ENCOREstate

ENabling Circular COnstruction to public space REgeneration in Shanghai new workers' estates

New workers' estates - aging urban area

1950s

11.39 million m²

200+

now

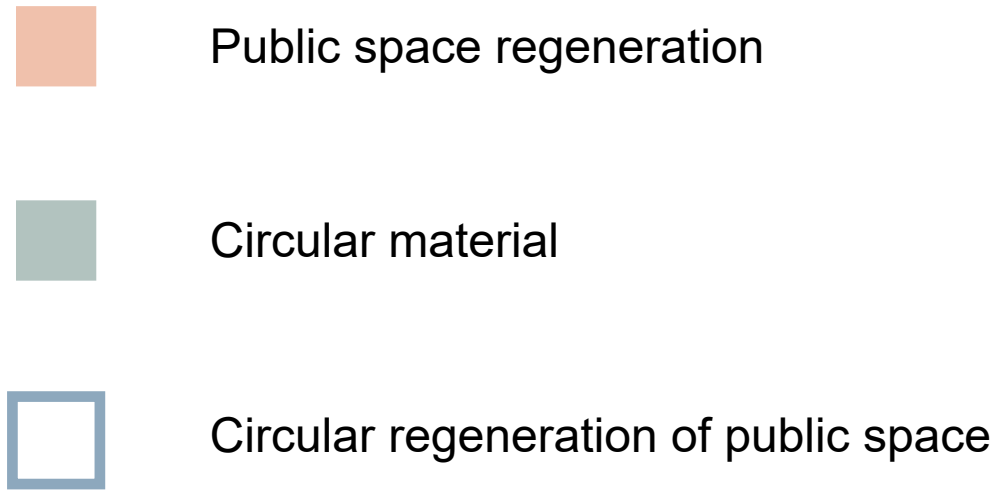
Public space regeneration

Waste generated during redevelopment

180 million tons per year

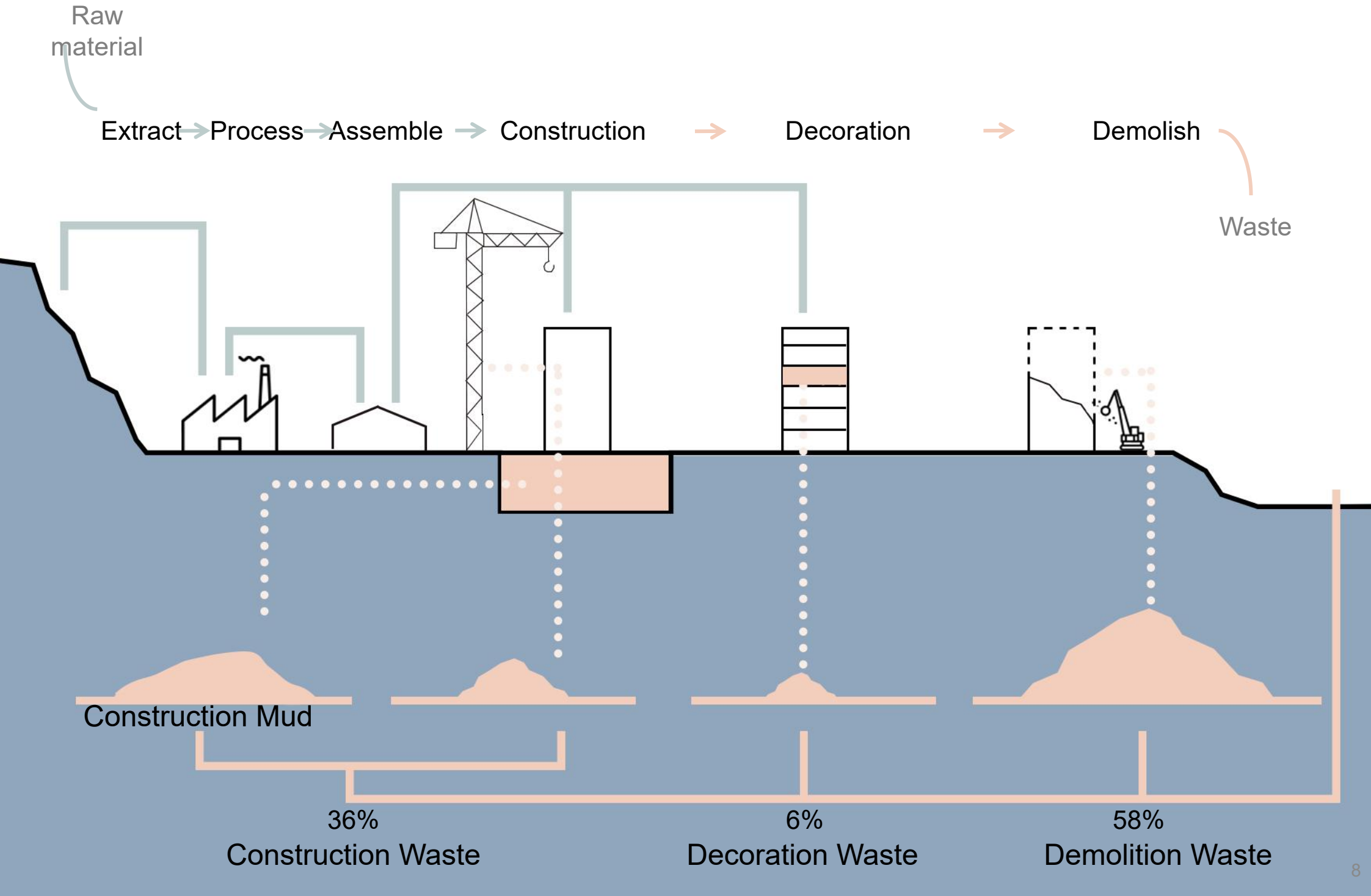
Material wasted

Motivation

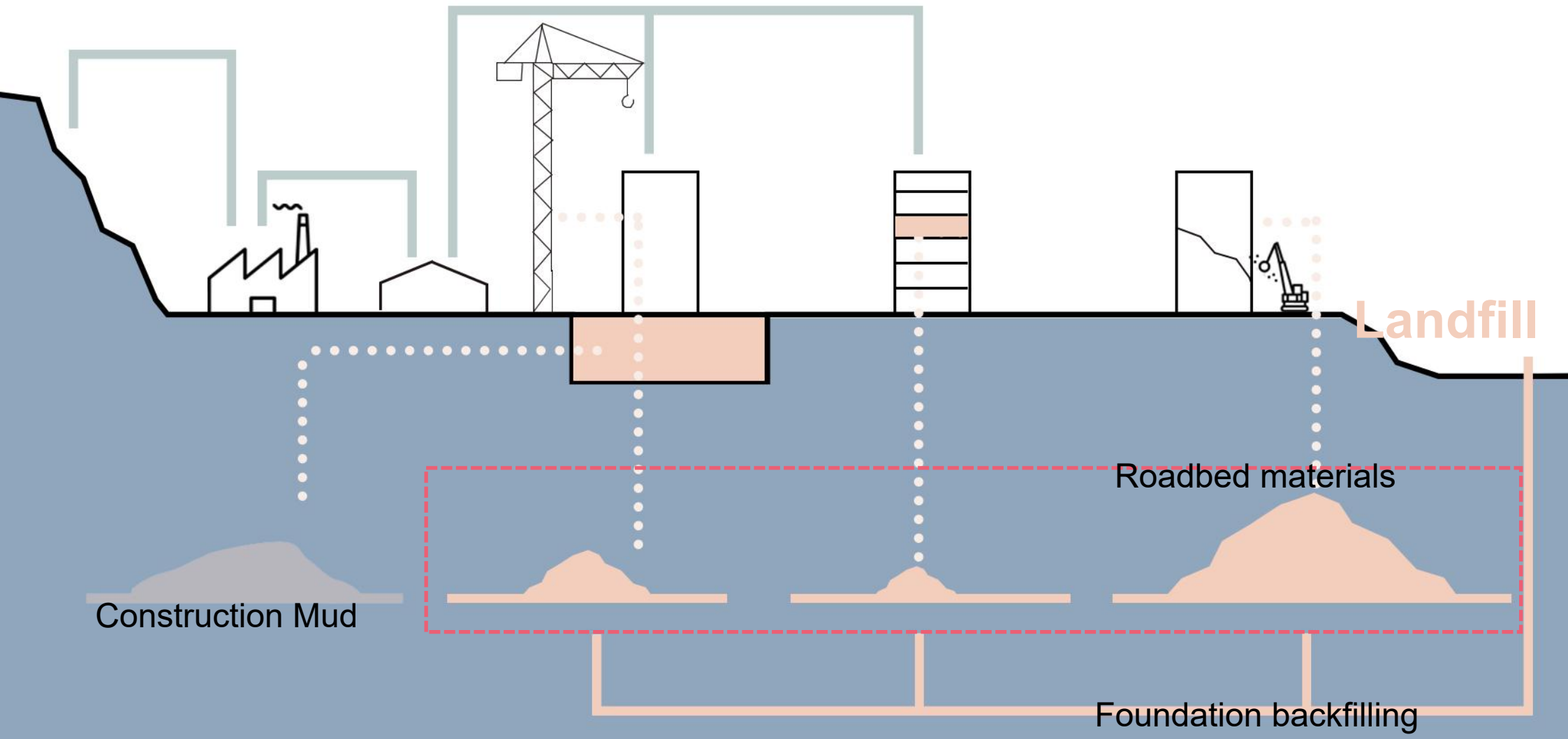

Public space regeneration
Circular material
Circular regeneration of public space

What are the wastes?

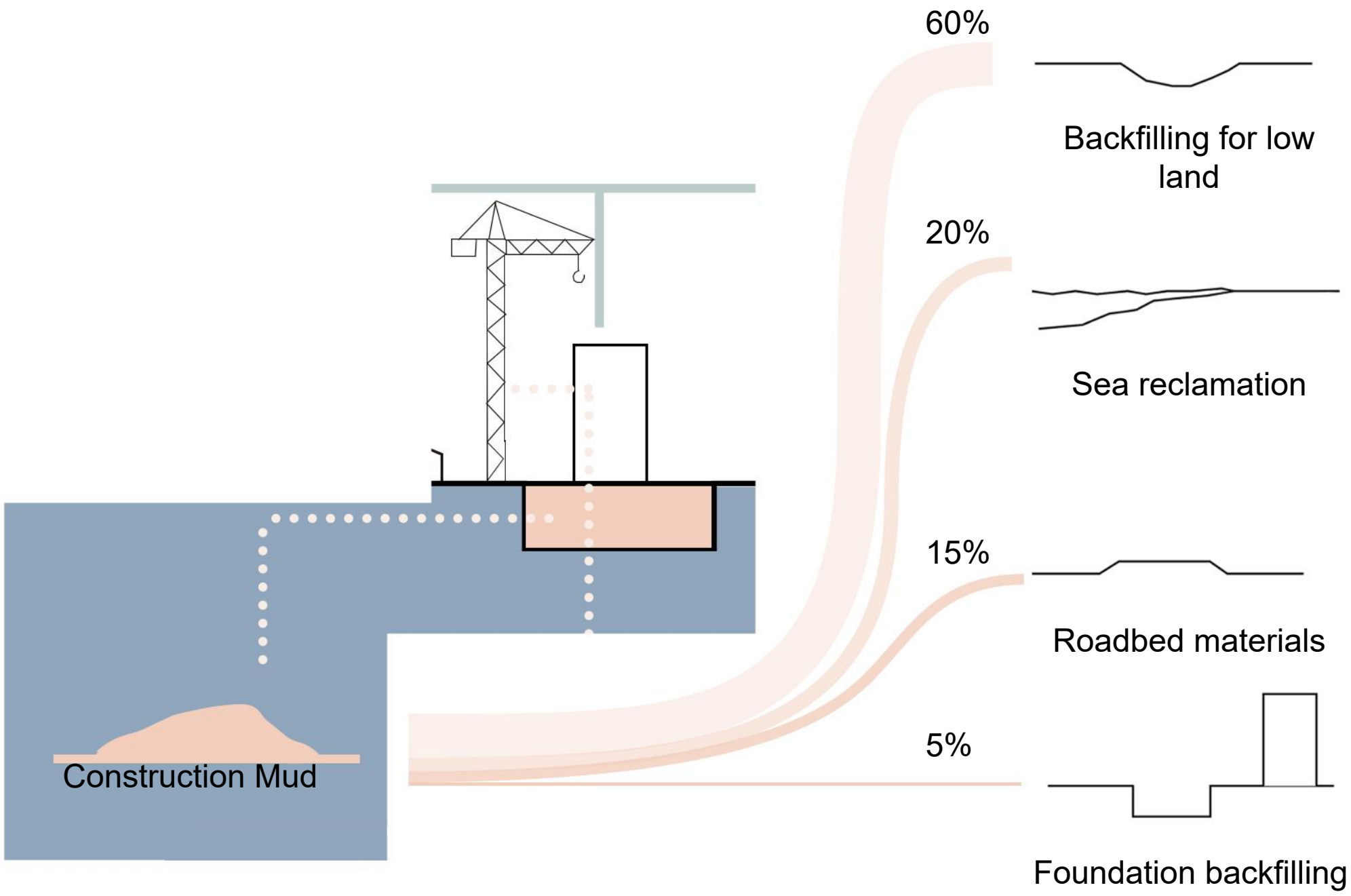
CDDW


Raw material
Extract
Process
Assemble
Construction
Decoration
Demolish
Waste
Construction Mud
36%
Construction Waste
6%
Decoration Waste
58%
Demolition Waste

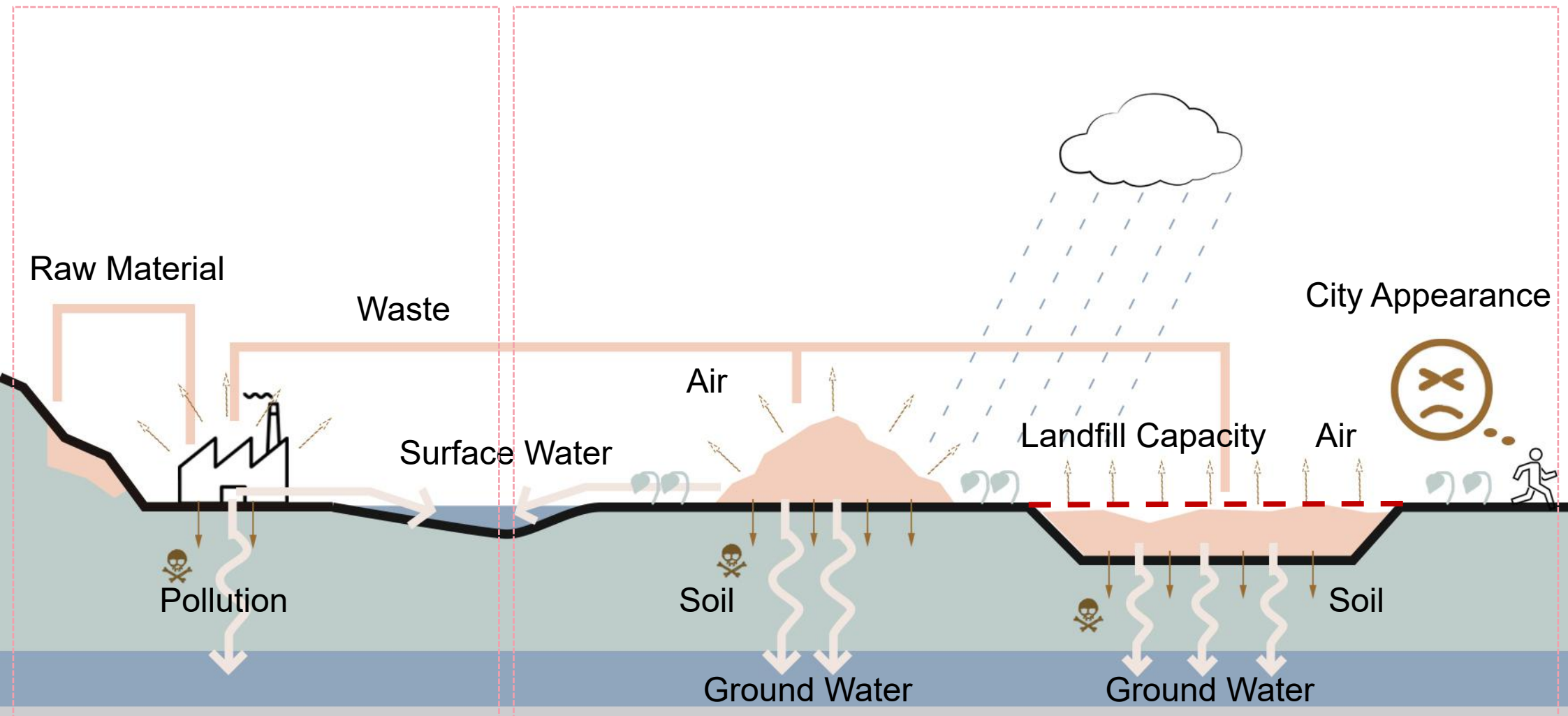
Current Down-cycle CDDW treatment



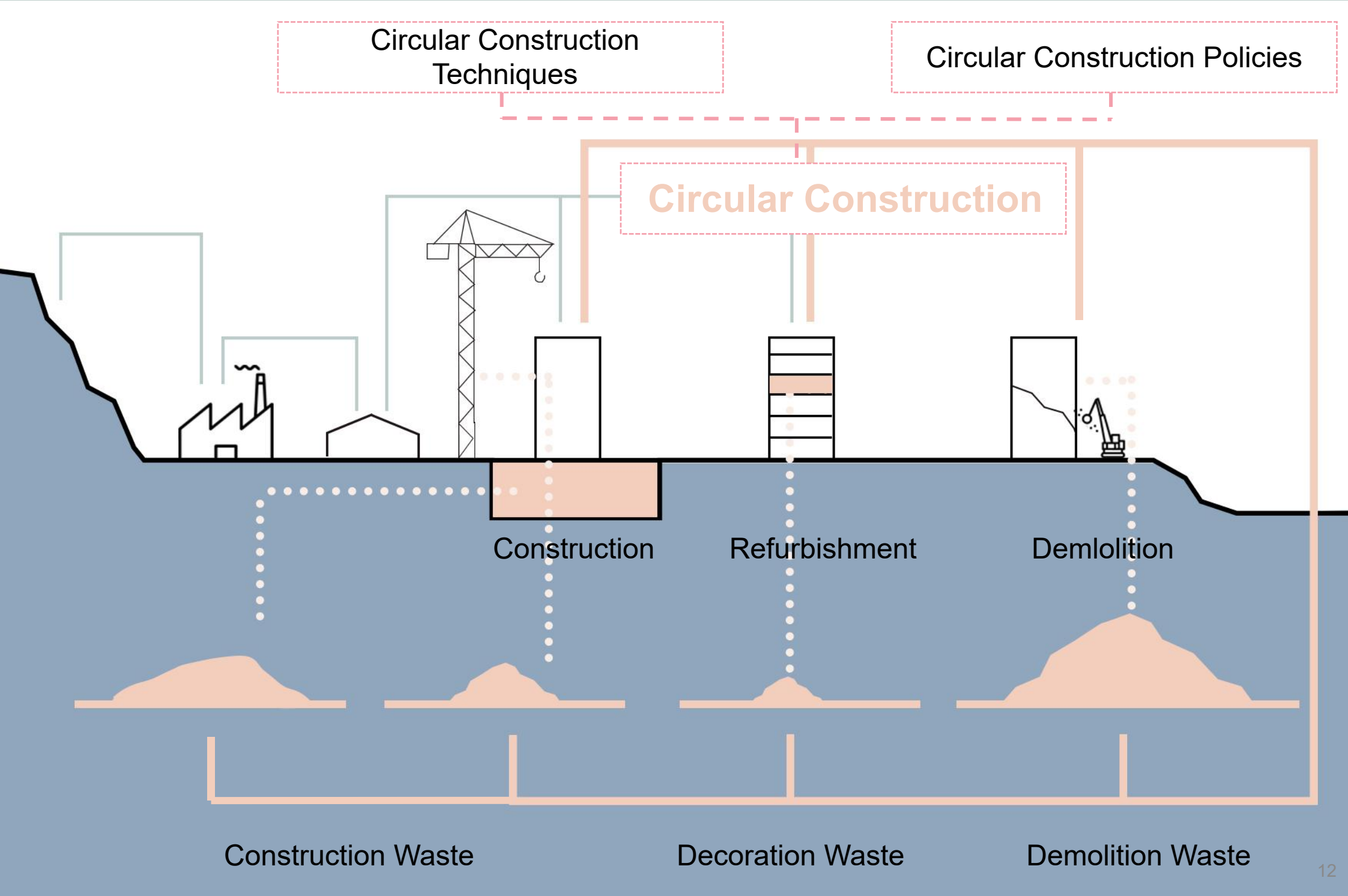
Current Down-cycle CDDW treatment



Harm of CDDW landfill

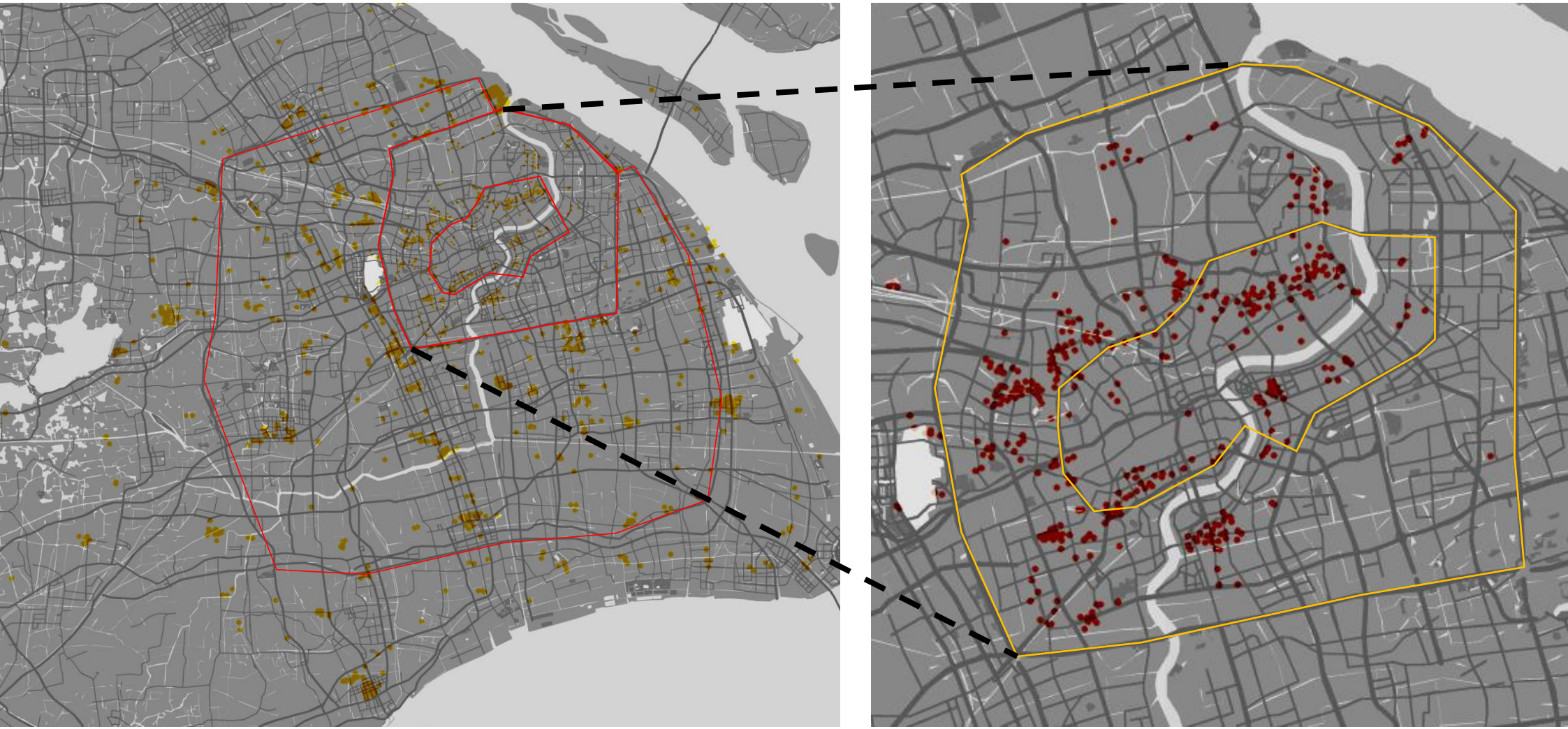


Potential for More value Less impact Circular CDDW treatment



Why new workers' estates?

High value for regeneration



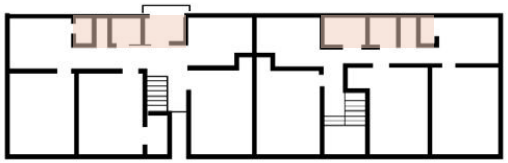
Location of new workers' estates

Necessity of regeneration

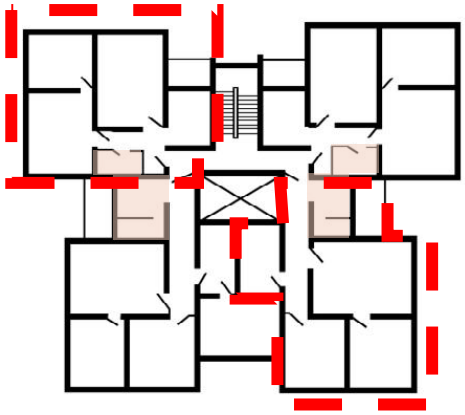

Aging facilities


Shabby interior


Deteriorated facade



Sharing functions




Structure safety


Property rights


Management

Problems of new workers' estates

Public space problems of new workers' estates

Low quality

Low usage

Low quantity

physical

design

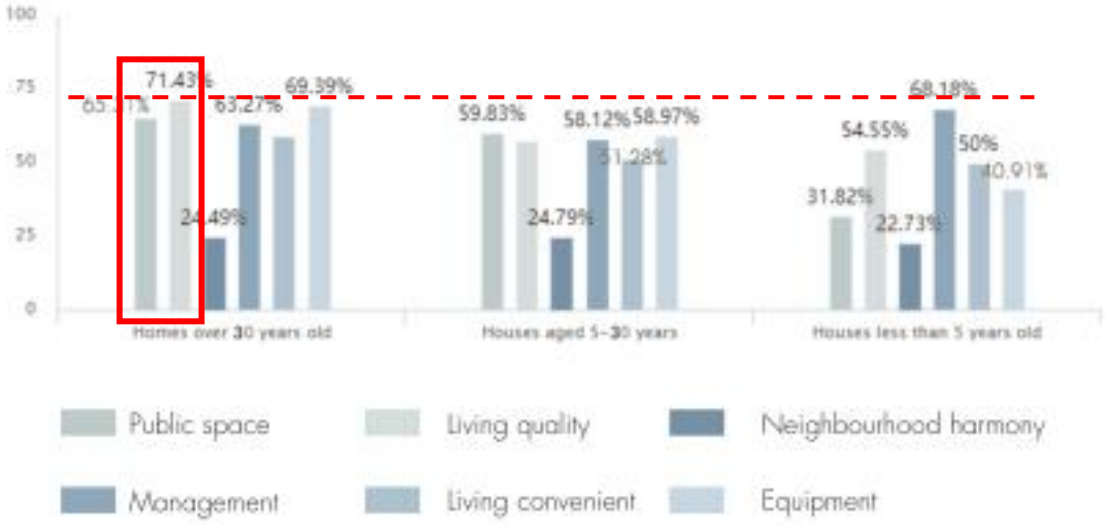
Evaluation of regeneration

Dissatisfaction of new workers' estates

Dissatisfy	Building interior quality	12	60%
	Road and parking facility	16	80%
	Public and green space	13	65%
	Public goods	6	30%
	Infrastructure	4	20%

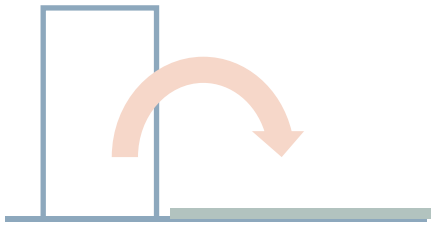
20 residents in one site

Disire for regeneration



188 people

Problem statement



Public space problems

Necessity of regeneration

CDDW

Circular construction

Improve quality

Circular use

Research question

- Scale 1 neighbourhood regeneration
- Scale 2 urban scale application

How? / How much?

How can the CDDW generated during the regeneration of

Different types and material flow

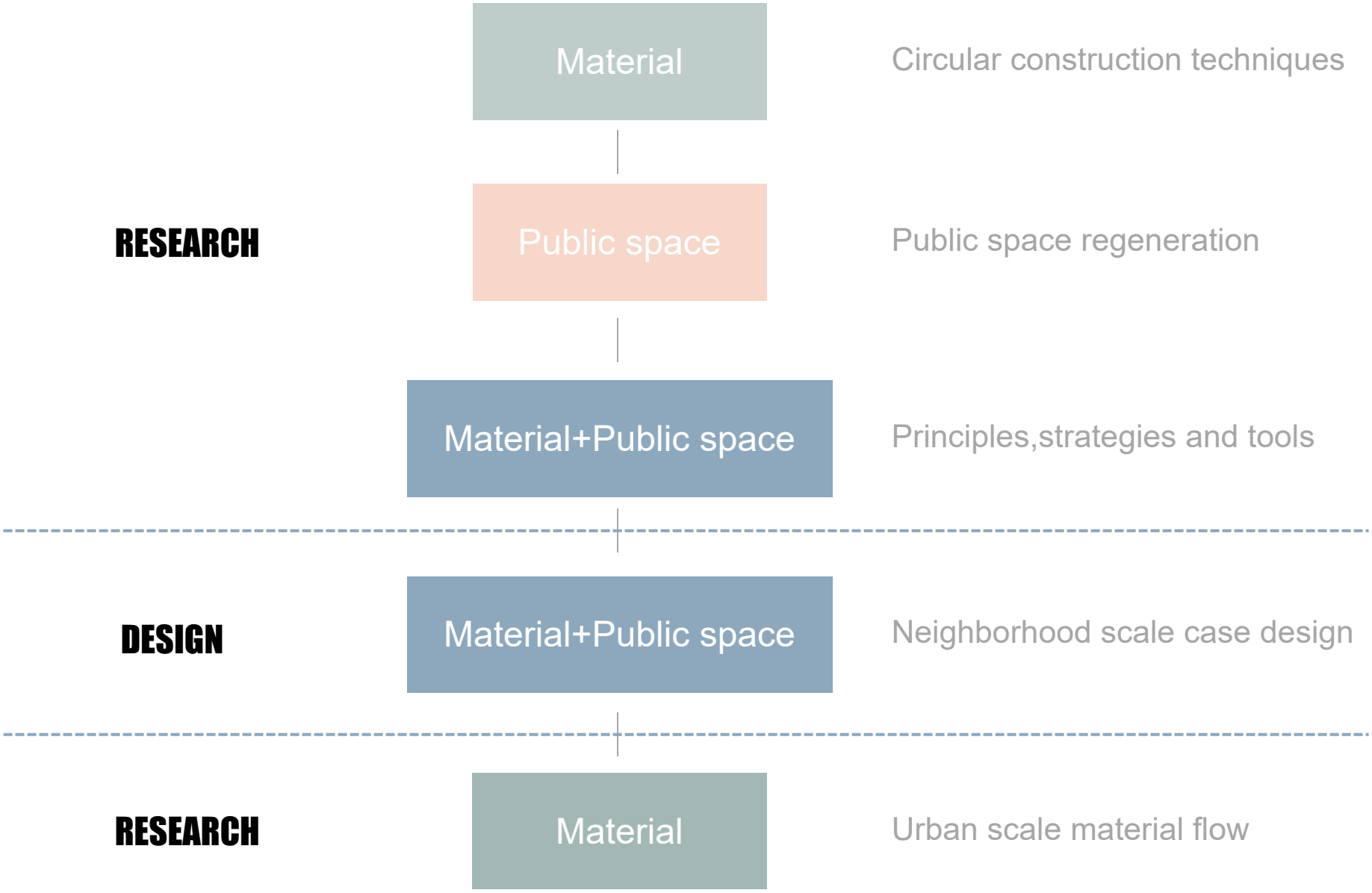
new workers' estate be circularly used to make the

On what?

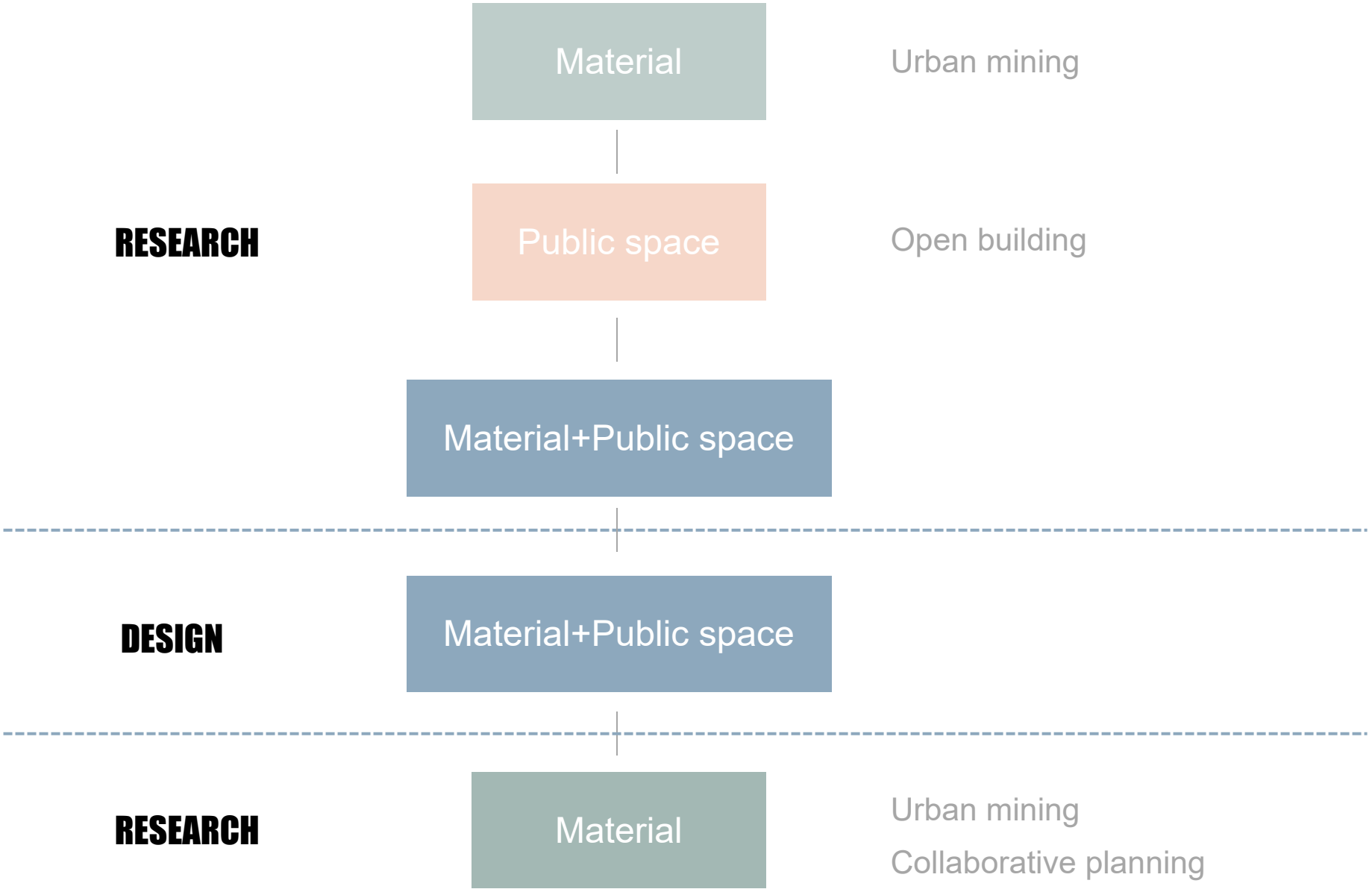
public space more sustainable and adaptive to future

changes?

Methodology



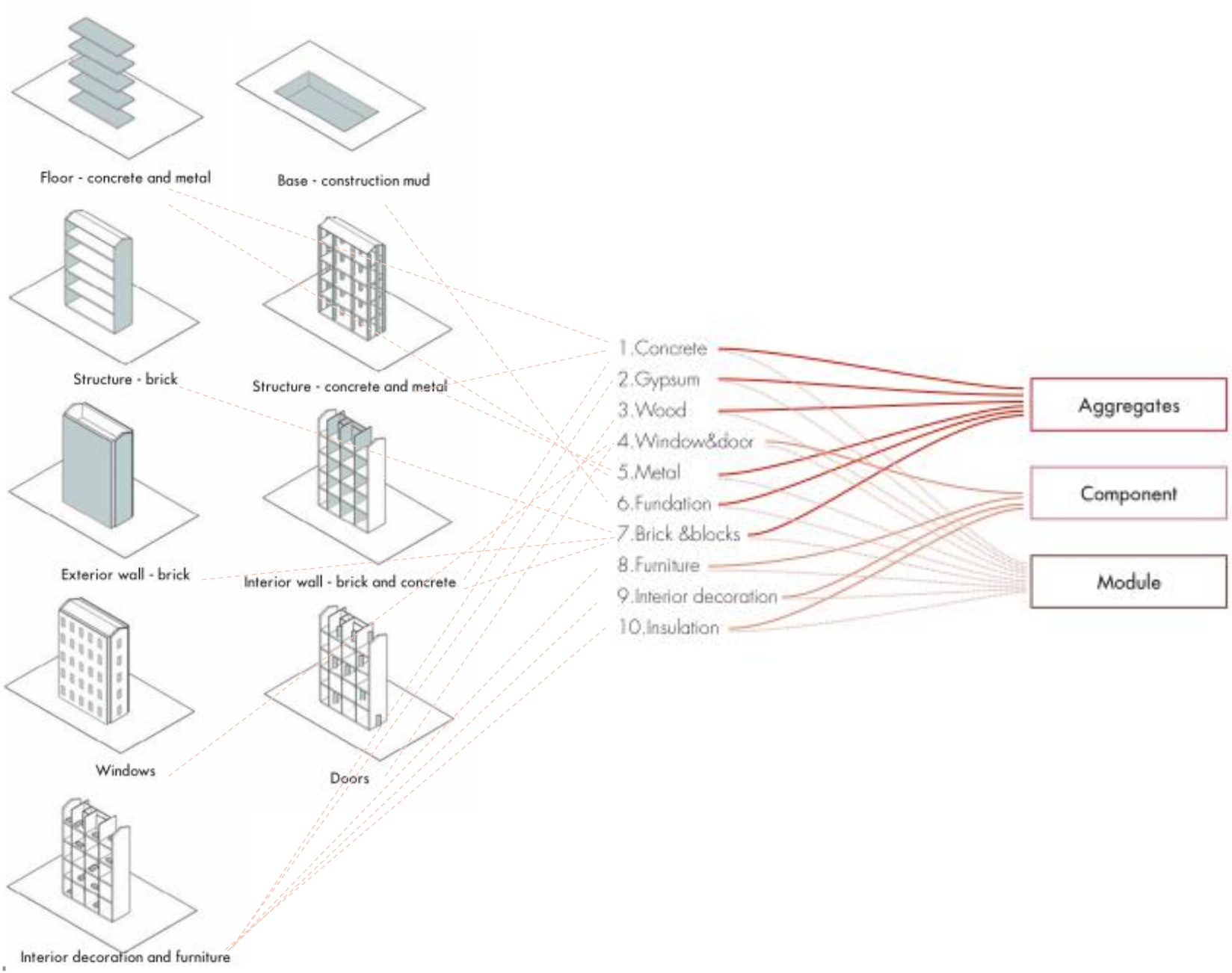
Theory


Material
Urban mining
RESEARCH
Public space
Open building
Material+Public space
DESIGN
Material+Public space
RESEARCH
Material
Urban mining
Collaborative planning

Material Research

Materials from buildings

WHAT



Reusability of materials

	Raw material	Recycle method
Recycle	Bricks	Recycled bricks
	Concrete	Recycled concrete/ brick
	Metal	Recycle metal
	Wood	Plywood

	Origianl material	Secondly-raw material	Reused method
Reuse	Bricks		Brick
			Partition filler
	Metal	Steel	Gallery/ Partition
		Steel bar	Sculpture/ Partition
		Metal components	Sculpture/ Partition
	Mud		Landcape
	Wood		Wood
	Component		Component
	Modules		Modules

Reuse and recycle

Reuse

Recycle

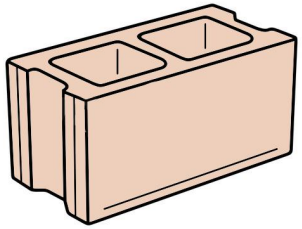
The reason why using circular materials in public space?

Material characteristic

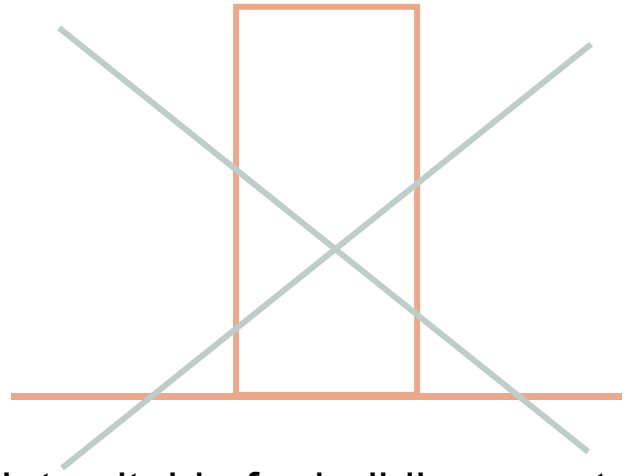
Questionnaire

Strength of materials more suitable for public space regeneration

Material characteristic

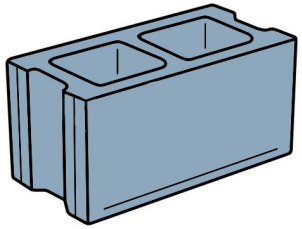


Strength:
MU5.0-MU20



Concrete block made of new materials

Not suitable for building construction

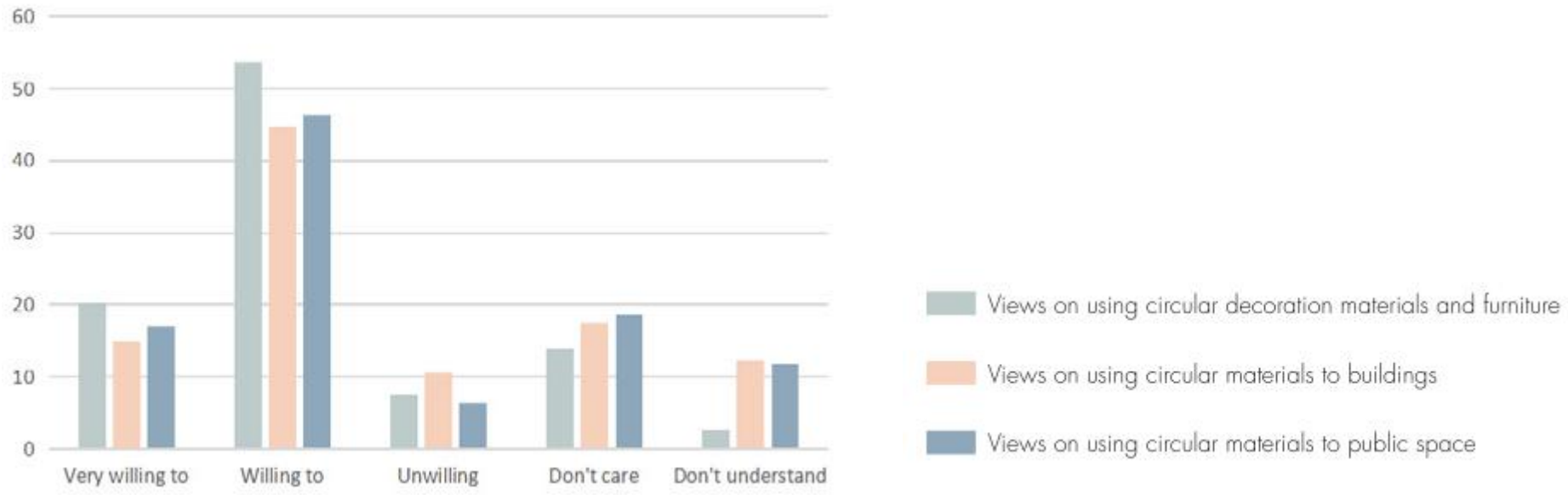


Strength:
≤MU5.0

Concrete block made of waste materials

Suitable for public space construction

Questionnaire:Survey of willingness to use circular material



The reason why using circular materials in public space?

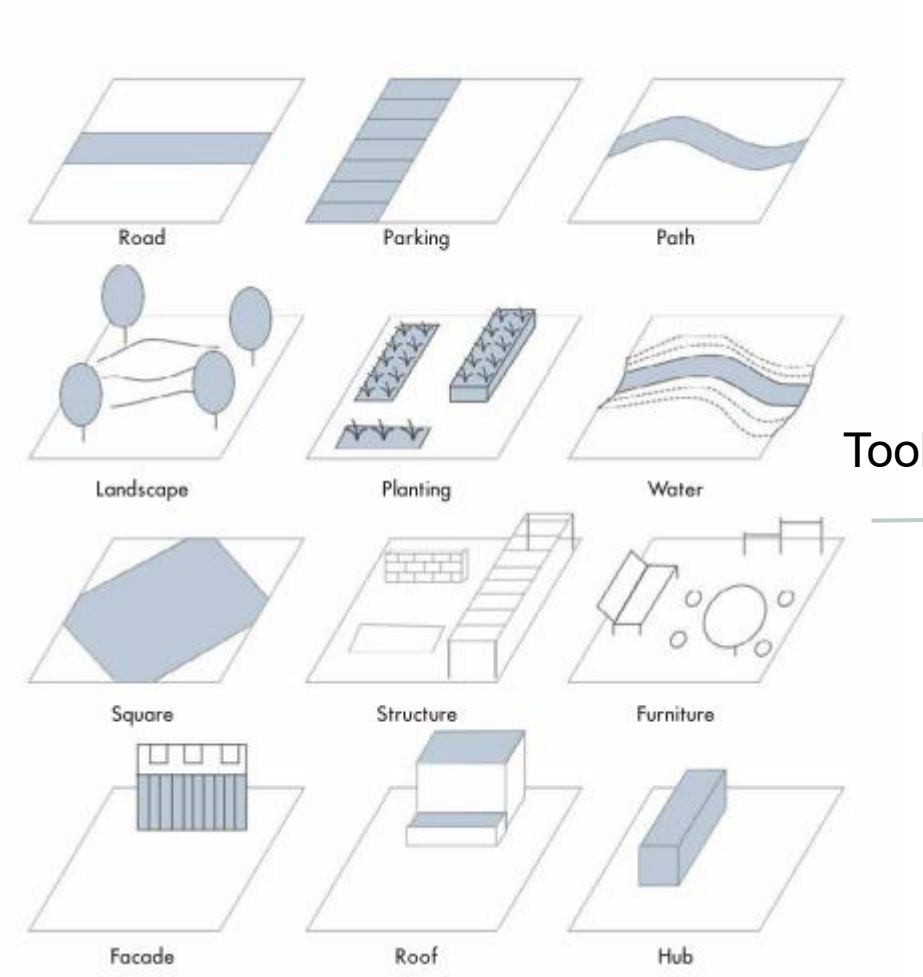
WHAT

WHY

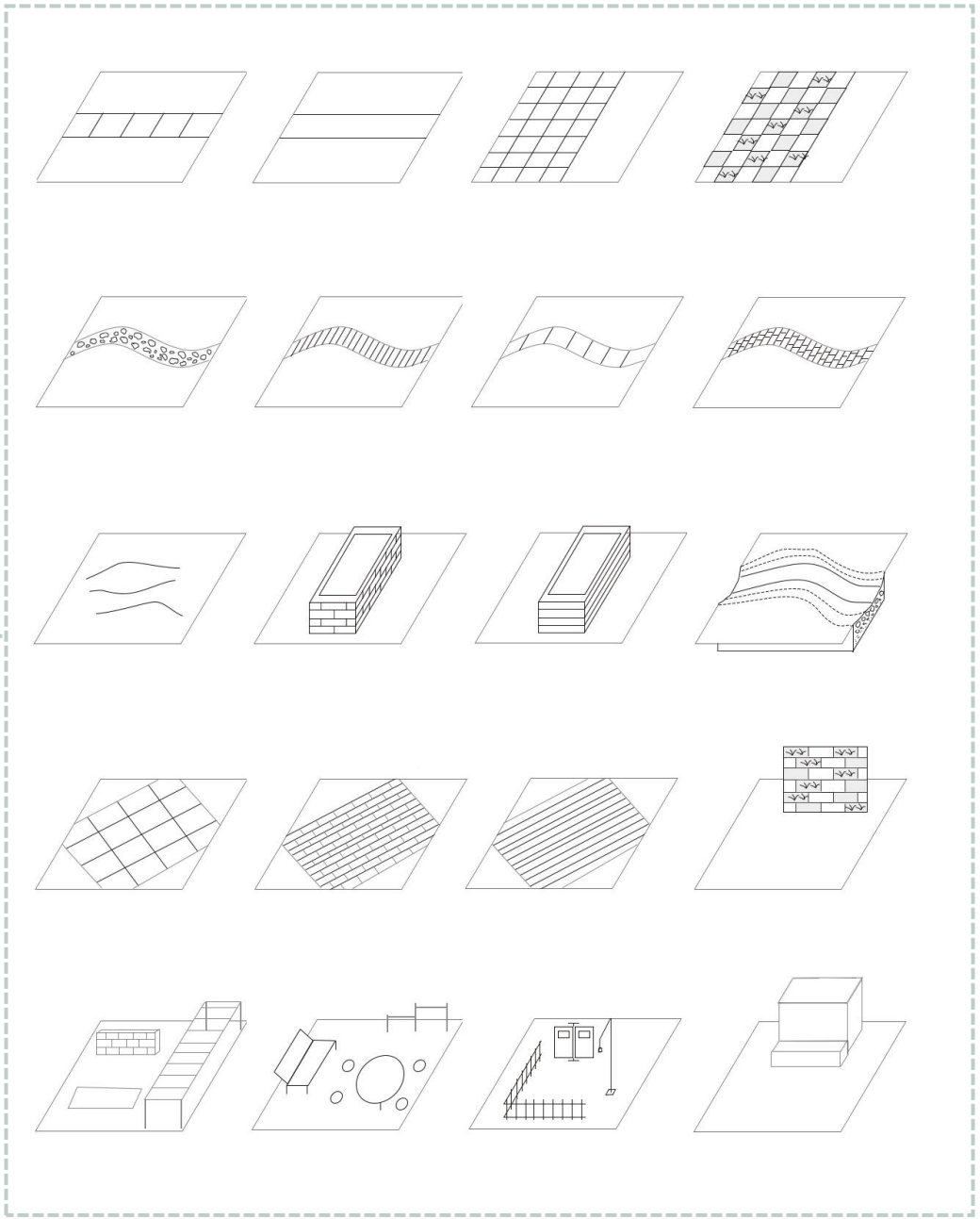
Transitional stage for techniques and users' adaption

How to use circular materials in public space?

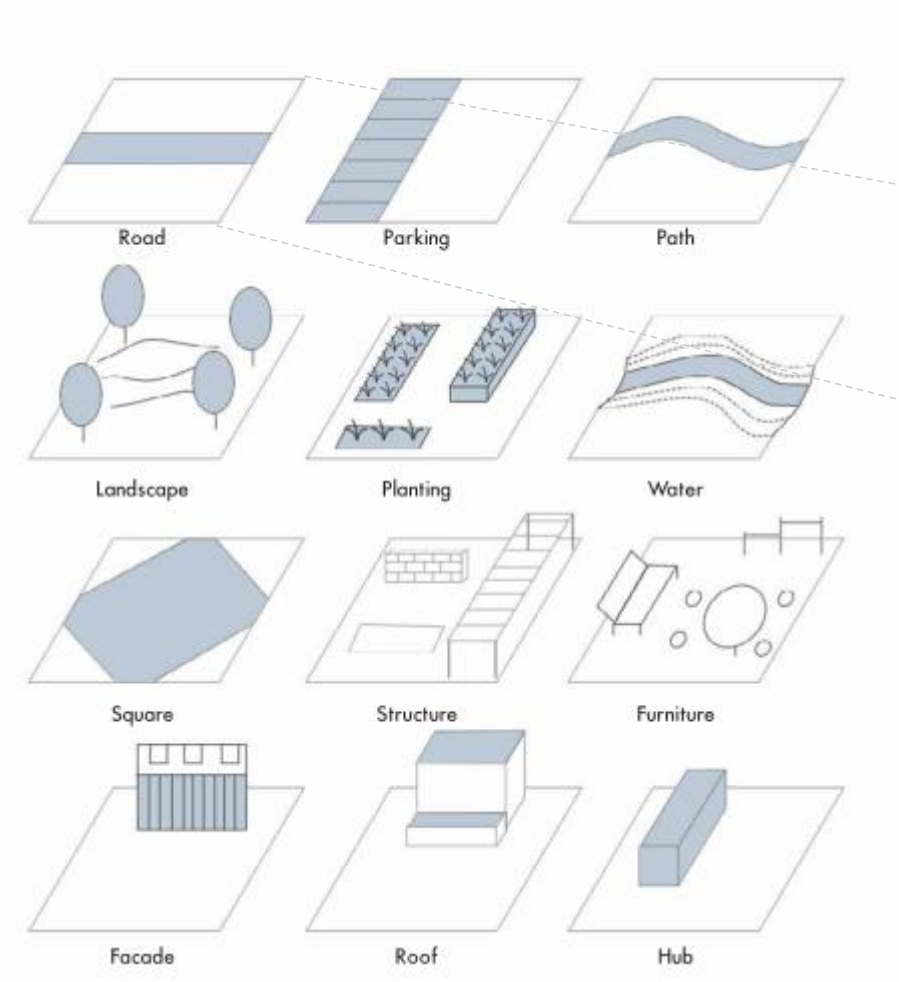
Circular materials used in public space



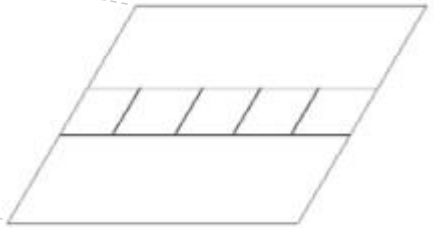
Toolbox



Circular materials used in public space

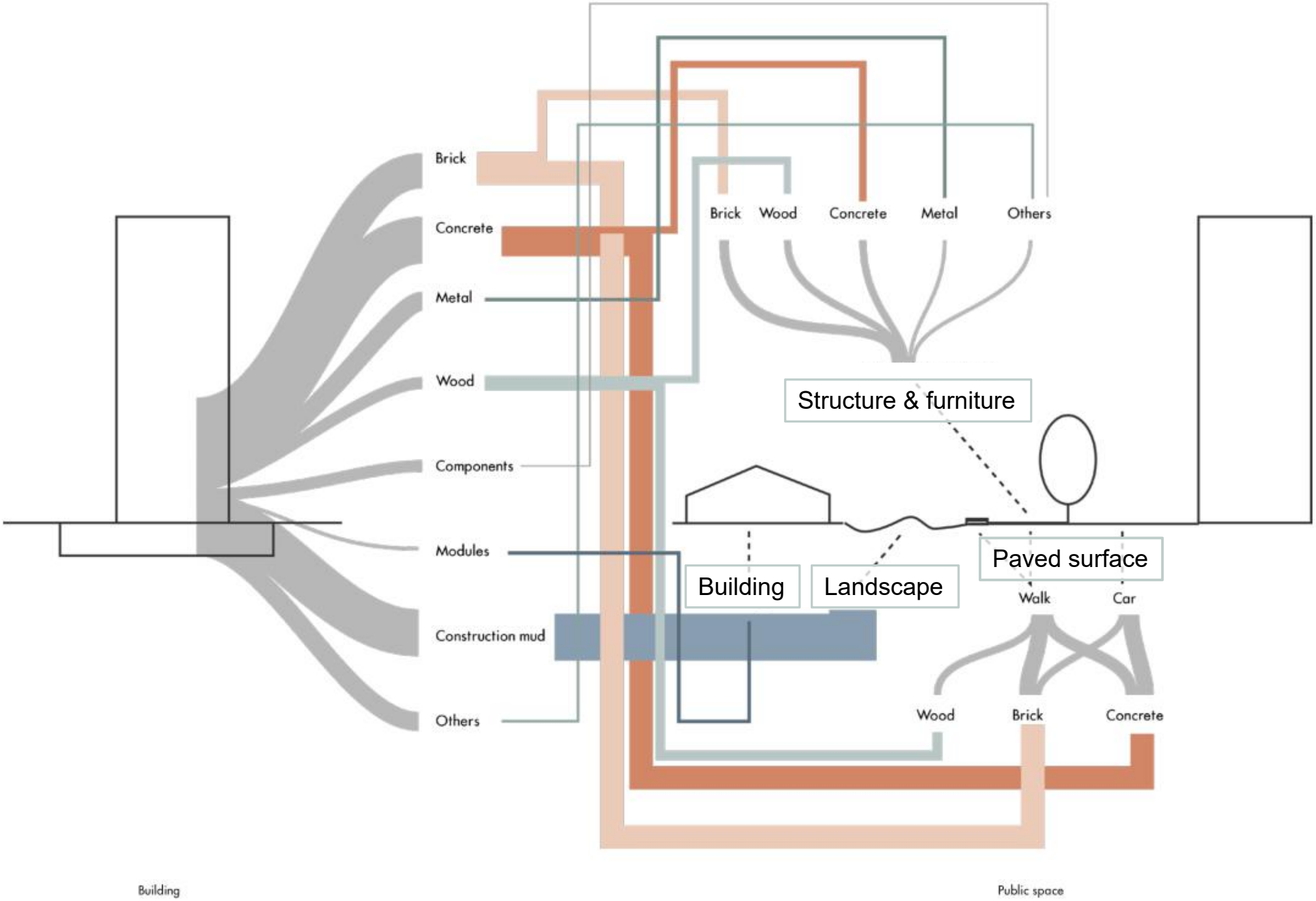


Example:

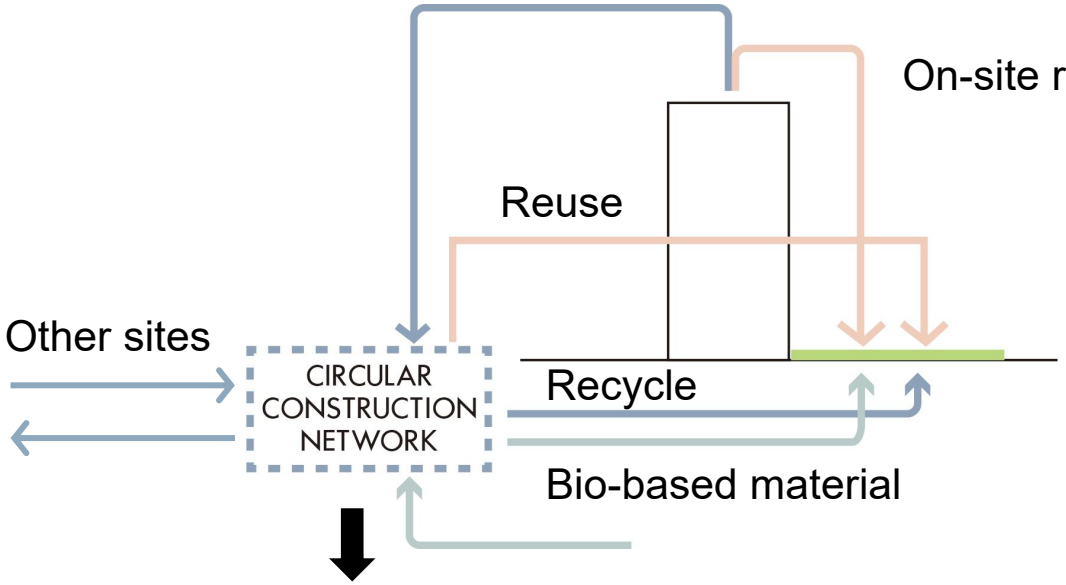


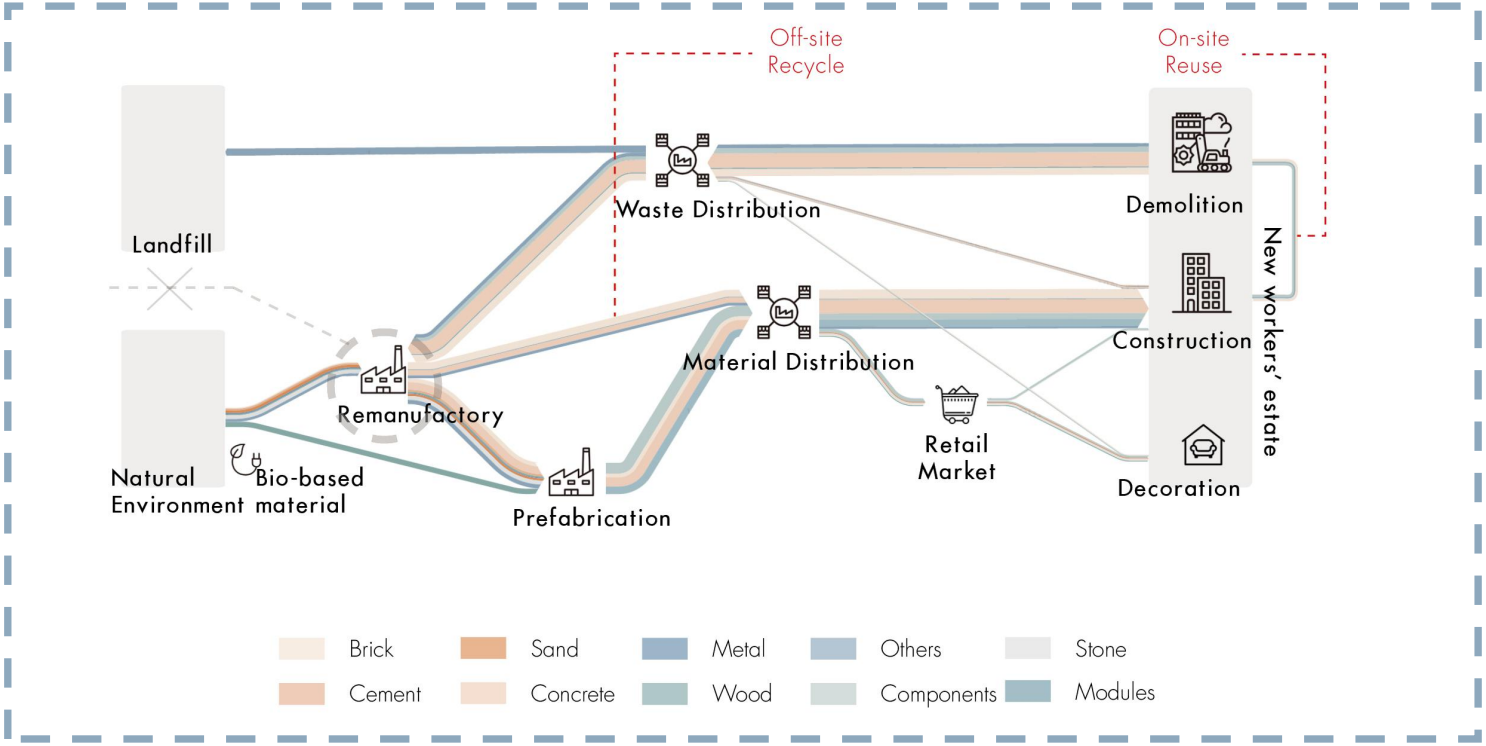
- Recycled concrete board
- 70% is waste material

Potential circular use of materials in public space

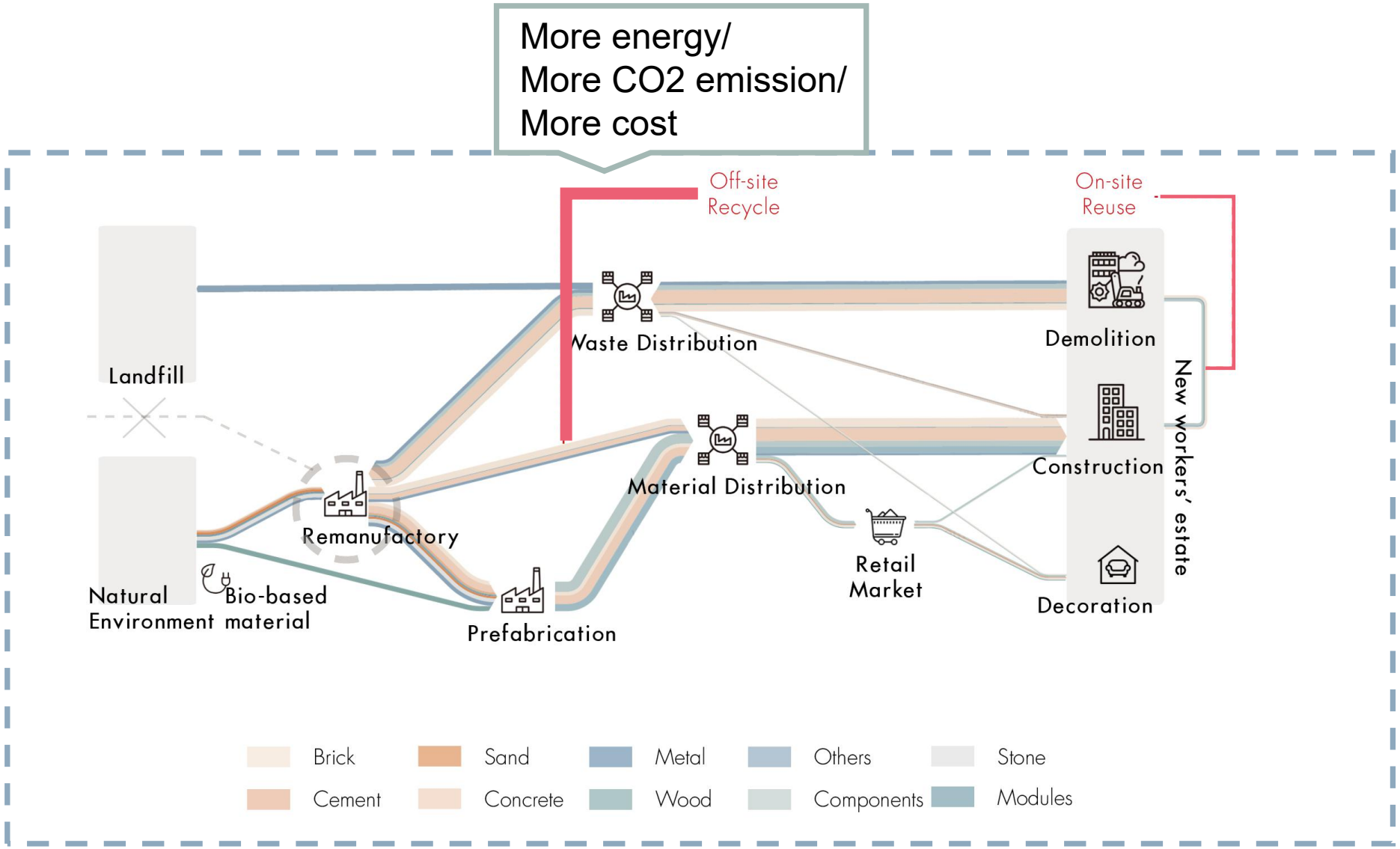


Complex process of the circular regeneration - Circular Construction Network





Reuse as a more long-term sustainable circular construction method



Currently, difficult to achieve

How to use circular materials in public space?

WHAT

WHY

HOW

- Methods from waste material to new products

- Circular construction network

- Reuse and recycle

How much material can be circularly used in public space?

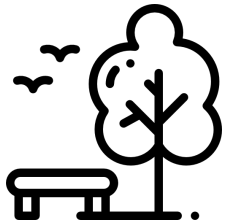
WHAT

WHY

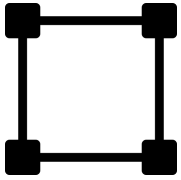
HOW

HOW MUCH

Material from buildings/ m²

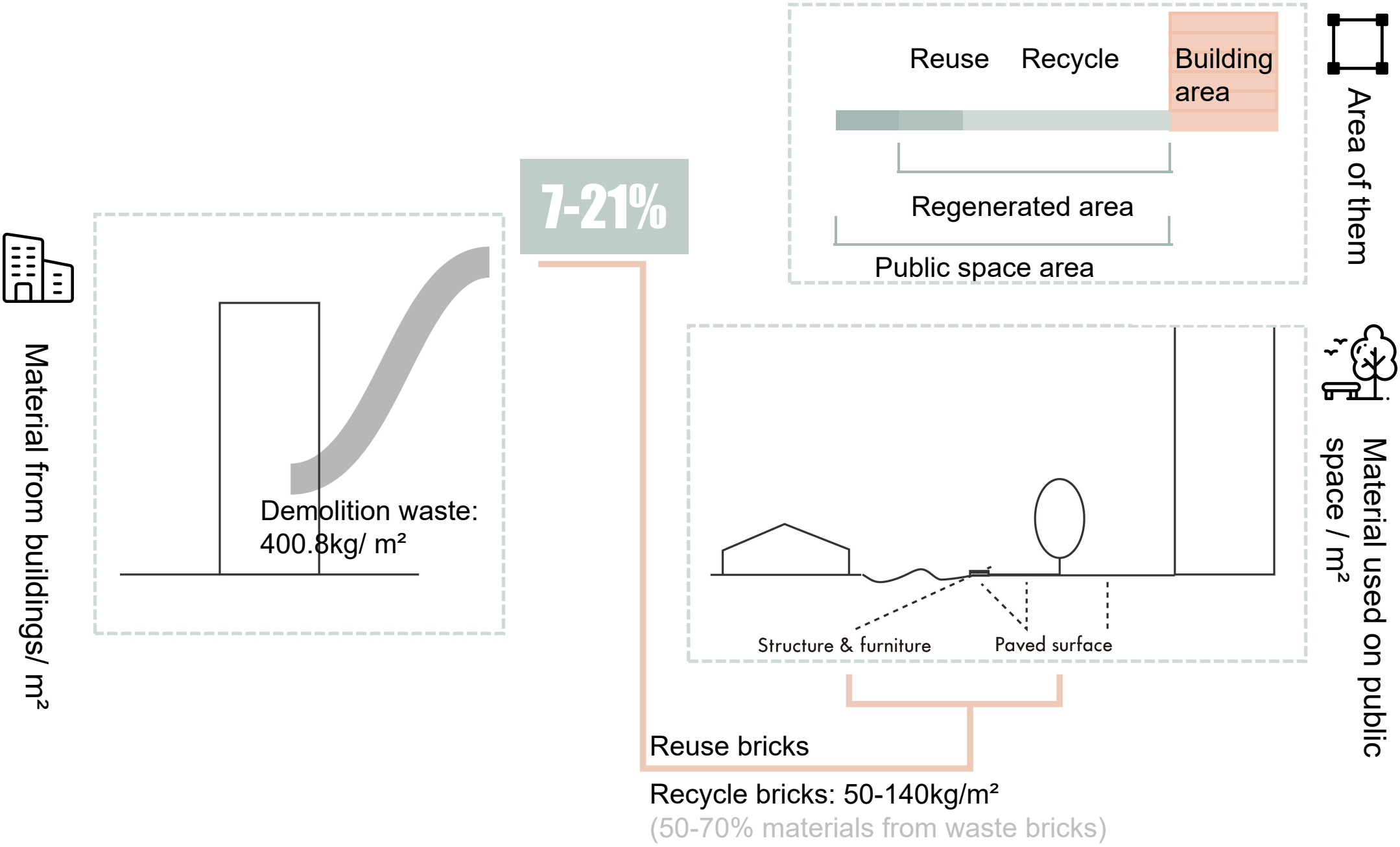


Material used on public space / m²

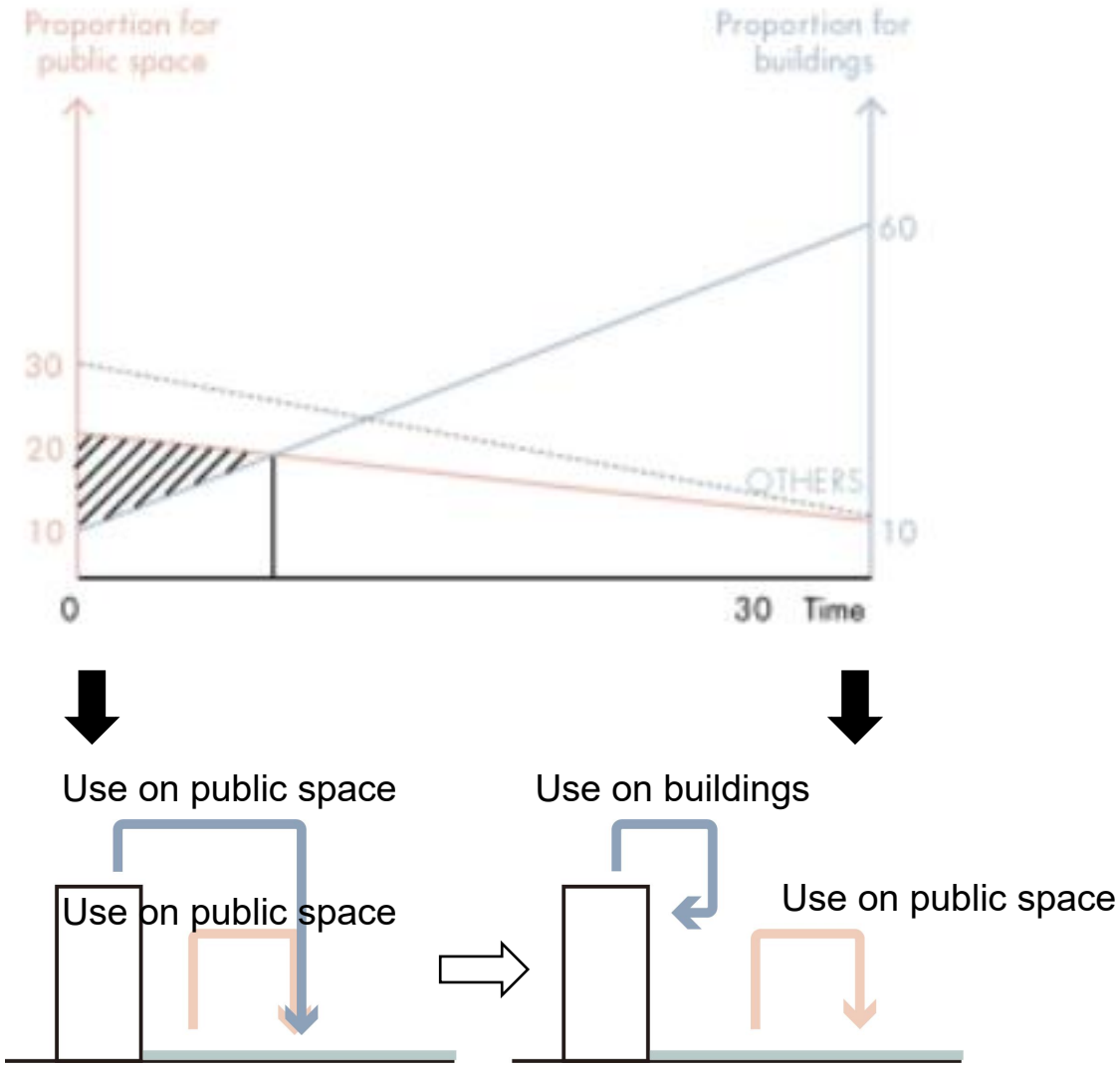


Area of them

Amount of brick circularly used in public space



Changing process of circular construction

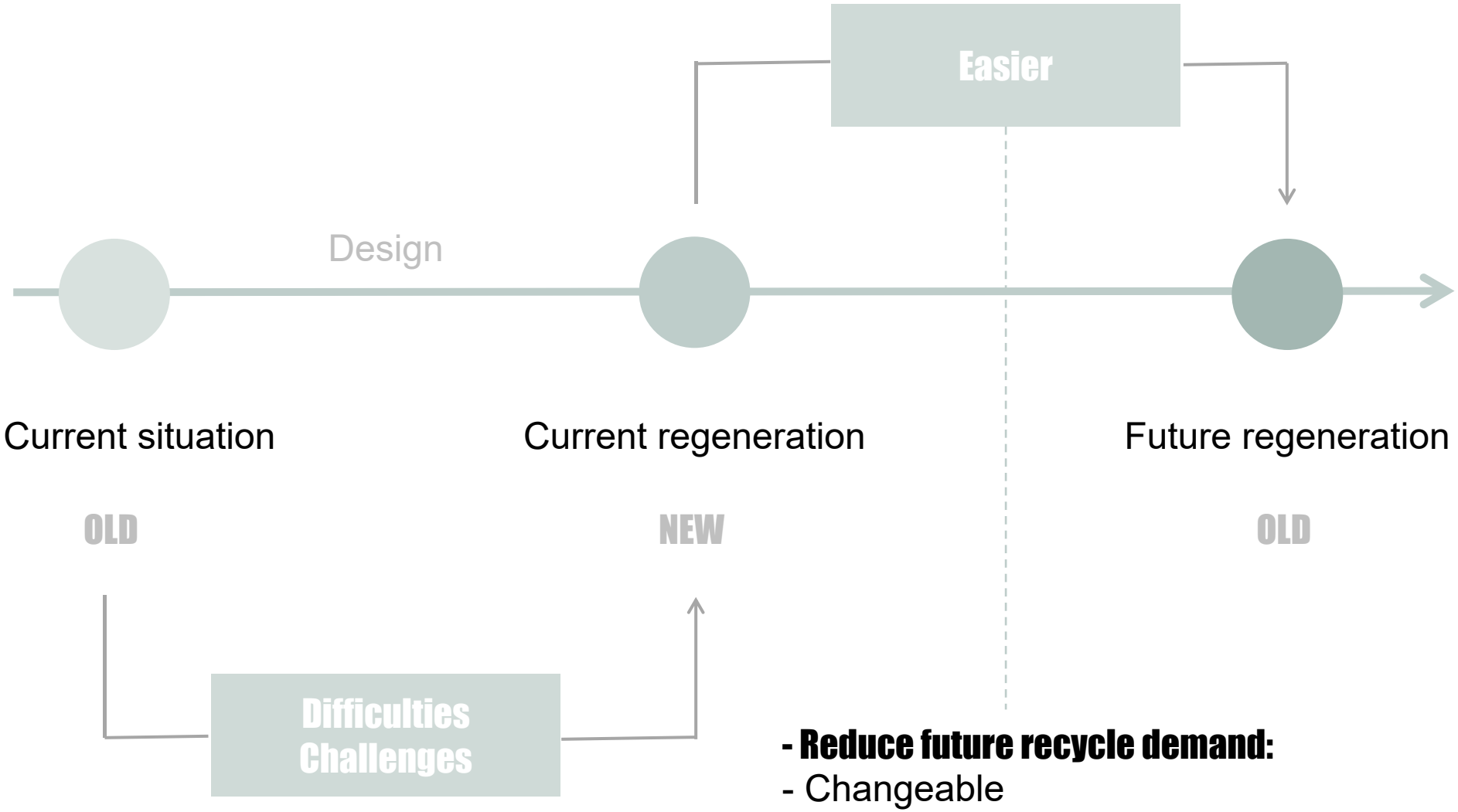


-Good chance for public space regeneration

-Future less

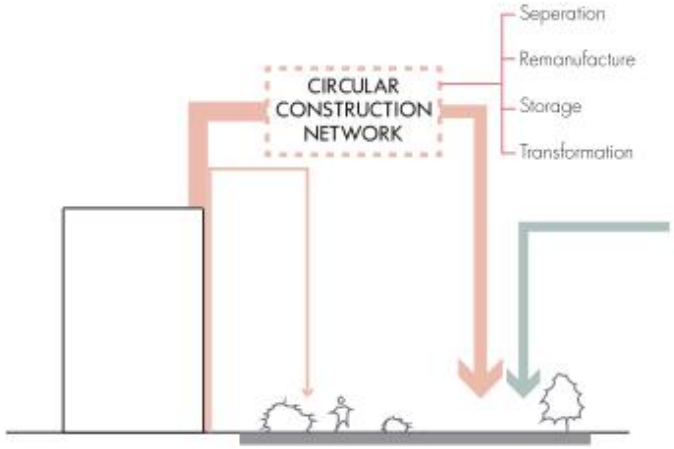
-Public space material cycle

Easier for future regeneration

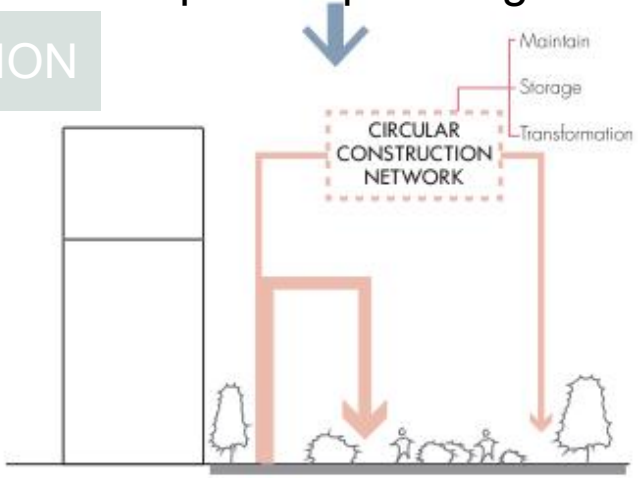


- Reduce future recycle demand:
- Changeable
- Reversible
- Prefabricated Modular

Long-term sustainable circular regeneration



Current public space regeneration



Future public space regeneration

Circularly use material for public space regeneration

Through circular construction network

Public space material reuse-priority cycle

Public Space Research

Use to public space of new workers' estates ON WHAT?

Spatial problems of new workers' estate

1. Lack of public space

2. Low quality of public space

3. Homogenization of public space

4.Chaotic walking and vehicle organization

5. Low usage of public space

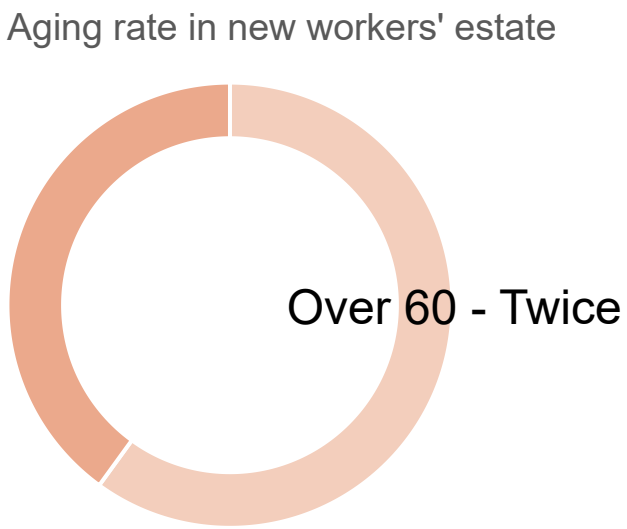
6. Poor management of public space





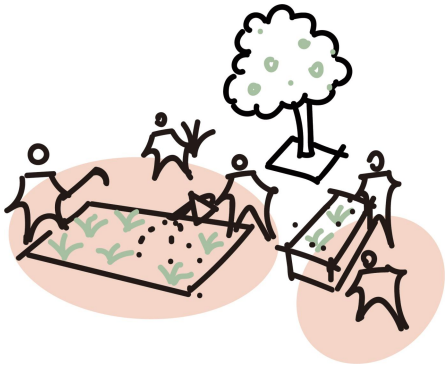



Aging problems of new workers' estate

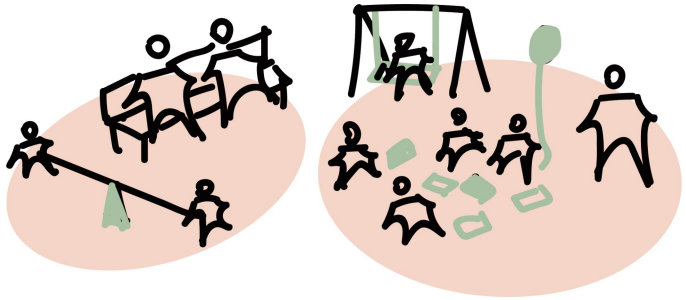


Ideal public space for the elderly

Gathering and rest facilities



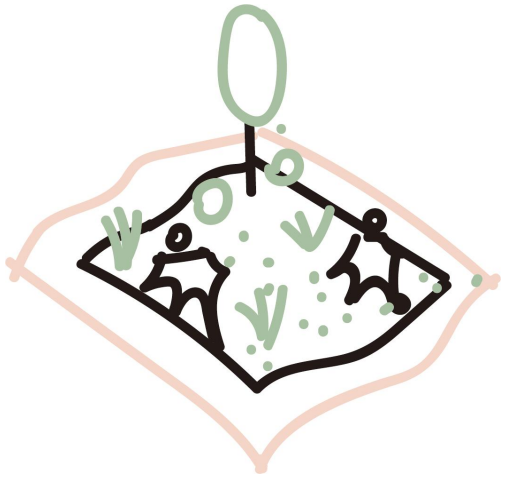
Urban farming



Accompanying children

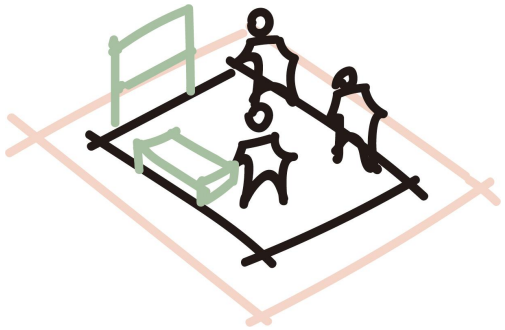
Climate change - Higher risk of flooding issue

Water resilient infrastructure & Public life



Open soil

Planting/ Grassland/ Landscape



Permeable Paved Surface

Square/ Path

Use to public space of new workers' estates ON WHAT?

Spatial quality

Aging problem

Climate change

Material + Public Space Regeneration

VISION

Apply the **circular construction network** to help make circular use of CDDW generated during regeneration of new workers' estate for the **improvement of elderly-friendly public space quality** to make the public space **long-term sustainable and adaptive to future changes.**

Principles

CIRCULARITY

- Reduce current material consumption of regeneration
- Prioity on-site reuse
- Reduce future recycle demand
- Collaborative circular construction network

ELDERLY ADAPTIVE

- Comfortable
- Safe
- Diversity
- Participateable

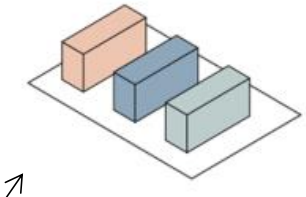
FUTURE ADAPTIVE

- Flexibility
- Permeability
- Ecology

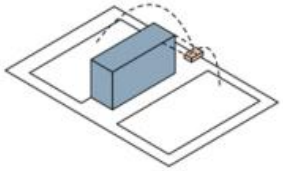
Strategies

CIRCULARITY

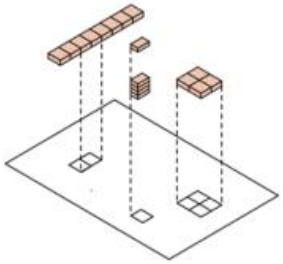
- Reduce current material consumption of regeneration
- Prioity on-site reuse
- Reduce future recycle demand
- Collaborative circular construction network



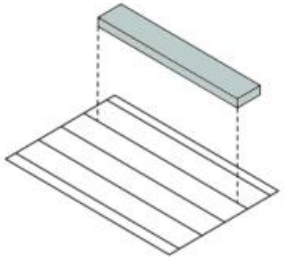
Minimize construction amount



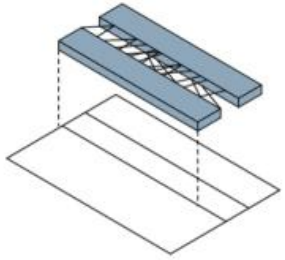
Use the complete waste element for on-site public spaces



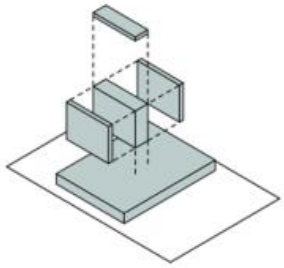
Use standard modular secondary materials



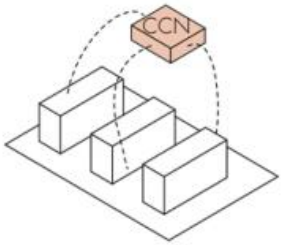
Use bio-based materials



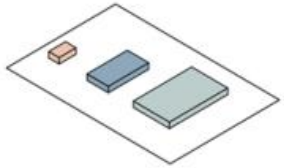
Use fewer hazardous materials



Reversible and disassembly design



Recycle the materials by circular construction network

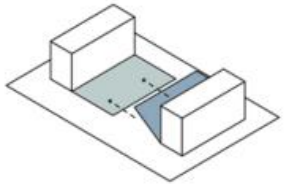


Set up collection points at various levels

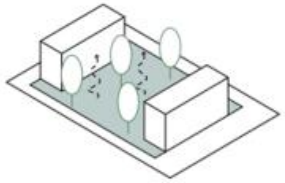
Strategies

ELDERLY ADAPTIVE

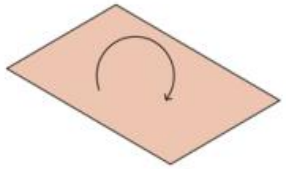
- Comfortable
- Safe
- Diversity
- Participateable



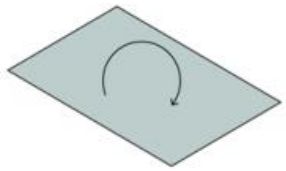
Guarantee sunshine in public spaces



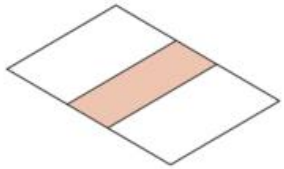
Improve the microclimate of public spaces



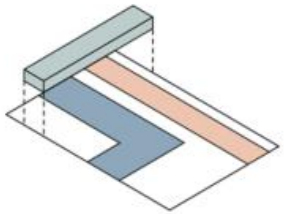
Optimize public event venues



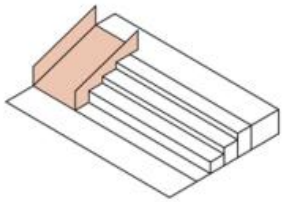
Improve greening quality



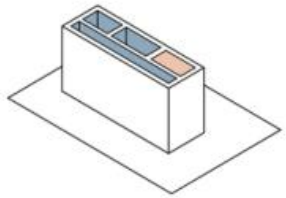
Establish walking system



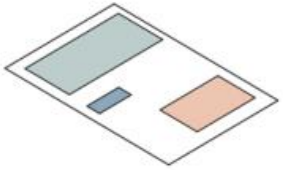
Reduce the impact of vehicle traffic on pedestrian areas



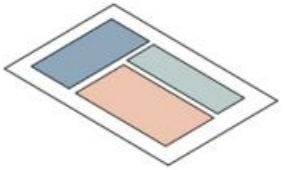
Ensuring accessibility by adding barrier-free facilities



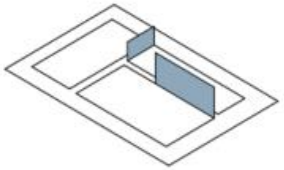
Age-appropriate regeneration of the building interior



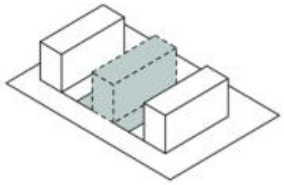
Space grading



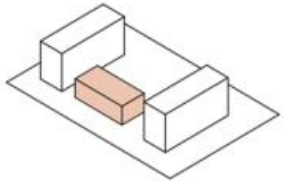
Space classification



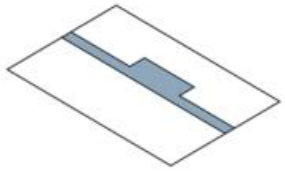
Space separation



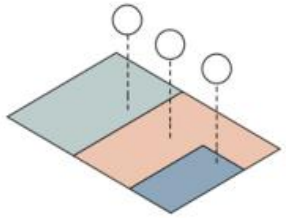
Increase public spaces



Add elderly service facilities



Reduce unusable large green areas

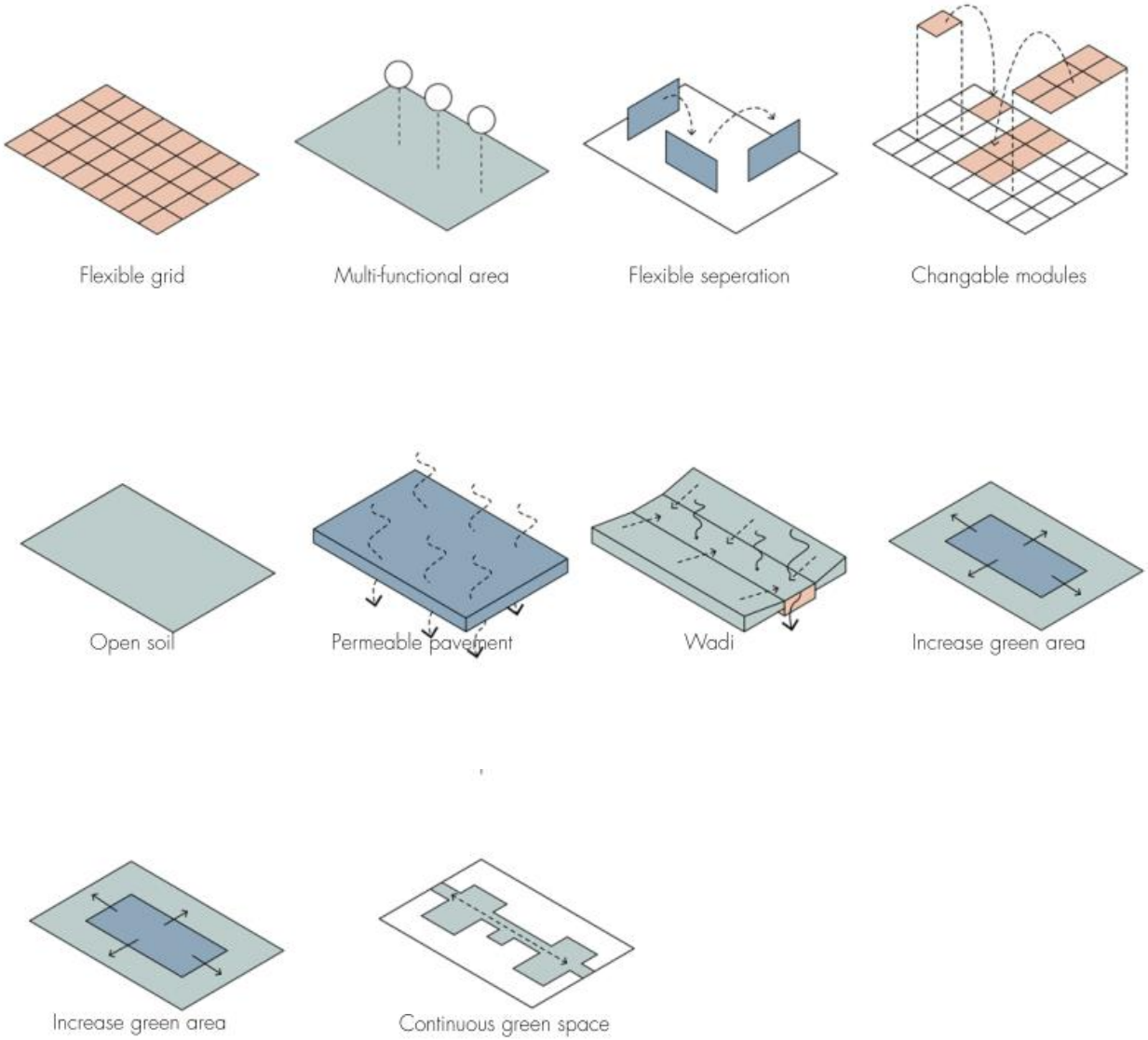


Design the space for the elderly activities

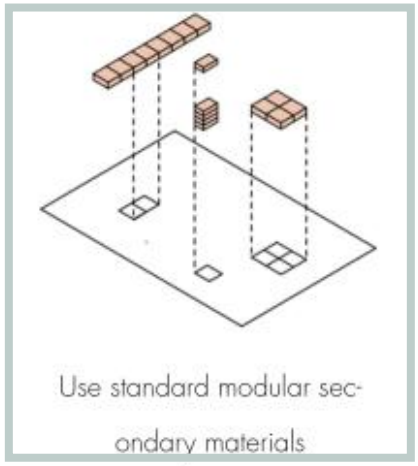
Strategies

FUTURE ADAPTIVE

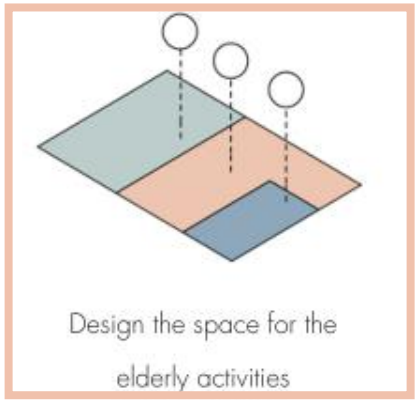
- Flexibility
- Permeability
- Ecology



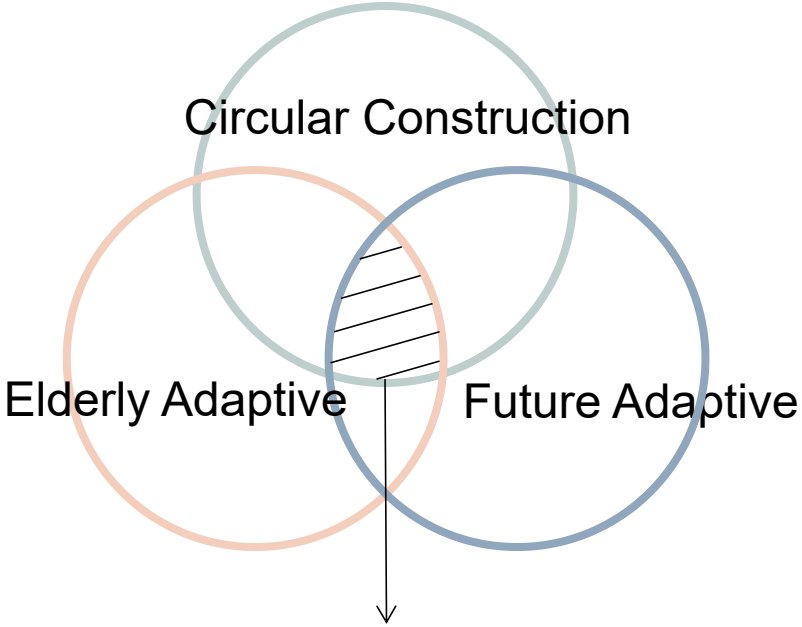
Combination of three strategies - Toolbox of modules

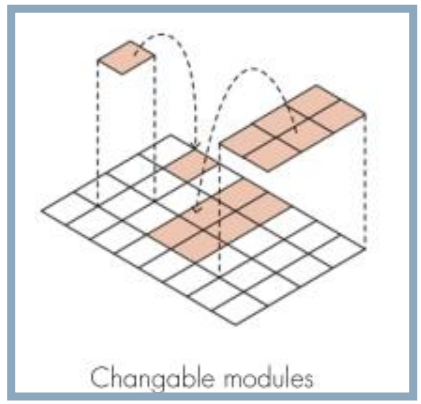


Use standard modular sec-
ondary materials



Design the space for the
elderly activities

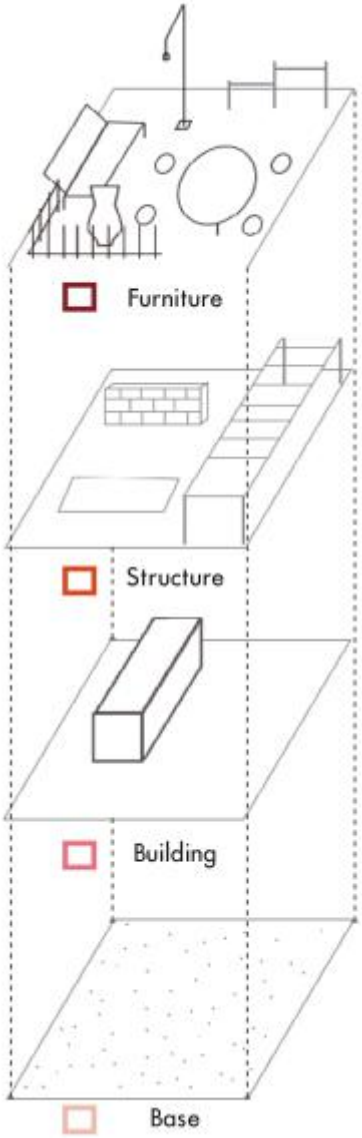




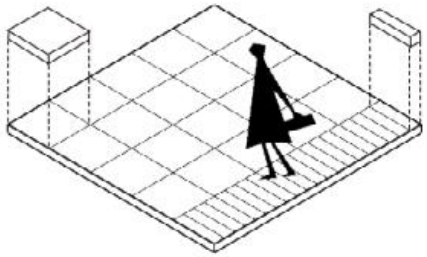
Changable modules

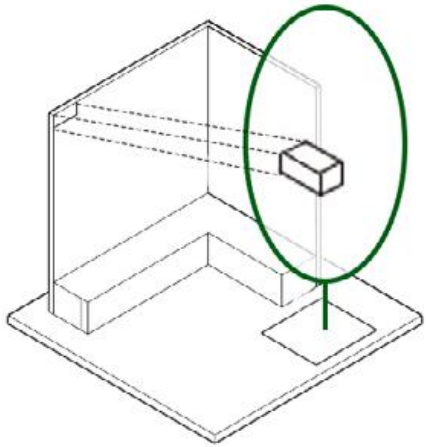
Circular construction

Layers

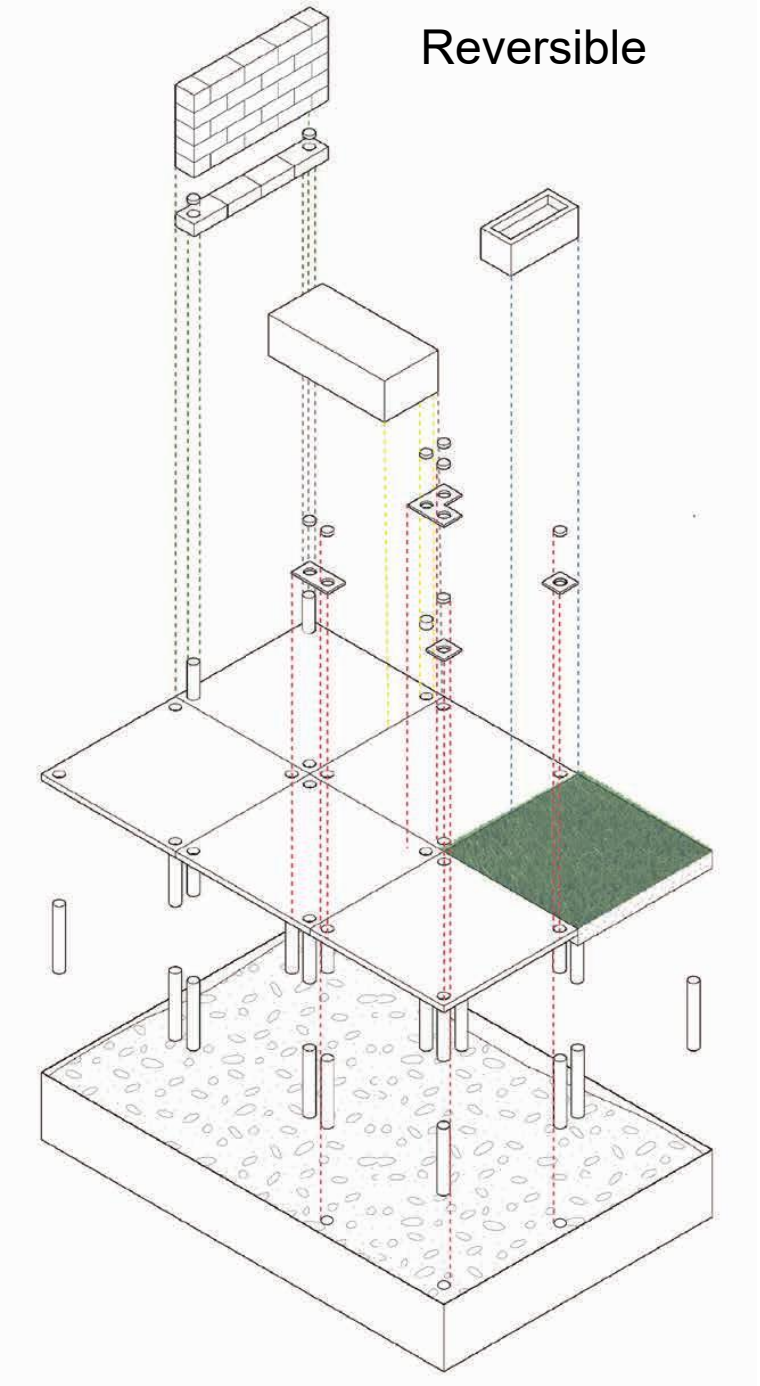


Circular materials

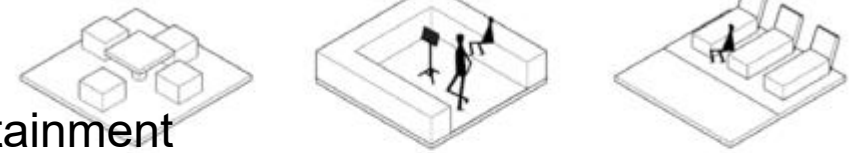




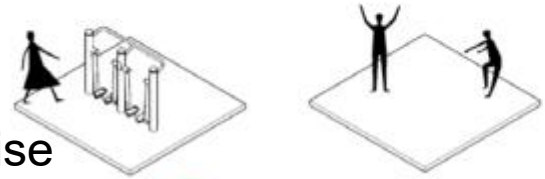
Reversible



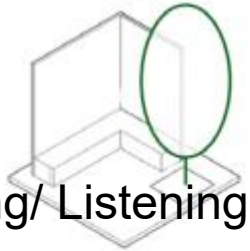
Elderly adaptive



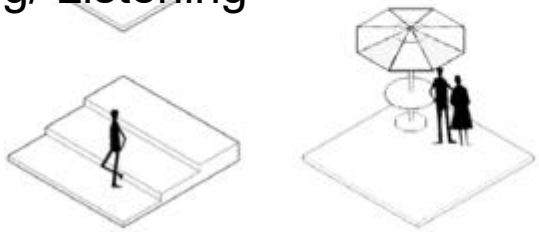
Entertainment



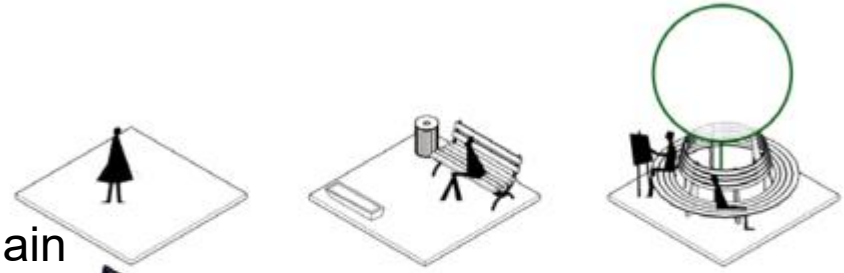
Exercise



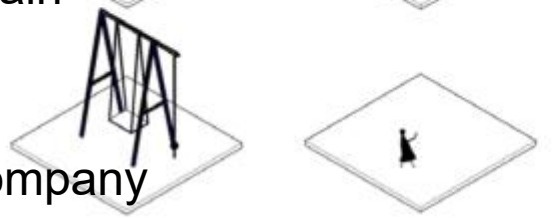
Reading/ Listening



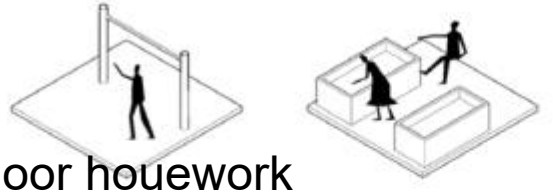
Social



Remain



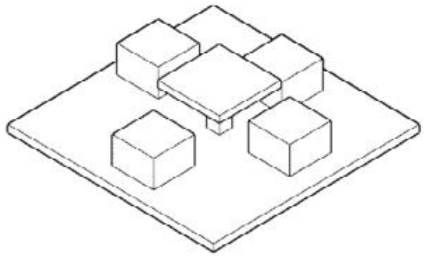
Accompany



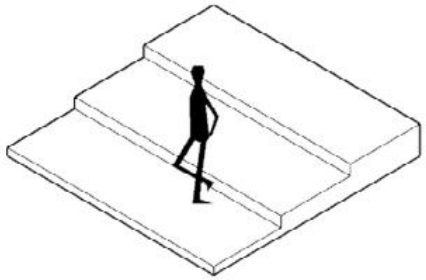
Outdoor houework

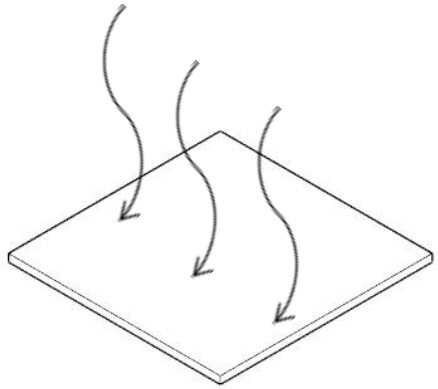
Move

Future adaptive

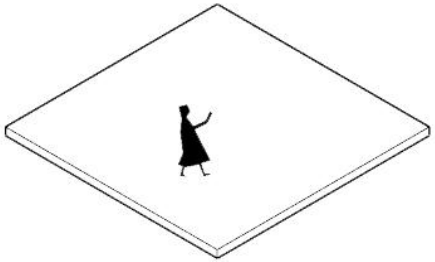


Multi-functional





Sponge



Open soil

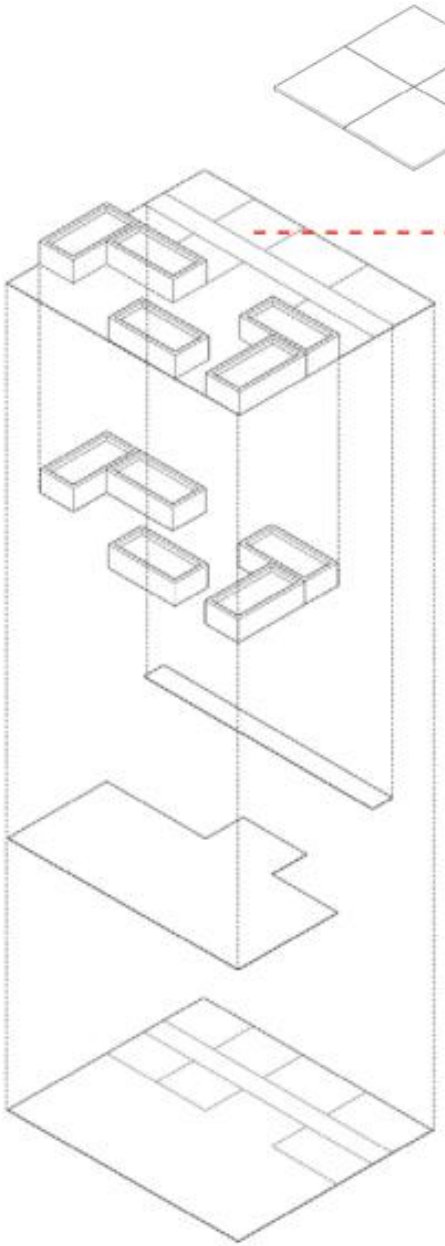
Reflection on modules

- Make the circular construction in the future city regeneration more convenient and simple
- Fast and less influence to residents
- Generalization

- More steps for current regeneration
- Cannot fully match the sites without modular design
- Unification of modulus
- Size limitation
- Not fully context or user specific

Design experiment
One possible scenario under current techniques

Cases of module

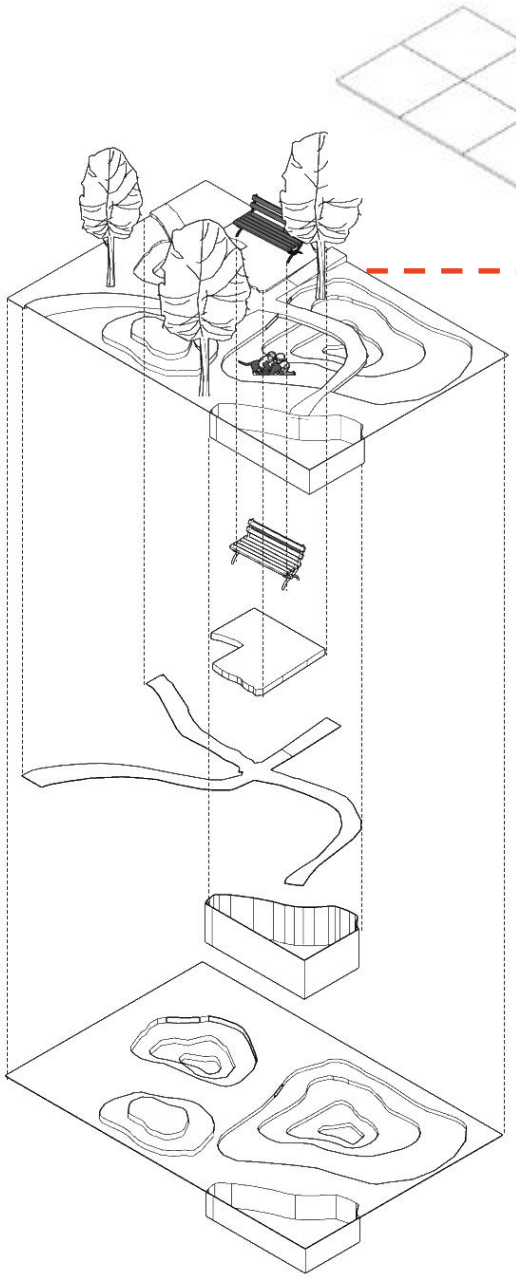


Planting bed- Reused bricks

Walking path- Recycled bricks

Base- Recycled permeable concrete board

Open soil- Reuse construction mud



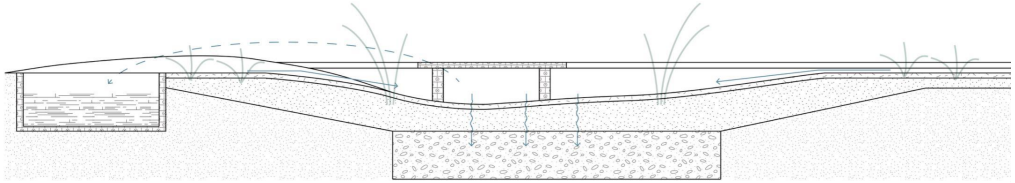
Furniture - Reuse furniture/ Recycled wood, plastic and metal

Rest platform - Bio-based material

Walking path - Recycled bricks

Pool - Reuse bricks

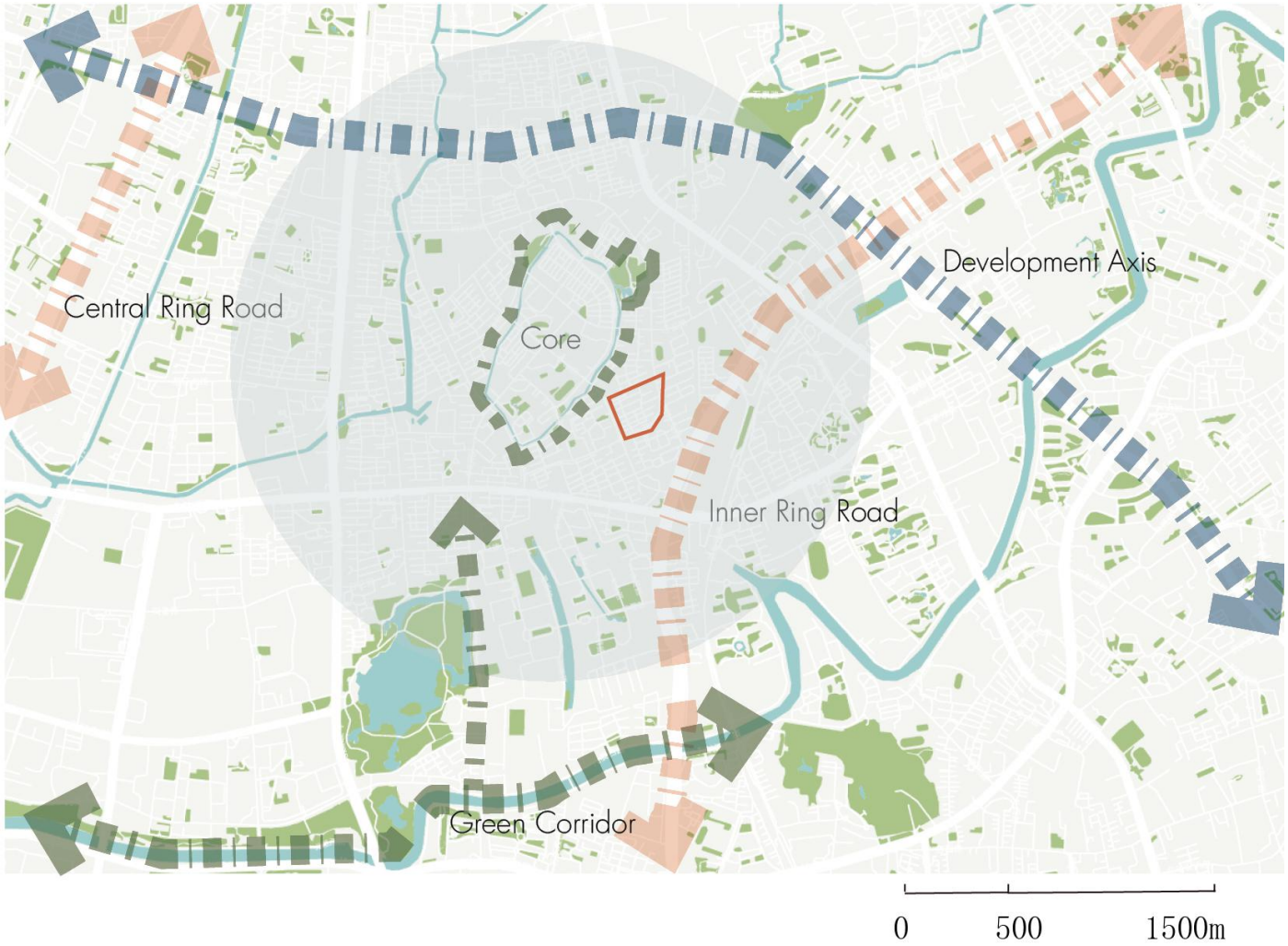
Open soil- Reuse construction mud



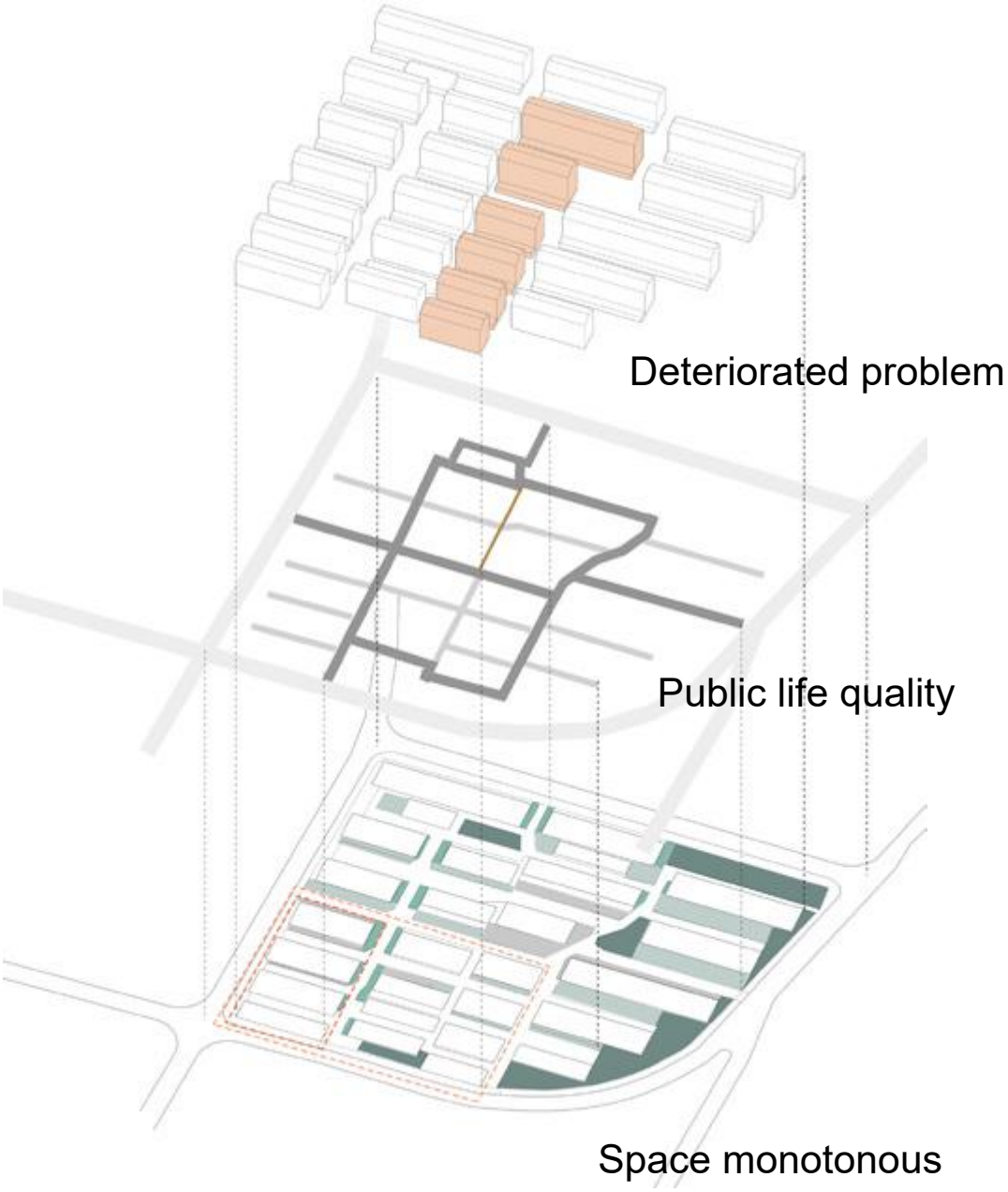
Design

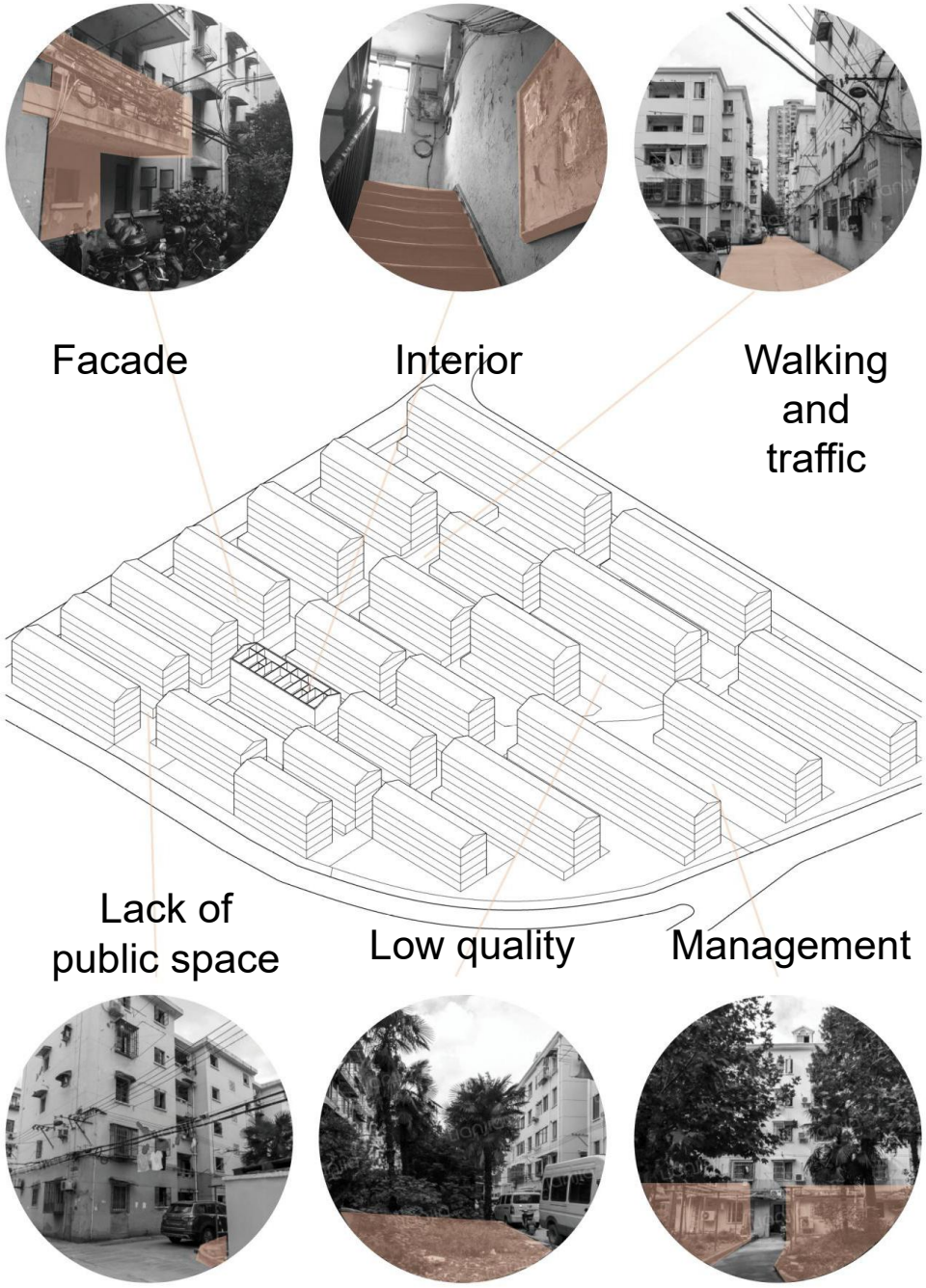
Apply strategies and modules to design

Nanling Estate

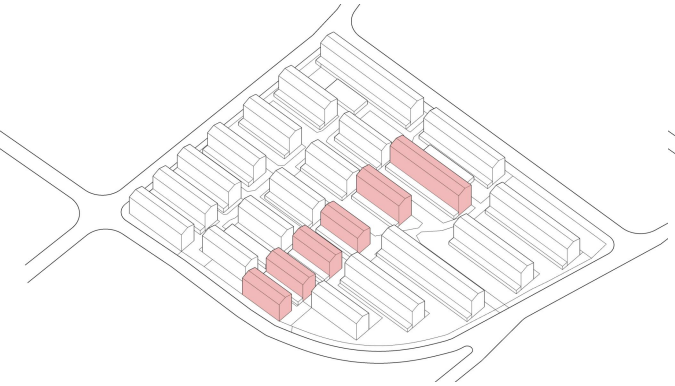


Status quo

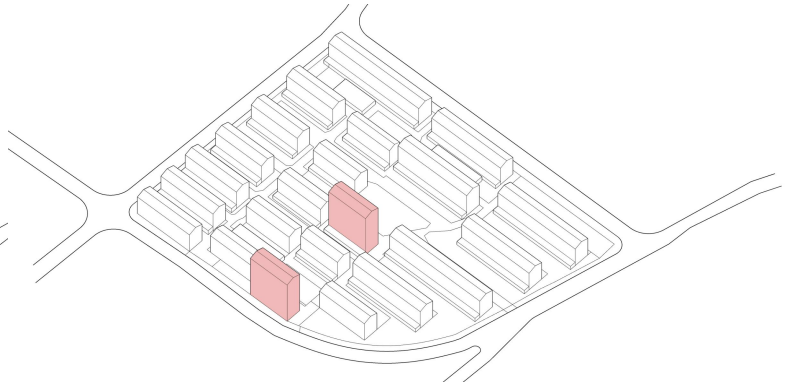

Deteriorated problem
Public life quality
Space monotonous


Facade
Interior
Walking and traffic
Lack of public space
Low quality
Management

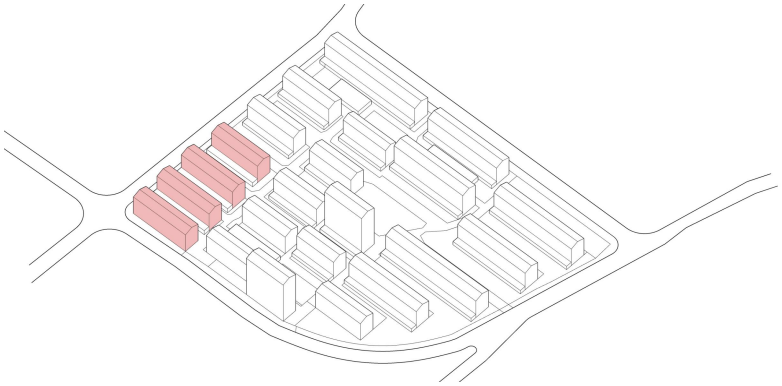
Overall regeneration



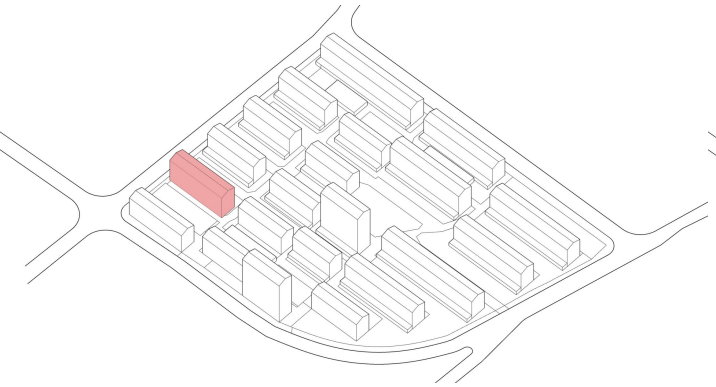
Low quality buildings



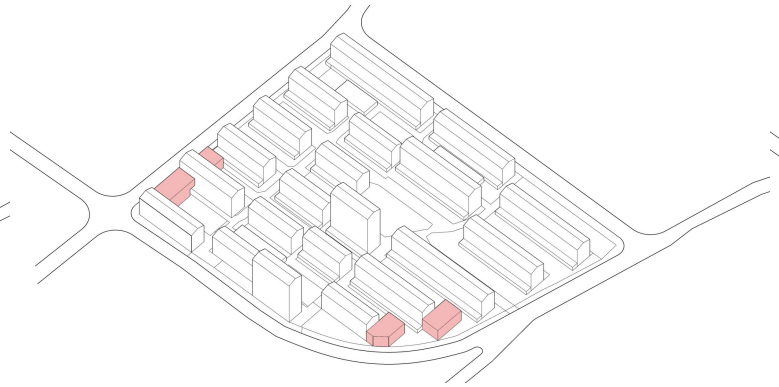
Demolition for public space and add floors



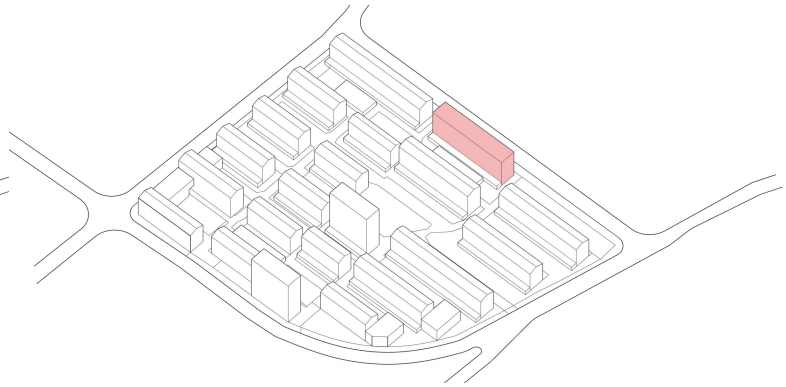
Shortage of public space



Demolition and rebuild for more public space

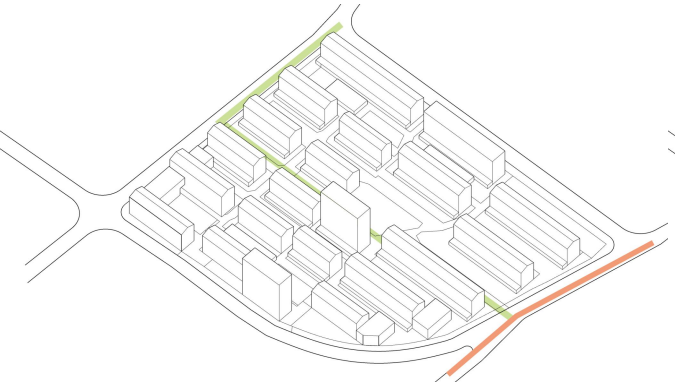


New buildings (elderly service facilities)

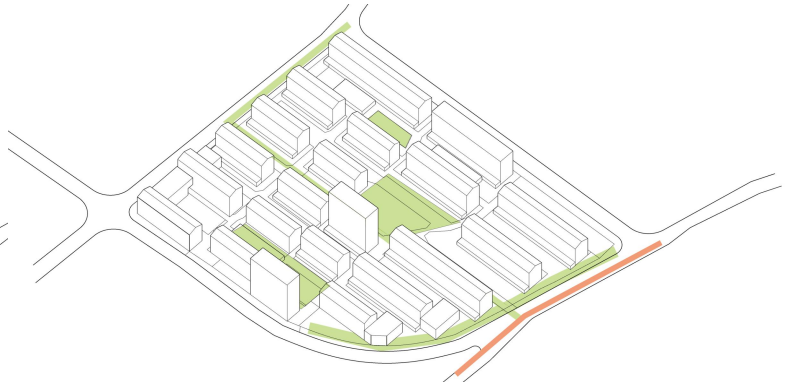


Extra floors for resettlement

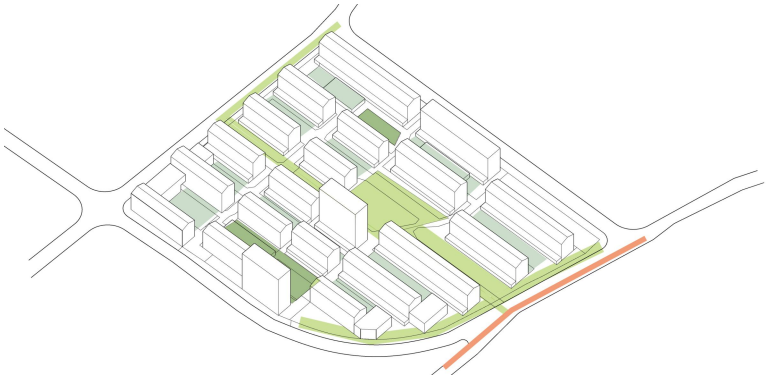
Overall regeneration



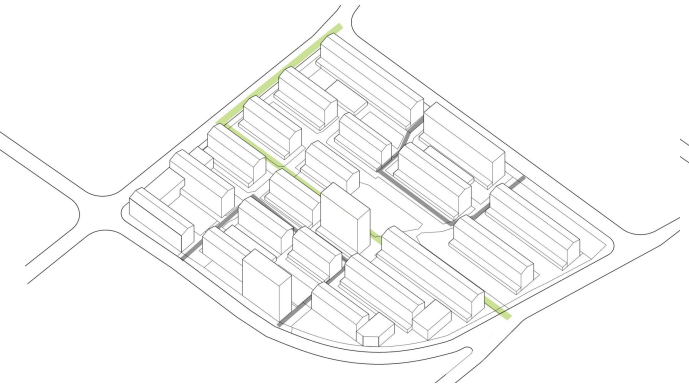
Main green corridor links the green and business function



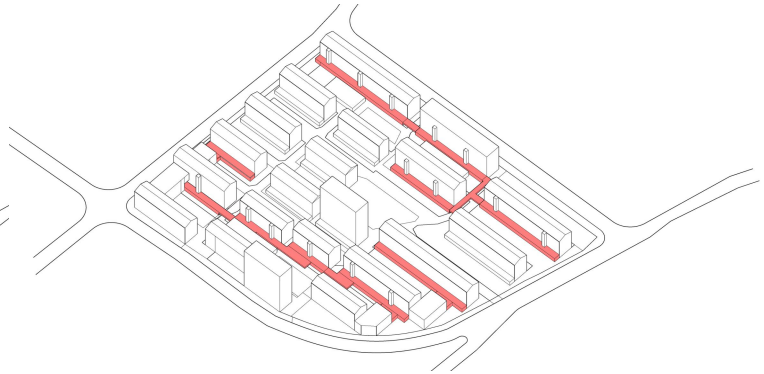
Centralized public space



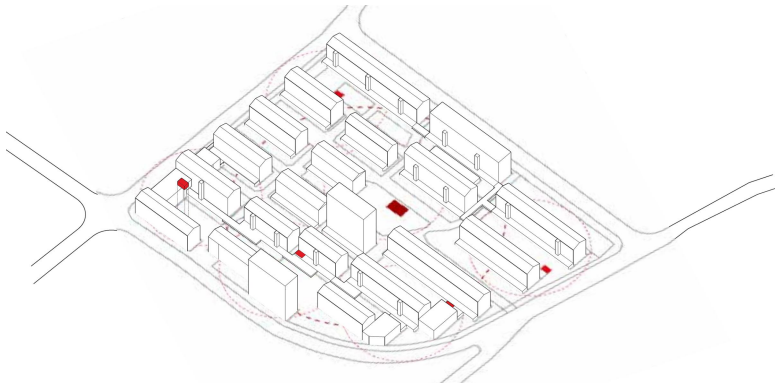
Three hierarchies of public spaces



Walking and traffic system

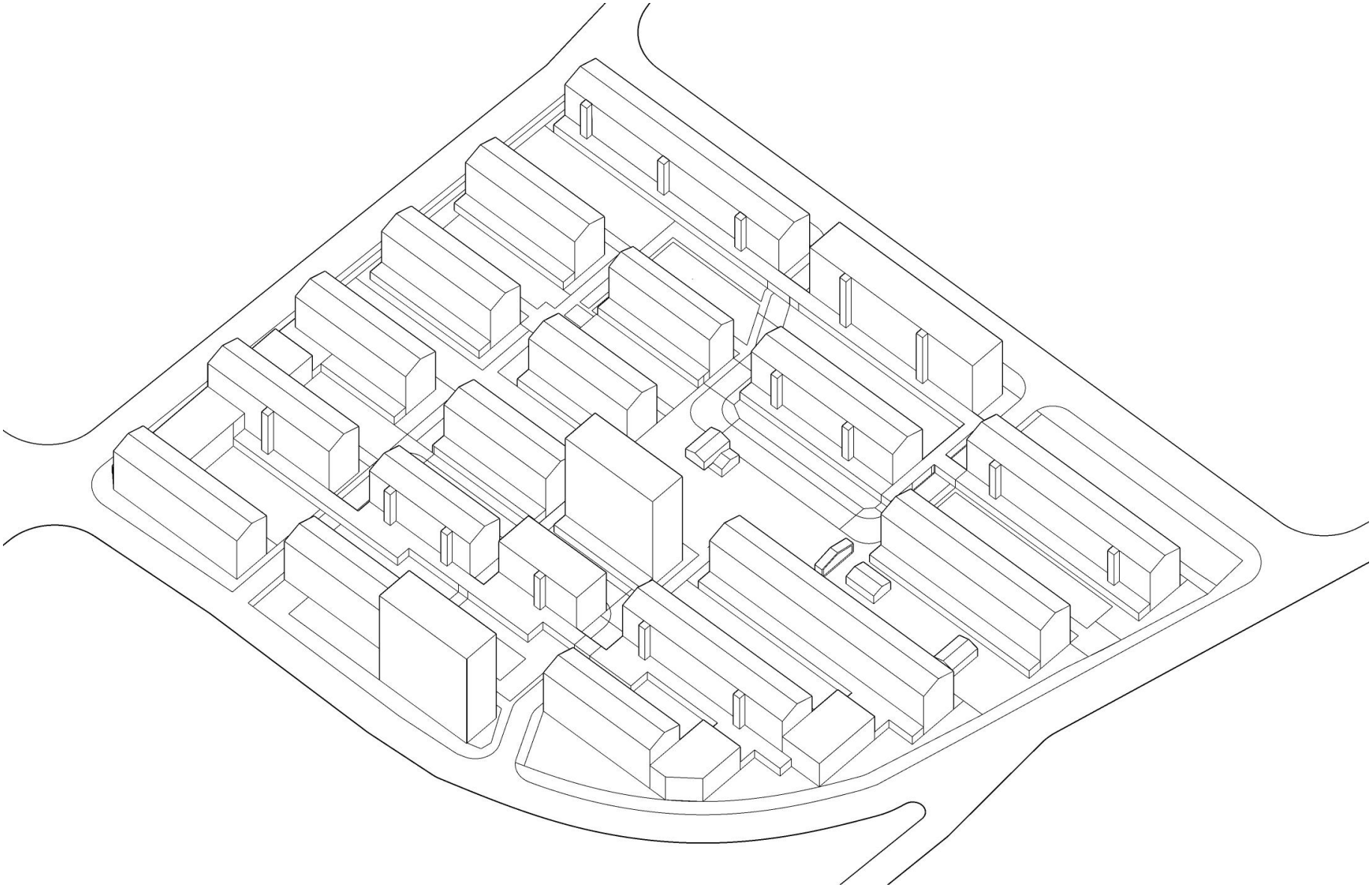


Continuous sky corridor



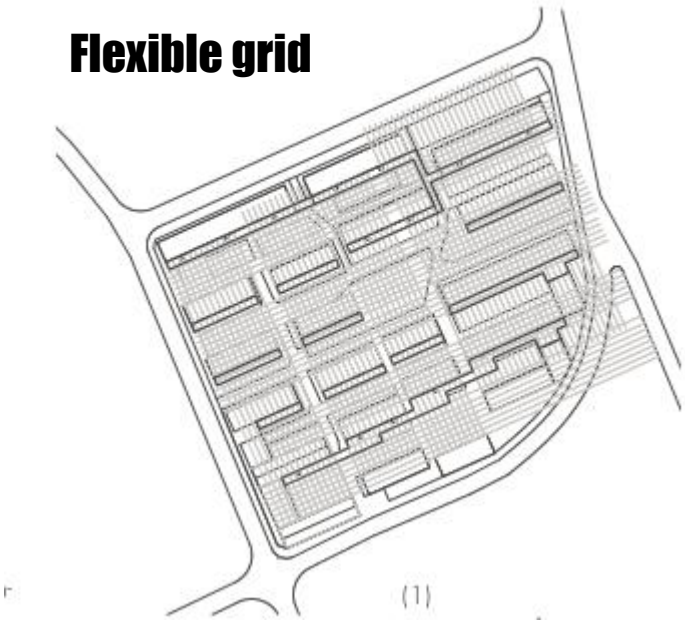
Waste collection points

Overall regeneration

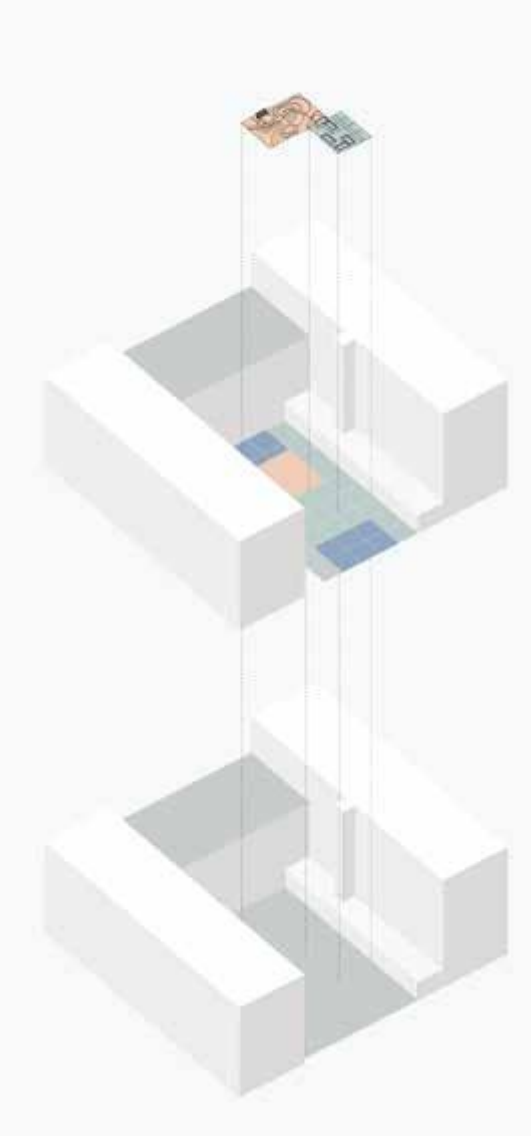


Future adaptive

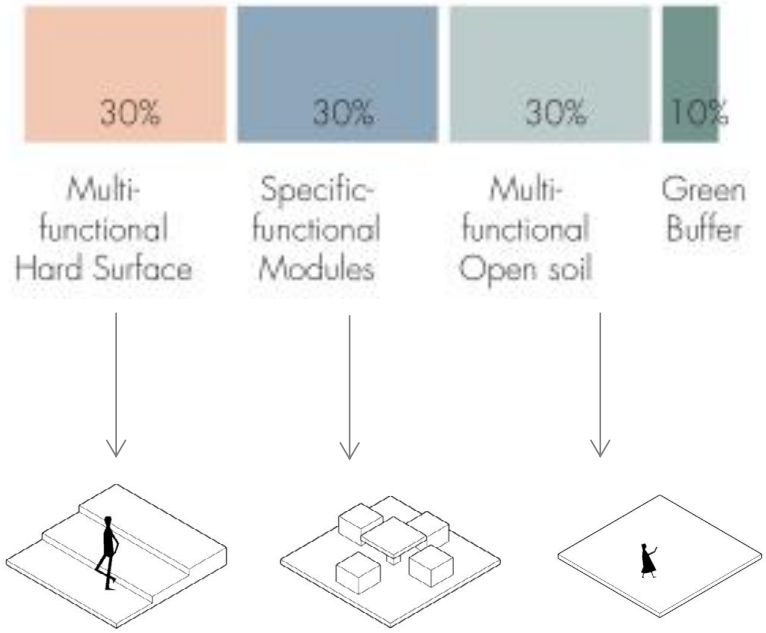
Flexible grid



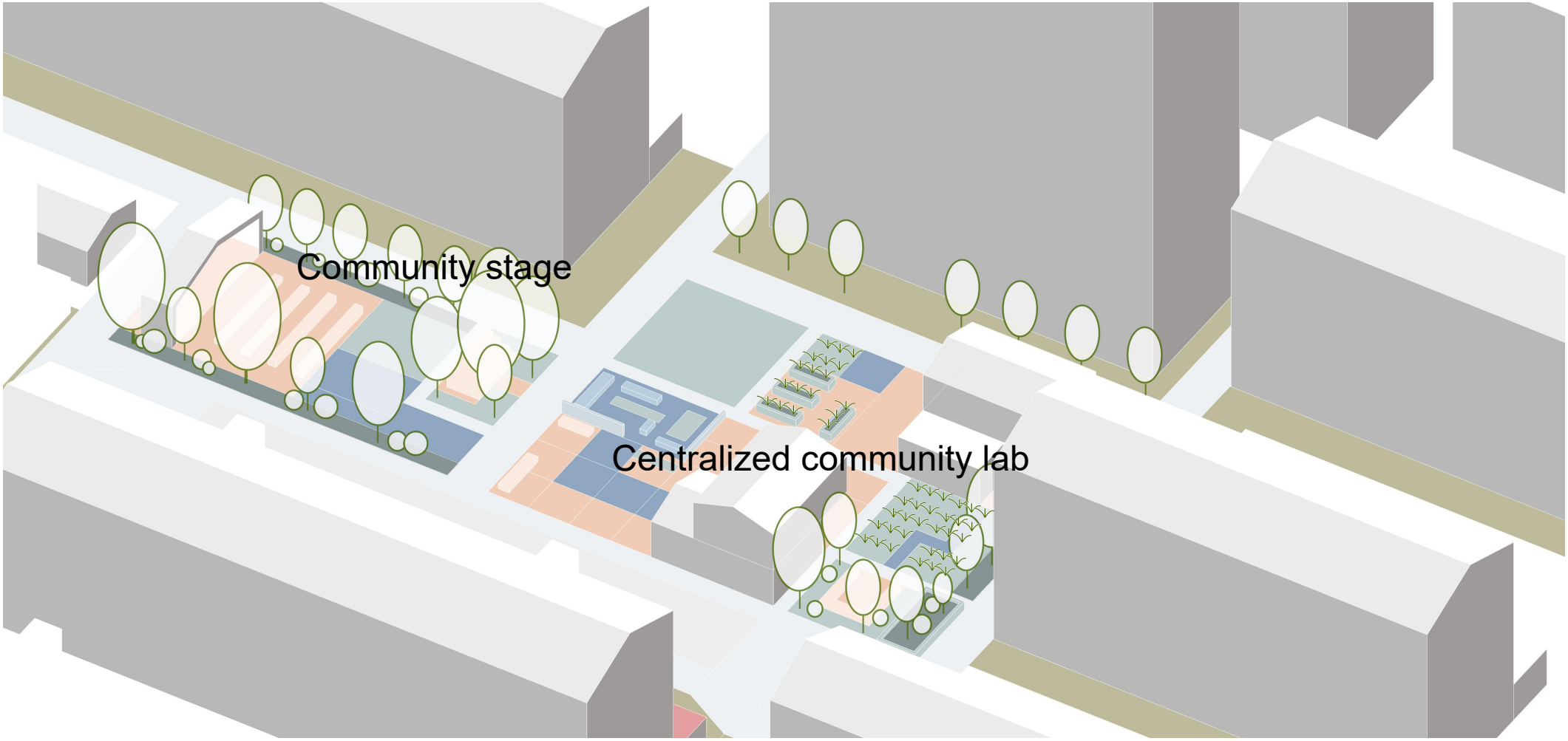
Put changeable modules in



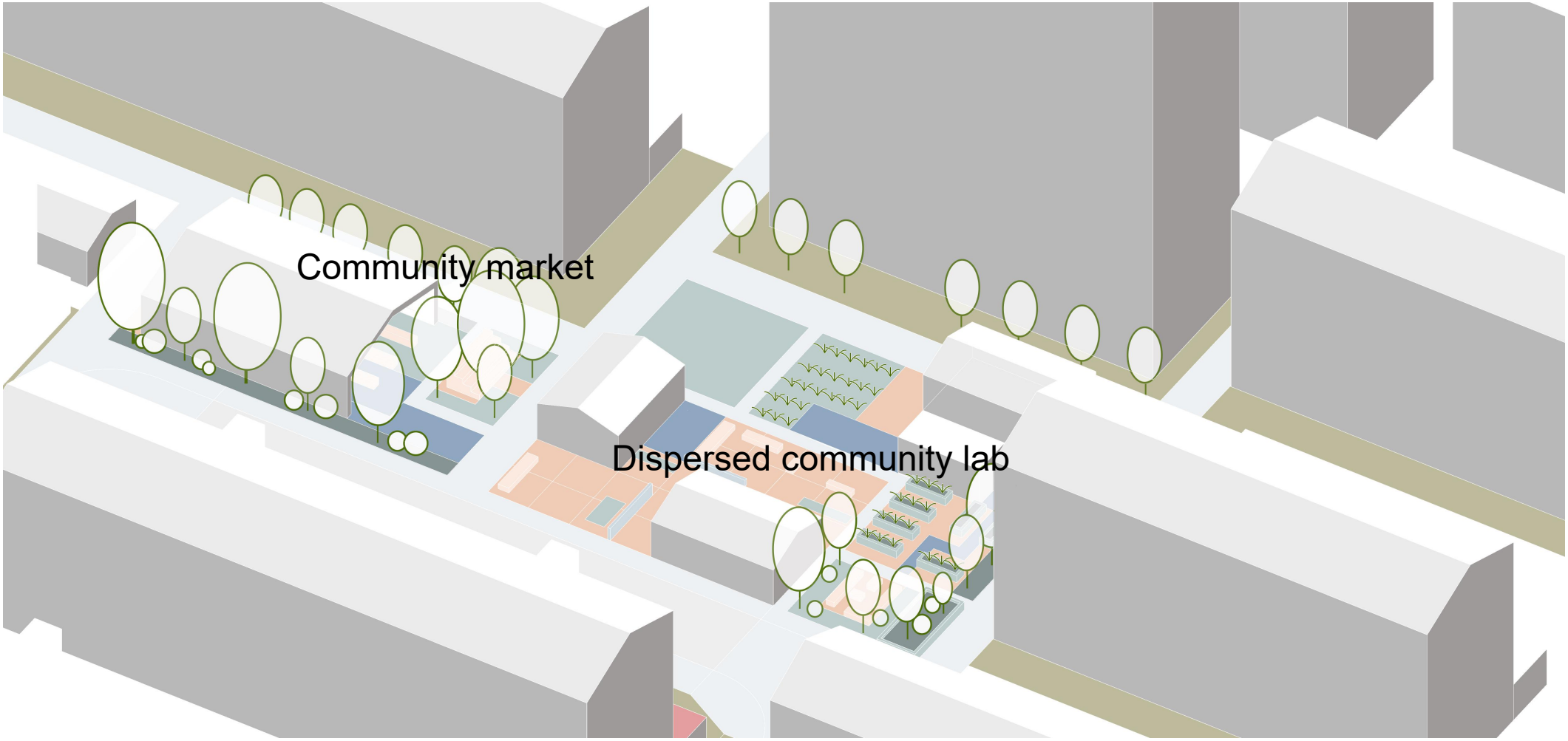
Multi-functional



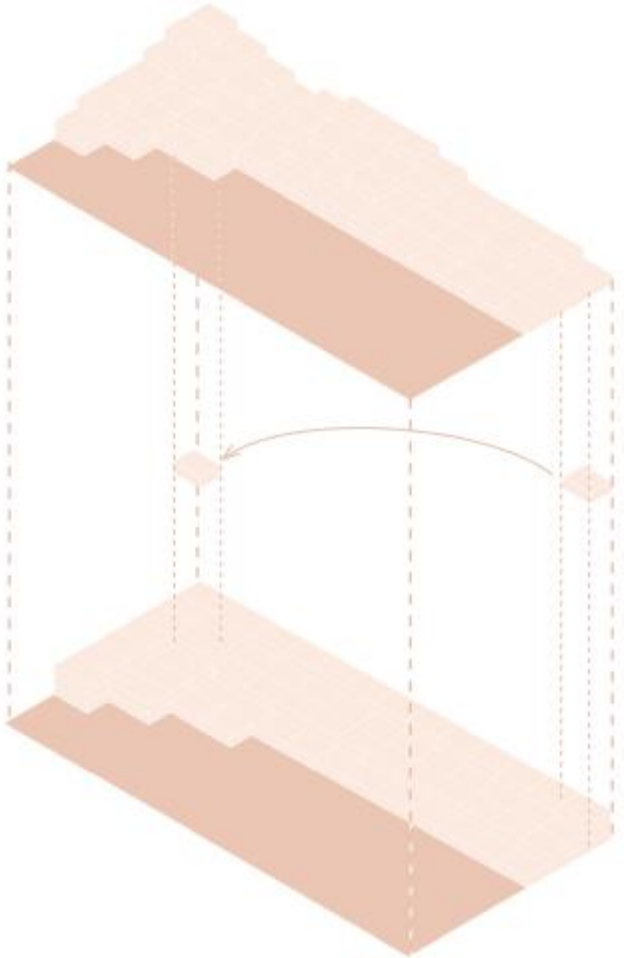
Changeable



Changeable

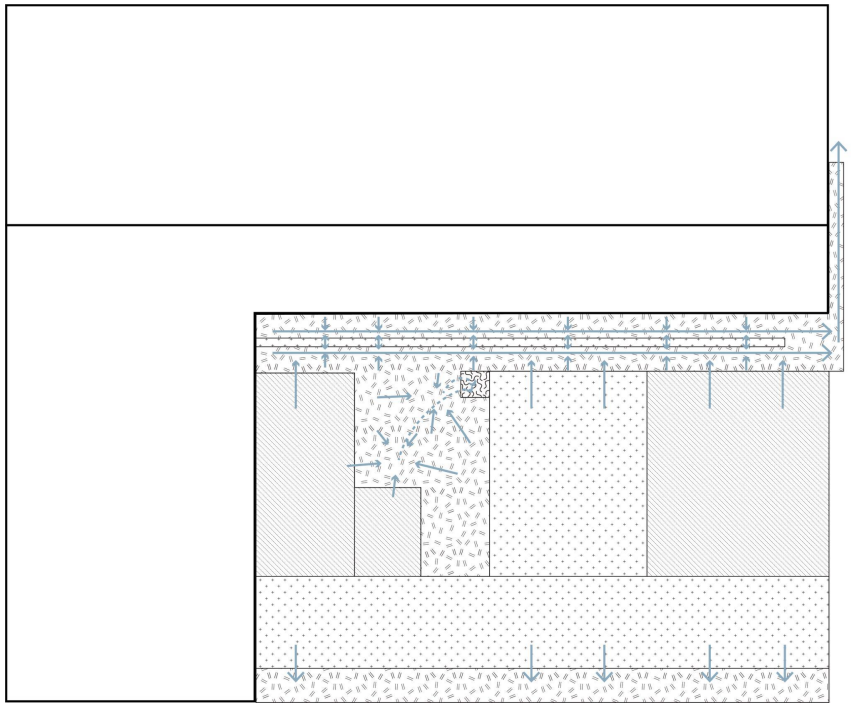


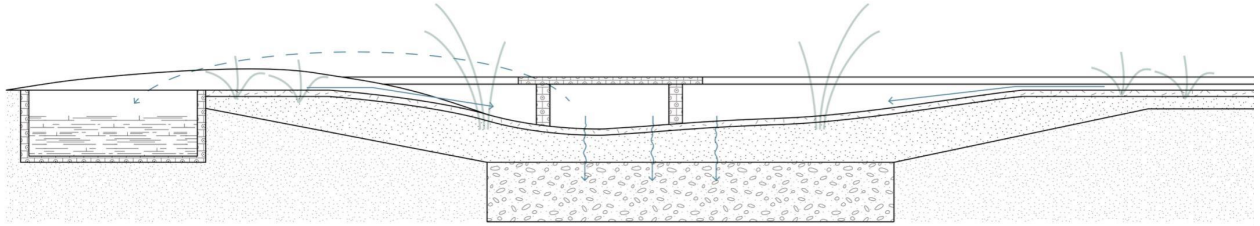
Changeable

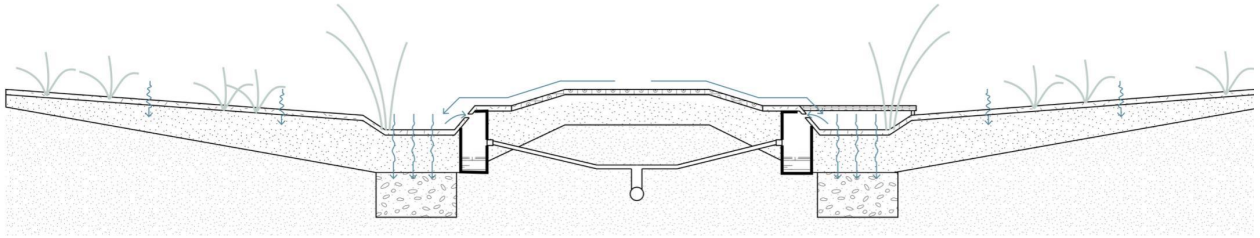


Wooden changeable modules

Permeable







Wood

Pearmeable Concrete

Open Soil

Water Flow

Elderly adaptive

Seperation or not?

Elderly stay dispersed

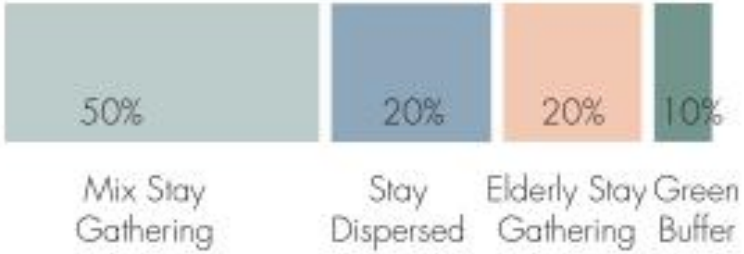
Elderly stay gathering

Mixed stay dispersed

Mixed stay gathering

Semi-private

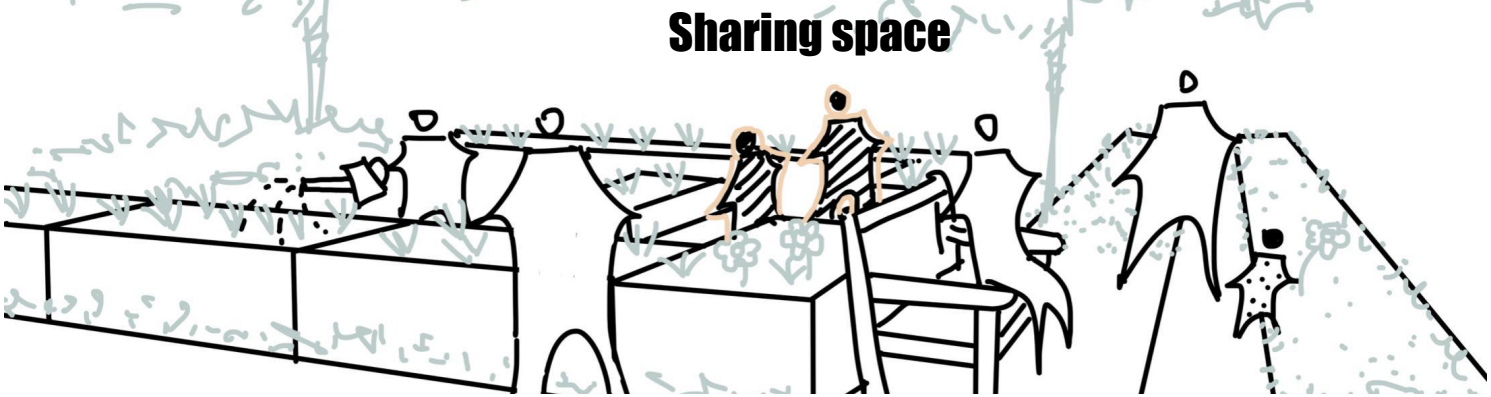
Semi-public (1)



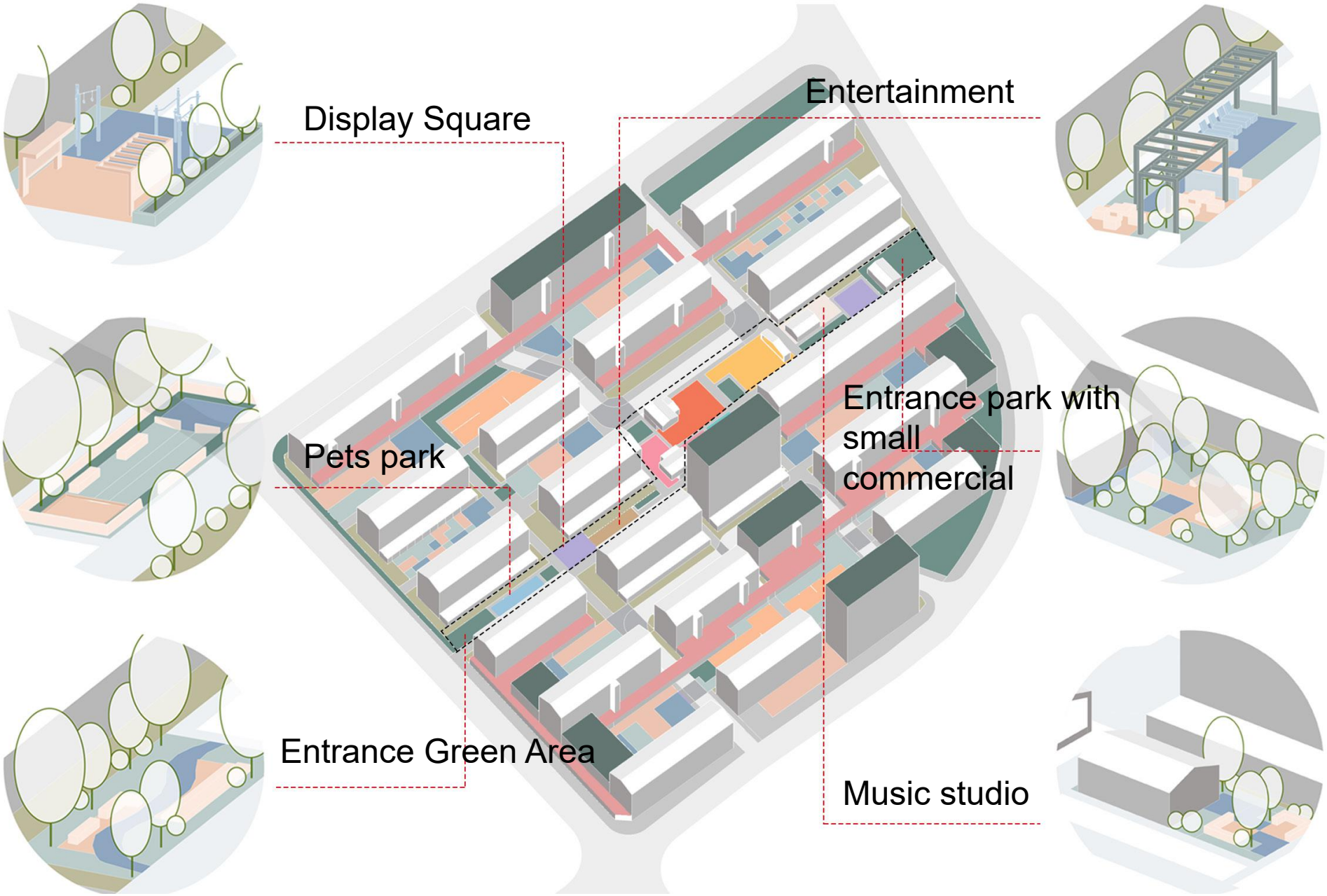
Public (2)

(3)

Elderly adaptive

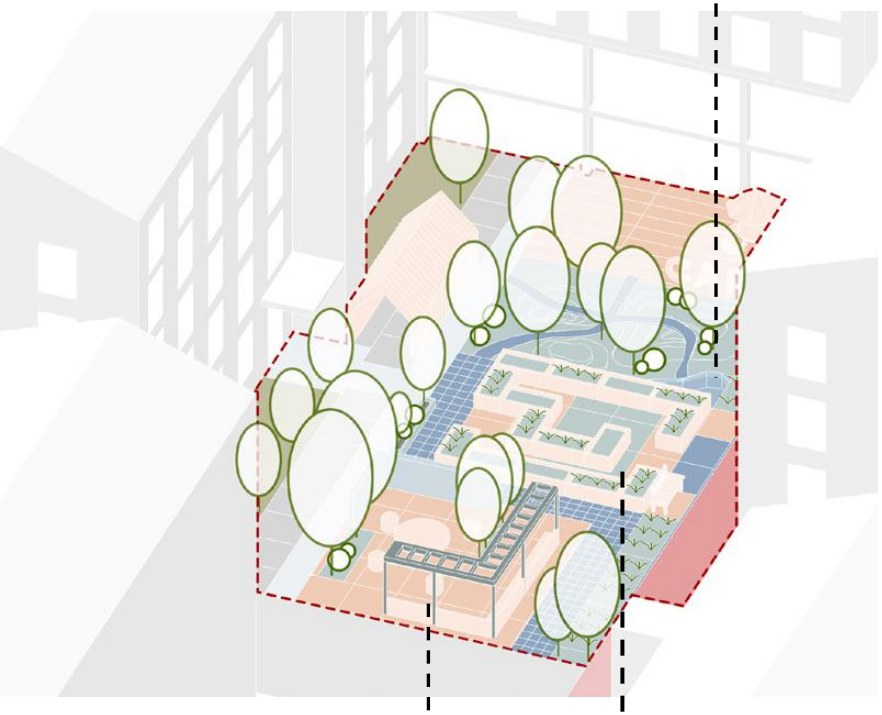


Elderly adaptive



Elderly adaptive

Green landscape

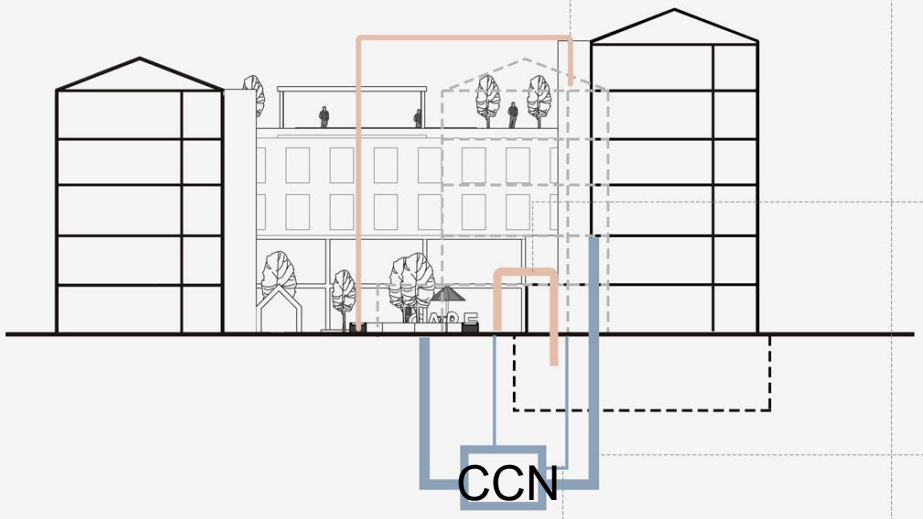


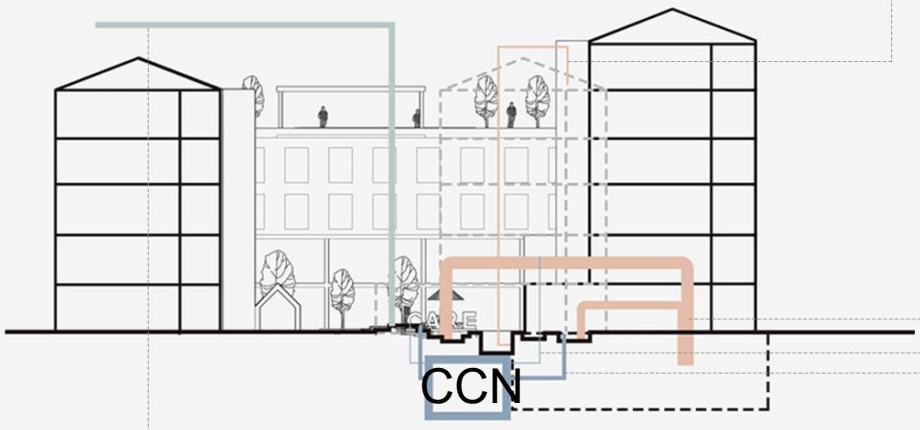
Urban farming

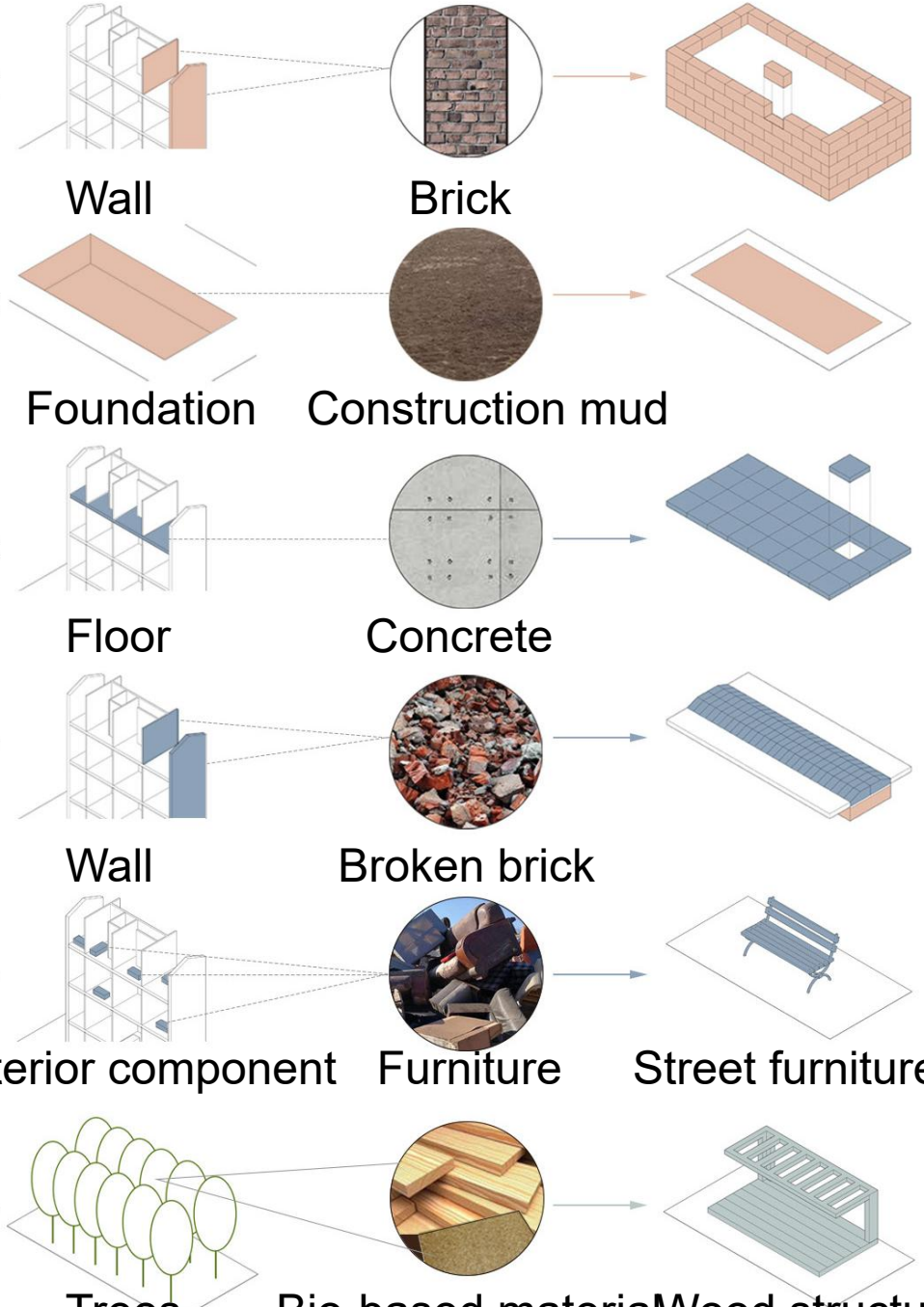
Gathering

Circular construction

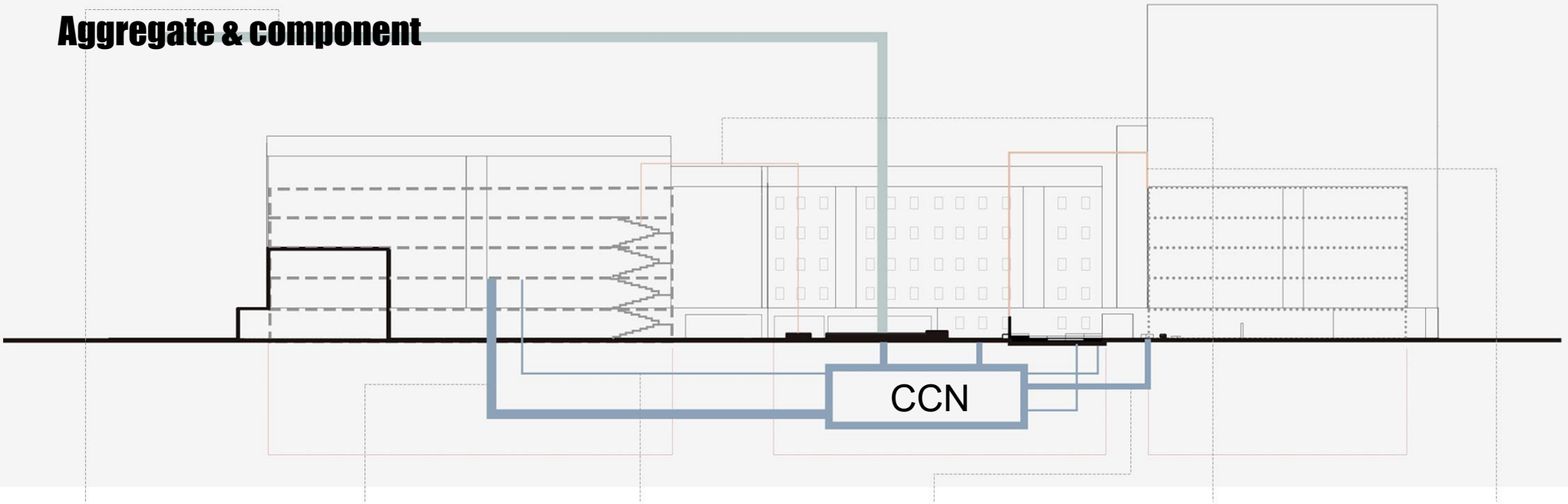
Aggregate & component

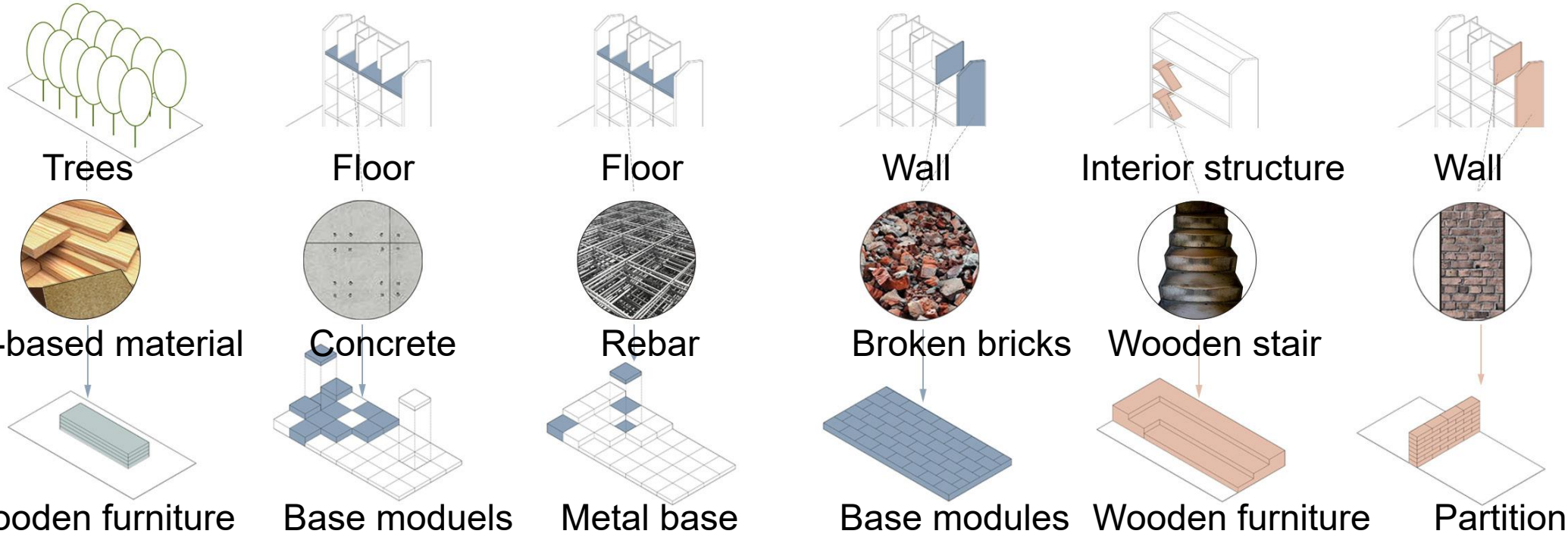




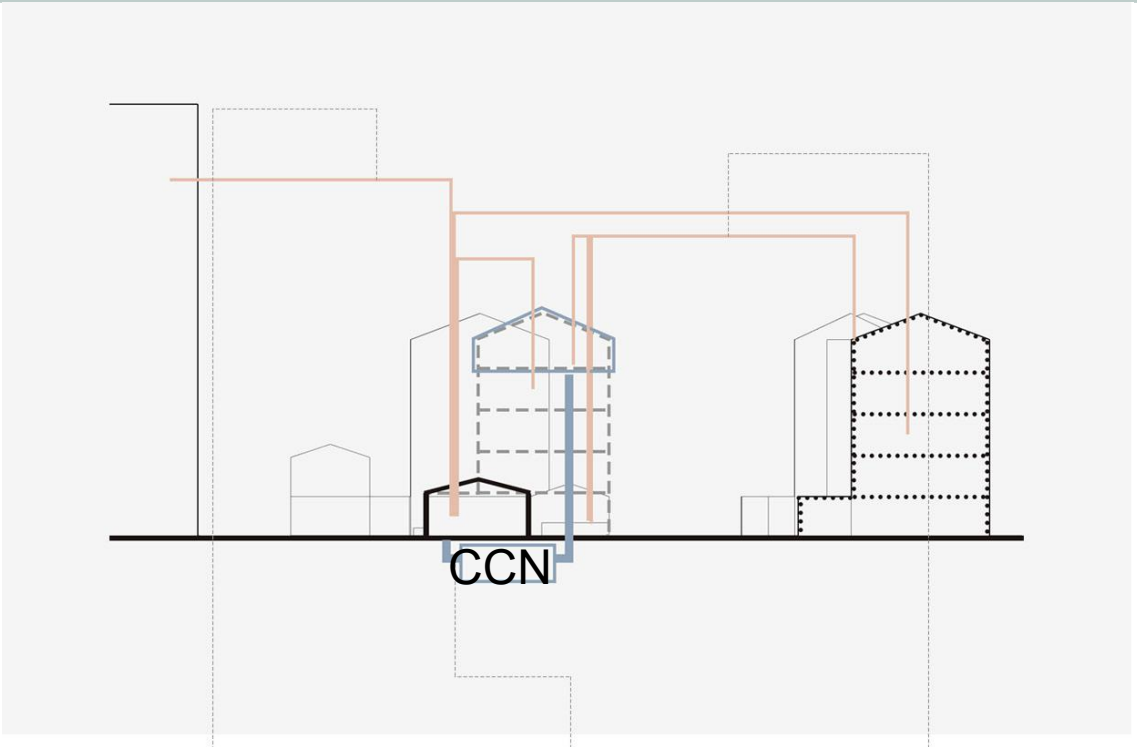


Circular construction



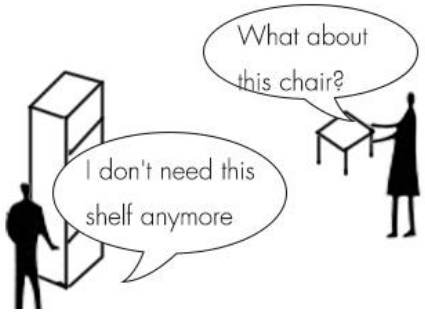


Component & Module

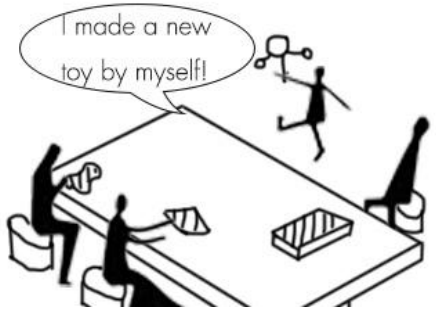


Circular Lab

Collection



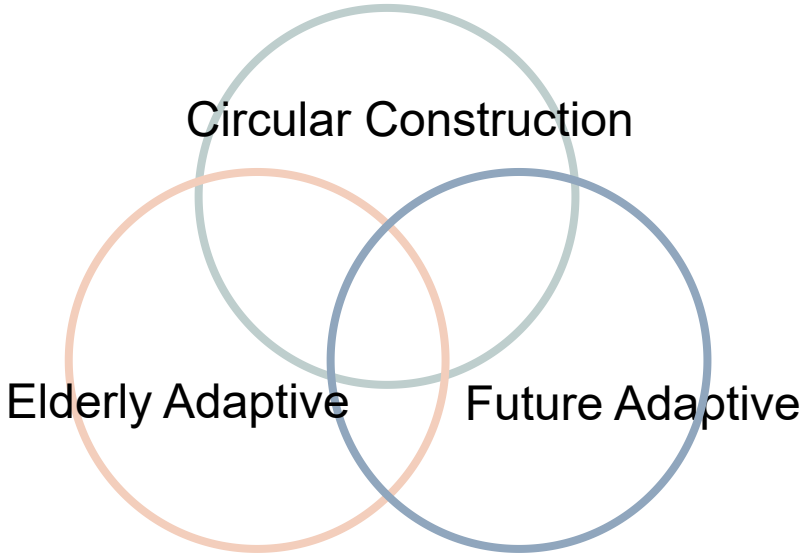
Exchange



Workshop

Display

Apply strategies and modules to design



URBAN SCALE MATERIAL FLOW

Circular Construction Network

Why circular construction network?

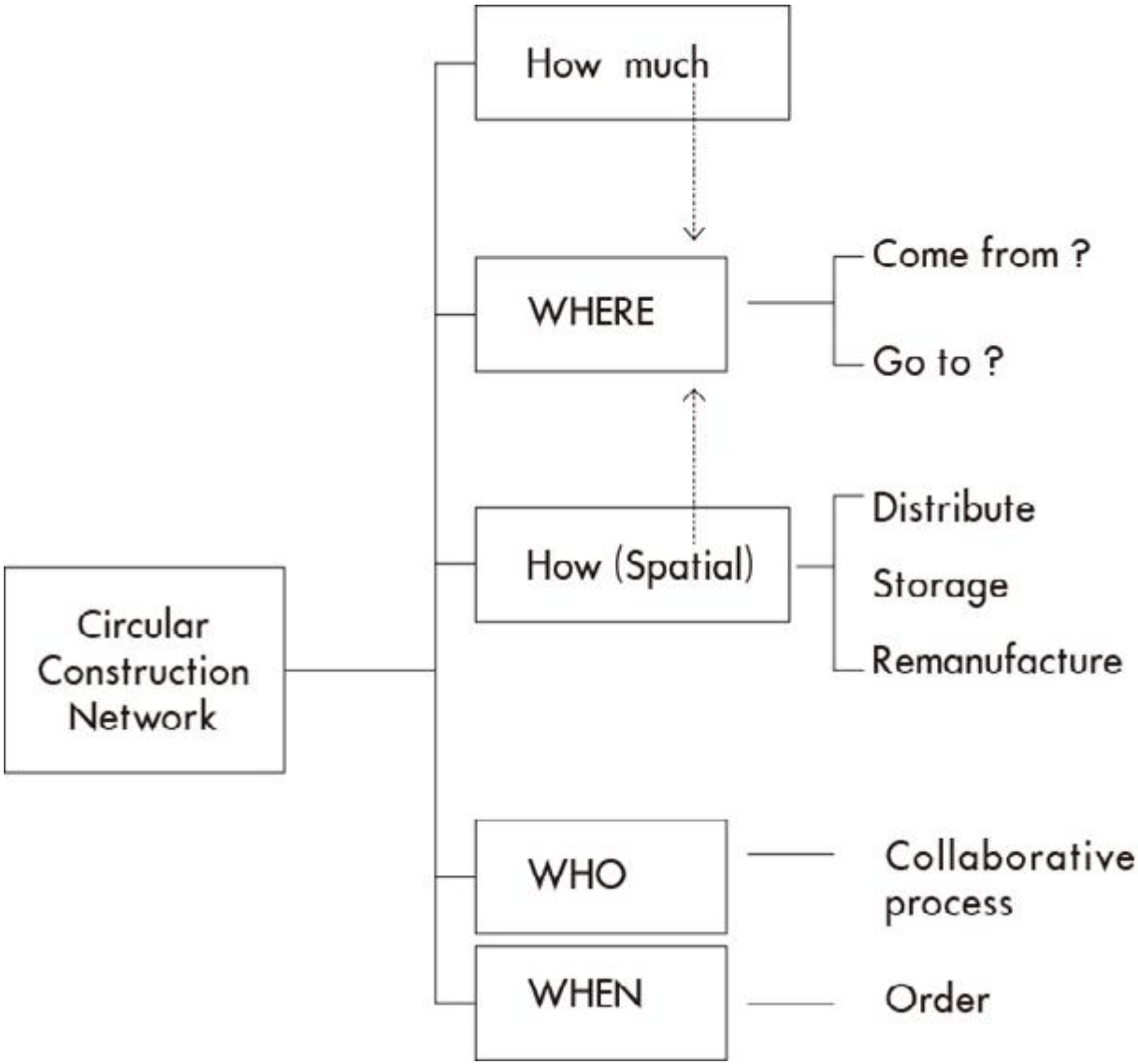
Systemetic

Scalable

Implement

Generalization

How to build the circular construction network?



Urban mining

Transformation of infrastructure

Collaborative network

Timeline

Urban mining - supply and demand

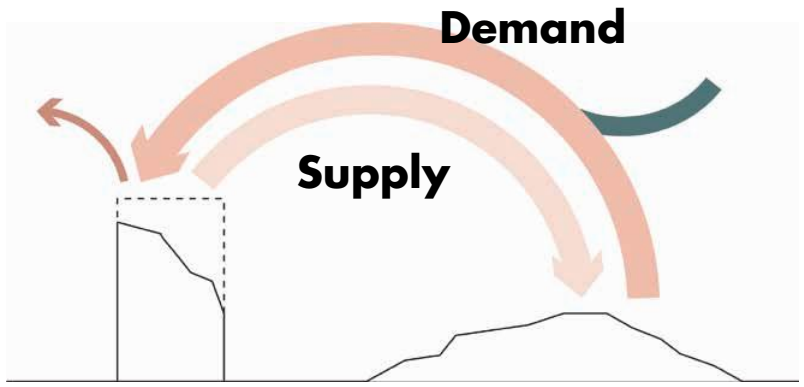
Different types of new workers' estates

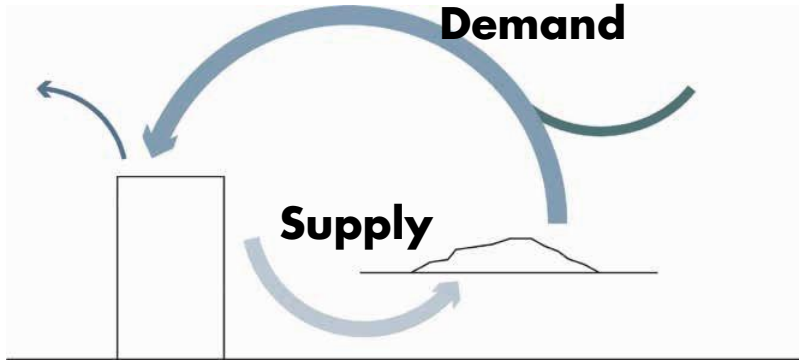
	Building Quality		
	High	Medium	Low
Low Public Space Quality	Maintain	Refurbish	Demolition

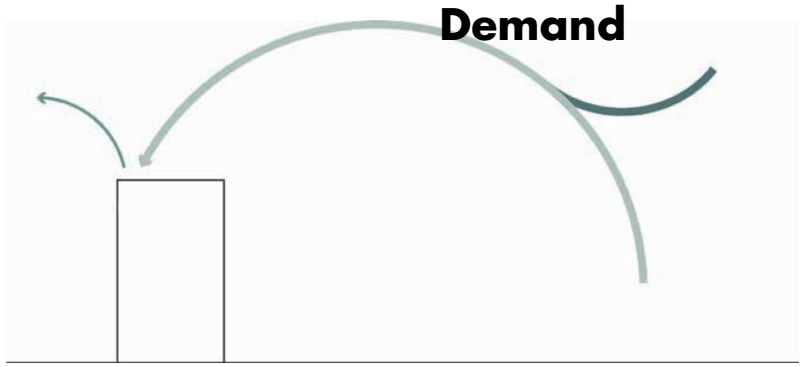
	Building Quality		
	High	Medium	Low
Low Public Space Quality	Maintain	Refurbish	Demolition

	Building Quality		
	High	Medium	Low
Low Public Space Quality	Maintain	Refurbish	Demolition

Material flow







Urban mining - Cases

Demolition

Low quality/high value

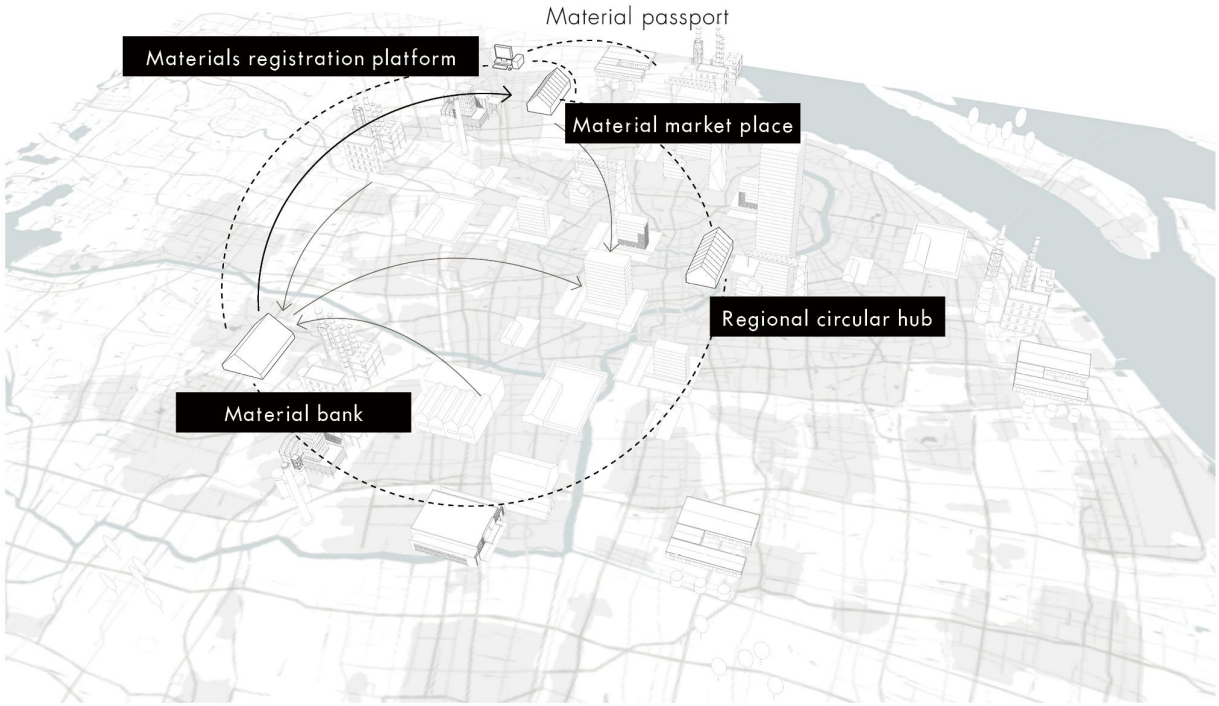
Refurbishment

Medium quality/Medium value

Maintain

High quality/low value

Supply and demand match



- Material passport (BIM)

- Material bank

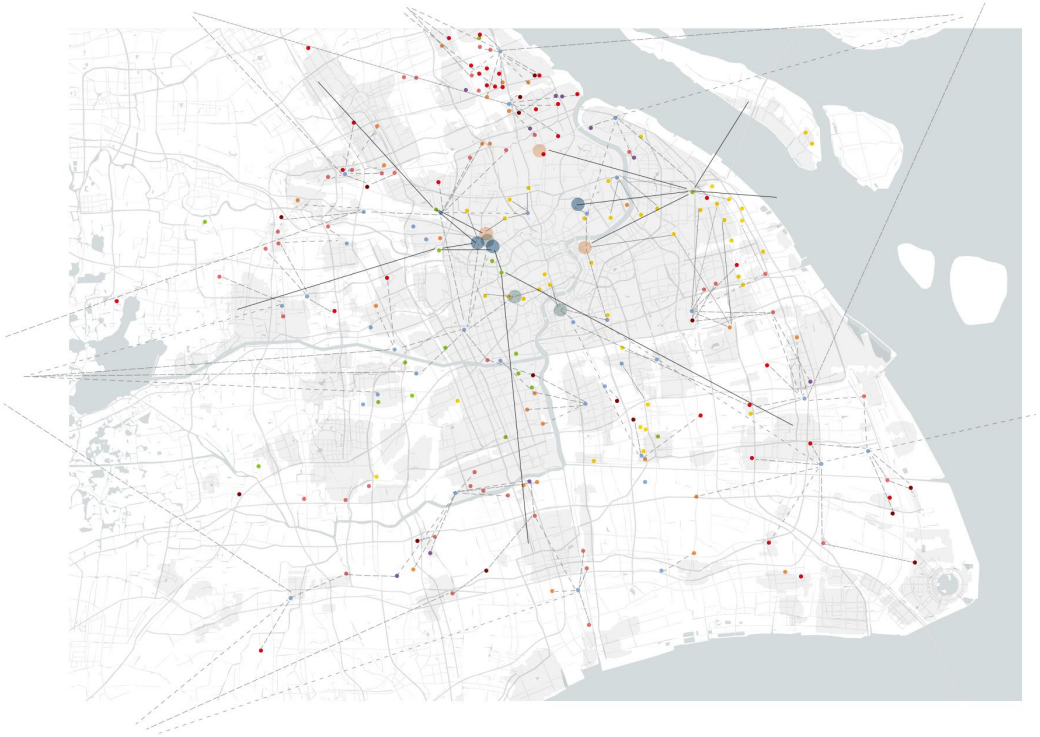
- Material marketplace

- Material registration platform

- Knowledge sharing hub

Transformation of infrastructure

Existing infrastructure and flow



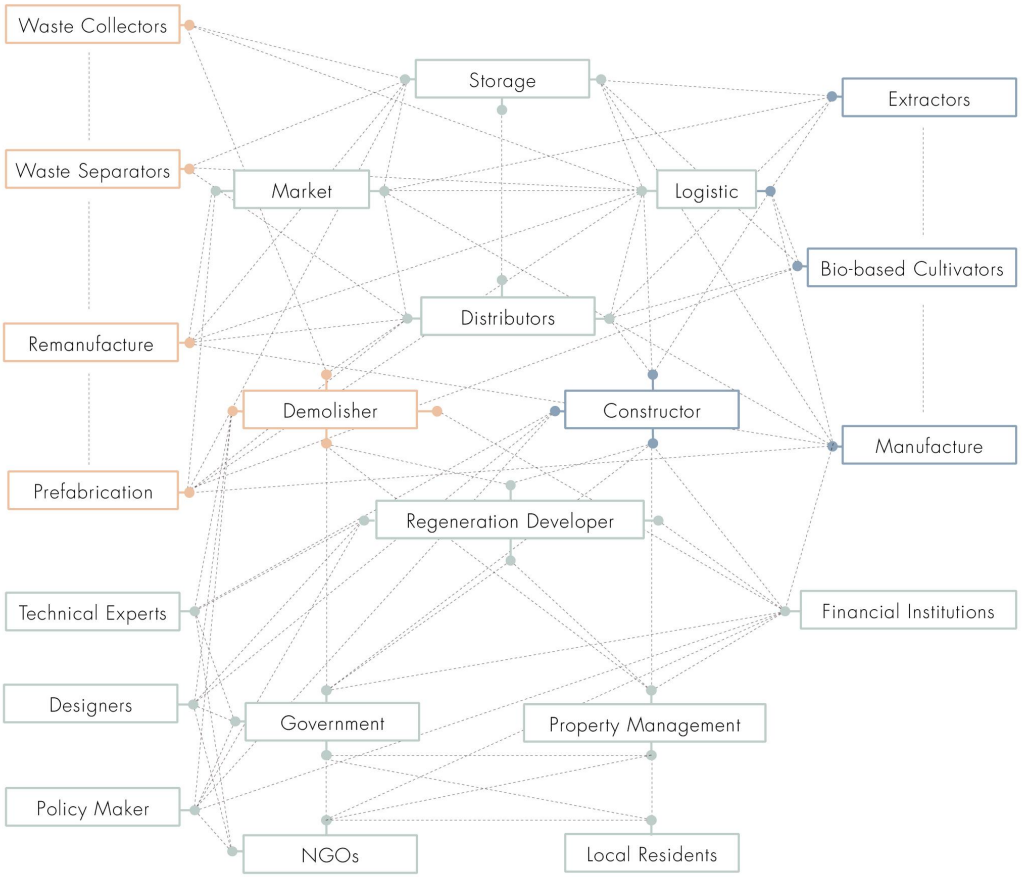
- Demolition sites
- Refurbishment sites
- Maintenance sites
- Brick industry
- Rebar industry
- Cement industry
- Concrete industry
- Wood industry
- Storage
- Waste collection
- Material markets
- Raw material flow
- Waste material flow

Circular construction nodes

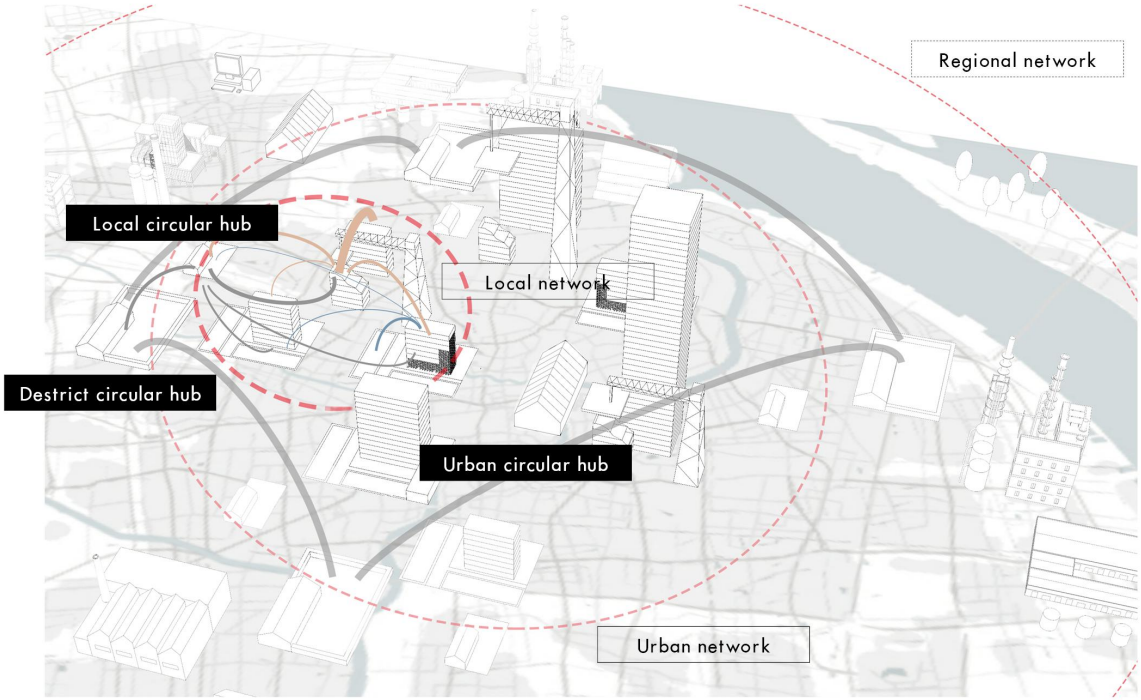
Prioritize transformation of existing infrastructure

Collaborative network

Collaborative stakeholders



Collaborative sites/ cross scales



Business model

Circular industries

Circular Supplies: Provide renewable energy, bio based- or fully recyclable input material to replace single-lifecycle inputs

Resource Recovery: Recover useful resources/energy out of disposed products or by-products

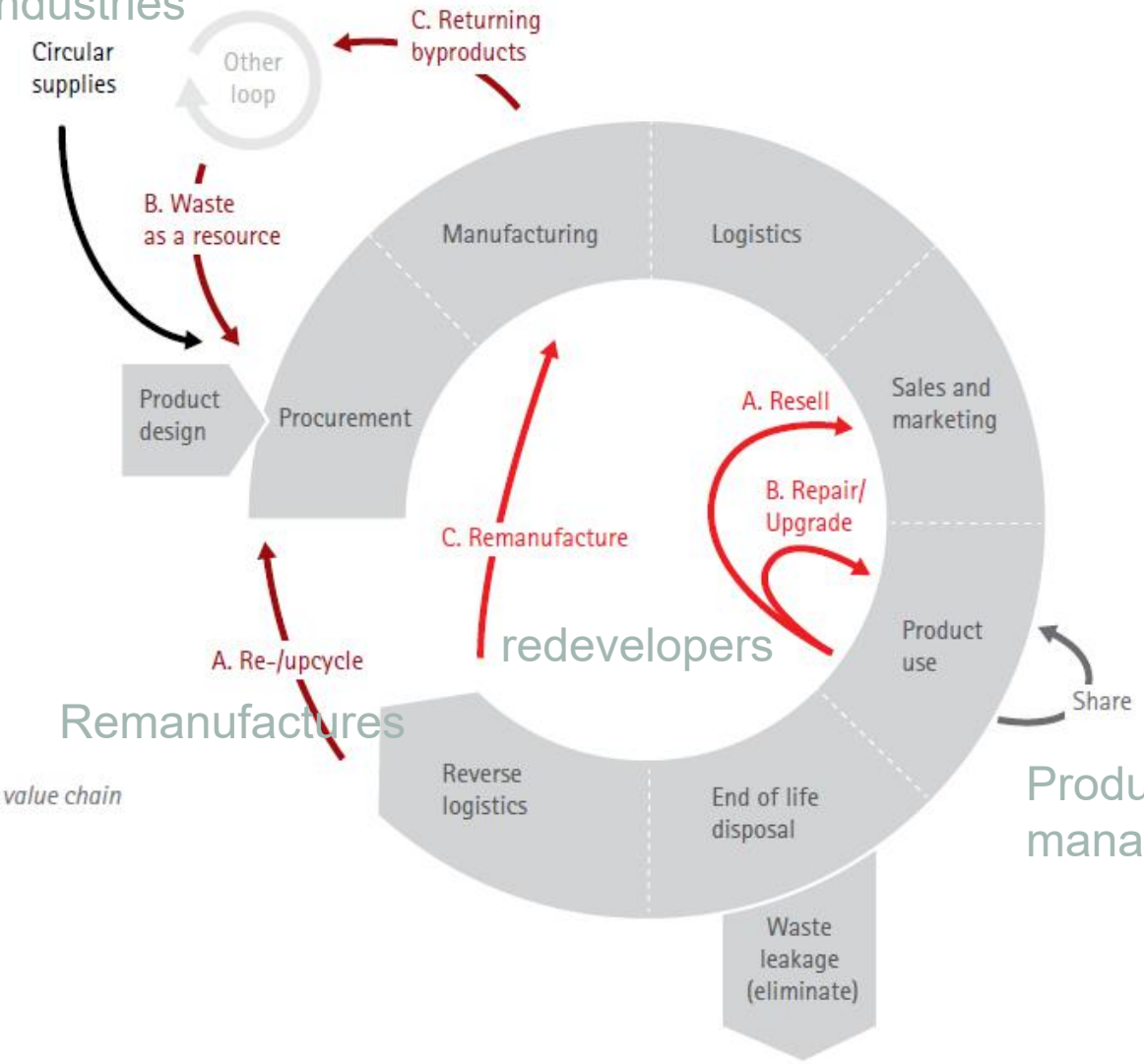
Product Life Extension: Extend working lifecycle of products and components by repairing, upgrading and reselling

Sharing Platforms: Enable increased utilization rate of products by making possible shared use/access/ownership

Product as a Service*: Offer product access and retain ownership to internalise benefits of circular resource productivity

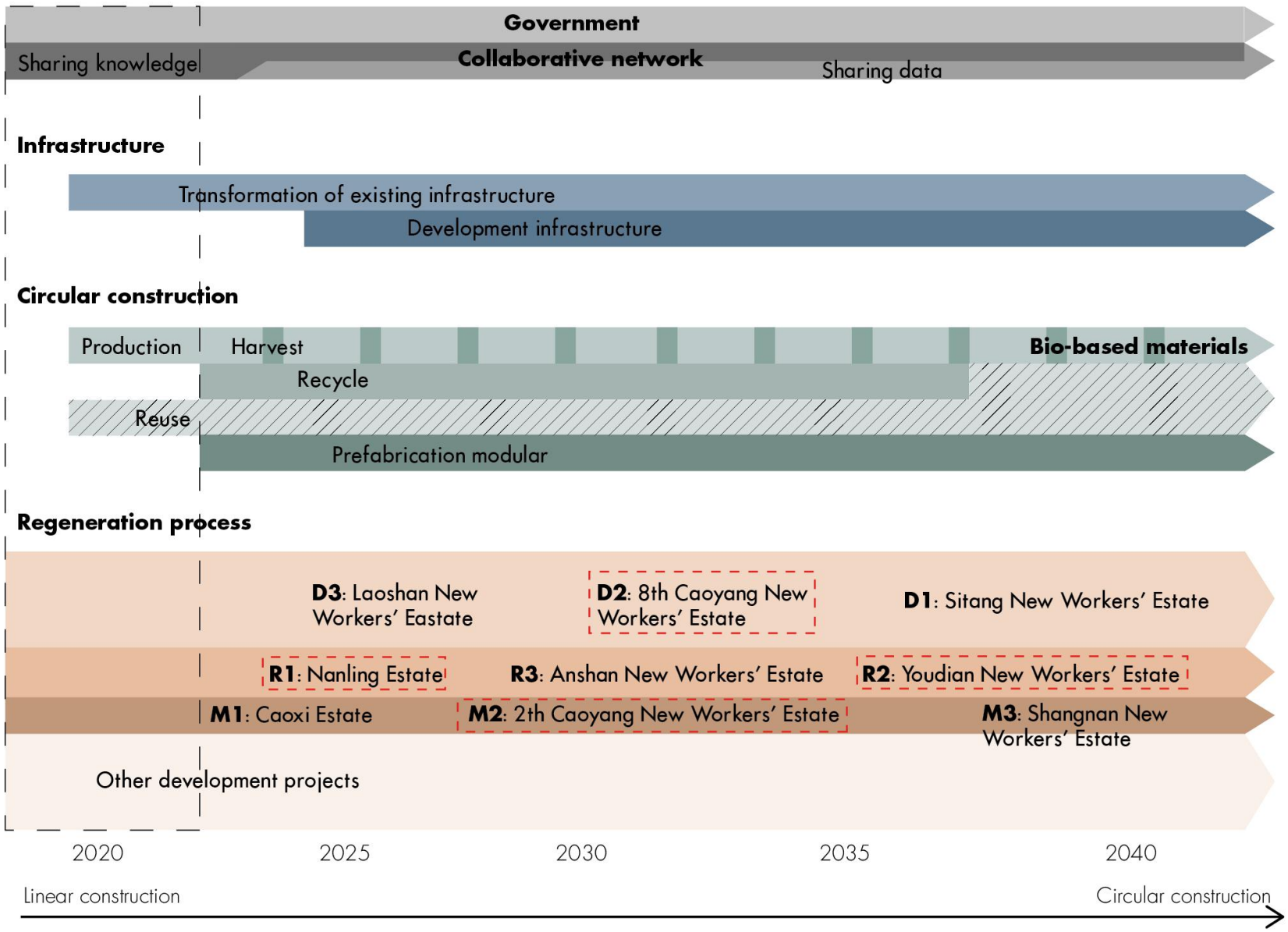
** Can be applied to product flows in any part of the value chain*

Modular construction



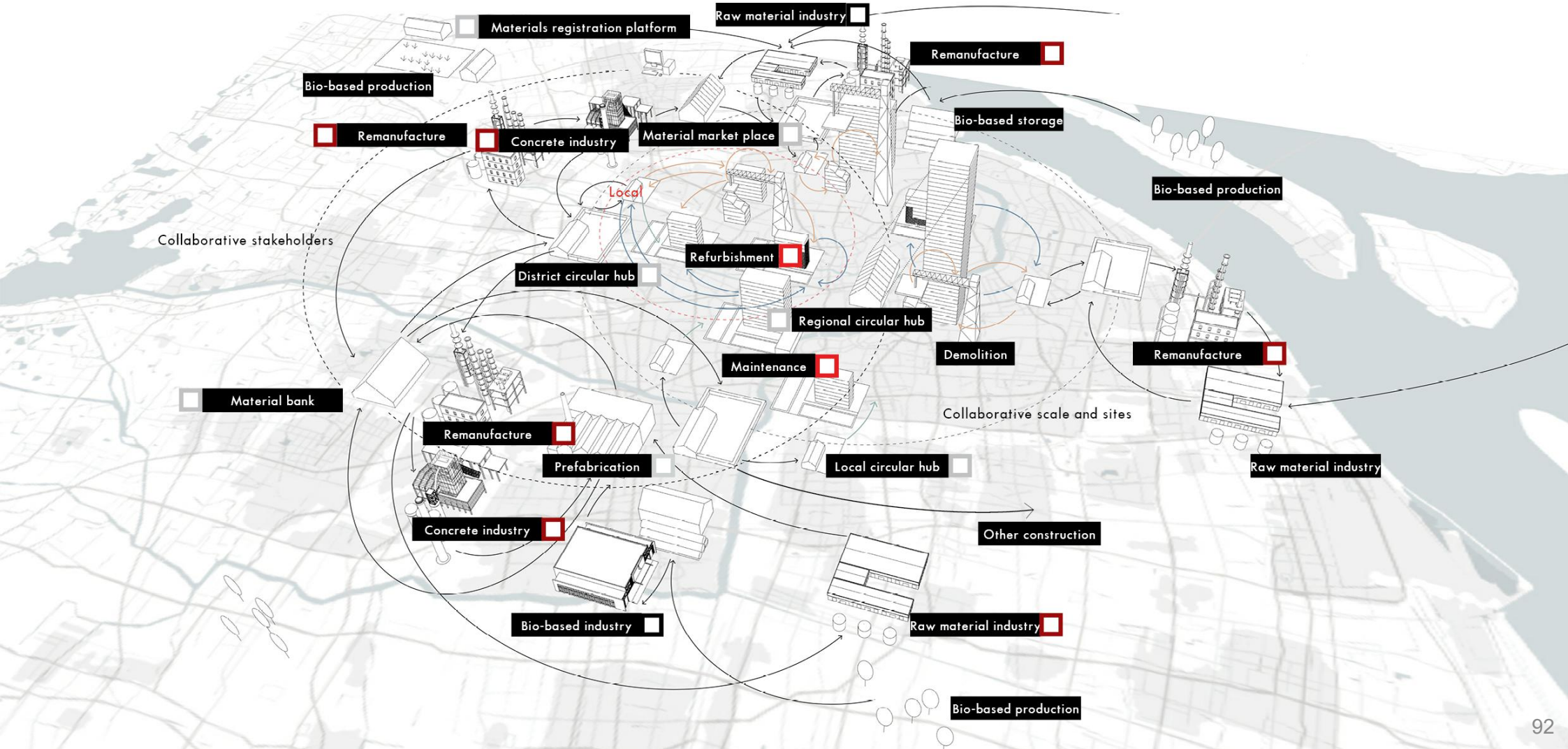
Accenture classification of circular business models (Lacy, 2014)

Timeline

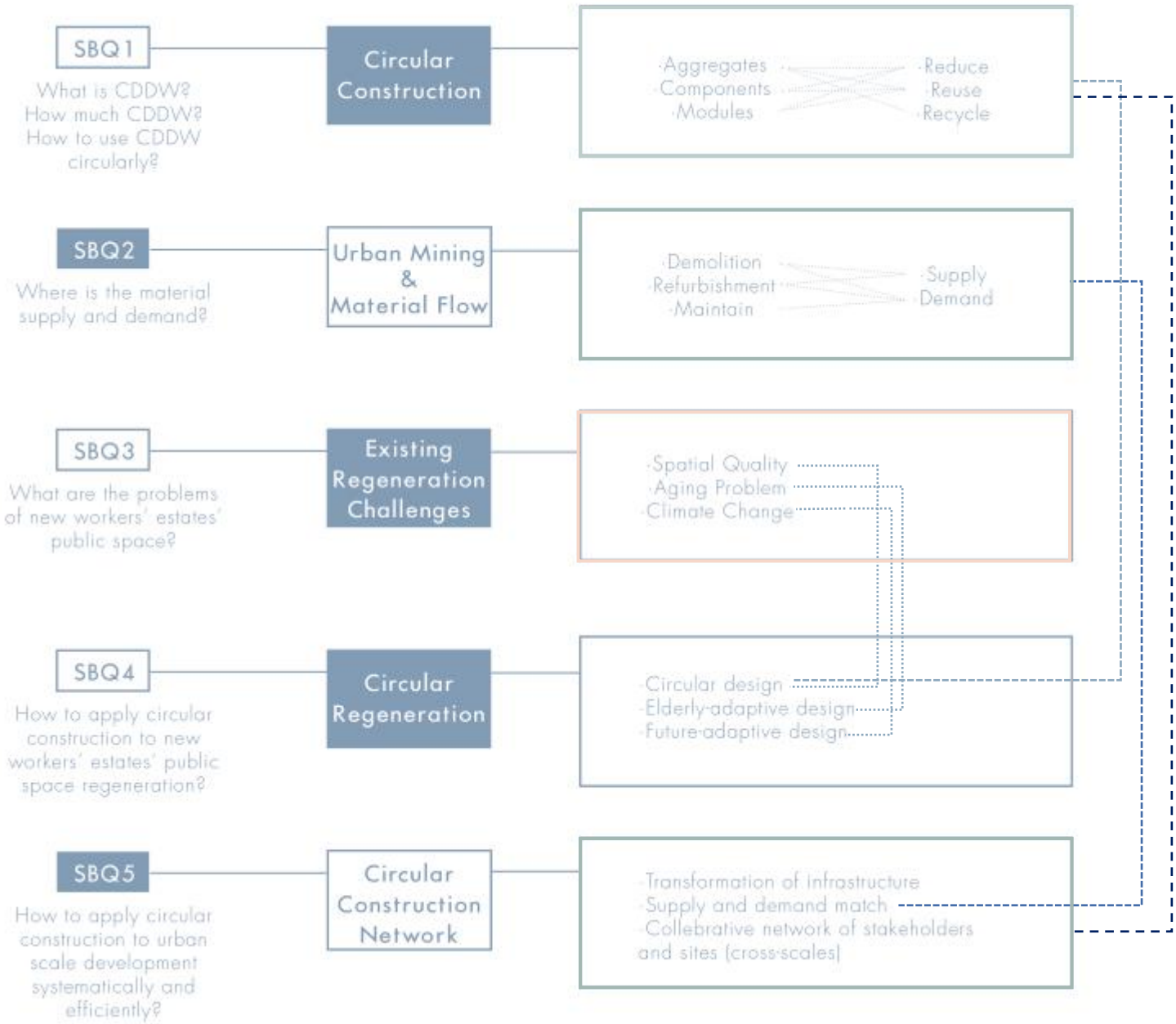

Government
Sharing knowledge
Collaborative network
Sharing data
Infrastructure
Transformation of existing infrastructure
Development infrastructure
Circular construction
Production
Harvest
Bio-based materials
Recycle
Reuse
Prefabrication modular
Regeneration process
D3: Laoshan New Workers' Eastate
D2: 8th Caoyang New Workers' Estate
D1: Sitang New Workers' Estate
R1: Nanling Estate
R3: Anshan New Workers' Estate
R2: Youdian New Workers' Estate
M1: Caoxi Estate
M2: 2th Caoyang New Workers' Estate
M3: Shangnan New Workers' Estate
Other development projects
2020
2025
2030
2035
2040
Linear construction
Circular construction

Circular Construction Network

- Urban mining- supply and demand
- Supply and demand match
- Transformation of infrastructure
- Collaborative network
- Business model
- Timeline



CONCLUSION


SBQ1
What is CDDW?
How much CDDW?
How to use CDDW circularly?
Circular Construction
Aggregates
Components
Modules
Reduce
Reuse
Recycle
SBQ2
Where is the material supply and demand?
Urban Mining & Material Flow
Demolition
Refurbishment
Maintain
Supply
Demand
SBQ3
What are the problems of new workers' estates' public space?
Existing Regeneration Challenges
Spatial Quality
Aging Problem
Climate Change
SBQ4
How to apply circular construction to new workers' estates' public space regeneration?
Circular Regeneration
Circular design
Elderly-adaptive design
Future-adaptive design
SBQ5
How to apply circular construction to urban scale development systematically and efficiently?
Circular Construction Network
Transformation of infrastructure
Supply and demand match
Collebrative network of stakeholders and sites (cross-scales)

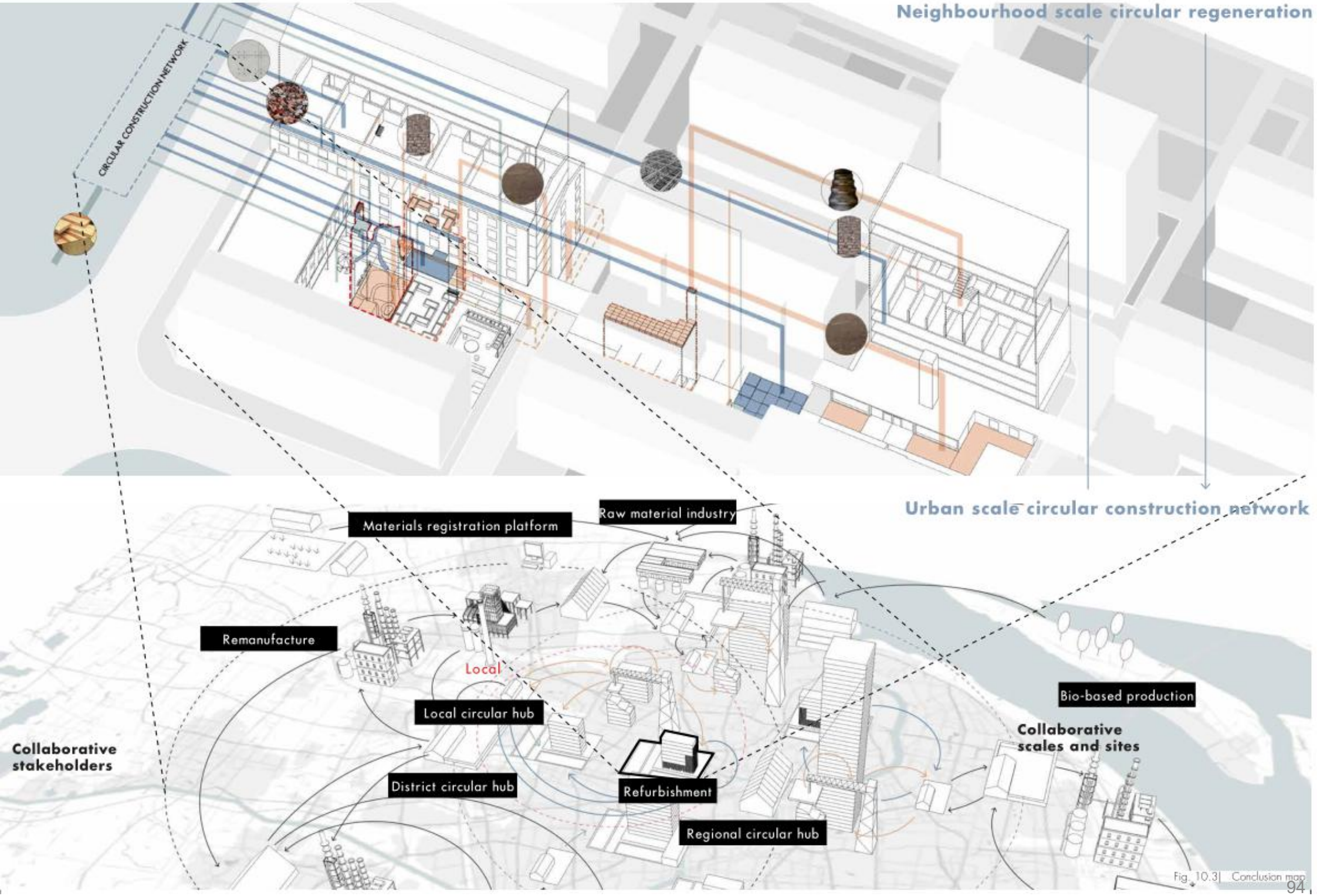
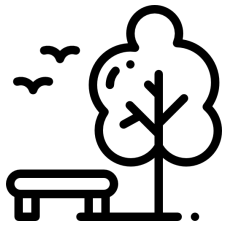
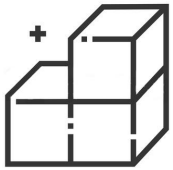


Fig. 10.3| Conclusion map

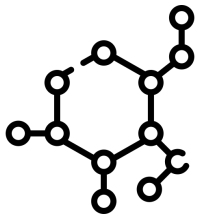
Reflection



Design

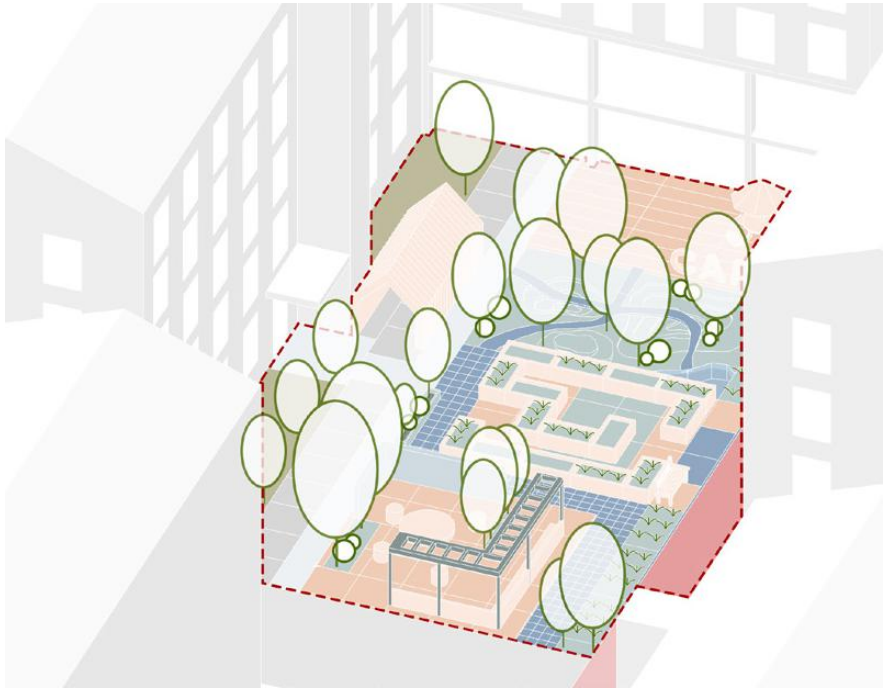


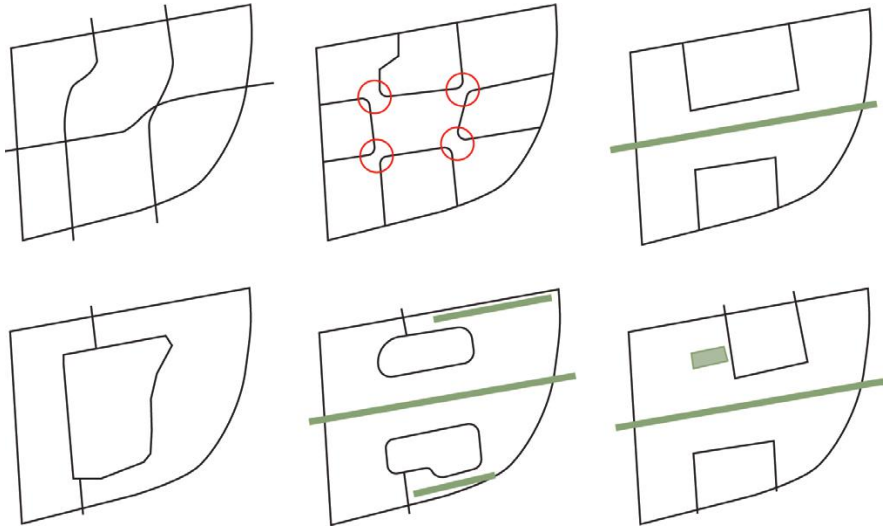
Modular

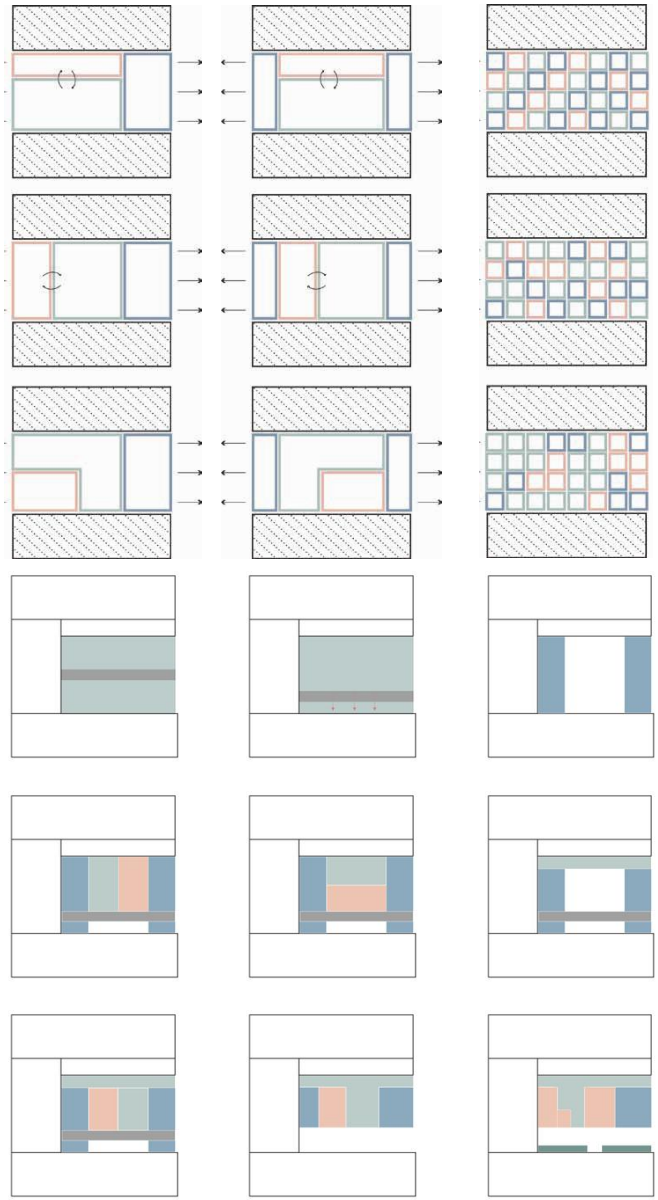


Network

Reflection







Thank you!