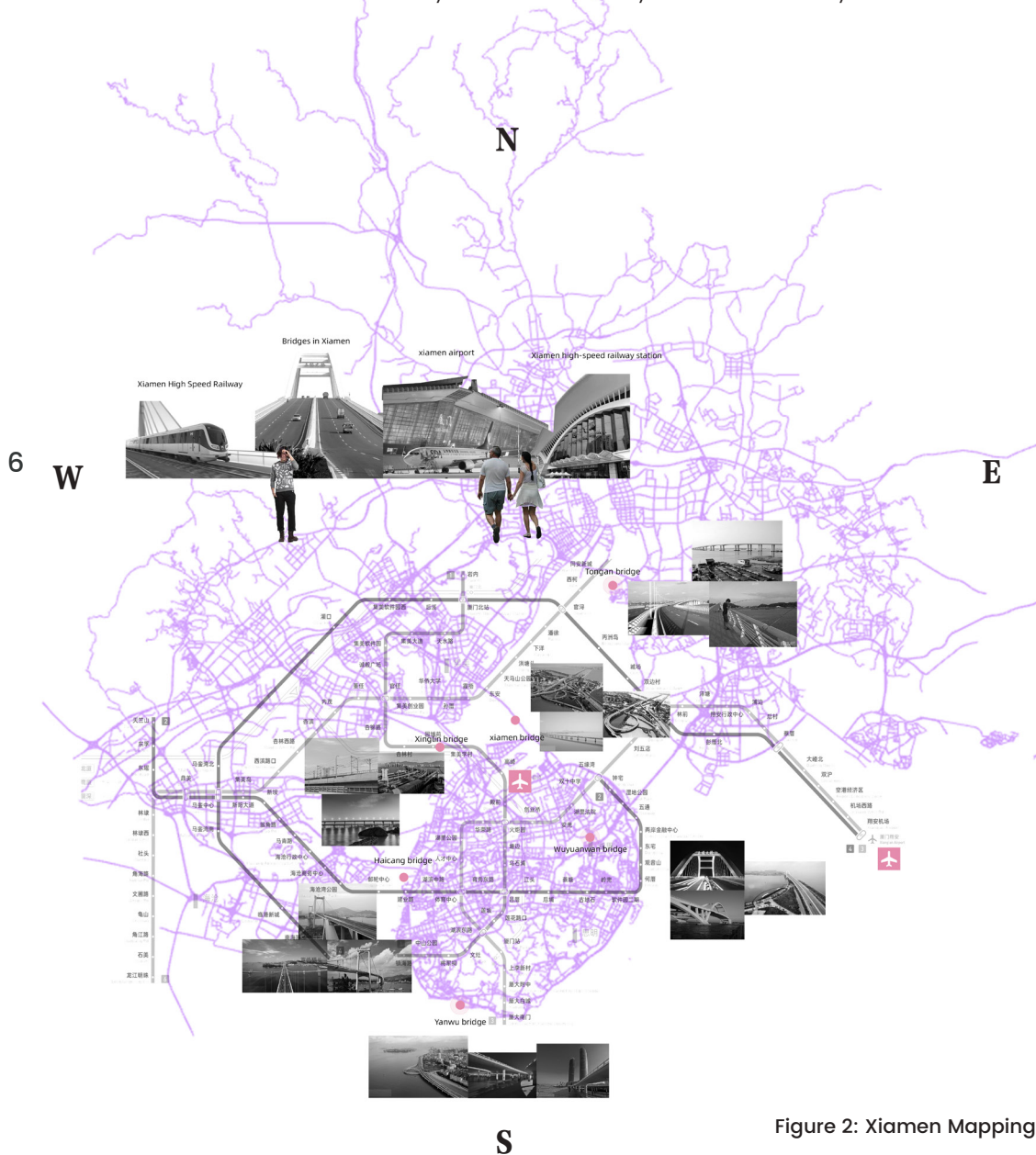
Looking forward, this revitalized space is expected to lead new trends in urban logistics and public services, redefining the convenience of urban living through an efficient logistics system, and shaping a dynamic and interconnected urban living environment.

Figure 1: City Thresholds Concept Diagram (Esquivel, 2022).

# Infrastructure Mapping

## Xiamen, Fujian

In Xiamen's urban landscape, infrastructure plays a key role in physical thresholds. Its infrastructure network, including roads, bridges, subway lines, etc., both divides different spaces and subtly connects them together. Connect them into a closely linked urban entity in an efficient way.



### Road layer

The road network in Xiamen is dense, divided into main roads and secondary roads, which are radial and circular distribution, connecting different parts of the city.

### Traffic layer

The traffic layer shows the diverse modes of transportation in Xiamen, including buses, subways, ferries and private transportation.

### Green stratum

Green stratum highlights the natural environment and urban greening of Xiamen. The city has a wide range of parks, gardens and waterfront green belts.

### Water layer :

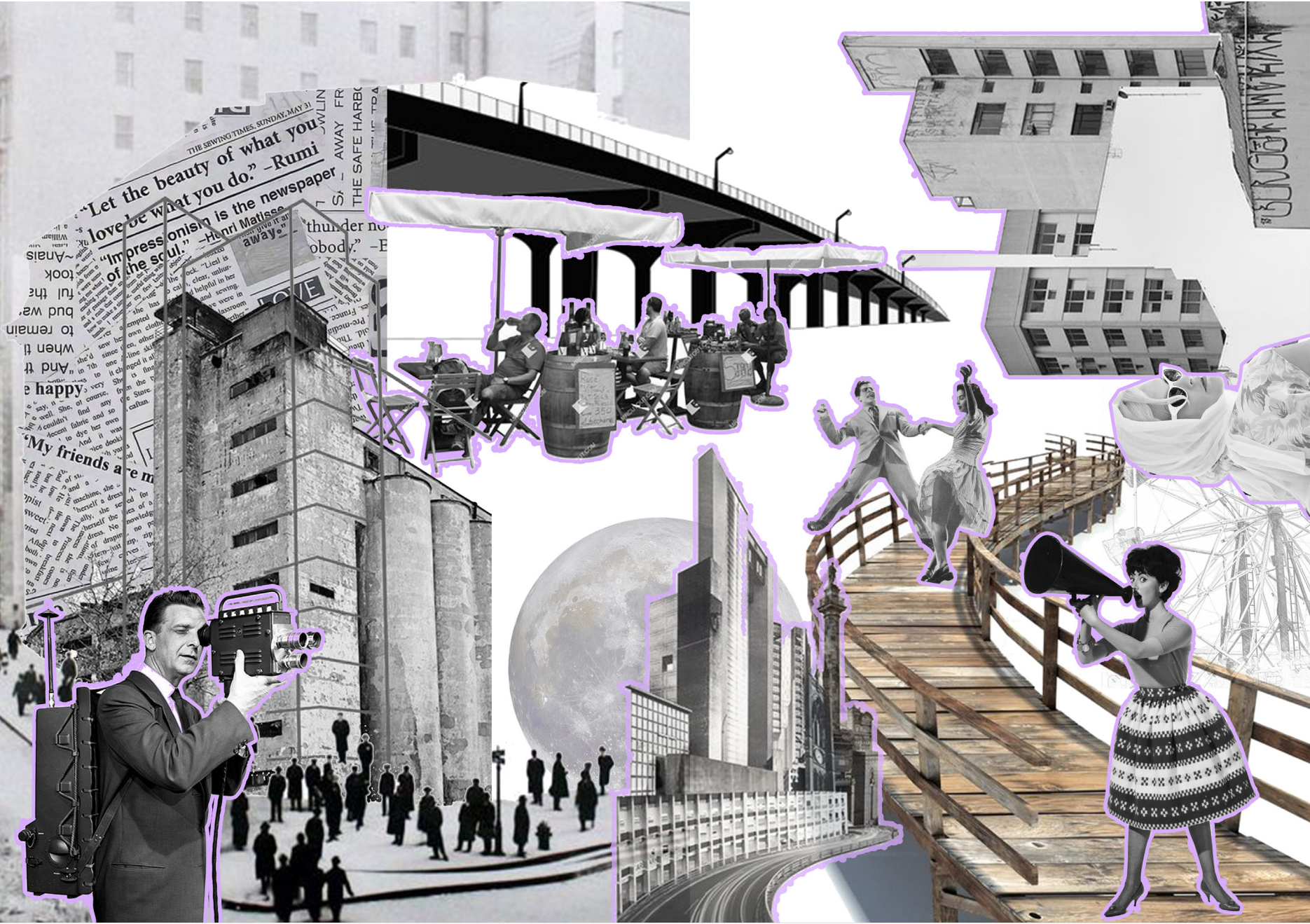
The water layer in Xiamen shows the distribution of ports, rivers and lakes. The port is an important economic hub.

### Regional partition layer :

Each region has unique characteristics and functions, such as business, housing, education, culture and so on.

Figure 2: Xiamen Mapping

Concept thresholds Collage



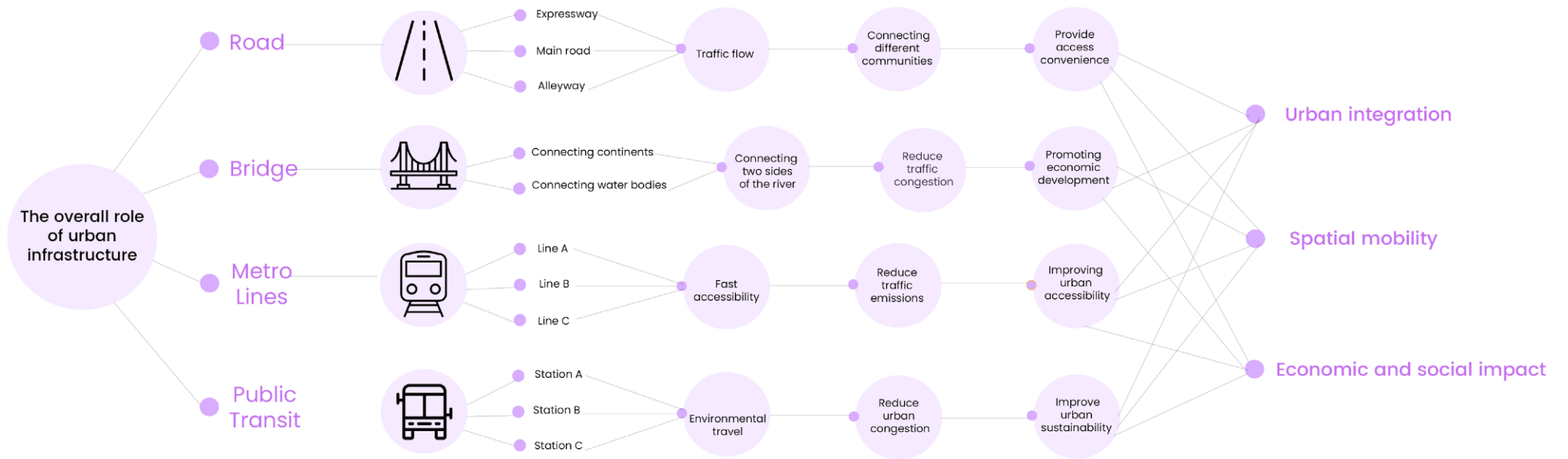
My project explores the city as a conceptual threshold of an active entity.

This design transforms the function of existing spaces, introducing new patterns of behavior and interactions into everyday life.

On a broader scale, this intervention demonstrates how the city, as a dynamic entity, can influence residents' lifestyles and community interactions through design and technological applications, reflecting the potential of urban space as a conceptual threshold.

Figure 3 : Concept Thresholds Collage

# Analysis of urban infrastructure



8

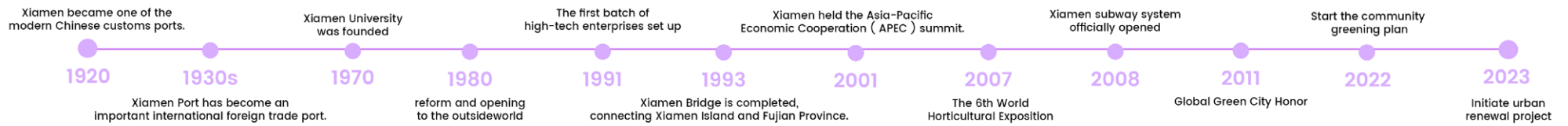


Figure 4 : Analysis of urban infrastructure



## Dual Interpretations of Grey Space



Figure 5.KISHO KUROKAWA



Figure 6.Saitama County Museum of Modern Art



### In the field of architecture

'grey space' is usually used to describe the transition area inside and outside the building, creating the effect of indoor and outdoor integration. This includes the building's colonnades, eaves, entrance areas, and places such as squares and green spaces around the building. These 'gray spaces' help to connect indoors and outdoors, while providing people with places to rest, socialize and engage in activities. (Wikipedia, 2024).



Figure 7.Space under the viaduct

### In the field of urban planning and urban geography

'grey space' is more used to describe the undefined or underdeveloped areas in the city, usually empty spaces on the edge of the city, unused parking lots, abandoned factories, or other similar vacant areas. This concept highlights the potential use and regeneration opportunities of these places in urban planning and development. (Tzfadia, 2017)

# Grey Space Analysis of Xiamen City

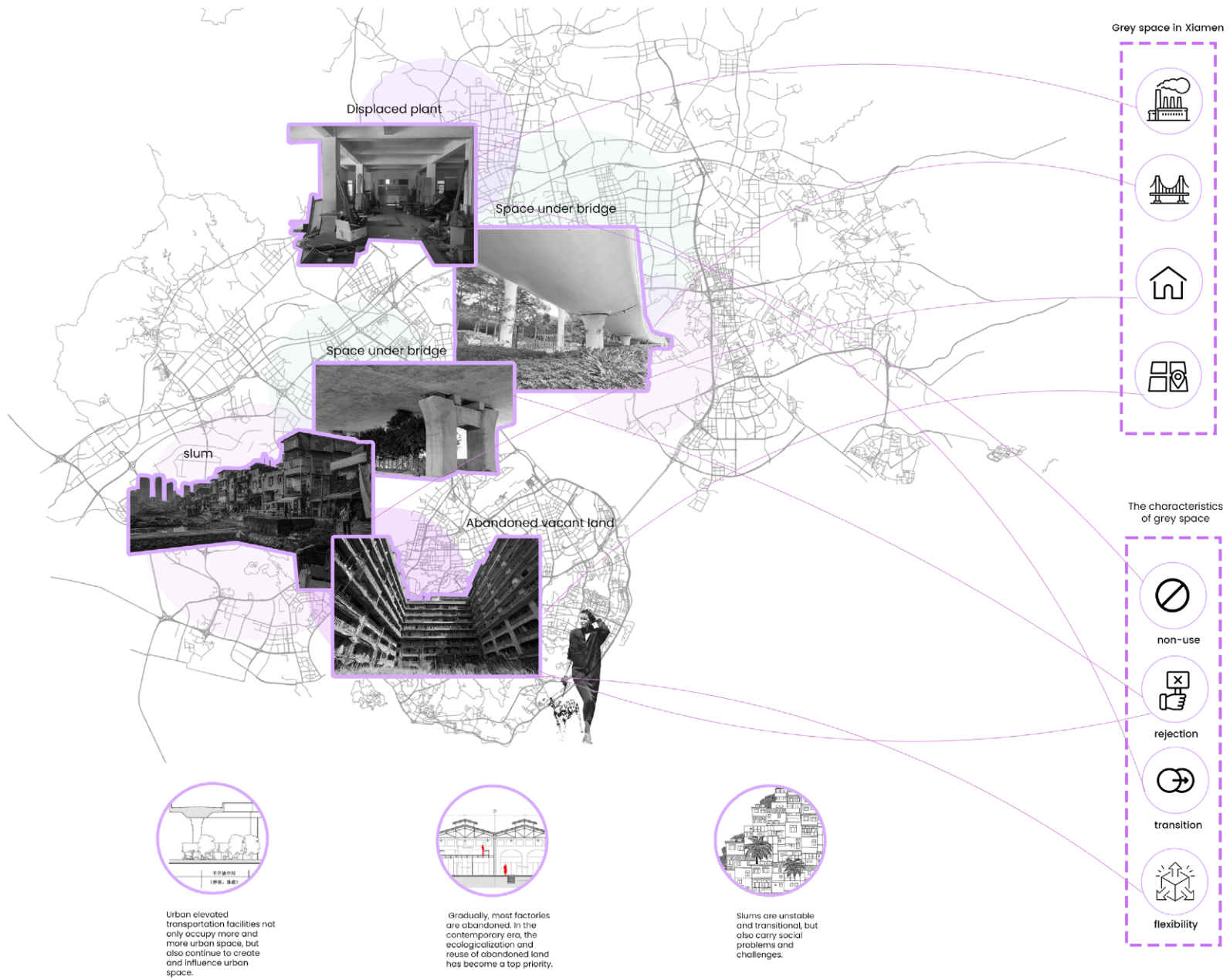


Figure 8. Grey Space analysis of xiamen

# Analysis of the space under the bridge

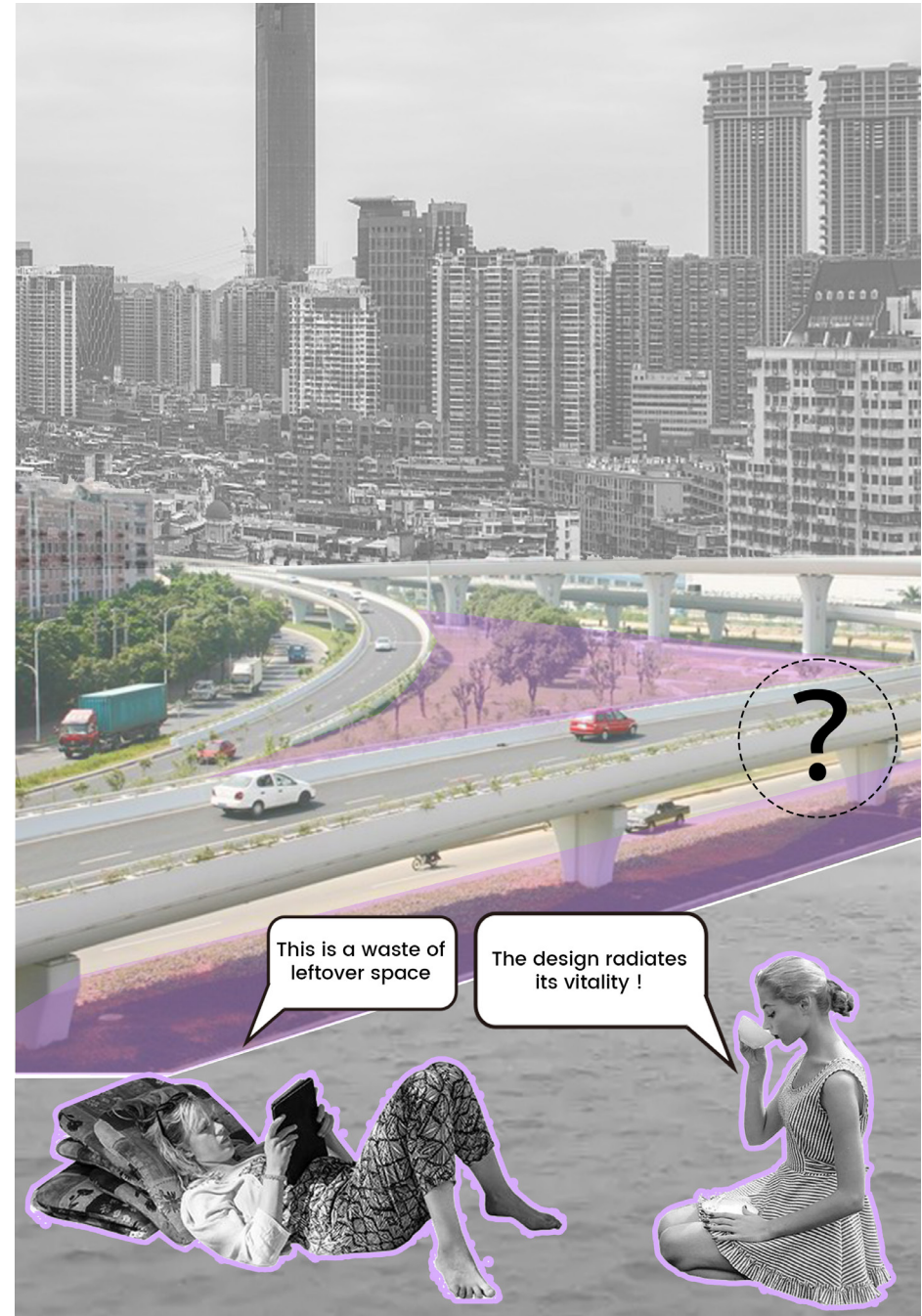
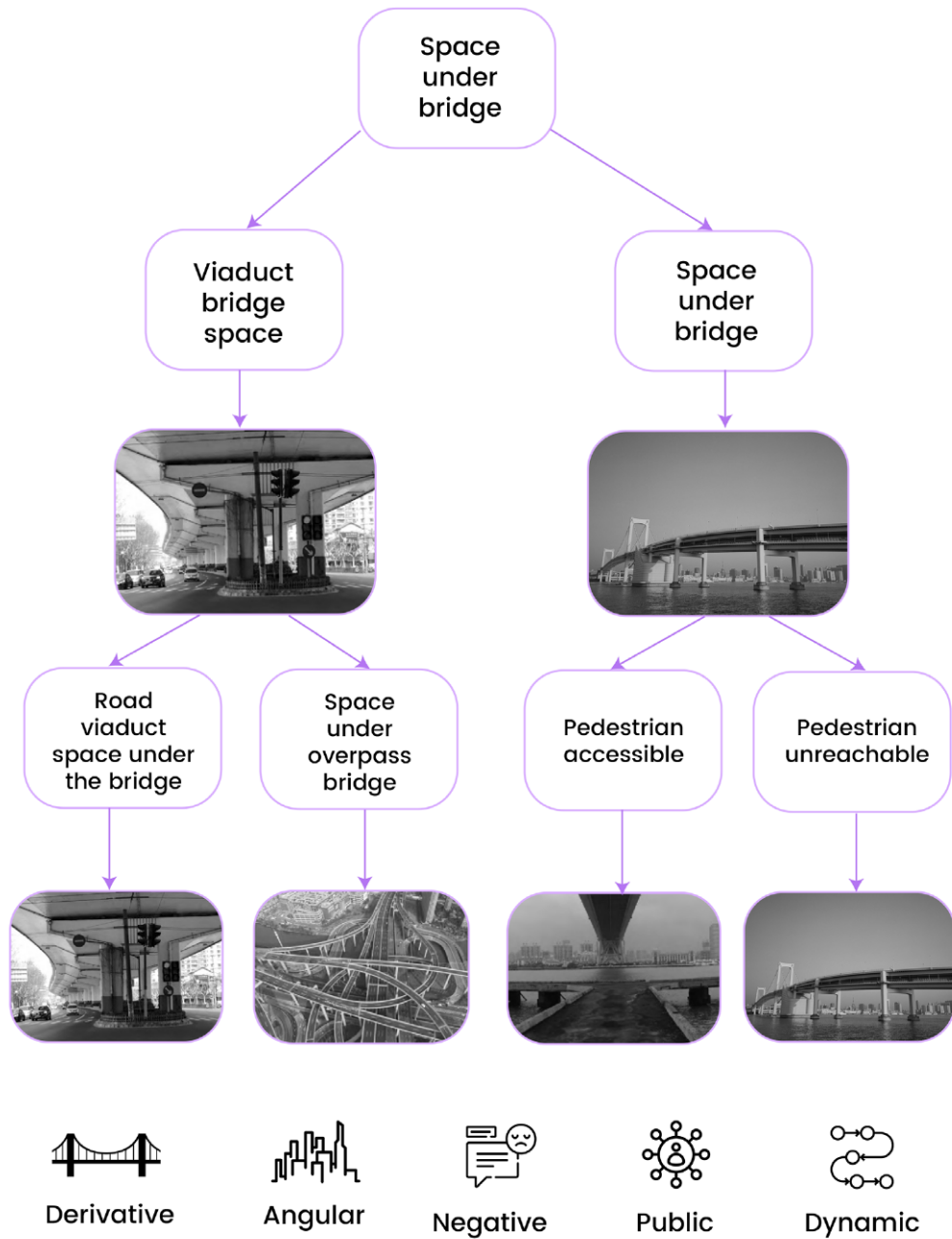


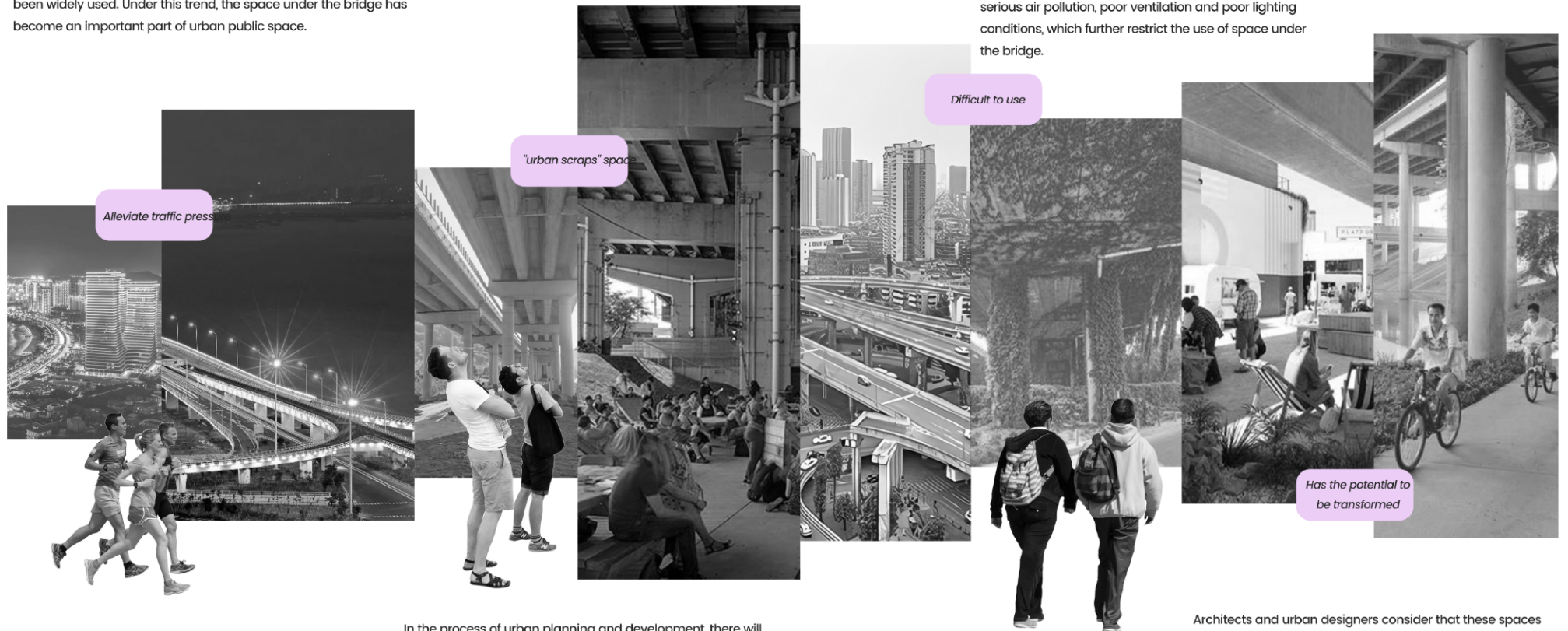
Figure 9. Analysis of the space under the bridge

# Grey Space Analysis of Xiamen City

In recent years, with the rapid development of the city and the continuous growth of the population, urban traffic has become more and more congested. In order to alleviate traffic pressure, urban viaducts have developed rapidly and three-dimensional traffic has been widely used. Under this trend, the space under the bridge has become an important part of urban public space.

Most of the space under the viaduct is located in the middle island of the urban traffic line, which is difficult to use and large. However, a large number of motor vehicles make the space noise and the end of the bridge, with serious air pollution, poor ventilation and poor lighting conditions, which further restrict the use of space under the bridge.

12



In the process of urban planning and development, there will inevitably be a large number of "urban scraps" space, that is, the remaining space. After classification, research, transformation and utilization, these Spaces will produce new value and become an important node in the city, or even identification (landmark).

Architects and urban designers consider that these spaces have potential to be transformed into distinguished space having visual pleasure. Designing them properly will reduce their frightening, cold, and dark effect and enable people to use them. Optimization of them could improve the utility of grey spaces.

Figure 10. Grey space analysis

## The limitation to a specific site within Xiamen

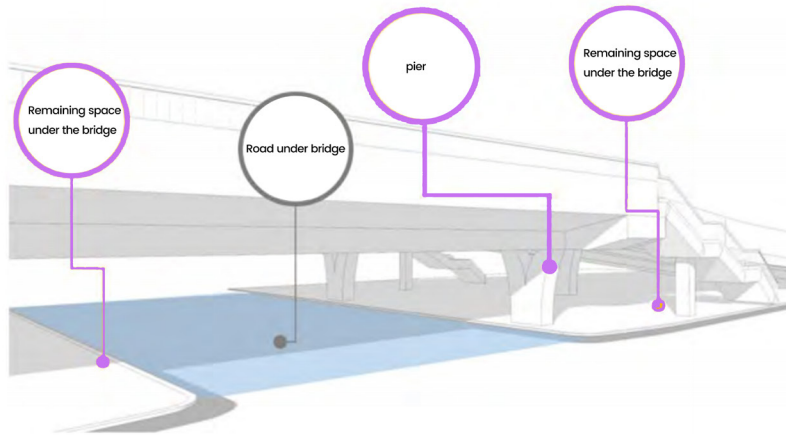


Figure 11. Concept of space under the bridge

The space under the bridge in this study refers to the space under the projection of the vehicle or pedestrian bridge on the urban municipal road, which is mainly the remaining space outside the road under the bridge. The space under the bridge is composed of roof, column and space under vertical projection, forming a unique overhead open space.



Famous Norwegian urban architect NorberSchuz.In 1979, he put forward the concept of "place spirit", which studies the relationship between human activities and the surrounding environment. In addition to the bridge, the physical space also carries the activities of people in the city. It is necessary to give the space under the bridge more connotation by studying people's activities. (Amapi, 2016)

Figure 12: Postcards from The Continuous City (Triennale, 2019).

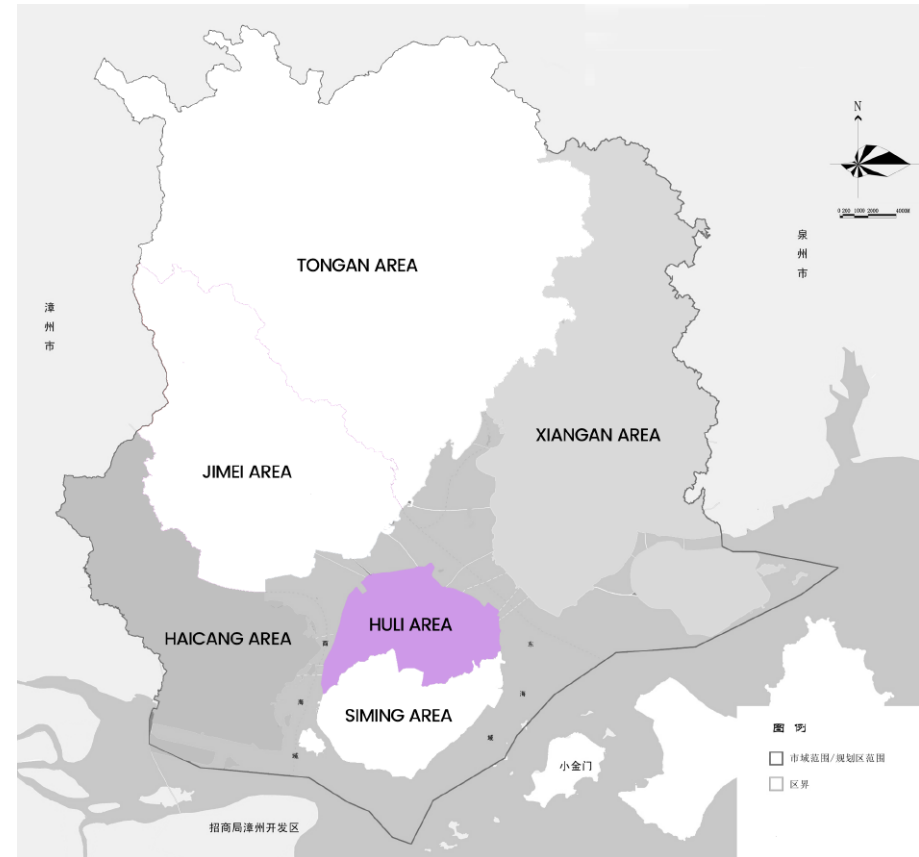


Figure 13: Xiamen Area Map

I will first focus on Xiamen's Huli district, which has become an ideal place to study urban infrastructure improvement and community service space innovation due to its rich viaduct connections and central location.

# Chapter 2: Conceptual Framework

## Research Questions

### Strategies for Creating Automated Logistics Distribution Centers:

How can the theories of Rem Koolhaas's 'congestion culture', Jane Jacobs's urban vitality, and Yona Friedman's 'mobile architecture' be applied to transform the underutilized grey spaces beneath viaducts into efficient automated logistics centers that enhance the convenience of parcel delivery for community residents?

## Sub-Research Questions

### Sub-question 1: Theoretical Application

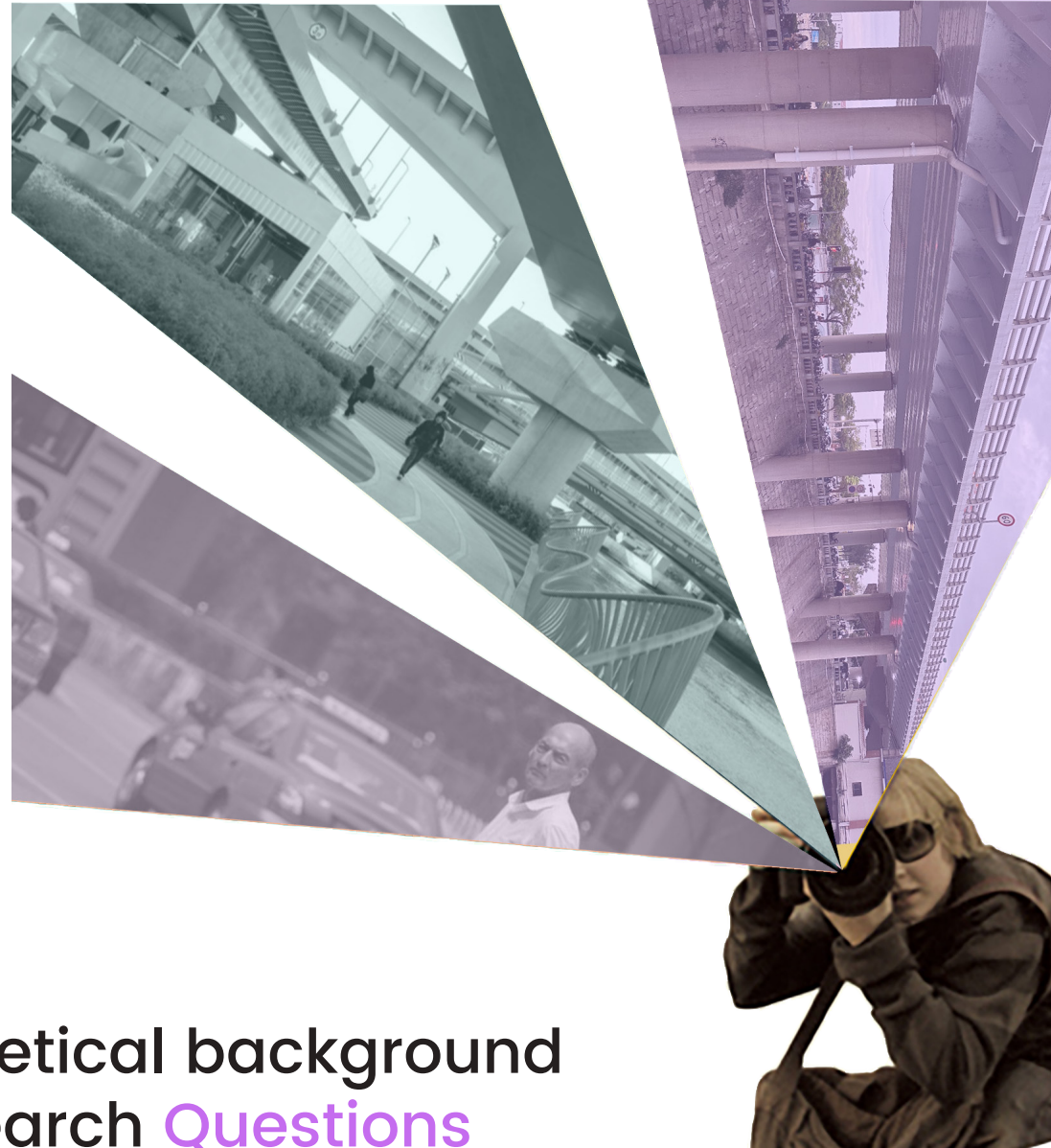
"How can Rem Koolhaas's theory of 'congested culture', Jane Jacobs's theory of urban vitality, and Yona Friedman's 'mobile architecture' be applied in the design and implementation of automated logistics centers to optimize the use of space under viaducts?"

### Sub-question 2: Design Practice

"What design strategies and practices are most effective in designing automated logistics centers that not only meet the requirements of technological implementation but also utilize urban grey spaces optimally and allow for future expansion?"

### Sub-question 3: Community Engagement and Impact

"What role does community engagement play in the design and realization of automated logistics centers under viaducts? What specific positive impacts do these spaces have on the lives of the residents in the surrounding communities?"



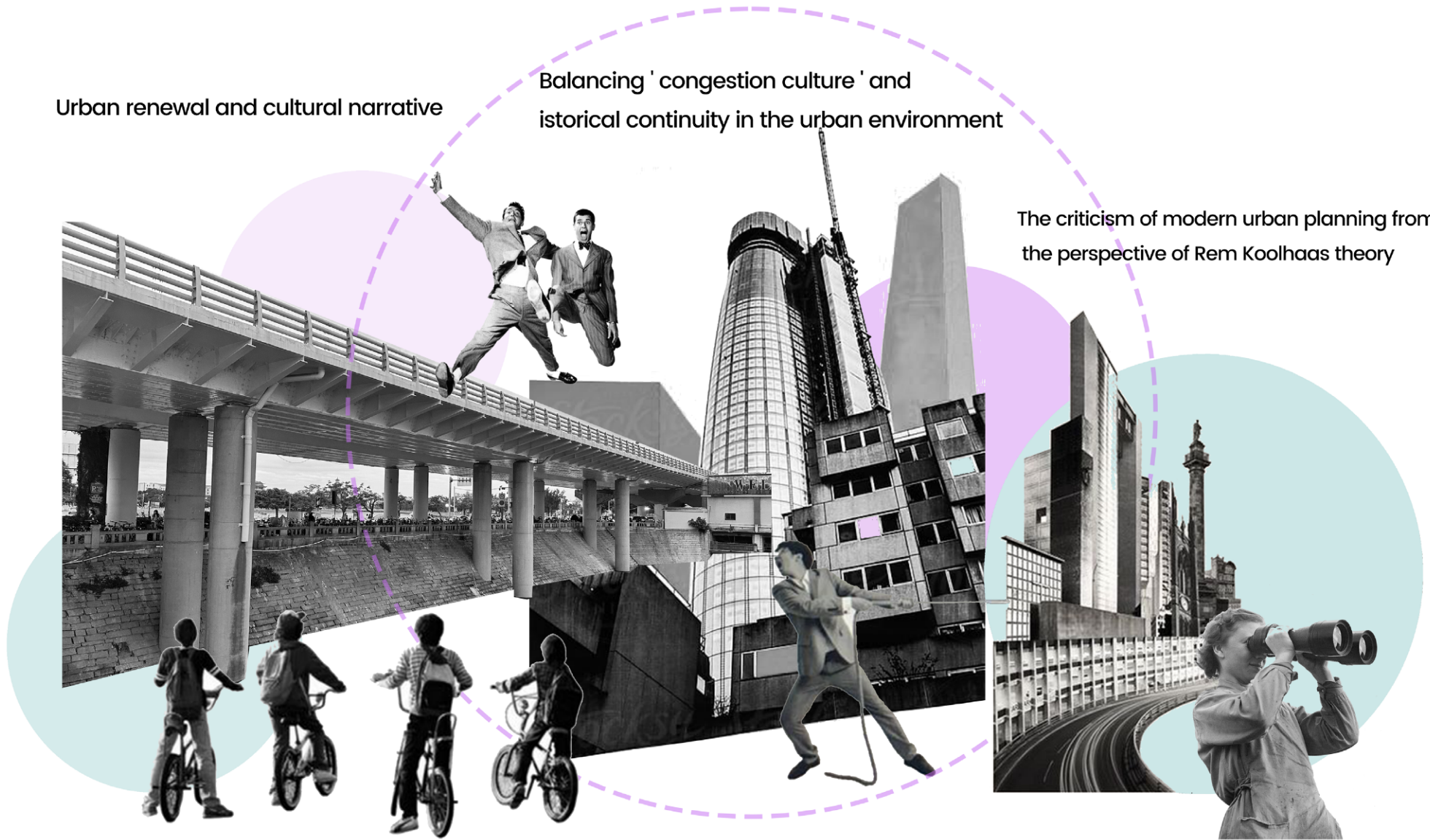
## Theoretical background -Research Questions

## A broader background and analysis

Urban renewal and cultural narrative

Balancing 'congestion culture' and  
historical continuity in the urban environment

The criticism of modern urban planning from  
the perspective of Rem Koolhaas theory



Exploring Urban Vitality: Regenerative Urbanism and Social Space Analysis of Underutilized Infrastructure  
from the Perspective of Congestion Culture.

Figure 14 .A broader background and analysis



## Theoretical framework

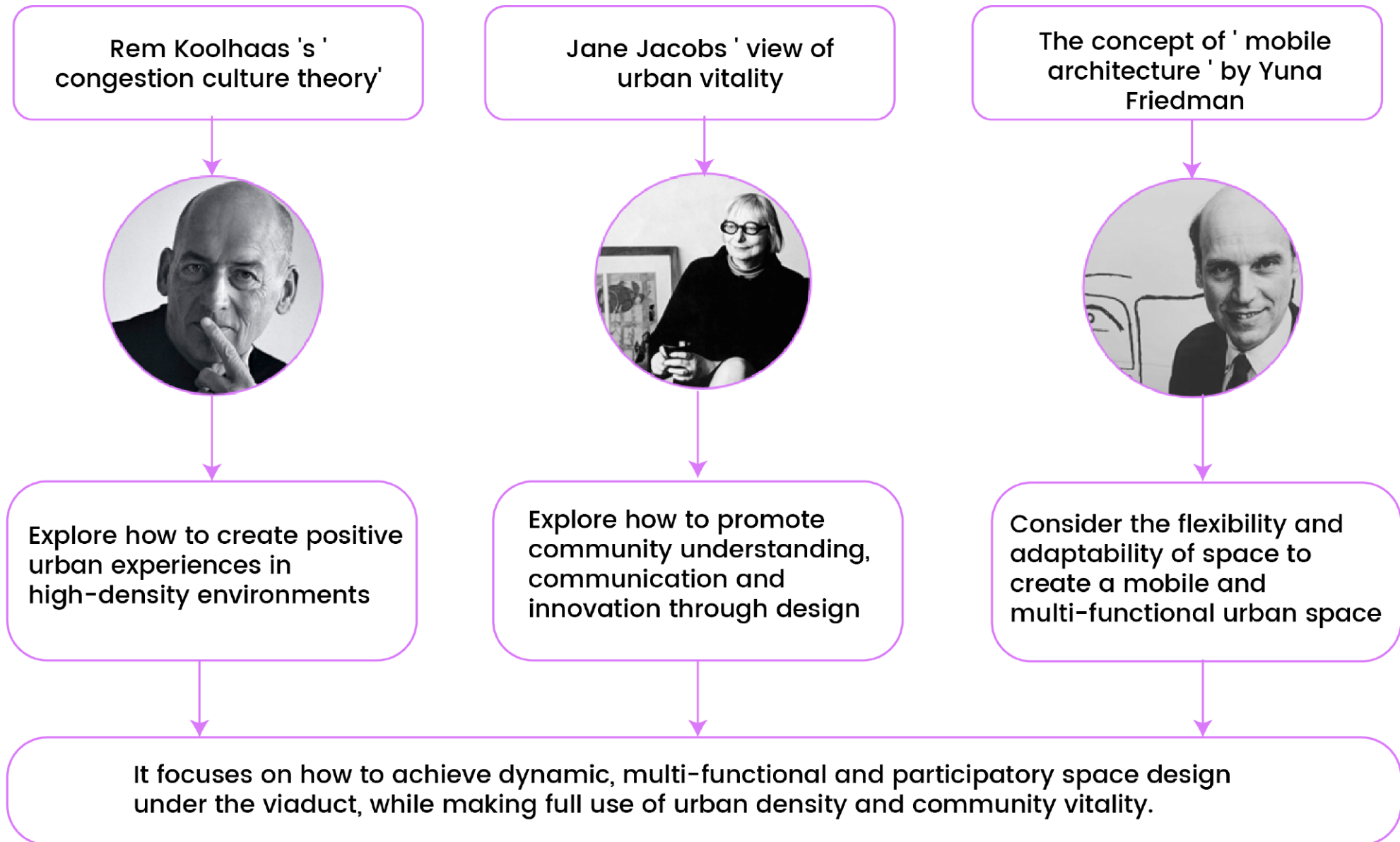
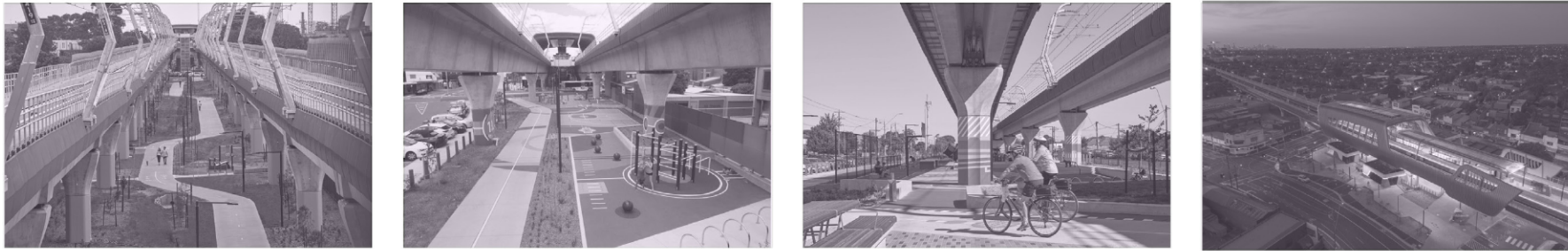


Figure 15: Theretical Framawork

## case study analysis

### Caulfield to Dandenong railway crossing reconstruction planning



The Caulfield to Dandenong Level Crossing Removal (CTD) project comprised the replacement of nine dangerous rail level crossings with five elevated railway stations along one of Melbourne's busiest transport corridors. By elevating the line and stations, this project presented an opportunity to transform an extensive tract of land within Melbourne's metropolitan zone into a new linear park. (Terremoto, 2020)

### 18 Roof Square by HG-Architecture



The city of Seoul is in the process of creating a public space for local community to use in the area by utilizing the lower space of the overpass, which is relatively unusable in cities with insufficient space. This project is a pilot project, and it is a project to improve the living environment and urban landscape of the region by changing the underpass, which was shadowy and desolate, a lively and vibrant environment. (HG-Architecture, 2022)

Most of the cases are to build the space under the viaduct as a public space for residents to entertain and relax. I hope I can make an innovative, future-oriented and bold design project.

Figure 16 .Case Study analysis

## Literature review

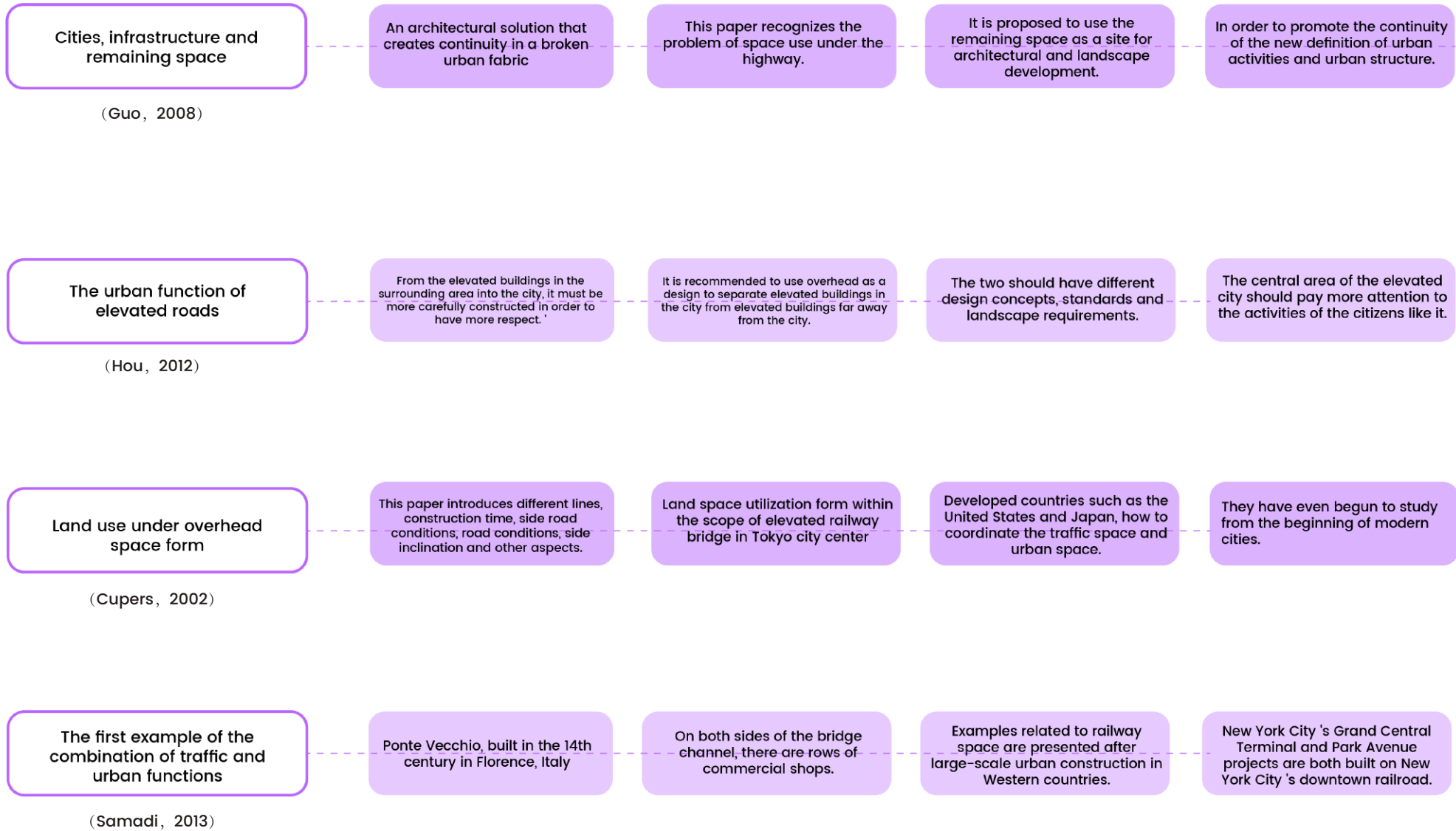


Figure 17: Literature review

# Chapter 3: Site Analysis & Phenomenon Identification

# Site Selection&Location Plan-Xiamen Distribution Center Mapping



Figure 18: Site Selection&Location Plan-Xiamen Distribution Center Mapping

# Contextual site plan



Figure 19 .Contextual site plan

# Device distribution strategy

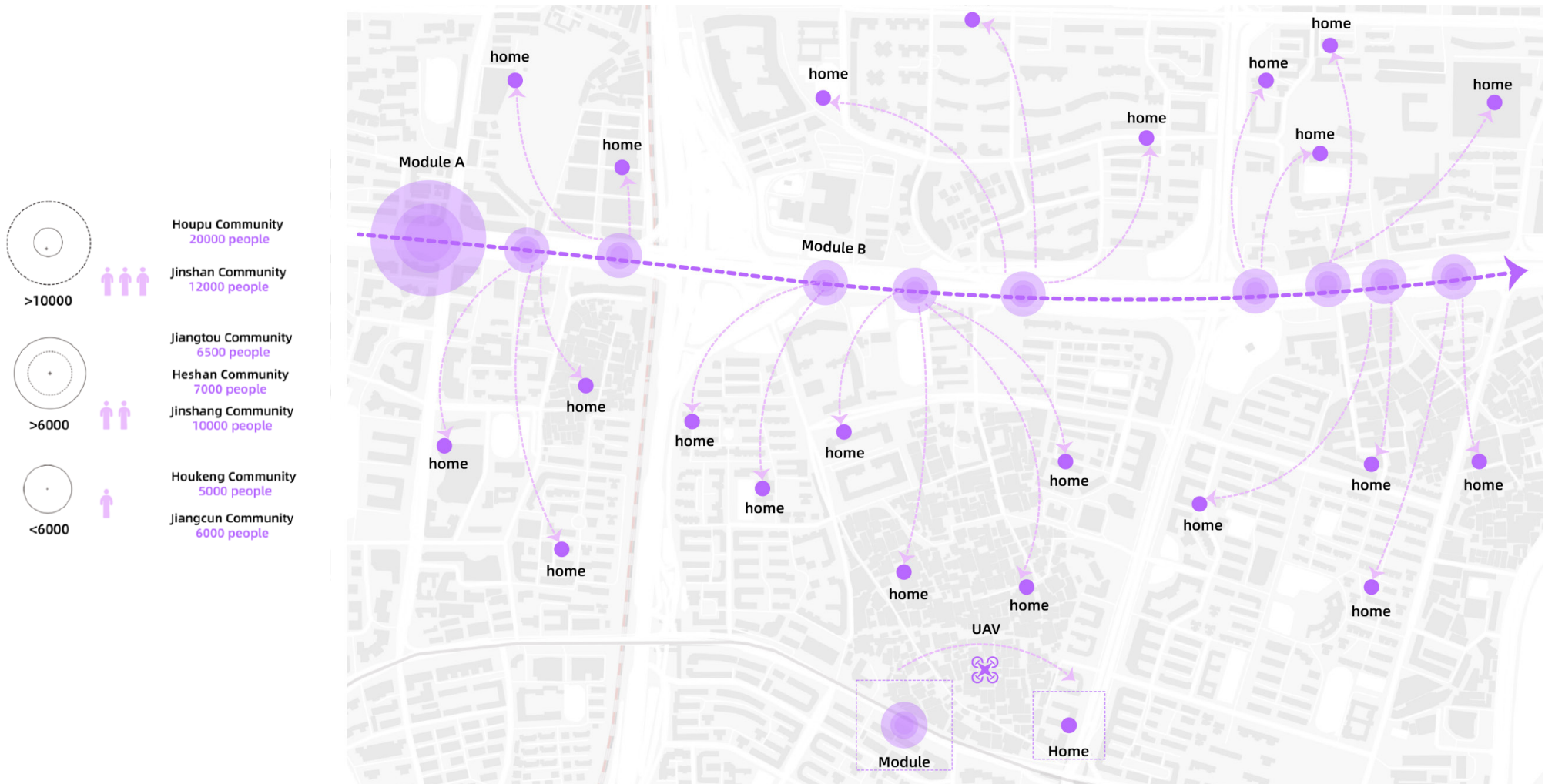
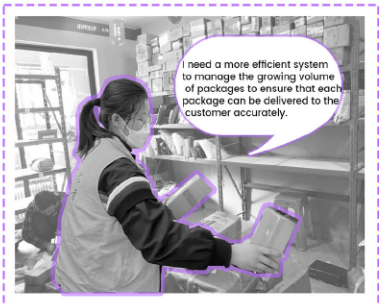
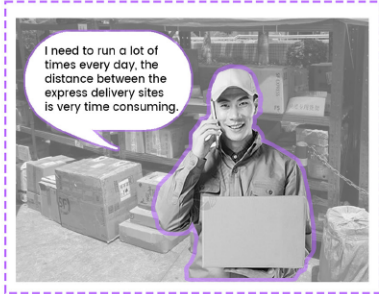
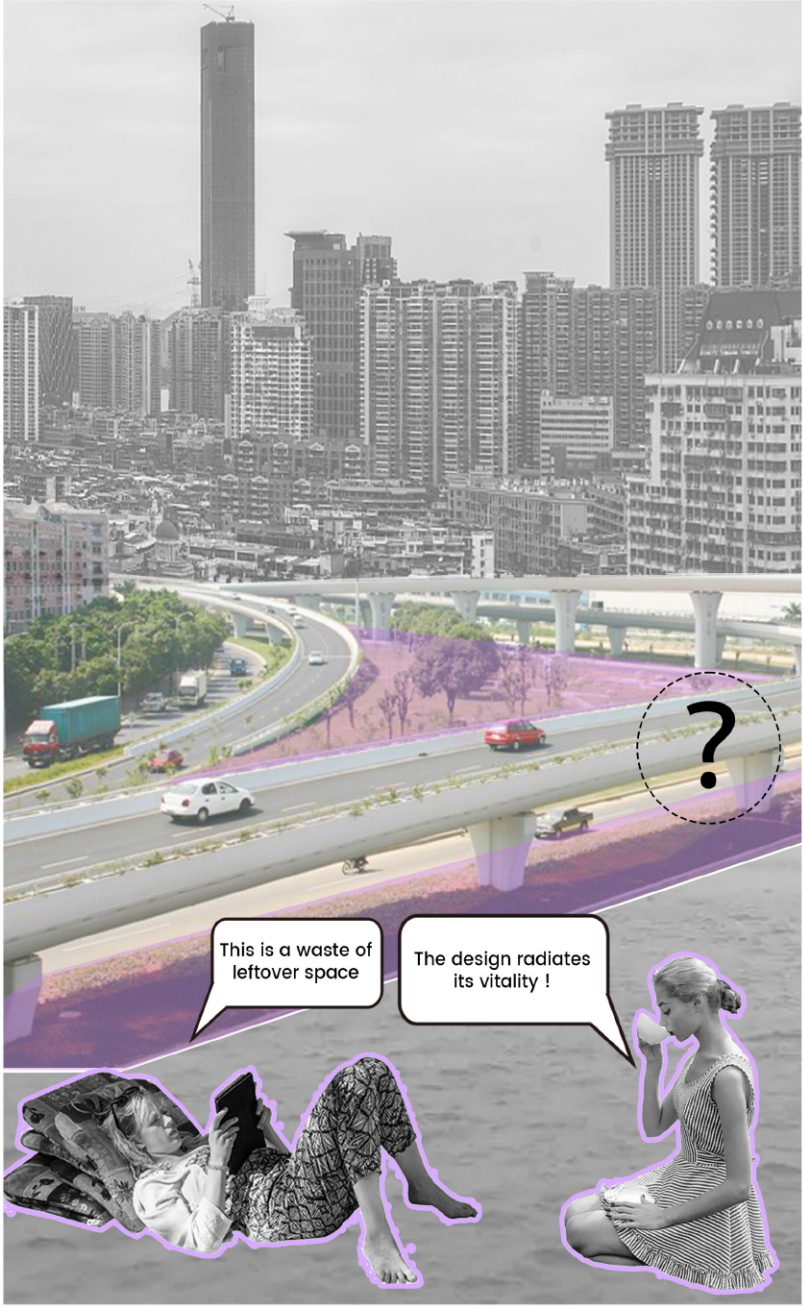


Figure 20. Device distribution strategy

# Population needs analysis

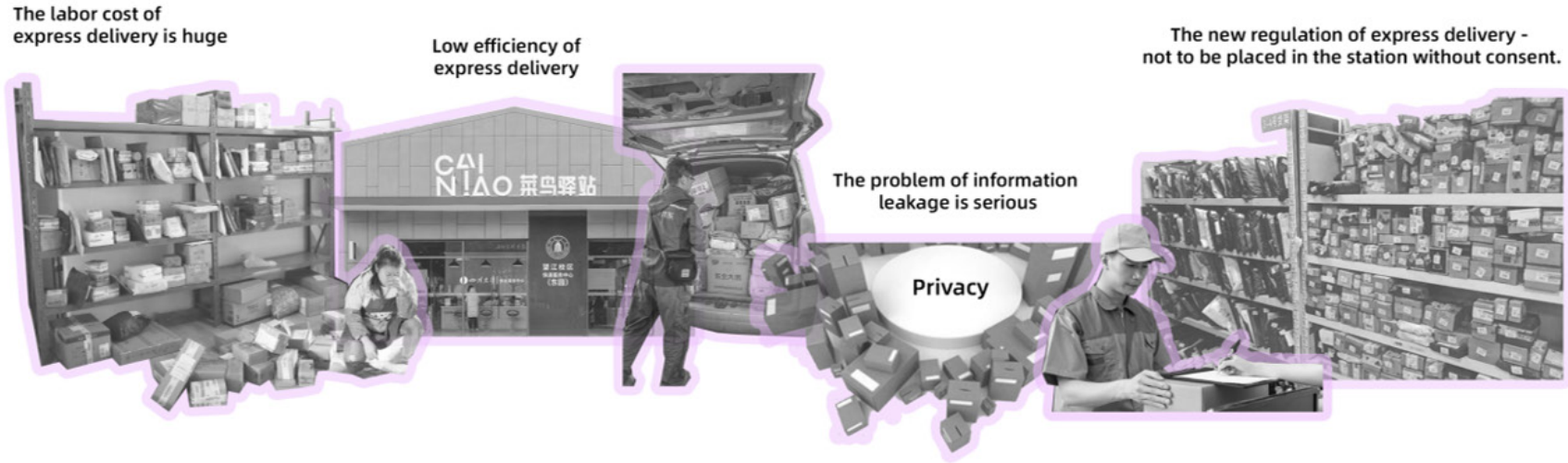


- Express messenger
- Tags : Logistics front
- Current situation : Existing logistics infrastructure is fragmented, resulting in inefficiencies.
- Benefits : A centralized logistics center can improve distribution efficiency and reduce transportation time.
- Improvement needs : More automated processing sites are needed to reduce the physical burden.
  
- bidder
- Tags : End users
- Current situation : Customers often need to pick up their parcels in person, which adds additional inconvenience.
- Benefits : The realization of direct home delivery service will bring great convenience to users.
- Improve demand : Improve home delivery services to ensure that each package can be delivered safely and on time.
  
- Courier station staff :
- Tags : Logistics operation core
- The current situation : staff face enormous package processing pressure, especially in the peak hours.
- Benefits : An automated and intelligent logistics system can greatly improve work efficiency and reduce labor burden.
- Improvement demand : It is necessary to introduce automated sorting technology and intelligent management system.
  
- Security :
- Tags : Safety supervision
- The current situation : there are many people in and out of the community, and the safety is difficult to supervise.
- Benefit : Intelligent distribution express delivery improves the overall security of the community.

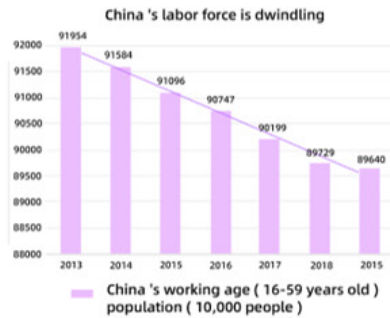
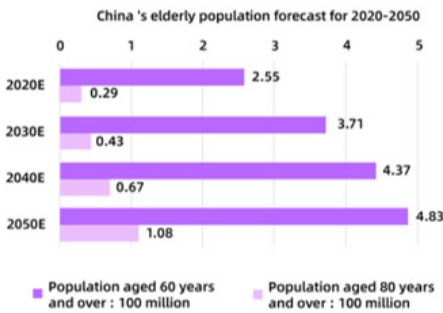
Figure 21 . Population needs analysis



# Problems with traditional express stations



01 Under the aging of the population, the shortage of labor in the distribution industry brings about cost growth.



02 under special circumstances ( weather, epidemic, etc. ) transport capacity is tight

03 Terminal distribution personnel frequent traffic accidents



weather



epidemic

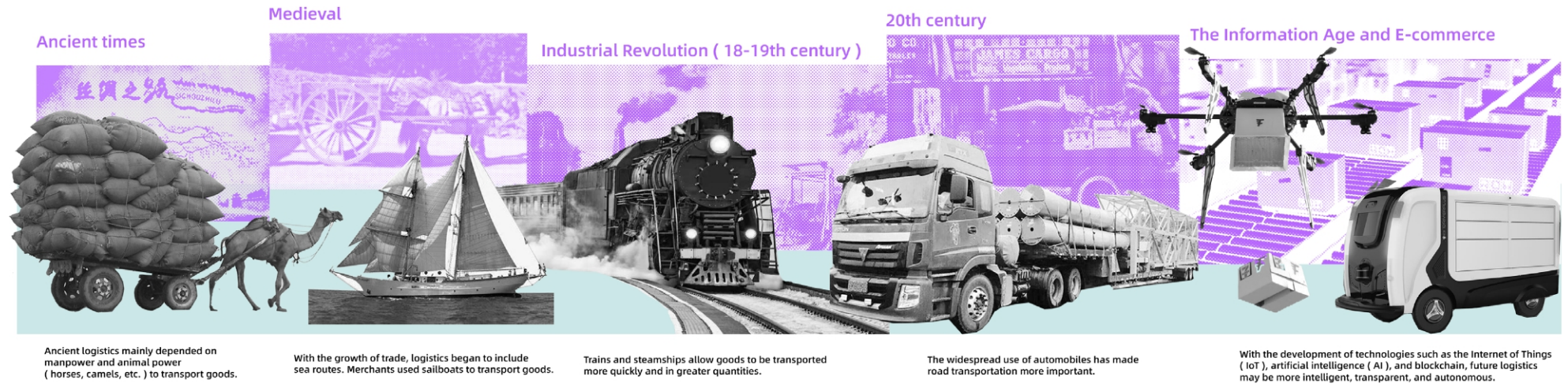


traffic accidents

Figure 22. Problems with traditional express stations

## The history of logistics evolution

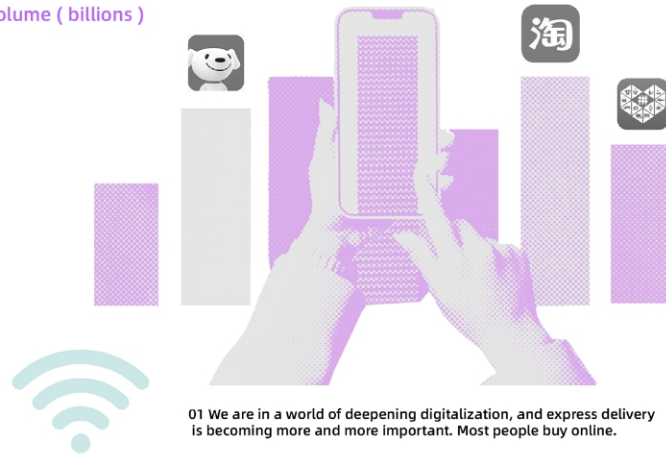
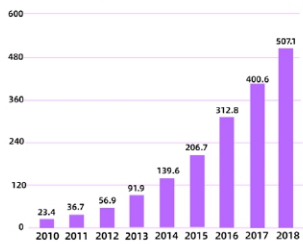
## Design Concept Narrative



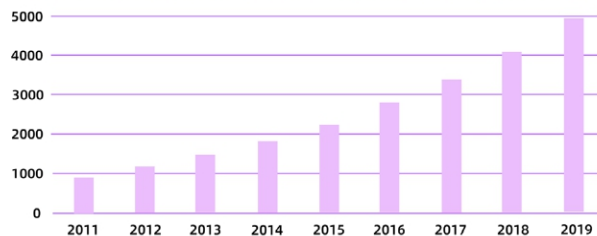
## Introductory narrative of the design project

26

China's express delivery business volume ( billions )



The transaction scale of China's smart logistics industry ( billion yuan )



**02** Online shopping is no longer just a convenient option, it has evolved into the new normal of our lives - We look forward to each order can be delivered to our hands with the fastest speed, the safest way and the highest efficiency.

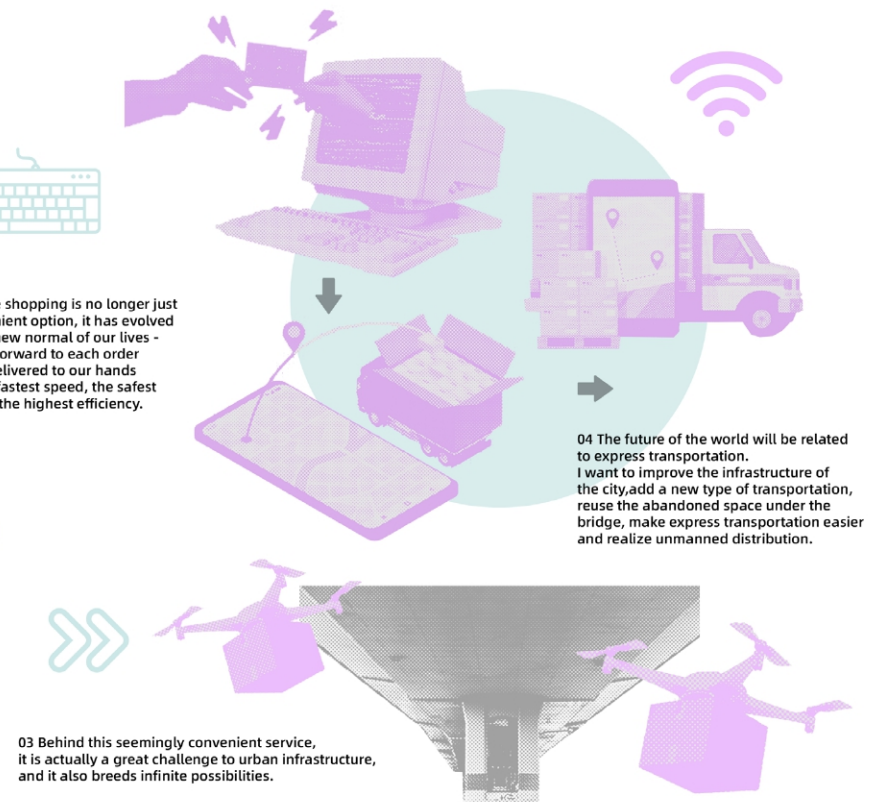


Figure 23 . Design Concept Narrative

# Design Concept Propose

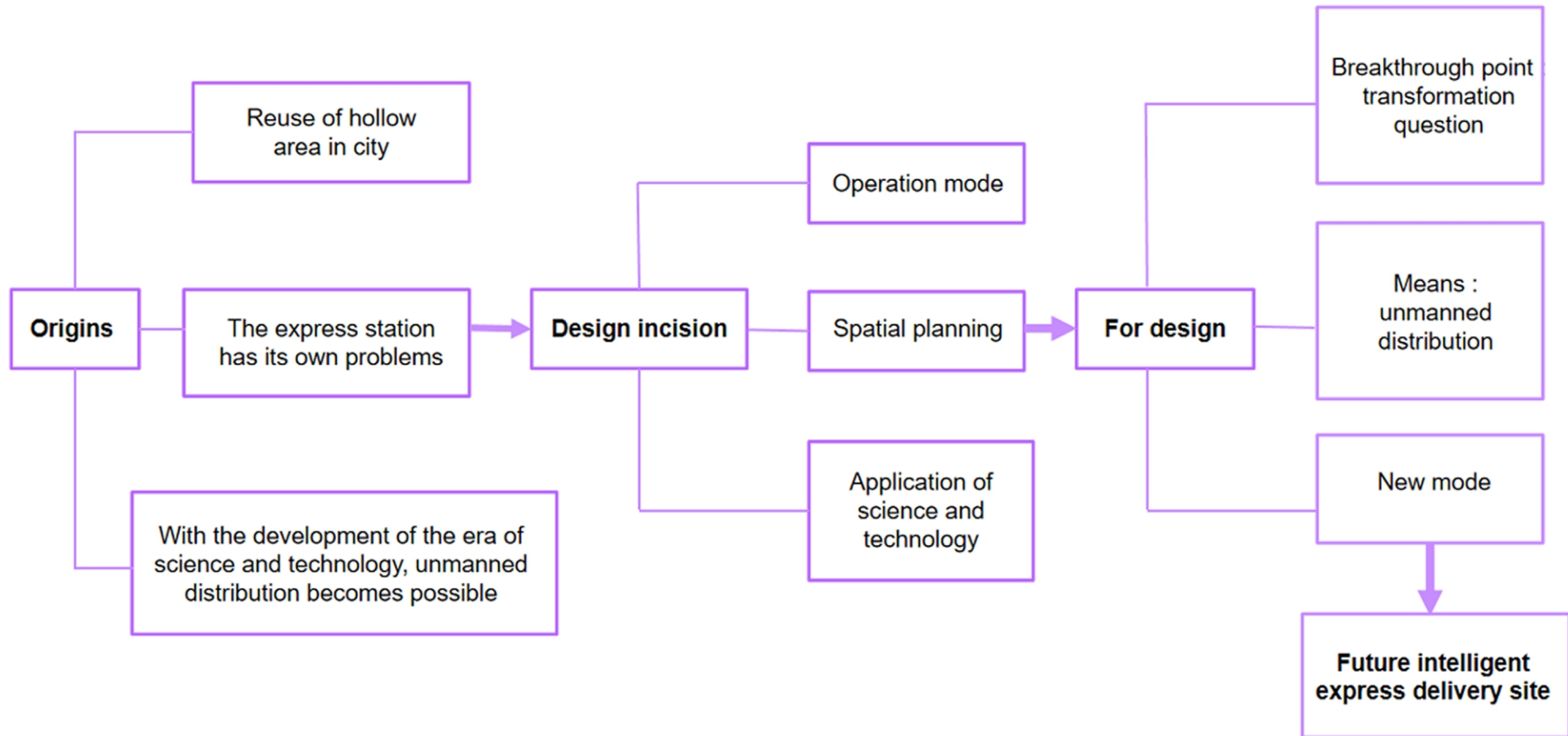


Figure 24.Design Concept Propose

# City Logistics distribution flow chart

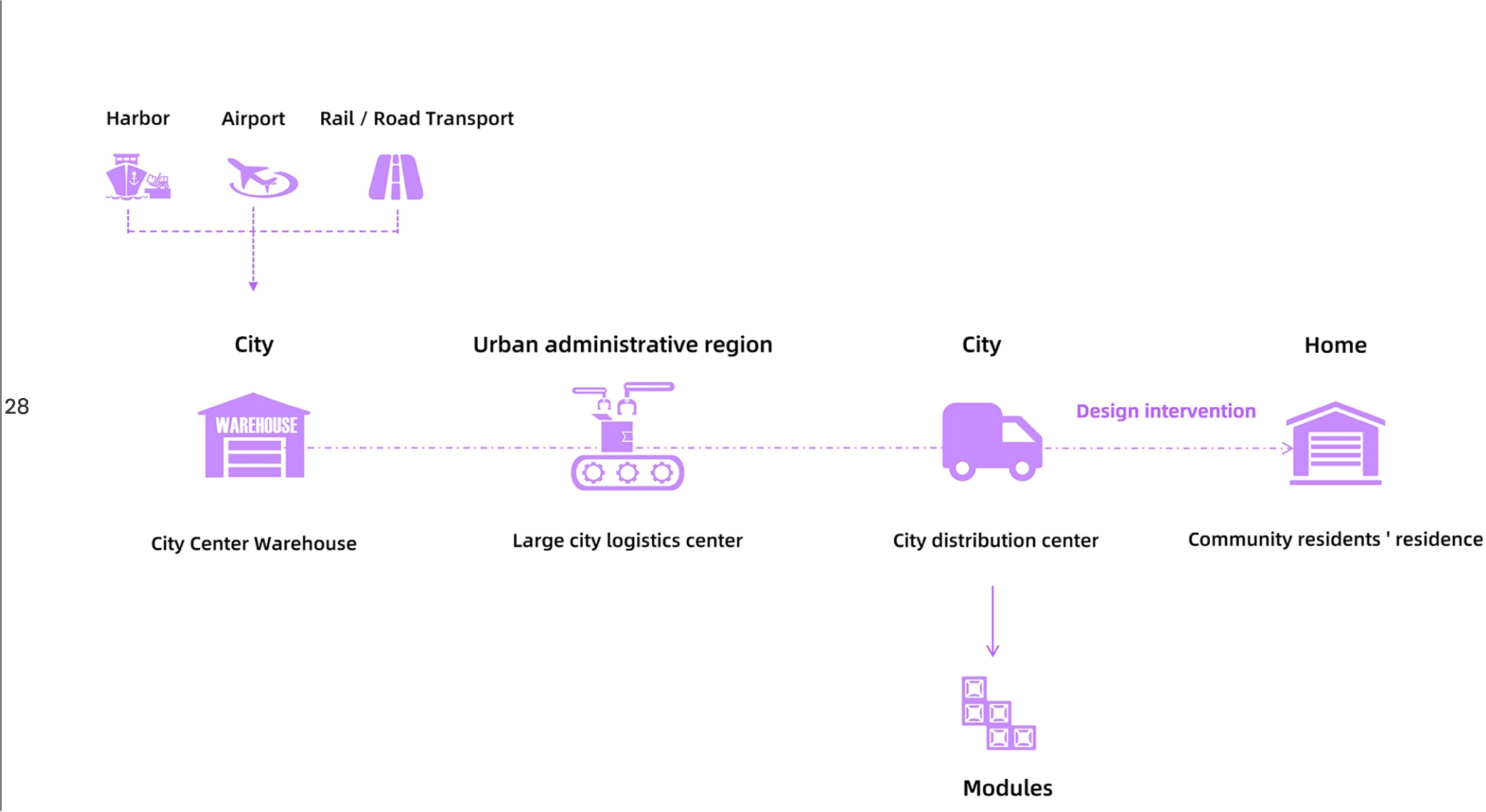


Figure 25 . City Logistics distribution flow chart

## Cargo handling process in modern logistics center

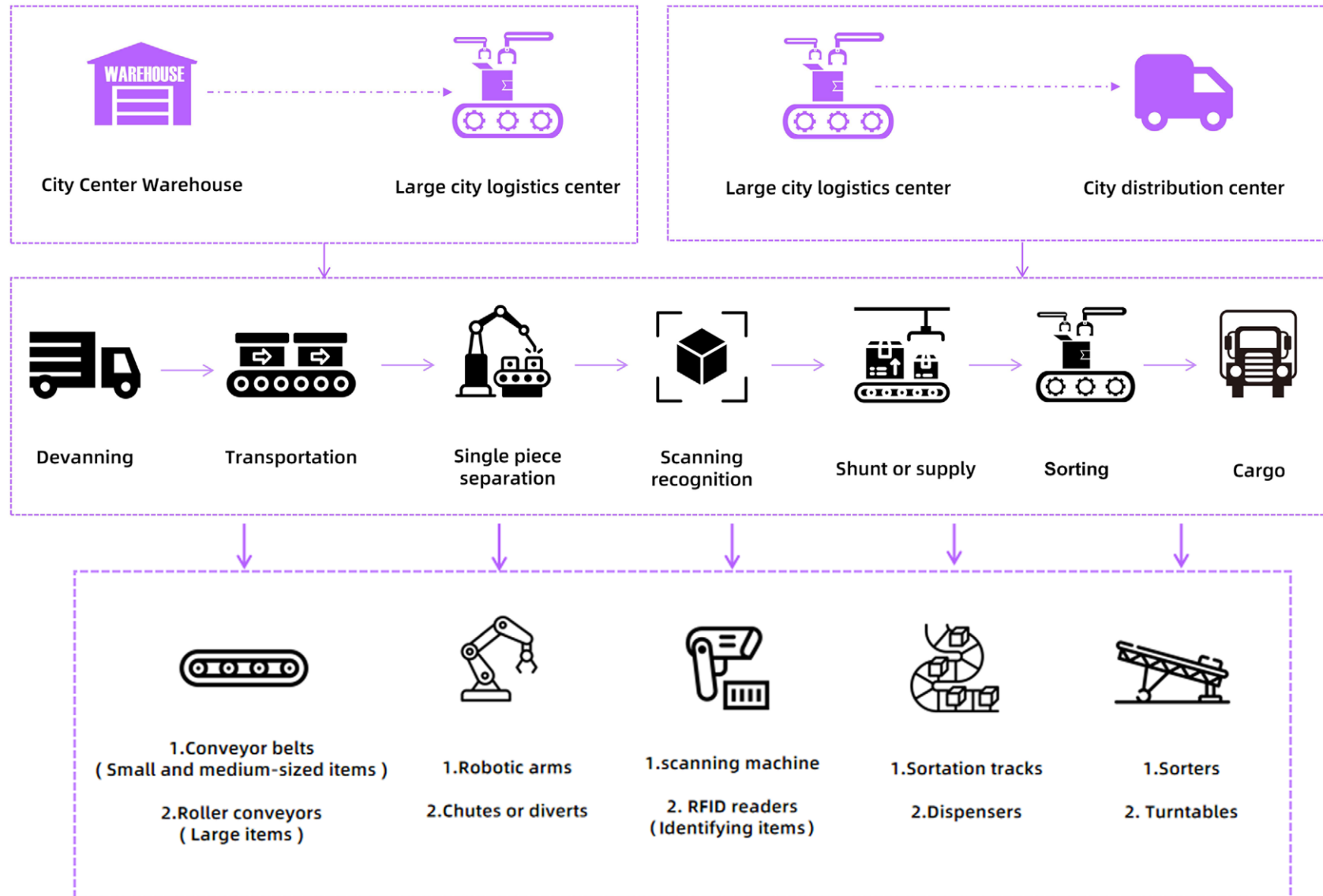


Figure 26. Cargo handling process in modern logistics center

# Module Volume&expansion module strategy

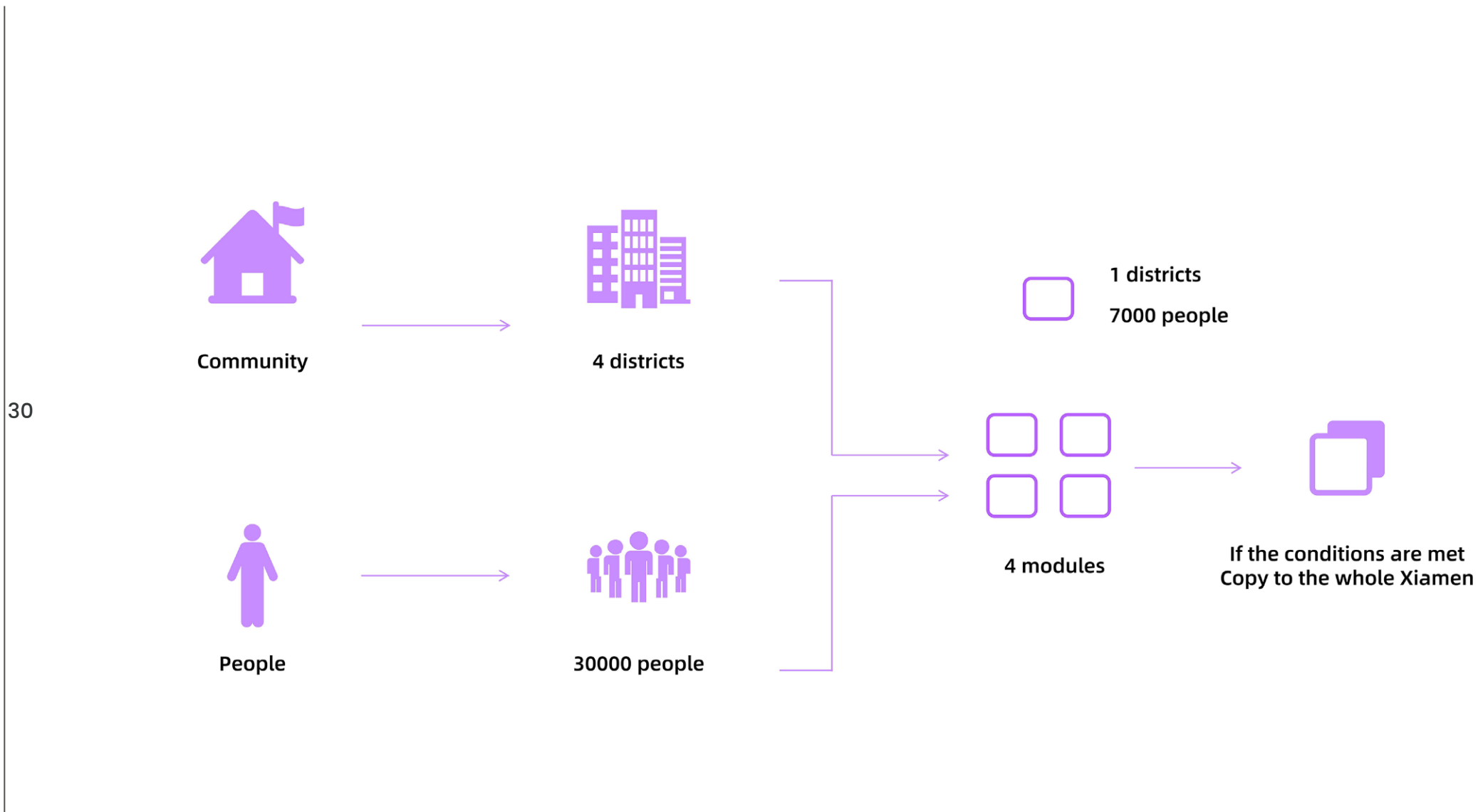


Figure 27 .Module Volume&expansion module strategy

# The last mile delivery process design

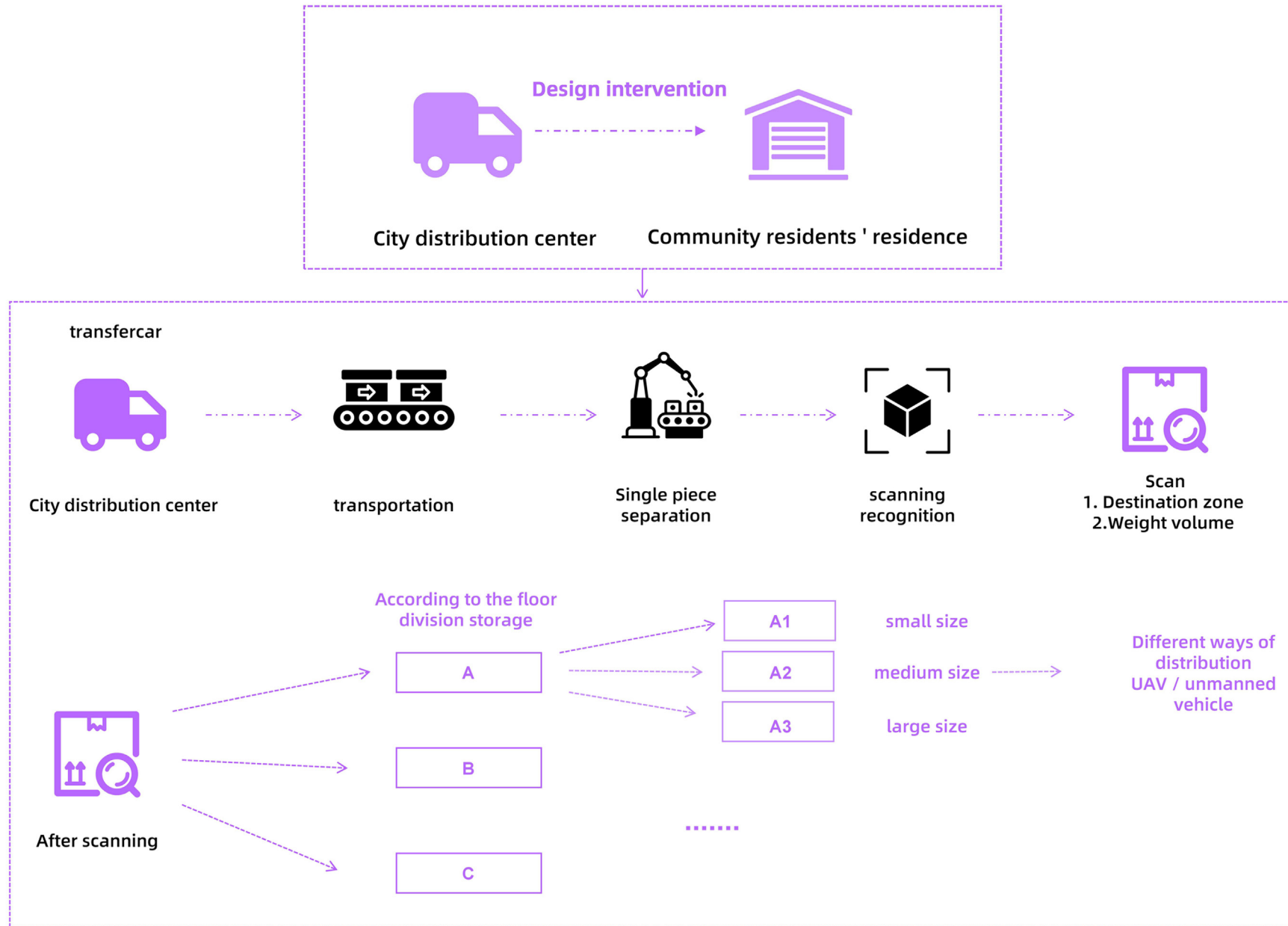


Figure 28.The last mile delivery process design

# Analysis of the scale of conventional community express stations

32



- 空间面积: 20m<sup>2</sup>-30m<sup>2</sup>
- Space area: 20m<sup>2</sup>-30m<sup>2</sup>
- 仓储体积: 50m<sup>3</sup>-60m<sup>3</sup>
- Storage volume : 50m<sup>3</sup>~ 60m<sup>3</sup>
- 每日派送量: 500-700件
- Daily Delivery : 500-700 pieces
- 每日寄件量: 50-70件
- Daily mailings : 50-70 pieces
- 覆盖1-2个小区, 约7000-14000人
- Covering 1-2 districts, About 7000-14000 people



Figure 29 .Analysis of the scale of conventional community express stations



# Module function analysis

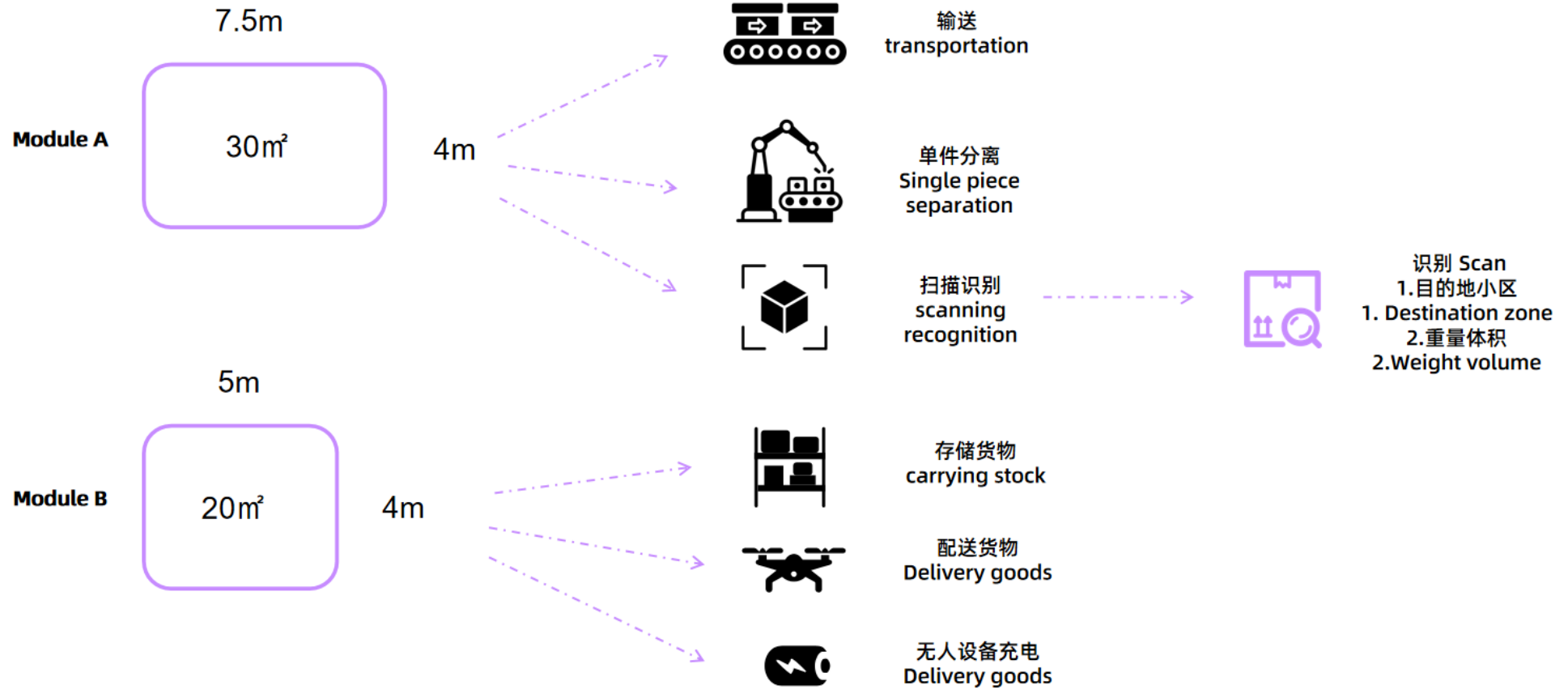


Figure 30.Module function analysis

# Chapter 4: Design Process

# Module Structure evolution

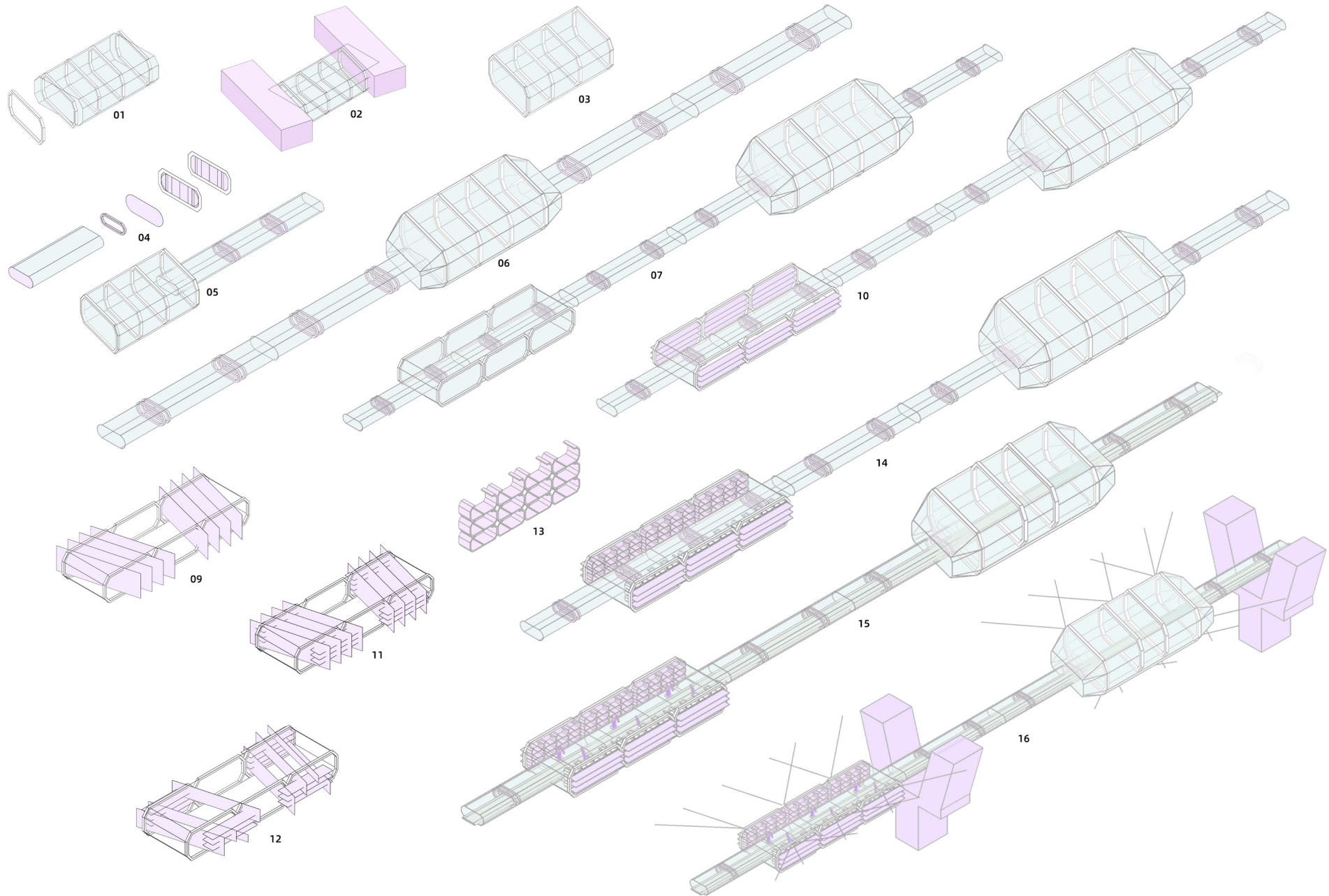
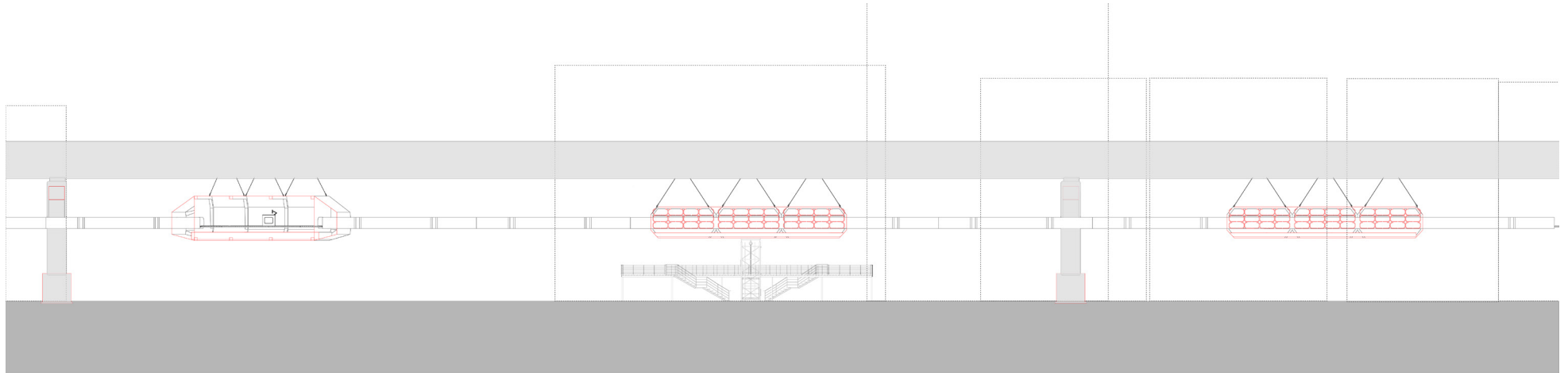


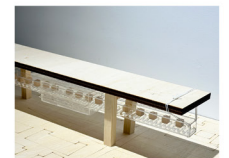
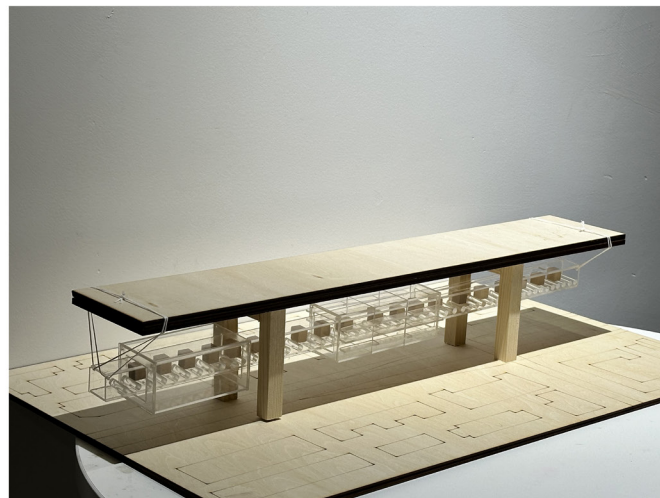
Figure 31. Module Structure evolution

## Section&sketch model



Physical Site and Project Models

36



This model shows an innovative under-bridge space reuse scheme and builds an intelligent logistics space through modular design.

The long conveyor belt in the center runs through the entire space and is responsible for efficiently transporting goods from the entrance to the specified processing module.

The large module function is to transport, sort, scan, and the small module function is to store goods, distribute goods, and charge the drone.

Figure 32 .Section&sketch model

## Project aerial view ( draft )

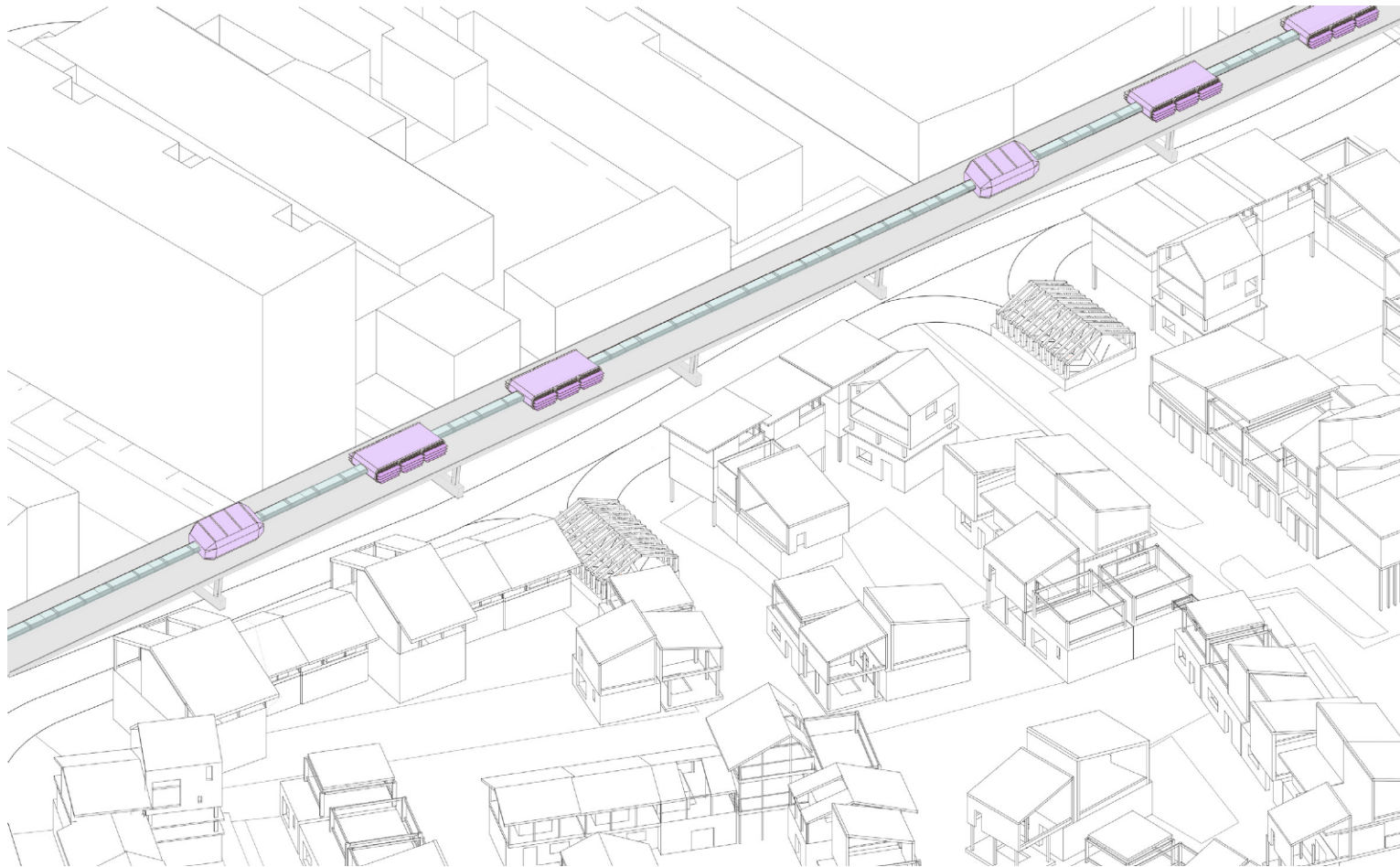


Figure 33. Project aerial view ( draft )

# Large scale flow chart

38

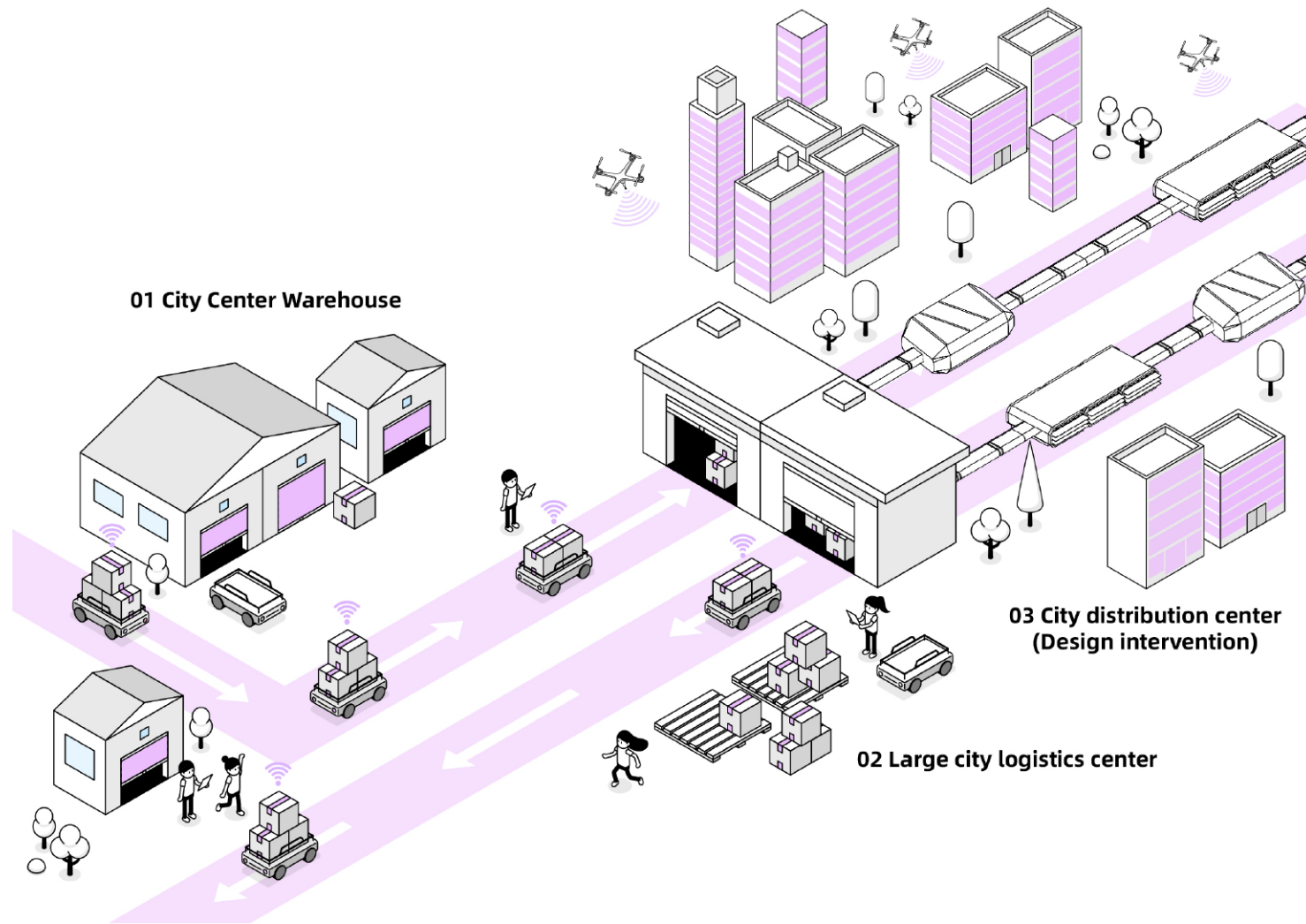


Figure 34 .Large scale flow chart

# Small scale flow chart

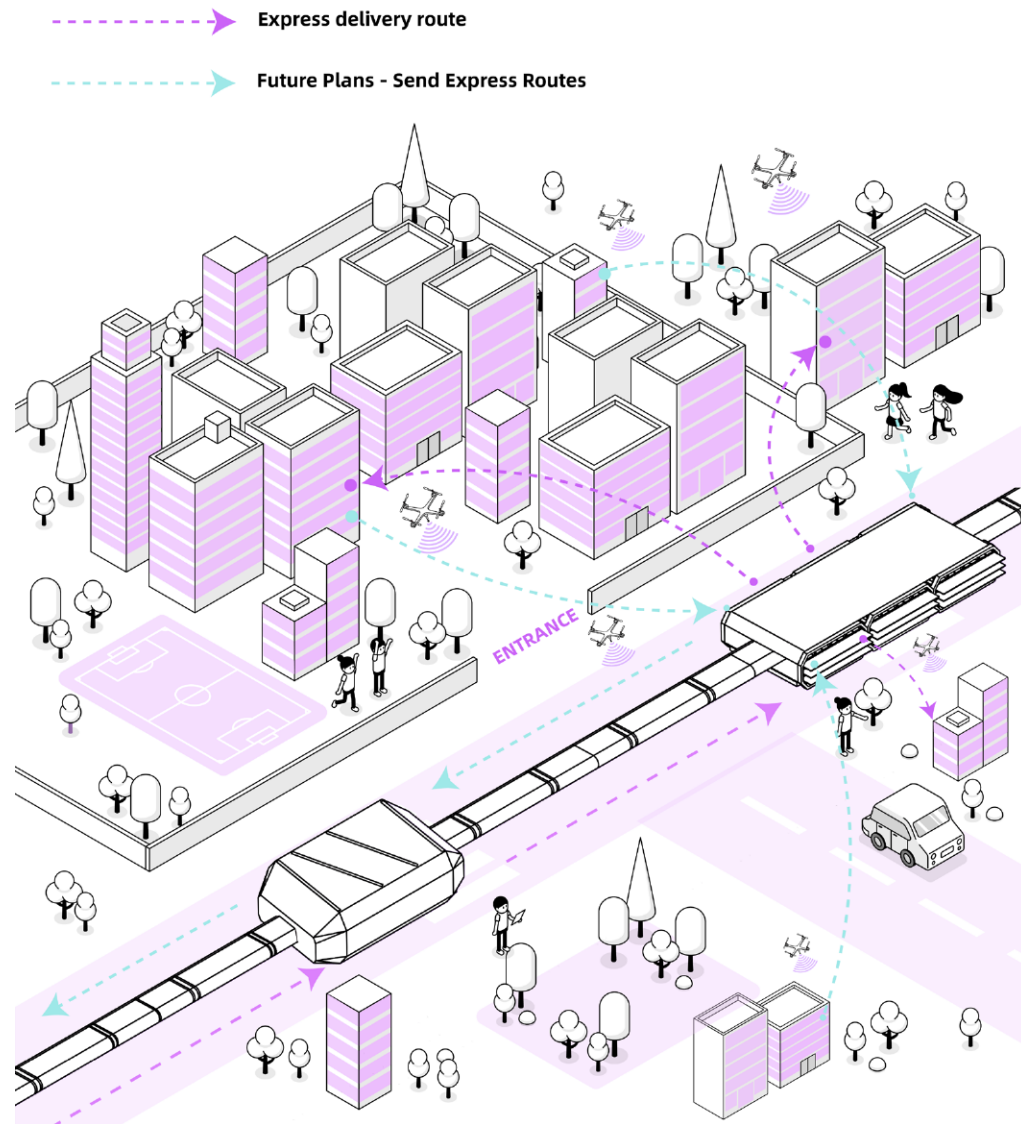


Figure 35.Small scale flow chart

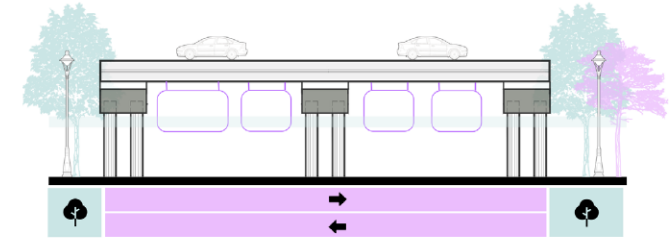
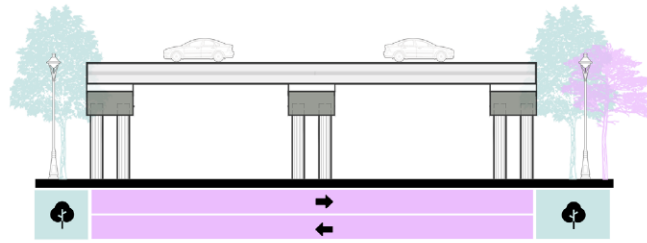
# Chapter 5: Design Proposal



# Application analysis of different terrain modules

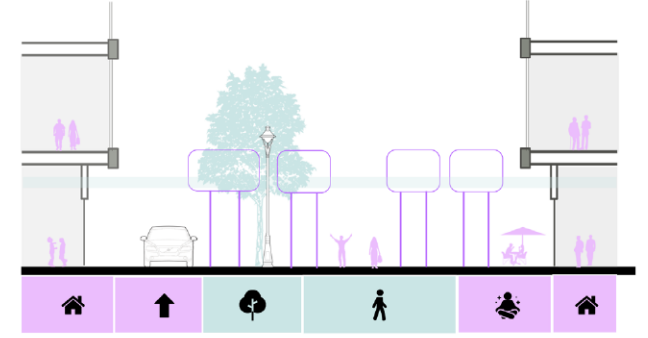
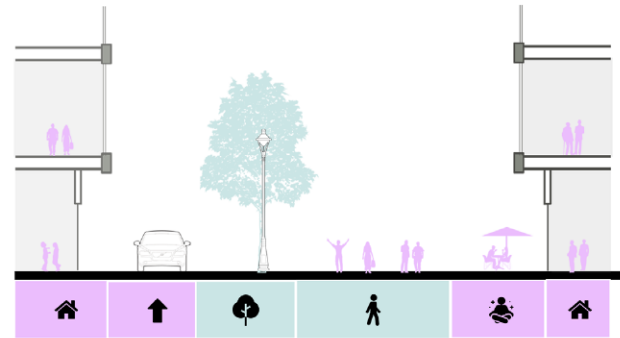
## Viaduct Section:

Title: Mount module under viaduct  
 Description: Designed to maximize space, the module fits snugly under the viaduct without affecting vehicle traffic, facilitating centralized management and distribution of goods.



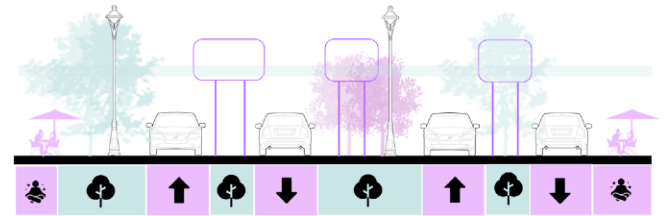
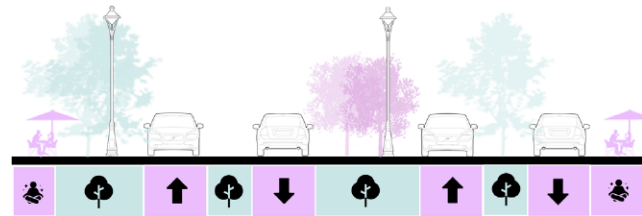
## Ground Normal Section:

Title: Integrated Sidewalk Module  
 Description: The module integrates with the urban streetscape to provide shelter for pedestrians and support efficient logistics operations without taking up additional space.



## Busy Traffic Sections:

Title: Edge Logistics Module  
 Description: Set up modules at the edge of a busy road to minimize traffic disruption.



## Mixed-use road sections:

Title: Compact Street Module  
 Description: Foldable or retractable logistics modules designed to provide the necessary services without occupying public space.

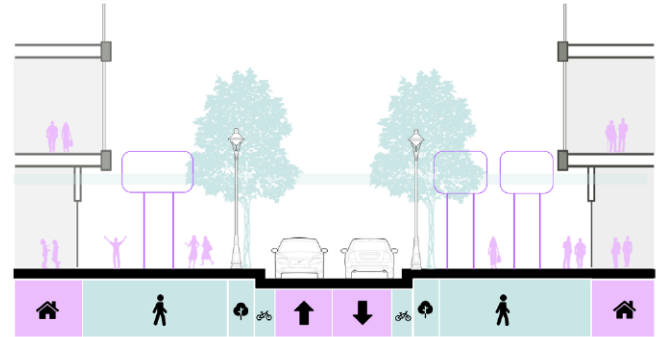
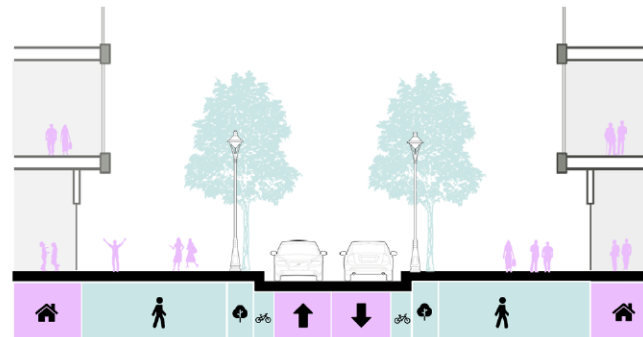


Figure 36. Application analysis of different terrain modules

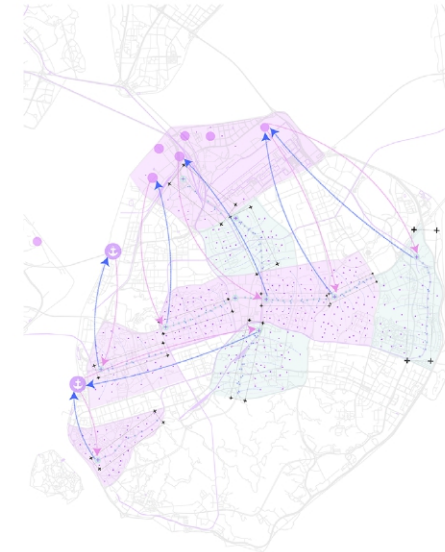
# Diagram of future expansion



**Phase 01: Start-up stage : basic layout ( current-5 years )**  
**Title : Concept Verification**  
 Description : The suspension module under the key viaduct in Xiamen is concentrated in the transportation hub area. The main purpose of this stage is to test and verify the operational efficiency of the logistics module and its impact on urban traffic.



**Phase 02: Development stage : network construction ( 5-10 years )**  
**Title : Bridge Network Construction**  
 Description : Based on the successful experience of the start-up phase, the logistics module network is extended to more viaduct areas to form a logistics network covering the main urban arteries.



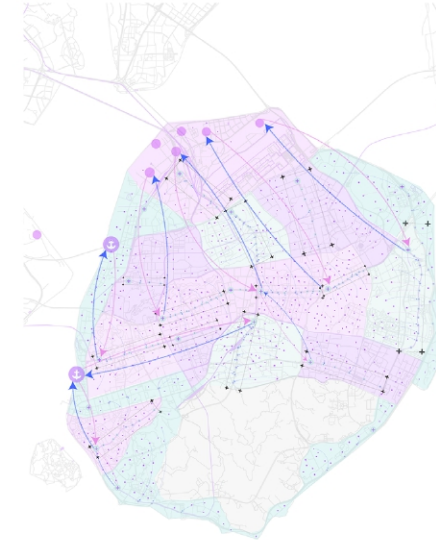
**Phase 03: the mature expansion of the viaduct network ( 10-15 years )**  
**Title : Elevated network improvement**  
 Description : Expand the logistics module to all major viaducts in Xiamen Island, build a comprehensive distribution network, and strengthen the city's logistics arteries.



**Phase 04: Diffusion stage : regional infiltration ( 15-20 years )**  
**Title : Urban Texture Fusion**  
 Description : The logistics module further penetrates into the various communities and business circles in Xiamen.



**Phase 05: Mature stage : global coverage ( 20-30 years )**  
**Title : All Island Connectivity**  
 Description : The logistics network in Xiamen Island has matured, and both the central area and the suburbs can enjoy efficient logistics services.



**Phase 06: Innovation stage : future vision ( 30-50 years )**  
**Title : Smart Logistics Blueprint**  
 Description : It is foreseen that the logistics of Xiamen Island will be fully intelligent and automated in the next half century.

**Legend**

- Horizontal coverage
- Vertical coverage
- Expand the range
- Edge expansion range
- Mountain range

In mountain areas, the expansion of logistics modules is limited by multiple factors such as steep terrain, inconvenient transportation, environmental protection regulations, and economic costs. These factors together constitute insurmountable obstacles, making it impossible to build and operate logistics infrastructure in these areas.

- Terminal
- Regional distribution center
- Module A
- Module B
- Home

Express delivery through the port, airport, rail transport to the city center warehouse, and then transported to the regional distribution center, classification, sorting, and then ready to transport to the city distribution center to prepare the distribution.

- Sending route
- Signing route

Figure 37 .Diagram of future expansion

# Master Plan

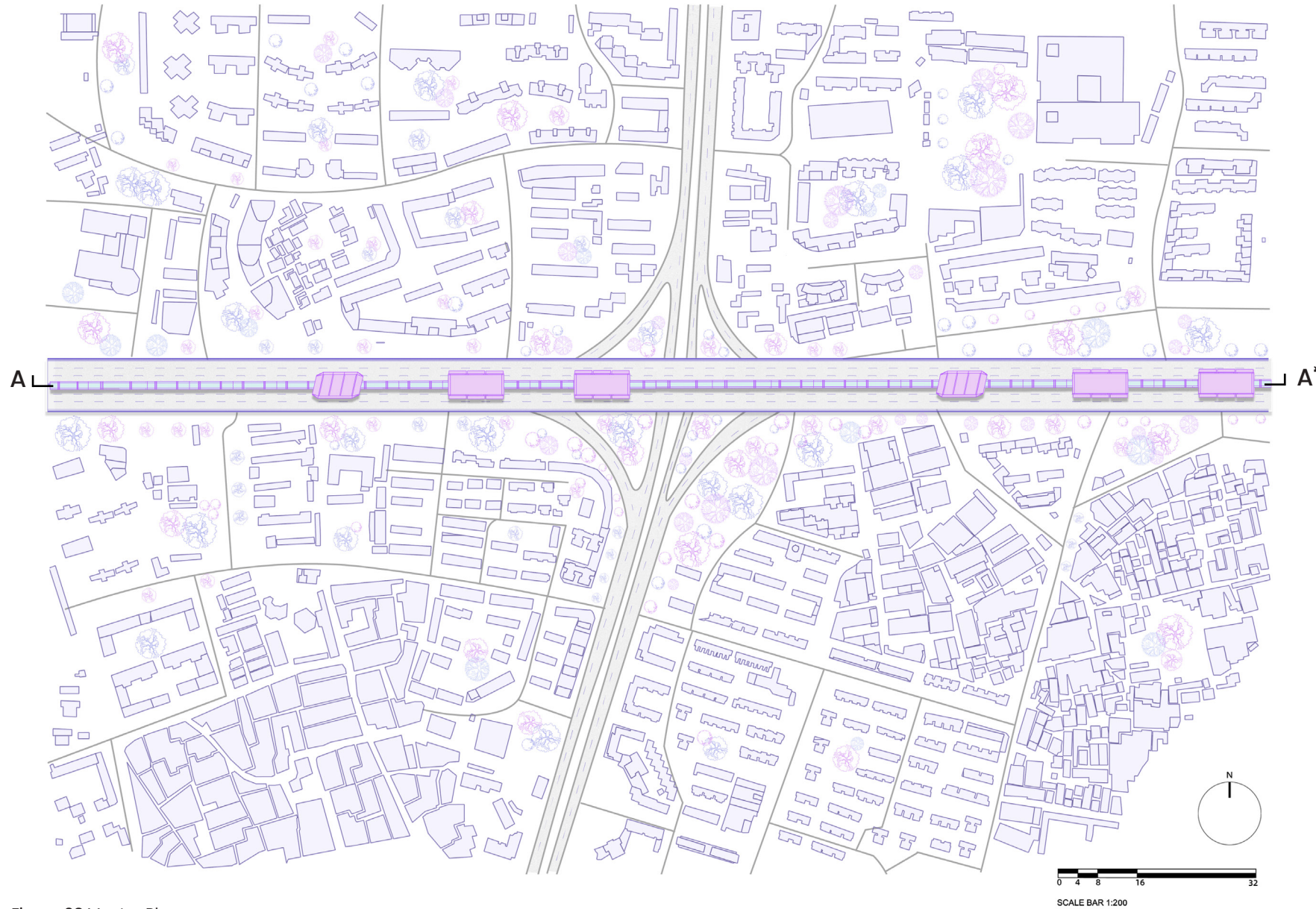


Figure 38. Master Plan

# Section AA'

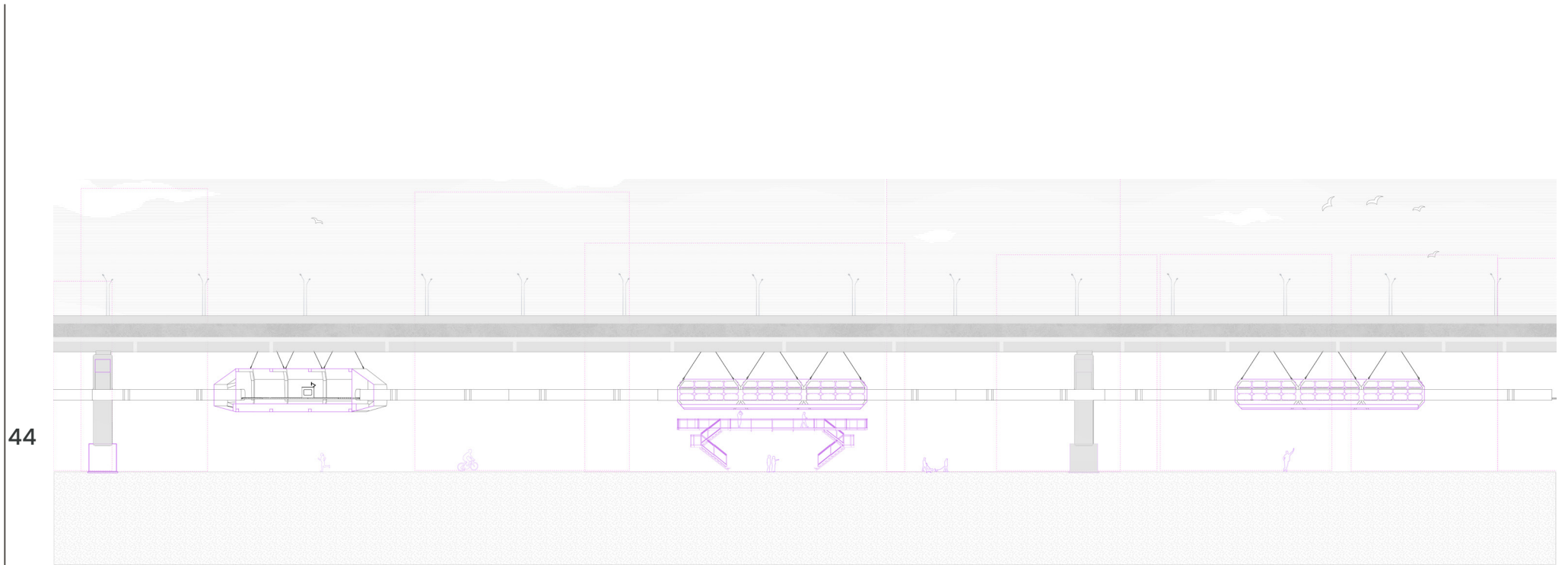
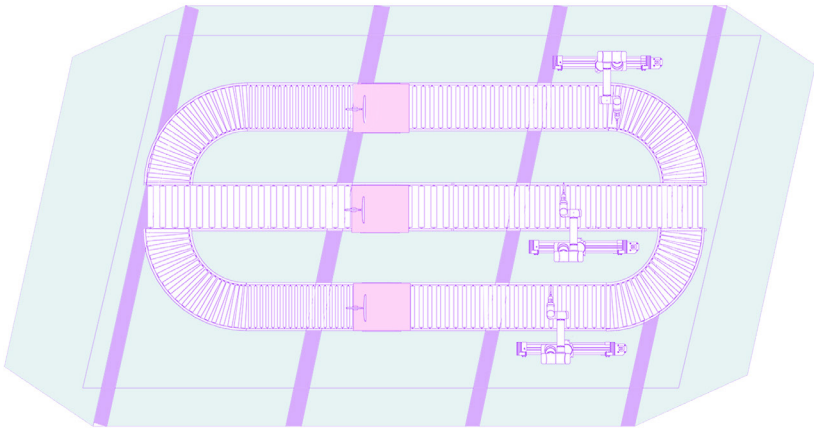
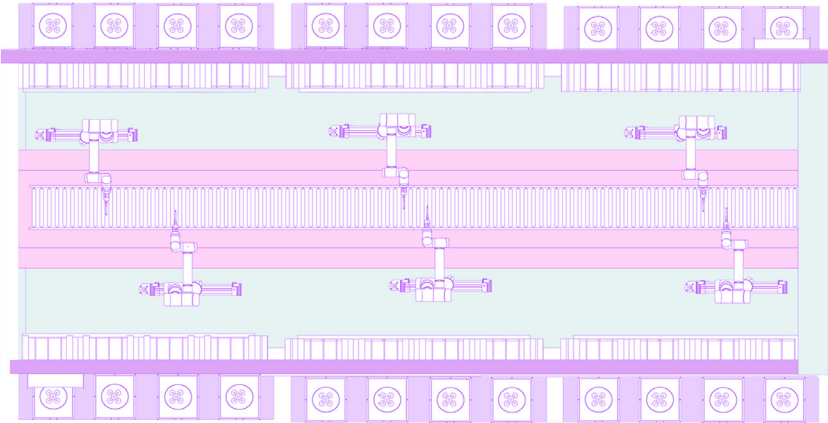


Figure 39 .Section

# Module Plan



Module A



Module B

## Introduction of functional parts

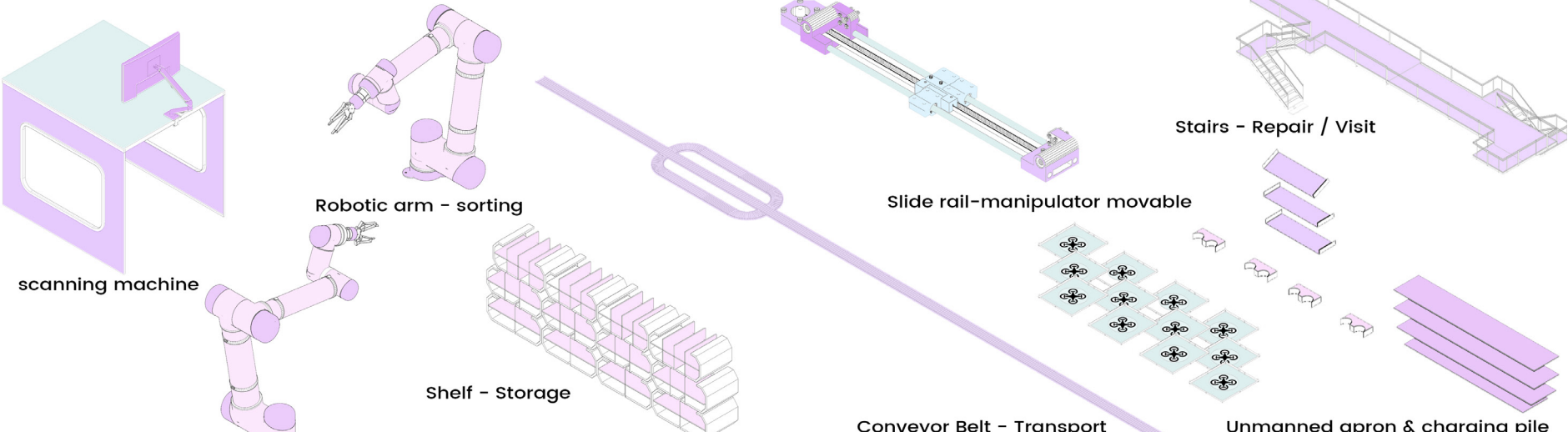
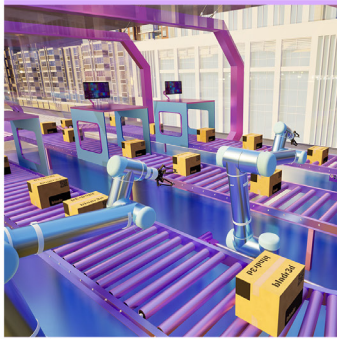
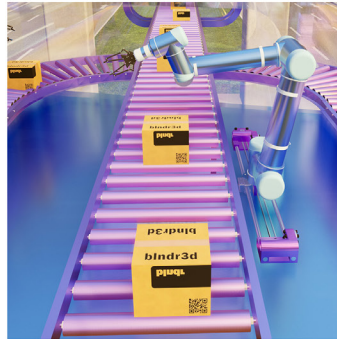


Figure 40.Module Plan

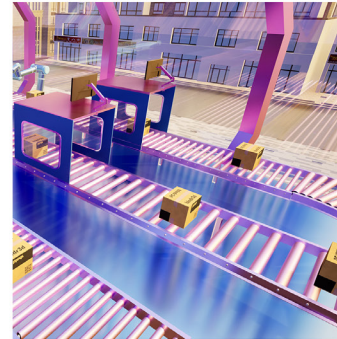
# Process Design



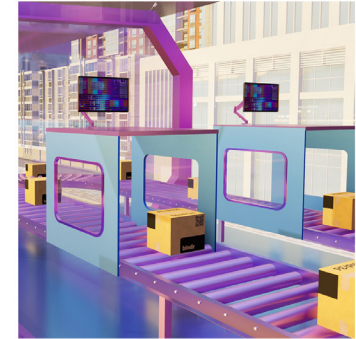
Express delivery into the channel



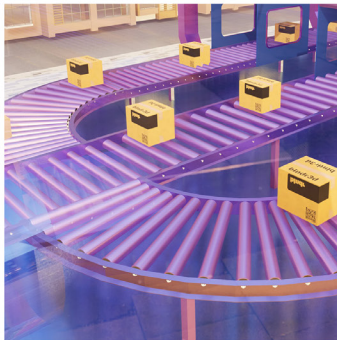
Single piece separation



prepare to scanning recognition



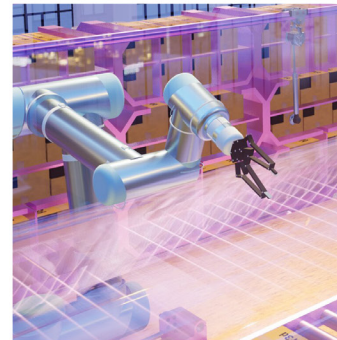
Scan: Destination zone&Weight volume



Summarize a single track after sorting



Mechanical arm + slide rail for clamping



According to the floor division storage



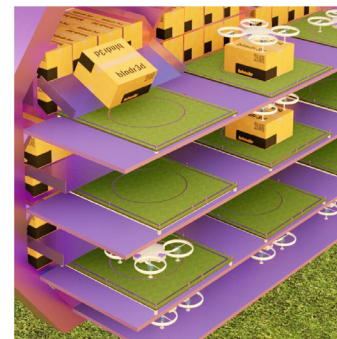
Storage according to the size of the express



The lowest layer is the UAV charging pile



Scalable and movable slider launch express delivery



Express delivery slips out to the tarmac



UAV delivery express

Figure 41 .Process Design

Render 01



Figure 42.Render 01

Render 02

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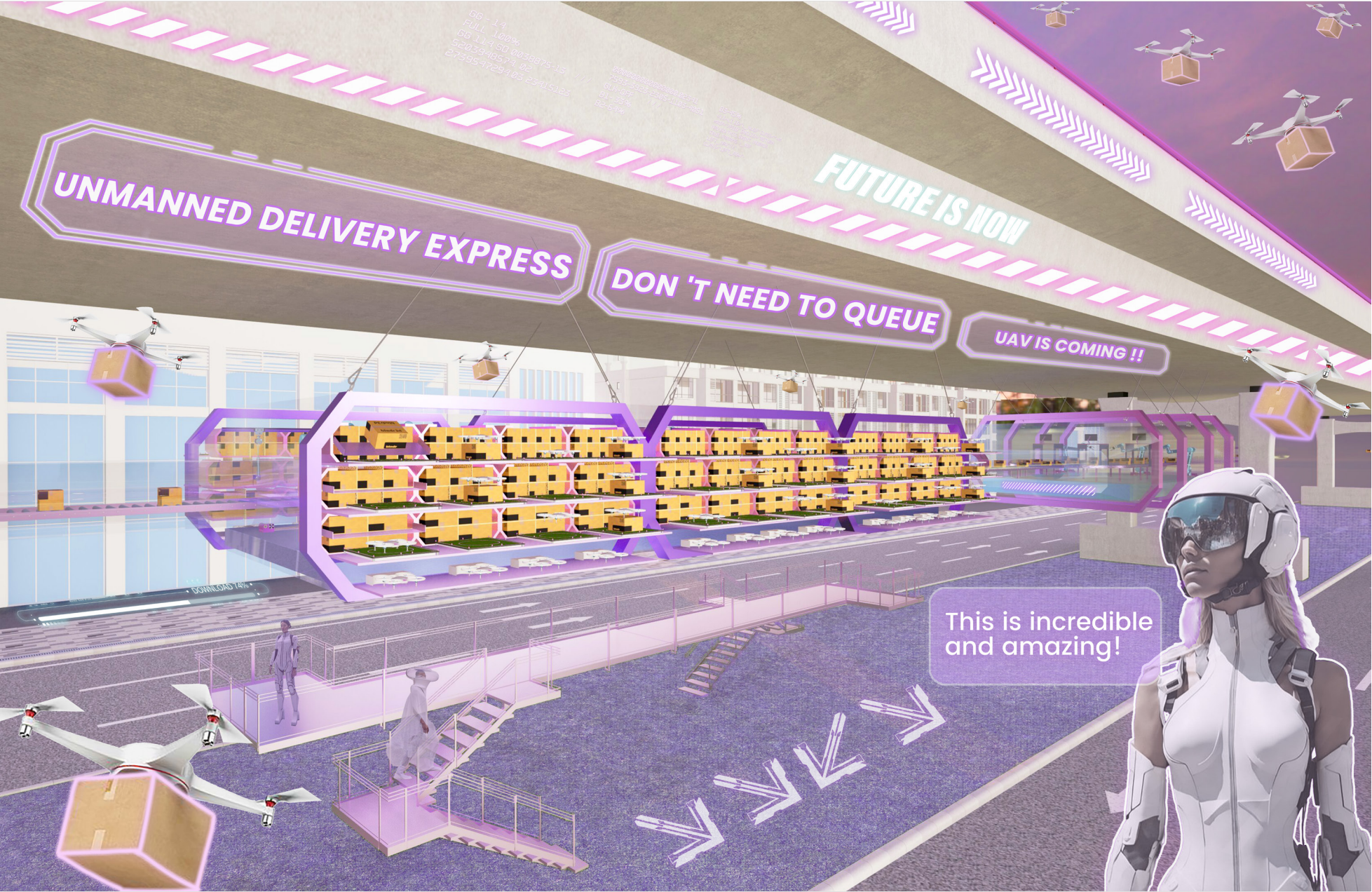


Figure 43,render 02



# Render 03

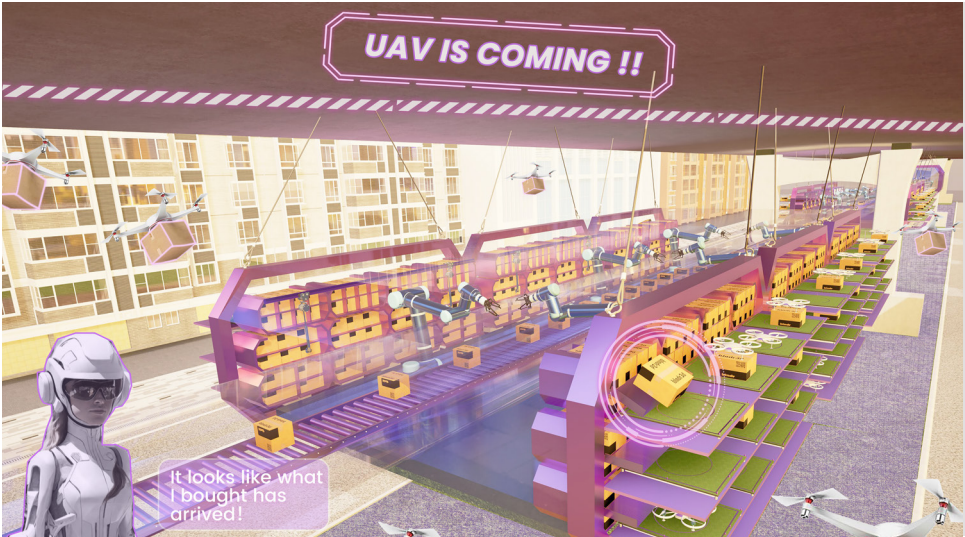
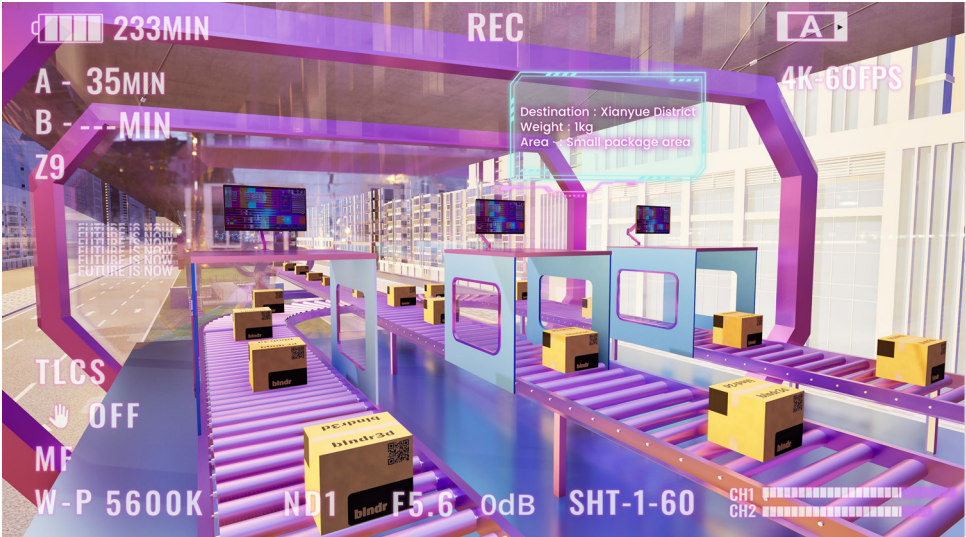
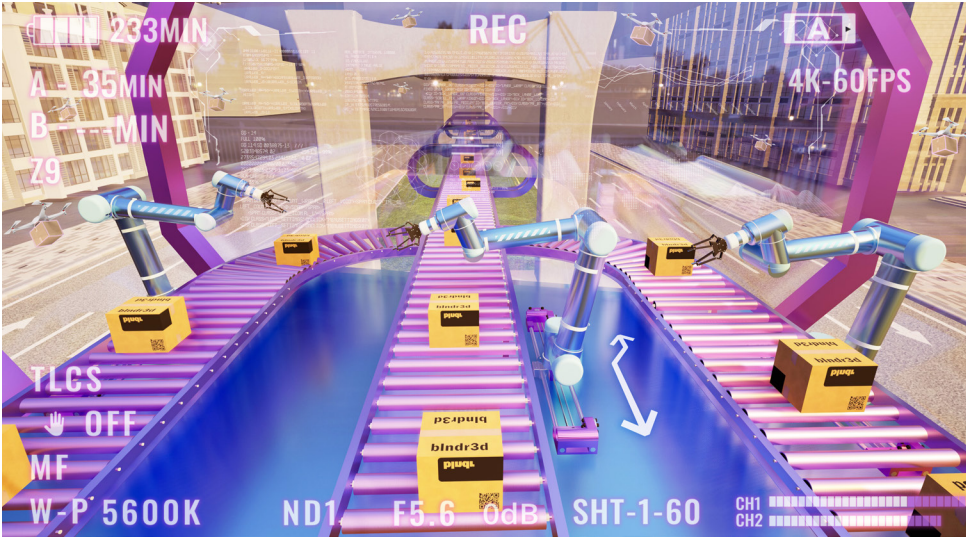


Figure 44.Render 03

# Sectional perspective & large sample

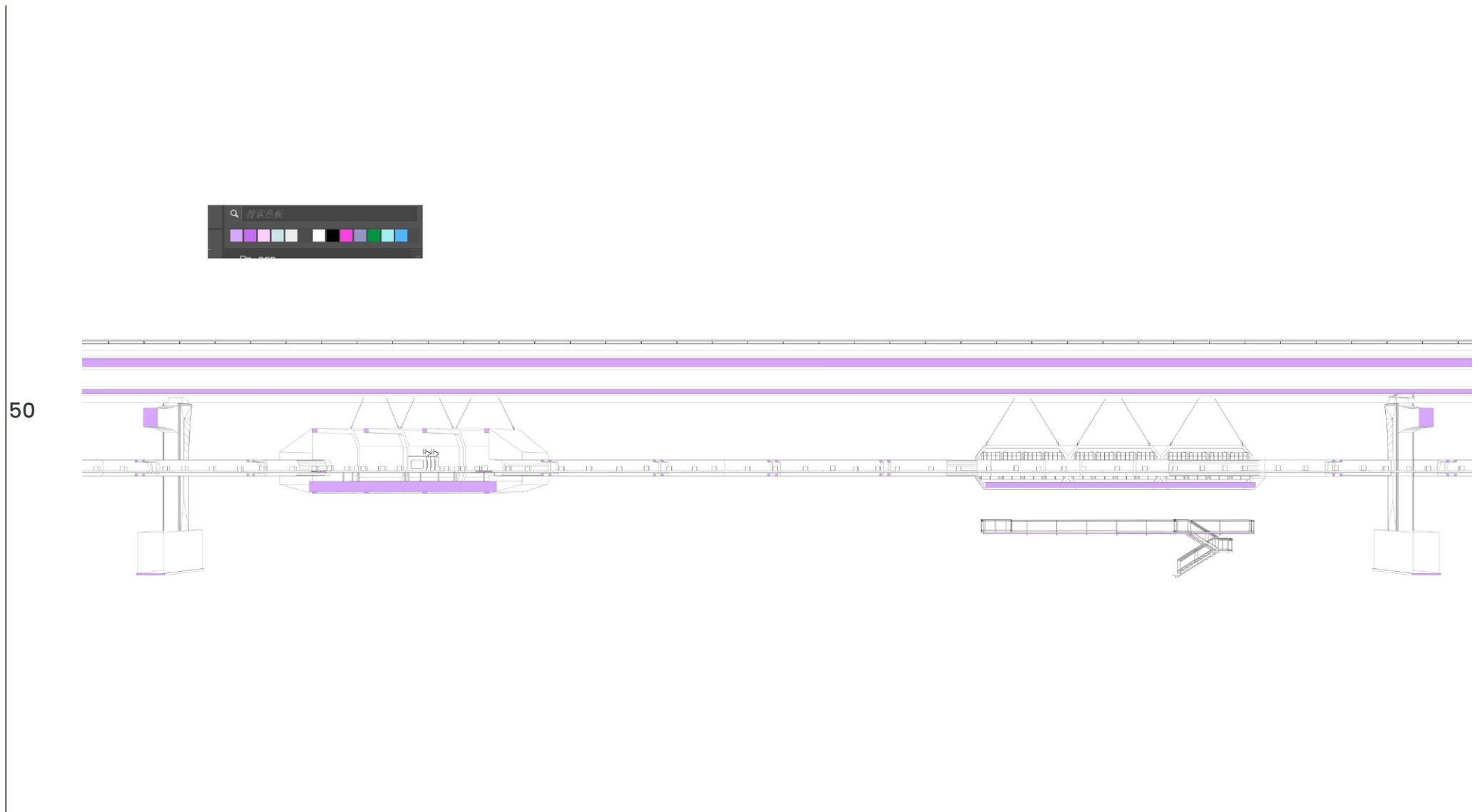


Figure 45,Sectional perspective & large sample

# Explosive view

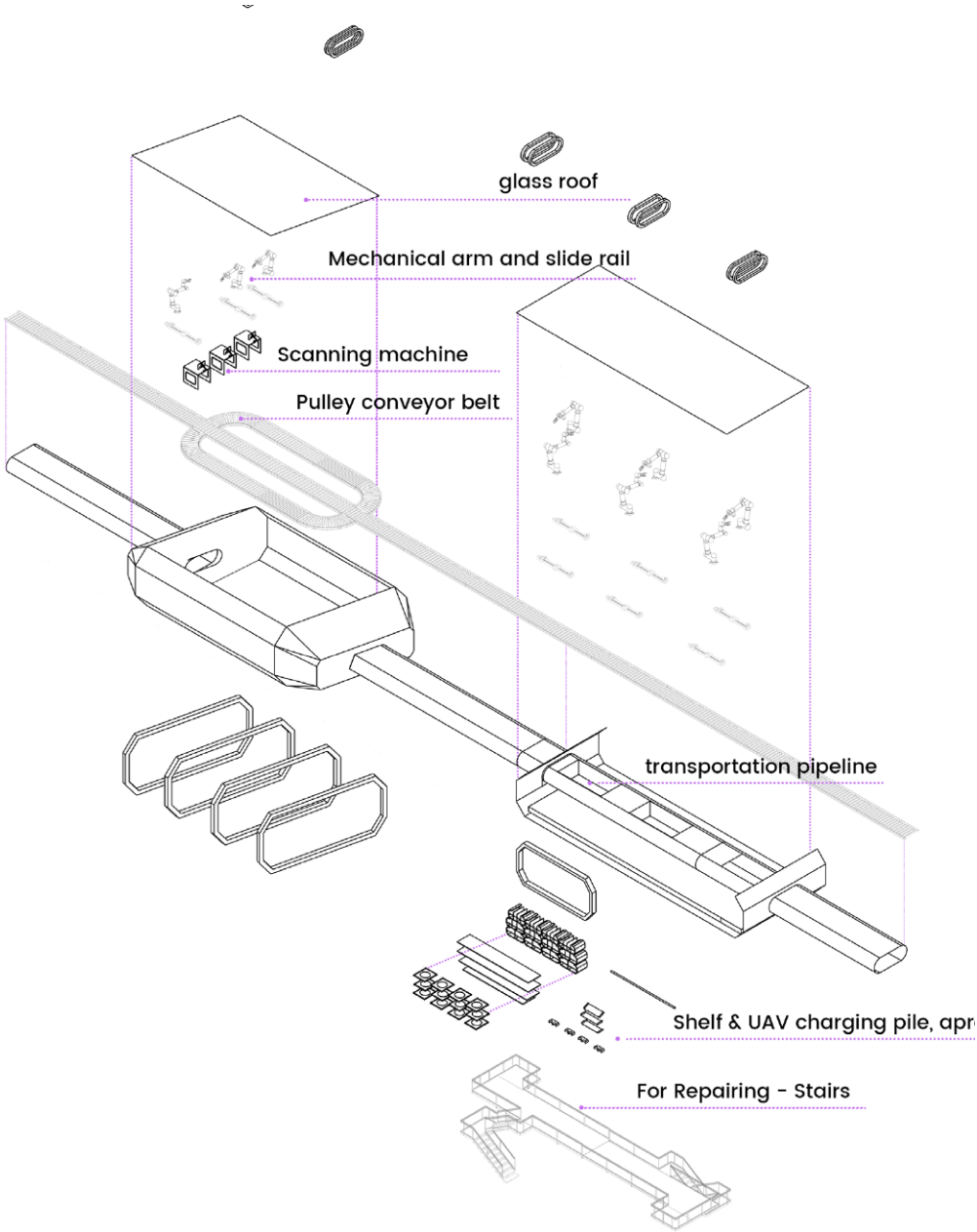


Figure 46.Explosive view

# Site Model

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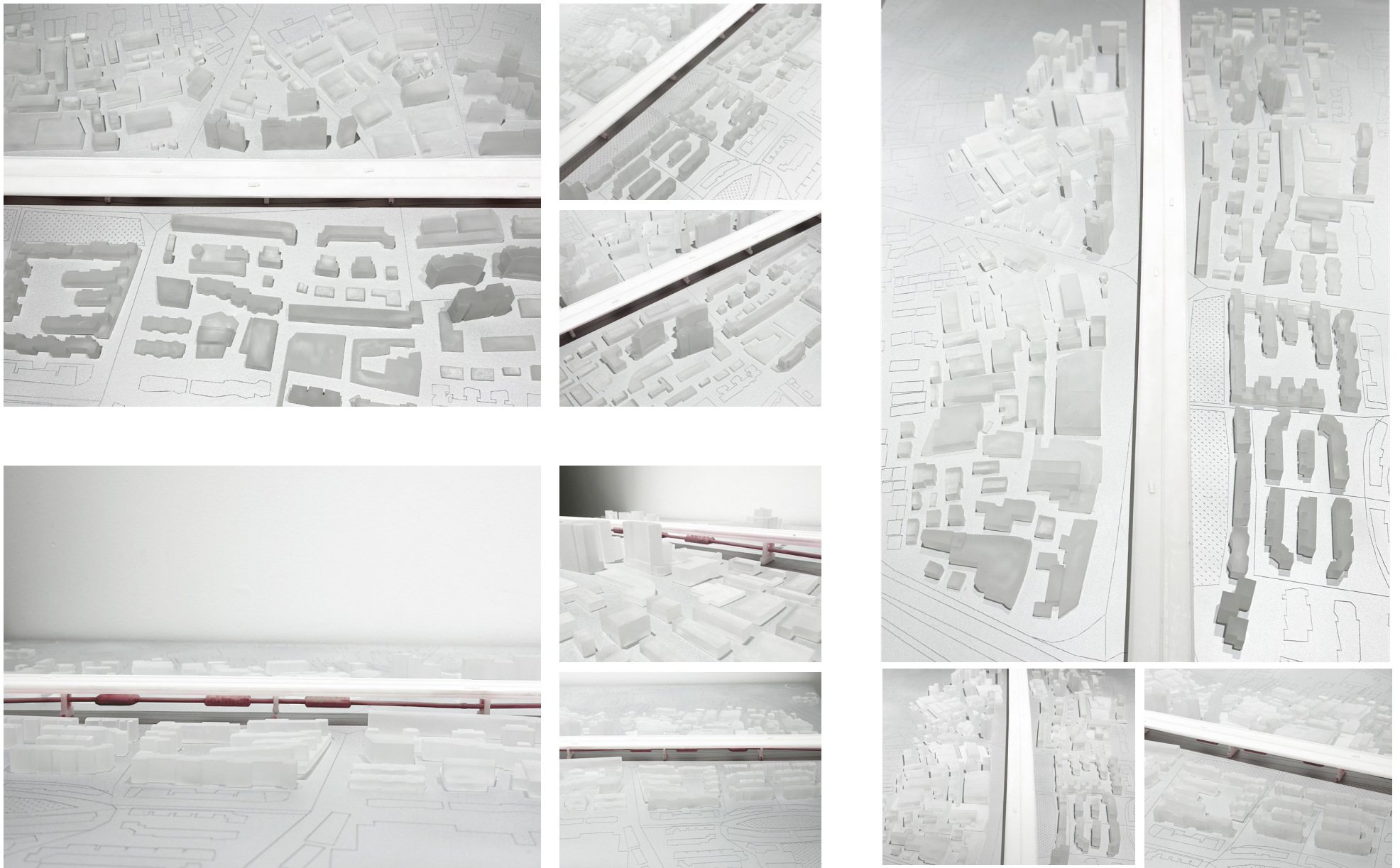


Figure 47, Site Model

# Detail Model

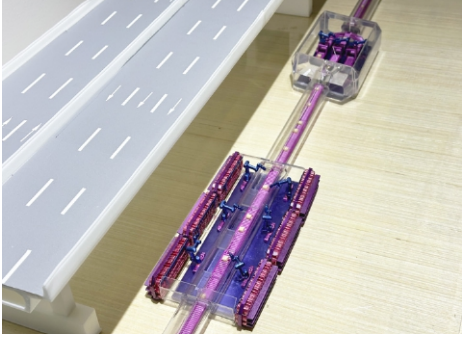
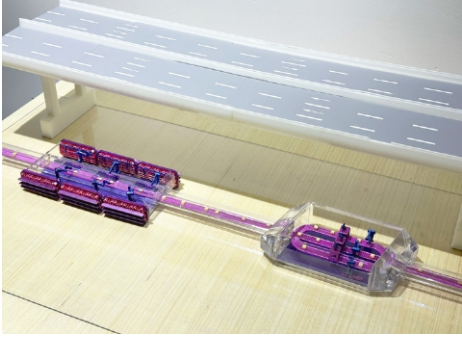
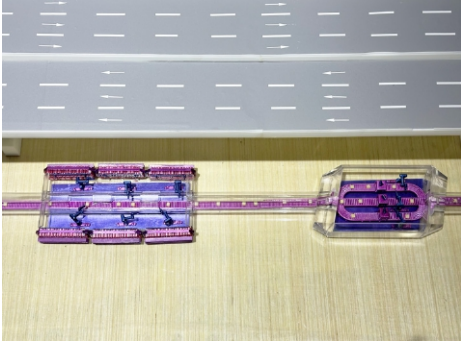
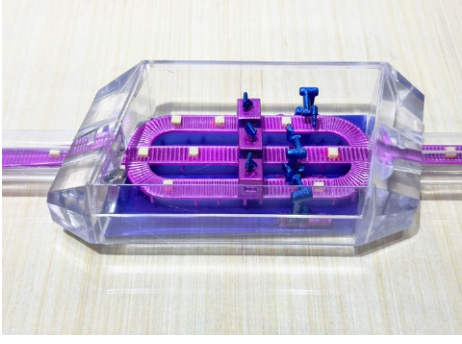
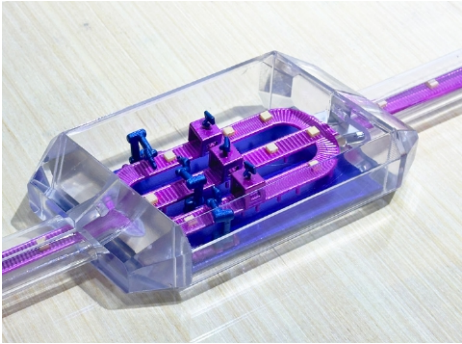
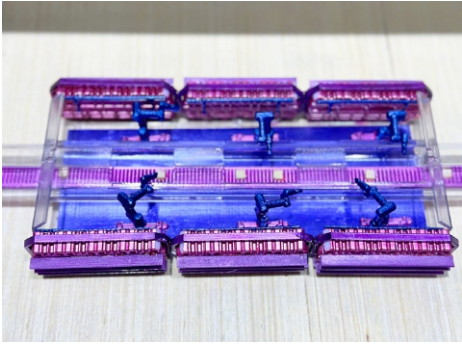
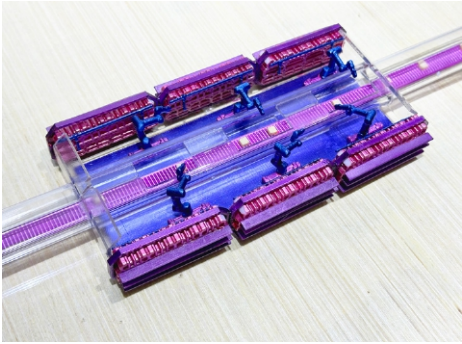
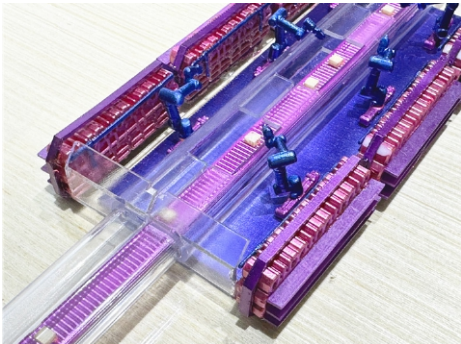


Figure 48.Detail Model

# Chapter 6: Conclusion and Reflection

# Conclusion&Reflection

This project explores how to transform the urban space under the viaduct through the design and implementation of automated logistics distribution centers, effectively applying Rem Koolhaas ' ' crowding culture ' theory, Jane Jacobs ' urban vitality theory, and Yona Friedman 's ' mobile architecture ' concept. The combination of these theories not only optimizes the use of urban space, but also promotes the connection and vitality of communities, demonstrating the importance and potential of urban thresholds in modern urban planning.

In the project practice, I faced a variety of challenges, including how to achieve efficient logistics operations in a limited space, and how to meet the practicality and technical feasibility while maintaining the beautiful design. These lessons provide valuable insights into our understanding of functional integration and spatial reuse in complex urban structures.

Looking to the future, it is recommended to further study the multi-functional use of space under viaducts and explore more ways to use these often neglected urban spaces to enhance urban ecological and social interactions. At the same time, it should also consider how to use emerging technologies, such as artificial intelligence and big data, to optimize urban logistics systems to make them more intelligent and sustainable.

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