



# **APPROACHES TO SHAPING THE STREET ENVIRONMENT ACCORDING TO THE PRINCIPLES OF UNIVERSAL DESIGN**

# Research Object Research Subject Research Objectives

## Research Object

The research object refers to the **broad thematic area or field of study that the research investigates**. It encompasses the broader context or phenomena being examined. In this case, the research object is the transformation of urban streets and public spaces according to Universal Design principles, with a particular focus on creating inclusive, accessible, and sustainable urban environments for diverse populations, including the elderly, children, and people with disabilities.

## Research Subject

The research subject is the **specific focus or target group within the research object that the study aims to understand, analyze, or improve**. It is the narrower segment of the broader research object that is directly studied. In this context, the research subject includes public spaces in residential developments, especially focusing on streets and communal areas that require retrofitting to be more inclusive and functional.

## Research Objectives

**To identify and analyze the barriers currently present in public spaces that hinder accessibility and inclusivity**, particularly for vulnerable groups such as the elderly and people with disabilities.

To develop design strategies and frameworks based on Universal Design principles that can be applied to retrofit public spaces and streets, ensuring they are accessible and usable for all citizens.

To evaluate the effectiveness of these design interventions in enhancing social interaction, community cohesion, and environmental sustainability within urban neighborhoods.

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01

## Research Foundations



# Why Universal Street Design Matters

## Urban Streets as Daily Living Rooms

Urban streets are the daily living rooms for citizens. When they exclude any user, the city fails its social contract. **Streets should be inclusive and accessible to all.**

## Current Barriers in Kharkiv and Changzhou

Residential streets in Kharkiv and Changzhou still present barriers for children, elders, parents with strollers, and people with disabilities. These barriers need to be addressed for a **more inclusive urban environment.**

## Universal Design as a Solution

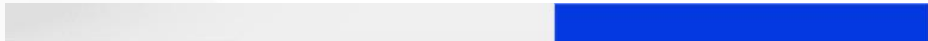
Embedding Universal Design into street retrofits is the most cost-effective route to safety, health, and social cohesion. It ensures that **streets are usable by all members of the community.**

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# Global Lessons in Community Regeneration

## Converging Priorities

Germany's Soziale Stadt re-uses existing fabric, the U.S. HOPE VI mixes incomes, Japan's compact-city strategy adds micro-green pockets, and Seoul's Sharing City activates idle lots through digital participation. Common denominators are small-scale, resident-led intervention, aging-in-place upgrades, and culture as a catalyst.



# Domestic Evolution and Policy Gaps

## China's Retrofit Timeline

China's retrofit timeline is compressed: basic infrastructure in the 2000s, aging-friendly add-ons after 2008, systematic governance since 2017, and carbon-smart pilots after 2020. Yet standards still treat accessibility as a technical checklist instead of a narrative experience.

## Policy Gap Identification

The research positions itself as the bridge between the state's quantitative targets and residents' qualitative everyday stories, identifying the policy gap where accessibility is seen as a checklist rather than an experience.

**Table for chapter 1**

| <b>Time Period</b> | <b>Domestic Research Status</b>                                                                                      | <b>International Research Status</b>                                                                                                                                                    | <b>Key Conclusions</b>                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1990s</b>       | Research started late, focusing on infrastructure improvement and housing conditions.                                | Europe: Urban regeneration concept, emphasizing urban space renewal and resource reuse. US: HOPE VI project focusing on community function recovery and resident participation.         | Domestic research started late, focusing mainly on infrastructure and housing improvement. International research focused on urban regeneration and resource reuse. |
| <b>2000s</b>       | Government gradually promoted urban renewal, focusing on infrastructure and housing improvement.                     | Japan, South Korea: Integration of aging-friendly design with self-management, promoting small-scale flexible updates. US: Focused on mixed-income housing and community participation. | Domestic urban renewal began in the 2000s, and international research expanded into small-scale community updates and aging-friendly design.                        |
| <b>2010s</b>       | Focus on incorporating aging-friendly design and community governance mechanisms.                                    | US and Europe: Community participation and coordination of social capital. Japan: Emphasis on aging-friendly design and social function integration.                                    | Government-driven large-scale renovation and policy systems in China are enhancing infrastructure and social functions.                                             |
| <b>2020s</b>       | Large-scale community renovation is promoted by the government, especially for infrastructure and service functions. | Continued emphasis on ecological sustainability and low-carbon renewal. Green buildings and smart communities become key directions in development.                                     | The international focus is on ecological design, smart communities, and low-carbon urban renewal.                                                                   |

02

## Design Framework



# Universal Design Principles for Streets

## Equitable Use

One surface serves wheelchair, pram, and scooter alike.

Universal Design ensures that all users can navigate the street without barriers.

## Simple and Intuitive Way-finding

Universal Design employs colour bands and scent planting instead of signage poles, making navigation easy and intuitive for all users.

## Flexibility in Use

Furniture that flips from seat to play edge. Universal Design accommodates a wide range of user needs and activities.

## Low Physical Effort

Micro-slopes and spaced resting nodes ensure that users can move through the street with minimal physical effort.

# Functional Zoning Strategy

## Concentric Strips

The street is divided into four concentric strips: building-edge intimate zone, pedestrian clear zone, activity pocket, and ecological edge. Each strip serves a specific function.

## Dimensioning in Modular Units

Each strip is dimensioned in modular 0.6 m units to match tile production, reducing cost and waste while ensuring functionality.

## Conflict Management

Conflicts are pre-empted by sound buffers and sight-line management, ensuring a harmonious and functional street environment.

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# Spatial Narrative as Design Method

## 01

### Episode Sequence

The street is scripted as a sequence of episodes: threshold, discovery, climax, and reflection. Each episode offers a unique experience.

## 02

### Emotional Variety

The narrative arc guarantees emotional variety while maintaining universal accessibility, turning routine walking into memorable journeys.

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Table for chapter 2

| Demand Type              | Core Content                                                                                                   | Design Points                                                                    | Key Conclusions                                                                                                         |
|--------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Universal Design Needs   | Ensure accessibility for all groups, particularly the elderly, disabled, and children.                         | Provide accessible paths, ramps, wide doorways, and seating.                     | Universal design ensures accessibility for all groups, especially vulnerable populations like the elderly and children. |
| Comfort Needs            | Provide spaces suitable for long stays, ensuring comfort through materials and design.                         | Comfortable seating, shaded areas, and soft materials.                           | Design should prioritize comfort and long-term use.                                                                     |
| Social Interaction Needs | Encourage social interaction between different groups through shared spaces.                                   | Open social spaces, such as communal seating and gathering areas.                | Social interaction spaces are vital for fostering community connections.                                                |
| Functional Needs         | Ensure functionality of the space, meeting the diverse needs of users.                                         | Functional zoning with areas like play zones, leisure zones, and activity areas. | Space should have a clear functional layout, with different areas serving distinct purposes.                            |
| Ecological Needs         | Ensure ecological functionality and sustainability in design, using natural elements and green infrastructure. | Integrate natural elements, use permeable pavings, and include green spaces.     | Ecological design is key to enhancing environmental quality and promoting sustainability.                               |

03

## Site Diagnosis



# Beizhijie Street Profile

1

## Street Dimensions

The chosen 480 m long residential street in central Changzhou was built in 1986. Current width fluctuates between 4 and 7 m, creating bottlenecks for two-way pedestrian flow.

2

## Existing Issues

Utility poles occupy the centre line, forcing wheelchair users onto the carriageway. Street furniture is limited to five decaying benches, with average spacing 96 m, far exceeding comfortable resting distance for seniors.

3

## User Peaks

Three critical nodes generate distinct user peaks: kindergarten gate at north, produce market at mid-block, and elderly centre at south, each with overlapping chaotic activity.

# User Survey Key Findings

1

## Survey Results

121 questionnaires and 18 interviews reveal that 72% of residents avoid the street after dark due to poor lighting, 65% of parents report stroller detours around poles, and 58% of elders demand seating within 50 m intervals.

2

## User Descriptions

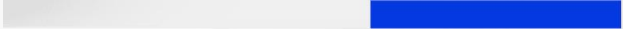
Asked for one word to describe the street, top answers were 'narrow', 'dark', 'messy'. Yet 80% still prefer retrofit over relocation, showing strong place attachment.

3

## Design Priorities

The survey translates numeric findings into three design priorities: widen perceptual space, add light and seating, keep familiar vendors.

# Problem Synthesis Matrix



## Cross-Matching Problems with User Groups

Seniors face tripping on uneven slabs and lack armrests. Children encounter narrow footways forcing them onto the roadway. Vendors need loading zones but block visibility at crossings. Disabled users find ramp gradients non-compliant and tactile paths discontinuous.

## Integrated Universal Approach

The matrix proves that single-issue solutions worsen other users' conditions, validating the need for an integrated universal approach rather than piecemeal fixes.



**Table for chapter 3**

| <b>Design Goal</b>                     | <b>Core Content</b>                                                                   | <b>Design Methods</b>                                                                    | <b>Key Conclusions</b>                                                                           |
|----------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| <b>Functional Goals</b>                | Ensure the functionality of each space by meeting user needs.                         | Zoning design, path and space layout for different functional areas.                     | Functional spaces must be designed to meet diverse user needs with a clear spatial organization. |
| <b>Comfort Goals</b>                   | Create a comfortable environment for users to stay for extended periods.              | Use human-centered design with comfortable materials, lighting, and seating.             | Comfortable spaces encourage longer use, making the space more attractive and user-friendly.     |
| <b>Social Interaction Goals</b>        | Promote social interaction through open spaces and shared areas.                      | Open space design, ensuring easy access for different social groups.                     | Social interaction is key to community cohesion, and design should foster this.                  |
| <b>Ecological Sustainability Goals</b> | Integrate ecological elements into the design, ensuring environmental sustainability. | Use green design, natural elements, permeable materials, and energy-efficient solutions. | Ecological and sustainable design elements ensure environmental quality and user well-being.     |
| <b>Flexibility Goals</b>               | Design flexible spaces that can adapt to future changes and needs.                    | Modular design, movable furniture, and adaptable layouts.                                | Design flexibility ensures spaces can evolve with future needs, enhancing long-term use.         |

04

## Design Proposal



# Masterplan and Episode Sequence



## Universal Promenade

The retrofit keeps the existing carriageway but reclaims one parking lane to create a 3 m universal promenade. Four episodes are stitched along this spine: Welcome Plaza, Market Veranda, Memory Garden, and Waterfront Deck.



## Episode Details

Each episode contains a minimum 6 m diameter turning circle for wheelchairs and 3 types of seating perch, lean, and lounge. The slide displays the overall plan and lists square metres allocated to each function.



## Functional Allocation

The masterplan ensures that each episode serves a specific function, from play areas to market spaces, while maintaining universal accessibility.

# Welcome Plaza for All Generations

## Plaza Dimensions

The footway widens into a 12 m x 12 m plaza surfaced with rubberised graphics of animal footprints that guide children while offering tactile way-finding for the visually impaired.

## Movable Cube Seats

Movable cube seats double as play elements; their 420 mm height suits both child climbers and elder armrests. During school drop-off, the cubes stack aside to create 4 m clear width.

## Light Mast Features

A light mast integrates parent-level phone charging and 360° luminaires eliminating dark corners. The slide shows how these features enhance usability and safety.

## Interactive Water Screen

An interactive water screen operates on push-button to save energy, creating a playful and engaging environment for children and adults alike.

# Market Veranda Enhancing Micro-Economy

## Tensile Canopy

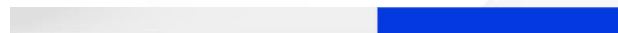
A 24 m long tensile canopy is proposed, with columns placed outside the 1.8 m clear corridor. Fold-down tables hook onto columns at 800 mm height, compatible with wheelchair armrests.

## Retractable Shading Mesh

Embedded track supports retractable shading mesh, allowing vendors to control sunlight without blocking sight-lines. Below-grade roller drawers store baskets overnight, reducing morning set-up time by 30%.

## Permeable Paver Base

Permeable paver base handles fruit-washing water, directing runoff to bioswales planted with citronella grass that deters mosquitoes naturally.



# Memory Garden and Sensory Walk

## Path Design

1

The garden inserts a figure-eight path with an inner loop offering a 1:25 gradient suitable for manual wheelchairs. The path is lined with sensory plants and Braille aluminium tags for identification.

## Seasonal Plant Palettes

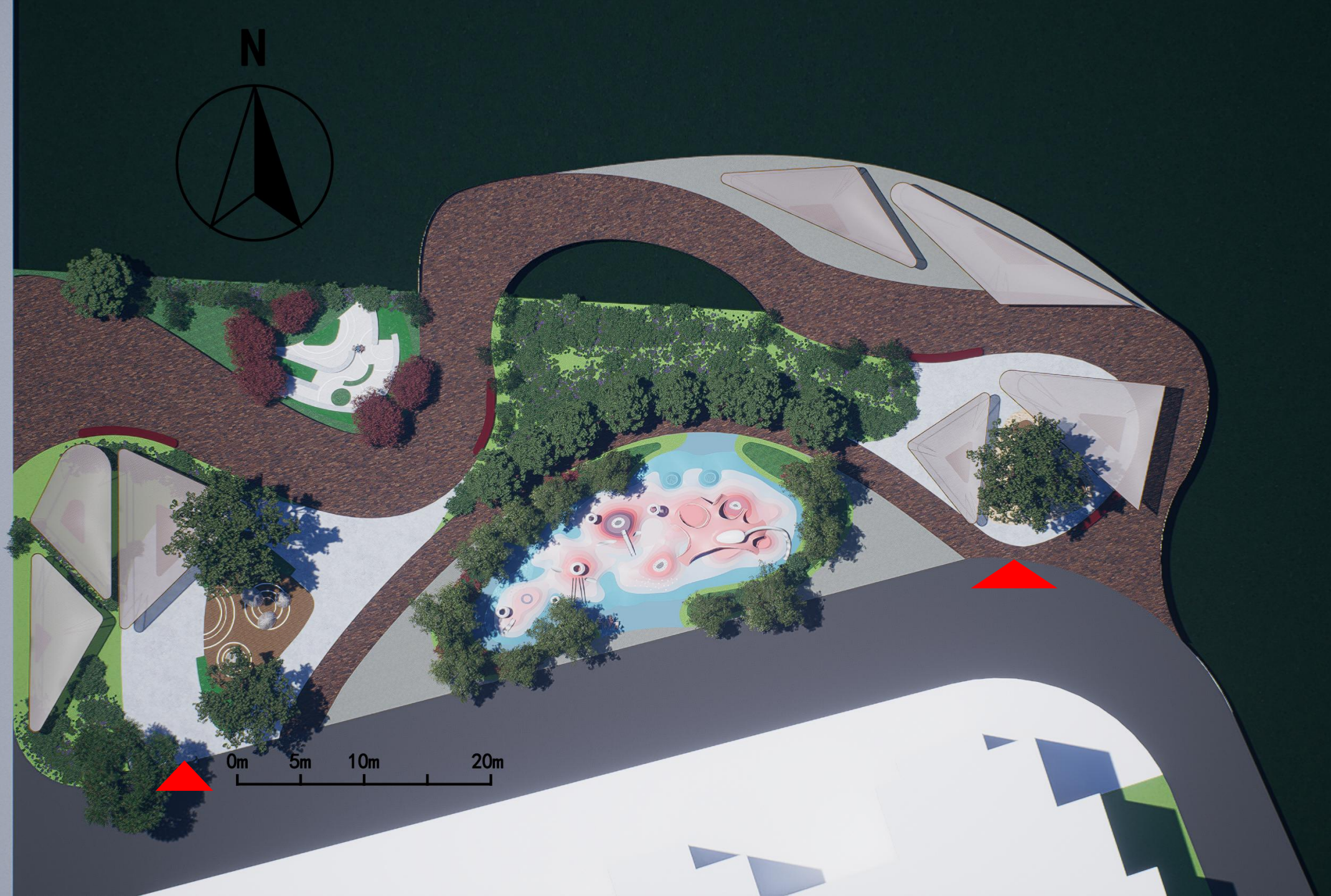
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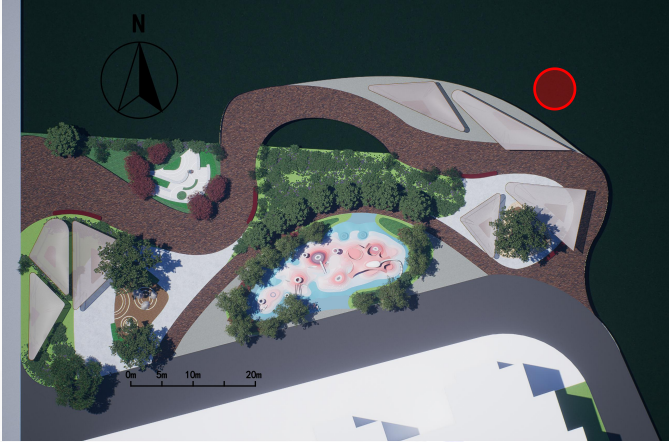
Plant palettes are arranged by season and scent: winter sarcococca, spring lilac, summer osmanthus, autumn sweet olive. These plants enhance the sensory experience and provide year-round interest.

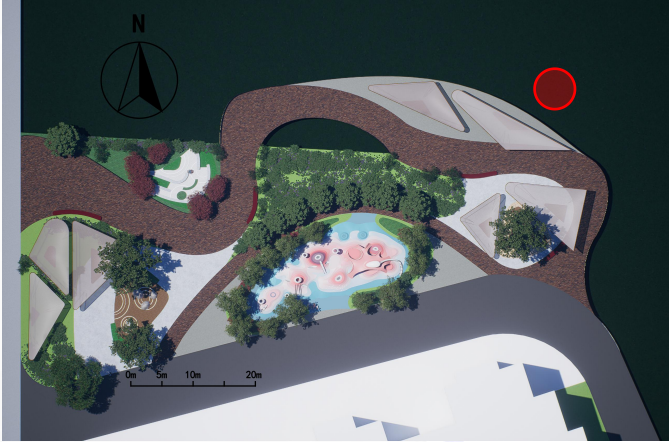
## Seating and Handrails

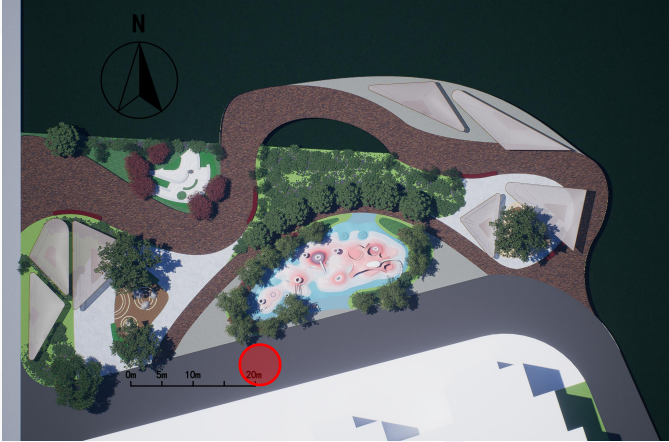
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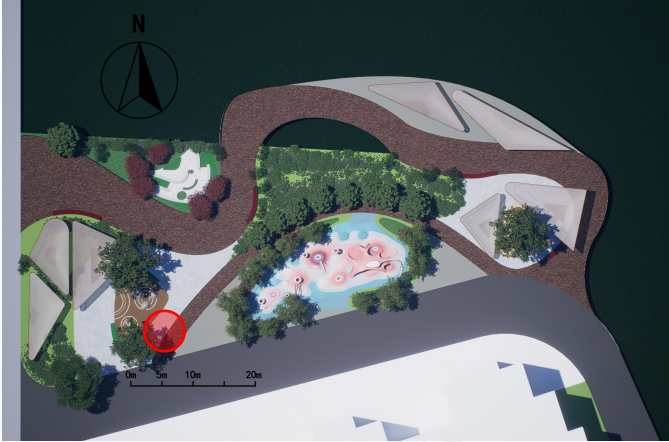
Benches are positioned every 25 m, angled 30° to encourage conversation while maintaining personal space. Low railings at 650 mm serve as both handrails and perch bars.

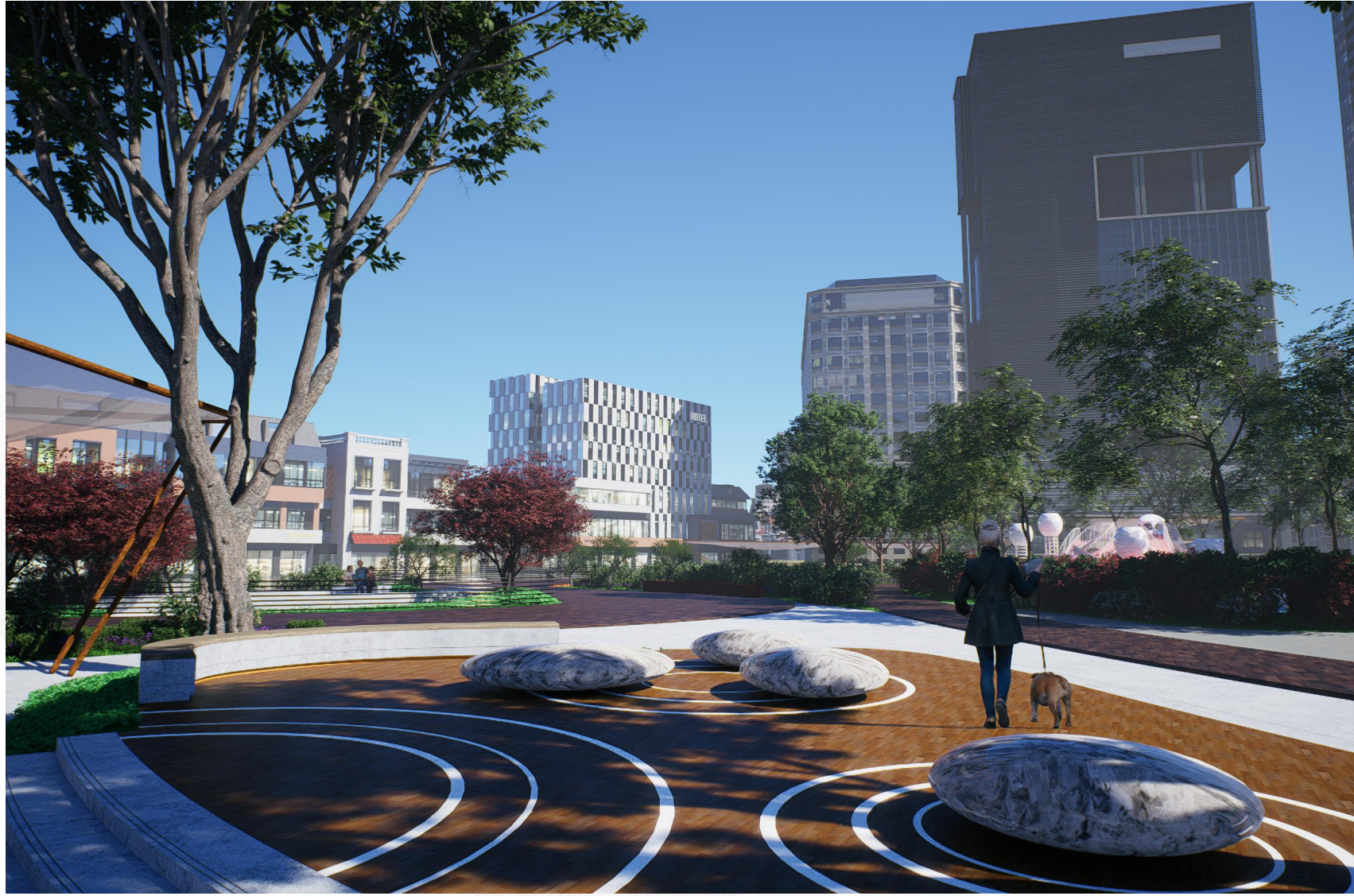
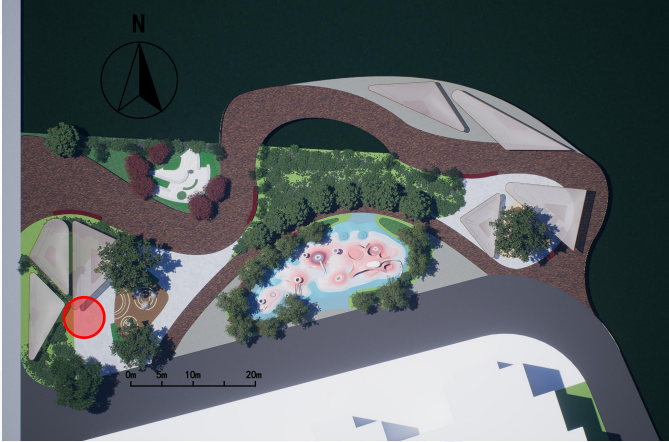


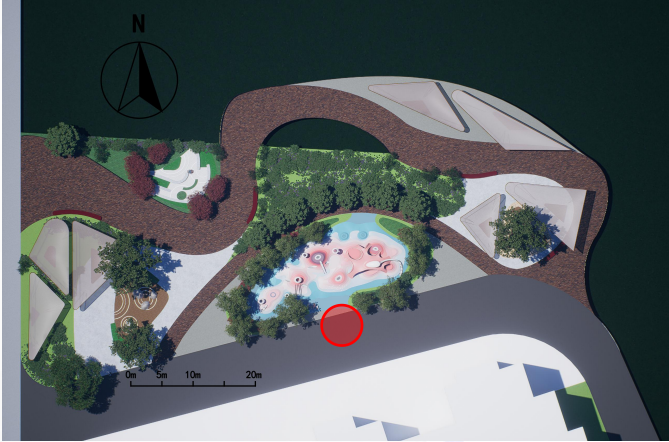


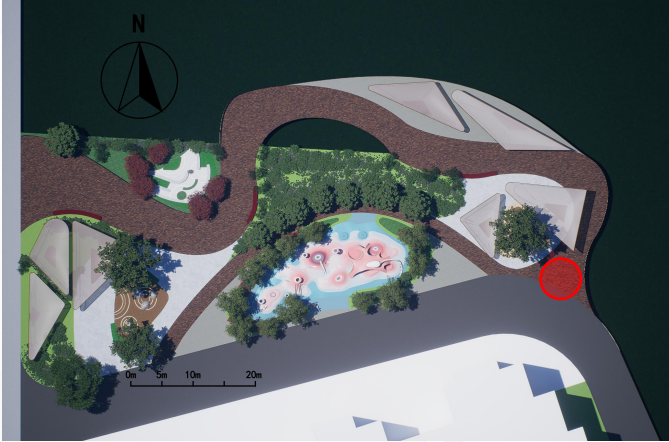


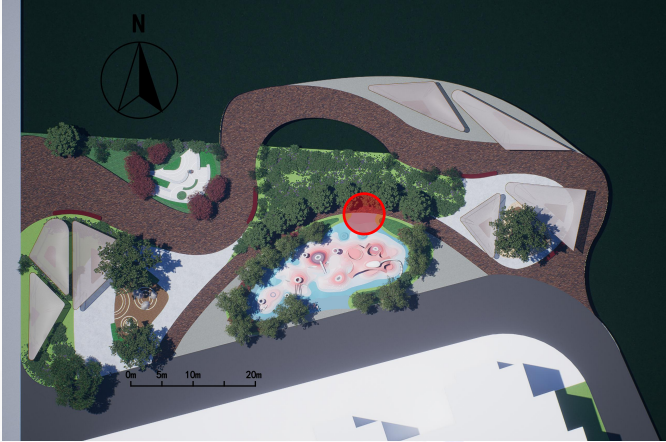


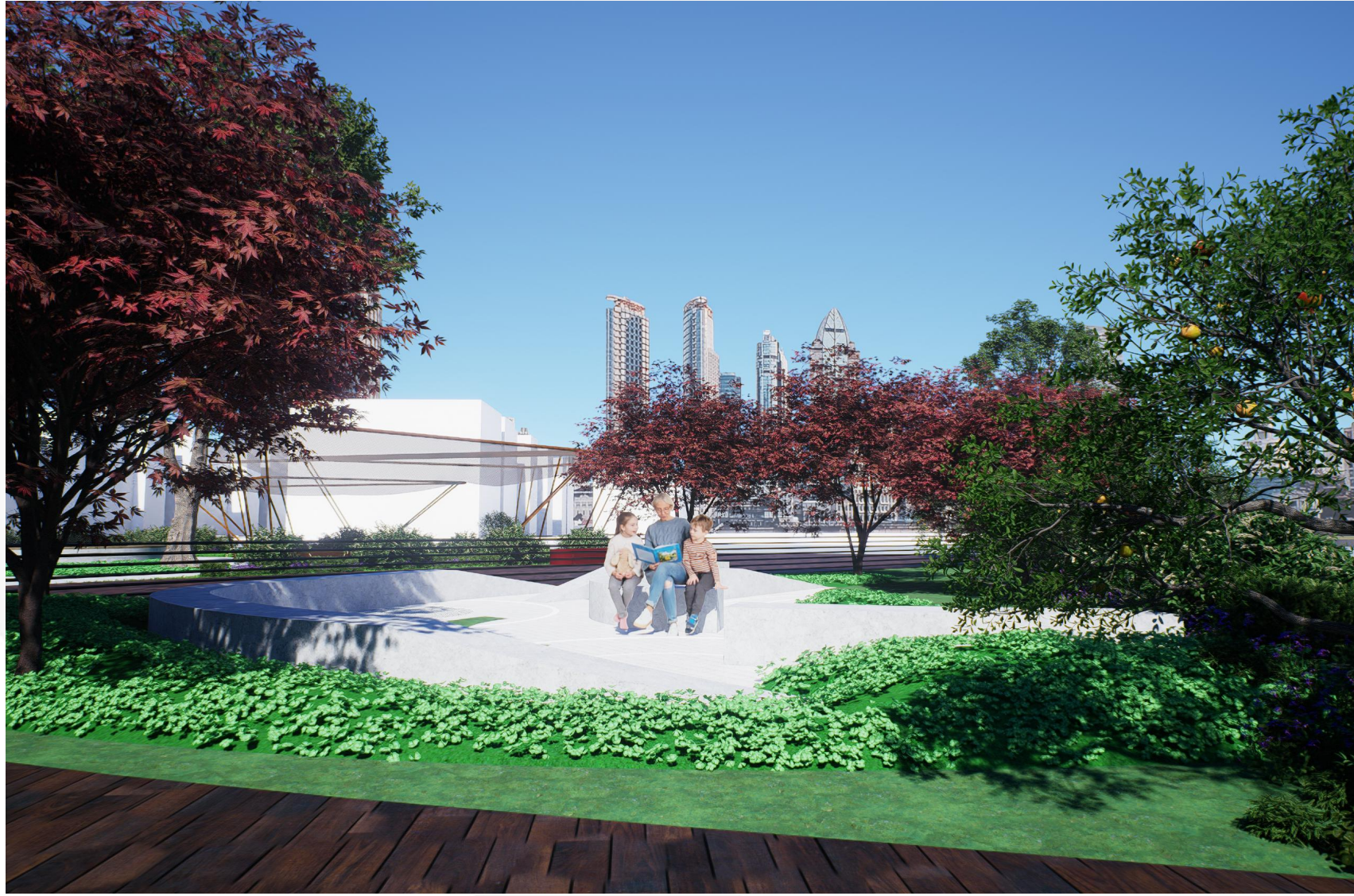
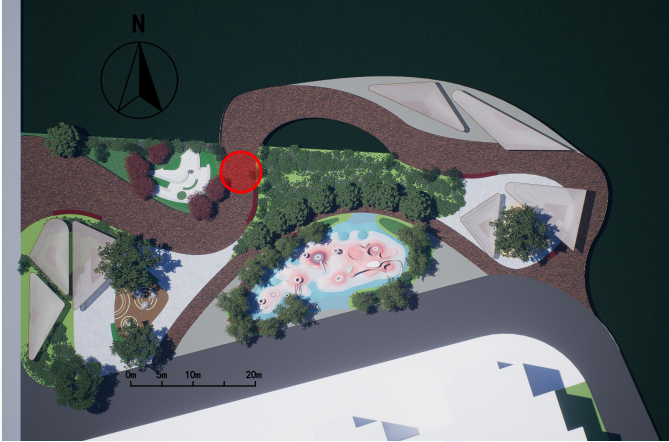


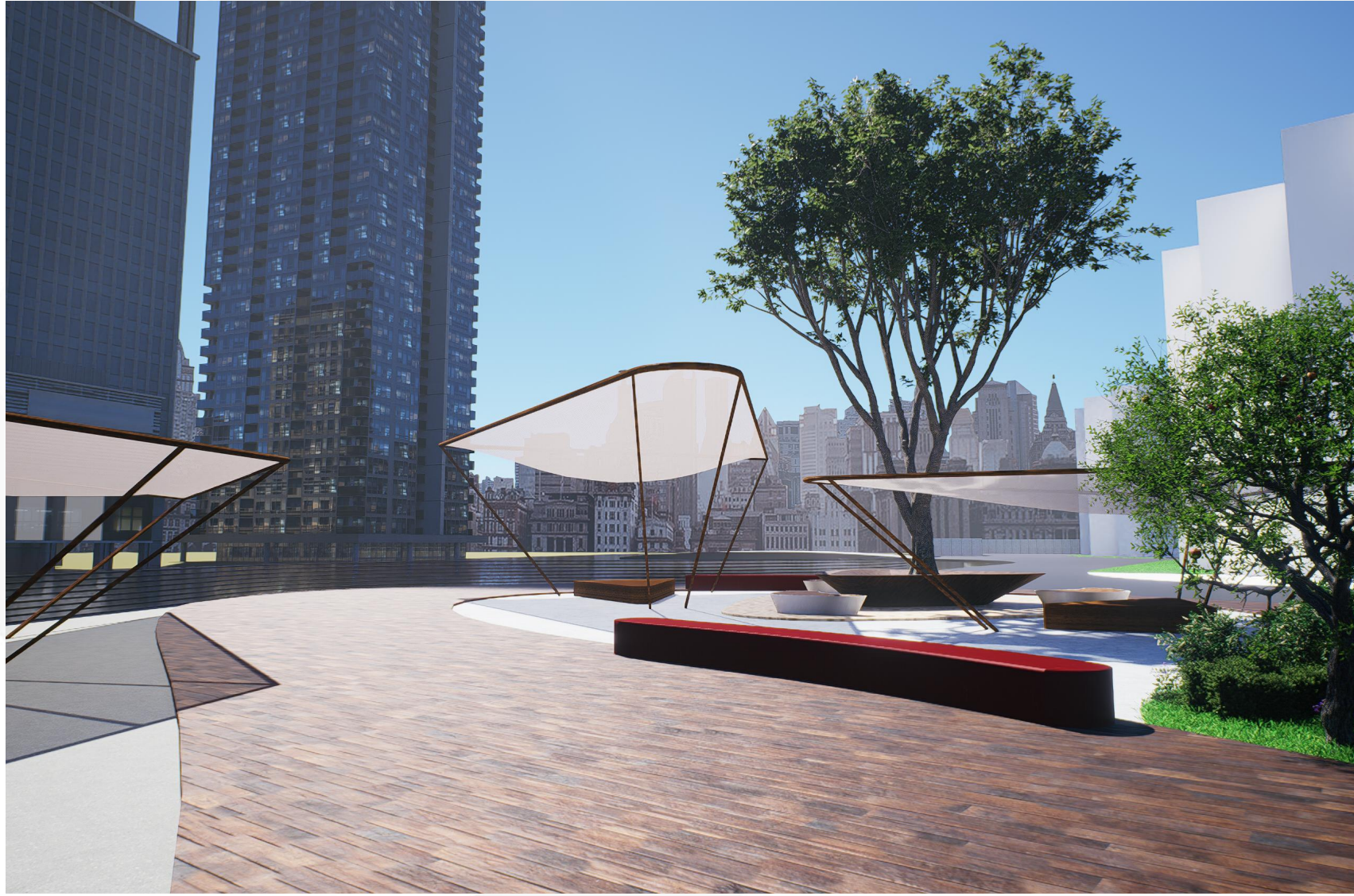
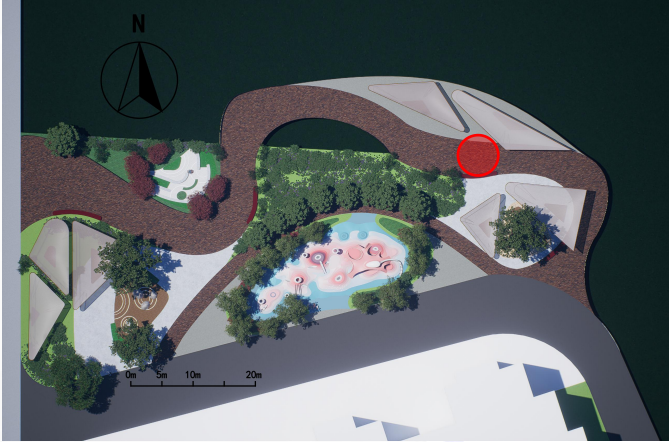


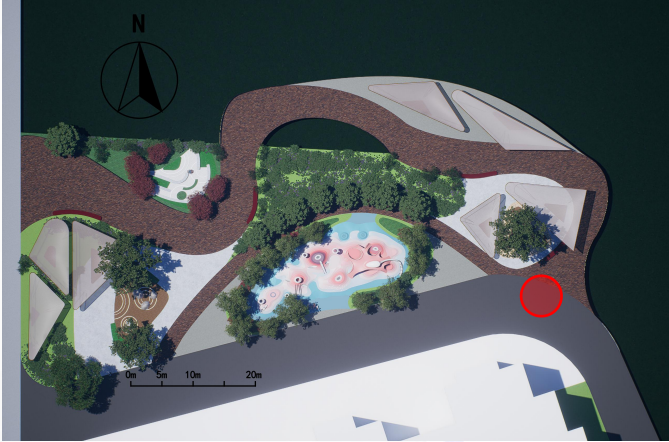






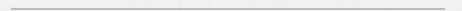






05

## Innovations & Impacts



# Material and Ecological Innovations

## Permeable Ceramic

All new surfaces use locally sourced permeable ceramic that infiltrates 4.5 mm/h, reducing storm peak by 28%. This material choice enhances sustainability and reduces runoff.

## Carbonised Bamboo

Carbonised bamboo replaces tropical hardwood in seating, cutting embodied carbon by 42%. This choice reduces the environmental impact of the project.

## Recycled Rubber

Rubberised graphics are produced from 1,800 kg recycled tyres, equivalent to 360 passenger tyres diverted from landfill. This reduces waste and promotes recycling.

## Modular Components

Modular components are bolted not glued, enabling future disassembly and reuse. Life-cycle costing predicts 20-year maintenance saving of 18% compared with conventional concrete footway.

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# Social Impact Forecast

## Increased Footfall

Post-occupancy modelling predicts daily footfall increase from 1,200 to 2,100, with gender ratio balancing from 42% to 48% female due to improved lighting and seating.

## Extended Elderly Staying Time

Elderly outdoor staying time extends by 35%, correlating with documented mental-health improvement. This enhancement fosters a more inclusive and healthy community.

## Increased Vendor Income

Vendor income is projected to rise 15% through weather protection and longer trading hours. This economic boost supports local businesses and the community.



# Design Transferability

## Scalable Episode Structure

The episode-narrative structure is scalable: episode number can expand or contract along 200 m to 1 km corridors. Modular furniture uses standard 600 mm grid compatible with mass production.

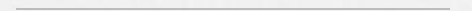
## Policy Adoption Potential

The approach is ready for policy adoption as a template for China's upcoming 2025-2035 old-district renovation wave. The slide argues for its widespread implementation.

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06

## Conclusion



# Research Contributions and Next Steps

1

## Core Outputs

The study delivers a translatable spatial-narrative method, a modular kit-of-parts catalogue, and an evidence-based impact forecast linking design moves to social metrics.

2

## Limitations and Future Work

Limitations include seasonal use observation pending construction. Future work will embed IoT sensors to track real-time usage, validating or refining predictive models.

3

## Call to Action

The closing statement calls for interdisciplinary teams of planners, ethnographers, and engineers to scale universal streets from pilot to policy, ensuring no citizen is excluded from the simple act of walking home.

THANKS FOR WATCHING!

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