

Three Creative Methods for High-Rise Building Design

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75–90

This paper explores three innovative high-rise building design concepts to enrich urban environments by enhancing human perception, integrating cultural heritage and promoting sustainability. Runxin Fu's 'The Perceptual Condenser' disrupts typical spatial experiences through composite wall systems and angled shear walls, encouraging active exploration and improving the human experience in vertical environments through Structuralism. Shiyao Feng's 'The Landscape City' integrates elements of traditional Chinese *shanshui* gardens and paintings, using masking techniques and spatial contrasts to create a distinctive and culturally enriched spatial experience. Biaoqing Tao's 'Arching' concept employs biomimetic modular methods, emphasising sustainability and reducing carbon emissions through the use of wood and modular construction. These approaches propose a transformative vision for high-rise buildings that aims to break free from homogenised urban architecture and foster diverse, sustainable and culturally rich urban spaces.

#structuralism

#symbolic translation

#bionics

#spatial interest

#sustainable architecture

Background

In the context of rapid urbanisation, high-rise buildings have become a ubiquitous element of modern urban landscapes worldwide. Common design methodologies often prioritise economic efficiency and information-centric approaches, which lead to building structures and forms that frequently lack values of localised culture and nature, as well as meanings of human perception. This paper combines three distinct yet complementary architectural approaches that challenge these conventional paradigms by infusing high-rise design with three different dimensions: enhanced human experiences, cultural depth and sustainable practices. By examining these approaches, this study aims to showcase how high-rise buildings can transcend conventional design limitations and contribute to enriching urban environments.

The First Approach: The Method of Structuralism

'The Perceptual Condenser'

Transparency is often abused indiscriminately, and the quality of space gives way to information transmission. If this trend continues, architecture in the future will lose its artistic value as a way for people to perceive the world and become appendages to information. The high-rise buildings seen everywhere in cities today epitomise this problem. We found that people who live and work in high-rise buildings are more likely to lose their sense of subjectivity. Just like the people in Jacques Tati's movie 'Play Time', all their actions become unconscious performances.

– Runxin Fu

In contemporary high-rise building projects, the conventional approach results in an economical condenser (Figure 1) with a core, optimising structure, equipment layout, management and

leasable areas. However, these economic concerns lead high-rise construction away from addressing human perceptions (Berkeley 1709; Pallasmaa 2012). To tackle this issue, Runxin Fu proposed 'The Perceptual Condenser', which breaks the core (Figure 2) and enhances human perception. Structurally replacing the core, he designed composite wall systems on two sides and utilised angled shear walls to support and partition the long-span space. Illusorily, the angled walls disrupt people's experience of perspective, creating a perceived depth that differs from the actual distance. This distinction offers a new opportunity for engaging multiple senses and actively exploring space, ultimately strengthening perception.

The shear wall was designed as shown in Figure 3. Although including shear walls limits spatial flexibility, the design restores spatial richness by examining the interactions between people and the wall across different dimensions, forming various spatial orders of prototypes. The three-dimensional prototypes were developed based on three groups of keywords: connect and extend, hinder and cross and connect and rise. Figure 4 illustrates the details of the composite wall system. With a cavity, the system accommodates ventilation pipes, water supply pipes and drainage pipes. The double-layered walls demonstrate strong thermal insulation performance, and the accessory space on both sides of the building provides excellent thermal comfort for the interior main space, achieving significant energy savings.

Runxin Fu's concept of 'The Perceptual Condenser' employs spatial and structural dimensions in high-rise design. It focuses on understanding human perception, investigating the dominant structural paradigms of modern tall buildings and examining the economic factors that shape them. By emphasising a structural design approach that revisits and innovates shear wall structures, this concept seeks to provide insights into the human experience and interactions within vertical urban environments.

The Second Approach: The Method of Symbolic Translation

Shanshui – ‘The Landscape City’

In the rapid development of urban construction, we have directly copied modernist architecture from Western civilisation. The architectural forms in cities are almost the same, and the ‘one-size-fits-all’ approach dissolves the historical characteristics and cultural background of cities and is disconnected from China’s traditional cultural language and architectural ideas. In the context of the gradual homogenisation of urban architecture, can we draw inspiration from traditional Chinese culture and create new spatial forms?

– Shiyao Feng

In this high-rise building project, the site is located on the edge of the city, with a dense grassland to the south situated between urban and natural environments providing an ideal testing ground for translating landscape elements. Shiyao Feng’s design goal is to combine traditional cultural ideas with modern architectural forms, infusing the spatial interests of landscape gardens into the living spaces of the cluster, breaking the flat layer and integrating nature with space. Both landscape painting and classical gardens reflect the traditional Chinese cultural context of ‘embracing nature and cherishing the landscape’ (寄情山水, 崇尚自然) (Li 2020). The techniques of landscape painting and classical gardens share similarities, such as the three viewing methods and masking techniques in paintings, which correspond to the winding and framing of landscape design techniques in classical gardens (Qi 2024). ‘A garden can be painted, and a painting can be a garden’ (園可畫, 畫可園); by transitioning from painting techniques to architecture, the design seeks to capture the essence of Eastern gardens within the space (Dong 2012).

In the initial concept stage, Shiyao Feng designed the partitioning of high-rise buildings inspired by the masking relationships in landscape paintings (Figure 5). In these paintings, artists use vertical or horizontal masking and perspective to create a sense of depth and distance through contrasting heights and distances. The divisions obtained through high-rise building partitioning can serve as the ‘mountain body’ in the painting and as different narrative structures. Each narrative structure has a unique spatial experience, which may be ‘narrow at first and then suddenly opening up after a few steps’ (初極狹, 才通人, 復行數十步, 豁然開朗) (Tao 2008) or something else, depending on the function and architectural narrative of that particular section.

In terms of specific spatial characteristics, Shiyao Feng draws more from classical gardening techniques, such as the winding entrance in Suzhou’s Linger Garden, which is intriguing and inviting (Tong 1984). Skilfully using contrast, the design (Figure 6) incorporates winding and intricate circulation routes within the building while meeting fire safety requirements, arranging spaces with different experiences along the path, such as passing through bright, open office space, traversing a shared staircase and arriving at a low, dimly lit resting space, creating a contrast between light and dark spaces; or moving from a row of shops to an open theatre, and after watching a performance, stepping out onto an outdoor platform and staircase, providing visitors with a contrasting experience of large and small, serious and lively, indoor and outdoor.

The Third Approach: The Method of Bionics

‘Arching’

Reinforced concrete forests are synonymous with cities, but I hope that in the future, cities can have more natural prosperity, even if there are conflicts between them. This high-level translation of the

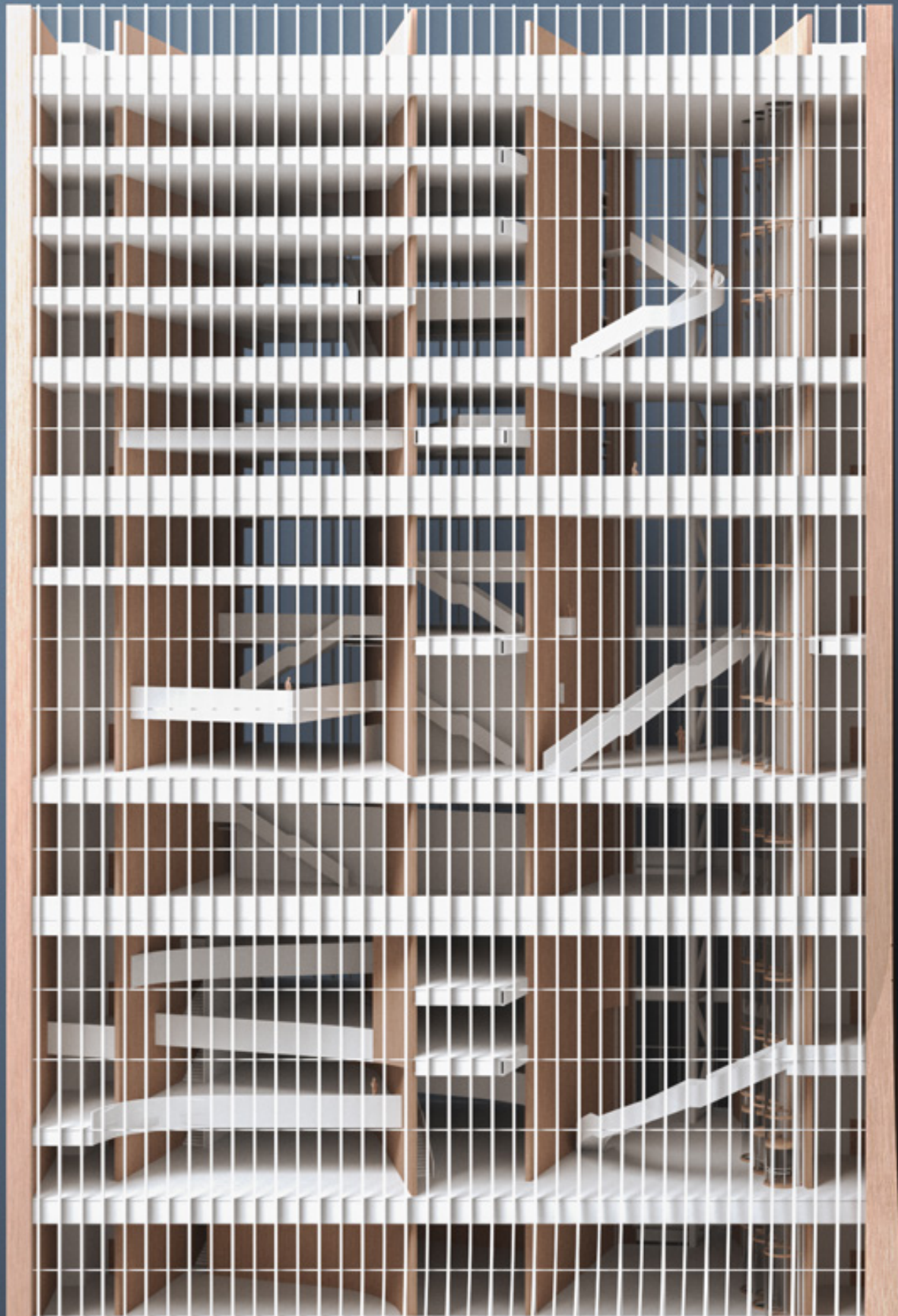
concept of arches, driven by the emerging functions of agricultural research, utilises arches of different scales to achieve the translation of traditional agricultural forms. The arches at different scales in architecture, as independent yet symbiotic entities, serve as façades and spaces and will undoubtedly play a demonstrative role in the development of the urban area. Under the new business model and good location planning, it is hoped that this attempt can achieve a poetic dwelling in urban skyscrapers.

– Biaoqing Tao

Biaoqing Tao's plan for this project is to construct a modern agricultural industrial park centralising production, processing and technology. The plan leverages the resource advantages of Heilongjiang Province's botanical garden to enhance every facet of agriculture and increase the value of the entire chain. The project also encourages the fusion of agriculture with the tourism, education, culture and health industries. By refining the structure of farming industries, the project aims to pioneer innovative experiential tourism and establish an agricultural leisure experience. The objective is to build a high-rise complex in an eco-demonstration area by fusing traditional agriculture and agricultural research functions (Figure 7). The complex will also serve as an educational base to deepen people's understanding of agricultural research.

'Arching' utilises a modular construction method in designing repetitive arched units arranged in a two-storey height scale. Each unit can be prefabricated in a factory and transported to the construction site for assembly. Therefore, construction efficiency is improved and carbon emissions during on-site construction are reduced (Li et al. 2022). The arch-shaped form of a seedling (Figure 8) inspires the basic unit of the module, which symbolises the vitality of green agriculture. Biaoqing Tao's concept is influenced by agricultural greenhouses and provides an ideal environment for small independent offices and research activities.

Biaoqing Tao used a design strategy that encompasses the effective integration of natural and artificial light achieved by constructing passive rooftop ventilation equipment, adjusting airflow and wind speed and driving wind turbines for power generation. As shown in Figure 9, using glass curtain walls not only brings abundant natural light to the interior but also blurs the boundaries between the building and the surrounding environment. It creates a seamless indoor-outdoor spatial experience. The renewable nature of wood and its circular carbon storage system contribute to the building's environmental sustainability (Duan et al. 2022). The use of wood materials adds a natural touch and a warm atmosphere to the building, giving it unique vitality and affinity within the concrete city.

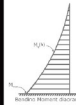


ECONOMICAL CONDENSER:

ECONOMICAL PRINCIPLES OF HIGH-RISES

STRUCTURE

When the core tube is added into the high-rise building as a structure, the stiffness of the whole building can be effectively improved to resist the bending moment and shear force brought by horizontal load.



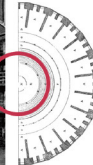
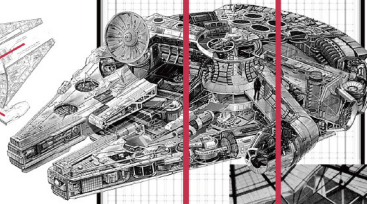
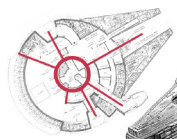
CORE

EQUIPMENT LAYOUT

In addition to organizing vertical traffic, the core also organizes equipment layout. Water supply and drainage, HVAC and other equipment pipelines are distributed to each area of each floor from here.

MANAGEMENT

The core makes the management of people very easy. It is both the starting point and the end point within each floor. So, there is nowhere for people to hide in an economical condenser.



LEASABLE AREA

The core leaves each floor as much rental space as possible. Also, the space can be easily divided, so that it can be rented to multiple tenants.

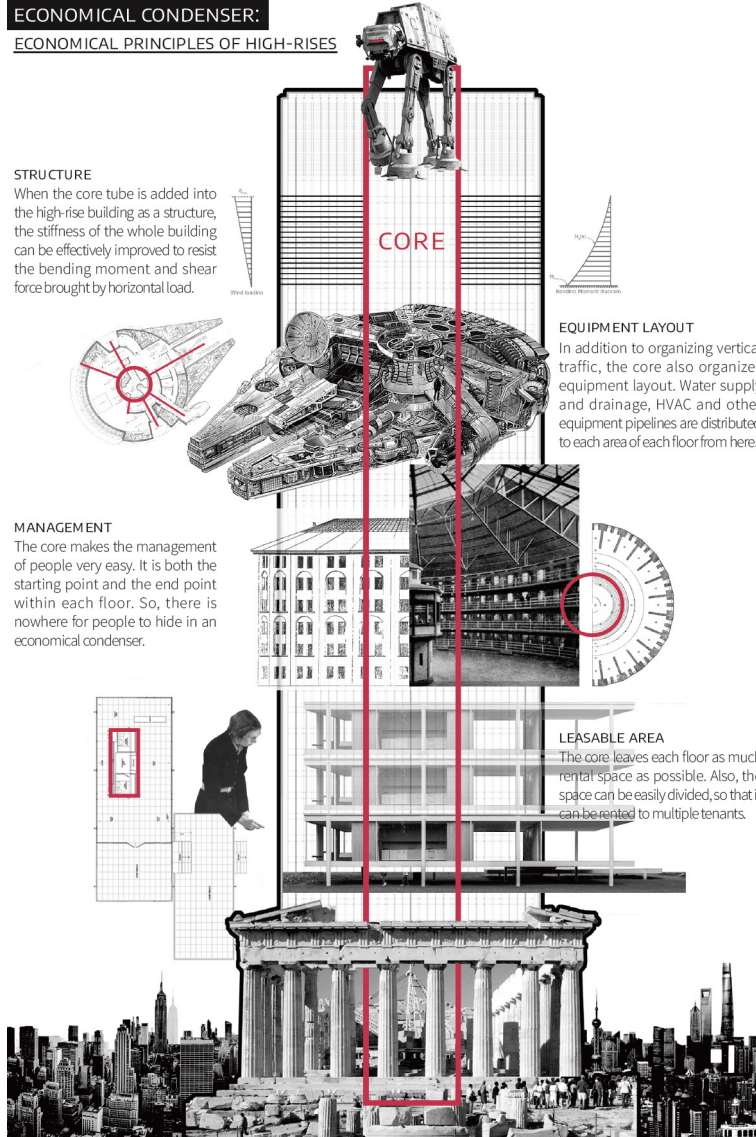


Figure 1 (previous page). Physical model of 'The Perceptual Condenser'. *Source: Runxin Fu*

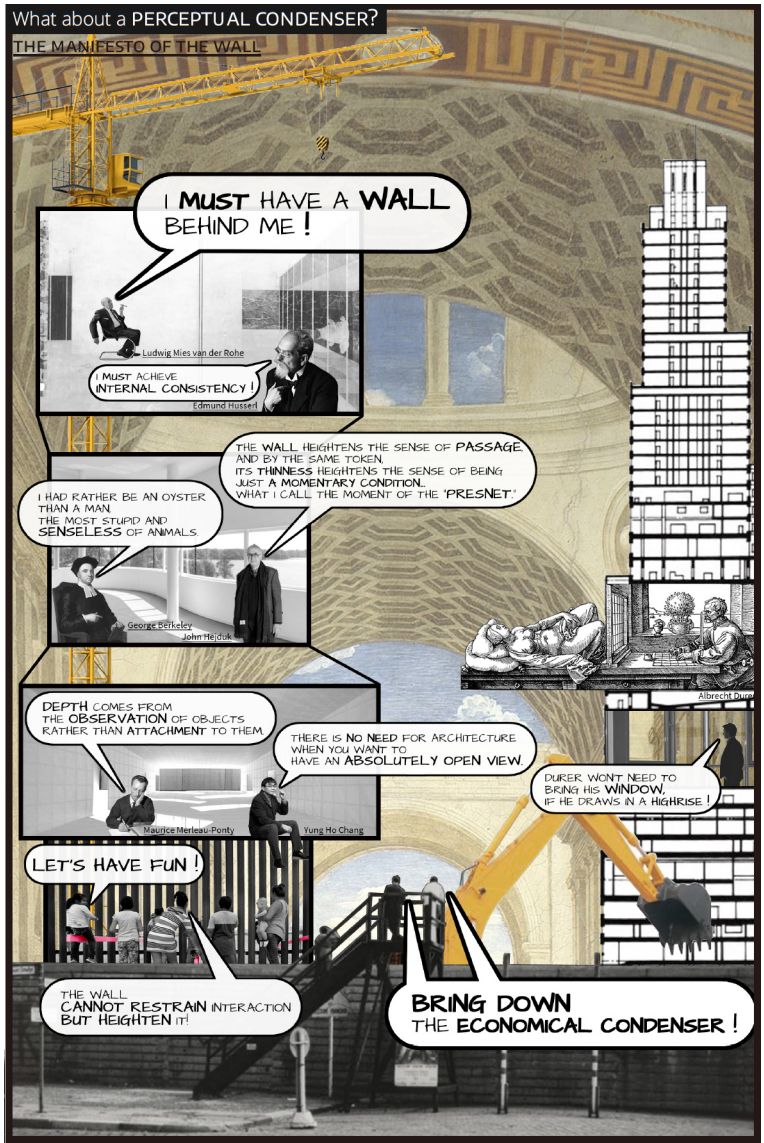
Figure 2 (next page, bottom). Breaking the core in a high-rise building. *Source: Runxin Fu.*

Figure 1a (this page). From 'Economic Condenser' to 'Perceptual Condenser'. *Source: Runxin Fu.*

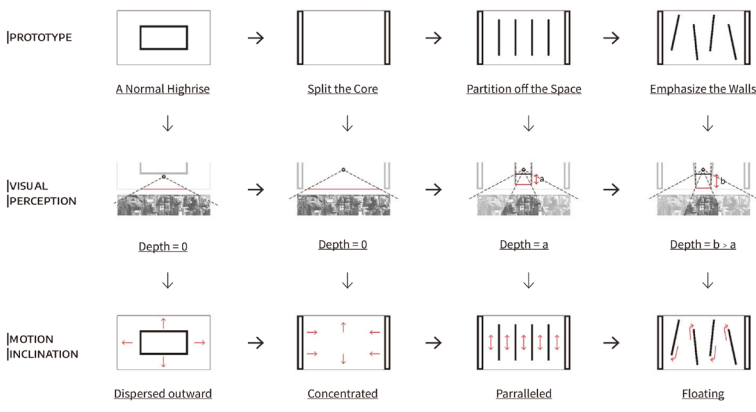
Figure 3 (page 80). Structure and the envelope. *Source: Runxin Fu.*

Figure 1b (next page, top). From 'Economic Condenser' to 'Perceptual Condenser'. *Source: Runxin Fu.*

Figure 4 (page 81). The relationship between podium and tower. *Source: Runxin Fu.*

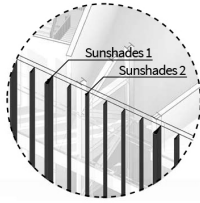


BREAK THE CORE



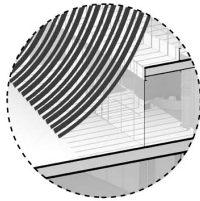
By breaking the core on the one hand, the depth of people's visual perception is deepened, and people's sense of subjectivity is also strengthened. On the other hand, people's motion inclination in high-rise buildings is no longer extroverted, so that people can explore space in a more organic way.

STRUCTURE and ENVELOPE



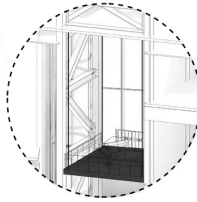
I Facade System1

Vertical sunshades are adopted for shading. Vertical sunshades 1 and 2 appear alternately in the office area to prevent glare. Vertical sunshades 2 alone are adopted in the exhibition area to meet greater lighting needs.



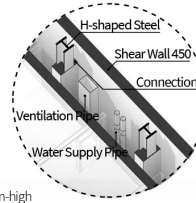
II Facade System1

The inner layer is made of overlapping glass curtain wall to maximize the use of space. The outer layer uses ETFE film to achieve high permeability and form a perfect planar. The curved sunshade not only emphasizes the integrity of the facade, but also supports and divides the ETFE film.



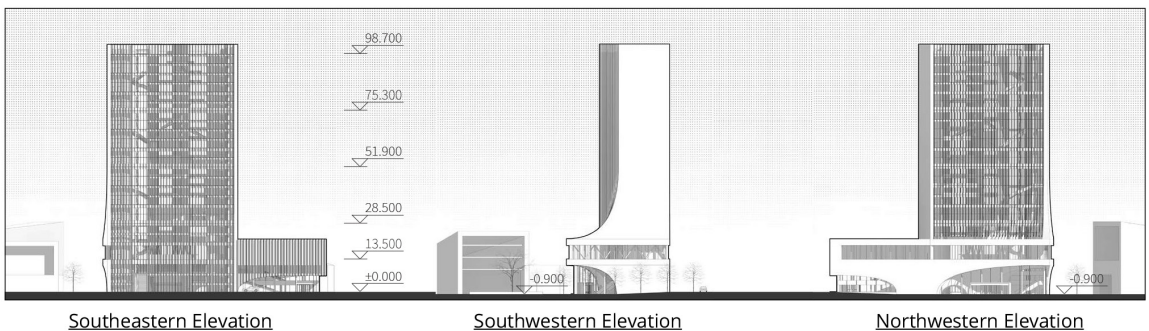
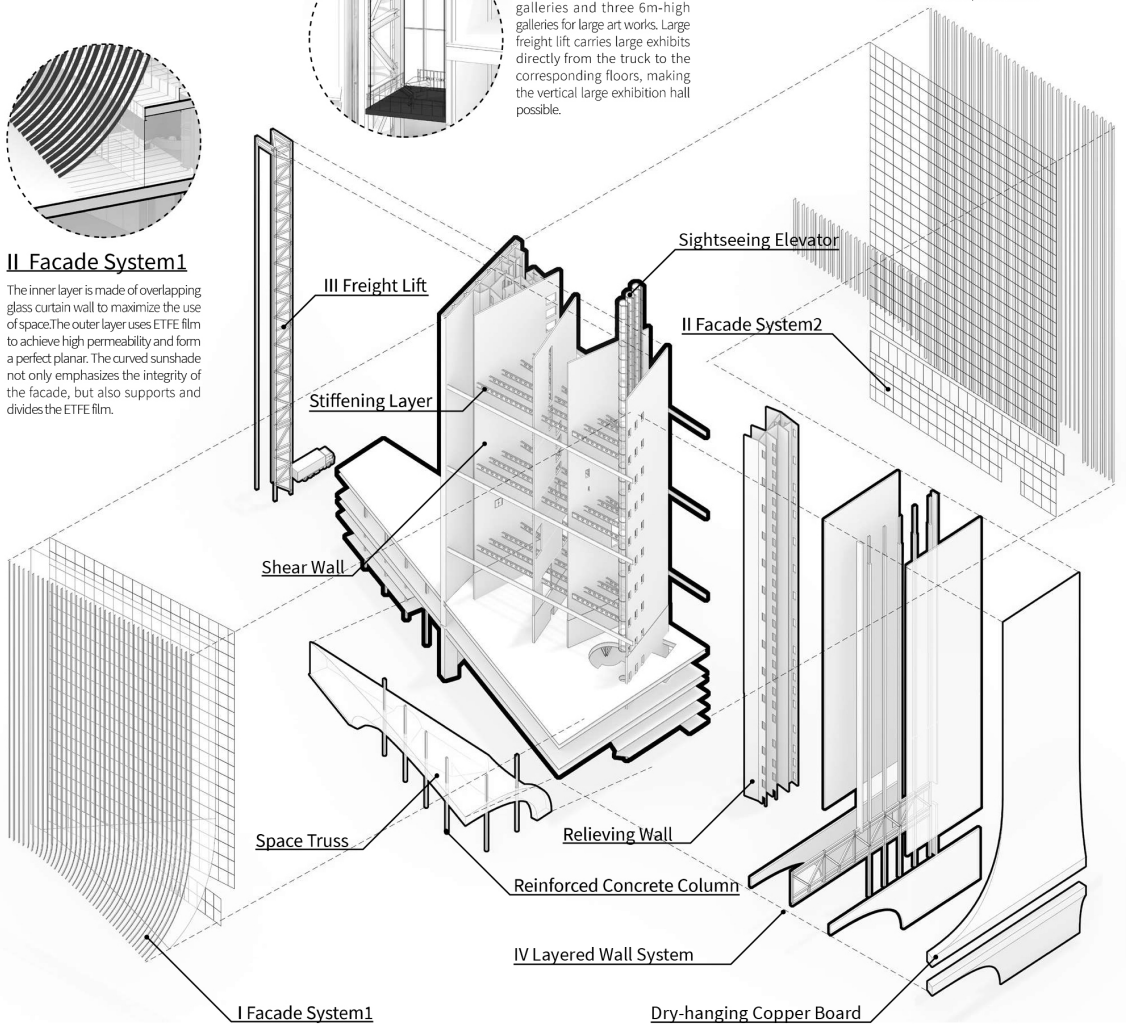
III Freight Lift

The building has three 14m-high galleries and three 6m-high galleries for large art works. Large freight lift carries large exhibits directly from the truck to the corresponding floors, making the vertical large exhibition hall possible.



IV Layered Wall

The total thickness of the composite wall system is 1350mm, consisting of two 300mm reinforced concrete shear walls and 450mm reinforced concrete horizontal connection (with HW400x400x13x21H steel to strengthen). The width of the cavity reaches 750mm, and the ventilation pipes and water supply and drainage pipes can be placed inside. The double-layered walls also show strong thermal insulation performance.

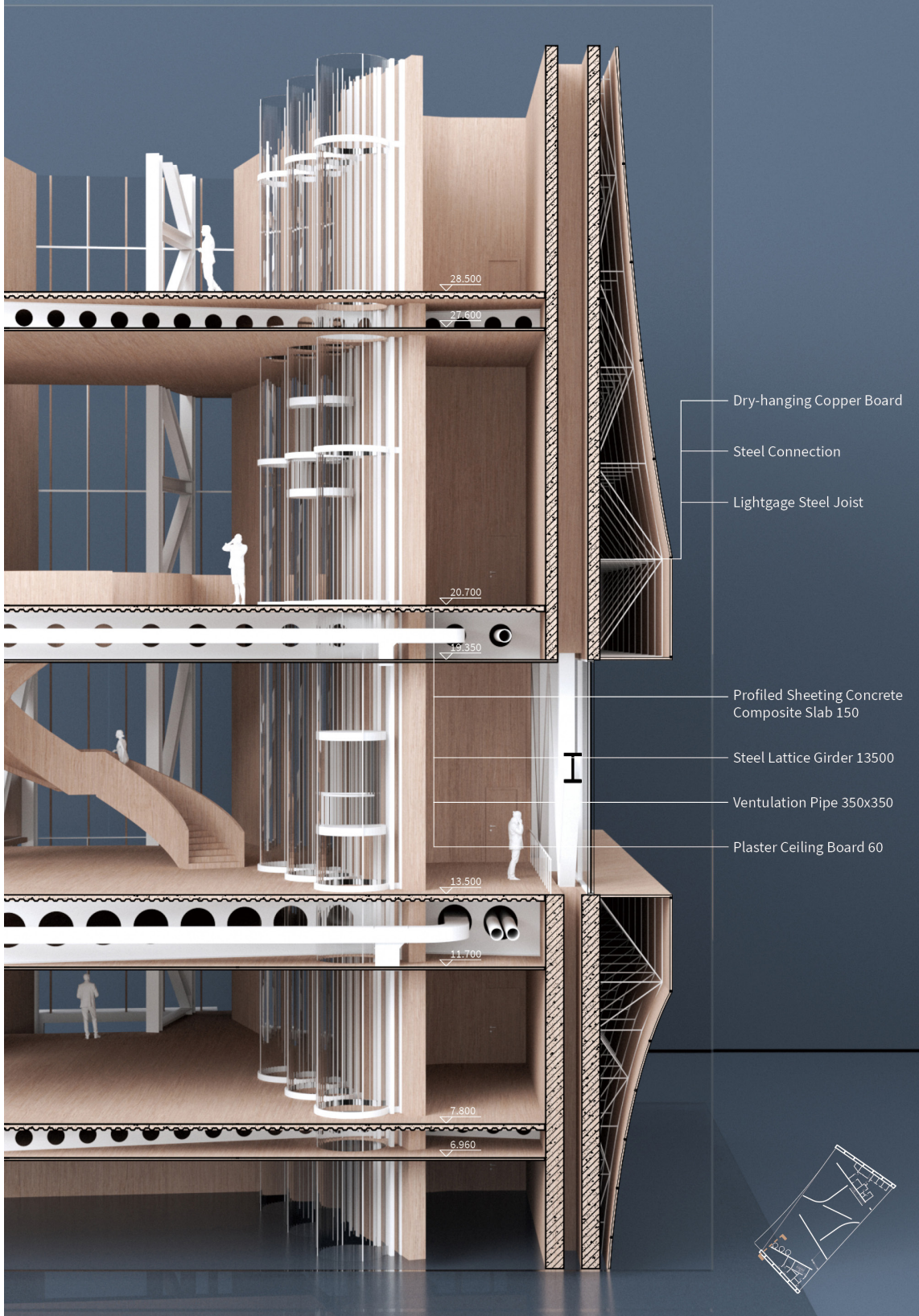


Southeastern Elevation

Southwestern Elevation

Northwestern Elevation

THE RELATIONSHIP of PODIUM and TOWER



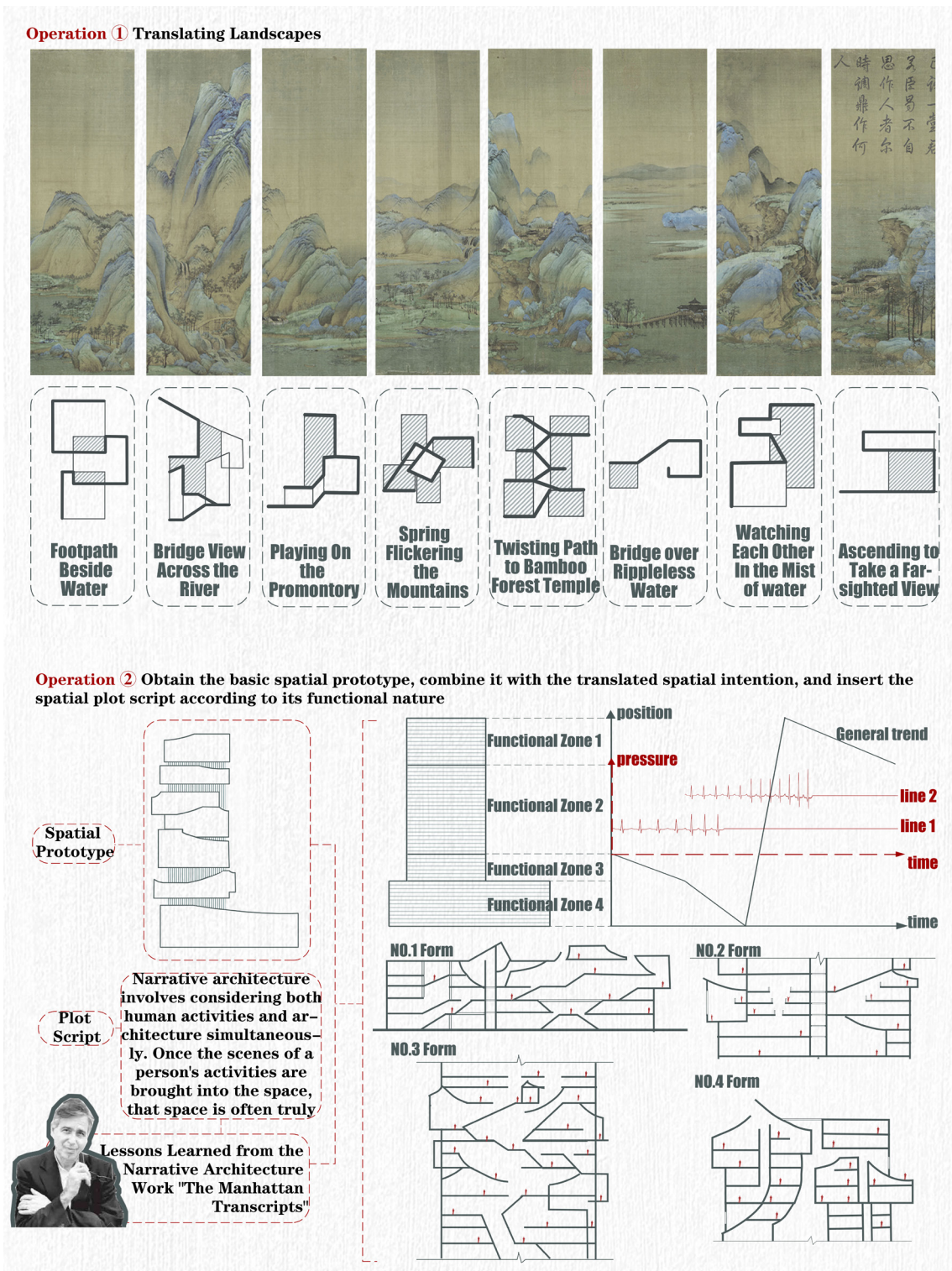
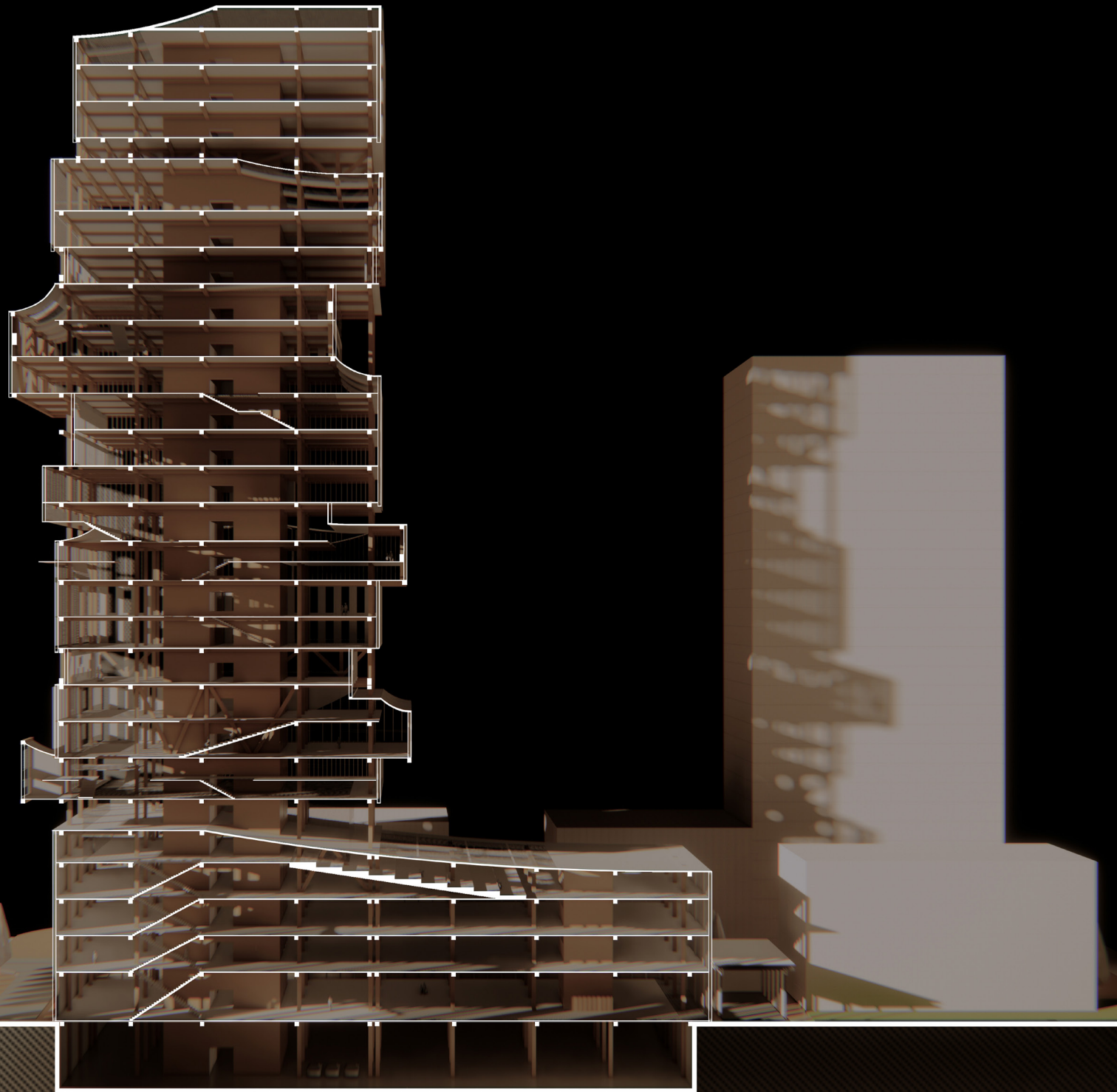
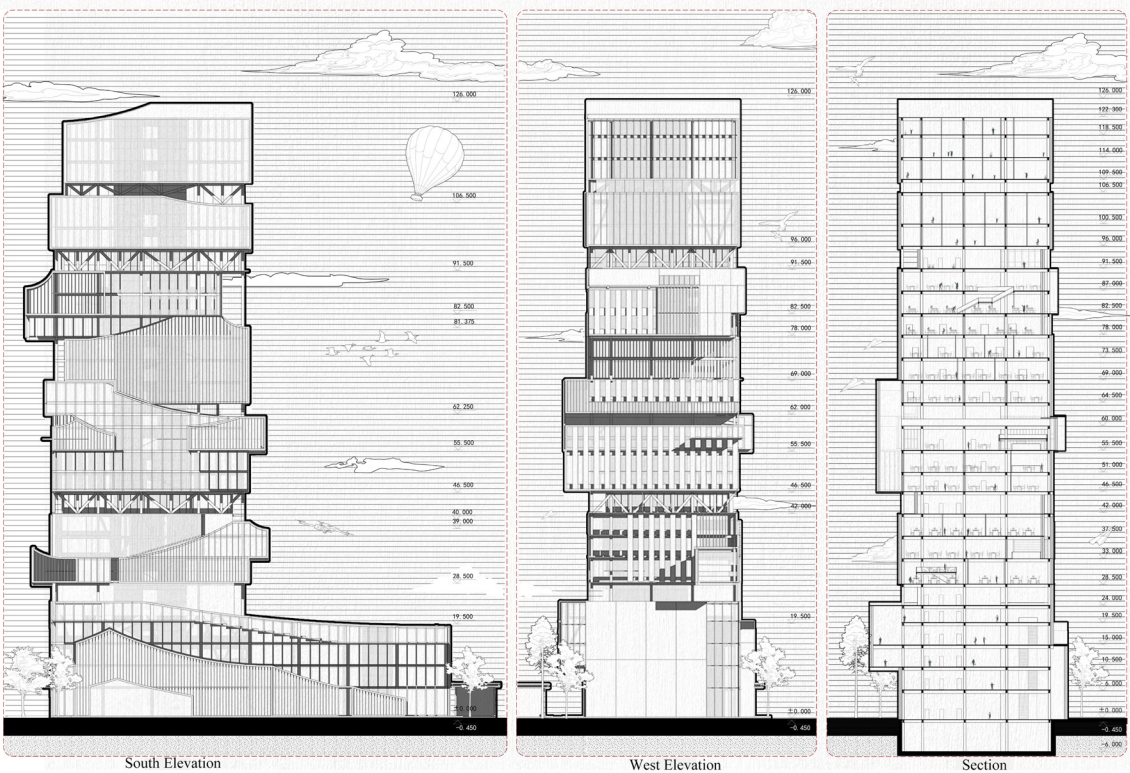


Figure 5. Process of translating landscape into partitions. Source: Shiyao Feng.





Previous page. Physical model of a section of 'THE LANDSCAPE CITY'. Source: Shiyao Feng

Figure 6. 'The Landscape City'. Source: Shiyao Feng.

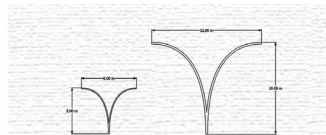
城市叠拱

基于农研新兴业态功能驱动下的高层设计探索

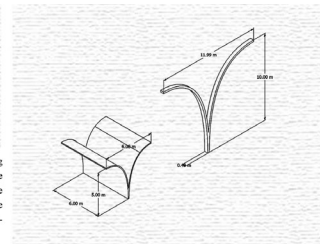




Individual Structure of Seedlings



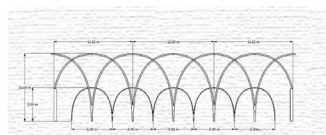
The building's arch-shaped individual structure, featuring green sprouts symbolizing green agriculture, embodies the functional attributes of emerging agricultural architecture while accommodating small-scale spatial needs and facade composition requirements across its two-scale monolithic construction.



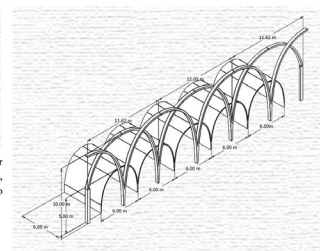
1 Individual Unit



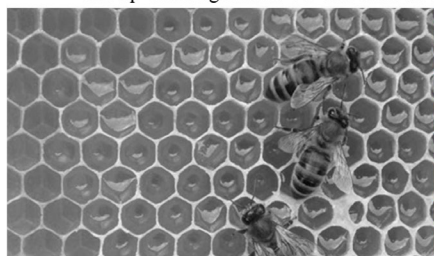
Group Arrangement of Greenhouse



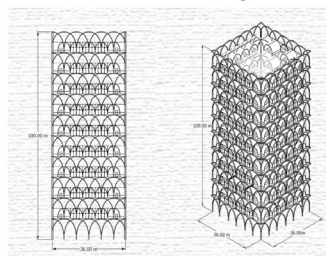
The building structures create a two-layer space with a lower "greenhouse type" area suitable for small offices and research, and spacious top floors that can be customized according to owners' needs.



2 Arrangement of Two scales Units



Vertical Distribution of Honeycomb



3 Vertical Distribution of the Arrangement

By stacking and replicating individual units around a core frame, the high-rise building design incorporates two types of standard floors in the agricultural building, resulting in a rhythmic and hierarchical facade, and a unique blend of glass curtain walls and engineered materials that offer a lighter alternative to the oppressive urban cement landscapes.

Figure 7 (previous page). Rendering of 'Arching'.

Source: Biaoqing Tao.

Figure 8 (this page). Process of conceptualisation.

Source: Biaoqing Tao



Figure 9. The relationship between indoors and outdoors. Source: Biaoqing Tao.

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Bio

Xi Deng is a research fellow in the Faculty of Architecture at the University of Hong Kong. Receiving his PhD in Architecture from Cardiff University, he has taught design studios for BA and MA students as a faculty lecturer (now an assistant professor) at Harbin Institute of Technology, where he also worked as the assistant chair of the Department of Architecture. Deng holds an MSc in Building Engineering/Architecture from Politecnico di Milano and a BEng in Civil Engineering from Chongqing University. He has rich experience in interdisciplinary research and design practice in the construction industry. His research interests include environmental design, low-carbon design, architectural design of large-scale buildings, aesthetics of building structures and digital fabrication.

Runxin Fu is an architect working at Laguarda.Low Architects, based in the US. Before completing an MSc in Advanced Architectural Design at Columbia University in 2023, he earned a graduate degree in architecture from Harbin Institute of Technology, China, in 2022. His innovative concept of 'Campus TOD' contributed to his team's first-place victory in the China National Undergraduate Sustainable Architecture Design Competition. His master's degree thesis on audiovisual educational technology garnered the prestigious Columbia GSAPP Writing Prize and widespread acclaim. His interests include spatial design, neuroscience and 3D printing.

Shiyao Feng, an architect and postgraduate student in architecture and planning, graduated from the School of Architecture and Design at Harbin Institute of Technology, China, in 2024. She pays close attention to details in life and believes that 'architecture is a form of social art'. She will always love the beauty of all forms in architectural spaces.

Biaoqing Tao, an architect and PhD candidate in digital architecture, graduated from the School of Architecture and Design at Harbin Institute of Technology, China, in 2024. He explores the possibilities of different materials and structures for shaping space and pays attention to the commonality and uniqueness of architectural forms and the environment, committed to creating comfortable and beautiful living spaces.